

October 2022
Online Print Version

International Journal of Scientific and Research Publications

Print Version, Volume 12, Issue 10
October 2022 Edition
ISSN 2250-3153



IJSRP
www.ijsrp.org

International Journal of Scientific and Research Publications

GENERAL INFORMATION:

IJSRP, International Journal of Scientific and Research Publications publish monthly journal under ISSN 2250-3153.

ONLINE VERSION

<http://www.ijsrp.org/e-journal.html>

PRINT VERSION

<http://www.ijsrp.org/print-journal.html>

All the respective authors are the sole owner and responsible of published research and research papers are published after full consent of respective author or co-author(s).

For any discussion on research subject or research matter, the reader should directly contact to undersigned authors.

COPYRIGHT

Copyright©2022 IJSRP.ORG

All Rights Reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except as described below, without the permission in writing of the Publisher.

Copying of articles is not permitted except for personal and internal use, to the extent permitted by national copyright law, or under the terms of a license issued by the national Reproduction Rights Organization.

All the published research can be referenced by readers/scholars/researchers in their further research with proper citation given to original authors.

DISCLAIMER

Statements and opinions expressed in the published papers are those of the individual contributors and not the statements and opinion of IJSRP. We assume no responsibility or liability for any damage or injury to persons or property arising out of the use of any materials, instructions, methods or ideas contained herein. We expressly disclaim any implied warranties of merchantability or fitness for a particular purpose. If expert assistance is required, the services of a competent professional person should be sought.

Contact Information:

Editor: editor@ijsrp.org

Website: <http://www.ijsrp.org>

Table of Contents

Analysis of Community Satisfaction in the “Mamanda Village” Socio-Cultural Program Balida Village, Paringin District, Balangan Regency.....	1
Aan Nurhadi, Heriyanto Andilolo, Muhammad Zulfadeli Rachman, Jatmiko Wicaksono, Lenie Marlinae, Muhammad Azmi Ma’ruf, Tien Zubaidah.....	1
Control of corporate management.....	5
Omran Alfky.....	5
Network forensics DDoS attack based on deep neural Network.....	9
SHEIKH SAZIB.....	9
Impact of parental involvement in Sunday school ministry on spiritual formation of teenagers.....	48
Irine jepkurui barkutwo, Dr. Joash Amwango, Dr. Mercy Mauki.....	48
Short Term Prediction of Ionospheric Total Electron Content (TEC) based on Solar and Geomagnetic Data.....	52
S. Nath, S.Kalita.....	52
Ayurvedic Management Of Histiocytic Sarcoma: A Case Report.....	59
Shreya Joshi.....	59
Epilepsy In Pregnancy.....	64
Dr. Neena Parashar.....	64
Energy Efficient Routing Protocol for wireless sensor network with Mobile Sink.....	67
Jolan Baccay Sy, Jake Dayag La Madrid.....	67
Impact of Systematic Lupus Erythematosus (SLE) In Pregnancy.....	82
Dr. Neena Parasher.....	82
Mesenchymal Stem Cell Therapy In Premature Ovarian Failure: Mechanisms And Future Prospects.....	86
Dr Renu Gupta, Dr Seema Manuja.....	86
Sildenafil Citrate – A Potent Solution To Fetal Growth Reduction/ Oligohydramnios.....	91
Dr. Nishtha Gupta.....	91
The Rare Cases of Mullerian Duct Anomalies and Pregnancy Losses.....	95
Dr. Nishtha Gupta.....	95

Indonesian Language Teachers' Strategy in Applying Blended Learning.....	100
Rintani Hidayat.....	100
Autologous Platelet-Rich Plasma(PRP) Treatment To Optimize Endometrial Thickness.....	106
Dr. Divya Kumar.....	106
Infertility Management: Whats the Latest ?.....	112
Dr Divya Kumar.....	112
Cord Cells and Regenerative Medicine.....	117
Dr. Nishtha Gupta.....	117
A GIS Approach to Land Use and Land Cover Change Assessment from 2016 to 2020 in Teknaf and Ukhiya Upazila of Cox's Bazar district of Bangladesh due to Rohingya Intrusion.....	119
Md. Shahjahan Ali, Mohammad Mahdi Hasan, Jagobandhu Some, Muhammad Sharif.....	119
Thomas Aquinas and "Ogden and Richards Triangle": The reality, language and human being.....	128
Francesco Paolo Pinello.....	128
Analysis Of The Influence Of Firm Size, Liquidity, And Leverage On Financial Distress.....	140
Jalu Aditya Nur Rochman, Noer Sasongko.....	140
Repetitive Loss of Pregnancy in First Trimester.....	144
Dr. Deepa Sethiya.....	144
Ovulation Induction.....	147
Dr DEEPA SETHIA.....	147
Ovarian Hyperstimulation Syndrome.....	149
Dr. Deepa Sethia.....	149
Evaluation of thyroid hormones in Alopecia Areata in Iraqi patients.....	152
Dr. Mohammad S. Nayaf, Dr. Ehssan Dawood Muckhlif, Dr.Abdul Karim Abdul-Jabbar khalaf, Dr. Wisam Suhail Najem.....	152
Affecting Capital Expenditure Allocation to Districts/Cities in The Provinces Of Central Java In 2016-2020.....	165
Rosalina Ayu Ketrin, Noer Sasongko.....	165

Improving The Efficiency Of Vesa-2 To Maximize The Energy Utilization.....	174
Darmawi, Irwin Bizzy, Ellyanie, Jimmy D Nasution.....	174
Flexible Human Resource Leadership Style On Performance of Kuppet Principals in Trans-Nzoia County, Kenya.....	182
Msc Bridgit K. Chebet and Dr. Anthony Osoro.....	182
Working Capital Management And Financial Performance Of Technical Vocational Education And Training Institutions In Meru County, Kenya.....	191
Msc Ringera J. Mugambi, Dr. Anthony Osoro & Dr. Julius Miroga.....	191
Employees Job Satisfaction And Performance Of High School Teachers In Trans Nzoia County, Kenya.....	201
Msc Patience N. Kwamboka and Dr. Anthony Osoro.....	201
The Accounting and mathematical methods of the economy in Libya.....	211
Dr, Husein El Hadi Sherif and Dr, Khalid Mohamed Reeh.....	211
The International Fisher Effect on Accounting and Technology Between, Theory and Application of Empirical Testing of International Fisher Effect in (Libya, and Euro Countries).....	215
Dr, Husein El Hadi Sherif and Mr, Akram Abdulla Eldawi.....	215
Prospects And Possibilities To Spur Productivity In The Informal Economy Of Nigeria.....	225
Nzenwata Beauty Chisom, Bimba Gana, Alhassan Amina Binta.....	225
Impacts Of Dilapidated Buildings On Secondary School Students' Academic Performance In Ogun State, Nigeria.....	235
Saheed Abiola OLASUNKANMI, Ifeoluwa AKANDE, Daniel Adebowale ADELANI.....	235
E-Banking Services and Performance of Cooperative Bank of Oromia.....	243
Tagay Mifta Aba-Bulgu.....	243
Recovery of gold by activated carbon from ammoniacal thiosulphate solution.....	253
Saira Sehar, Muhammad Mohsin Sher Ali Khan, Waqas Saif, Yasmeen Iqbal, Kashaf Sehar, Tayyaba Nasreen, Ghulam Murtaza, Amiza.....	253

Quantify Carbon Emission for Employees Working from Home.....	261
Varun Gaur.....	261
Prediction of Preterm Labour.....	266
Dr. Sheetal Sachdeva.....	266
The Role of Somali Woman in East Africa Regional Peace Building: A Case of Wadajir District in Mogadishu, Somalia.....	269
Musa Mohamed Ali.....	269
Autopsy Case Of Head Injury In Decomposing Corpse.....	288
Reza Priatna, Adriansyah Lubis, Zulfia Retnanti Marissa.....	288
Inventory Ownership Analysis And Its Influence On Performance Of Manufacturing Firms In Kenya.....	291
Benedict Mutinda Kimwaki, Prof. Patrick Karanja Ngugi, Prof. Rommanus Odhiambo.....	291
An Impact Of Mutual Funds In Long Term Investments.....	297
Dr.R. Sangeetha, Ms.V. Arthi, Ms.T. Harini Nivetha.....	297
Electrical and Thermal performance analysis of a 1000W monocrystalline solar PV Power generator in Eastern Uganda.....	301
David Kibirige, Afam Uzorka, Ukagwu Kelechi John, Mustafa Mundu Muhamad.....	301
Effect of Covid19 on Elementary Education in Odisha and Government Policy Response.....	312
Swetapadma Nayak, Dr. Lipishree Das.....	312
Gaucher’s disease : a rare genetic disorder.....	321
Dr. Avinash Narayan More.....	321
Autopsy of an Abortion Case with Birth Concealment.....	325
Reza Priatna, Adriansyah Lubis, Zulfia Retnanti Marissa.....	325
Zambia’s Response To The Coronavirus (Covid-19) Driven- School-Closures: The Effectiveness Of TV Teaching To The Learners And The Teachers In Secondary Schools: The Case Of ZNBC TV4 channel introduced in the wake of COVID-19 on the Topstar Decoder.....	329
Gladys Matandiko.....	329

Skill Development in Electronics Sector: A Tool for Employability.....	334
Dr Mary Jacintha M, Vivek Arya, Manish Kumar.....	334
Physical Activity levels associated with Overweight and Obesity amongst female traders in Municipal Markets in Eldoret, Kenya.....	340
Mugotitsa Lynnah, Prof. Jennifer Wanjiku Khamasi, Florence Wakhu Wamunga.....	340
Amount Of Damage Due To Landfill In The Area Near The Construction.....	348
B. Lhamsuren, B. Bolorchuluun.....	348
Awareness and Attitudes of Men towards Prostate Cancer Screening in Makurdi Metropolis.....	353
Raymound Tartenger Tachin & Simon Agbo Itodo.....	353
Quality Of Life And Temporal Adaptation Of Refugees Relocating To New Environments.....	361
Kavitha Padmanabhan.....	361
Digital Transformations in Central Asia: Internet Stimulus on Trade.....	366
Fazal Ahmad Afzali.....	366
The Influence of Interest Rate Fluctuation on Final Consumer Consumption in Central Asia: Empirical Study.....	382
Fazal Ahmad Afzali.....	382
Cash Waqf in Indonesia: Legal Aspects and Its Impact on Economic Resilience.....	397
Adi Nur Rohman, Sugeng.....	397
Impact of Covid-19 on the spending patterns, saving and investment behavior of lower middle classes in an urban city.....	404
Parth Tiwari, Sanjay Tomer.....	404
Graphic organizers and the level of students' performance and self-efficacy in an online learning environment.....	414
Estacio, Randel D., Reyes, Erlee Angel S., Torre Franca, Edward R.....	414
Flipped classroom and students academic achievement in mathematics.....	424
Josephine S. Uy.....	424

The Impact of electronic word of mouth on customer purchase intention: A study on mobile banking with special reference to Western Province in Sri Lanka.....	430
Kalinga Senanayake, Thilini Mudiyanse.....	430
The Influence of Accounting Systems, Internal Control, And Transparency of Regional Financial Management on The Performance of Local Governments.....	452
Raisita Mutiara Sani, Andy Dwi Bayu Bawono.....	452
Forecasting The Price Of Broiler Chicken In Ambon City-Maluku Province And The Risks That Increase On The Purchase Power Of The Community.....	457
Adolf B. Heatubun, Michel J. Matatula.....	457
A Study To Assess The Effectiveness Of Information Booklet On Knowledge Regarding Premenopausal Symptoms Among Women, In Selected Rural Area, Lucknow, UP.....	464
Laxmi Pandey, Komal Gautam ,Nidhi, Anushka Sharma,Lakshmi,Neeshu Rawat , Roshni Rani , Somi Singh.....	464
Contraception Following Abortion.....	471
Dr. Sheetal Sachdeva.....	471
Adolescent PCOS – Diagnosis and Management.....	474
Dr. Sheetal Sachdeva.....	474
Investigating the Impact of SERVQUAL Dimensions on Customer Satisfaction: Evidence from Outbound Travelers in Sri Lanka.....	480
R.A.D.D.N. Ranatunga, W.M.A.H. Bandara, P.G.S.S. Pattiyagedara, A.M.N.M. Gangananda.....	480
A Comparative Analysis of Financial Performance Before and During The Pandemic of Covid-19: Empirical Study of Textile and Garment Companies Listed On The Indonesian Stock Exchange in 2018-2021.....	493
Aditya Reyhan Yafi Wiryawan, Noer Sasongko.....	493
Pulp survival of permanent teeth following crown fractures - A prospective cohort study.....	500
Lokuappu Kuttige Nadeesha Premathilaka, Sivaguru Vasantha, Lekamalage Hansamali Prasangika.....	500
Qualitative Study of Barriers in Adopting a Healthy Diet and Lifestyle Among Kadazandusun Community with Nasopharyngeal Carcinoma in Sabah.....	507
Raja Muhammad Raja Omar, Che wan Ilmiyah, Freddie Robinson, Haryati Abdul Karim.....	507
Transformational Leadership and Learning Organizations through the Organizational Culture of the Indonesian Police.....	514
Sigit Dany Setiyono, Abdul Hakim, Tjahjanulin Domai, Siswidiyanto.....	514

Mott Transition in Strongly Correlated Fermionic Systems: Hubbard Model Review.....	527
Moukouri Mikano Jonas, Ndjacka Jean-Marie Bienvenu, Mane Mane Jeannot, Epesse Misse Samuel, Guefano Serge, Nyangono Kouma Jean Michel, Bwanga Thomas Christophe, Abanda Esomba Christian Gilles, Asse Jean Bernard, Libog Laurent, Kouoh Sone Paul-Michel Adolphe.....	527
The Status Of South Sudan’s Peace Agreement Outputs Enabling Disarmament, Demobilisation And Reintegration.....	540
Mwanyika, M. E., Professor Okoth, P. G and Professor Were, M. E.....	540
Data Bias Detection in Machine Learning.....	557
Harshaprabha N Shetty, Sony Asampalli, Prabhu Vara Prasad Bonam.....	557
Cloud Powered AI Based Solar Tracker.....	563
AhmedUvesh Mevawala, Subhadip Ghosh, Harshaprabha N shetty, Tanusree De.....	563
Impact of Real Agricultural Outputs, Human Capital and Power Supply on Nigeria’s Real Economic Growth (1981-2020).....	568
Simon Ibrahim Achi & Lucy Obahor.....	568
Work Breakdown Structure and Project Performance in Rwanda: A Case of Electricity Transmission Line Project in Bugesera District.....	576
Angel Nabasa & Dr. Eugenia Nkechi Irechukwu.....	576
Use of Information Communication Technology Tools and Teacher’s Performance in Rwanda: A case of secondary Schools in Rulindo District.....	587
Jean d’Amour Ndayisenga & Dr. Hesbon Opiyo Andala.....	587
Community Inclusivity and Teenage Pregnancy Prevention Project in Rwanda: A case of association of Kigali Women in Sports in Musanze District.....	596
Marie Grace Nyinawumuntu & Prof. Edwin Odhuno.....	596
Socio-Economic Factors Associated With Type2 Diabetes Complications Among Patients In Kigali City, Rwanda.....	608
TOM Muhimbise Mudenge, Dr Dr. Nasiru Sani.....	608
Project Implementation Practices and Project Performance in Rwanda: A case of Masaka Farm Supported by Africa to Africa Green Solutions Ltd.....	621
Assumpta Mukamugenga & Dr. Eugenia Irechukwu Nkechi.....	621

The antibiotic efficacy of levofloxacin tablet was determined utilizing a verification method that included computational and experimental techniques. DFT, UV-VIS, and HPLC-20
AD.....631
Zain Iqbal, Rakshanda Javaid, Muhammad Tahir, Sohaib Hasnain, Bakar Bin Khatab Abbasi, Faiza Shafiq, Muhammad Ishaq.....631

Green Currency Based On Green Asset Valuation Has The Potential To Mitigate Poverty, Inequality, And Global Warming.....641
**Dr. (Prof.) Suman Pamecha¹, ‘Kailashi’ Punit D. Sharma², Dr. Indu Sharma
3.....641**

Bioplastic formation from wasted paper.....651
Rovan Ashraf.....651

The effect of e-Banking on Tanzania commercial banks’ Return on investments: A case of CRDB bank in Same district Kilimanjaro Region.....663
Fadhili E. Maseko.....663

Anthropocentrism Is An Important Paradigm In Linguistics.....678
Prof. Dr. Mahmudov Nizamiddin Mamadalievich.....678

Corporate Governance And The Financial Performance Of Deposit-Taking Savings And Credit Co-Operative Societies In Nairobi City County, Kenya.....685
Charles Katua Kithandi.....685

Influence Of Monitoring And Evaluation Practices On Implementation Of Road Construction Projects In Kiambu County, Kenya.....692
**Mercy Wambui Rubia*, DR. Serah Wairimu Kimaru
.....692

The Barriers to Resolving Human Security Challenges In Light of The Current Protracted Refugee Crisis In Kenya With Specific Reference To Garissa County.....697
**Lusiola, A.O., Professor Matanga, K. F and Dr. Simiyu,
R.....697**

Evaluating Peacebuilding Strategies Applied by Sub-County Peacebuilding Committees In Mombasa County.....713
**Odallo, D.O., Professor Okoth, P. G and Professor Were, M.
E.....713**

Corporate Social Responsibility Strategy and Organizational Image of Commercial Banks In Trans Nzoia County, Kenya.....730
Josephine Atieno Onyango, Julius Miroga.....730

Analysis of Community Satisfaction in the “Mamanda Village” Socio-Cultural Program Balida Village, Paringin District, Balangan Regency

**Aan Nurhadi^{*}, Heriyanto Andilolo^{*}, Muhammad Zulfadeli Rachman^{*}, Jatmiko Wicaksono^{*}, Lenie
Marlinae^{**}, Muhammad Azmi Ma'ruf^{***}, Tien Zubaidah^{***}**

^{*} CSR Department PT Adaro Indonesia, Balangan

^{**} Karya Kompas Konsultan, Samarinda

^{***} Universitas Lambung Mangkurat, Banjarbaru

^{****} Politeknik Kesehatan KEMENKES RI, Banjarbaru

DOI: 10.29322/IJSRP.12.10.2022.p13002

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13002>

Paper Received Date: 18th August 2022

Paper Acceptance Date: 24th September 2022

Paper Publication Date: 6th October 2022

Abstract- The development of the PT Adaro Indonesia mining community's Corporate Social Responsibility program is very focused on cultural preservation. One such program is the Advanced and Empowered Village (Mamanda) in Balida, Balangan Regency. A program that carries out village tourism activities through the development of the Racah Ablelang Cultural Market with the attraction of traditional arts through cultural market events, educational tours through endemic flora conservation and family tourism facilities. The program started in 2017. This study uses a cross-sectional survey methodology and is analytic and observational. The instrument or tool used in this research is a public perception questionnaire based on the Community Satisfaction Index (CSI) which was developed from PANRB Candy 14/2017. The sample of this research is the beneficiaries of the Mamanda Village program, namely: 25 people consisting of the community, government, and companies. Next, the values of satisfaction index obtained will be analyzed by quadrant analysis to identify priority attributes or quality indicators that must be improved, maintained, ignored, or redundant. In general, the community's satisfaction with the CSR program in the socio-cultural sector is 92.22 with a very satisfactory category. If traced back to the last three years, the socio-cultural program run by PT Adaro Indonesia has increased, namely 90.66 in 2019, 82.71 in 2020, and 92.22 in 2021. This result occurs because of the strong performance of the community and CSR in implementing this program without forgetting the indicators that must be improved, namely the handling of complaints, suggestions, and inputs as well as indicators of supporting facilities and infrastructure such as easy access to the socialization of CSR programs through the company's website or social media.

Index Terms- Adaro Indonesia, CSR, Mamanda Village

I. INTRODUCTION

CSR is not only a creative activity of the company and is not limited to compliance with the rule of law, but is the company's commitment to building a better quality of life with relevant stakeholders (government and society), especially the community around the company. Because the role of CSR is now increasingly important for the community around the company to balance development, both economic, social, cultural, and environmental health.

Cultural preservation is one of the focuses in developing the community around the mine in the Corporate Social Responsibility program run by PT Adaro Indonesia's CSR (3). The socio-cultural program implemented is one of the appropriate community development programs with the Decree of the Minister of Energy and Mineral Resources Number: 1824/K/30 MEM/2018 concerning Guidelines for the Implementation of Community Guidance and Empowerment by implementation consist of Assistance for the construction of facilities and/or infrastructure for worship and friendship in religious programs, natural disaster assistance and participation in the preservation of culture and local wisdom as has been implemented in the Maju and Empowered Village Program (Mamanda), which is located in Balida Village, Paringin District, Balangan Regency.

The Mamanda Village Program carries out village tourism

activities through the development of the Racah Ablelang Cultural Market with the attraction of traditional arts through cultural market events, educational tours through endemic flora conservation and family tourism facilities. Racah Ablelang has bamboo tours in the form of a bridge that is 350 meters long and has 10 photo spots made of bamboo as well, and there is also a viewing tower with a height of 7.5 meters to monitor rice field tours, there is also a cafe/bar in the middle of the rice fields that sells a variety of drinks and food from the traditional to the contemporary. The objectives of this program are:

1. As a forum for the preservation of local culture and arts
2. As a place to promote local products
3. As a forum for community economic activities
4. As a means of education about environmental care for the community
5. Able to adapt to the Covid-19 pandemic
6. Increase employment opportunities for local communities in the village
7. Increase the income of local people in the village
8. Increase the village's original income

Carrying out an efficient, effective, quality, and reliable CSR program must be carried out economically and rationally to increase company profits. To be implemented effectively and efficiently, CSR programs require tools or techniques used in planning and controlling the CSR function. For companies, corporate social responsibility cannot be separated from the business. The effectiveness of planning and control activities is strongly influenced by the existence of CSR program data and non-CSR CSR program data that allows management to obtain information as material for analysis for further decision-making and as a measure to see the extent of the company's performance.

Therefore, PT Adaro Indonesia's CSR becomes a service center for stakeholders in its operational area. To provide good service, the company must be able to understand the needs being served, be fast in providing services, be precise-time, and be responsive to the fulfillment of the needs served. The quality of service in various aspects is one of the main links in the public trust in the government. For this reason, efforts to improve service quality must be carried out consistently by taking into account the needs and expectations of the community, so that government services to the community can be provided in a transparent, fast, precise, cheap, simple, and easy and non-discriminatory manner.

To evaluate these services, it is necessary to measure the quality of a service or product, which can be obtained through the measurement of community satisfaction as indicated by the variables of expectations and performance perceived by the customer, stakeholders or program beneficiaries. This is what prompted the formation of this research, namely to measure community satisfaction with the socio-cultural program of PT. Adaro Indonesia.

II. METHOD

This research is an analytic observational study with a survey method through a cross-sectional approach, where data on independent and dependent variables can be collected at one time.

The population in this study was taken from the beneficiaries of the CSR program. The instrument or tool used in this study is a public perception questionnaire based on the Community Satisfaction Index (Community Satisfaction Index) according to the Regulation of the Minister of Administrative Reform and Bureaucratic Reform Number 14 of 2017 concerning General Guidelines for Compiling a Community Satisfaction Index, which consists of several indicators, namely:

1. **Requirements** are requirements that must be met in the management of a type of service, both technical and administrative requirements
2. **Systems, mechanisms, and procedures** is a service procedure carried out for service providers and recipients, including complaints
3. **completion time** is the period required to complete the entire service process of each type of service
4. **Fees/Tariffs** is a fees charged to service recipients in managing and or obtaining services from providers, the amount of which is determined based on an agreement between the provider and the community.
5. **Product Specification Service Type** is the result of services rendered and received by the stipulated provisions. This service product is the result of each type of service specification
6. **Applying Competence** the capabilities that must be possessed by the implementer include knowledge, expertise, skills, and experience.
7. **Implementing Behaviors** the attitude of officers in providing services
8. **Handling complaints, suggestions, and input** is the procedure for implementing the handling and follow-up of complaints
9. **Facilities and infrastructure** is everything that can be used as a tool in achieving goals and objectives. Infrastructure is everything that becomes the main support for the implementation of a process (business, development, project). Facilities are used for movable objects (computers, machines) and infrastructure for immovable objects (buildings).

Data processing in the Community Satisfaction Survey refers to PAN RB Regulation Number 14 of 2017 starting with Likert scale measurements, processing survey data, and reporting the results of index preparation:

1. (Not satisfied) : 1
2. (Less satisfied) : 2
3. (Satisfied) : 3
4. (Very satisfied) : 4

The SMI value is calculated using a “weighted average” of each service element. In calculating the community satisfaction index for the 9 service elements studied are as follows:

Perception Value	Interval Value	Value Interval Conversion	Quality of Service (X)	Institutional Performance Service
1	1.00 – 2.5996	25.00 – 64.99	Not satisfied	Not satisfied
2	2.60 – 3.064	65.00 – 76.60	Less satisfied	Less satisfied
3	3.064 -3.532	76.61 – 88.30	Satisfied	Satisfied
4	3.5324 – 4.00	88.31 – 100.00	Very satisfied	Very satisfied

Furthermore, the values obtained will be analyzed by quadrant analysis to identify priority attributes or quality indicators that must be improved, maintained, ignored, or redundant. The sample from the study amounted to 25 beneficiaries consisting of the community, government, and companies related to the "Mamanda Village" Socio-Cultural Program.

III. RESULT AND DISCUSSION

The socio-cultural program analyzed was the Mamanda Village Program, with the following results:

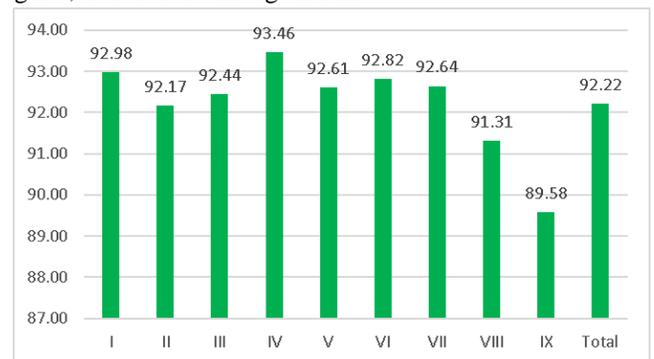


Figure 1. Community Satisfaction Index for the “Mamanda Village” Socio-Cultural Program

The value of the community satisfaction survey on the CSR program of PT. Adaro Indonesia In 2021 the Mamanda Village Socio-Cultural Program achieved an average community satisfaction score of 92.22. Referring to the Regulation of the Minister for Empowerment of State Apparatus and Bureaucratic Reform Number 14 of 2017 concerning Guidelines for Compilation of Community Satisfaction Surveys for Public Service Provider Units, the service quality of PT. Adaro Indonesia in 2021 the Socio-Cultural program is included in the category very satisfied. Quadrant analysis performed shows the following:

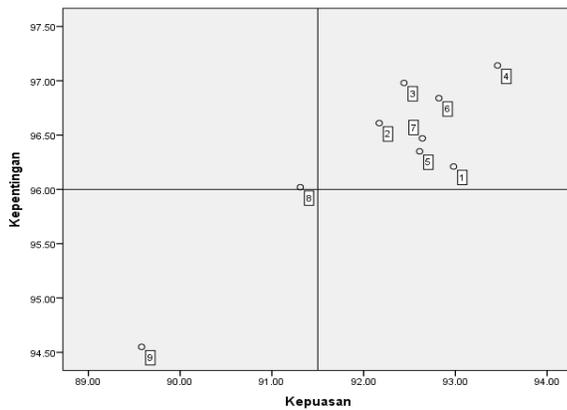


Figure 2. Analysis of the SMI Quadrant of the Socio-Cultural Program "Mamanda Village"

Information

- A = High Priority
- B = Maintain Achievement
- C = Low Priority
- D = excessive

Main priority	Keep Achievement
(8) Handling Complaints, Suggestions, and Feedback	(1) Requirements (2) Systems, Mechanisms, and Procedures (3) Completion Time (4) Fees/Tariffs (5) Product Specification Service Type (6) Implementing Competence (7) Implement Behavior
Low priority	Excessive
(9) Facilities and Infrastructure	-

Based on quadrant analysis, it was found that most of the satisfaction indicators were in the "Maintain Achievement" position, meaning that from the beneficiary's perspective, they feel very interested in the Mamanda Village program and are very satisfied with the implementation of the Mamanda Village Program. There is one indicator, namely indicator 8 (Handling complaints, suggestions, and feedback) which is in "high priority, which means that the community still wants performance improvement for this indicator to be a top priority. As for one of the indicators, indicator 9 (Facilities and Infrastructure) is included in quadrant C which means it is in "Low Priority" This means that the community feels the need to improve performance even though it is not a top priority for the community. In general, the IKM indicator from the Socio-Cultural Program is in the "Keep Achievement" position.

IV. CONCLUSION

In general, community satisfaction with the socio-cultural program of Manada Village is in a very good position. This result can occur because of good CSR performance and the community also plays an active role in the implementation of the program. Some of the

recommendations that are given to be improved are indicators of handling complaints, suggestions, and inputs such as the availability of information standards and Ease of access to complaints handling services, suggestions, and input on the CSR program of PT. Adaro Indonesia so that it can solve problems that occur in the implementation of PT Adaro Indonesia's CSR program. Meanwhile, indicators of facilities and infrastructure that need to be improved are the ease of finding information on CSR programs through the website or other online media of Adaro Indonesia.

REFERENCES

- [1] Koentjaraningrat. Introduction to Anthropology. Jakarta : PT. Rinka Cipt, 1990.
- [2] Noorkasiani, H & Ismail, R. Sociology of Nursing. Jakarta: EGC, 2009.
- [3] Sigalingging, G. Socio-Cultural and Socio-Economic Effects of Elderly Families on the Utilization of the Elderly Posyandu in the Working Area of the Darussalam Health Center Medan, 2011.
- [4] Hilawati; Afrizal D. Community Goals for the Implementation of the Corporate Social Responsibility (CSR) Program of PT. PERTAMINA RU II Dumai. JIANA (Journal of State Administration Science) 2021, 19.2: pp. 60-74.
- [5] Irwanto AK, Prabowo A. Study of the effectiveness of the Unilever Indonesia Foundation's corporate social responsibility (CSR) program. Journal of Management 2009;1(1).
- [6] PMPTSP Department. 2019 Semester II Community Goals Survey. Bandung: CV. REWARD, 2019.

Control of corporate management

Omran Alfky

phd.candidat

DOI: 10.29322/IJSRP.12.10.2022.p13003
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13003>

Paper Received Date: 19th August 2022
Paper Acceptance Date: 24th September 2022
Paper Publication Date: 6th October 2022

Abstract- In today's business world, due to the globalization of the world market, in which multinational companies take precedence, the function of corporate governance is gaining an increasing role. The need for corporate governance is necessary in order to separate the two segments of the company, namely: ownership structure, on the one hand, and corporate governance, on the other hand. Also, due to the globalization of the world market, the integration of large organizational systems is frequent. In such cases, a large number of interest groups appear as stakeholders, such as: shareholders, supervisory boards, various committees, employees, business associates and others.

The function of control is a modern business philosophy, which represents professional support to management, and which contributes to transparency, coordination and integration of business. If corporate governance is to be implemented effectively, certain factors must be met. The first, there are factors that are conditioned by the environment in which the organization operates. Environment determines the normative legal system of the country in which it operates. Normative legal regulations should provide protection of property to shareholders, ie legal protection of business. Globalization has brought instability to the market, due to increasing competition. Also there is economic crises that have affected the whole world, both due to poor financial operations and due to the crisis caused by the Covid-19 virus.

Index Terms- corporate governance, control function, management, human resources, crisis, crisis management, economy, economy, Libya.

I. INTRODUCTION

For all crisis periods it is common to face risks that are inevitable and that must be adequately analyzed, controlled so as not to jeopardize the work of the organization. There is no single model for resolving crisis situations, which can be applied in all national economies or organizations individually. Each case of crisis must be approached separately from the previous one, taking into account economic, social, political specifics of the country where the crisis arose and goals. and organizational values.

Only those companies that permanently strengthen the positive practice of corporate management are able to create the conditions for the improvement of the responsibility system, which results in a lower risk related to fraud by the company's employees. All of

the above, including effective risk management, then improvement of the internal control system, as well as control mechanisms for responsible employee behavior, enables timely recognition of possible problems before a more serious crisis occurs. Only if the company applies the above-mentioned approach in its daily activities, then it creates the possibility to maintain the long-term growth and development of the company. Only by applying the standards of good corporate governance, companies achieve positive effects that are reflected in the improvement of the decision-making system within the company. If the company wants to implement the principles of corporate governance in the best possible way, it is necessary to have an effective control system, so that it can be aware of the implementation of corporate governance activities at all times. Control represents the phase of the management process in which managers check the realization of management decisions, the effectiveness of organization and leadership, and where, if necessary, they take corrective action measures to eliminate disturbances.

II. INTERNAL CONTROL FACTORS OF CORPORATE GOVERNANCE

Some of the most important internal control factors of corporate governance are:

- "separation of company management from its ownership;
- professionalization of managerial functions and other managerial bodies;
- setting managerial standards and performance norms;
- measuring and evaluating the performance of managers;
- rewarding successful and punishing unsuccessful managers;
- conclusion of professional managerial contracts;
- concentration of ownership;
- shareholders' supervisory bodies;
- the relationship between interest-influential groups;

- financial transparency and appropriate disclosure of relevant and important information.¹

"Owners in business systems, i.e. in larger companies, they generally do not perform a managerial function, they do not manage the business and management of the company, and they are also not responsible for the result and success of the company. In the name and on behalf of the owner, the business of the company is performed by hired professionals, i.e. managers. Considering that shares in a joint-stock company are the subject of purchase and sale, it means that ownership in the company becomes by purchase, or is lost by selling shares, and this means that the ownership of the company is not permanent and exists until the moment the owners own the shares of the company."² As mentioned before, due to the sale of shares, the ownership of one entity ceases, while on the other hand, due to the purchase of the same, there is new ownership. The change of ownership in the company does not necessarily imply that the company ceases to exist. The fact that the owners of the company have changed does not affect the operation of the management activities in the same, but the company continues to renew itself and operate, regardless of the fact that there has been a change in the ownership structure of the company.

"The development of more complex forms of enterprise organization conditions the realization of a smaller number of economically complex, but also organizationally complex enterprises (corporations) for the successful management of which the owners often do not have enough opportunities, so they hire professional and competent teams of experts to whom they entrust the management of such enterprises. Realizing power through the application of new knowledge-based ideas and concepts, managers in an enterprise become an irreplaceable factor in the enterprise's ability to change, adapt and create new opportunities in order to successfully compete in the changing business environment. However, the professionalization of the managerial function and the transfer of responsibility for company management to managers also results in the appearance of abuse of managerial positions in order to achieve their own interests."³ Today's modern environment has undergone a large number of changes in a relatively short period of time, and as a result, companies are facing increasing challenges, as various interest groups demand much more from them than just providing data on the current state.

„Management performance norms represent the measurement of the expected results of the manager's business in the company for a certain period of time. Norms of performance of managers in a company led by professional managers are, as a rule, defined in advance in companies and business groups and have practical significance, both for managers and owners in the company.”

¹ Mihailović, M.: The relationship between company management and corporate governance, UDC review paper: <https://scindeks-clanci.ceon.rs/data/pdf/2217-401X/2016/2217-401X1601004M.pdf>. Accessed on 24/03/2022. years relevant and important information."

² Wiig, K.: Knowledge management foundations, Arlington, Tx: Schema Press, 2002., 4

³ Aleksandra Radojević, Corporate governance in the function of aligning the interests of management and shareholders in

Performance standards are significant for managers, since they clearly and concretely specify obligations in running the business of the company, which, by comparing the achieved with the planned owners, enable the acquisition of reliable information about the manager's success. Norms of manager's performance are established for all levels of company management, and failing to set norms related to the introduction of such a system of norming the success of management in a company in which the manager can be irresponsible can have serious and criminal consequences, especially when setting managerial goals and interests above goals and interests of business owners.

Establishing standards of manager's performance, as well as measuring and evaluating managers by comparing the achieved with the planned standards of manager's performance, is applied in almost all companies of the world, which in companies and corporations of many countries of the world is a basic, not an auxiliary way of monitoring the work of managers. In countries with a developed capital market such as the USA and Great Britain, the capital market and information provide important information obtained from the rise and fall of share prices, becoming one of the most important parameters on the basis of which the success of the manager's work is determined and evaluated in the same way, while performance norms and the comparison of the achieved with the planned benefits as an auxiliary system for evaluating the success of the manager's work."⁴ If a company wants to effectively measure and evaluate the performance of the company's work, it is necessary for managers to assume certain responsibilities for their decisions and the performance of the company as a whole. They should, among other things, create and implement a code of ethics that helps management promote every important characteristic of quality corporate governance.

Here are some of the most important measures:

- a clear organizational strategy;
- effective risk management;
- discipline and commitment;
- fairness towards employees and customers;
- transparency and information sharing;
- Social Responsibility; and
- regular self-evaluation.⁵

"A modern system of corporate management implies the readiness of the top management to enable the creation of an organizational structure for the company in which all employees would be able to participate in the development of the company's operations. From the moment of separation of ownership and managerial functions, the basis for more efficient and effective

Montenegro, Faculty of Mediterranean Business Studies Tivat, University "Adriatik" Bar, Tivat, 2020, page 24

⁴ Aleksandra Radojević, Corporate governance in the function of aligning the interests of management and shareholders in Montenegro, Faculty of Mediterranean Business Studies Tivat, "Adriatik" University Bar, Tivat, 2020, page 25-26

⁵ <https://smallbusiness.chron.com/seven-characteristics-good-corporate-governance-57207.html> pristupljeno 24.3.2022. godine

business operations of the company is created, but it also creates the possibility of a natural conflict between the owner and management. This requires defining and designing an adequate mechanism for stimulating and rewarding management, in order to balance conflicting interests and encourage more profitable and responsible business operations. Stimulating the management is based on a set of various monetary and non-monetary rewards for the management's work or contribution in achieving the company's goals. The goal of the reward system has changed over time, from proper reward, stimulating managers to achieve the best possible business success, and the effort to attract and retain the most capable and skilled. Manager reward systems or "manager motivation packages" can be in monetary or non-monetary form. The fact is that every employee in the company wants to be adequately rewarded for his work, effort, commitment, etc. For this reason, it is necessary for each company to develop its own reward methods."⁶

III. DIFFERENT TYPES OF INTEREST GROUPS

The most important advantage of the Anglo-Saxon model of corporate governance enables the collection of larger sums of financial resources, given that a large number of owners provide capital to the company, while the lack of this model can be seen in the passivity of small and smaller shareholders, because managers have more significant decision-making power and make decisions that are primarily directed towards excessive investments. The lack of the continental model is characterized by the existence of limited financial resources available to the company, and greater concentration of ownership means that control is in the hands of larger and larger shareholders who hold greater power, influencing decision-making and increasing profitability. Greater profitability is a fundamental advantage of the continental model of corporate governance."⁷

A comparative analysis of business systems emphasizes the importance of two elements: surveillance costs and the effectiveness of hostile takeovers. If we look at the values of the costs of supervision, on the one hand, and the possibility of a hostile takeover, on the other hand, then the optimal mechanism of corporate governance is reflected in:

- "concentration of ownership (when supervision is more expensive and there is no threat of takeover);
- surveillance (in case of low surveillance costs and when downloads are ineffective) or
- dispersed ownership and hostile takeovers (when there is a weak takeover defense mechanism and monitoring costs are high)."⁸

Interest groups mean those actors who are directly or indirectly involved in the work of the company and without whose presence the company would hardly survive. "Although

companies often will not always be aware of all influence-interest groups, neither will interest-influence groups always be aware of the potential impact of the company on their interests. Interest-influential groups are all individuals or groups that have an interest in the business of a trade, company or corporation. There are many interest groups, and their demands are different, but their overall fulfillment is almost impossible. Nevertheless, interest-influential groups and other investors, as a rule, strive to achieve profit maximization on the invested amount of capital, i.e. to increase the value of the company, and to independently decide how to use the money they have earned. On the other hand, managers must satisfy all interest-influential groups, because they often run the company, and are responsible for bad results, and at the same time they want to achieve their goals and interests, which are usually in conflict with the interests and goals of the company owner.

Employees strive for good and regular salaries, opportunities for training, a good attitude of management towards them, to advance in their careers, and to realize many other rights, which are often ensured by engaging unions. Consumers, on the other hand, want to achieve products and services that are as cheap as possible, but also of better quality, while suppliers aim to have a correct and fair relationship, and that the purchase price of the materials procured through them is as high as possible, faster and with regular payment terms. . The local and political community has several interests, the most important of which are those related to the increase and preservation of jobs, the possibility of collecting taxes under the conditions that the company operates positively, encouraging the company to successfully continue its work, etc. All these goals and requirements, which are often very contractual for the subjects that are an integral part of the corporate management process in the company, so managers are required to balance successfully by striving to make compromises in order to achieve the general satisfaction of the majority."⁹

IV. CONCLUSION

Corporate governance is a form of company management that deals with issues arising from complex interactions between the board of directors, top management, owners and other interested parties, including creditors, analysts, auditors, and more widely deals with issues of social responsibility of companies towards employees, customers, creditors, suppliers and society as a whole. The most important goal of all those interested in the economic field is the efficient functioning of the economy, that is, companies, because only then are incomes, employment and general well-being maximized. In order for this to be achievable, it is necessary for companies to be well managed, i.e. that the business decisions made in them are the best possible, given the circumstances. And the basic prerequisite for making valid business decisions is a well-organized company management

⁶ Mahmutović, H., Šabić, A.: Reward models for corporate managers in the function of company development. Scientific-expert meeting with international participation "Quality 2015", Neum, Bosnia and Herzegovina, June 10-13, 2015, 47-56.

⁷ Savović, S.: Concentration of ownership as an internal mechanism of corporate control Journal "Economic topics", XLVI, no. 3, 2008, p. 165-179.

⁸ Kose, J., Dedia, S: Design of Corporate Governance: Role of Ownership Structure, Takeovers, and Bank Debt, Article in SSRN Electronic Journal · December 2006.

⁹ Aleksandra Radojević, Corporate governance in the function of aligning the interests of management and shareholders in Montenegro, Faculty of Mediterranean Business Studies Tivat, University "Adriatic" Bar, Tivat, 2020, page 34-35

system. So, under the problem of corporate governance, we do not mean the issue of the quality of the company's business decisions, that is, its business management, but, as stated, the management and control system of the company. In other words, it is a set of the most important rules according to which the internal organization of the company functions (jurisdictions and procedures of the assembly, board of directors, management, etc.). Corporate governance is a system of relationships defined by structures and processes. For example, the relationship between shareholders and governing bodies consists in the former providing capital to the latter to achieve a return on their (shareholder) investment. Shareholders elect members of the company's body, which determines the company's business strategy and supervises the company's operations. That body should represent the interests of shareholders in the company. It essentially provides strategic guidance and control to the company's executives. Managers through this body should regularly and transparently submit financial and operational reports to shareholders. In addition, the managers are responsible to this strategic-supervisory body, which in turn is responsible to the shareholders through the shareholders' assembly. The structures and processes that define these relationships typically focus on various mechanisms to ensure effective governance and reporting.

These relationships may involve parties with different and sometimes conflicting interests. Between the main bodies of society, i.e. shareholders' meetings, directors (executive and non-executive) and members of the supervisory board may have different interests. Conflicting interests most often exist between owners and managers and are often called the "principal-agent" problem². Conflicts can also exist within each governing body, such as among shareholders (majority vs. minority, shareholders who control the company vs. those who do not control it, individual shareholders vs. institutional shareholders) and company board members (executive vs. non-executive, external vs. internal, independent vs. dependent); and each of these conflicting interests must be carefully observed and kept in balance.

REFERENCES

- [1] Mihailović, M.: The relationship between company management and corporate governance, UDC review paper: <https://scindeks-clanci.ceon.rs/data/pdf/2217-401X/2016/2217-401X1601004M.pdf>. Accessed on 24/03/2022. years relevant and important information."
- [2] Wiig, K.: Knowledge management foundations, Arlington, Tx: Schema Press, 2002., 4
- [3] Aleksandra Radojević, Corporate governance in the function of aligning the interests of management and shareholders in Montenegro, Faculty of

- Mediterranean Business Studies Tivat, University "Adriatik" Bar, Tivat, 2020, page 24
- [4] Aleksandra Radojević, Corporate governance in the function of aligning the interests of management and shareholders in Montenegro, Faculty of Mediterranean Business Studies Tivat, "Adriatik" University Bar, Tivat, 2020, page 25-26
- [5] <https://smallbusiness.chron.com/seven-characteristics-good-corporate-governance-57207.html> pristupljeno 24.3.2022. godine
- [6] Mahmutović, H., Šabić, A.: Reward models for corporate managers in the function of company development. Scientific-expert meeting with international participation "Quality 2015", Neum, Bosnia and Herzegovina, June 10-13, 2015, 47-56.
- [7] Savović, S.: Concentration of ownership as an internal mechanism of corporate control Journal "Economic topics", XLVI, no. 3, 2008, p. 165-179.
- [8] Kose, J., Dedja, S: Design of Corporate Governance: Role of Ownership Structure, Takeovers, and Bank Debt, Article in SSRN Electronic Journal - December 2006.
- [9] Aleksandra Radojević, Corporate governance in the function of aligning the interests of management and shareholders in Montenegro, Faculty of Mediterranean Business Studies Tivat, University "Adriatik" Bar, Tivat, 2020, page 34-35
- [10] Barton, L.: Crisis in Organizations: Managing and Communicating in the Heat of Chaos, South-Western Publishing Company, Cincinnati, OH, 1993, p. 2.
- [11] Becht, M., Bolton, P., & Roell, A. (2005). Corporate governance and control. ECGI Working Paper Series in Finance - Working Paper N°. 02/2005, pp. 1-128.
- [12] Bell, J. and Schaffer, E. (2005), Financial Leadership for Nonprofit Executives: Guiding Your Organization to Long-Term Success, USA: Fieldstone Alliance, strana 10.
- [13] Coombs, T., Holladay, S. (2001). An Extended Examination of the Crisis Situations: A Fusion of the Relational Management and Symbolic Approaches, Journal of public relations research, 13(4), p. 321-340.
- [14] D. Asch (Ed.), Readings in Strategic Management, MacMillan Press, London, 1989.
- [15] Denis, D. & McConnell, J. (2003). International corporate governance. Journal of Financial and Quantitative Analysis, 38, 1-36.
- [16] Kotler, Filip, Li, Nensi (2007): Korporativna društvena odgovornost – Učiniti najviše za svoju kompaniju i za izabrani društveni cilj, Čigoja štampa, Beograd
- [17] Milton Fridman (2002), Capitalism and Freedom. University of Chicago Press.
- [18] Triki Damak, S.: The corporate governance mechanisms: evidence from Tunisian banks, IOSR Journal of Business and Management (IOSR-JBM), www.iosrjournals.org, ISSN: 2278-487X, p-ISSN: 2319-7668. Volume 9, Issue 6, Mar. - Apr. 2013., 61-68.
- [19] <https://www.kcns.org.rs/agora/svetske-ekonomске-križe-pojam-cikličnost-križe-uzroci-nastajanja-tipovi-križe-sanacija-i-istorijski-pregled/>
- [20] www.ecgi.org/codes/documents/ceps_june1995.pdf

AUTHORS

First Author – Omran Alfky, phd.candidat

Network forensics DDoS attack based on deep neural Network

SHEIKH SAZIB

School of Computer and Communications Engineering, Changsha University of Science and Technology
Changsha, Hunan, China.410114.

E-mail : mdsazibsheikh380@gmail.com

DOI: 10.29322/IJSRP.12.10.2022.p13004

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13004>

Paper Received Date: 20th August 2022

Paper Acceptance Date: 24th September 2022

Paper Publication Date: 6th October 2022

Abstract: The safety as well as reliability of computers networks and systems, essential modern infrastructures, are now urgently threatened by DDoS attacks. DDoS attack detection must be accomplished even before prevention strategies can be implemented. However, because to a flaw in ML/DL-based systems known as the Open Set Recognition (OSR) problem, full-scale success is still out of reach. An ML/DL-based system handling new instances that aren't taken from either the distribution system of a training data in this situation. It occurred when comes to DDoS attack detection because these attacks' technology is always changing, traffic patterns are shifting. The study looks into how the OSR issue affects the ability to identify DDoS attacks. We present a new DDoS detection system, a Gaussian Mixture Model (GMM), and bi-directional long short-term memory (BI-LSTM) in response to this issue. Traffic engineers discriminate and identify an unknown information collected by the GMM, which is then supplied back to the infrastructure as more training data. The findings of the experiment demonstrate that perhaps the suggested BI-LSTM-GMM can obtain recall, precision, and accuracy up to 94% through using dataset sets CIC-IDS2017 and CIC-DDoS2019 in training, testing, and assessment. The proposed architecture appears to offer a promising means of detecting unidentified DDoS attacks, according to experiments.

Keywords: DDoS Attack, Machine Learning, Regression method, SDN

CHAPTER 1

1.1 Introduction

Rapid technological development over the decades has been focused on efficiently enhancing our way of life in an effort to address particular, targeted human requirements. With the help of technology, we may easily expand our way of life to greater plains and higher levels of complexity. The use of initiatives that seek to successfully share data from one person to another has substantially advanced thanks to the Internet's widespread use and integration. This utilization, simplicity, accessibility of its type, minimal rates of transaction, and confidence in communications platform have all been credited for this implementation and acceptance; all of which keep increasing its reputation, adoption convenience, and utilization. This popularity has attracted spams as well, a well-organized enterprise that uses messages without users' permission to generate revenue. Their services include the dissemination of malware known as spam, phishing,

and unsolicited advertisements. Unwanted or unsolicited texts are known as spam. Security experts have expressed tremendous alarm about the increase in spam(Bhaya & Manaa, 2014).

The amount of time people spend online is skyrocketing these days. In January 2021, there were 4.66 billion Internet users worldwide. Concessions like these, intended to circumvent security, obfuscate data privacy, and erode network infrastructure, have grown to be a major worry with detrimental effects on the uptake of technology. That provides customer denial, access, cyber attacks on data, theft of private data, and outages. Studies continue to demonstrate network intrusions that successfully assault any site at any moment. Denial of service attacks are just one example of how the exponential rate of attacks is as varied as the breadth of useful technology itself. This necessitates the urgent necessity to put an end to the attacks as quickly and closely as is practical. Most of these network resource attacks are planned, directed at a client system, then executed against with the servers through a variety of other compromised machines(Hoque et al., 2015a). It shows that there are many computers and systems that are interconnected with the outside world, raising important security issues. Security elements like Intrusion Detection Systems (IDS) must be added because no system is completely secure. An attack detection system that operates without human assistance is known as an IDS. The main issue that has caused problems even before the first IDS was released is misclassification brought on by the poor attack detection accuracy and inability to recognize contemporary attacks. Researchers have concentrated on this problem since it makes security analysts' jobs more difficult. Analysts may accidentally disregard serious cyber attacks as a result of this kind of responsibility. IDSs must be aware of every attack type and deal with it separately. The Denial of Service (DoS) and Distributed Denial of Service (DDoS) attacks are among the most significant of these assaults. Due to sending a lot of requests to a target at once, DoS attacks take place when a lot of resources (such memory and CPU time) have been used. As a result, it prevents legitimate users from using the service. DDoS assaults, as opposed to DoS attacks, happen when multiple computers or devices simultaneously produce a large quantity of service demand. The attacker is in control of these machines, often known as botnets. In DDoS attacks, the attacker's main goals are to consume network bandwidth and buffer memory(Hoque et al., 2015b).

Researchers have worked on enhancing DDoS detection systems or other IDS by implementing deep neural networks in order to address the aforementioned problems. Deep neural networks are used in intrusion detection systems to acquire information from enormous data sets in order to identify unusual network activity. The data sets' collected data can be utilized to improve detection systems. The algorithms can be trained to achieve this, giving security experts the level of satisfaction they want on the misclassification. In order to overcome the mentioned issues, researches have been done on improving DDoS detection systems or other IDS by incorporating deep neural network approaches. In order to discover unusual network behavior, intrusion detection systems employ deep neural networks to gather data from massive data sets. The obtained data from the data sets can be used to enhance detection methods(Baig et al., 2013). To accomplish this, the algorithms can be taught, providing security specialists with the level of satisfaction they desire regarding the misclassification.

A specific type of denial-of-service attack is distributed denial of service, or DDos. The security and integrity of PC companies and data systems, which are important pillars of modern society, are now under severe threat from these attacks. Before any measures of moderation can be used, it is challenging to identify DDoS assaults. Furthermore, ML/DL (Machine Learning/Deep Learning) has indeed been successfully used to predict the location of DDoS attacks. Here, an ML/DL-based framework ignores fresh cases not taken from the preparatory information distribution model. This problem is particularly important for spotting DDoS assaults since these attacks are becoming more innovative and have shifting traffic characteristics. DDoS attacks are growing and rising in size, frequency, and sophistication together with the increase and advancement of hazardous Web advancements. Organizational risks that might have

a significant impact on a company's operations include professional private time, information breaches, and sometimes even financial demands from programmers(He et al., 2017).

1.2 Fewer False Alarms and Efficient Identification

In order to uncover unusual invasion occurrences, DDoS detection algorithms employ stochastic analysis and make use of the entropy of network data. Traffic rate-limiting as well as screening mechanisms are implemented whenever an intrusion signal is triggered to lessen its effects. Any mitigation measures, nevertheless, that are implemented carelessly will harm legal traffic. Although the victim doesn't really experience a lot of traffic, a poor response could refuse access to authenticated traffic. Therefore, the detection technique ought to be able to tell the difference between attack traffic and legal traffic in order to be allowed to identify that somehow a DDoS attack activity is occurring(Gupta, 2018b).

Machine learning techniques are being used more and more in DDoS detection to categorize and detect suspicious traffic. Despite having to explicitly specify legitimate and harmful operations, these approaches are capable of learning the fundamental data properties. Although machine learning-based solutions show potential, the majority of methods concentrate upon offsite traffic monitoring and have difficulty capturing the constantly changing traits of DDoS attacks. Lastly, the detection technique should reduce false alarms, which can also harm reliable sources inadvertently. Therefore, the defensive system does not only stop attack traffic but also ensures that legal traffic is delivered to end users in a dependable manner(Ranjan & Sahoo, 2014).

1.3 Instantaneous mitigation and efficient inline inspection

Large businesses frequently use the scrubbing center technique to lessen the effects of DDoS attacks. All traffic is directed to a specified centralized information purification facility, known as a scrubbing center, wherein additional traffic analysis and protection are implemented whenever a questionable DDoS attack is found. Hazardous traffic is prevented while valid traffic is allowed to the system for transmission. Every traffic is rerouted using routing updates once the attack is over. This approach works well to shield victims from volumetric traffic, but it has three significant drawbacks. First of all, latency is typically increased. All traffic directed at the victim is diverted to the cleaning facility. In contrast to the detour-related latency, the scrubbing unit may also be a bottleneck and contribute significantly to latency, particularly if its bandwidth is constrained. Additionally, a complicated system is required for the detour strategy to correctly redirect traffic, which might be quite expensive in terms of both money and computation. Another benefit of utilising a scrubber centre is that monitoring is limited to inbound traffic (Peng et al., 2016). For companies and service providers that wish to prevent themselves from being used as an inadvertent DDoS attack platform, thus a strategy is insufficient. A perfect defense system would respond instantly and without any delays. We require an integrated assessment and immediate response system to do this. With inline analysis, all incoming and outgoing traffic across the protected network is examined. Without any need for route optimization, any detected attack traffic would then be simply blocked. Although inline inspection is the best option, it presents a significant challenge: how to do deep packet inspection at cable velocities while adhering to the strict memory and complication requirements? The majority of inline assessments now use packets or traffic monitoring algorithms to deal with this problem. Recent studies have nevertheless demonstrated that sampling techniques alter traffic patterns and reduce the detection performance. This substantial problem is still open(Osanaiye et al., 2016).

1.4 Defense that is Dynamic, Multilingual, and Cooperative

A common DDoS attack originates from numerous infected devices that unintentionally host attack applications. These infected devices cooperate with one another to direct attacking traffic toward the victim network's objective. The source of the attacking packets is therefore widely spread. As IoT and smartphone technology have grown, attackers are increasingly using a large number of potentially weak and unsecured devices as weapons. The origins of the assaults are not only widely spread but also might be located everywhere in the world. The frequency of DDoS assaults also shows that the malicious traffic also targets the companies that the victims depend on, such cloud service providers and Internet service providers (ISPs). Recent assaults appeared to be well-planned, very effective, and widespread. We argue that to effectively fight against DDoS assaults before they have a chance to substantially hurt both the model used to identify and the Web infrastructure, a broad and collaborative defensive strategy is necessary. Based on an examination of attack patterns, experts separated the deployment of detection methods into three key areas: the origin system, the core-end network, as well as the victim-end connection. Each prospective deployment location has benefits and drawbacks of its own. The source-end network is the greatest place to limit attack traffic because there, it may be halted before it enters the World wide web core and consumes shared resources. It is difficult to tell the difference between genuine traffic and attack traffic at this location.

As already said, DDoS attack data is very dispersed, and the detection technique sees insufficient data at the source end to make a reliable identification. The victim-end network serves as a current perspective for DDoS suspicious network identification in comparison to the source-end network. Irrespective of the assault's nature or the perpetrators' location, since the detection method monitors the aggregated attack traffic close to the target, malicious activity and poor application servers are comparatively easy to see (Mahjabin et al., 2017). Sadly, it frequently happens that it would be too late to lessen the impact at this place. Deployed defense systems in the core-end network can also view the aggregated traffic, which puts them in a stronger way to implement impede the assault traffic.

It is obvious that a networked and cooperative infrastructure was necessary for an efficient defense system. Close to the victim end might be used to detect DDoS attack traffic, and upstream could be informed of the discovered attack traffic signature. As a result, it is possible to restrict the harmful traffic as far from the victim is practicable. Furthermore, by exchanging specific traffic data among several deployment locations, a distributed and cooperative mechanism can aid in early detection. The detection accuracy is improved by having a wider traffic monitoring area. A decentralized defence system also offers scalability, allowing for quick and affordable defensive updates in response to DDoS threat evolution in the future (Shieh et al., 2021a).

1.5 Forms of DDoS

There seem to be two main forms of DDoS attacks: (i) An attacker attempts to swamp an infrastructure with customer request that emission or saturate Computational time, energy, bandwidth, etc., finding it challenging for some other customers to reach the above assets (i.e. flooding); and (ii) An attacker attempts to generate a full volume of network attacks to a domain controller (i.e. protocol attack). If the attacker spoofs the source ip address to disguise packets and making it impossible to distinguish between legitimate and malicious data, a DDoS attack can avoid detection (Tavallaee et al., 2009). According on where they are deployed, detection systems are typically categorized as follows:

- Whenever a customer device (also known like an access point) is equipped with security features that allow it to identify and filter potentially harmful data in outgoing packets This finding, according to sources, was found just at site of the remote users that started the DDoS assault. The detector minimises harm to the system and other legitimate, unharmed packets of data while attempting to halt DDoS as fast and closely as feasible to the source of attack (best practise).

- Whenever a penetrated system notices an inbound malicious packet, it may easily discriminate between legitimate "incompressible" packets and "vulnerable" attack packets using either an anomalous detection scheme or the wrongful use of intrusion. We refer to this as a victim-end detection. As well as an attack packet that hits a victim may experience bandwidth saturation and service denial.
- Whenever a network device has the freedom to freely attempt to identify a hazardous signal through percentage upon information in an effort to preserve overall performance of detection and the bandwidth consumption of an activity. When assaulting and legal packets are received at the routers, its network data is mixed by applying a proportion including all traffic information, which makes it easy to identify the attack's origin. Commonly, this is known as core-end identification.

Deep learning, which resembles the human brain, has become a hot topic of research in recent decades. Voice recognition software, image analysis, and translation software seem to be just a several of the areas wherein DL had proven useful in addition to the IDS industry. Despite the fact that the current DL model is faster and more accurate than prior models, a DL algorithm by itself cannot effectively invert multidimensional attribute links. In order to create the innovative technique known as the CLSTMNet, the present study combines two of the most popular deep learning algorithms, the Deep Neural Network (DNN) and the Long Short-Term Memory neural network (LSTM). DNN was used to automatically choose characteristics. LSTM was used to make predictions(Gupta, 2018a).

1.6 Motivation

The security of today's networks is not flawless, and as new technologies are developed and network infrastructure is continuously altered, new security issues arise. Multiple levels of security must be developed securely in order to address these issues, i.e., a suitable defense-in-depth architecture must be put in place. Network Intrusion Detection System is one of these security levels. An IDS aids in alerting whether a sophisticated attack is currently underway. In contrast, if an attack was made previously and by whom, suggesting that it somehow aids in locating the enemy and its movements.

In order for intrusion detection systems to stay current and be able to identify new attacks, they must be constantly improved. There are indeed difficulties in developing highly effective intrusion detection systems, despite the fact that many investigations have attempted to do so. In order to determine the effectiveness of attack detection and the optimum strategy for this sort of attack, study on IDSs must focus specifically on one form of assault(Alghazzawi et al., 2021). Furthermore, the primary aim of this project is to use deep learning algorithms to detect DDoS attacks.

1.7 Objective

- This study will propose a DDoS discovery model and defence framework in light of the environment for deep neural networks.
- This study offers a consolidated learning method for developing a DDoS model that takes use of the neural network learning's capacity for growth and adaptation.
- For DDoS recognition, a joint technique combining neural networking and information presentation is presented.
- To explore the ways by which the DDoS could be prevented
- To utilize the neural networking calculation to foster a model for DDoS, an information diagram framework which makes the model expandable and adaptable

1.8 Problems

(Dispersed) Denial of Service (DDoS) intrusions which can be induced by enhanced network connections, manipulation of network protocols weak points, or interfering with the Operating System (OS)/Firmware, resulting in a non-functional unified state as bricks, are a threat to the continuous production of a deep neural network. A further common IoT strike that really can impact Neural Network is electricity exhaustion, which is a limited resource that can be harmed by unreasonably increasing the burden of the network as well as its detectors, which can be accomplished whether through dedicated cyber-attacks or as a metabolic end (consequence) of DoS and DDoS attacks. Moreover, because deep Neural networks communicate data among base stations, surveillance and manipulation of data attacks such as Man-In-The-Middle (MITM) can compromise their security and integrity.

1.9 Significance of research

This study emphasizes on the investigation of detection of DDoS attacks with implementation of deep neural networks and had proposed solutions for these attacks. We had presented a unique network forensic framework based on deep neural networks for the processing and tracking of attacks. To establish the credibility of building network forensics, we had used a variety of machine/deep learning approaches with network data sources as network forensics models. In addition to this, we had investigated attack events and their traces in attack based on deep neural Network by analysing large data sets and constructing effective network forensics models. Lastly, we had evaluated and compare network forensics for detecting attacks in IoT networks using deep/machine learning.

1.10 Research Questions

- How to prevent DDoS attacks?
- How to recover DDoS attacks?
- What is the best detection approach for DDoS?

CHAPTER 2

2.1 Associated Works

Different ML approaches are often used to detect DDoS attacks, primarily as classifiers. The Naive Bayes Classifier, Random Forest (RF), Density-Based Spatial Aggregation of Application with Noise (DBSCAN), Artificial Neural Networks (ANNs), and Support Vector Machines (SVM) are a few examples of these. With SVM, a hyperplane is built in the transform coefficients to categorize unseen collected data on labeled training data. Cheng has developed a IAI (Ip Interactions Features) model that distinguishes between regular and abnormal traffic flows and aids in quickly and accurately identifying attack patterns. K nearest neighbors of the incoming data are found in KNN. The categorization of the entering data is determined by the bulk of these k neighbors. In order to categorize network state according to each step of a DDoS assault, Vu employed KNN and got excellent results. A Nave Bayes classifier is a classification method that relies on the Bayes theorem and the assumption of predictor independence. A Nave Bayes classifier makes the assumption that the existence of one feature in a class has nothing to do with the availability of any other features. Based on average as well as standard deviation of ethernet frames, Fadil used the NB approach to forecast the occurrence of DDoS attacks and obtained accurate findings. A decision tree collection is an RF. The classification is determined by the majority of independent decision tree results(Cheng et al., 2009). Wang et al. demonstrated that an RF technique may achieve an acceptable classification efficiency and an ideal feature subset with well-computed essential features in DDoS data.

It works well with data that has clusters with a comparable density. Dincalp dealt with the diversity of attack vectors by using a DBSCAN clustering technique. In their experiments, the suggested system performed admirably with the selected qualities. ANNs are simulations of biological brain networks. Using the back-propagation process, ANNs train the transformation matrix using label data. Ahanger suggested a DDoS detection strategy based on ANNs that had a 99.8% detection accuracy for identifying DDoS attacks. For DL, DDoS detection success stories exist as well. To identify DDoS attacks, Li and Lu utilized Bayesian techniques and Long Short-Term Memory (LSTM). The LSTM is appropriate for time-domain events with large gaps and delays. In the other terms, LSTM can decide whether information should be erased or maintained for an extended amount of time. In order to increase the accuracy of the detection process, the author employed the Bayesian technique in combination with LSTM to determine the confidence index of DDoS attacks (Vu et al., 2008). The auto encoder was used by Yang et al. to detect DDoS attacks. A number of neural network with just an unsupervised training process is called an autoencoder. During the training phase, it keeps the most important information while removing less important information and noise.

In their detection method called LUCID, which includes a dataset-independent preprocessing process and an activation analysis, Doriguzzi Corin et al. used CNN. The processing time of the suggested LUCID has been reduced by 40 times, making it suitable for situations with limited resources. In order to create safe solutions for IoT networks, Yong et al. employed deep learning models to identify webshell. These machine learning models' results are enhanced by ensemble methods such random forest (RF), random decision trees, and voting. According to their research, the Voting approach works well for heavyweight IoT scenarios whereas RF and ET are suited for lightweight IoT scenarios. An effective malware detection method deep learning based is proposed by Hemalatha et al. By addressing concerns with unbalanced data, the method uses an iteratively class-balanced prediction error in the Dense Net model's final classification layer to significantly enhance classification performance for malware. Extensive testing on establish a strong malware datasets revealed that the suggested technique performs better than the competition with a greater detection rate and reduced computing cost (Fadlil et al., 2017).

Despite the success of ML/DL-based systems, a crucial problem the OSR problem is ignored. Without appropriate safeguards, ML/DL could forcibly categorize cases from a new sample space into the incorrect category, as noted by Bendale et al. and Sabeel et al. The right course of action is to distinguish fresh cases from training samples, and this is the tactic used by. They calculated the hyper distance between entering data and known classes, and if the distance surpassed a certain threshold, they tagged the data as a new instance. Open Max, a brand-new model layer, is presented; it calculates the likelihood that an input belongs to an unidentified class. Furthermore, the Extreme Value Machine (EVM) is put forth, which builds models from training data using the Weibull function. For classification purposes, EVM will calculate overall insertion probability for every existing class given a fresh sample. A new instance that is distinct from all other classes is thought to belong to that class (Wang et al., 2017). Due to this trait, EVM is a strong contender for OSR issues, like the identification of recognized DDoS attacks.

2.2 Distributed Denial of Service attack

Critical oil and gas industrial installations are increasingly the target of network intrusion threats today. Industrial units have been made aware of a current industrial attack utilizing the malware Stuxnet on Iranian nuclear plants, which compromised active industrial process applications to cause damage or render them inoperable. Shamoon, Mirai, Wannacry, and other malware are only a few examples of those that have given threat profiling in several industries new depth. In the area, recent examples of oil industry behemoths like Saudi ARAMCO and others are common. Due to this, the production corporations have begun investing millions of dollars in preventive measures to safeguard their vital infrastructure. Denial of Service (DoS) attacks are a very popular form of network extortion computer

attack in today's world of the internet. In these attacks, an attacker disables a computer or backfires the network system and exhausts its legitimate users' systems, whether temporarily or permanently, preventing them from connecting to a host or the Internet (Ahanger, 2017). In a distributed denial of service (DDoS) attack, the incoming network traffic of the victim network is flooded by a variety of online victimized devices on the internet (numbers can reach millions), known as bots, and in such a situation, it will be impossible to prevent the attack by obstructing a few of the incoming data sources.

Botnets are groups of interconnected computers and other devices that communicate with one another over the Internet. Whenever made as just a targeted attack employing botnets, DDoS attacks are incredibly difficult to halt. Recurrent neural networks monitor network traffic and, using statistical analysis of genuine network activity, can identify attacks. Machine learning is a growing method for detecting attacks with improved performance and refining the detection based on past data (Li & Lu, 2019). These machine learning techniques do, though, have a limited model presentation restriction. Criminals frequently use DDoS attacks on high-profile servers that provide web services, including financial institutions, virus protection providers, website services businesses (OVH, that also maintains as well as broadcasts numerous essential internet sites), gaming internet sites, and online payment gateways, with the goals of retaliation, extortion, and social movements.

2.3 DDoS attack commonly used types

2.3.1 UDP flood

UDP flood is a type of distributed denial-of-service attack. Additionally, the connectionless User Datagram Protocol (UDP) protocol. In this form of attack, the host looks for apps that are connected to the data grams, and if it doesn't find any, it sends a "Destination Unreachable" packet return to sender. Many of the workstations send large amounts of UDP packets to the target system. As a result of these flood attacks, the system will be overburdened and unable to handle legitimate traffic (Yong et al., 2022).

2.3.2 Flood in SYN

Due to a flaw in the three-way handshake portion of the TCP protocol, a SYN flood is a specific kind of DDoS assault. When a SYN demand to create a Network interface with a server is accompanied by a SYN-ACK reply from the host, which is then verified by an ACK reply from the requester, a 3 handshake will also be carried out. When the host's SYN-ACK is silent or the requester uses a forged IP address to send several SYN requests, the situation is known as a SYN flood. We didn't have 3 handshakes since number three was forgotten, as a consequence. Eventually, DoS will happen since the host will keep waiting for each request's confirmation, which will prevent them from creating a new connection.

2.3.3 Death Ping

A "POD" attack occurs when a machine receives repeated damaging or malicious pings. IP packets have a header and are 65,535 bytes long. The maximum frame size may be limited by the Data Link Layer (DL). For instance, the frame limit on an Ethernet network is 1500 bytes. In this case, the destination host would have to separate a large number of IP packets (also known as fragments) into smaller packets before reassembling the packets. Due to malicious change of fragment content, the reassembled packet ends up being larger than 65,535 bytes, which is what happens in the "ping of death" situation. Due to an excess of storage buffers generated for packets, this may result in denial of service for legitimate packets.

2.3.4 Smurf assault

A DDoS attack that happens at the network layer is known as the Smurf attack. Smurf attacks are one type of amplification-shape attack that broadcast networks use an ICMP request to address. ICMP is typically used to define the operational status of nodes and for data

exchange. The attacker spoofs the victim's IP address using an ICMP request. Because ICMP does not use a handshaking protocol, the end node cannot verify the legitimacy of the source node. Every connected device in the network will immediately receive the request once the router receives it. Attackers are assured of success once they hear these replies from victims. Due to a high volume of ICMP, the server will deny access to its services.

2.3.5 HTTP influx

The application layer is the target of this DDoS attack type. A web server or application can be attacked using an HTTP GET or HTTP POST request. Due to the fact that an HTTP assault can be launched without the use of reflection technology, distorted packets, or spoofing, it is very challenging to identify and stop. In comparison to other assaults, this one requires less bandwidth to bring down the targeted server (Bendale & Boulton, 2016). One of the most sophisticated unstable security concerns is the HTTP flood attack, which exploits the common URL request and makes it exceedingly difficult to distinguish between legitimate traffic.

2.4 Methods for Detecting DDoS

To identify DDoS attack traffic, many different approaches have been developed. The early methods concentrate on stochastic analysis to track the behavior of network traffic flows and take advantage of network traffic entropy to recognize typical behavior and find anomalous intrusion events. Utilizing machine learning techniques to categorize and identify malicious traffic has become popular recently as a method of detecting DDoS attack activity. We examine both conventional and intelligence based detection approaches in this part.

2.4.1 Customary Detection Methods

Network traffic is characterized by conventional identification techniques employing statistical and information theoretic analysis. Typically, they take a preset model of the normal state as a given. The data of any monitored traffic are periodically inferred and compared to the predetermined model. Any traffic that doesn't conform is viewed as an attack. In, the authors suggested detection strategies that track the ratios of packets transmitted to and received from the guarded network. They contend that for a given protocol, the observed proportion for valid traffic should be lower than a particular threshold. Then, DDoS attack data is recognized appropriately. In, the article looks at the significant association that either an attack or legal traffic presents from several angles. They analyze network traffic metrics using correlation coefficients, compare the observed changes, and come to choices. In, the authors make the assumption that typical user behavior, such as the frequency of web page requests and the duration of browsing, generally follows certain distributions (Sabeel et al., 2019). The frequency distribution of the sampled flows is calculated periodically by the detection technique. The flow will be recognized as attack traffic if the estimated value is sufficiently high.

In DDoS detection, information-based metrics are very widely used. With a specified time window, entropy can be calculated for a variety of variables, including real networks, supplier IP addresses, packet counts, supplier IP ports, etc. Various information parameters are utilized to assess the variations in the generated entropy values, which are then used to detect DDoS attack traffic. The difficulty these methods encounter comes from the requirement to define exactly a standard profile and distinguish between typical and abnormal behaviour. The statistical behavior of authorized users can be easily imitated with a large enough number of active hacked workstations. As a result, the main premise of the proposed works will be broken, and the defense strategies will be misled (Yulita et al., 2017). Furthermore, the deployment location of these monitoring systems might have a significant impact on their performance.

2.4.2 Methods for Intelligent-Based Identification

- Utilizing machine learning approaches has yielded promising results in recent DDoS detection studies. These methods circumvent the drawbacks of conventional detection methods by being able to confidently learn the properties of the underlying data with no need to explicitly identify good and bad behavior. DDoS detection issues are conceptually characterized as binary

classification issues, where monitored traffic is either categorized as genuine or attack traffic. On well-known benchmarks, various categorization methods have been tested and put to use. Researchers have also looked into various feature sets to increase detection accuracy while reducing false alarms. Deep learning, a sizable percentage of machine learning techniques, has been used to solve challenging problems in various of industry sectors, such as machine learning, networking site sorting, electronic games, applied linguistics, language processing, health insurance, computational biology, computer vision, and drug discovery. However, it hasn't been widely employed for DDoS detection (Gupta, 2018a). In this part, we highlight many recent important initiatives on this subject. A number of studies use autoencoder, an unsupervised learning approach, to derive non-linear models from the input data, and then they use a classification methodology to distinguish between malicious and legitimate traffic.

For network intrusion detection, the authors of integrate a machine with just a soft-max regression layer. Both in binary and multi-class text categorization, the suggested technique performs admirably. In order to detect DDoS attacks, the authors then expand on their approach by stacking two auto encoders. In order to understand the intricate correlations between features, the developers stack two auto encoders. They integrate the tightly packed machine with a Classification Algorithm for intrusion detection, arguing that the soft-max surface is slower than conventional classifiers. In addition to using auto encoder for feature learning, the authors also use it to cut down on the amount of random variables taken into account. An number of layers, that reflects the condensed characteristics, is being used as the classifier's input rather than the auto encoder's output layer. The classifier is an SVM (Support Vector Machine). According to the authors, the SVM shows the best performance of reliability than other traditional classifiers. The suggested techniques successfully deal with the issue of feature selection, however they do not deal with the difficulties of feature extraction. RNN is a well-liked alternative to auto encoders for intrusion detection. An extension of a traditional neural network known as an RNN is frequently used to model sequential data and address time-series issues (Rudd et al., 2017).

The majority of methods use KDD99 and NSL-KDD, that employ manually created flow-level feature engineering, to implement RNN algorithms to well-formatted datasets. Each record in these datasets represents a particular network flow and is identified by a number of variables, including time, amount of frames, number of data packets, etc. The majority of proposed approaches consider each set of attributes as sequential data that is utilized the inputs for RNN models. These studies employ several RNN model types to enhance classification performance and other assessment criteria. It adopts a straightforward RNN. The developers use LSTM RNN and concentrate on choosing the smallest possible collection of characteristics. Gated Recurrent Unit RNN was utilized by the authors. Although these proposed systems perform better than conventional machine learning techniques, they fall short in solving the feature extraction problem. The assumption of order of events between variables in RNN networks is also debatable. RNNs have a memory cell that can retain data received previously as well as retain the temporal relationship among data, which makes them advantageous in modeling sequential data.

CHAPTER 3

Machine Learning

3.1 Utilizing Machine Learning to Identify DDoS

3.1.1 Machine-learning strategies

Modern machine learning techniques are employed, particularly just at phase of intrusion detection system, to identify and defend against DDoS. Svm Algorithm, Neural Network, K-Nearest Neighbor, Decision Tree, and Naive Bayes are some of the methods that are now in practice. Utilizing predetermined mathematical factors or predetermined guidelines to analyze and train in accordance with the recorded rules from the predefined database, network traffic is initially retrieved and processed. For subsequent analysis, characteristics are selected and eliminated from the traffic (for example, the method, byte frequency, and packets percentage in the stream of data). In the following phase, the features are normalized to prepare them for training. The learning methods will be used to train the neural network, and packets from network traffic will be separated out depending on whether they are from an attacker or a genuine source. The algorithm will modify the database because of its screening criteria and remove the recognized DDoS attacker packets (illegal traffic) from the network traffic(He et al., 2017).

3.2 Machine learning Types

Supervised learning, unsupervised learning, and semi-supervised learning are the three primary categories of machine learning. Subtypes can be created within each of these three categories.

3.2.1 Supervised learning

A machine can be trained using supervised learning utilizing labelled datasets. As the name suggests, it denotes that many of the labeled data has been associated with the right response. With supervised learning, one can forecast unexpected outcomes by retraining the labeled data. For instance, if one wants to teach a machine to estimate the travel time between two points, relevant information must be obtained and examined. In particular, such information may consist of the route taken, time of day, and weather conditions. These specifics are all regarded as inputs. Presumably, everyone believes that this will take longer to get to the destination if this is raining, however a machine uses statistics. Therefore, particular data like the entire time required from a start place as well as corresponding data which requires time, weather, route, and so on are needed to construct a dataset which can be trained.(Blomstrom & Kokko, 1998) The program would be able to determine the relationship between various variables and forecast the amount of time it will take to travel between two locations using the provided information.

3.2.2 Un supervised learning

The machine learning does not need to be supervised when using the unsupervised learning technique. Unsupervised learning utilizes unlabeled datasets because the model will attempt to find the information on its own. The computer can find any kind of data pattern in unsupervised learning, and it also aids in figuring out the features required to classify the data.

3.2.3 Semi-supervised learning

A different kind of learning is known as semi-supervised learning. Either supervised learning as well as unsupervised learning are used in this method. During the training phase, it blends a small amount of labeled data with a vast amount of unlabeled data.

3.2.4 Categorization

Characterization is used to predict the numbers that will be provided. The basic objective of this kind of machine learning techniques is to create a model that can accurately divide an input vector into classes that are available and accessible depending upon that labeled and training data. Each sample typically has just one input class. Assessment edges and decision borders are used to partition the input

space into decision regions. Data pre - processing, retraining, and categorization are the procedures that must be completed in that order during the classification process.

Training: Data are trained as the model enters this phase to achieve the maximum level of predictability possible.

The given input is assigned to being one of the learnt algorithms, that generates a judgment based on previously developed decision rules, to start the classification step.

There are three major components to the classification issue. First, the distribution of potential classes and class frequency of the input data. The relationship among input and output is established in order to define distinguishing traits. Thirdly, figuring out the loss function will help to lower the overall cost of penalizing incorrect predictions. Its probability theory-based categorization issues can all be found in real-world scenarios. By constructing a vector that represents the likelihood of each probable class, prediction models are being used to demonstrate and describe uncertainty. The ultimate learning model is used for forecasting, enabling the learned model to shed light on an unidentified input type (test data)(Gupta, 2018a). Despite the fact that this is true, every classification algorithm that is created and constructed aims to store training data in memory. Due to the training process, the classifier's efficiency may degrade when applied to new data, but it will continue to be accurate when applied to training data. This problem is referred to as over fitting.

3.3 Deep Learning

In deep learning systems that employ conventional machine learning techniques, features play a significant role. To choose such features, domain expertise and fine-tuning are necessary, and they contribute to the success of conventional machine learning methods. A collection of methods known as representation learning are useful for categorizing and making predictions about almost anything. The ability of the learning process known as "deep learning" to learn from several levels of representation by combining various non-linear transformations sets it apart from other learning methodologies. The rationale behind stacking numerous layers of transformations is the idea that the data is made up of a number of fundamental components that are connected to one another in a hierarchical structure(Alghazzawi et al., 2021).

When referring to the layers closest to the input, the bottom layer is often used. This is predicated on the idea that although low-level qualities, like gradients and edges, are shown by levels nearest to the input, or even at the 'least' level, more complex characteristics, like faces and objects, are indicated by levels nearest to the output, or even at the 'highest' level. Two of the most major differences among machine learning and data mining techniques are data size and approaches to problem-solving. In contrast to machine learning, deep learning usually makes use of big data. Deep learning will complete a problem from beginning to end, in contrast to machine learning, which employs a split-and-handle methodology. This is the second distinction among machine learning techniques. Additionally, deep learning enables sequential layer parallel processing, whereas machine learning only permits single layer parallel processing. One of the most popular deep learning techniques is called a deep neural network (DNN)(Siddiqi & Pak, 2020)

CHAPTER 4

4.1 Research design

In this study qualitative methodology had been adopted. To investigate the maximum capacity of the proposed system there had been some examination headings that merit further examination: approval on more datasets, auto-setup. This strategy had propelled the current practice and issues in DDoS identification.

4.2 An expandable and adaptable Deep Learning strategy

In this exploration, an expandable and adaptable neural learning network interruption recognition framework had been introduced. Writing on building a prescient model for circulated forswearing of administration assault (DDoS) is rich, yet entirely the high level DDoS doesn't cover the expandability and adaptable way of behaving of the interruption recognition model. Versatility is becoming progressively expected for the present network interruption discovery.

4.3 Suggested Framework (GMM)

This study suggests a system that integrates a Gaussian Mixture Model (GMM), supervised learning, and bi-directional long short-term memory (BI-LSTM) to address the issue of DDoS assault detection. The BI-LSTM is used for the distinction between routine data as well as DDoS attacks using learning algorithm. The GMM is used to create a distribution model for the training data that is based on an idea similar to unsupervised learning. If fresh attacks or new valid traffic extend beyond a certain bounds of the built distribution model, they can be intercepted using GMM. The traffic engineer must identify and categorize newly captured traffic before using it to upgrade the BI-LSTM and the GMM in the gradual process of learning. The BI-LSTM can be thought of as a detector for something like the differentiation of positive and negative traffics, and the GMM can be thought of as a classifier for differentiating learnt samples and novel cases. Our system creates models that will be used to identify network using deep learning by using past traffic data for training. We also add the Gaussian mixture modules to the model to enable detection of previously undetected attacks. Finally, specialists will identify and categorize unidentified attacks or traffic categorised by the Gaussian mixture model, and the supervised neural model will be upgraded through incremental learning.

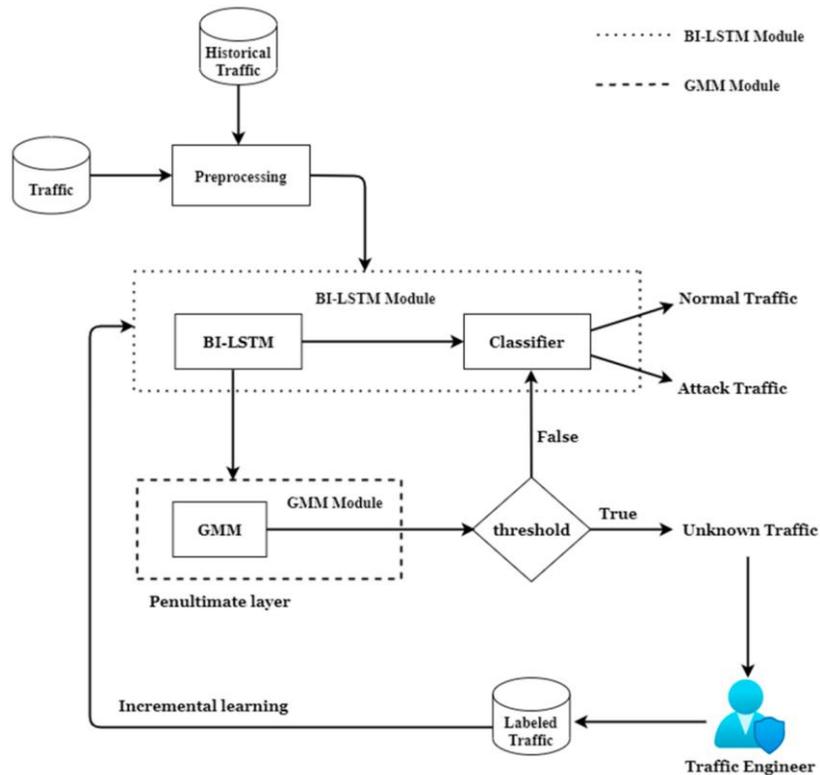


Figure 1 The BI-LSTM-GMM functional block diagram that has been suggested.

4.4 Module BI-LSTM

The LSTM is a Recurrent Neural Network (RNN) design featuring gates for explicit input, output, and forget control and a memory cell. Because of its distinctive form, LSTM is especially well suited for applications involving data sequences. An LSTM's operation is controlled by (a), which includes the following:

$$\begin{aligned}
 i_t &= \sigma(W_i, [h_{t-1}, x_t] + b_i) \\
 o_t &= \sigma(W_o, [h_{t-1}, x_t] + b_o) \\
 f_t &= \sigma(W_f, [h_{t-1}, x_t] + b_f) \\
 \tilde{C}_t &= \tanh(W_c, [h_{t-1}, x_t] + b_c) \\
 C_t &= f_t \cdot C_{t-1} + i_t \cdot \tilde{C}_t \\
 h_t &= o_t \cdot \tanh(C_t)
 \end{aligned}$$

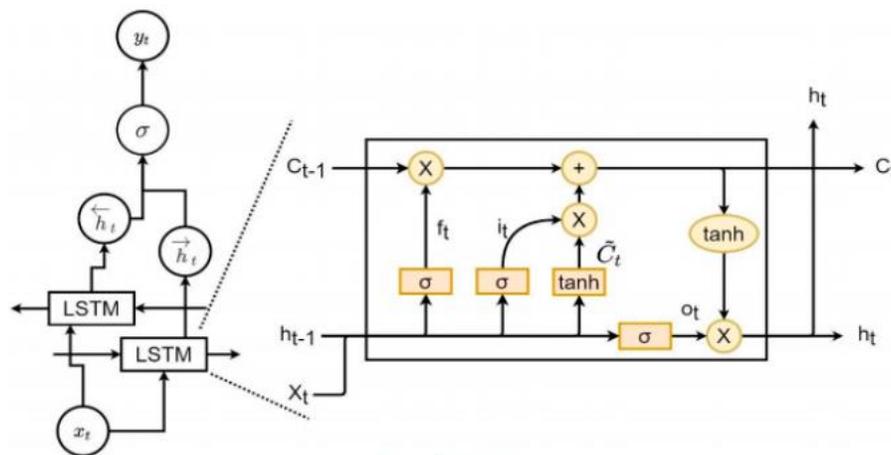


Figure2 The LSTM stage's inner architecture

where C_t and C_{t-1} are the current and last states, respectively; t is the index of the LSTM stage; x_t is the inputs; h_t is the outputs; W is the mass; b is the bias; and $\sigma()$ is the sigmoid function. A DL design with two LSTMs—one for forward motion and another for backward motion—is known as a BI-LSTM. As with data sequences, a BI-LSTM is now a non-causal network. A desirable quality again for identification of DDoS assaults is its ability to grasp correlations along both sides of the time axis. The BI-output LSTM's is sent to a deep network that acts as a classifier to distinguish between legitimate and malicious data (Shieh et al., 2021c). Only when the GMM indicates that the given instance falls inside the learning distribution of data is the output of the classifier counted.

4.5 Module GMM

An ML/DL-based system must be able to recognize its limitations. We use the GMM in our design, an extension of the single Gaussian model, to give the DDoS assault detection system the capacity to detect instances not drawn from either the estimation method of the training dataset. Clustered data, a common case in DDoS attack detection, is modeled using GMM by using several Gaussian probability density functions. In the feature space, many valid traffic types and DDoS attacks cluster together according to similarities they share. GMM can create a model that matches the distributions of the training sample using unsupervised learning. A statistical model made up of K Gaussian probabilities is known as a GMM. Each kernel's weighting factor (w_k), mean (μ_k), and covariance matrix (Σ_k) can be described as follows:

$$\Lambda = \{\lambda_k = (w_k, \mu \rightarrow k, \Sigma_k)\}, k = 1, \dots, K$$

A particular instance x 's likelihood of becoming a part of a GMM can be calculated using the following equation:

$$p(x \rightarrow || \Lambda) = \sum_{k=1}^K w_k N(x \rightarrow || \mu \rightarrow k, \Sigma_k)$$

The expectation-maximization approach is the method most frequently used to produce an estimate of the mixture model using a testing dataset and K . The GMM could be used to exclude unknown instances once the model has been created (Sarker et al., 2020). A failed occurrence would be logged, subject to data engineers' identification and labeling.

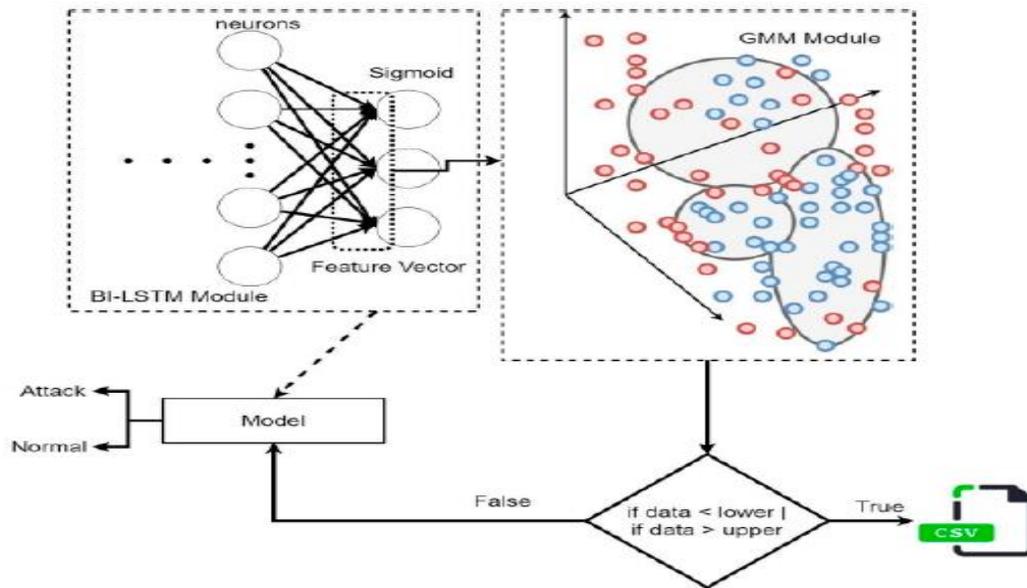


Figure 3 The GMM module's control flow.

4.6 Continuous Learning

If a thing can keep learning, it can keep getting better. Retraining the program from scratch is a possibility but a time-consuming operation given the current training set and newly acquired training data. Incremental learning, on the other hand, is a more logical and effective choice. The process of continuously improving an old model with fresh data is known as incremental learning. Given the constant evolution of both the assaulting technology and the accompanying traffic, this feature is crucial for DDoS attack detection. Traffic engineers will log and classify any traffic that the GMM module rejects within the suggested framework (Sarker et al., 2020). The tagged information would be used as training data for the BI-LSTM and the GMM during the incremental learning stage.

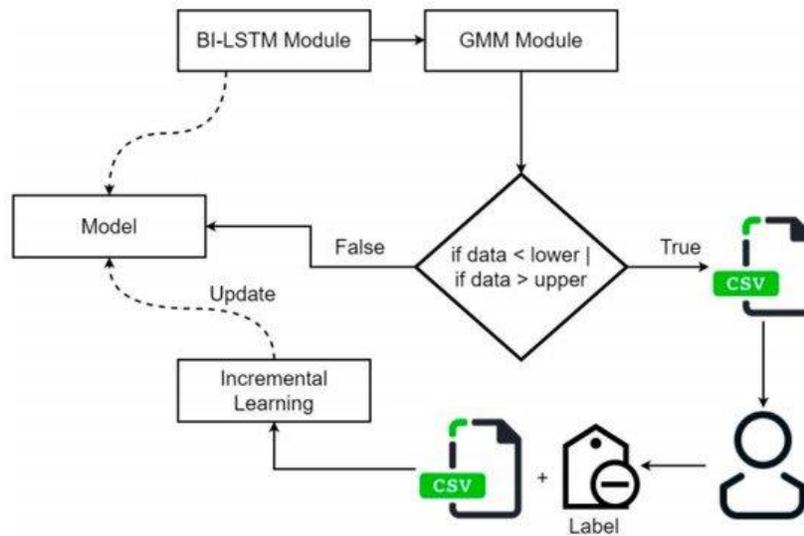


Figure 4 An incremental learning process's control flow

4.7 Framework for Detecting DDoS Attacks Employing Multiple Linear Regression

The main research goal of the suggested approach is to develop a machine learning model relying on multiple linear regression modeling and to visualize data by taking coefficient of determination and fit charts into account. The suggested method's goal is to investigate the viability of using multiple linear regression analysis on the CICIDS 2017 dataset, the benchmark dataset that has been extensively utilized in a number of the most notable development research publications. The goal is to first use the feature selection technique to identify the crucial characteristics that make superior outputs for the prediction model. For carrying out feature selection in the current approach, as shown in fig, we adopted the Information Gain approach method. A common paradigm used in many data mining-based applications is the information gain technique. The behavior of the chosen and retained significant attributes of the CICIDS 2017 dataset is analyzed by examining the fit charts and residual plots after the selected features are taken into consideration for carrying out multiple linear regression analysis. The experiment results are analyzed using the suggested methodology in the next part utilizing the Friday log files from the most popular CICIDS 2017 study dataset.

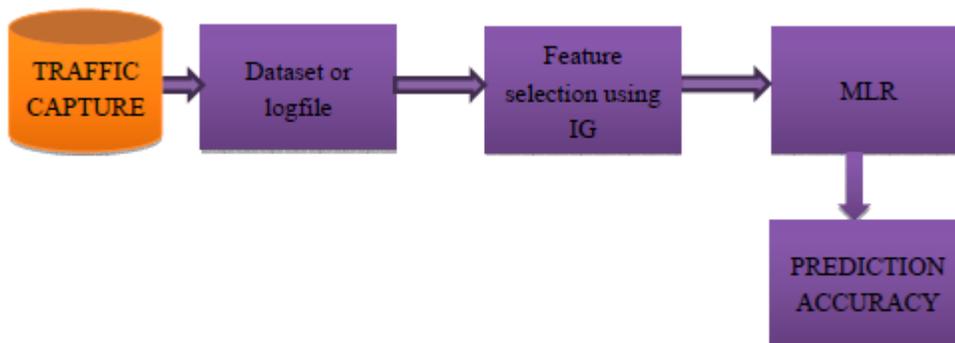


Figure 5 suggested machine learning method for detecting DDoS attacks

4.8 DDoS Attack in SDN

The DDoS assault is among the most harmful ones against SDN. The attacker can quickly generate a large amount of traffic using fake IPs, severely damaging the network and rendering the controller inaccessible to authorized users. Unfortunately, DDoS attacks can

occur at any SDN layer, and these attacks differ from those that are recorded in traditional networks and even from those that are classified as DDoS.

4.8.1 Solutions Based on Deep Learning

Deep Learning (DL) methods now play a major part in anomaly detection methods. Such methods can automatically and without human involvement extract the deep structure as from incoming data. The DL was only seldom used in works to launch DDoS attacks on SDN networks. In order to effectively defend from DDoS attacks in SDN networks, Li et al. constructed DL algorithms. The suggested model was tested on the ISCX dataset using three deep learning (DL) algorithms: CNN, LSTM, and RNN. In both the training and test sets of data, their model effectively attained accuracy levels of 99% and 98%, respectively. The majority of the current studies verified their models using a dataset created based on standard IP networks instead of SDN platforms, demonstrating how greatly the DL techniques may solve the fundamental issues of traditional ML techniques.

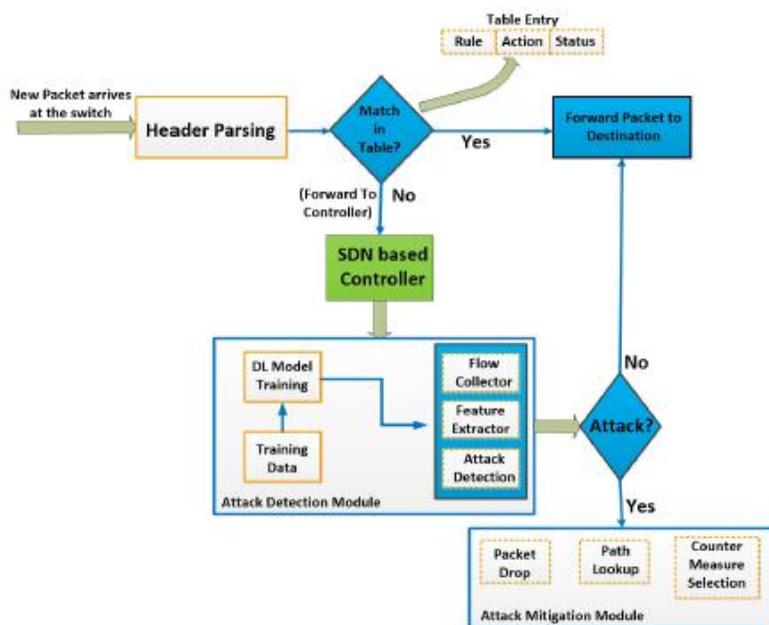


Figure 6 Framework for SDN anomaly detection and mitigation.

CHAPTER 5

Methodology and Results

5.1 Experimentation

To verify the viability and efficacy of the suggested framework, a number of experiments were carried out. The TensorFlow 2.0 and Keras frameworks were used to implement the tests, which were run on an Intel i5-9500 CPU with 32 GB of RAM.

5.2 Data Set

In our studies, two well-known datasets—CIC-IDS2017 [23] and CIC-DDoS2019—are used. The Canadian Centre for Information security used Wireshark in simulated situations to gather the datasets. They are created utilizing different DoS and DDoS attacks, two different consumption profiles, and multistage attacks like Heart bleed. The CIC Flow Meter is then used to pre-process the collected traffic. To provide the various DoS and DDoS traffic data, it contains 80 network traffic features. The final data collection includes CSV files of traffic aspect records. The non-numeric variables are changed using One-Hot encoding to fit within the framework's recommended numeric structure. Then, all fields are normalized in preparation for rescaling their dynamic ranges.

DATA SET	TRAFFIC TYPE	NO OF INSTANCES	RATIO	TOTAL NO OF INSTANCES
CIC-IDS2017/Wednesday	BENIGN	440,030	0.62	692,703
	DoS GoldenEye	10,294	0.013	
	DoS Hulk			
	DoS	231,074	0.334	
	Slowhttptest	5498	0.007	
	DoS Slowloris	5795	0.006	
	Heartbleed	12	1.6×10^{-5}	
CIC-IDS2017/Friday	BENIGN	97,717	0.431	225,745
	DDoS	128,028	0.568	
CIC-DDoS2019/NTP	BENIGN	14,366	0.0119	1,217,007
	DDoS/NTP	1,202,641	0.9880	
CIC-DDoS2019/LDAP	BENIGN	1611	0.0006	2,181,542
	DDoS/LDAP	2,179,931	0.9993	
CIC-DDoS2019/SSDP	BENIGN	764	0.0003	2,611,374
	DDoS/SSDP	2,610,610	0.9996	

Table 1 CIC-IDS2017 and CIC-DDoS2019

The confusion matrix and indeed the Reliability, Proficiency, and Recall are performance indices. Precision makes an effort to determine what percentage of affirmative identifications are in fact accurate. Recall is concerned with the accuracy of genuine positive identification. The percentage of instances that are accurately categorised when they are identified is known as precision.

$$\text{Accuracy} \triangleq \frac{TP+TN}{TP+FP+FN+TN}$$

$$\text{Precision} \triangleq \frac{TP}{TP+FP}$$

$$\text{Recall} \triangleq \frac{TP}{TP+FN}$$

$$\text{F1 Score} \triangleq \frac{2*TP}{2*TP+FP+FN}$$

Predicted	Actual	Attack	Normal
Attack		TP(True Positive)	FP(False Positive)
Normal		FN(False Negative)	TN(True Negative)

Table 2 Jumbled matrix.

5.3 Preprocessing

One of the most important steps in both machine learning and data mining methodologies is data preparation. Preprocessing can be helpful in assisting you in overcoming a variety of data issues, as well as difficulties once you have a large dataset and need to get a more precise output. The preprocessing method guarantees that raw data is updated, preprocessed, and transformed into acceptable, suitable, and pure data, boosting accuracy.

5.4 Module BI-LSTM

We developed a BI-LSTM design with setup and parameter settings after making some investigative efforts. L2 regularization imposes constraints on the kernels, biases, and activation. During the training and testing, we used a 10-fold cross-validation approach. The pullout process was used to get around the over-fitting issue.

Layer (type)	Output Shape	Param #
Hidden_Layer_1 (Dense)	(None, 28)	1596
Hidden_Layer_2 (Dense)	(None, 10)	290
Output_Layer (Dense)	(None, 1)	11
Total params: 1,897		
Trainable params: 1,897		
Non-trainable params: 0		

Table3 Settings for the BI-LSTM

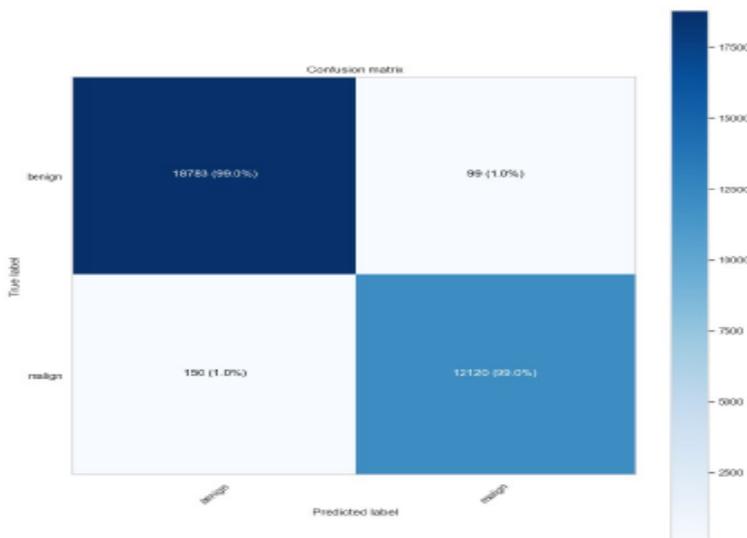


Figure7 confusion matrix

Parameter	Setting
Epoch/size of batch	500/1023
Clipnorm	0.8
Learning rate	0.00858
Momentum	0.88
Decay	0.001
Bidirectional Layer	2

Table 4 Setting up the BI-parameters. LSTM's

First, we looked at the BI-performance LSTM's as just a DDoS detector. The "CIC-IDS2017/Wednesday" data set was used to test the BI-LSTM. The BI-LSTM was tested using the same data set, "CIC-IDS2017/Wednesday," after training. The BI-LSTM was properly trained and behaved, as can be seen in initial row of Table, in accordance with its intended use. The training data set's malicious and legal traffic may be distinguished with great ease by the BI-LSTM.

Test Data set	Recall	Precision	Accuracy	AUC	F1
CIC-IDS2017/Wednesday	0.997	0.971	0.988	0.985	0.984
CIC-IDS2017/Friday	0.413	0.985	0.663	0.704	0.583

Table 5 Effectiveness of the BI-LSTM trained on "Wednesday, CIC-IDS2017"

Our focus is now on the consequences of the OSR issue. In other words, we looked at how a well-trained BI-LSTM responds to novel occurrences that it has never encountered before. The BI-LSTM trained with "CIC-IDS2017/Wednesday" was tested using "CIC-IDS2017/Friday". The performance, recall, and accuracy significantly decreased to about half, which is effectively random guess, as in the second row of Table. This issue arises because BI-LSTM lacks an internal method for determining something does not grasp. The BI-LSTM compulsorily chooses the currently serves on a mismatched model for novel instances not derived from the distribution model of the training set, which typically yields inaccurate classification. Notably, accuracy does not suffer noticeably. Due to this, the distribution of legitimate traffic in "CIC-IDS2017/Friday" and "CIC-IDS2017/Wednesday" is identical in feature space.

5.5 Module GMM

Our preferred approach to the OSR issue is GMM. With GMM, a provided training data set's distribution is modeled by weighting K Gaussian probability distribution functions. A crucial system parameter is K, the amount of Gaussian distributions. The computational expense for calculating the K value and model correctness must always be balanced. The AIC (Akaike Information Criterion), which measures information entropy, is frequently used to assess the accuracy of fitting. The accuracy improves as the AIC decreases.

$$AIC \triangleq 2K - 2\ln(L)$$

We used "CIC-IDS2017/Wednesday" to build the GMM model, and we looked at how the AIC changed for various K values. It is obvious that greater precision is caused by a higher K value. But at the other end, a higher computing cost is implied by a bigger K value. Consequently, in following studies, a reduced K value of 5 and its corresponding =12.23 and =2.20 were observed.

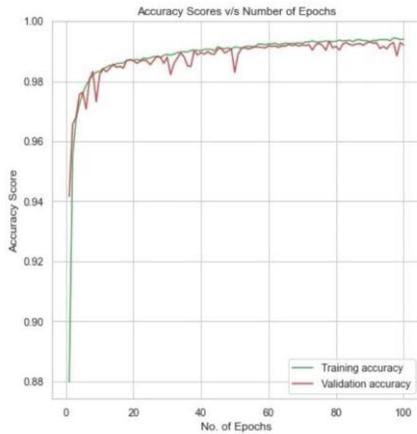
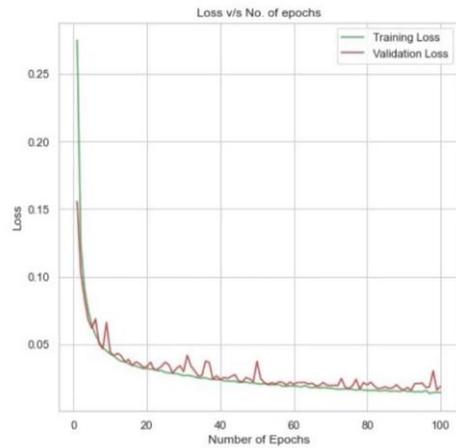


Figure 8 showing accuracy and no of epochs

5.6 BI-LSTM-GMM with Continuous Learning

With GMM, unlearned traffic can be captured and documented. An occurrence that deviates from the mean by three times, or $x3$ or $x+3$, is referred to under the proposed framework as a novel instance. Traffic engineers will record it and label it. Even though an unique occurrence may be malicious traffic or, more likely, a novel sort of legitimate traffic, data engineers must intervene. With in incremental learning phase, collected, tagged fresh instances are returned directly to the BI-LSTM and the GMM. After the loop has been completed, the results are shown in Table 5. The "CIC-IDS2017/Friday" has a significantly high detection accuracy of unknown traffic when compared to Table 4, both in terms of recall and accuracy.

Test Data set	Recall	Precision	Accuracy	AUC	F1
CIC-IDS2017/Wednesday	0.952	0.896	0.943	0.931	0.923

CIC-IDS2017/Friday	0.999	0.978	0.981	0.965	0.989
--------------------	-------	-------	-------	-------	-------

Table 6 Effectiveness of the incremental learning BI-LSTM-GMM.

Remain aware of the modest degradation in the detection of the previous attack, CIC-IDS2017/Friday. The result of progressive learning is this. An progressive training data set will slant an existing model and cause it to shift in the higher dimensional space. In "CIC-DDoS2019," we also used data sets to simulate hypothetical attacks in order to analyze the proposed framework's general operation. The outcomes are outlined. The biggest cause of misclassification is unknown traffic. The pure BI-LSTM, as shown in Table, is unable to appropriately counter unknown threats. The recall indicator drastically decreases as a result of unknown traffic. There is a persistent trend that the BI-LSTM by itself was unable to manage ambiguous traffics effectively. The GMM can, however, filter out new cases that weren't previously learned.

Model	Test Data set	Recall	Precision	Accuracy	AUC	F1
BI-LSTM	CIC-DDoS2019/NetBIOS	0.988	0.998	0.897	0.852	0.947
BI-LSTM-GMM	CIC-IDS2017/Wednesday	0.994	0.735	0.867	0.835	0.846
BI-LSTM-GMM	CIC-DDoS2019/NetBIOS	0.983	0.998	0.981	0.966	0.991
BI-LSTM	CIC-DDoS2019/NTP	0.363	0.994	0.367	0.607	0.562
BI-LSTM-GMM	CIC-IDS2017/Wednesday	0.986	0.751	0.876	0.851	0.932
BI-LSTM-GMM	CIC-DDoS2019/NTP	0.931	0.986	0.923	0.928	0.975
BI-LSTM	CIC-DDoS2019/LDAP	0.391	0.998	0.391	0.567	0.562
BI-LSTM-GMM	CIC-IDS2017/Wednesday	0.998	0.871	0.945	0.908	0.930
BI-LSTM-GMM	CIC-DDoS2019/LDAP	0.957	0.995	0.952	0.947	0.975

Table 7 BI-LSTM and BI-LSTM-GMM efficiency with "CIC-IDS2017/Wednesday" as the old traffic and "CIC-DDoS2019" as the new traffic.

An Open Set Recognition (OSR) difficulty in identifying unknown attacks can be successfully solved by integrating BI-LSTM with GMM. Identified new versions are supplied returned towards the BI-LSTM as well as the GMM enabling incremental learning with the aid of traffic engineers. The revised model can then gently and accurately handle both the new and the old traffic. The CIC-DDoS2019/NetBIOS performance decrease is not severe. Perhaps it has a similar traffic pattern like CIC-IDS2017/Wednesday. Both CIC-DDoS2019/NTP and CIC-DDoS2019/LDAP perform significantly better. However, overall productivity indicators rebound to adequate levels with the assistance of the suggested BI-LSTM-GMM architecture and the incremental learning strategy.

The suggested approach has produced encouraging findings in the identification of unidentified DDoS attacks. However, a number of difficulties necessitate further study to ensure its general application. The test datasets are the first problem. Prior to drawing a firm conclusion, further datasets must be validated. The second problem is that, for the current architecture, there is some trial-and-error involved in determining the BI-LSTM arrangement as well as the amount of kernels inside the Gaussian Mixture model. This vital system parameters' automatic setting will be a profitable area for investigation. The third issue is the continued need for traffic engineers' assistance. A global hub for the collecting of attack traffic that is constantly changing could be one solution to this problem.



Figure 9 visualization of continuous features

5.7 Data preparation

Before handling, data is arranged being an input at this phase. Although noisy, fragmented, or inconsistent input data would be present in the vast majority of cases, preprocessing is essential because it is frequently important to clean up the basic data any significant processing can begin. You could work on numerous data-related tasks while performing these tasks, including feature extraction, data transformation, and data cleaning.

5.8 Analysis of the experiment's results

The five-day log recordings from Monday through Friday were the focus of the experiment's dataset, which was in csv format. We took into account the Friday afternoon log file, which additionally contained two class labels, for experiment analysis. The classification names are DDoS and Benign (Normal) (attack). 225,746 traffic packets were included in the log file's total number of trac packets.

5.8.1 Experimental Assessment for the Log File with DDoS (Attack) and Benign (Normal) Class Labels

The Friday afternoon log file initially has 78 attributes, with the class label serving as the final attribute, making 79 dimensions total. The use of the feature selection procedure, which is based on the computing of mutual information for each of the features in the dataset, served as the initial step in the modeling process. Other characteristics in the set of attributes are dropped in favor of keeping the top 16 attributes. Regression analysis was done on the file system with these 16 attributes in order to execute multiple linear regression calculations for the purposes of mathematical modeling. Following first analysis, the characteristics at measures 1, 5, 6, 7, 9, 11, 13, 35, 36, 53, 54, 55, 56, 64, 66, and 67 are those that are kept. Thus, the analysis is carried out utilizing the reduced dimension log file that contains the aforementioned 16 properties. The linear regression model's absolute percentage mean error is calculated to be 0.2621. As a result, the multiple linear regression model's accuracy is calculated to be 73.79%, or 0.7379.

The residual plot in each of the 16 variables of the CICIDS 2017 database with respect to the Friday afternoon log file is shown in the figure. The fit chart and residual plot for the total multiple linear regression model are shown in Figure. Following the development of the initial model, we removed 10 attributes that are not statistically meaningful and kept the following 6 attributes. Thus, there are now only six qualities instead of the previous nine. The dimensions of the property are 1, 9, 13, 53, 54, and 64. Then, on these statistically significant attributes, the multiple regression evaluation is done out once more. The fit chart, which depicts the actual label as well as anticipated label, is shown in Figure 8. Figure 9 displays the residual plots for these six attributes, and Figure 10 displays the residual plot for such model. As a result, the machine learning model's accuracy using these six criteria is 71.6%, making it abundantly evident that the first model's 16 features are significantly superior.

The fit chart obtained by performing multiple regression analysis on the CICIDS 2017 input data with the top 16 variables allows the measurement through the information gain-based feature selection method is superior to the fit chart obtained by taking into account six attributes of the CICIDS 2017 dataset, as can be observed from the experiment result analysis. This is due to the fact that the discrepancy between the real label and projected label is readily obvious in the subsequent fit chart. As a result, the first model with 16 features is more effective in detecting DDoS attacks.

ANOVA					
	df	SS	MS	F	Significance F
Regression	16	29778.18946	1861.136841	23832.54328	0
Residual	225733	25640.72297	0.113588722		
Total	225749	55418.91243			

	Coefficients	Standard Error	t Stat	P value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	1.480163181E0	1.214964E-3	1.218277377E3	0	1.477781883E0	1.48254448E0	1.477781883E0	1.48254448E0
Destination Port	-7.9586E-06	5.07513E-08	-1.568157955E2	0	-8.05807E-06	-7.85913E-06	-8.05807E-06	-7.85913E-06
Total Length of Fwd Packets	0	0	6.5535E4	#NUM!	0	0	0	0
Total Length of Bwd Packets	3.05845E-06	6.49544E-08	4.770183338E1	#NUM!	2.97114E-06	3.22576E-06	2.97114E-06	3.22576E-06
Fwd Packet Length Max	8.64604E-06	1.1702E-06	7.388505992E0	1.48996E-13	6.35248E-06	1.09396E-05	6.35248E-06	1.09396E-05
Fwd Packet Length Mean	0	0	6.5535E4	#NUM!	0	0	0	0
Bwd Packet Length Max	2.86673E-06	7.00377E-07	4.093126063E0	#NUM!	1.49401E-06	4.23945E-06	1.49401E-06	4.23945E-06
Bwd Packet Length Mean	7.06531E-05	3.26813E-06	2.161880723E1	1.5235E-103	6.42476E-05	7.70585E-05	6.42476E-05	7.70585E-05
Fwd Header Length	0	0	6.5535E4	#NUM!	0	0	0	0
Bwd Header Length	-5.97066E-4	5.71258E-06	-1.045177417E2	#NUM!	-6.08262E-4	-5.85869E-4	-6.08262E-4	-5.85869E-4
Average Packet Size	2.81867E-4	4.07743E-06	6.912847606E1	0	2.73875E-4	2.89858E-4	2.73875E-4	2.89858E-4
Avg Fwd Segment Size	-1.40979E-4	4.89145E-06	-3.053887974E1	2.0805E-204	-1.58966E-4	-1.39792E-4	-1.58966E-4	-1.39792E-4
Avg Bwd Segment Size	0	0	6.5535E4	#NUM!	0	0	0	0
Fwd Header Length	4.1925E-4	7.04326E-06	5.952493054E1	#NUM!	4.05445E-4	4.33054E-4	4.05445E-4	4.33054E-4
Subflow Fwd Bytes	-3.81369E-06	4.82535E-07	-7.903452827E0	2.72494E-15	-4.75944E-06	-2.86793E-06	-4.75944E-06	-2.86793E-06
Subflow Bwd Bytes	0	0	6.5535E4	#NUM!	0	0	0	0
Init_Win_bytes_forward	-1.24761E-05	9.91958E-08	-1.257727911E2	#NUM!	-1.26706E-05	-1.22817E-05	-1.26706E-05	-1.22817E-05

Figure 10 confidence interval and p-values

Concise summary of dataset
df.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 104345 entries, 0 to 104344
Data columns (total 23 columns):
#   Column                Non-Null Count  Dtype
---  ---                ---
0   dt                    104345 non-null  int64
1   switch               104345 non-null  int64
2   src                  104345 non-null  object
3   dst                  104345 non-null  object
4   pktcount             104345 non-null  int64
5   bytecount            104345 non-null  int64
6   dur                  104345 non-null  int64
7   dur_nsec             104345 non-null  int64
8   tot_dur              104345 non-null  float64
9   flows                104345 non-null  int64
10  packetins            104345 non-null  int64
11  pktperflow           104345 non-null  int64
12  byteperflow          104345 non-null  int64
13  pktrate              104345 non-null  int64
14  Pairflow             104345 non-null  int64
15  Protocol             104345 non-null  object
16  port_no              104345 non-null  int64
17  tx_bytes             104345 non-null  int64
18  rx_bytes             104345 non-null  int64
19  tx_kbps              104345 non-null  int64
20  rx_kbps              103839 non-null  float64
21  tot_kbps             103839 non-null  float64
22  label                104345 non-null  int64
dtypes: float64(3), int64(17), object(3)
memory usage: 18.3+ MB
```

Figure 11 concise summary of dataset

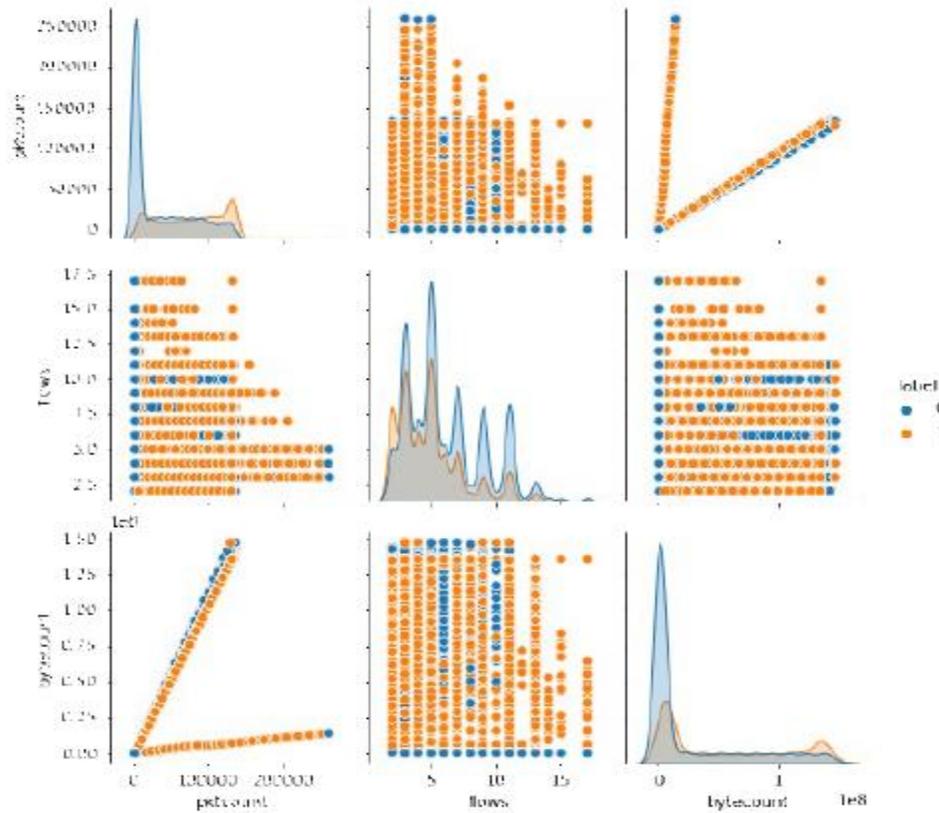


Figure 12 Pair plots of selected features

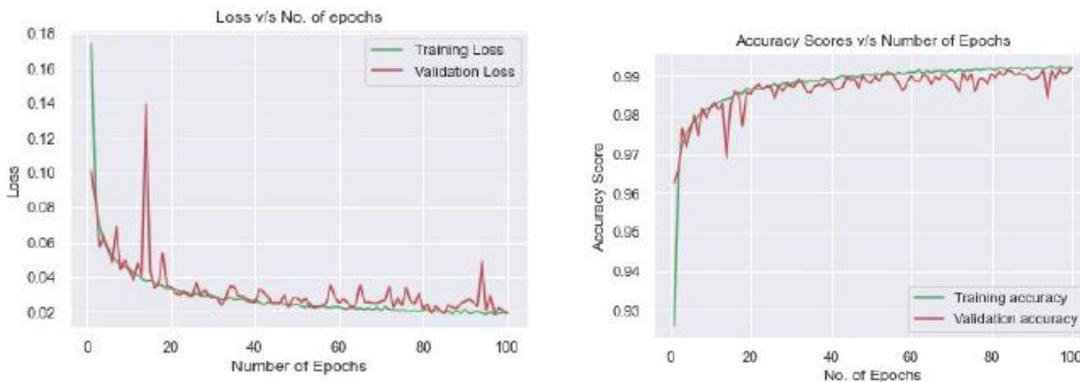


Figure 13 regression approach

5.9 Methodology

This section goes into great detail about our experimental procedure, the datasets we utilized to evaluate our experiment, how we chose the features, and how we went about detecting DDoS. We investigate the possibility of DL methods for SDN environments DDoS attack detection.

5.9.1 Dataset Description

The caliber of the training datasets is crucial to the development of a successful anomaly detection-based IDS. However, a major issue is the lack of readily available high-quality databases for malware detection as well as network traffic in general. Numerous high-quality datasets from several application domains, including translation software and computer vision, are accessible to the public online.

This publication is licensed under Creative Commons Attribution CC BY.

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13004>

www.ijssrp.org

the other hand, network data may contain private customer data, and it is prohibited from making such information public. As a result, the performance of the classifier models is significantly changed by the fact that the majority of different datasets for vulnerability scanning are anonymized payload data. Furthermore, the vast majority of datasets are out-of-date, have low traffic variety, and are useless for current attack detection methods. Since network traffic is fluid and businesses might constantly alter the used protocols, using incompatible datasets can result in a rigid model and a contradiction between both the models and the new technology. For instance, until 2010, the most well-known video companies, such as YouTube and Netflix, used the Flash as well as Silverlight protocols extensively. The HTML5 protocol has taken their place at the moment. As a result, a number of research projects have been suggested to simulate new databases for the research. One of the important centers in the world, the Canadian Institute for Cybersecurity (UNB), has helped to provide trustworthy and validated datasets. Utilizing network typologies that resemble the actual network data centers, the UNB developed intrinsic datasets that are accessible to the general public. Although the statistics created by UNB are widely used in many SDNs research projects, they were not created using SDNs but rather traditional or conventional IP networks. The Internet protocol network and SDN, however, operate very differently, as was previously covered in section II. In addition, the network becomes vulnerable to new attack vectors that are distinct from those observed in conventional IP networks as a result of the decoupling of the management plane from the routing protocol. Detaching the SDN controller from the connected devices, for instance, raises the likelihood that an attacker may launch different kinds of attacks against data communications systems or the SDN controller itself. Due to the attacker's authorized connection to the target server, these assaults are difficult to identify. Therefore, utilizing an inappropriate dataset can trick the detection algorithm and lead to a significant number of false alarms. Along with the above mentioned issue, to the best of our knowledge, there is currently no publicly accessible dataset for assessing and testing IDS in the context of SDNs. The majority of the work done on anomaly identification in SDNs has utilized typical datasets created using the traditional network. We utilized the InSDN dataset to examine the effectiveness of the suggested DL models to address each of these issues. This work additionally uses the CICIDS2017 and CICIDS2018 databases for additional examination. The following is a discussion of the three separate datasets:

InSDN: The InSDN dataset takes into account the updated SDN network structure. It was made with the aid of four virtual servers (VMs). The first VM served as an SDN controller, or ONOS, and the second one served as just an Open Virtual Switches (OVS). Kali Linux, the third virtual system, served as the invader machine, and Metasploitable2, among other venerable programs, was loaded on the last virtual machine. A mininet emulator program was also used to construct four internal virtual machines to impersonate both legitimate users and some malicious hosts. A number of attack classes from both within and outside the SDN network were thus simulated by the dataset. Several application services, including HTTPS, DNS, SSH, FTP, email, and others, were reflected in the usual flow in the InSDN dataset. Some internal hosts are permitted to access the Internet for this reason and gather intrinsic traffic from many websites, like YouTube, Facebook, SKYPE, and others, to simulate real-world traffic. The InSDN dataset has a total of 361; 317 occurrences, with samples for the normal and attack classes having sizes of 69; 423 and 291; 894, correspondingly.

CICIDS2017: The dataset included five days' worth of network traffic that was created between Monday, July 3 and Friday, July 7, 2017. A network connectivity topology with several devices, including router, ports, firewalls, and various operating systems platforms, was used to develop the CICIDS2017. The usual flow in the datasets was created by the authors using the notion of profiles. The data set was accessible to the general public online in PCAP and CSV formats. The overall number of instances in the CICIDS2017 is 2,830,743, and the size of the attacks made up 19.7% of the entire data.

CICIDS2018: To create a fresh realistic database in a scalable way, the authors expanded the CICIDS2017 project. A total of 16,233,002 instances from the CICIDS2018 footprints were collected in 10 days, and the size of the attacks accounted for 17% of the overall data. The authors created the normal and attack classes using the same concept of profiles, but they did so using the Amazon Web Services

(AWS) infrastructure rather than the outdated network infrastructure. With much more over 80 network flow characteristics in the form of CSV files, the 3 dataset features were created through using CIC Flow Meter program. Different attack classes can be found within the three datasets. Other attack classes are not included in our study because this work exclusively focuses on DDoS attacks. We take all labels classified under the regular and DDoS classifications because the InSDN sample is considerably smaller than other datasets. However, just the Friday afternoon (July 7) data from the CICIDS2017 dataset is chosen for our studies, whereas the CICIDS2018 dataset uses the Wednesday (February 21) file.

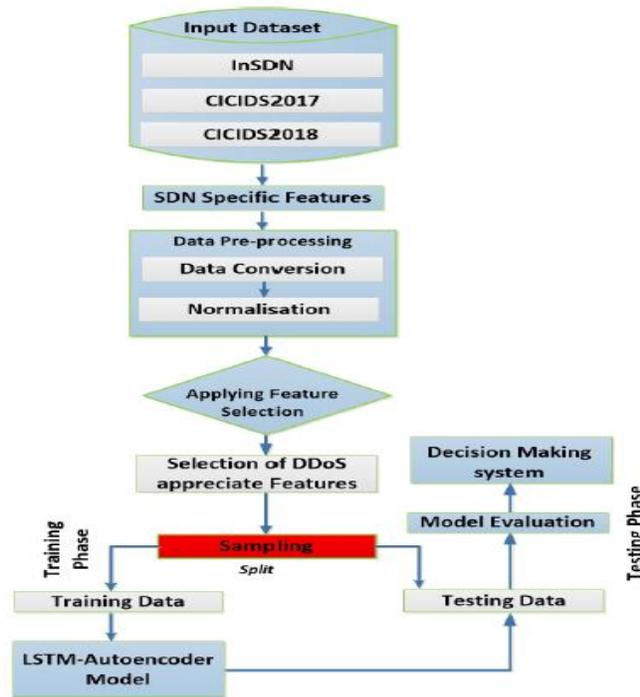


Figure 14 The flow diagram of the DDoS Detection mode

5.9.2 Features Particular to SDN

In this part, we'll go over a few typical features that apply to SDN networks. The application software CICFlowMeter tool was used to obtain the characteristics of the three datasets. And over 84 flow features are generated by the CICFlowMeter. Several of these capabilities, nevertheless, are extractable within the SDN context. Utilizing Open Flow calls towards the SDN switches, only statistical features in SDN may be collected from the SDN controller. We employ the same architecture to achieve this goal in order to locate the sub-features, which can be quickly obtained either directly from the SDN controller source or by competitive analysis of the flow statistics. For instance, we can manually compute various attributes like standard deviation, minimum and maximum values, and mean of flow features. The table shows the features in the InSDN dataset mapped to the derived features from the SDN environment. Additionally, Table displays extra functionality that can be estimated from the set of 50 variables that were used for their research goal. Only a portion of the 48 features are utilized in this post because the source and destination Intrusion detection system are not used in our research. The two characteristics are interchangeable between networks, and an attacker can also employ a valid user's IP address.

As a result, utilizing these features to train a classifier model can bias the model toward particular socket features, leading to an overfitting issue. The obtained SDN features are shown in Table.

	switch	flows	Pairflow	port_no
0	1	3	0	3
1	1	2	0	4
2	1	3	0	1
3	1	3	0	2
4	1	3	0	3
5	1	3	0	1
6	1	3	0	4
7	1	3	0	1
8	1	3	0	2
9	1	3	0	4

Table8 Discrete numeric features

5.9.3 Data Preparation

To create an accurate detection system, data preprocessing must be done on the input data before model training. The original data cannot be used to create or train ML/DL models, hence the following procedures are taken to make the input dataset intelligible and readable:

- Many infinite & missing (nan) values can be found in the CICIDS2017 as well as CICIDS2018 datasets. Data cleaning is the first step in creating an accurate model. In actuality, there are two different approaches that may be used to manage the missing and infinite values in a given column. We have two options: either we eliminate these data or we compute the mean and then add the results. Because the two datasets in this study have sufficient sample sizes, we can eliminate every null and infinity values without significantly affecting the model's effectiveness.
- Because ML/DL approaches are built on mathematical equations, categorical data must be transformed into numerical values in order to preserve the integrity of the equations. The designated column's content is changed to a number using the OneHotEncoder class. These experiments categorize DDoS or regular attacks using simply binary classification. As a result, DDoS attacks are coded as 1, whereas regular traffic takes the number of 0.
- The varying sizes of the dataset's characteristics can interfere with the DL model in several ways. For instance, some features or columns in a dataset may have a narrow range of values, whereas other columns may accept values that are higher than those in other columns. Utilizing feature scaling, we restrict the variety of variables so that the common ground may be used for comparison. Scaling can be done in two main ways: normalization and standardization. The standardization transforms the input variables into a new scale with a zero mean (μ) and a one standard deviation (σ) whereas the normalization adjusts the attributes between 0 and 1. For all datasets in this study, we used the standardization approach in accordance with Eq. 1.

$$x(i) = \frac{x(i) - \mu(x(i))}{\sigma(x(i))}$$

- Using test train split from the sklearn module, we divided the dataset into a 75:25 ratio, which implies that 70percent of total of the dataset was used for training and the remaining 30% was set aside for the model test to see how well we could predict it. Graph depicts the total number of testing and training samples for all datasets.

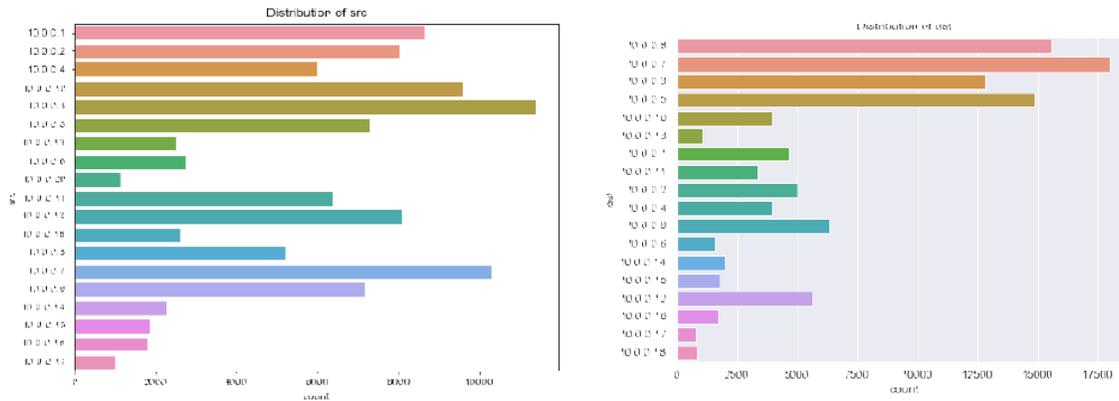


Figure 15 Showing frequency distribution

5.9.4 Deep Learning Classifier

Recently, DL methods have become more and more popular for a wide range of applications, including natural language processing, computer vision, and language translation. Multiple hidden layers are used in DL approaches to handle increasingly complex issues that are challenging to solve with a linear function. The traditional approaches frequently involve extensive feature engineering, whereas the DL methods have the ability to automatically extract the features from input data without human intervention, addressing the limitations of standard ML algorithms. When dealing with data points with high levels of nonlinearity, DL performs noticeably well. As a result, it is anticipated to enhance cybersecurity trends like IDSs. This section outlines the DL strategy for addressing the issue of DDoS attacks in SDN networks.

5.10 The suggested DL Model

The suggested deep learning model is based on our prior model, DDoSnet, which combines autoencoder and recurrent neural networks (RNN). In compared to conventional ML algorithms, the suggested model successfully recognized DDoS attacks with outstanding performance and few false alarms. To get around the issue of vanishing gradient, we improve model performance in this article by employing LSTM, a particular sort of RNN, rather than simple RNN. A neural network's weight values are updated via gradients. However, as the gradient value backpropagates through time, it does not significantly contribute to learning when it is exceedingly small. Small gradient modifications hurt the RNN, particularly in earlier layers. As a result, it cannot retain the information for lengthy sequences.

$$\text{New weight} = \text{weight} - \text{learning rate} * \text{gradient}$$

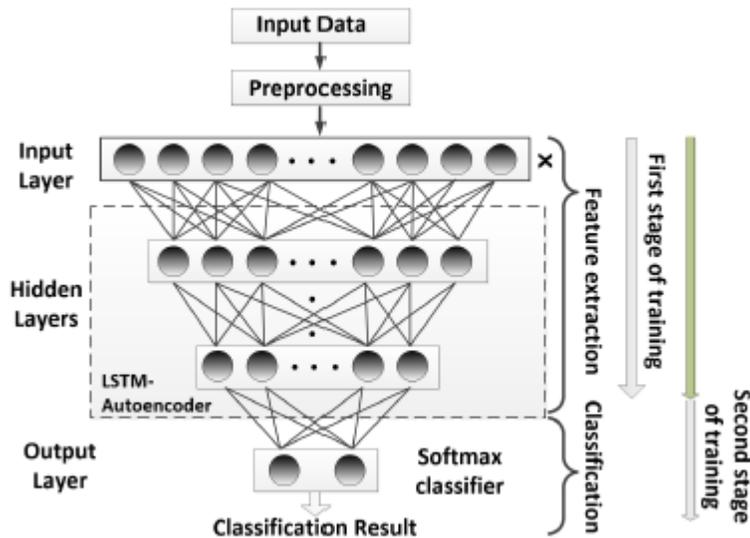


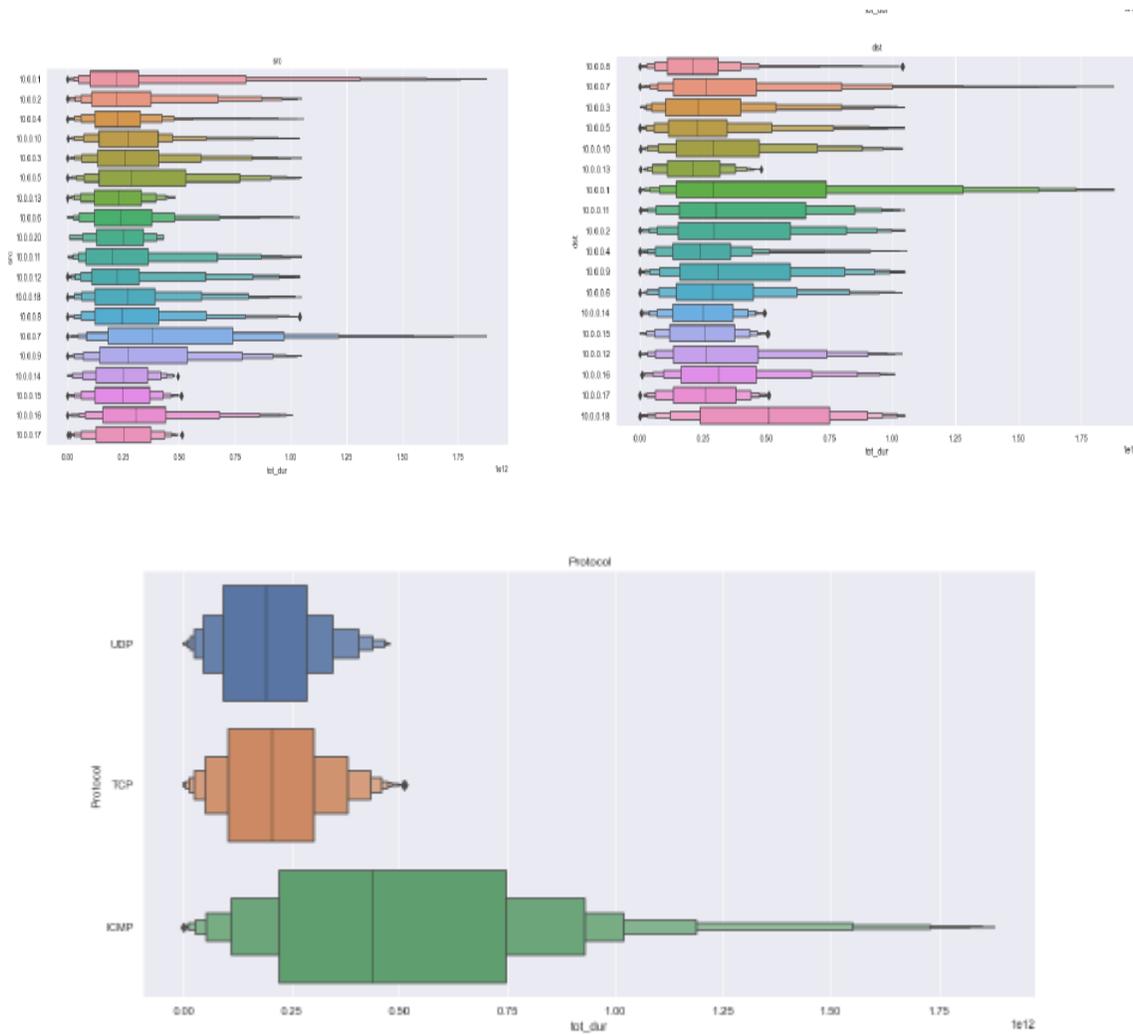
Figure 16 DL method structure

The model has two phases: the first employs unsupervised learning for the basic phase, while the second uses supervised learning for the fine-tuning phase. Without any labels, unsupervised learning is used in the first stage to identify distinguishing characteristics in the raw data. The autoencoder converts representational information from its native space into a different one. To enhance model performance, an LSTM layer is added in place of each dense layer in the original autoencoder. As temporal correlations of input data creates sequential traffic, the main concept driving the use of LSTM in DL method is the character of network traffic. As a result, using such techniques to develop DL models will remove loss because the output of each layer is independent of both its input and output history.

Setting for the experiment: Due to the absence of theoretical support, tuning hyper-parameter values is one of the major obstacles in DL training. Consequently, there is no magic formula for selecting the ideal hyper-parameter values. To determine the optimal amount of network layers, neurons in each layer, iterations, batch size, etc., numerous tests as well as variations based on trial and error have been carried out. We examine the effectiveness of the DL model by evaluating several values of learning rate (η), i.e. 0:001, 0:01, and 0:1, in order to show the optimal values of hyperparameters. We analyze the model's performance for every value of for several other parameters. Whenever the amount of hidden layers is equivalent to three, the classifier accuracy is at its best. Repeating trials numerous times revealed that using the hyper-parameters listed in Table VI led to the best performance for the supplied data. Through one dataset to another, hyper-parameter values can be altered. Since the fluctuation in the findings can be disregarded, we utilized the very same hyper-parameters as listed in Table for all samples to keep things simple.

The 3 hidden layers at the encoder phase successively lower the input dimensions to 32, 16 and 8 pixels. Compressed input data is the phase's end result after encoding. With 8, 16, and 32 channels, respectively, the decoded phase is performed in the opposite sequence of the encoded phase. The hierarchy features are collected from the unlabeled data after the model has been built and the best weight and bias values have been determined. In the second step, labeled data is used for fine-tuning to optimize the network and train the top layers of the network. Finally, by including the softmax activation function at the output nodes, the model's output is obtained. For each output class, the softmax layer produces an output in the region of (0, 1), with a probability of 1 for all output classes. We only looked at samples from traditional and DDoS attacks in this study. Therefore, binary categorization assigns a value of 0 to legitimate attacks and a digit of 1 to malicious or DDoS attacks. The softmax layer uses categorical cross-entropy,

and the Adam optimiser is utilized to iteratively update the network weights. 100 periods of history and 128 batches were used to train the model.



5.10.1 Feature identification algorithm

This section makes use of feature selection algorithms to identify the pertinent DDoS attack attributes in each dataset independently. The feature selection algorithms only consider the features that are most pertinent to each class label, disregarding any redundant or unimportant features. In order to create a classifier that is lightweight and resistant to overfitting, it may be helpful to train the detection model using a limited set of features. Additionally, the lightweight model can be quickly implemented in a network platform without having a substantial negative impact on system resources [8]. Although the approach to determining the most important features varies depending on the feature selection algorithm, we used two alternative techniques: Random Forest (RF) and Information Gain.

IG: One of the most widely used algorithms to determine total amount each variable affects the choice is Information Gain (IG). It falls under the genre of filter methods and uses the idea of information theory to determine the significance of features. Shannon entropy is a frequently used indicator of information. The entropy assesses each feature's uncertainty in terms of how important it is for classifying data. The following equation can be used to determine the entropy for a certain attack class $H(C)$:

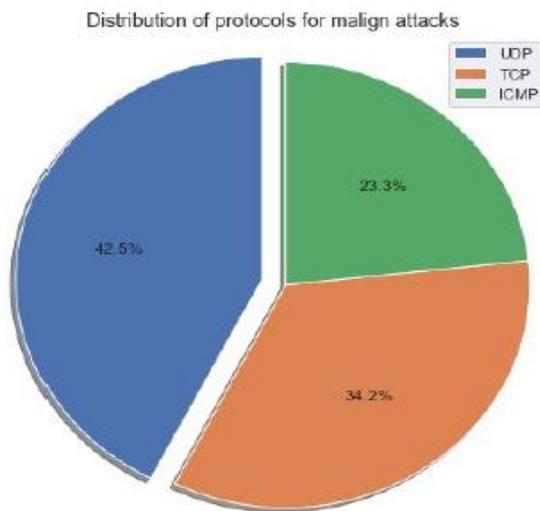
$$H(C) = - \sum_{i=0}^n \rho(i) \log \rho(i)$$

By calculating the information weight of every feature and removing the extraneous information for each class label, the IG employed a straightforward attribute rank. A feature with a tiny information gain also has a small impact on the categorization of the data and can be disregarded without harming the model's performance. The entropy reduction is calculated using the following equation to determine the IG for every single given input F in the dataset:

$$IG(C;F) = H(C) - H(C|F)$$

where $IG(C;F)$ is the feature F's information gain, taking taking C's class characteristics into consideration, and $H(C|F)$ is C's average conditional entropy.

Random Forest: Has an excellent predictive performance and is less prone to overfitting, and is frequently employed to address the issue with individual Decision Trees. It falls under the umbrella of Embedded methods, a category that mixes filter and wrapper methods. The main goal of the RF is to quantify the contribution of each feature to the prediction. This is a crucial variable if change is substantial. In a similar vein, a modest change indicates that the feature doesn't offer much insight. The RF is a mix of thousands of built-in decision trees based on random dataset observation and random separating characteristics. Because the trees are de-correlated, the amount of features can vary from one to the next, protecting the model from overfitting. Each variable's weight is determined by the RF in one of two ways. The basis for the first metric is the reduction in Gini distortion when a variable is selected to separate a node. The second metric looks at how much accuracy is lost when the variable is taken out.

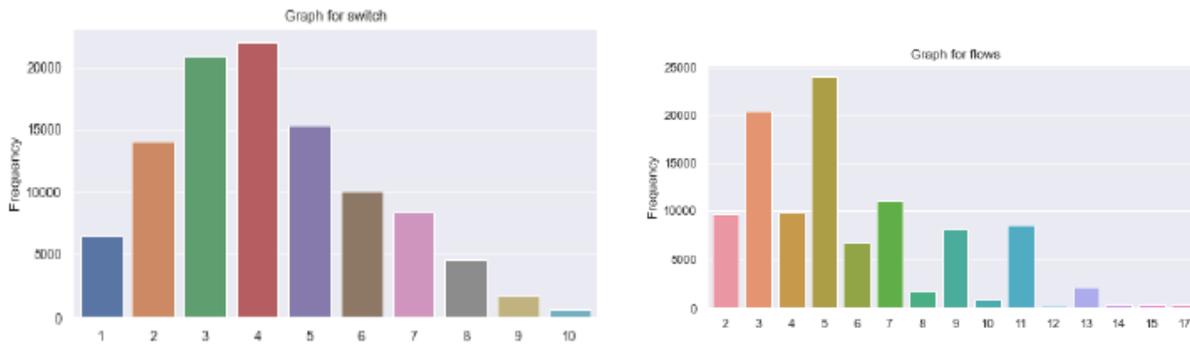


5.11 Experimental Findings

The experimental findings of the suggested strategy are covered in this section. The percentages of Precision, Recall, as well as f1-score for samples with various subsets of features are shown in Table IX. When 48 subfeatures were utilized in the training phase, the model produced the best results; however, when only 10 subfeatures were used for the RF and IG algorithms, the model's performance somewhat decreased. The performance reduction can be disregarded, allowing us to create a lightweight model with fewer features. Making a model that is lightweight will use fewer resources and render it better suited for the SDN framework. Additionally, it should be noted that the IG algorithm performs somewhat better overall than the RF approach. We further verify our assertion and show how using different datasets generated in various contexts can dramatically reduce the model's performance.

The proposed DL technique is trained using the CICIDS2017 dataset during the training phase, but its performance is evaluated using the test portions of the InSDN and CICIDS2018 databases. The model is initially trained and tested using all 48 subfeatures, and only the top 10 RF and IF features, which were previously chosen in light of the CICIDS2017 dataset, are then used. The results demonstrate that the measurement methods are extremely greater and very close to those presented in Table if we test performance of the model on the CICIDS2018 dataset using a subset of 48 features. On the InSDN dataset, performance has, however, drastically decreased. The stated accuracy is 99.61% for the CICIDS2018 dataset and 55.18% for the InSDN dataset, respectively. Additionally, both datasets' performance is greatly decreased when the model has been trained on just 10 features, although the decline for InSDN is much worse than it is for CICIDS2018. For the InSDN dataset, the model was unable to detect any DDoS entities. The overall accuracy for the RF technique is 88.21% and 36.22% for the CICIDS2018 and InSDN datasets, respectively, whereas the overall accuracy for the IG approach is 89.09% and 32.94%. We display the model's execution time for all dataset, to further assess the model's performance and demonstrate the impact of the component selection procedure. The graph demonstrates that the model's execution time for CICIDS2018 is very high while it is minimal for InSDN.

This is as a result of the unusually large sample sizes in CICIDS2018 when contrasted to other datasets. Once all 48 subfeatures are included, it is also observed that the model took a long time to train, although the execution time was very short for RF but significantly longer for IG.



CHAPTER 6

CONCLUSIONS

In this work, a Gaussian Mixture Model and Deep Learning (DL) are used to demonstrate how DDoS attacks can be detected (GMM). The suggested system uses GMM, incremental learning, and bi-directional prolonged short-term memory (BI-LSTM) to address the Open Set Recognition (OSR) issue in DDoS detection. The Bi-LSTM has proven to be an effective method for differentiating between

malicious and lawful traffic samples taken from either the dispersion of the training data. The GMM has proven to be a useful tool for differentiating between untrained samples and trained cases. The GMM can record unknown traffic, label it with the help of data engineers, and afterwards feed that labeled information back to the BI-LSTM and GMM for learning algorithms. The upgraded model can accurately and gracefully manage both the new and the old traffic. A number of tests using the data sets CIC-IDS2017 and CIC-DDoS2019 have verified the viability and efficacy of the proposed framework.

BI-LSTM is completely capable of carrying out the tasks for which it has been trained, such as identifying recognized DDoS attacks. However, the system performance suffers greatly when faced with innovative attacks. The recall decreases for Dataset CIC-IDS2017/Wednesday and Friday from 99.8 to 41.2 percent. GMM allows for the capturing of unknown traffic, which traffic engineers can later annotate. For Dataset CIC-IDS2017/Wednesday and Friday, incremental learning then raises detection rates to 95.3 percent and 99.8 percent, respectively. Some research topics need more attention if the suggested BI-LSTM-GMM architecture is to be used to its full potential. These directions include validation on other databases, auto configuration of BI-LSTM as well as GMM, as well as the removal of involvement transportation systems.

It is crucial to identify assaults that result in Cloud services being unavailable since DDOS attack detection has increased in frequency in dispersed environments like the cloud. Machine learning models have the potential to train and test attack detection datasets in order to recognize such attacks. As an alternative, we can employ the regression analysis method by using multiple linear regression analysis, one of its crucial forms. The goal of this study's research is to create a machine learning model that combines feature selection with regression analysis and information acquisition. The dataset taken into consideration for the experimental study was from the well-known CICIDS 2017 dataset. In particular, the Benign, Bot, and DDoS classes in the Friday morning and afternoon logfile are taken into account. This ensemble model for the Friday morning dataset has been seen to attain a predictive performance of 97.86%. Similar results were obtained for the Friday afternoon log file, where the prediction accuracy for 16 characteristics derived from feature selection based on information gain and ML model based on regression analysis was 73.79%. Thus, this study set the road for demonstrating the value of regression analysis in creating ML models. It also illustrates certain crucial visualizations, including such residual plots and fit charts, which demonstrate the significance of the model and demonstrate its applicability for prediction. In this work, we have restricted our analysis to one day's worth of log files; however, in the future, this research may be expanded to take into account all five days' worth of trac log files and produce a prevailing opinion machine learning model.

The complexity of the suggested classifier rises during intrusion detection network system training utilizing a high-dimensional dataset, resulting in long training and classification times. To increase classification accuracy and avoid the curse of excessive computational complexity, pre-processing feature selection approaches are crucial in selecting the significant characteristics from the original dataset. The objective of this research is to eliminate redundant or pointless features while minimizing any negative effects on classification accuracy. Using two widely used feature selection techniques, IG and RF, we have chosen 10 features from the 48 available features. DDoS attacks were employed as a case study, and a redesigned DL model is developed based on LSTM Autoencoder was utilized for experimental reasons. Our method offers a high detection accuracy and a quicker, more effective way to create the model. To determine how the used dataset might influence the effectiveness of the SDN controller, we subsequently tested the trained model on the SDN controller's performance. The outcomes demonstrated that the suggested strategy did not impair network performance. We will examine fresh assault categories for the test evaluation in our next work. Additionally, we intend to test our suggested model on an actual SDN network in order to better understand how well this IDS can respond to an incursion in real-time.

References

- Ahanger, T. A. (2017). An effective approach of detecting DDoS using artificial neural networks. *2017 International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET)*, 707–711.
- Alghazzawi, D., Bamasag, O., Ullah, H., & Asghar, M. Z. (2021). Efficient detection of DDoS attacks using a hybrid deep learning model with improved feature selection. *Applied Sciences*, *11*(24), 11634.
- Baig, Z. A., Sait, S. M., & Shaheen, A. (2013). GMDH-based networks for intelligent intrusion detection. *Engineering Applications of Artificial Intelligence*, *26*(7), 1731–1740.
- Bendale, A., & Boulton, T. E. (2016). Towards open set deep networks. *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, 1563–1572.
- Bhaya, W., & Manaa, M. E. (2014). A proactive DDoS attack detection approach using data mining cluster analysis. *Journal of Next Generation Information Technology*, *5*(4), 36.
- Blomstrom, M., & Kokko, A. (1998). MNCs and spillovers. *Journal of Economic Surveys*, *12*, 97–110.
- Cheng, J., Yin, J., Liu, Y., Cai, Z., & Wu, C. (2009). DDoS attack detection using IP address feature interaction. *2009 International Conference on Intelligent Networking and Collaborative Systems*, 113–118.
- Fadlil, A., Riadi, I., & Aji, S. (2017). Review of detection DDOS attack detection using naive bayes classifier for network forensics. *Bulletin of Electrical Engineering and Informatics*, *6*(2), 140–148.
- Geng, C., Huang, S., & Chen, S. (2020). Recent advances in open set recognition: A survey. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, *43*(10), 3614–3631.
- Gupta, A. (2018a). *Distributed Denial of Service Attack Detection Using a Machine Learning Approach*. Graduate Studies.
- Gupta, A. (2018b). *Distributed Denial of Service Attack Detection Using a Machine Learning Approach*. Graduate Studies.
- He, Z., Zhang, T., & Lee, R. B. (2017). Machine learning based DDoS attack detection from source side in cloud. *2017 IEEE 4th International Conference on Cyber Security and Cloud Computing (CSCloud)*, 114–120.
- Hoque, N., Bhattacharyya, D. K., & Kalita, J. K. (2015a). Botnet in DDoS attacks: Trends and challenges. *IEEE Communications Surveys & Tutorials*, *17*(4), 2242–2270.
- Hoque, N., Bhattacharyya, D. K., & Kalita, J. K. (2015b). Botnet in DDoS attacks: Trends and challenges. *IEEE Communications Surveys & Tutorials*, *17*(4), 2242–2270.
- Jonker, M., Sperotto, A., & Pras, A. (2020). DDoS Mitigation: A measurement-based approach. *NOMS 2020-2020 IEEE/IFIP Network Operations and Management Symposium*, 1–6.

- Li, Y., & Lu, Y. (2019). LSTM-BA: DDoS detection approach combining LSTM and Bayes. *2019 Seventh International Conference on Advanced Cloud and Big Data (CBD)*, 180–185.
- Mahjabin, T., Xiao, Y., Sun, G., & Jiang, W. (2017). A survey of distributed denial-of-service attack, prevention, and mitigation techniques. *International Journal of Distributed Sensor Networks*, 13(12), 1550147717741463.
- Osanaïye, O., Cai, H., Choo, K.-K. R., Dehghantanha, A., Xu, Z., & Dlodlo, M. (2016). Ensemble-based multi-filter feature selection method for DDoS detection in cloud computing. *EURASIP Journal on Wireless Communications and Networking*, 2016(1), 1–10.
- Peng, J., Choo, K.-K. R., & Ashman, H. (2016). Bit-level n-gram based forensic authorship analysis on social media: Identifying individuals from linguistic profiles. *Journal of Network and Computer Applications*, 70, 171–182.
- Pouyanfar, S., Sadiq, S., Yan, Y., Tian, H., Tao, Y., Reyes, M. P., Shyu, M.-L., Chen, S.-C., & Iyengar, S. S. (2018). A survey on deep learning: Algorithms, techniques, and applications. *ACM Computing Surveys (CSUR)*, 51(5), 1–36.
- Pouyanfar, S., Yang, Y., Chen, S.-C., Shyu, M.-L., & Iyengar, S. S. (2018). Multimedia big data analytics: A survey. *ACM Computing Surveys (CSUR)*, 51(1), 1–34.
- Ranjan, R., & Sahoo, G. (2014). A new clustering approach for anomaly intrusion detection. *ArXiv Preprint ArXiv:1404.2772*.
- Rudd, E. M., Jain, L. P., Scheirer, W. J., & Boulton, T. E. (2017). The extreme value machine. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 40(3), 762–768.
- Sabeel, U., Heydari, S. S., Mohanka, H., Bendhaou, Y., Elgazzar, K., & El-Khatib, K. (2019). Evaluation of deep learning in detecting unknown network attacks. *2019 International Conference on Smart Applications, Communications and Networking (SmartNets)*, 1–6.
- Sarker, I. H., Kayes, A. S. M., Badsha, S., Alqahtani, H., Watters, P., & Ng, A. (2020). Cybersecurity data science: An overview from machine learning perspective. *Journal of Big Data*, 7(1), 1–29.
- Shieh, C.-S., Lin, W.-W., Nguyen, T.-T., Chen, C.-H., Horng, M.-F., & Miu, D. (2021a). Detection of unknown ddos attacks with deep learning and gaussian mixture model. *Applied Sciences*, 11(11), 5213.
- Shieh, C.-S., Lin, W.-W., Nguyen, T.-T., Chen, C.-H., Horng, M.-F., & Miu, D. (2021b). Detection of unknown ddos attacks with deep learning and gaussian mixture model. *Applied Sciences*, 11(11), 5213.
- Shieh, C.-S., Lin, W.-W., Nguyen, T.-T., Chen, C.-H., Horng, M.-F., & Miu, D. (2021c). Detection of unknown ddos attacks with deep learning and gaussian mixture model. *Applied Sciences*, 11(11), 5213.
- Siddiqi, M. A., & Pak, W. (2020). Optimizing filter-based feature selection method flow for intrusion detection system. *Electronics*, 9(12), 2114.

Tavallae, M., Bagheri, E., Lu, W., & Ghorbani, A. A. (2009). A detailed analysis of the KDD CUP 99 data set. *2009 IEEE*

Symposium on Computational Intelligence for Security and Defense Applications, 1–6.

Vu, N. H., Choi, Y., & Choi, M. (2008). DDoS attack detection using K-Nearest Neighbor classifier method. *Proceedings of the 4th IASTED International Conference on Telehealth/Assistive Technologies. Baltimore, Maryland, USA*, 248–253.

Wang, C., Zheng, J., & Li, X. (2017). Research on DDoS attacks detection based on RDF-SVM. *2017 10th International Conference on Intelligent Computation Technology and Automation (ICICTA)*, 161–165.

Yong, B., Wei, W., Li, K.-C., Shen, J., Zhou, Q., Wozniak, M., Połap, D., & Damaševičius, R. (2022). Ensemble machine learning approaches for webshell detection in Internet of things environments. *Transactions on Emerging Telecommunications Technologies*, 33(6), e4085.

Yulita, I. N., Fanany, M. I., & Arymuthy, A. M. (2017). Bi-directional long short-term memory using quantized data of deep belief networks for sleep stage classification. *Procedia Computer Science*, 116, 530–538.



Author short profile

SHEIKH SAZIB

Major: computer science and applications

Student number:GJ201963120066

School of Computer and Communications Engineering,

Changsha University of Science and Technology

Changsha, Hunan, China.410114

E-mail : mdsazibsheikh380@gmail.com

Impact of parental involvement in Sunday school ministry on spiritual formation of teenagers.

A case of Africa Inland Church Kapropita District

Irine jepkurui barkutwo*, Dr. Joash Amwango**, Dr. Mercy Mauki**

* Pastor, Africa inland Church Eldoret Fellowship

**Department of religious studies, Africa International University

** Department of education, Africa International University

DOI: 10.29322/IJSRP.12.10.2022.p13005

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13005>

Paper Received Date: 20th August 2022

Paper Acceptance Date: 24th September 2022

Paper Publication Date: 6th October 2022

Abstract-

The study sought to determine the extent of parental involvement in Sunday school ministry impact on the spiritual formation of teenagers in Africa inland church Kapropita district church council. The target population was 349 participants. The study used mixed methods with a sample size of 181 using Yaro Yamane formulae. The researcher used simple random sampling to obtain participants who filled the questionnaires, and focus group to complement quantitative research methods. The analysis was conducted using (SPSS) version 23 and QDA miner lite version 2.0 8.

The findings indicated a strong relationship between parental involvement in Sunday school ministry and the spiritual formation of the Teenagers. There is a need for the parents to enhance how they instill discipline, prayer, and impact knowledge onto their teenagers as well as the financial support as the majority believes that they don't have to offer voluntary financial support to their children.

Index Terms- Parental Involvement, Sunday school Ministry and Spiritual formation.

I. INTRODUCTION

Sunday School is the ground where Christian moral values are communicated to the children especially when the ministry is effective. However, spiritual guides and mentors come alongside them in their journey of spiritual formation(Chiroma, 2015, p. 72).Wisdom from the book of proverbs strongly states that "train a child in the way he should go, and when he is old, he will not turn from it" (Proverbs 22:6). Teenagers are challenged to develop critical thinking and analytical skills as they grow up, and effective Sunday school ministry needs to re-shape their new relationship with Jesus and continue talking about how the relationship is transformational in its very essence. As a result, they continued celebrating how that faith had driven and focused their whole rounded spiritual growth.

Sunday schools in A.I.C Kenya are conducted for children and young people aged between 3 years and 21 years. The Bible teachings given are intended to train the current generation for Christ. It is also supposed to be conducted in different ways for different age groups. Children are supposed to be grouped according to their ages and taught by trained teachers who understand their feelings and interests (Mumo, 2013). Many families, institutions, and churches," have realized the fruitful impact of effective Sunday school training" (Brewster, 2015). In Kapropita D.C.C, some teenagers from Christian families have exhibited negative lifestyles such as stealing, use of illicit drugs, lying, killing, teenage pregnancies, and dropping out of school.

In Kapropita District Church, most of the teenagers both boys and girls rarely attend church services. Pastor Francis Chesire (personal communication, December 5, 2019) comments that" in almost every Sunday school in Kapropita D.C.C, the population is going down when children reach teenage years". He continues to say that" many don't show interest in the church and its involvement" which raises a concern about what makes them draw from the church activities.

II. THEORETICAL REVIEW

One theory that heavily influenced this study is the faith development theory. This theory was developed by James Fowler (Andrade, 2014). Fowler's theory states that" individuals grow spiritually in stages"(Andrade, 2014). Fowler's faith development theory is applied to this study especially in stages three and four where it talks about children showing interest in learning new things and as a result developing a personal identity. And stage four enables one to gain understanding, Stage 3 – "Synthetic-Conventional" Faith (Ages 12 to Adult) and Stage 4 – "Individuate-Reflective Faith" (Ages Mid-Twenties to Late Thirties). Teenagers need to be introduced to this friend who is closer than a brother which results in an understanding of deeper Christian truths.

2.1 Literature Review

2.1.1 Parental Involvement

Parenting is the process of promoting and supporting the

physical, emotional, social, and intellectual development of a child from infancy to adulthood. Parenting refers to the intricacies of raising a child aside from the biological relationship" (Brooks 2013, 45). The quality of parents' and children's relationships is one of the most powerful factors in child growth and development. Early experiences influence the later development of children. The findings according to Lara and Saracostti (2019, p. 1). "Show that there are differences in children's academic achievement between the parental involvement profiles, indicating children whose parents have a low involvement have lower academic achievement". The involvement of parents and church in Sunday school ministry can help the teenagers become young people who are emotionally and spiritually mature for their age.

Parents need to recognize that God has called them to be His agents. Parents must," guide their children to understand life, themselves, and their needs from a biblical perspective" (Deut. 6:6-7) (Tripp, 1995). Not only to live it for the Sunday school teachers to do it.

Stewart attests to the fact that "Children who are fortunate enough to grow up in a family where Christ is known, loved, and served came to know about God through their parents, even before they are old enough to fully understand all the beliefs their parents hold" (Stewart, 2013). This is true because family life offers an excellent opportunity for teaching, especially Christian education. Taking children to Sunday school and Church services is necessary although the trust and love which a Christ-centered family displays towards God provide a natural setting for spiritual learning.

An effective mentor is a good role model who can strengthen the learning experience by being approachable, planning a variety of different learning experiences, and maximizing learning opportunities" (Brooker et al. 2007, 113). A good role model is always positive, calm, and confident in themselves. Role models demonstrate their commitment to the desired goal and are willing to invest the necessary time and effort to achieve success.

Follow-up programs such efforts, "show teenage participants that an adult cares and is not satisfied with just focusing on program time and activities" (Delgado 2012, 140). Teaching teenagers can be beneficial to both children and their parents. As a parent gets to understand the areas he or she needs to concentrate on. As the subject matter taught, all of them shared the following common characteristics.

Moral support, "parental supportive or emotional relationship between parent and offspring directly affects the socialization of the children" (Kumar 2019, 188). Moral support is a manner of showing support for a person, a cause, or one side in a conflict without contributing anything other than the emotional or psychological worth of the support. The parental financial situation" can adversely influence child care both in terms of the basic provisions available and the very quality of the parent-child relationship" (Whittaker & Garbarino 2009, 229).

2.1.2 *Spiritual formation for teenagers*

Willard defined spiritual formation as, "the spirit-driven process of forming the inner world of the human self in such a way that it becomes like the inner being of Christ himself"

(Willard 2002, 22). Further, "spiritual formation is a process in which one exhibits a change from spiritual infancy to spiritual maturity" (Moore, 2014). Moore stated spiritual formation is "a step-by-step process, through which a child is guided, encouraged, nurtured, admonished, and disciplined to embrace Christ as Savior and be a disciple to develop as a Christian through the work and power of the Holy Spirit" (Moore 2014, 258). Spiritual formation, "becomes a growth in Christian maturity or as psychological, moral, or character" (Doornenbal 2012, 232).

James 1:17 says, "every good and perfect gift is from above, coming down from the Father of the heavenly lights, who does not change like shifting shadows". Horan wrote, "Transformation occurs when life conflicts produce anxiety prompting one to scan for solutions with the assistance of the Holy, consciously or unconsciously" (Horan 2017, 61). The idea is, that "the individual begins to be a person who makes the right choices and does the right thing because the transformative power of the Spirit indwells in them" (Willard, 2022). The individual stands firm in his godly character, he is fixed and steadfast in godliness. In the first nine verses of Philippians 4, Paul tells us in verse 1 to, "Stand firm in the Lord." Paul wants his spiritual children to be mature. The Church needs to do all it takes to see that teenagers grow into maturity according to the processes that God has ordained that they grow to wholeness.

The Bible teaches that Samuel as a child grew in the knowledge of the Lord (1st Samuel 2:26). Jesus at age twelve grew in wisdom, stature, and favor with God and man (Luke 2:52).

III. RESEARCH METHODOLOGY.

The target population of interest for the quantitative research method had 329 respondents and for qualitative research had 20 participants. The study used mixed methods and embedded design with quantitative as the main source of data, while qualitative data was supported. The samples were drawn on the quantitative research using Yaro Yamane formulae which lead to a sample size of 181 comprising of both male and female genders. The researcher used simple random sampling to obtain participants for quantitative. Data collection was done on selected participant's who filled the questionnaires, and there was a focus group to complement quantitative research methods. The analysis was conducted using the statistical package for social sciences (SPSS) version 23 for quantitative data and QDA miner lite version 2.08 for qualitative data. A descriptive analysis and inferential analysis were done using both qualitative and quantitative tools of analysis.

IV. RESEARCH FINDINGS

4.3.1 *Parental follows-up*

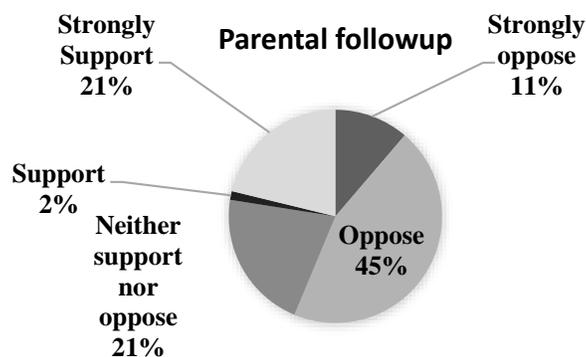
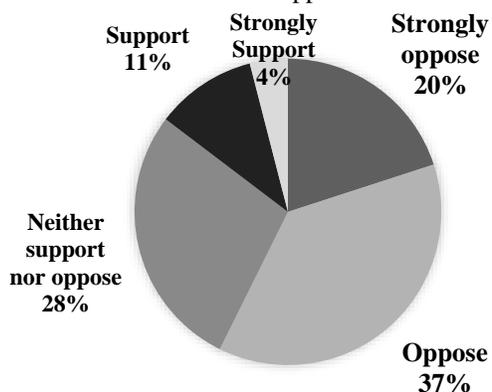


Figure 4.4 Parents take time to make follow-up program

The researcher was able to determine that most respondents opposed that parents take time to make follow-up programs with what is happening to their teenagers, Kapropita district church council. There were 17 respondents (11 percent) and 68 respondents (45 percent) who *Strongly opposed* and *opposed* respectively that Parents take time to make follow-up programs on what is happening to their teenagers at Kapropita district church council. Further, there were 32 respondents (21 percent) and 2 respondents (2 percent) who *Strongly supported* and *supported* respectively that parents take time to make follow-up programs on what is happening to their teenagers. Lastly, 4 respondents (2 percent) neither supported nor opposed that parents take time to make a follow-up on what is happening to their teenagers at Kapropita district church council.

4.3.2 Teens program financial support by parents.

Figure 4.6: Parental financial support



The finding from the study indicates that most respondents opposed that parents usually offer financial support to the programs undertaken by their children. Statistically, there were 54 respondents (30 percent) and 30 respondents (20 percent) who *Strongly opposed* and *opposed* respectively that parents usually offer financial support to the programs undertaken by their teenagers at Africa inland church Kapropita district church council. While 16 respondents (25 percent) and 6 respondents (4 percent) *strongly support* and *support* respectively that parents usually offer financial support to the programs undertaken by their children at Kapropita district church council. Lastly, 6 respondents (2 percent) neither supported nor opposed. Parents usually offer financial

support to the programs undertaken by their teenagers, at Africa inland church Kapropita district church council.

4.33 Hypothesis testing

Table 4.3: H02: There is no significant relationship between parental involvement in Sunday school ministry and the spiritual formation of the Teenagers.

		Curriculum	Spiritual
Parental involvement	Pearson Correlation	1	.943**
	Sig. (2-tailed)		.000
	N	150	150
Spiritual formation	Pearson Correlation	.943**	1
	Sig. (2-tailed)	.000	
	N	150	150

** . Correlation is significant at the 0.01 level (2-tailed).

Therefore, there is a strong relationship between parental involvement in Sunday school ministry and the spiritual formation of the Teenagers as Pearson Correlation which is $r = .943^{**}$ which indicates a strong relationship with a p-value of 0.000, which is less than the conventional p-value of 0.05 ($r = .943^{**}$, $p = 0.000$). This further reveals that there is a positive significant statistical relationship between parental involvement in Sunday school ministry and the spiritual formation of Teenagers. Based on these results, the H0 is rejected.

Table 4.4: Multiple Regression

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	-.109	.085		-1.280	.203
	Curriculum	.283	.127	.216	2.234	.027
	Parental involvement	.897	.116	.748	7.727	.000

a. Dependent Variable: Spiritual formation of the Teenagers

The study used multivariate regression analysis to establish a relationship between the independent variables and the dependent variable by use of the following regression model:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \epsilon$$

Where,

$$Y = -.109 + .283 X_1 + .897 X_2$$

Y = Spiritual formation of teenager (Dependent Variable)

X₁ – X₂ – Independent Variables

X₁ = Curriculum

X₂ = Parental participation

β₀ = Co-efficient of the model

β₁ – β₂ = Beta Co-efficient of dependent variables.

ε = Stochastic Error Term

The results of the Regression of Coefficient reveal that there is a positive with a statistically significant impact between Parental participation and Spiritual formation of the teenagers as ($r = 0.748$, while $p = 0.000$). This is supported by a beta coefficient of 0.748 and a p-value of $0.000 < 0.05$. This therefore further indicates that an increase in parental involvement by 1 unit would lead to an increased spiritual formation of teenagers by 74.8%.

CONCLUSION

The study reveals that parental involvement is important in Sunday school and impacts the spiritual formation of teenagers. The study established that the parents are taking time to make follow-up programs with what is

happening to their children. Further, it was established that parents are not adequately providing moral support to their children. In terms of financial support, they have not provided the financial support as expected. Therefore, in conclusion, there is a challenge as the study has established that there is a strong relationship between parental involvement in Sunday school ministry and the spiritual formation of Teenagers.

RECOMMENDATION

The researcher makes the following recommendation for parental involvement; therefore, they need to start making follows up on what their children are being taught in the church and ensure what the teenagers are taught is implemented. Secondly, they need to offer moral support to their children when they are affected in one way or the other, and whenever financial support is needed, they need to be ready and willing to support the needs of the ministry financial support through making generous contributions, it has been evident that they have not been providing the financial support as it is expected. As the study has established that parental involvement in Sunday school ministry has a greater impact on the spiritual formation of their teenagers in Africa inland church Kapropita district church council.

ACKNOWLEDGMENT

This research represents a major milestone in my life as a student at Africa International University (AIU). I owe my gratitude to God, my lecturers, and to all those who made it possible for me to reach this far. I am greatly indebted and sincerely grateful to my supervisors Dr. Joash Amwango and Dr. Mercy Mauki for your continued encouragement, insightful criticism, and immense knowledge in this field. I sincerely thank Kenneth Mburugu for assistant in peer reviewing of this article. I greatly thank my husband and children for their great support.

REFERENCES

- 1) Chiroma, N. H. (2015). The Role of Mentoring in Adolescents' Spiritual Formation. *Journal of Youth and Theology*, 14(1), 72-90. <https://doi.org/10.1163/24055093-01401005>
- 2) Brewster, D. (2005). *Child, Church, and Mission*. Makati City, Philippines. Compassion International
- 3) Brooks, J. B. (2013). *The Process of Parenting*, 9th edition (9 edition). Humanities & Social Sciences.
- 4) Stewart, M.W. (1983). *How to Motivate your Child to Success*. Illinois: Tyndale House.
- 5) Brooker, C., Waugh, A., Briggs, E., & Smith, F. (2007). *Foundations of Nursing Practice E-Book: Fundamentals of Holistic Care*. Elsevier Health Sciences.
- 6) Chesire, F. (2019). Retrieved from Pastor Francis Chesire, Personal
- 7) Communication
- 8) Delgado, M. (2012). *New Frontiers for Youth Development in the Twenty-First Century: Revitalizing and Broadening Youth Development*. Columbia University Press.
- 9) Kumar, S. A. (2019). *Social Psychology*. PHI Learning Pvt. Ltd.
- 10) Willard, D. (2002). *Renovation of the Heart: Putting on the character of Christ*. Colorado Springs, CO: Navpress.
- 11) Moore, D. (2014). Most common teacher characteristics related to intentionality in
- 12) Student spiritual formation. *Journal of Research on Christian Education*.
- 13) Tripp, T. (1995) *Shepherding a Child Heart*. Wapwalloper. Shepherd Press.
- 14) Governor, L. P. S., District. (2016). *Lions 324B1 District Directory (2004-05): - Digital Edition*. Signpost Celfon. In Technology.

AUTHORS

i. Irine jepkurui barkutwo. Pastor Africa inland Church Eldoret Fellowship. kuruibarsh123@yahoo.co.uk

ii. Dr. Joash Mutua (Ph.D.) Department of religious studies, Africa International University Joash.

This publication is licensed under Creative Commons Attribution CC BY.

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13005>

Mutua@Africaninternational.edu

iii. Dr. Mercy Mauki (Ph.D), Department of education, Africa International University, Mercy.Mauki@africaninternational.edu

Correspondence Author – Irine jepkurui barkutwo, kuruibarsh123@yahoo.co.uk, alternate email address (if any), 0724910547.

Short Term Prediction of Ionospheric Total Electron Content (TEC) based on Solar and Geomagnetic Data

S. Nath, S.Kalita

Department of Computer Application
Mahapurusha Srimanta Sankaradeva Viswavidyalaya, Nagaon, Assam, India
Email:surajit.nath2@gmail.com

DOI: 10.29322/IJSRP.12.10.2022.p13006

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13006>

Paper Received Date: 21st August 2022

Paper Acceptance Date: 24th September 2022

Paper Publication Date: 6th October 2022

Abstract—Deep learning algorithm are useful for investigation of ionospheric weather using past ionospheric data under various space weather conditions. The Total electron content (TEC) is an important parameter of the ionosphere and prediction of TEC are very challenging task, mainly in anomaly crest station. This research develops and analyzes a technique based on long short-term memory (LSTM) neural network (NN) for the short-term ionospheric TEC prediction. In this work, multi-input LSTM forecasting technique is utilized and tested for evaluating its capability in prediction of ionospheric TEC over Lhasa, China station (Longitude: 91.10397200 , Latitude : 29.65734166) using vertical Total Electron Content (TEC_v) with Solar and Geomagnetic time series data. The results were then compared with the observed TEC collected by the IGS network. The result shows that the model could recognize the variation trend of typical TEC profile and have a good performance of the short term ionospheric TEC prediction.

Keywords— Total Electron Content (TEC), LSTM, Neural Network

1. Introduction:

Prediction of space weather and the solar-terrestrial relationship is necessary for scientific and economic purposes and it has been under investigation for a long time. Prediction of ionospheric variability is one of the important parameters for the study of space weather. The ionospheric total electron content (TEC) is important in the study of ionospheric variability (Goodman, 1992). Actual Prediction of TEC is very much challenging for Earth- and space based systems like positioning of satellite and remote sensing applications (Belehaki et al, 2009; Samardjiev, 1993). In general TEC is an important parameter for ionospheric description and has lots of practical applications like Satellite navigation, civil aircraft landing, missile guidance application, time delay, range error correction for GPS satellite signal receivers (Bhuyan and Borah, 2007). Ionospheric parameters like electron density, Total Electron Content (TEC) describe the condition of ionosphere, which show regular diurnal and seasonal variations as a function of altitude and geomagnetic conditions. One of the major indications of magnetosphere –ionosphere coupling is the significant variations of electron density during a storm.(Buonsanto 1999; Danilov 2001). It is observed that, from the study of Total Electron Content (TEC) we can characterized the of ionospheric variations during geomagnetic storms (Jakowski 1996, Lu, Richmond & Roble 1998). Deep learning algorithms are considered to be a second-generation NNs (Hinton & Salakhutdinov, 2006) and may be applied to better model prediction and variations in ionospheric TEC (Orus Perez, 2019).

Hochreiter and Schmidhuber(1997) developed a model which is very popular in the field of deep-learning known as a long short-term memory NN (LSTM NN). For analysis of Time series data the model have been developed. This LSTM NN model is used to perform short-term regional ionospheric TEC prediction. In the variations of ionospheric TEC, solar and geomagnetic parameters play significant roles. Realistic solar irradiance and geomagnetic activity index are also needed for accurate prediction of TEC. Therefore Multiple input data, including historical time series of TEC, disturbance storm time (Dst) index, geomagnetic Kp, Ap , Solar flux F10.7 and hour of the day, are used in the developed of LSTM NN model.

2. Analysis and techniques

2.1 Data Collection and Pre-Processing

The TEC data of dual frequency GPS receiver’s data from Lhasa China station is obtained from IGS network stations. TEC derived from GPS receivers are used for predicting the future TEC values.

Gopi Seemla ,GPS-TEC processing software was used to processing of GPS data. The software allows to extract the vertical TEC from GPS measurements. The software also reads raw data, processed the cycle slips and reads satellite biases from International GNSS service. It also calculates receiver bias, and calculates the inter channel biases for different satellites in the receiver and then calculates the slant TEC (TECs) along the path of the GPS signal using the following equation :

$$TECs = \frac{1}{40.3} \left(\frac{f_1^2 f_2^2}{f_1^2 - f_2^2} \right) (P_1 - P_2)$$

In the above equation, on L1 and L2 signals, P1 and P2 are pseudo ranges observable and f1 is the high GPS frequency and f2 is low GPS frequency. Then using the mapping function M(e), TECs measured at an interval of 10 s were converted to TECv ,which takes the curvature of the Earth into account (Shim 2009) as follows:

$$TEcv = M(e) \times TECs - (b_s + b_r + b_{rx})$$

Where b_s is satellite bias, b_r is a receiver bias and b_{rx} is a receiver inter channel bias, and

$$M(e) = \left[1 - \left(\frac{\cos(e)}{1 + h/R_E} \right)^2 \right]^{\frac{1}{2}}$$

Where e is an elevation angle of a satellite, h is ionospheric shell height and R_E is the Earth's mean radius. To ensure the data used have no undesirable errors which might result from the effect of multipath, a minimum elevation angle of 30° was used.

2.2 Algorithm Selection

Hochreiter (1991) and Bengio et al. (1994) underlined a weakness of RNN which is the vanishing gradient problem occurring during the training phase of RNN. LSTM are designed to avoid this problem depending upon the characteristics and relations between the input data different features are extracted using deep learning algorithm. The parametric algorithm like LSTM NN is used to prediction of TEC, because NN increase the number of neurons to reduce the error would give maximum accuracy. The data set is categorized into Training set ,Testing and validated using classification categories of probabilistic root Mean Square Error (RMSE) to check the performance of the model.

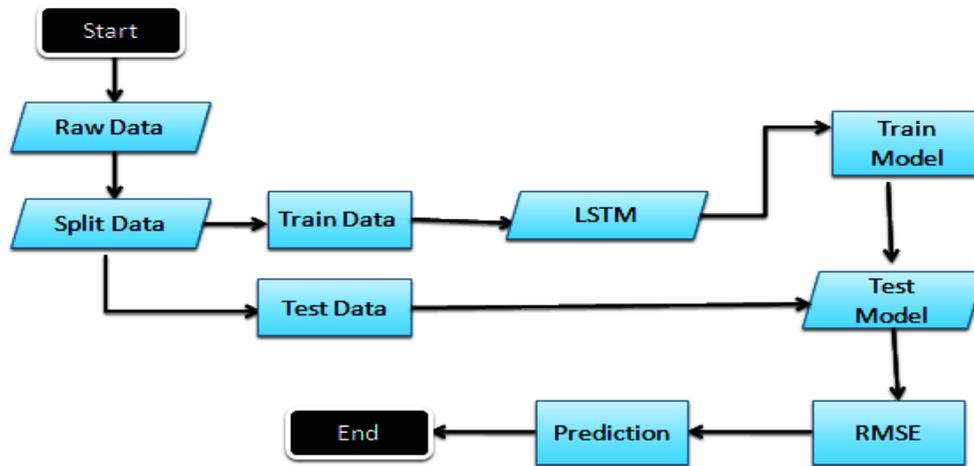


Figure 1. LSTM NN algorithm workflow

2.3 LSTM NN model:

Models based on LSTM neural networks and Deep learning is seeing a rise in popularity in space physics. In particular, prediction and the forecasting of TEC and geomagnetic indices with LSTM neural network models is becoming a popular field of study. In this work, LSTM modeling the data are first split into a training, test and validation set. Using scaling parameters each training, test and validation set is scaled and normalized. A sliding window is used for removal of invalid measurements. Before assigning entries to one of the data sets, the data are split into daily samples and hourly samples which are highly correlated and causes the model to artificially perform better on the test set. Then the data set is fit into the LSTM model, train and tests the model and calculated RMSE to check the performance of the model and predict the vertical TEC as an output.

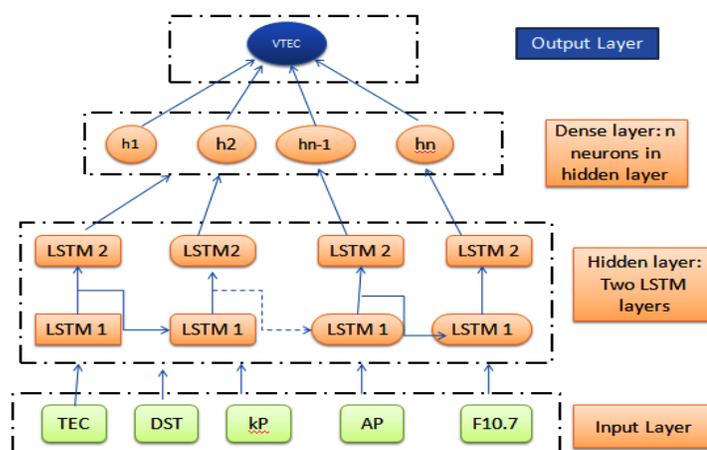


Figure 2. Architecture of LSTM neural network for TEC prediction

The neural network model's architecture consists of an LSTM combined with a dense neural network; LSTMs are a type of recurrent neural network in which the previous iteration's output is used as an additional input.. In the model, the LSTM has a few hyper parameters that have impact on its performance. First is the number of neurons in the LSTM hidden layer and .second is the number of layers in the LSTM. Two LSTM's layers are applied on top of each other. The first LSTM gives the intermediate hidden states as input for the second LSTM, and so on. In the input layer, the input time span is set to 24 hr and in the hidden layer, two LSTM layers are used to extract their features from the input data and then are connected to the complete hidden layer. In the output layer, the output parameters are the vertical Total Electron Content.

3. Results and discussion:

In this work vertical TEC trend of quiet day is presented in the figure 1 and 2 . Disturb day is presented in figure3. It is observed from the figures that, time series of TEC data showing diurnal behavior. This time series of TEC, Solar and Geomagnetic data are applied to the LSTM model for prediction of ionospheric TEC values. The predicted values are compared with actual TEC values to determine the accuracy of the prediction.

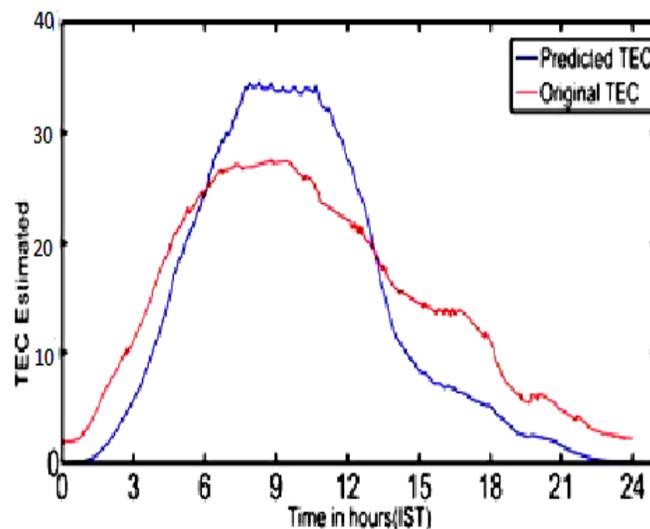


Figure 1. An hourly comparison of GPS TEC and predicted TEC for 16th January 2017 on Quiet day

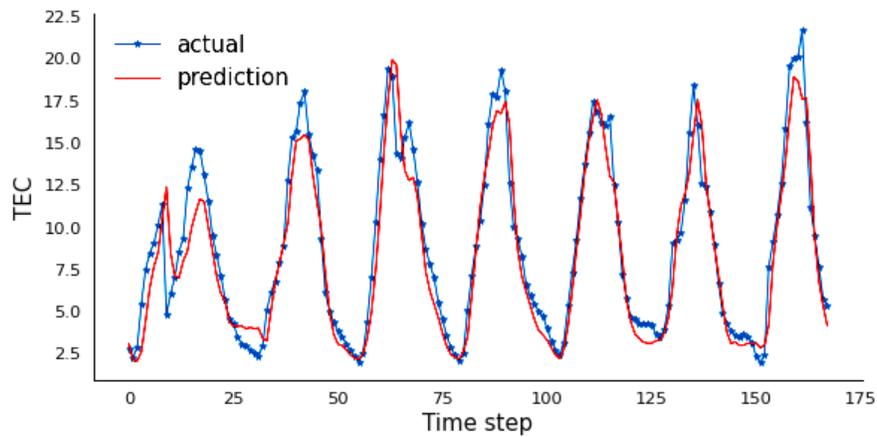


Figure 2. An hourly comparison of GPS TEC and predicted TEC from 1-7 January 2017 On Quiet day

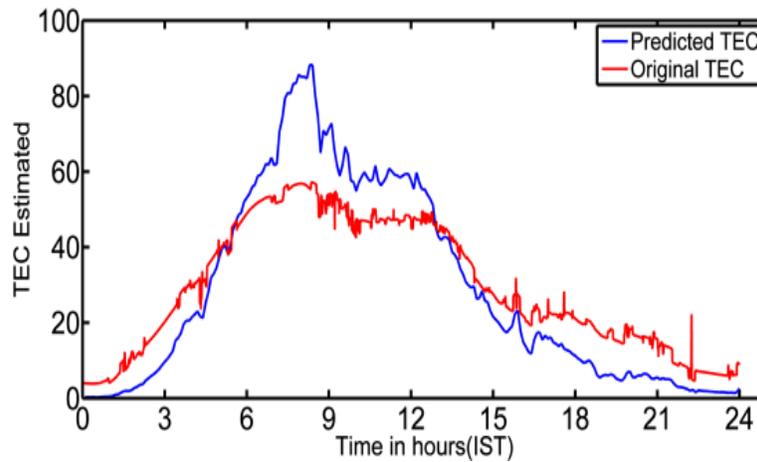


Figure 3. An hourly comparison of GPS TEC and predicted TEC for 28th May 2017 on Disturb day

The performance of LSTM model is investigated on a quiet day 16th January 2017 and continuous hourly comparison of 7 days of January 2017 on quiet days and disturbed day 28th May 2017. It is observed that TEC values resulting from a disturbed day have a higher prediction error than TEC values resulting from a quiet day. It is found that the RMSE obtained from both the training and validation sets reaches minimum when the input Combination of TEC, D_{st} , K_p , A_p , $F_{10.7}$ is used in the input layer.

This suggests that the combination of the solar and geomagnetic activity information is able to improve the TEC prediction. The developed LSTM NN model has shown satisfactory short-term TEC prediction performance based on experimental results obtained. The result shows that the model recognize the variation trend of typical TEC profile and have a good performance of the short term ionospheric TEC prediction.

4. Conclusion:

In this paper ionospheric total electron content data obtained from GNSS receiver over Lhasa, China station has been used for predicting short term variation trend of typical TEC profile. For this purpose, LSTM model with a dense neural network has been utilized. It is found that the RMSE obtained from both the training and validation sets reaches minimum when the input Combination of TEC, D_{st} , K_p , A_p , $F_{10.7}$ is used in the input layer. These preliminary results indicated that, LSTM model is able to perform well in both disturbed and quiet day conditions.

References:

- Bhuyan PK and Borah RR 2007 TEC derived from GPS network in India and comparison with the IRI. *Adv. Space Res.* 39(5): 830-840
- Watthanasangmechai 2012 TEC prediction with neural network for equatorial latitude station in Thailand. *Earth, Planets Space* 64: 473-483.
- Noelie Cherrier, Thibaut Castaing, and Alexandre Boulch. Forecasting ionospheric Total Electron Content maps with deep neural networks. In *Proc. of the Conference on Big Data from Space*, 2017
- Sepp Hochreiter and Jürgen Schmidhuber. Long Short-Term Memory. *Neural Comput.*, 9(8):1735–1780, November 1997
- Klimas, A.J., D.N. Baker, D. Vassiliadis, and D.A. Roberts, Substorm recurrence during steady and variable solar wind driving: Evidence for a normal mode in the unloading dynamics of the magnetosphere, *J. Geophys. Res.*, 99, 14855, 1994.
- Emmanuel D Sulungu¹ and Christian BS Uiso², Total Electron Content Prediction Model using the Artificial Neural Networks over the Eastern Africa Region, *Tanzania Journal of Science* 45(3): 502-517, 2019
- Akhoondzadeh M, Parrot M, Saradjian MR. (2010). Electron and ion density variations before strong earthquakes ($M > 6.0$) using DEMETER and GPS data. *Natural Hazards and Earth System Science*, 10(105)
- Milos MARKOVIĆ¹, Determination of Total Electron Content in the Ionosphere Using GPS Technology, *Typology: 1.02 Review Article*, DOI: 10.14438/gn.2014.22.
- Kornyanat Watthanasangmechai¹, Pornchai Supnithi¹, Somkiat Lerkvaranyu¹, Takuya Tsugawa², Tsutomu Nagatsuma², and Takashi Maruyama², TEC prediction with neural network for equatorial latitude station in Thailand, *Earth Planets Space*, 64, 473–483, 2012.
- Adarsha Ruwali, A. J. Sravan Kumar, Kolla Bhanu Prakash, G. Sivavaraprasad, and D. Venkata Ratnam, Implementation of Hybrid Deep Learning Model (LSTM-CNN) for Ionospheric TEC Forecasting Using GPS Data, *IEEE Geoscience and Remote Sensing Letters*.

Pan Xiong¹, Dulin Zhai², Cheng Long³, Huiyu Zhou⁴, Xuemin Zhang¹, and Xuhui Shen⁵, Long Short-Term Memory Neural Network for Ionospheric Total Electron Content Forecasting Over China, Space weather ,Article ,10.1029/2020SW00270.

Feldstein, Y.I., V. YU. Pisarsky, N.M. Runeva and A. Grafe, Ring current simulation in connection with interplanetary space conditions, Planet. Space Sci, 32, 975-984, 1984.

Ayurvedic Management Of Histiocytic Sarcoma: A Case Report

Dr. Shreya Joshi^{*1}, Dr. Abhishek Bhushan Sharma^{*2}

^{*1}M.D Scholar Kayachikisa Dept., Patanjali Ayurvedigyan Evam Anusandhan Sansthan, Haridwar,

^{*2}Professor, Dept. of Kayachikitsa, Motherhood University, Roorkee, Uttarakhand, India.

DOI: 10.29322/IJSRP.12.10.2022.p13007

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13007>

Paper Received Date: 18th August 2022

Paper Acceptance Date: 24th September 2022

Paper Publication Date: 6th October 2022

Abstract- Histiocytes play an important role in defense mechanism (innate and acquired immunity) by phagocytizing pathogens and / or cellular debris and by presenting antigens to stimulate lymphocytes and other immune cells to augment response to pathogens. Abnormal proliferation of histiocytes occur in cell differentiation and results in histiocytic sarcoma (HS). It is extremely rare and malignant form of tumor with usually aggressive clinical course. The signs and symptoms are systemic symptoms (fever, weight loss), hepatosplenomegaly, adenopathy's, intestinal obstruction, rash and pancytopenia. Here, a case report on 12- year- old female patient suffering from histiocytic sarcoma for 1 year 10 months. A relief in form of decrease in size of lump present at neck and relief in systemic symptoms were noted by treatment of one month of *Ayurvedic* medicine and local application of *Lepa*, which clearly indicate the efficacy of *Ayurveda* treatment and improve quality of life of patient.

Index Terms- Histiocytic sarcoma, *Ayurveda*, *Ayurvedic* medicine, *Lepa*.

I. INTRODUCTION

Histiocytic sarcoma is a rare neoplasm, and its aetiology and pathogenesis is unknown. It is malignant proliferation of neoplastic cells showing immunotypic and morphologic features similar to tissue histiocytes. HS in pediatric patients is rare, with only a handful of reported cases¹. It can involve any region of body mainly lymph nodes are involved. The overall incidence of HS was 0.17 per 1000000 individuals². Current epidemiological data estimate that < 1% of tumors presenting in lymph nodes or soft tissue can be defined as HS³. Histiocytic sarcoma commonly presents as a painless solitary mass at an extra nodal site (gastrointestinal tract, soft tissue, skin, spleen, or liver). Systemic symptoms like- fever, weight loss, fatigue, night sweat and weakness are commonly seen in HS⁴. Lymphadenopathy and skin manifestation can also be seen in this disease. Haemophagocytosis may occur in neoplastic cells. The definitive diagnosis of the disease is by an anatomicopathological study of one of affected organ, bone marrow biopsy, an immunophenotypical study and genetic studies⁵. The tumor cells express one or more

tissue cell antigens, including CD163, which is the most important antigen for detecting macrophages⁶, CD68 and lysozyme. HS is an aggressive neoplasia managed using different types of treatment including- surgery, radiotherapy, chemotherapy and combinations with autologous hematopoietic stem cell transplantation may improves treatment efficacy. But it poses unwanted side effects and complications after treatment. The differential morphological diagnosis of histiocytic sarcoma includes- inflammatory pseudo tumor, follicular dendritic cell sarcoma, interdigitating dendritic cell sarcoma, malignant Langerhans's cell histiocytosis, large cell anaplastic lymphoma, melanoma and other sarcoma⁷. The prognosis of histiocytic sarcoma is poor. The aim of this case report is to show effectiveness of *Ayurveda* treatment in management of HS. An *Ayurvedic* approach in form of medication and *Lepa* was given to HS patient, due to its property like- *Lekhan (scrapping)*, *Balya (nourishment)*, *Bruhana (increases built)*, *Ayurvedhak (longevity)*, *Rasayana (rejuvenation)*, *Shothhar (anti-inflammatory)*, *Shoolhar (analgesic)*, *Agnideepan (increases digestive fire)*, *Jwarhar (anti-pyretic)*, *Kaphamedahar, Tridoshashamak* etc and marked relief was noticed in patient. In *Lepa- Bryophyllum pinnatum (Parna beej)* leaves which possess antimicrobial⁸, antifungal, anti-inflammatory⁹ and analgesic properties. The *Ayurvedic* modalities in form of oral medication and external application of *Lepa* benefited in HS patient.

II. CASE REPORT

A 12 -year- old female patient was asymptomatic before Oct, 2018. Gradually she suffered with pain and swelling in left side of neck region. She visited nearby hospital and one week treatment for tonsils were given. But the size increased progressively in two weeks. She visited Rishikesh AIIMS hospital where all relevant investigations were done and by biopsy she was confirmed diagnosed with histiocytic sarcoma. 6 cycles of Chemotherapy were done and size of lump in neck was mildly reduced. She had reduced Hb level (7mg/dl) for which 3-unit Blood Transfusion was done. In Jan 2021, she was having continuous high-grade fever (104°) for one month, difficulty in swallowing food, generalized weakness, and decreased appetite. Then, she visited hospital where PET CT was done in which

enhancing left cervical and supraclavicular lymph nodes, bilateral lung nodules, splenomegaly were noted. She was advised tab. Ibrutinib 420 mg once daily for 3 months. But after one month of medication no relief was found in above symptoms and size of lump was also increasing gradually. So, in June, 2021 she visited OPD number 13, *Kayachikitsa* department, Patanjali ayurveda hospital, Haridwar, where she was prescribed with *Ayurvedic* medicines and local administration of *Lepa* treatment for one month and continuing allopathic medication as prescribed. Marked improvement in reduction in size of lump in neck and marked relief in symptoms (fever, difficulty in swallowing food, generalized weakness and decreased appetite) was noticed. This show effectiveness of *Ayurvedic* treatment in management of HS.

Histopathology report (16/7/2019) revealed- non-Langerhans cell histiocytosis, increased proliferative index (Ki67-30%) histiocytic sarcoma.

The PET-CT report (26/4/2021) revealed-

*FDG avid (SUV max~20.7) heterogeneously enhancing level ii-iv, right level iii and level vi cervical and left supra clavicular lymph nodes.

*(SUV max~11.9) multiple variable sized nodules in bilateral lung fields

*Splenomegaly ~11.0cm.

PET -CT report after treatment (12/10/2021)

*FDG avid (SUV max15.10) variable sized lymph nodes are seen in bilateral level II,III,IV,V and supraclavicular region.

*(SUV max~4.53) multiple vriable sized nodules in bilateral lung fields

*No splenomegaly.

Parameters for assessment

1. Size of lump is assessed pre and post treatment. 80% reduction in size of lump in neck region was noticed.

Size of lump is measured by making a circle on lump in neck and mid-line diameter of circle is measured pre and post treatment. Pretreatment i.e.-20cm and post treatment i.e.-7cm

2. Symptoms were assessed pre and post treatment.

100% relief in symptoms- fever, decreased appetite, difficulty in swallowing food, generalized weakness, was noticed.



Before treatment (20cm)



After treatment (7cm)

Therapeutic Interventions

As histiocytic sarcoma is rare disease, no definitive treatment modalities are yet proved to cure the disease. We plan the treatment for concerned disease on basis of *Ayurvedic* principles for preventive, curative aspect and improving quality of life of patient. Here, a combination of drugs was selected by their properties and actions. Histiocytic sarcoma can be co-related to *Arbuda* in *Ayurveda*, where *Tridoshas* are involved and *Mamsa*, *Meda*, *Rakta Dhatus* are involved¹⁰. As patient was suffering from high grade fever so, *Tikta ras* dominant, *Jwarhar* (*anti-pyretic*) drugs were also prescribed. For increasing appetite *Deepan* (*appetizer*), *Pachan* (*digestive*) drugs were also added. *Lepa* of polyherbal formulations was advised due to its

anti-inflammatory action. Diet regimens were also planned on basis of giving *Rasayana* medication to patient. Patient is given oral medications and local administration of *Lepa* for one month as follow-
Table n.o.-1

III. DISCUSSION

Ayurveda offers wide range of medical formulations and therapeutic modalities that are found to be useful in management of *Arbuda Roga* along with less side-effects and maintenance of optimum health by enhancing immunity of body. Following *Ayurvedic* drugs had been selected in treating the histiocytic

Drug	Dosage	Relation to food	Advice
1. Sarvakalpa kwath- 200gm <i>Kayakalpa kwath- 100gm</i> <i>Ashmarihar kwath- 100gm</i> <i>Chirayta kwath- 100gm</i> <i>Ajwain seed powder- 25gm</i>	Take 50 ml of <i>kwatha</i> twice a day	Empty stomach	
2. Sanjeevani vati- 20gm <i>Shila sindoor- 3gm</i> <i>Abhrak bhasma- 5gm</i> <i>Giloy sat- 20gm</i> <i>Mukta pishti- 4gm</i> <i>Praval panchamrit ras- 5gm</i> <i>Swarna basantmalti ras-3gm</i> <i>Tamra bhasma- 3gm</i> <i>Heerak bhasma- 600mg</i> <ul style="list-style-type: none"> Crush <i>sanjeevani vati</i> 	Mix all drug & make 90 doses, take 1 dose twice a day.	Before meal	With honey
3. Mahasudarshanghan vati-40gm <i>Kanchnaar guggulu- 40 gm</i> <i>Vridhivaadhika vati- 40gm</i> <i>Arogyavardhini vati- 40 gm</i>	1 tab each thrice a day.	After meal	With luke warm water.
4. Wheat grass juice- 25ml <i>Giloy juice- 10ml</i> <i>Godhan arka- 10ml</i> <i>Neem leaves- 5gm</i> <i>Tulsi panchanga juice- 10ml</i> <i>Khadirarishtha- 25 ml</i>	Mix all & take twice a day.	Before meal	With luke warm water.
5. Local application of <i>lepa</i> in neck region- <i>Dasanga lepa-10gm</i> <i>Trikatu churna-5gm</i> Patharchatta leaves (<i>Bryophyllum pinnatum</i>)-2-3 leaves	Once a day		Leave for 6 hr

Diet- Light and easily digestible food was advised. Pulses (green gram, lentil, pigeon pea), vegetables (bottle guard, ridge guard, pointed guard, round guard, green leafy vegetables), fruits (apple, chiku, pomegranate, mango, papaya), nuts (walnut, almond, peanut), brown rice, *Sali* and *Shastik* rice, cow milk, ghee, butter milk etc were advised.

sarcoma co-related to *Arbuda* in *Ayurveda* by breaking the *samprapti* (pathogenesis) of *Arbuda* by their properties and actions. *Nidanans* like *mithya ahar vihar* etc causes vitiation of *tridosha* and leads to *mamsa, meda, raktavah shroto dushti*. Aggravated *tridoshas* predominantly *vata, kapha* leads to *jatharagnimandya* and then *dhatvagnimanya*. Where there is *khaivagunya* produces swelling or an abnormal growth in any part of respective *dhatu*¹¹. The *samprapti* cycle can be broken by

ushna, laghu, ruksha, katu ras and deepan, lekhan, rakta prasadak and rasayan etc property *dravyas* or formulations.

Table n.o.-2

Heerak, bhasma, Tamra bhasma pacifies *tridoshas, Lekhan* (scrapping) property which helps in decreasing abnormal growth in neck region. *Tulsi* (*Ocimum sanctum*) has unique combination of actions that include: antimicrobial, antioxidant, chemo preventive, hepato-protective, anti-carcinogenic, analgesic, and immunomodulatory activities.¹² Various researches on wheat grass establish that its anti-cancer¹³ and anti-oxidant¹⁴ potential. *Giloy* (*Tinospora cordifolia*) bitter principle present shows adaptogenic, antispasmodic, anti-inflammatory, antipyretic, anti-neoplastic, antioxidant, and hepatoprotective properties¹⁵ *Kanchanara Guggulu* is an *Ayurvedic* formulation having properties of *Vata-Kapha Dosh*a pacification, *Granthihar, Lekhana* (scrapping) and *Shothahara* (anti-inflammatory).¹⁶ Others-*Mukta pishti, Abhrak bhasma, Shila sindoor, Sanjeevani vati, Sarvakalpa kwath* contains (*bhumiamaki, makoy, punarnava* as active ingredient), studies suggest that *Phyllanthus (Bhumiamalki)* may suppress the growth and replication of the virus also support the overall health of the liver¹⁷, *Kayakalpa kwath, Khadirarishta, Arogyavardhini vati, Dasanga lepa*, were selected for the metastatic involvement of disease in lung, spleen etc. Combination of *Ayurvedic* formulations had been given and an effort was made to treat histiocytic sarcoma.

Tridosha shamak	Sothahar (Anti-inflammatory) / Granthihar	Jwarhar (Anti-pyretic)	Agnimandya
<i>Heerak bhasma Tamra bhasma Wheat grass juice Neem leaves Tulsi panchan g juice</i>	<i>Kanchnaar guggulu Vridhdhivadika vati, Patharchatta leaves (Bryophyllum pinnatum)-</i>	<i>Mahasudarshangha n vati Swarna basantmalti ras Giloy Sat Chirayta kwath Giloy juice</i>	<i>Ajwain seed powder Trikatu churna Praval pancharmit ras</i>

IV. CONCLUSION

This is a single case report and marked improvement was observed in patient of Histiocytic sarcoma. Significant reduction in size of lump in neck was observed and marked relief in systemic symptoms like - fever, difficulty in swallowing food, generalized weakness, and decreased appetite by *Ayurvedic* treatment. Patient had metastatic involvement *Ayurvedic* formulations and diet regimens improved Quality of life of patient. Therefore, integrative approach should be encouraged in treating the patient with histiocytic sarcoma as early as diagnosed for preventing further progression of disease and pilot study can be planned.

Declaration of patient consent

This publication is licensed under Creative Commons Attribution CC BY.

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13007>

It is certified that I have taken appropriate patient consent. In the form, the patient and her guardian has given her consent for her images and other clinical information to be reported in the journal. The patient and her guardian understood that their name and initials will not be published and due to efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

REFERENCES

- [1] Buonocore S, Valente AL, Nightingale D, Bogart J, Souid AK. Histiocytic sarcoma in a 3-year-old male: a case report. *Pediatrics* 2005; 116: e322-5. doi: <http://dx.doi.org/10.1542/peds.2005-0026>
- [2] <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5757688/>
- [3] Pollen M, El Jamal S, Lewin J, Manucha V. Histiocytic sarcoma in a kidney transplant patient: A case report and review of the literature. *Case Rep Pathol.* 2016; 2016:3591050.
- [4] Histiocytic sarcoma: an updated literature review based on the 2008 WHO classification. Takahashi E, Nakamura S *J Clin Exp Hematop.* 2013; 53(1):1-8
- [5] Primary histiocytic sarcoma arising in the head and neck with predominant spindle cell component. Alexiev BA, Sailey CJ, McClure SA, Ord RA, Zhao XF, Papadimitriou JC *Diagn Pathol.* 2007 Feb 26; 2(7):7.
- [6] A case of primary histiocytic sarcoma arising from thyroid gland. Yu L, Yang SJ *Pathol Oncol Res.* 2010 Mar; 16(1):127-32.
- [7] Lillo NC, Sastre ER, Uriach AP, Cósio-Piqueras MG, Roldan AS, Beiras A, et al. Sarcoma histiocítico con rasgos inmunohistoquímicos y ultraestructurales de células dendríticas interdigitantes *Rev Esp Patol* 200841 (3): 237-241
- [8] Okwu DE, Nnamdi FU. Two novel flavonoids from *Bryophyllum pinnatum* and their antimicrobial activity. *J Chem Pharm Res.* 2011;3:1-10.
- [9] Antinociceptive, anti-inflammatory and antidiabetic effects of *Bryophyllum pinnatum* (Crassulaceae) leaf aqueous extract. Ojewole JAJ *Ethnopharmacol.* 2005 May 13; 99(1):13-9.
- [10] Acharya Sushruta, Sushruta Samhita, edited by Ayurveda Tatva Sandipika commentary by Kaviraj Ambikadutta Shastri, Chowkhambhasanskrit series, Varanasi, nidanstan 11/11,12
- [11] Acharya Sushruta, Sushruta Samhita, edited by Ayurveda Tatva Sandipika commentary by Kaviraj Ambikadutta Shastri, Chowkhambhasanskrit series, Varanasi, nidanstan 11/13
- [12] Mondal S, Mirdha BR, Mahapatra SC. The science behind sacredness of *Tulsi* (*Ocimum sanctum* Linn.) *Indian J Physiol Pharmacol.* 2009;53:291-306.
- [13] Ferruzia MG, Blakesleeb J. Digestion, absorption, and cancer preventative activity of dietary chlorophyll derivatives. *Nutr Res* 2007;27:1-12.
- [14] Kulkarni SD, Tilak JC, Acharya R, Rajurkar NS, Devasagayam TP, Reddy AV. Evaluation of the antioxidant activity of wheatgrass (*Triticum aestivum* L.) as a function of growth under different conditions. *Phytother Res* 2006;20:218-27.
- [15] Evaluation of Cytotoxic Effects of Dichloromethane Extract of *Guduchi* (*Tinospora cordifolia* Miens ex Hook F & THOMS) on Cultured HeLa Cells. Jagetia GC, Rao SK *Evid Based Complement Alternat Med.* 2006 Jun; 3(2):267-72.
- [16] Vidhyasagar Parshuram S Pt., editor. *Sharangadhara Samhita* of Sharangadhara, Madyama Khanda. Ver. 95. 4th ed. Ch. 7. Varanasi: Chaukhamba Surbhaarati Prakashana; 2006. p. 205.
- [17] Sharma SK, Ali M, Gupta J. Evaluation of Indian Herbal Protective Drugs. Recent Progress in Medicinal Plants (Phytochemistry and Pharmacology)". Vol. 2. Texas, USA: Research Periodicals and Book Publishing House; 2002. p. 253-70.

AUTHORS

First Author – Dr. Shreya Joshi, M.D. Scholar Kayachikitsa Dept., Patanjali Bhartiya Ayurvedigyan Evam Anusandhan Sansthan, haridwar.

Second Author- Dr. Abhishek Bhushan Sharma, Professor. Dept of Kayachikitsa, Motherhood University, Roorkee, Uttarakhand,

Epilepsy In Pregnancy

Dr. Neena Parashar

Shankar Medicare Centre, Faridabad

DOI: 10.29322/IJSRP.12.10.2022.p13008
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13008>

Paper Received Date: 21st August 2022
Paper Acceptance Date: 24th September 2022
Paper Publication Date: 6th October 2022

I. INTRODUCTION

Epilepsy is a serious neurologic disorder that manifests as recurrent unprovoked seizures that result from excess neuronal discharge. Epilepsy is a problem that affects 0.5-1.0 percent of women of the reproductive age. It's an estimated prevalence of 1.2 percent of the population. While nearly 90% of women are blessed with uncomplicated pregnancy and smooth deliveries, women who suffer from epilepsy have a higher chance of developing postpartum complications, including intra-, and ante- women will be stable during pregnancy and 96% have an uninjured baby. However, for certain epileptic women, there could be a danger of significant maternal and postnatal morbidity and mortality.

The management of epilepsy during pregnancy is really challenging, especially in those taking anti-epileptic drugs. There isn't an all-time cure.

II. PRE-CONCEPTIONAL COUNSELING

Preconception counseling for women with epilepsy is a must and is associated with improved outcomes for both the mother and baby. This involves coordinated care with a multi-disciplinary team involving neurologists, physicians and obstetricians. Folic acid supplementation must begin at least three months prior to conception, as the low levels of folic acid in the serum are associated with fetal malformations and delayed neurodevelopment. Women with epilepsy. 1mg per day is the starting point and maintained throughout the pregnancy. The dosage can be increased to 4 mg per day in case of an earlier neural tube problem.

Reassure women that the majority of pregnancies (>95 percent) are expected to have a favorable outcome. Women who are seizure-free for more than nine - 12 months have an excellent chance of controlling seizures during pregnancy. Some women might require dosage changes prior to, or even during pregnancy. Women who are taking multiple AEDs could be reduced to one or two safer medications.

III. EFFECT OF PREGNANCY ON EPILEPSY

About 60% of women will remain seizure free.

20% will experience increase in the frequency of seizures. 15% will experience lower seizure frequency. There is a low risk of seizures that occur during pregnancy (2-3 percent).

Factors that can contribute to poor seizure control during pregnancy is Pregnant women suffering from epilepsy, there is a higher chance of having seizures when they are pregnant compared to non-pregnant epilepsy patients. The risk increases with advancement of pregnancy and increasing seizure frequency during the postpartum and intrapartum period. There are a myriad of possible causes for this increase, such as less amount and quality of sleep, increased anxiety, and stress. Beyond these, one of the most important reasons for the increase in probability of seizures in pregnancy is the diminution of antiepileptic drug (AED) levels in the plasma. AED levels decrease due to increased renal and hepatic clearance, as in general, an increase in amount of diffusion during pregnancies. Things like hormonal changes as well as stress, water retention and hormonal changes can trigger seizures.

IV. FETAL RISKS

The risk is usually low to the fetus. There is a small increase in the chance of intrauterine deaths in epilepsy-afflicted women. Seizure activity in the mother has been linked to evidence of hypoxia in the fetus. In contrast, the chance of hypoxic injuries to the fetus increases with increasing gestation. The possibility of fetal injuries caused by trauma to the mother in a seizure or possibility of abruption of the placenta are indirect mechanisms that link seizures with fetal injuries. Prematurity could be another risk. There is also the risk of preeclampsia, preterm birth, intrauterine growth restriction. There is a greater risk of severe congenital malformations resulting from AEDs. There is a higher chance of developing epilepsy in childhood during the fetus's development.

V. MATERNAL RISK.

Epilepsy sufferers are at a 10-fold higher risk of maternal mortality in comparison to women with epilepsy. It might also be associated with a risk of seizure-related problems that are made worse due to the shared physiology caused by pregnancy. It could also be an increase in the incidence of the condition known by the

name sudden unexpected death in epilepsy (SUDEP). Preeclampsia is more prevalent in women with epilepsy.

VI. SYMPTOMS OF EPILEPSY DURING PREGNANCY

Seizures may be of a generalized or partial. They affect all brain's parts. They affect the entire body, causing loss of consciousness and a fall during an episode. The seizures are only affecting one area of the brain. They cause symptoms within the body that is controlled by the brain region.

Alongside convulsions, there are other signs that are:

- Headache
- Changes in the mood
- fainting and falling down
- confusion and dizziness
- memory loss
- tongue biting
- absent and repeated blinking of eyes, licking lips in absence seizures
- nausea and vomiting

			(causes drowsiness)
Phenytoin	Facial clefts poor cognition & neuro development	1-2%	Pregnancy: relatively safe breastfeeding: safe
Sodium valproate	Neural tube defects facial clefts hypospadias poor cognition & neuro development	6-10% dose dependent	Pregnancy: avoid if possible breastfeeding: safe
Topiramate	Cardiac defects facial clefts	4-6%	Pregnancy: avoid if possible breastfeeding: safe

Anti epileptic drugs

AED	Possible congenital malformations	Risk of congenital malformation	Safety in pregnancy and breastfeeding
Carbamazepine	Cardiac defects facial clefts	2-5% dose dependent risks	Pregnancy: considered safe breastfeeding: safe
Lamotrigine	Cardiac defects facial clefts	2-5% dose dependent risks	Pregnancy: considered safe; may need dose adjustment breastfeeding: safe
Levetiracetam	Cardiac defects neural tube defects	1-2%	Pregnancy: considered safe breastfeeding: safe; further studies needed
Oxcarbazepine	Cardiac defects facial clefts	1-3%	Pregnancy: relatively safe breastfeeding: safe
Phenobarbital	Cardiac defects	2%	Pregnancy: relatively safe breastfeeding: avoid

VII. MANAGEMENT OF EPILEPSY IN PREGNANCY

- A multidisciplinary team that has the capability of managing the risks of pregnancy is crucial for the prevention of epilepsy during pregnancy.

Antepartum management

- Create a thorough background from the patient or an experienced family member regarding the time and date when was epilepsy diagnosed. What kinds of seizures are being experienced as well as how often seizures occur, what was the last time a seizure occurred, any triggers, and also what AED and dose of AED she is taking.
- Begin taking folic acid 5 mg a day until at least the 1st trimester.
- Pregnancy antenatal visit frequency is recommended to be raised.
- Be aware of nausea and vomiting, because it can result in lower levels of AEDs.
- Every time you visit, talk about and be aware of triggers, make sure to ensure AED compliance, take into consideration AED levels and titrate the dosage.
- The monitoring of fetal malformations starts at the end of the first trimester.
- Mother blood AFP levels are increased in the neural tube defect that is open.
- Take a look at fetal echocardiography for women who are taking AEDs especially those taking polytherapy.
- Ultrasonography with a detailed image starting at 11-14 weeks, followed by a specific imaging scan for fetal anomalies scan around 18-20 weeks.
- The third trimester of care is marked by more visits and more monitoring that would be expected for patients who don't suffer from epilepsy.

- Every month, ultrasounds are performed for the growth of fetuses to exclude intrauterine growth restriction.
- Continue to monitor monthly plasma AED levels.
- The idea of induction is best considered during the 39 week, due to the constant possibility of maternal and fetal injury due to seizures and the fact that the fetus is been fully developed by this stage of gestation.
- Insufficient sleep is an issue for everyone mothers, yet it's especially problematic for women suffering from epilepsy.
- Patients with a medical diagnosis often notice that they wake up early after a night of sleeping and are unable to return to sleep.
- Patients must try to get the minimum of four hours of continuous sleeping and could consider taking a nap during the day if the schedule allows to increase the number of hours of sleep.

Intrapartum management

- Epilepsy sufferers are reassured that the risk of having intrapartum seizures is very low (3.5 percent).
- A proper analgesia regimen is crucial along with hydration since these could trigger for a seizure-like episode.
- The delivery model should be determined exclusively by the indication of an obstetrical doctor. Aside from an anomaly in the neuroanatomical structure.
- There is no reason to consider the cesarean birth solely because of the reason of epilepsy in the mother.
- Minimum of 4 hours of restful sleep in the postpartum period is required.
- Intravenous access must be sought even if neuraxial pain is disregarded.
- Lorazepam in both intravenous and oral preparations should be available in case of an aura or seizures 1 mg in the event of aura. 2mg for seizure activity.
- Pediatricians must be present at the birth if lorazepam was administered due to the risk that respiratory regulation may be affected in the infant.
- Hyperventilation, stress and sleep deprivation should be avoided because there is a risk of increased possibility of seizure with their usage.

Seizures in labour should be treated with

- Benzodiazepenes (IV Lorazepam 2-4 mg bolus repeated every 10-20 minutes or diazepam 5-10 mg IV in a slow bolus, if lorazepam not available)
- Left tilt lateral () or manual displacement of the lower uterus)
- Oxygenation
- Continuous electronic, fetal heart rate monitoring.

Postnatal care & breastfeeding

- The risk of having postnatal seizures is greater in the postnatal phase than pregnancy. the risk is linked to an increase in stress postpartum, sleep deprivation and less compliance to AEDs.
- Patients with epilepsy should be allowed to take a room off their child so that they get a minimum of four hours of sleep.
- Postpartum personnel may need to be informed that this isn't a just a matter of convenience, instead it is a preventative "medication".
- AED dosing must be tapered down to pre-pregnancy doses.
- Tapering should not be initiated before three days after the birth unless the patient shows signs of excessive dosing.
- The practice of breastfeeding should be encouraged. While many AEDs can be absorbed through breastmilk, levels of baby plasma are likely to be a small fraction of those in the maternal blood.
- Parents should also not participate in co-sleeping.

Contraception

- All epilepsy patients should be informed about contraception.
- Levonorgestrel release intra-uterine system (LNG-IUS and medroxyprogesterone injections must be promoted as effective contraceptives which are not impacted by AEDs that induce enzymes.

AUTHORS

First Author – Dr. Neena Parashar, Shankar Medicare Centre, Faridabad

Energy Efficient Routing Protocol for wireless sensor network with Mobile Sink

Jolan Baccay Sy¹, Jake Dayag La Madrid²

Isabela State University
College of Computing Studies , Information and Communication Technology

DOI: 10.29322/IJSRP.12.10.2022.p13009
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13009>

Paper Received Date: 20th August 2022
Paper Acceptance Date: 24th September 2022
Paper Publication Date: 6th October 2022

ABSTRACT

A network of tiny battery-operated devices known as a wireless sensor network requires careful consideration of its energy usage. Care should be made in their design because they are typically used in hostile environments where battery replacement is impossible. In order to manage energy usage, routing is one of the key design considerations. At the same time, route is likely the most challenging aspect of network architecture. A noble centralized clustered tree-based routing system with a mobile sink was our suggestion. It is centralized to take advantage of the base station's limitless capacity and made into a cluster to cut down on energy use from redundant data transmission. For the control of mobile sink and load, we employed a tree-based technique.

The employed deputy cluster head and cluster head panel in our protocol to reduce the energy

consumption resulting from control packet overhead due to re-clustering and re-construction of a tree after the energy of a node is less than some given threshold value. Then, we contrast our excellent procedure with the established CTRP and TEDD protocols. Our simulation findings show that the suggested

protocol reduces the typical control packet overhead by roughly 11% compared to CTRP and 63% compared to TEDD. As a result, the average amount of energy used is reduced by 82% when compared to TEDD and by 25% when compared to CTRP. Additionally, it is demonstrated that when compared to CTRP and our suggested protocol, the first node's death is deferred by 83%.

Key words: re-clustering, tree, routing, WSN, control packet, mobile sink

1. INTRODUCTION

Advancement in micro-electronics technology has led to the development of small inexpensive wireless sensor devices capable of performing wide range of tasks. A wireless sensor consists of a micro-controller, wireless transceiver, memory, battery and sensor(s) like temperature, pressure, motion detection etc. These small devices are capable of performing fine grain sensing tasks and then communicating them over wireless media. Sensor networks applications are very vast ranging from large scale habitat monitoring, battle fields and intrusion detection applications to small critical health monitoring body area networks. Due to their vast applications, WSNs have seen a lot of interest from the research community. Many issues related

to data dissemination, energy consumption, auto configuration, etc. have been addressed [1].

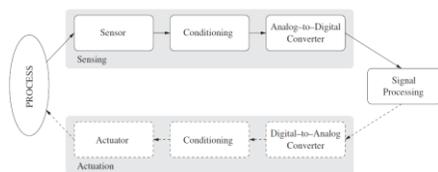


Figure 1.1 Sensing Processes[2]

Numerous thousands of inexpensive sensor nodes make up the wireless sensor network. Constraints on a sensor node include restricted computing power, storage, and energy. The sensor node keeps track of several environmental and physical parameters, including humidity, motion, fire, motion, temperature, and pressure. Tracking, surveillance, monitoring, healthcare, disaster relief, event detection, mapping biodiversity, intelligent buildings, facility management, preventive maintenance, etc. are all possible with WSN. Typically, sensor nodes are placed in hostile, unmanaged environments to monitor things like battlefields, chemical industries, nuclear reactors, and wild forests. Therefore, replacing or recharging the battery becomes a difficult operation. An abundantly equipped base station has limitless power, communication, and storage capacity. It could be a mobile node based or a static node.

Routing techniques play an important role in wireless sensor networks. It is cumbersome and/or impossible to assign global ids for a huge numbers of deployed sensor nodes. Therefore, traditional protocols might not be applicable for wireless sensor networks. Unlike conventional wireless communication networks (cellular network, MANET etc.), wireless sensor networks have inherent characteristics. It is highly dynamic network and specific to the application, and additionally it has limited energy, storage, and processing capability. These characteristics make it a very challenging task to develop a routing protocol. In most of the scenarios, multiple sources are required to send their data towards a particular sink. The nodes near the base station depleted their energy quickly and hence eventually die. This causes the network to partition; consequently, the life span of the network gets to reduce. The main

constraint of sensor nodes is energy. Since the sensors are battery-powered computing devices and it's hard to replace the batteries in many applications, WSN requires an energy-efficient routing protocol. There are many reasons for this. For instance, due to dense deployment, the sensor nodes generate redundant data, and the base station may receive multiple copies of the same data. Therefore, it highly consumes the energy of the sensor nodes. The other reason is that wireless sensor networks do not have any fixed infrastructure and hence it is highly dynamic. There are mainly two reasons responsible for the dynamic infrastructure. The first one is the energy since the sensor nodes have limited energy derived from batteries. The protocol should be able to balance the load among the nodes to ensure that the sensor nodes do not die. It leads to the dynamic network structure. The second reason is mobility; in many scenarios after the deployment of sensor nodes they are static but sink may move within and/or around the network. It also makes the network dynamic, and the protocol that works for static sink may not be applicable for mobile sink. In many applications, sensor nodes are required to know their location information. It is not feasible to enable all nodes with Global Positioning System (GPS)[3]. So the routing protocol should be able to take the help of the techniques like triangulation based positioning [4], GPS-free solutions [5], etc. to get location information of the nodes.

In recent years, attractive characteristics of sensor networks have led to incremental utilization in many military and civil applications such as battle field surveillance, environmental control, and security management. In such applications, it is important to efficiently disseminate information from each source to a sink node. However, if a sink moves to a different location, the data dissemination route may no longer be effective. The path will have to be continuously reconfigured based on the sink movement. The continuous reconfigurations can bring about tremendous traffic and energy wastage in the network. In particular, energy is considered as one of the most expensive resources in sensor networks [6].

Sink aggregates all the data received from the sensor field and forward it to the user through the

Internet. The sink is mobile in the case of WSN that makes the network dynamic. The energy consumption of the sensor nodes, which are nearest to the sink node, is much more than other nodes in WSNs. Because of more energy consumption, the nearest nodes die prior to the other nodes. This problem is known as an energy-hole problem. The sink mobility overcomes this problem. Energy efficiency and lifetime enhancement of the network is the prime concern of any wireless sensor network. The sensor network requires routing techniques for increasing the efficiency of any sensor nodes. **Wireless sensor network Motivation**

Many protocols and methods have been developed [7][8][9] to reduce energy consumption and manage mobility. In the type of networks under consideration of this thesis, a considerable amount of energy is consumed for re-clustering and re-construction of tree. Thus, the main motivation is to reduce the control packet overhead due to re-clustering and re-construction of the tree in tree based protocols. As a result the overall average energy consumption of the network can be noticeably improved. This motivated us to develop an energy efficient routing protocol.

1.1. Statement of problem

Sensor nodes are driven by battery and in many applications, these batteries cannot be replaced. They die when the battery exhaust and the network functionality are affected. Thus, a routing technique is very much essential to enhance the life span and manages the battery efficiently. This characteristic motivates to design energy-efficient routing techniques.

The energy hole problem can be solved using the mobile sink. However, the mobile sink management is a tedious task. Many routing protocols are working in the mobile sink environment but possess flaws like; ineffective management, increased energy consumption, and reduced data delivery ratio. It is essential to efficiently manage the mobile sink to prolong the lifetime of the network.

In the existing cluster based routing protocols with mobile sink, the energy consumption due to re-clustering and Cluster Head (CH) selection is causes high control packet overhead and average energy consumption of a network. This in turn causes shorter life time and high latency and need to be solved.

1.2. Objectives

1.2.1. General objective

The main objective of the research is developing energy efficient routing protocol with mobile sink by minimizing the control packet overhead caused by re-construction of a tree, re-clustering and cluster head selection.

1.2.2. Specific objectives

The specific objectives are:

- Increasing the life time of a wireless sensor network by using deputy cluster head and cluster head panel method.
- Managing the mobility of the sink using tree based architecture.
- Reducing the energy consumption of control packets overhead.
- Decreasing the average energy consumption of the network.
- Minimizing the packet delivery latency.

1.3. Methodology

1.3.1. Literature Survey

A number of journal papers and books from springer and IEEE transactions for wireless sensor computing and ad hoc networks are investigated in detail as books and journal papers are the major source of literature survey. Upon the investigation it can be seen that these papers are of two types. The first types are journal paper surveys published to elaborate particular concepts and to give hints on future works. These surveys along with books are studied to gain basic understanding of routing in wireless sensor networks, methods of mobile sink management and energy management algorithms. The second types are those papers which contain related works on the aforementioned methods.

1.3.2. Identifying the problem and research gap

A number of related works are extensively studied for identifying advantage and disadvantage of each work. From the pros and cons of previous works, a detailed analysis is performed to identify the gap

and extract a researchable aspect. Besides to this, the methods used to prove the evidences the different authors applied are thoroughly investigated to be able to propose state of the art methods and algorithms.

1.3.3. Design of the protocol

After identifying the research gap through an extensive survey and analysis of existing works, a number of design models and existing standards are studied to be able to come up with a reasonable network protocol design. Existing methods and algorithms are also investigated. A reasonable number of mobility models, network models and energy models are also identified and investigated as a basis for the design of better network protocol design.

1.3.4. Simulations of the proposed network protocol and tools

Appropriate evaluation metrics are studied from literatures and the performance of the proposed protocol is tested using evaluation metrics like network life time, average energy consumption, control packet overhead, end to end latency and packet delivery ratio. In testing these metrics, Castalia version 3.2 [10] is used as it is the most realistic simulator for dynamic wireless sensor networks and body area networks. It is also witnessed that this simulator has a suitable structural design which is suitable for the problem identified.

1.3.5. Comparison of the proposed algorithm with existing works

For testing the performance of the proposed protocol, it is compared with protocols of the same structure using the above mentioned evaluation metrics. Then a detailed and extensive analysis of the results is performed and finally conclusion is drawn from the simulation results found from Castalia 3.2.

2. PROPOSED PROTOCOL AND METHODS

Cluster tree based protocols are better in terms of control packet overhead, average energy consumption, network life time and latency from

the existing protocols. However these still have high control packet overhead in re-clustering and cluster head selection. So a centralized routing protocol is proposed where most of the computing tasks are handled by the sink. This protocol minimizes storage requirements at the node level and majority of the computing burden is shifted to the Base Station since the Base Station is a resourceful node. The clusters are formed by the Base Station and each cluster contains a Deputy Cluster Head (DCH) node and one Cluster Head (CH) node. This arrangement is to reduce the workload in the single CH node. The base station will periodically check the residual energy level of the cluster head nodes to ensure network connectivity and initiate tree formation and cluster head assignment. If the residual energy level of the cluster head is below a threshold level, the Base Station takes necessary actions such as change of headship or initiating re-clustering process. Initiating the entire re-clustering or Cluster Head selection process frequently, is energy consuming and actually an overhead. In order to reduce it, we used the notion of cluster head panel which is a set of suitable nodes for the roles of Cluster Head as well as Deputy Cluster Head. This is prepared at the time of system setup and is valid for the longest duration possible [11].

For the implementation of this proposed protocol, we used OMNETT ++ with Castalia, a simulator for wireless sensor networks which is based on OMNET ++ platform. So the proposed protocol is compared with the existing protocols in terms of Average Control Packet Overhead, Average Energy Consumption, Average End-to-End Latency, Packet Delivery Ratio and Network Lifetime.

2.1. System Model

2.1.1. Assumptions

The following assumptions are considered for the proposed protocol [30].

- Sensors node are all stationary after deployment.
- The sink is moving within the network with a specified speed.

- The sensor nodes are uniformly distributed in the network field with random deployment.
- The base station possesses unlimited memory, computation and battery power.
- The sensors are homogeneous and have the same capabilities.
- Sensor nodes are battery powered, hence have limited energy.
- Sensor nodes can calculate their residual energy.
- Links are symmetric, i.e., the data speed or quantity is the same in both directions, averaged over time.
- There is no obstacle hindering the movement of the sink.

2.1.2. Network model

It is considered that a wireless sensor network that consists of n number of sensor nodes and a mobile sink. The protocol generates a tree T from the sensor nodes. It can be represented as a graph $G(V,E)$ where $V = \{v_1, v_2, \dots, v_n\}$ is the sensor nodes and E is the link between a node set (v_i, v_j) where $v_i, v_j \in V$. The tree construction is independent of the sink position. The sink is moving within the network with the varying speed of 5 to 30 meter/second. The Pause time (δ) for sink to collect the data is 5 seconds [12]. The network is divided into equal sized virtual grids. The grids are formed in such a way that every node of a grid can communicate directly with the nodes of adjacent and diagonal grids. The Base Station or Sink is located far away from the sensor field. Sensor field is the geographic region in which sensor nodes are deployed. The sensor nodes are deployed in such a manner that they organize themselves into a dense network. Depending on the application, the number of sensor nodes deployed for studying a phenomenon may be in the order of hundreds or thousands.

2.1.3. Mobility model

For modeling the movement of the sink, an appropriate mobility model should be implemented. Because the performance of the proposed protocol is highly dependent on the movement pattern of the sink.

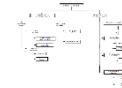


Figure 2.1 Classification of Mobility Models and Examples [13] [14]

Existing mobility models in literature can be classified into two main categories where the first category is called heterogeneous mobility models and the second one is named homogenous mobility model [15][16].

In contrast, homogeneous mobility models are based on having nodes of the same type in the network. To elaborate, the network will be consisting of a group of mobile nodes adopting and using the same mobility model. Furthermore, these mobile nodes will collaborate in order to monitor the area of interest and collect the required information. In some cases all the nodes in the network might be mobile while in other cases only a sub-group of sensor nodes are mobile which are able to move from one location to another [15][16].

Note that each of the previously mentioned categories can be further divided into different subcategories that are summarized in Figure 3.1 which is adapted from [61] and [63]. Heterogeneous mobility models can be divided into four subcategories namely; random models, controlled models, predictable models and geographic models. On the other hand, homogeneous mobility models can be further classified into controlled models and random models where the random models can also be divided into totally random and partially random subcategories. Example of mobility models that fall under each category are provided in Figure 3.1.

In our case, the sink is moving and the nodes are stationary from which we can conclude that our network movement pattern belongs to heterogeneous type. Among the heterogeneous mobility models, the random waypoint mobility model is considered as a benchmark for studying wireless sensor networks [13].

Random Waypoint mobility model:

Random Waypoint model is a “benchmark” mobility model for Ad-Hoc networks to evaluate the performance of the routing protocol. The random waypoint model is used for the sink

mobility in WSNs. It generates the next position randomly in between P_{min} and P_{max} . Sink travels towards its succeeding position with constant speed or random speed. When the sink node reaches the next position, it pauses for the time duration called the Pause time (δ) [17]. The values of pause time and speed should be carefully selected as it impacts the stability of a network. Fast nodes and long pauses produce a more stable network than slow nodes and short pauses [18].

2.1.4. Energy Model

In wireless sensor networks energy is expended due to several reasons like transmission of messages, reception of messages, sensing and local data processing. Therefore a good energy model is required in order to have an insight into where the energy is expended. So the total energy consumption is derived considering the above sources of expenditures and used for the implementation of the proposed protocol. Let's assume that the energy expense due to the transmission of k bits of data over a distance d is given by $E_{tx}(k, d)$ and the energy expended due to the reception of k bits of data is given by $E_{rx}(k)$. So the total energy consumption of the sensor network can be given by:

$$E_{Total} = E_{tx}(k, d) + E_{rx}(k) + E_{agg}(k) + E_{sleep}(t) \dots \dots \dots 3.1$$

Where $E_{sleep}(t)$ is the energy spent by the node while in the sleep mode for a specified period of time and $E_{agg}(k)$ is the energy spent by the cluster head for the fusion of the energy where it is given in Equation 3.2.

$$E_{agg}(k) = E_{pro} \times k \dots \dots \dots 3.2$$

Where E_{pro} is the energy cost of one bit for processing and k is the data size in bits.

Equations 3.3 and 3.4 are the energy derivations for $E_{tx}(k, d)$ and $E_{rx}(k)$ respectively.

$$E_{tx}(k, d) = E_{elec} \times k + E_{amp} \times k \times d^\alpha \dots \dots \dots 3.3$$

Where d is the transmission distance and α is the path loss exponent.

$$E_{rx}(k) = E_{elec} \times k \dots \dots \dots 3.4$$

Where E_{elec} is the energy cost of the electronic circuit used to receive or transmit a bit of signal. By using the free space propagation model [19] the energy cost on amplifier E_{amp} referred as:

$$E_{amp} = \epsilon_{fs} \dots \dots \dots 3.5$$

ϵ_{fs} is the energy cost of one bit to transmit in one hop in an open space or transmission and E_{amp} is the energy consumption of the amplifier to maintain the radio for reliable transmission. [20]. α is the path-loss-exponent and the value of $\alpha \in \{2, 4\}$ [21]. If the distance between the transmitter and recipient is d meter and threshold value of the distance is d_0 then;

$$\alpha = \begin{cases} 2 & \text{if, } d \leq d_0 \\ 4 & \text{if, } d > d_0 \end{cases} \dots \dots \dots 3.6$$

d_0 can be

given by:

$$d_0 = \sqrt{\frac{\epsilon_{fs}}{\epsilon_{mp}}} \dots \dots \dots 3.7$$

ϵ_{mp} here is the energy cost of one bit in a multi hop transmission model.

Using Equations 3.5, 3.6 and 3.7, equation 3.3 can be rewritten as:

$$E_{tx}(k, d) = \begin{cases} E_{elec} \times k + E_{amp} \times k \times d^2 & \text{if, } d \leq d_0 \\ E_{elec} \times k + E_{amp} \times k \times d^4 & \text{if, } d > d_0 \end{cases} \dots \dots \dots 3.8$$

Now let's define the energy spent by the node during sleep mode.

$$E_{sleep}(t) = E_{lo} \times t \dots \dots \dots 3.9$$

Where E_{lo} is the energy consumption of a node at sleep mode in one second duration while the total time is given by t . Therefore the total energy consumption of a sensor node is given as shown in Equation 3.1.

2.2. Performance Metrics

To demonstrate the performance of the proposed protocol, we used some standard performance metrics such as average energy consumption, control packet overhead, network lifetime and end to end latency.

1. **Average Energy Consumption:** it is the total average energy that each node expends for transmission, reception, aggregation, processing,

sleeping and listening. It is the measure of how a protocol is efficiently working and highly dependent on the design of the energy model we apply in the protocol. The energy expense for the control packet communication also affects the total energy measurement.

2. **Control Packet Overhead:** apart from the data transmission and reception in a particular protocol, there are also packets communicated among nodes for different purposes like grid construction, cluster formation, tree construction, re-clustering, and so on. These packets are called overhead packets because, they are not the actual data packet intended to reach at a particular destination. So these packets take some amount of energy and the measure of the energy cost due to them is termed as control packet overhead.
3. **Network Lifetime:** it is the measure of the life span of a particular network for which it lasts functional. The definition of this metric is quite dependent on applications and might be different accordingly. Some applications may not be affected with the death of some nodes in the network while some may be highly sensitive to a death of a single node which causes network partition. Thus it may be defined as a life span till the first node dies, some portion of the nodes die or particularly partition is created. Therefore the energy model we use to efficiently manage the energy consumption and the control packet overhead is very important in enhancing the lifetime of a network.
4. **End-to-End Latency:** The end-to-end latency is measured as the time taken for a data packet to transmit over a network from source to sink. It may consider all types of delay such as queuing delay, route discovery delay, processing delay, and so on. This metric indicates the robustness of the routing protocol[20].
5. **Message Delivery Ratio:** this metric is the measure of the ratio of the message received at the base station to the message sent. It measures how successfully a message is delivered to the intended destination and shows reliability of a route or a network in general.

2.3. The proposed protocol

The proposed protocol is called an energy efficient centralized tree based routing protocol for wireless sensor networks. It majorly consists of cluster formation and tree construction phases. The entire network is divided into equal sized square grids where these grids are considered to be clusters. Under normal conditions, cluster formation consists of cluster head election and joining process. After

the cluster head is selected in each grid, all the rest of the nodes discovered their cluster head and join it. Then these cluster heads in each grid are considered as vertices to construct a tree. This protocol consists of DCH and cluster head panel. The cluster head panel contains candidate nodes including the DCH which eventually takes the CH position when the energy of the CH is drained below threshold value. The DCH and the candidate nodes from the panel are selected by the sink. In the set up phase, the DCH and the other candidates advertise themselves to the rest of the nodes. In this proposed protocol, when the residual energy of the cluster head is less than the threshold energy, the sink initiates the change of headship to the deputy cluster head without going through all the normal re-clustering process. This process of changing the headship is important because it doesn't require the entire tree re-construction process.

The proposed protocol consists of several phases such as grid construction, cluster formation, re-clustering, tree formation, tree re-construction, mobile sink management, and data transmission.

2.3.1. Grid construction

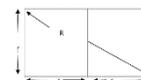


Figure 2.2 Grid size estimation

Grid based routing protocols are the most efficient protocols for data disseminating towards a mobile sink [22]. Because the total overhead due to the formation of equal sized square grids is negligible.

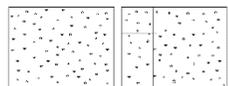


Figure 2.3 Grid size estimation with diagonal grids

This smaller-sized grid provides better connectivity with neighbor grids and freedom to transmit the data with shorter path length [12]. Once the grid size is decided using the above mentioned methods, the sensor nodes find their grid coordinate (X, Y) using Equation 3.14.

$$X = \left\lfloor \frac{x}{Sg} \right\rfloor, Y = \left\lfloor \frac{y}{Sg} \right\rfloor \dots\dots\dots 3.14$$

Now the entire network is divided into equal virtual grids and looks as shown in Figure 3.4.



a. Network before the grid is formed
 b. network after grid formation
 Figure 2.4 grid construction



a. Cluster head selection
 b. cluster formation final view
 Figure 2.5 cluster formation

2.3.2. Cluster formation

What follows immediately after the grid construction is the cluster formation phase in which a cluster head is selected from each grid. The cluster and non-cluster head nodes are represented as shown in Figure 3.5. The cluster head is elected using two main criteria.

1. The residual energy of the node should be greater than the threshold value where the threshold value is the average energy of the network at the time of consideration represented as:

$$Er(z) \geq E_{threshold} \dots\dots\dots 3.15$$

Assuming that G_z is the grid coordinate of any node z , $CH(z)$ is the cluster head of any node z in grid G_z , and $Er(z)$ is the residual energy of any node $z \in G_z$.

2. The candidate node to be selected as cluster head should be closer to the centroid of the grid given by:

$$CH(z) = \min_{1 \leq i \leq j} (|D(z_i)|) \dots\dots\dots 3.16$$

Where $z_1, z_2, z_3, \dots, z_j$ are the nodes in the grid G_z , and $|D(z_i)|$ is the distance of any node z_i from the centroid of the grid.

After the cluster heads are elected from each grid, they broadcast advertisement (CH_ADV) packet within the grid. The non-cluster head nodes then send join request packet (CH_JOIN) and join the cluster head of that grid and create a cluster as shown in Figure 3.5(b). Then the cluster head generates a time-slot schedule for the cluster members to collect data in a collision-free manner [12]. This process is shown in Algorithm 3.1.

Algorithm 3.1

Cluster Formation

Data Structure for any sensor node A:

- CH(A): cluster head of node A.
- G_A : Grid coordinates of node A.
- CHSelected_A: set to **true** when the sensor node A selected the cluster head, initialized to **false**.
- ChMbr(CH): set of cluster members of any cluster head CH.
- id_{CH}: Id of Cluster head
- G_{CH} : the grid of the Cluster head
- id_A: Id of node A
- id_{CH(A)}: Id of the cluster head of node A

Node A receives following packet from CH.

```

CH_ADV: <CH_ADV, idCH, GCH>;
if (GA == GCH) then
    CHSelectedA ← true;
    idCH(A) = idCH;
    Send (CH_JOIN, idA, idCH(A));
    //Send the join request to the CH
else
    Drop the packet;
end if
    
```

```

CH_JOIN : <CH_JOIN, idA, idCH(A)> //
CH receives join request from any node A
if (idCH == idCH(A)) then
    CHmbr(CH) ← CHmbr(CH) ∪ A;
else
    Drop the packet;
end if
    
```

After receiving all CH_JOIN packets, the CH broadcasts the time-slot schedule to the cluster members CHmbr(CH).

2.3.3. Re-Clustering

When the residual energy of the cluster head in any one of the virtual grids becomes less than the threshold value of the energy, the sink node initiates a change of cluster headship. As a result the deputy cluster head will take the head responsibility and takes the position of the vertex of the tree which were taken by the cluster head and communication continues as always. This is done by the instruction of the sink towards the nodes and their new cluster head. As shown in Algorithm 3.2, the cluster head

with residual energy less than the threshold energy hands over the responsibility to a deputy cluster head node or any node amongst the cluster head panel by the intelligent instruction of the sink..

Algorithm 3.2

Re- Clustering

Data Structure for any sensor node A :

DCH(A): new cluster head of node A.

ChMbr(DCH): set of cluster members of any new deputy cluster head.

node A receives the following packet from sink:

```
DCH_ADV : < DCH_ADV, idDCH>;
send (CH_JOIN, idA, idDCH(A));
//Send the join request to the deputy cluster head
else
Drop the packet;
end if
```

DCH receives the following packet from node A:

```
CH_JOIN : < CH_JOIN, idA, idDCH(A)>
if(idDCH == idDCH(A)) then
CHMbr(DCH) ← ChMbr(DCH) u A;
else
Drop the packet;
end if
```

Therefore using Algorithm 3.2, the Cluster head responsibility is handed over to the DCH. This enables the re clustering process to only involve change of the cluster head which saves considerable amount of energy. After joining their Deputy Cluster head, the nodes start transmitting using their previously assigned time slots.

2.3.4. Tree construction

In this phase, the cluster heads in each virtual grid are taken as vertices and a tree is constructed for data dissemination to the mobile sink. Any one of the cluster heads intelligently selected by the sink may initiate the tree construction by broadcasting T_MSG control packet. This is shown in Algorithm 3.3.

Algorithm 3.3

Tree Construction

Data Structure for any sensor node A :

Children (A): children set of node A.

Parent (A): parent of node A.

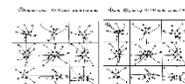
IsCHA : it is true if any node A is a cluster head.

Parent_Selected_A : set to **true** when the sensor node A selects its parent, initialized to **false**.

T_MSGSent_A : set to **true** when the sensor node A sends T_MSG packet, initialized to **false**.

node A receives the following packets from node B:

```
T_MSG : < T_MSG, idB, Parent(B) >
if (IsCHA == true) then
if (idA == Parent(B)) then
Children(A) ← Children(A) u { idB };
else if (Parent_SelectedA == false) then
Parent(A) ← idB;
Parent_SelectedA ← true;
if ((T_MSGSentA == false)) then
T_MSGSentA ← true;
Broad (T_MSG, idA, Parent(A)); //Broadcast
T_MSG packet
else
Drop the packet;
end if
end if
else
Drop the packet;
end if
```



- a. Tree construction initial view
- b. tree construction after gateway node is selected

Figure 2.6 Tree construction

We can see from the Algorithm 3.3 that, when the cluster heads of the different grids receive the T_MSG they perform following operations:

- If the recipient is the cluster head, it checks the sender's parent *id* and if it is the same as the receiver node *id*, then includes the sender *id* in the children list *Children(A)*.
- If it has not selected any parent, then select sender node as its parent.
- If T_MSGSent flag of the recipient Cluster head is false, then broadcast T_MSG packet with modified parameter to the network.

This way the tree is constructed as shown in figure 3.6 (a) to make sure the network is connected.

2.3.5. Tree re-Construction

Whenever the residual energy is less than the threshold energy, we said that the sink intelligently instructs the change of cluster head. In this process the cluster head is going to be changed by the deputy cluster head or the respective nodes from the cluster head panel. This dictates the re-construction of the tree. The following algorithm shows this re-construction process.

Algorithm 3.4

Tree re-Construction

Data Structure for any sensor node A:

Children(DCH) : children set of the new cluster head

Parent(DCH) : parent of The new cluster head

DCH receives the following packets from the sink:

T_MSG : < T_MSG, id_{DCH}, Parent(DCH), children(DCH) >

Send (T_MSG, id_{DCH}, Parent (DCH) children (DCH)); //send only to its parent and child nodes.

Upon receiving the T_MSG described in Algorithm3.4, the receiving cluster head nodes know that they are parent or child node of the newly elected cluster head and they automatically update their parent or children member list accordingly.

2.3.6. Mobile Sink Management and load balancing

In the wireless sensor networks of this type where the sink is mobile, the random waypoint mobility model is the suitable model. So the sink in this protocol follows this model to go around the network and collect information. An appropriate

pause time is selected so that the sink pauses for some time and collect the information in that area. The sink is intended to go with speeds varying from 3 m/s to 30 m/s with a pause time of 5 seconds. The sink selects the closest node from among the nodes as a gate way node and a communication link is created to the rest of the network through the gate way node. The data then is transmitted through this link from the cluster heads. This is demonstrated in Figure 3.6 (b) and Algorithm 3.5.

When the mobile sink reaches to the new position, it selects the closest cluster head as a gateway node and transmits a Gateway packet. The gateway packet consists of sink *id* and selected gateway node *id*. When the selected gateway node receives the packet, it selects the next node as the sink to transmit the data and broadcasts the acknowledgment (ACK) packet. The ACK packet consists of the sender *id* and gateway node *id*. The recipient cluster head performs the following operations:

- Checks if the ACK packet sender is a parent or a child, then
- Checks if the ACK packet is not for the previous gateway node, then
- Selects the gateway node as newly selected gateway node and selects next node as sender node *id*.
- Forwards the ACK with its *id* and gateway node *id*.

Using the above illustrated process, the next cluster head to receive the data is selected. In the same way when the sink is displaced to another position, it communicates the gateway node with a *stop* signal. Then upon receiving the *stop* signal, the gateway node broadcasts the packet to the rest of the network to instruct them to stop transmitting until a new position of the sink is announced. This enhances the message delivery ratio and at the same time prevents the message loss.

Algorithm 3.5

Mobile Sink Management

Data Structure for any sensor node A and sink:

Gateway_{sink}: gateway node selected by the sink.
 next node_A: the cluster head *x* selects the next cluster head for data transmission.

SendData_A : set to true once the cluster head chooses the next node_A for data transmission, initialized to false.

IsCHA : it is true if any node x is a cluster head.
Gateway_A : gateway node selected by the node x.

Sink transmits the following packet to the closest cluster head.

Send (Gateway, id_{sink}, Gateway_{sink}); //the sink unicasts the Gateway packet to the selected gateway node.

Cluster head node A receives following packets from the sink:

Gateway: < Gateway, id_{sink}, Gateway_{sink}>

if (id_A == Gateway_{sink}) *then*

next node_A ← id_{sink};

broad (ACK, id_A, Gateway_{sink});

//Broadcast the ACK packet.

else

Drop the packet;

end if

Cluster head node A receives following packets from node B:

ACK: < ACK, id_B, Gateway_{sink}>

if (IsCH &&((id_B ∈ Parent(A)) || (id_B ∈ Children(A)))) *then*

if (Gateway_A ≠ Gateway_{sink}) *then*

Gateway_A ← Gateway_{sink};

SendData_A ← true;

next node_A ← id_B;

broad (ACK, id_A, Gateway_{sink});

//Broadcast the ACK packet.

end if

else

Drop the packet;

end if

2.3.7. *Data Transmission*

Nodes sense the data and send it to the cluster head. The cluster head then aggregates the data and sends it to the next cluster head in the tree if the *SendData* flag is true. In this way the data reaches to the gateway node. Once it reaches to the gateway node then the gateway node forwards it to the sink as described in detail in Algorithm 3.6.

Algorithm 3.6

Data Transmission

Data Structure for any sensor node A :

Send_Data_A : set to *true* once the relay node chooses the *next_node_A* for data transmission, initialized to *false*.

Send_Data(A) : node A add the pair of id and seq_no after receiving the DATA packet.

node A will receive the following packet from node B.

DATA : < DATA, id_{source}, seq_no_{source}, Nextnode_B>

if (id_A == Nextnode_B) *then*

if (< id_{source}, seq_no_{source}> ∈ Send_Data(A))

then

Send_Data(A) ← Send_Data(A) ∪ {id_{source}, seq_no_{source}};

if (Send_Data_A == true) *then*

Forward (DATA, id_{source}, seq_no_{source}, next_node_A); //Forward the DATA packet to the next node.

end if

end if

else

Drop the packet;

end if

4. SIMULATION RESULTS AND DISCUSSIONS

4.1. *Simulation Software*

For the proper simulation of performance metrics, the selection of the appropriate simulation tool is very crucial. In our case, OMNET++ with Castalia is the preferable tool as it fully supports mobility and its structural design is suitable for our problem.

OMNeT++ with Castalia:

OMNeT++ is a component-based discrete event simulator. OMNeT++ uses building blocks called modules to implement their simulation. Modules are connected in a hierarchical nested fashion, where each module can contain several other modules. It uses Castalia which is a simulator for Wireless Sensor Networks (WSN), Body Area Networks and generally networks of low-power embedded devices. It is based on the OMNeT++ platform and used by researchers and developers to test their distributed algorithms and/or protocols in a realistic

wireless channel and radio model, with a realistic node behavior especially relating to access of the radio. Castalia uses the lognormal shadowing model as one of the ways to model average path loss, which has been shown to explain empirical data in WSN [24]. It also models temporal variation of path loss in an effort to capture fading phenomena in changing environments (i.e., the nodes or parts of the environment are moving). Castalia's temporal variation modeling is designed to be fitted to measured data instead of making specific assumptions on the creation of fast fading. The main features of Castalia are given as follows which clearly shows why this simulator is chosen [10]:

- Advanced channel model based on empirically measured data.
 - ✓ Model defines a map of path loss, not simply connections between nodes
 - ✓ Complex model for temporal variation of path loss
 - ✓ Fully supports mobility of the nodes
 - ✓ Interference is handled as received signal strength, not as separate feature
- Advanced radio model based on real radios for low-power communication.
 - ✓ Probability of reception based on SINR, packet size, modulation type. PSK FSK supported, custom modulation allowed by defining SNR-BER curve.
 - ✓ Multiple TX power levels with individual node variations allowed
 - ✓ States with different power consumption and delays switching between them
 - ✓ Realistic modeling of RSSI and carrier sensing
- Extended sensing modeling provisions
 - ✓ Highly flexible physical process model.
 - ✓ Sensing device noise, bias, and power consumption.
- Node clock drift
- MAC and routing protocols available.
- Designed for adaptation and expansion.

Evaluation parameter	value
Network area	200 x200 m ²
Number of sensor nodes	200
Data packet size	512 bytes
Control packet size	32 bytes
Initial Energy	1J
E_{elec}	50 nJ/bit
E_{fs}	10 pJ/bit/m ²
E_{mp}	0.0013pJ/bit/m ⁴
d_o	45m
E_{low}	0.2 nJ/sec

Simulation time	1000 seconds
MAC Protocol	TMAC

Table 4.1. Simulation parameters.

4.2. Simulation results

An extensive and repetitive simulation have been done to verify and compare our proposed protocol with the well-known tree based protocols CTRP and TEDD using the performance metrics average energy consumption, control packet overhead, network life span and message delivery ratio.

We used the Castalia simulator v 3.2 to experiment our proposed algorithm and used sets of parameters shown in Table 4.1. The parameters have been taken as standardized for the MICAz Mote data sheet [25].

4.2.1. Average control packet overhead

Figure 4.1 illustrates the average control packet transmission and reception overhead expressed in joules.

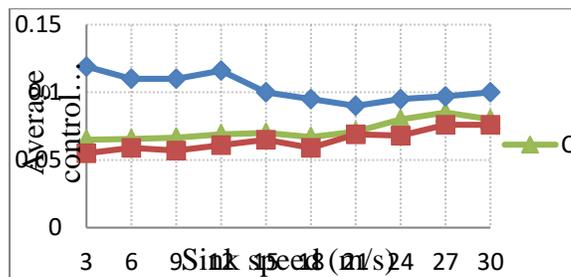


Figure 4.1 average control packet overhead

The control packet overhead includes the energy consumption for connection establishment, cluster head selection, tree construction, mobility management and load balancing. In TEDD and CTRP, the energy consumption due to relay and non-relay node interaction and the interchanging between their roles is higher than the proposed protocol. In the proposed protocol, the energy consumption of control packets is considerably reduced by the application of deputy cluster head and the cluster head panel as well as the mechanism employed for re-clustering and tree re-formation which removes the involvement of all nodes for re-clustering and tree formation every time the energy of a node is below the threshold value. Therefore the average control packet overhead in the proposed protocol is reduced by 11.78% compared to CTRP and 63.012% compared to TEDD.

4.2.2. Average energy consumption per node

This is the average energy each node consumes for the transmission and reception of data packets and control

packets that are exchanged among nodes. In the CTRP and TEDD protocols, once the energy of the cluster heads is below the threshold energy required, the entire clustering and tree formation process is initiated.

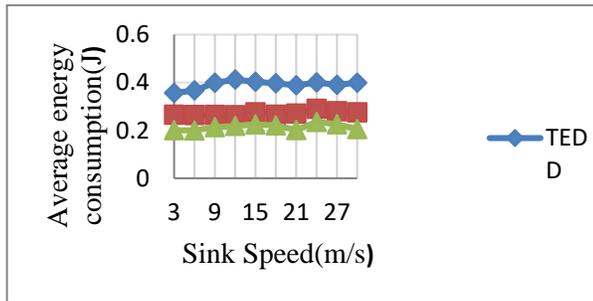


Figure 4.2 Average energy consumption

But in the proposed protocol, no re-clustering and tree re-formation is expected which results in a relatively low average energy consumption of each node. Figure 4.2 depicts that the proposed protocol consumes an average of 25.78% less energy than CTRP and 82.36% compared to TEDD.

4.2.3. Network life time

Network life time can be defined as the life span of a network until the first node dies. In routing protocols in wireless sensor networks in general, the life time is affected by many factors. It is affected by the control packet overhead due to the communication among nodes, between a node and a cluster head, a node and sink, a cluster head and a sink. It can also be affected by neighbor discovery, cluster head selection, data fusion, tree formation and other factors.

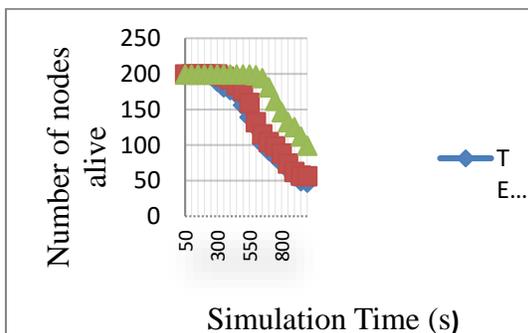


Figure 4.3 Network lifetime

In the proposed protocol the control packet overhead for re-clustering and Tree re-formation is highly reduced and the life time of the network improves considerably as a result. As can be seen in Figure 4.3, the death of the first node in TEDD is recorded after 250s of simulation time and CTRP after 300s whereas the first death in the proposed protocol happens after 550s of simulation time. Thus, death of the first node in the proposed protocol is postponed by almost 83% compared to CTRP and by 120% compared to TEDD. This results in an energy efficient protocols which leads to higher lifetime.

4.2.4. End-to-End Latency

The total time it takes for a packet to travel from its transmission to reception is dependent on many factors such as the speed of the sink, pause time and the time it takes to manage the mobility and cost of sink as well as re-clustering and re-construction of a tree. As can be seen from Figure 4.4, the latency of the proposed protocol relative to CTRP and TEDD is shown and it is different for different sink speeds. But the proposed protocol takes an average of 4.55% less time and cost when compared to CTRP and an average of 70.02% compared to TEDD. Therefore the proposed protocol outperforms in terms of latency compared to CTRP and TEDD.

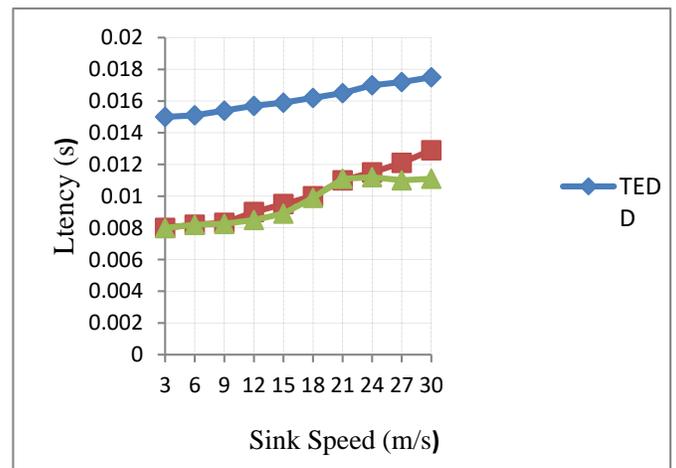


Figure 4.4 End to End Latency

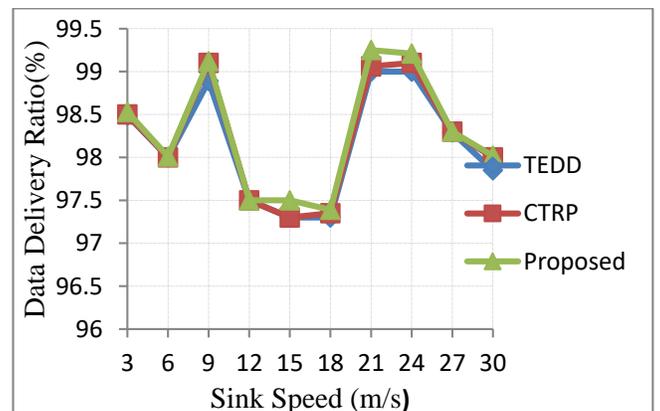


Figure 4.5 Data Delivery Ratio

4.2.5. Message Delivery Ratio

A routing protocol with a mobile sink usually suffers from data loss caused by link failure due to the movement of the sink in a certain speed. Message delivery ratio is ratio of the received data by the sink to the sent data by nodes which shows reliability of the link. As shown in Figure 4.5, the

message delivery ratio of the protocols for different sink speeds varies. In our protocol the message delivery ratio is improved with an average of 0.052% compared to CTRP and with an average of 0.123% compared to TEDD.

5. CONCLUSION AND FUTURE WORKS

5.1. Conclusion

As routing in wireless sensor networks is one of the major sources of energy wastage and as these networks are very energy deficient, we examined many energy efficient routing protocols and proposed a noble routing protocol. Our proposed protocol is centralized to shift most of the energy consuming tasks to the base station which is a resourceful node. It is also clustered, tree based for data aggregation and load balancing to enhance the network lifetime. In this thesis work, Castalia v.3.2 simulator which is based on OMNeT++ is used to simulate and compare our proposed protocol with the well-known tree based protocols called CTRP and TEDD. Our protocol focuses on reducing energy consumption due to re-clustering and tree re-construction. By applying the concepts of deputy cluster head and cluster head panel in our protocol, the control packet overhead is considerably reduced. To prove that the application of these concepts brings the expected results an extensive and repetitive simulation is performed in our protocol and compared with the simulation results of CTRP and TEDD. Our simulation results demonstrate that the life time of the network in our protocol is improved by postponing the death of the first node by almost 83% compared to CTRP and 120% compared to TEDD. It is also shown that the control packet overhead and average energy consumption is reduced by considerable amount. The end to end latency is also reduced and message delivery ratio is improved. Therefore we concluded from our simulation results that our proposed protocol outperforms the well-known energy efficient routing protocols CTRP and TEDD in terms of average energy consumption, control packet overhead, network lifetime, end to end latency and message delivery ratio.

5.2. Future Work

Our proposed protocol is a centralized one. This limits its scalability. Even though it is sufficiently applicable for some specific applications like wild life monitoring, air pollution monitoring in a certain area and machine health monitoring etc., its scalability is limited. Therefore enhancing its scalability keeping its best performance can be considered for future work.

I. REFERENCES

- [1] D. Son, B. Krishnamachari, and J. Heidemann, "Experimental study of concurrent transmission in wireless sensor networks," *SenSys'06 Proc. Fourth Int. Conf. Embed. Networked Sens. Syst.*, pp. 237–250, 2006.
- [2] C. P. Walteneagus Dargie, "Fundamentals Of Wireless Sensor Networks Theory And Practice" a john wiley and sons, ltd, publication, pp 4-8. 2010.[Book].
- [3] K. Jana, "A distributed algorithm for energy efficient and fault tolerant routing in wireless sensor networks," *Int. J. Information and Communication Technology*, Vol. 8, pp. 196-203, 2014.
- [4] B. Cheng, R. Du, B. Yang, W. Yu, C. Chen, and X. Guan, "An Accurate GPS-based Localization In Wireless Sensor Networks : A GM-WLS Method," *IEEE transactions on parrallel processing*, pp 146-152, 2011.
- [5] S. Capkun, M. Hamdi, and J. Hubaux, "GPS-free positioning in mobile Ad-Hoc networks," *Proceedings of the 34th Hawaii International Conference on System Sciences*, vol. 10, no. -, pp. 1–10, 2001.
- [6] J. Li and P. Mohapatra, "Analytical modeling and mitigation techniques for the energy hole problem in sensor networks," *Pervasive Mob. Comput.*, vol. 3, no. 3, pp. 233–254, 2007.
- [7] J. Wang, Y. Gao, W. Liu, A. K. Sangaiah, and H. J. Kim, "Energy efficient routing algorithm with mobile sink support for wireless sensor networks," *Sensors (Switzerland)*, vol. 19, no. 7, pp. 1–19, 2019.
- [8] S. Tamilselvi and S. Rizwana, "Traffic-Aware Reliability Enhanced Cluster Head Selection Based Routing for Heterogeneous WSNs," *Int. J. Innov. Technol. Explor. Eng.*, vol. 9, no. 3, pp. 2604–2609, 2020.
- [9] I. Chatzigiannakis, A. Kinalis, and S. Nikolettseas, "Efficient data propagation strategies in wireless sensor networks using a single mobile sink," *Comput. Commun.*, vol. 31, no. 5, pp. 896–914, 2008.
- [10] "Castalia Wireless Sensor Network Simulator website and user manual." [Online]. Available: <http://castalia.npc.nicta.com.au/>.
- [11] Hiren Kumar Deva Sarma, Avijit Kar, Rajib Mall "Energy Efficient and Reliable Routing Protocol for Dense and Mobile Wireless

- Sensor Network System,”IEEE transactions on distributed sensor systems, pp. 75–101.2010.
- [10] I. Slama, H. Jouini, A. Mami, and N. Boulajfen, “Wireless Sensor Network Energy Optimization in Smart Home Using LEACH Protocol : Comparative Study with CTP Routing Protocol,” International journal of engineering and technology, vol. 7, pp. 147–154, 2018.
- [11] W. R. Heinzelman, A. Chandrakasan, and H. Balakrishnan, “Energy-Efficient Communication Protocol for Wireless Microsensor Networks,” Proceedings of the 33rd Hawaii International Conference on System Sciences vol. 33, no. -, pp. 1–10, 2000.
- [12] N. Bagga, S. Sharma, S. Jain, and T. R. Sahoo, “A Cluster-tree based Data Dissemination Routing Protocol,” *Procedia Comput. Sci.*, vol. 54, pp. 7–13, 2015.
- [13] F. Bai and A. Helmy, “Wireless Adhoc Networks,” international journal of innovative tech. pp. 1–30, 2012.
- [14] A. A. Taleb, “A Comparative Study of Mobility Models for Wireless Sensor Networks,”journal of computer science, pp. 12.21 2018.
- [15] A. Abu, T. Tareq, A. A. Reem, A. Taleb, and O. A. Hassan, “Sink Mobility Model for Wireless Sensor Networks,”Arab Journal of science and Engineering, vol 10, pp. 1775–1784, 2014.
- [16] A. A. Taleb and T. Alhmiedat, “Depth First Based Sink Mobility Model for Wireless Sensor Networks,” International journal of electrical, electronics and computer systems, vol. 19, No 02, 2014.
- [17] S. Sharma and S. K. Jena, “Data Dissemination Protocol for Mobile Sink in Wireless Sensor Networks,” *Journal of Computational. Engineering.*, vol. 24, pp. 1–10, 2014.
- [18] R. A. Pushpa, “Impact of Mobility models on Mobile Sensor Networks,” IEEE transactions on communication vol, 17, pp. 102–106.2011.
- [19] W. B. Heinzelman, A. P. Chandrakasan, S. Member, and H. Balakrishnan, “An Application-Specific Protocol Architecture for Wireless Microsensor Networks,” vol. 1, no. 4, pp. 660–670, 2002.
- [20] S. Sharma, P. Agarwal and Jena, “EAMRP : energy aware multipath routing protocol for wireless sensor networks *Int. J. Information and Communication Technology*,” vol. 8, no. 2/3pp. 235–248, 2016.
- [21] Q. Wang, M. Hempstead, and W. Yang, “A Realistic Power Consumption Model for Wireless Sensor Network Devices,” IEEE communications, 2006.
- [22] S. Sharma, P. Agarwal and Jena, “EAMRP : energy aware multipath routing protocol for wireless sensor networks *Int. J. Information and Communication Technology*,” vol. 8, no. 2/3pp. 235–248, 2016.
- [23] Q. Wang, M. Hempstead, and W. Yang, “A Realistic Power Consumption Model for Wireless Sensor Network Devices,” IEEE communications, 2006.
- [24] M. Zuniga and B. Krishnamachari, “Analyzing the Transitional Region in Low Power Wireless Links,” IEEE transactions, vol. 09, no. 10, pp. 517–526, 20
- [25] “MICAz Wireless Measurement System Datasheet, Crossbow Technology, Inc.” [Online]. Available: http://www.openautomation.net/uploadsproducts/micaz_datasheet.pdf.

AUTHORS

Author 1 - Jolan Baccay Sy
Isabela State University
Email – jolan.b.sy@isu.edu.ph

Author 2- Jake Dayag La Madrid
Isabela State University
Email – jake.d.lamadrid@isu.edu.ph

Impact of Systematic Lupus Erythematosus (SLE) In Pregnancy

Dr. Neena Parasher

(D.G.O), Director, Department of OBS and Gynae , Shankar Medicare Centre, 1251, Sector 28, Faridabad, Haryana

DOI: 10.29322/IJSRP.12.10.2022.p13010
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13010>

Paper Received Date: 20th August 2022
Paper Acceptance Date: 24th September 2022
Paper Publication Date: 6th October 2022

Abstract- Systematic lupus erythematosus (SLE) is a long-term autoimmune disease (a chronic condition) that results from malfunctioning of the immune system with severity from mild to life-threatening (1). It can cause rash, arthritis, serositis, nephritis, seizures, or psychosis, which might be continuous in some cases (2). There is a high incidence of SLE in black Caribbean females (33/100000), whereas in India it is 9.9/100000 (1). The disease has a female preponderance, especially among women of childbearing age (3). In spite of the fact that SLE is the most common autoimmune rheumatic disease encountered in pregnancy, modern drug therapies and management have helped many women who are of childbearing age to conceive. SLE-suffering women have a higher fetal and material risk during pregnancy than healthy women (4). When SLE has been quiescent for six months or more before getting pregnant, the prognosis for both mother and child is best.

Index Terms- Lupus, Erythematosus, Preponderance, Quiescent, Pre-Eclampsia, Lupus nephritis, Breastfeeding, Contraception

1. In order to determine whether pregnancy may pose an unacceptably high risk to either the mother or the baby, it is imperative to conduct an assessment prior to conception.
2. When a woman with SLE is undergoing a preconception evaluation, her disease activity and major organ involvement should be assessed, along with hypercoagulability or concurrent medical disorders that could impact the pregnancy.
3. The risk of lupus flare and other pregnancy complications increases when women discontinue medications used to control disease activity.
4. Pregnant women should be moved to medication compatible with pregnancy and continue to take them throughout the pregnancy.
5. A pregnant woman should have a quiescent SLE condition for at least six months before pregnancy.
6. Active SLE patients, particularly those with lupus nephritis, should be advised not to become pregnant until the disease has been well controlled for at least six months. In cases of severe cases, surrogacy or adoption may be an option.

I. INTRODUCTION

Pre-Conception Evaluation

CHARACTERISTIC	PREGNANCY-RELATED CHANGES	SLE FLARE
Mucocutaneous	Facial Flush	Photosensitive rash
	Palmar erythema	
	Postpartum hair loss	Oral or nasal ulcers
Musculoskeletal	Arthralgias	Inflammatory arthritis
	Myalgias	
Hematologic	Mild anemia	Leucopenia, lymphopenia
	Mild thrombocytopenia	Immune hemolytic anemia
		Thrombocytopenia
Renal	Physiologic proteinuria <300mg/day	Active urinary sediment
		Proteinuria >300mg/day
Immunologic	Higher complement levels	Falling complement levels
		Rising anti DNA levels
Others	Fatigue	Fever
	Mild edema	Lymphadenopathy
	Mild resting dyspnea	Pleuritis

Symptoms-Above

II. IMPACT OF LUPUS ON PREGNANCY

The prevalence of obstetric complications was also higher in women with SLE, including preterm labor, cesarean delivery, fetal growth restriction, pre-eclampsia, eclampsia, thrombosis, infection, and thrombocytopenia (15,16).

A. Maternal Complications

- **Pre-Eclampsia** –

In 16-30 percent of women with SLE, preeclampsia is one of the most common pregnancy complications (17).

- **Pre-Term Birth** –

It has been reported that preterm birth is one of the most common obstetric complications in women with SLE (19). Rates of preterm birth range from 15 to 50 percent, with an increased incidence in women with lupus nephritis or high disease activity.

- Births by cesarean section due to obstetric complications or an SLE flare-up.

B. Fetal Complications (20,21) – Pregnant women with SLE have a greater risk of miscarriage, stillbirth, growth restriction, neonatal lupus syndromes, and prematurity.

- **Foetal loss** – The risk of early and late pregnancy loss is higher in women with SLE. Women with active SLE, lupus nephritis and antiphospholipid syndrome (APS) are at increased risk of fetal death beyond 10 weeks.
- **Foetal Growth Restriction** - In women with SLE, about 10 to 30 percent of pregnancy complications are related to fetal growth restriction, and the babies are small for their gestational age. They also have lower birth weights throughout their gestation period.

- **Neonatal lupus (22,23)** – A passively transmitted autoimmune disease referred to as NL affects some babies who are born to mothers with specific antibodies, such as anti-Ro/SSA and anti-LA/SSB, but do not yet have SLE. In addition to cutaneous and cardiac symptoms, NL can also manifest as hematological and hepatic abnormalities.

III. SPECIAL CONSIDERATIONS

Lupus nephritis

Women with active lupus nephritis should be encouraged to delay pregnancy until the disease is inactive for at least six months to optimize maternal outcomes.

Presence of antiphospholipid antibodies

aPLs are present in about a quarter to a half of patients with SLE; however, few patients develop thrombotic or obstetric complications related to APS.

Pregnant women with SLE with have an obstetric history suggestive of APS (fetal death after 10 weeks or more consecutive miscarriages, or premature birth <34 weeks due to preeclampsia or placental insufficiency) or unexplained venous or arterial thrombotic event, should be tested for the presence of aPLs (i.e. lupus anticoagulant [LA], immunoglobulin G [IgG] and IgM anticardiolipin [aCL] antibodies; and IgG and IgM anti-beta2-glycoprotein [GP] I)

IV. Presence of anti-Ro and anti-La antibodies

As mentioned above, a fetus exposed to anti-Ro/SSA and/or anti-La/SSB antibodies is at an increased risk of developing congenital complete heart block or NL.

Management of SLE in pregnancy

1. During pregnancy, a rheumatologist and an obstetrician who is experienced in caring for high-risk members should collaborate closely to manage pregnant women with SLE.
2. Monitoring SLE activity – Initial evaluation at the time of diagnosis
 - a. Physical examination, including blood pressure
 - b. Renal function (creatinine, urinalysis, spot urine protein/creatinine ratio).
 - c. CBC
 - d. Liver function tests
 - e. Anti-Ro/SSA or anti-LA/SSB antibodies
 - f. Lupus anticoagulant (LA) and anticardiolipin antibody (ACL) assays
 - g. Anti-double stranded DNA (dsDNA) antibodies
 - h. Complement (CH50, or C3 and C4)
 - i. Serum uric acid
3. Monitor by repeat testing, including CBC, Creatinine, Urinalysis with an examination of urinary sediment, urine protein/creatinine ratio or 24-hour urine collection, Complement (CH50, or C3 and C4), Anti-double-stranded DNA antibodies (dsDNA).
4. Maternal-fetal monitoring – During pregnancy, a recommended schedule for monitoring maternal and fetal health should be followed. Over and above routine T1 and T2 anomaly scans,
 - a. First-trimester ultrasound evaluation to know the date of delivery.
 - b. Monitoring fetal growth and placental insufficiency with ultrasound in the third trimester. The frequency of monitoring will depend on fetal and maternal well-being, but around four weeks will normally be recommended.
 - c. The final four to six weeks of pregnancy are an ideal time to conduct nonstress tests and/or biophysical profiles for women with lupus.
 - d. Patients with positive anti-Ro/SSA or anti-LA/SSB antibodies should be closely monitored for congenital heart block.
5. Postpartum laboratory testing – There is a possibility that some women with SLE might experience an exacerbation of the disease during the postpartum period.

Women with active disease at conception or those with significant organ damage should be aware that they are at a greater risk of disease flares during this timeframe than women with inactive disease.

Recommended tests include:

- a. Urinalysis, urine protein/creatinine ratio
- b. Renal function if the urinalysis is abnormal
- c. CBC

A woman who develops active SLE after delivery is treated as a non-pregnant woman; however, some medications used to treat active SLE may not be compatible with breastfeeding; It is, therefore, important to discuss with their clinicians the risks and benefits of various treatment options with breastfeeding women.

V. MEDICATIONS

A. Recommended During Pregnancy

- Hydroxychloroquine –

HCQ is generally considered safe when administered to pregnant women with SLE (6,7) unless contraindications are present. Several studies have demonstrated that patients who continued their HCQ during pregnancy had fewer disease flares and better outcomes, and they did not suffer adverse congenital malformations.

- Low dose Aspirin –

Regardless of the presence of antiphospholipid antibodies, this treatment can be given after 12 weeks of pregnancy to reduce the risk of preeclampsia (8) and its sequelae.

B. Selectively Used During Pregnancy

- NSAID's –

However, conflicting evidence suggests an increase in spontaneous abortion in the first trimester (9+) despite its use not being associated with congenital anomalies. NSAIDs are safe to use after the first trimester of pregnancy and should be avoided after 30 weeks. They may cause premature closure of the ductus arteriosus and other complications.

- Glucocorticoids –

Prednisolone should be started with the lowest dose possible. If possible, it should not exceed 10mg. Use of steroids =in 1st trimester might cause cleft lip, cleft palate, etc.

- Azathioprine –

(10) The dose cannot exceed 2 mg per day during pregnancy.

- Cycloserine –

(11) In pregnancy, this drug can be used, but the maternal benefits must outweigh the risks to the fetus.

- Tacrolimus –

(12) If lupus nephritis flares severely during pregnancy, it should only be considered.

Contra Indication

- Cyclophosphamide
- Methotrexate
- Mycophenolate mofetil
- Leflunomide (13,14)

Breastfeeding

Most women with systemic lupus erythematosus (SLE) are encouraged to breastfeed. The safety of medications in lactation varies. Hydroxychloroquine (HCQ), prednisone, cyclosporine, azathioprine, and tacrolimus are considered safe during breastfeeding. Breastfeeding is not comparable with methotrexate, mycophenolate, cyclophosphamide, leflunomide, and small molecules such as facitininib.

Contraception

- Since few drug interactions are seen with SLE drugs, oral contraceptives should be avoided.
- POP is a better option
- These patients should consider IUCDs as the best contraceptive method.

REFERENCES

1. Rees F, Doherty M, Grainge M, Davenport G, Lanyon P, Zhang W. The incidence and prevalence of systemic lupus erythematosus in the UK, 1999-2012. *Ann Rheum Dis*. 2016;75(1):136-141. 2. Dall'Era M. Chapter 21. Systemic lupus erythematosus. In Imboden JB, Stone JH, eds. *Current rheumatology diagnosis & treatment*. 3ed. USA: McGraw-Hill, 2013 3. Petri M. Epidemiology of systemic lupus erythematosus. *Best Pract Res Clin Rheumatol*. 2002;16(5):847-858 4. Buyon JP, Kim MY, Guerra MM, et al. Predictors of Pregnancy Outcomes in Women with Lupus A Cohort Study *Ann Intern Med* 2015; 163:153. 5. Kwok LW, Tom LS, Zhu T, et al. Predictors of maternal and fetal outcomes in pregnancies of patients with systemic lupus erythematosus. *Lupus* 2011; 20:829. 6. Clowse ME, Magder J, Witter J. Placental abruption in lupus pregnancy. *Arthritis Rheum* 2006; 54:3640 7. Parke AL, Rothfield NF. Antimalarial drugs in pregnancy--the North American experience. *Lupus* 1996; 5 Suppl 1:567 B. LeFevre ML, U.S. Preventive Services Task Force. Low-dose aspirin use for the prevention of preeclampsia: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med* 2014; 161:819 9. Ostensen M, Khamashta M, Lockshin M et al. Anti-inflammatory and immunosuppressive drugs and reproduction. *Arthritis Rheum* 2018 2024 Seppola M. Immunosuppression during pregnancy: transmission of azathioprine and its metabolites from the mother to the fetus. *Am J Obstet Gynecol* 1973; 115:1100,

11. Ostensen M, Lockshin M, Doria A, Valesini G, Meroni P, Gordon Brucato A, Tincani A. Update on pregnancy of biological agents and some immunosuppressive anti-rheumatic drugs. *Rheumatology (Oxford)* 2008;47(3):28-31. 12. Webster P, Wardle A, Bramhom K, et al. Tacrolimus is an effective treatment for lupus nephritis in pregnancy. *Lupus* 2014, 23:1182. 13. Robinson L, Braddock S, XU R, Lopez Jimenez J, Mirrosoul N, Salas E, Luo Y, Jones K, et al. Pregnancy outcome in women exposed to leflunomide before or during pregnancy. *Arthritis Rheum*. 2012 14. 50. Chambers CD, Johnson DL, Robinson K, Braddock SK, X Cassina M, Johnson D, Robinson L, Braddock S, XU R, Lopez Jimenez, Sovi, Salast, Luo YJ, Jin S, et al. Birth outcomes in women who have taken leflunomide during pregnancy. *Arthritis Rheum*. 2010;62(5):1494-1503. 15. Smyth A, Oliveira GH, Lahr BD, et al. A systematic review and meta-analysis of pregnancy outcomes in patient with systemic lupus erythematosus and lupus nephritis. *Clin J Am Soc Nephrol* 2010, 5:2060. 16. Petri M. Prospective study of systemic lupus erythematosus pregnancies. *Lupus* 2004; 13:688. 17. Chakravorty EF, Colón I, Longen ES, et al. Factors that predict prematurity and preeclampsia in pregnancies complicated by systemic lupus erythematosus. *Am J Obstet Gynecol* 2005; 192:1897. 18. Gibbins KI, Ware Branch D. Pre-eclampsia as a manifestation of antiphospholipid syndrome: assessing the current status. *Lupus* 2014, 23:1229. 19. Saavedra E, et al. Maternal and foetal outcomes in pregnant patients with active lupus nephritis. *Lupus* 2009, 18:1013. 20. Wagner S, Craid Vero-Lastra O, et al. Impact of previous lupus nephritis on maternal and fetal outcomes during pregnancy. *Clin Rheumatol* 2012, 31:813. 21. Petri M. Pregnancy and systemic lupus erythematosus: review of clinical features and outcome of 51 pregnancies at a single institution. *Clin Rev Allergy Immunol* 2010; 38:302. 22. Brucato A, Frassi M, Franceschini F, et al. Risk of congenital heart block in pregnancies complicated by systemic lupus erythematosus. *Arthritis Rheum* 2001; 44:1832. 23. Buyon JP, Hiebert R, Copel J, et al. Autoimmune associated congenital heart block: demographic, more block in newborns of mothers with anti-Ro/SSA antibodies detected by morbidity and recurrence rates obtained from a national neonatal lupus registry. *J Am Coll Cardiol* 1997 9; 30(1):51.

AUTHORS

First Author – Dr. Neena Parasher, D.G.O,
Parashar_neena@yahoo.com

Mesenchymal Stem Cell Therapy In Premature Ovarian Failure: Mechanisms And Future Prospects

Dr Renu Gupta *, Dr Seema Manuja **

* MBBS DGO, SR. Consultant (OBS AND GYNAE), Sarvodaya Hospital Faridabad

** MD FICOG, Director & HOD (OBS AND GYNAE), Sarvodaya Hospital Faridabad

DOI: 10.29322/IJSRP.12.10.2022.p13011

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13011>

Paper Received Date: 19th August 2022

Paper Acceptance Date: 24th September 2022

Paper Publication Date: 6th October 2022

Abstract- Premature Ovarian Failure (POF) is one type of ovarian dysfunction that is characterized by severe changes in the reproductive and physiological functions of females, resulting in 1 percent of infertility before 40 years old. The traditional treatment options using hormonal substitute therapy (HRT) comes with numerous negative side effects, and it isn't able to repair the normal reproduction capacity and ovarian function.

With the aid of Regenerative medicine, mesenchymal cells (MSCs) therapy has opened promising new possibilities for POF, with high efficacy, especially for those suffering from infertility. They are stem cells that have multipotency that have low immunogenicity. They can be extracted from various tissues, including bone marrow, umbilical cord peripheral blood vessels, fat tissues, menstrual fluid and the placenta. This article reviews the various types of MSCs that are currently available for treatment with POF, the properties as well as their complicated mechanism of action and their therapeutic value in clinical application.

In a short period of expansion, apoptosis, vaccination autophagy, oxidative stresses and fibrosis of the Ovarian cells are controlled by paracrine actions following migration of MSCs into the ovary that has been injured. Clinical trials and preclinical studies are progressing smoothly. The latest breakthroughs in the

field of engineering MSCs and their efficient components along with additional measures have made them a perfect source for the future of cell therapy in POF to ensure security in clinical use.

Index Terms- premature ovarian failure, mesenchymal stem cells, regenerative medicine.

I. INTRODUCTION

Premature Ovarian Failure (POF) is a complicated hormonal disorder that develops before 40 years of age with a prevalence of 1% worldwide and is characterized by elevated gonadotrophin levels (FSH >= 40 mg/ml) and reduced hormone (E2) levels, accompanied by amenorrhea secondary or primary. It is the main causes for female fertility problems. The destruction of the ovary is irreparable and the causes are autoimmunity, heredity, Iatrogenic infections, viral infections, psychological and environmental factors, with approximately 90% of cases being Idiopathic.^{2,3}

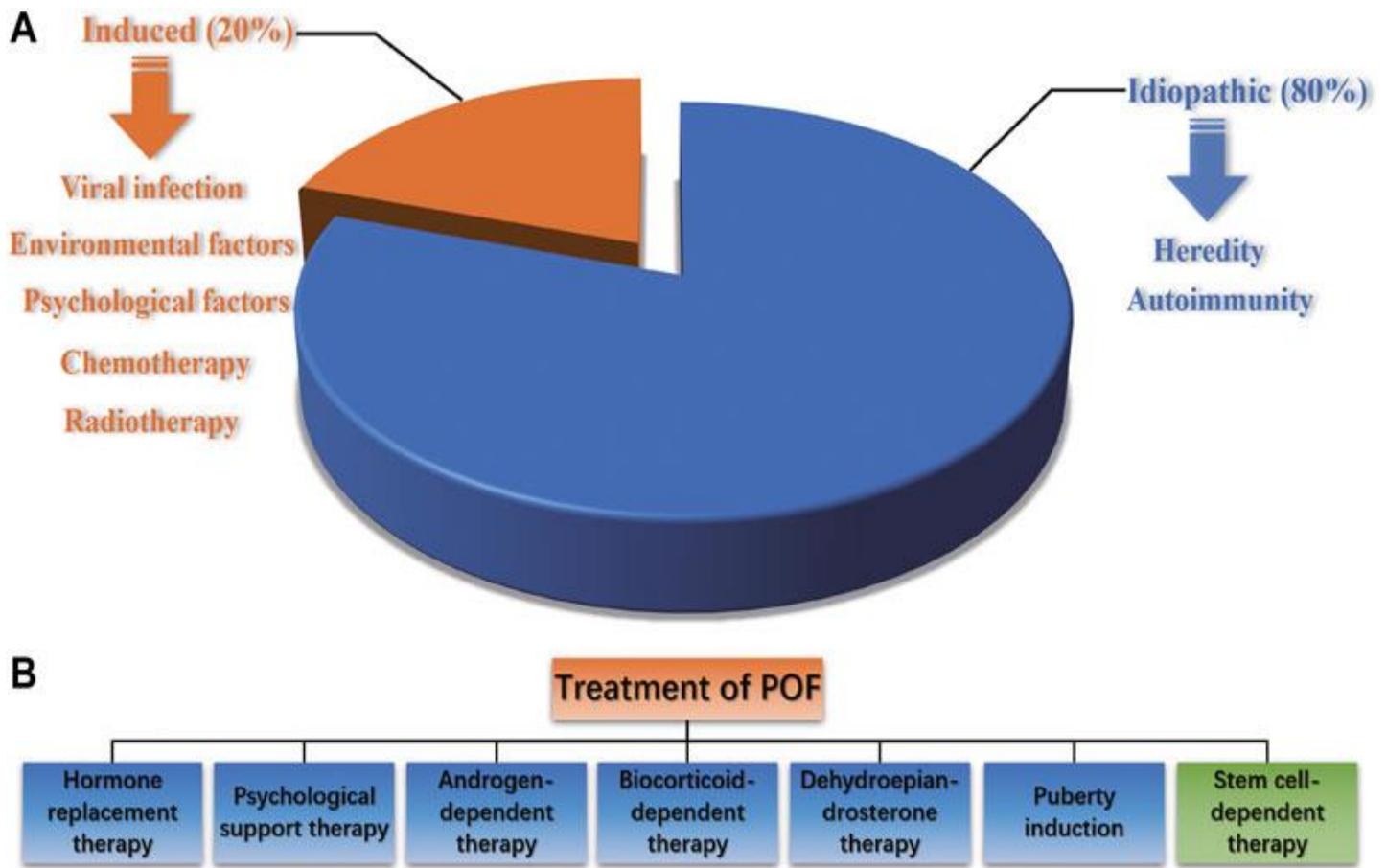


Figure1 Pathogenic factors and treatment of POF ⁴

II. PATHOPHYSIOLOGY

Granulosa cell (GC's) and Oocytes are vital components of the the ovarian system of functioning. They play a significant function in maintaining the follicular development and the release of growth and hormones which regulate the growth of oocytes. The hormone receptors that are expressed in GC's , such as estrogen receptor as well as the follicle stimulating hormone receptor (FSHR) are essential for folliculogenesis as well as the ovulation process. ⁵ Although the exact cause is unknown, the possible molecular causes of POF include accelerated apoptosis the GC's and Oocytes, and blocking maturation of follicles and other abnormalities of follicular functions, which result in the depletion or dysfunction of the follicles of the ovarian.

III. MSCs IN POF

Mesenchymal Stem Cells (MSCs) comprise a collection of stromal cells that can differentiate into a variety of embryonic lineages, including mesodermal. MSC-based treatments are an ideal alternative for POF because of their lack of immunogenicity, the wide range of sources, and accessibility ⁶.. This treatment has made significant advancements as it develops into a technologies

for regenerative and cell therapy. Their efficacy in treating reproductive disorders is proven through clinical and preclinical research. ⁷

MSCs used for treatment of POF are

BMMSCs	Bone marrow
UCMSCs	Umbilical cord
PMSCs	Placental
AMSCs	Amnion
AFMSCs	Amniotic fluid
MBMSCs	Menstrual blood
ADMSCs	Adipose tissue
PeMSCs	Peritoneum
SMSCs	Skin

The sources mentioned above of stem cells share similar characteristics, and following treatment, they have seen the number of hair follicles present in each stage of development including dormant, antral and mature follicles significantly increased. The treatment improves the hormone secretion capacity as well as improves the growth of follicular cells and the survival of GCs and also restores function of the ovary. ⁸ MSCs in the form of IV infusions is simple, fast and efficient method. A meta-analysis of POF revealed that MSCs may reduce the levels of FSH and raise E2 levels, and encourage the growth of follicles. ⁹

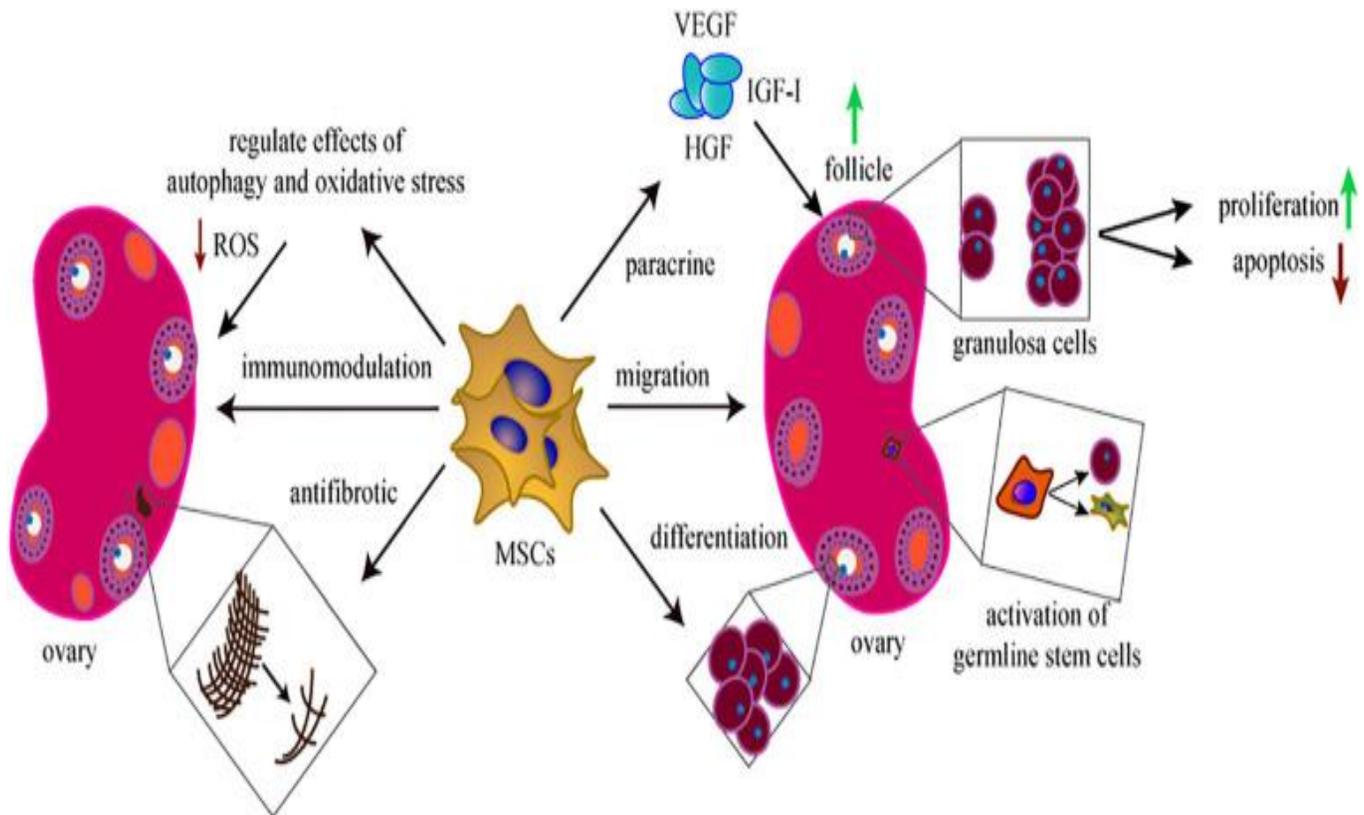


Figure 2 Mechanisms of MSCs in treating POF¹⁰

IV. MECHANISMS OF MSCs

The therapeutic effect of MSCs cannot be controlled by one factor, but is a complex system of biological regulation and mechanisms. Immunisation, proliferation, apoptosis angiogenesis, oxidative stress and the fibrosis of ovarian cells is affected by paracrine reactions following the migration of MSCs into the ovary that has been injured.

1) Migration and hosting of MSCs

Homing is the process of delivering stem cells to the damaged location. MSCs can migrate into the an ovary via intravenous transfer and, once they moving to the organ of choice it can have a long therapeutic effects. Migration is therefore an essential to the therapeutic efficacy. MSCs are not able to directly differentiate into oocytes however they do reside in the an ovarian matrix, and release various hormones and enhance the function of the ovarian reserve via paracrine pathways. Homing factors include TNF- (Tumor Necrosis Factor), (Tumor Necrosis Factor), HGF (Hepatocyte Growth Factor) and FGF (Fibroblast Growth Factor). 11

2.) Effects of paracrine activity MSCs

The improvement in ovarian function through MSCs is due to the release of the cytokines. Some of the most significant cytokines that influence different phases of follicular development include TGF-b, IFN -a, AMH, IFN-a, IL-1, Activin, Inhibin and BMP (Bone Morphogenic Protein). These cytokines can alter the ovarian microenvironment that aids in follicular development and selection, while also controlling cell development and the process of differentiation and follicular longevity/atresia as well as maturation of oocytes. 12,13

3) Proliferation as well as antiapoptotic actions

MSC transplantation can lower apoptosis levels and increase GC growth through the release of VEGF (Vascular Endothelial growth factor), HGF, IGF2 (Insulin growth Factor 2) and FGF. 14 It blocks its expression PTEN (Phosphatase and the tensin homolog that is deleted from the chromosome 10) in addition to PDCD4 (Recombinant Human Programmed Cell Death) by enhancing the expression in miR-21 (microRNA) and blocks the process of apoptosis. miR-144-5p, derived from MSC exosomes can influence p53 signaling, and may also inhibit GC cell apoptosis. 15

4) Promotes angiogenesis as well as antifibrotic effects

Angiogenesis-related substances secreted by MSCs include VEGF HGF, IGF as well as FGF. VEGF and HGF exhibit an interplay effect that promotes length, size and branches of induced vessels, as well as increase in the size of the vascular surface. 16 These factors promote neovascularisation and enhance the perfusion of blood of transplanted ovarian tissue. The antifibrotic effect of MSCs following transplantation are due to controlling the TGF-b/SmaD-3 signaling.

5) Anti inflammation as well as Immunomodulatory effect of MSCs

MSCs have immunomodulatory effects through moving to tissues affected to reduce local inflammation, without suppressing the immune system in general. 17. MSCs control the proliferation and functions of T cells. Restoring the function of the ovaries is accomplished by regulation of TGF-b interferon g (IFN-g) T-helper 1, T-helper 2 cells (Th1/Th2) cell cytokine ratio as well as the modulation of the numbers of naturally killer (NK) cells. The

PI3/Akt signal pathway regulates the balance between Th17/Tc17 as well as Treg and Th17 cell. 18

6.) Stress regulation and autophagy

ROS (Reactive Oxygen Species) is an immediate precursor of the process of oxidative stress as well as an early trigger of autophagy. Thus, reduction of ROS is essential to decrease the rate of apoptosis as well as damage caused by oxidative stress the Ovarian. 19 MSCs reverse the damaging effect of H₂O₂ treated endothelial cells, which in turn enhance cell proliferation and migration. This is accomplished through the secretion of HGF and

IL-6, IL-8 and VEGF, as well as activation of the FOXO, PI3K/Akt pathways.

V. NEW APPROACH AND FUTURE PROSPECTS

The combination of tissue engineering materials and MSCs for transplantation is an innovative and promising approach to POF treatment that has excellent potential for therapeutic benefits.

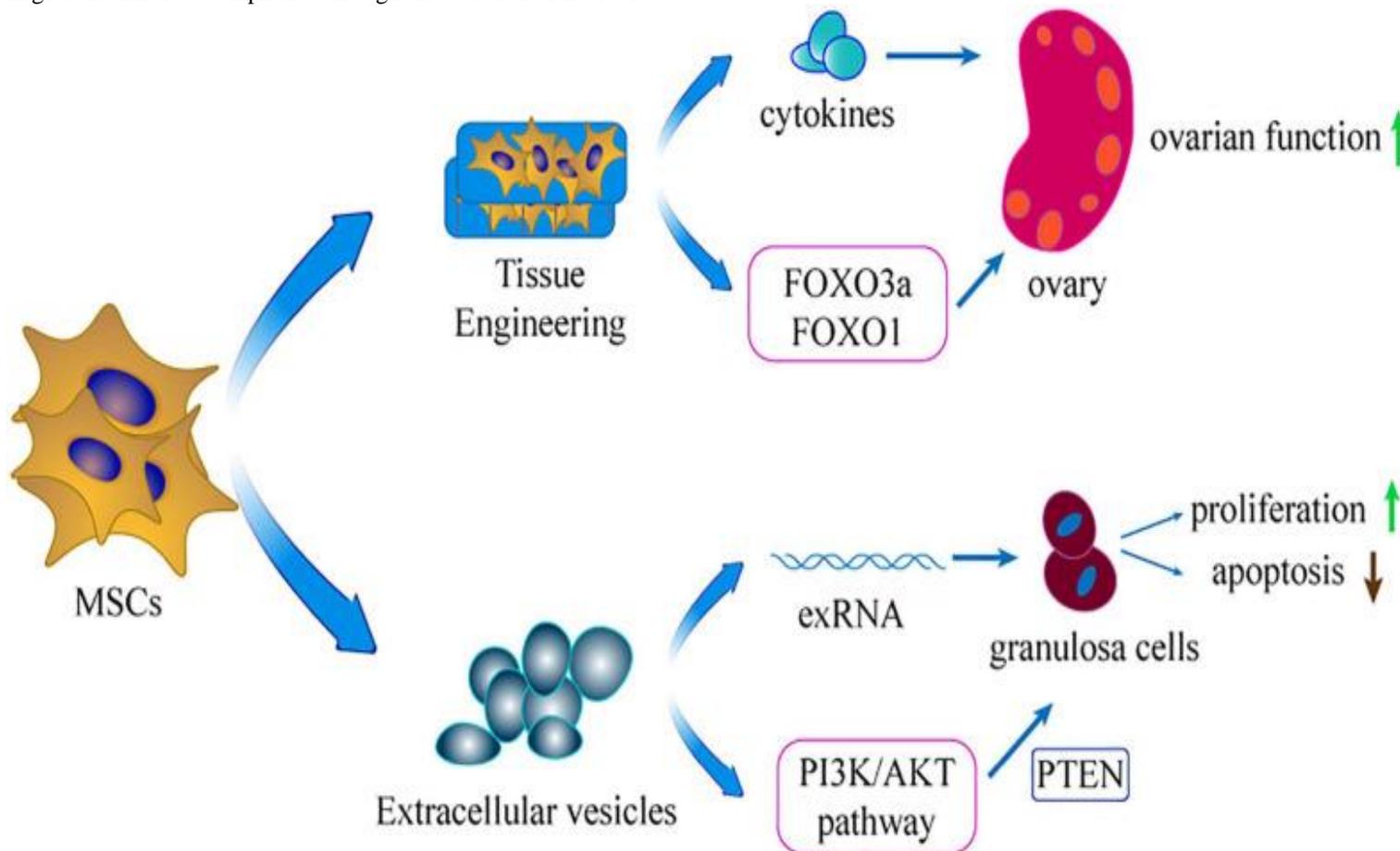


Figure 3 Extension of applying MSCs¹⁰

EXTRACELLULAR VESICLES (EV's) are major paracrine effectors that are derived from MSCs. They are more efficient than MSCs on their own. MSCs regulate the PI3/Akt signaling pathway through targeting PTEN that can help restore biological activity. There are three kinds of EVs such as Microvesicles, Exosomes, i.e ex RNA from cells (ex RNA) such such as microRNA and microRNA as well as Apoptotic body 15.. They are very stable in vivo and , being cells-free, they offer an innovative low-risk treatment for POF.

TISSUE Engineering is a rapidly developing biotechnology process that blends cells biology and material science to build tissues in vitro and in the vivo. 20 Materials like collagen scaffolds can enhance stem cell attachment to the tissue of interest, and improve proliferative and ovarian angiogenesis by phosphorylation of FOXO3a as well as FOXO1. 21

MEASURES FOR AUXILIARY USE are also utilized to boost the therapeutic value of MSCs, which includes

- A) Pulsed ultrasound with low-intensity plus MSC Therapy 22
- B) Preheat shock therapy + MSC treatment 23
- C) MSCs combined with Estrogen therapy 24

VI. CONCLUSION

MSCs are widely utilized stem cells that have great potential to alleviate POF in clinical and preclinical studies conducted over the last decade. Immunization, proliferation, apoptosis autophagy, oxidative stress and fibrosis are regulated through paracrine effects following the transfer of MSCs into the ovary that has been

injured. 13 Tissue engineering and extracellular vesicles are the newest methods of MSCs treatment of POF with great effectiveness. 21 The establishment of a system of standards for the culture process to the use of MSCs could increase the security of treatment while avoiding negative side negative effects. This therapy is a great potential for the fundamental restoration of the function of the ovary in patients suffering from POF.²⁵

REFERENCES

- [1] Chon S. J., Umair Z., Yoon M. S. (2021). Premature ovarian insufficiency: past, present, and future. *Front. Cell Dev. Biol.* 9:672890. 10.3389/fcell.2021.672890
- [2] Kokcu A. (2010). Premature ovarian failure from current perspective. *Gynecol. Endocrinol.* 26 555–562. 10.3109/09513590.2010.488773
- [3] Nelson L. M. (2009). Clinical practice. Primary ovarian insufficiency. *N. Engl. J. Med.* 360 606–614. 10.1056/NEJMc0808697
- [4] *Front. Cell Dev. Biol.*, 13 December 2021 Sec. Stem Cell Research <https://doi.org/10.3389/fcell.2021.749822> review article
- [5] Meduri G., Charnaux N., Driancourt M. A., Combettes L., Granet P., Vannier B., et al. (2002). Follicle-stimulating hormone receptors in oocytes? *J. Clin. Endocrinol. Metab.* 87 2266–2276. 10.1210/jcem.87.5.8502
- [6] Caplan A. I. (1991). Mesenchymal stem cells. *J. Orthop. Res.* 9 641–650. 10.1002/jor.1100090504
- [7] Kolios G., Moodley Y. (2013). Introduction to stem cells and regenerative medicine. *Respiration* 85 3–10. 10.1159/000345615
- [8] Lai D., Wang F., Dong Z., Zhang Q. (2014). Skin-derived mesenchymal stem cells help restore function to ovaries in a premature ovarian failure mouse model. *PLoS One* 9:e98749. 10.1371/journal.pone.0098749
- [9] Lai D., Wang F., Yao X., Zhang Q., Wu X., Xiang C. (2015). Human endometrial mesenchymal stem cells restore ovarian function through improving the renewal of germline stem cells in a mouse model of premature ovarian failure. *J. Transl. Med.* 13:155. 10.1186/s12967-015-0516-y
- [10] Mesenchymal Stem Cells in Premature Ovarian Insufficiency: Mechanisms and Prospects Zhongkang Li, Mingle Zhang, Yanpeng Tian, Qian Li, and Xianghua Huang
- [11] Minieri M., Cossa P., Antenucci D., Sala M., Gnocchi V., et al. (2006). Hepatocyte growth factor effects on mesenchymal stem cells: proliferation, migration, and differentiation. *Stem Cells* 24 23–33.
- [12] Li J., Yu Q., Huang H., Deng W., Cao X., Adu-Frimpong M., et al. (2018). Human chorionic plate-derived mesenchymal stem cells transplantation restores ovarian function in a chemotherapy-induced mouse model of premature ovarian failure. *Stem Cell Res. Ther.* 9:81. 10.1186/s13287-018-0819-z
- [13] Ling L., Feng X., Wei T., Wang Y., Wang Y., Wang Z., et al. (2019). Human amnion-derived mesenchymal stem cell (hAD-MSC) transplantation improves ovarian function in rats with premature ovarian insufficiency (POI) at least partly through a paracrine mechanism. *Stem Cell Res. Ther.* 10:46. 10.1186/s13287-019-1136-x
- [14] Ding C., Zou Q., Wang F., Wu H., Chen R., Lv J., et al. (2018). Human amniotic mesenchymal stem cells improve ovarian function in natural aging through secreting hepatocyte growth factor and epidermal growth factor. *Stem Cell Res. Ther.* 9:55. 10.1186/s13287-018-0781-9
- [15] Fu X., He Y., Wang X., Peng D., Chen X., Li X., et al. (2017). Overexpression of miR-21 in stem cells improves ovarian structure and function in rats with chemotherapy-induced ovarian damage by targeting PDCD4 and PTEN to inhibit granulosa cell apoptosis. *Stem Cell Res. Ther.* 8:187. 10.1186/s13287-017-0641-z
- [16] Oliva J. (2019). Therapeutic properties of mesenchymal stem cell on organ ischemia-reperfusion injury. *Int. J. Mol. Sci.* 20:5511. 10.3390/ijms20215511
- [17] Shi Y., Wang Y., Li Q., Liu K., Hou J., Shao C., et al. (2018). Immunoregulatory mechanisms of mesenchymal stem and stromal cells in inflammatory diseases. *Nat. Rev. Nephrol.* 14 493–507. 10.1038/s41581-018-0023-5
- [18] Liu M., Qiu Y., Xue Z., Wu R., Li J., Niu X., et al. (2020). Small extracellular vesicles derived from embryonic stem cells restore ovarian function of premature ovarian failure through PI3K/AKT signaling pathway. *Stem Cell Res. Ther.* 11:3. 10.1186/s13287-019-1508-2
- [19] Filomeni G., Desideri E., Cardaci S., Rotilio G., Ciriolo M. R. (2010). Under the ROS...thiol network is the principal suspect for autophagy commitment. *Autophagy* 6 999–1005.
- [20] Ghahremani-Nasab M., Ghanbari E., Jahanbani Y., Mehdizadeh A., Yousefi M. (2020). Premature ovarian failure and tissue engineering. *J. Cell. Physiol.* 235 4217–4226. 10.1002/jcp.29376
- [21] Suuronen E. J., Veinot J. P., Wong S., Kapila V., Price J., Griffith M., et al. (2006). Tissue-engineered injectable collagen-based matrices for improved cell delivery and vascularization of ischemic tissue using CD133+ progenitors expanded from the peripheral blood. *Circulation* 114(Suppl. 1) I138–I144. 10.1161/circulationaha.105.001081
- [22] Ling L., Feng X., Wei T., Wang Y., Wang Y., Zhang W., et al. (2017). Effects of low-intensity pulsed ultrasound (LIPUS)-pretreated human amnion-derived mesenchymal stem cell (hAD-MSC) transplantation on primary ovarian insufficiency in rats. *Stem Cell Res. Ther.* 8:283. 10.1186/s13287-017-0739-3
- [23] Chen X., Wang Q., Li X., Wang Q., Xie J., Fu X. (2018). Heat shock pretreatment of mesenchymal stem cells for inhibiting the apoptosis of ovarian granulosa cells enhanced the repair effect on chemotherapy-induced premature ovarian failure. *Stem Cell Res. Ther.* 9:240. 10.1186/s13287-018-0964-4
- [24] Song K., Cai H., Zhang D., Huang R., Sun D., He Y. (2018). Effects of human adipose-derived mesenchymal stem cells combined with estrogen on regulatory T cells in patients with premature ovarian insufficiency. *Int. Immunopharmacol.* 55 257–262. 10.1016/j.intimp.2017.12.026
- [25] Liu T., Huang Y., Guo L., Cheng W., Zou G. (2012). CD44+/CD105+ human amniotic fluid mesenchymal stem cells survive and proliferate in the ovary long-term in a mouse model of chemotherapy-induced premature ovarian failure. *Int. J. Med. Sci.* 9 592–602. 10.7150/ijms.4841

AUTHORS

First Author – DR RENU GUPTA MBBS DGO, SR.
CONSULTANT (OBS AND GYNAE), SARVODAYA
HOSPITAL FARIDABAD

Second Author – DR SEEMA MANUJA MD FICOG,
DIRECTOR & HOD (OBS AND GYNAE), SARVODAYA
HOSPITAL FARIDABAD

Sildenafil Citrate – A Potent Solution To Fetal Growth Reduction/ Oligohydramnios

Dr. Nishtha Gupta

Sr. Consultant Obs And Gynae The Gynae Clinic, Faridabad

DOI: 10.29322/IJSRP.12.10.2022.p13012
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13012>

Paper Received Date: 18th August 2022
Paper Acceptance Date: 24th September 2022
Paper Publication Date: 6th October 2022

Abstract- Fetal growth restriction (FGR), is a condition where an unborn baby (fetus), is smaller than what is expected for the number weeks of pregnancy (gestational year). This is usually described as a weight that is less than the 10th per centile. It is a baby whose estimated weight is less than the 10th percentile. An AFI that shows a fluid level less than 5 cm (or the 5th percentile) or a lack of fluid pockets 2-3 cm in depth at 32-36-week gestation would indicate oligohydramnios. It vasodilates myometrial arteries, and increases the amniotic fluid quantity. To provide a comprehensive description of sildenafil Citrate's use in iugr or oligohydramnios, we reviewed the numerous literature sources.

Index Terms- phosphodiesterase5 inhibitor, cyclic guanosine monophosphate, transdermal, cerebroplacental ratio, pre- eclampsia, nitic oxide.

I. INTRODUCTION

Fetal growth restriction, also known as intrauterine growth limitation ([IUGR]), is a term used to describe a fetus who has not reached its potential for growth due to environmental or genetic factors. IUGR can occur due to impaired gas exchange or if the nutrients provided to the fetus do not allow it to thrive normally in utero. This can happen due to any maternal condition that causes a decrease in oxygen-carrying ability (e.g. This can be caused by any maternal disease that reduces oxygen-carrying capacity (e.g., hemoglobinopathy, smoking, cyanotic heart diseases, or hemoglobinopathy) or disorders in the oxygen delivery network secondary to maternal cardiovascular diseases [1].

When there is no rupture of the membranes, oligohydramnios occurs. This is defined by the amniotic fluid index (AFI) being less than 5 cm or the AFI falling below the 5th percentile. The condition affects 3-5% of pregnancies and is caused by ruptured membranes, placental insufficiency, congenital abnormalities, post-term pregnancy, prostaglandin synthase inhibitors, twin-to-twin transfusions, or idiopathic causes.¹

Fetal growth restriction can affect up to 8% in all pregnancies. This includes those with early-onset and late-onset fetal growth restrictions with higher perinatal mortality. Our country has a high burden of IUGR. [2] IUGR is responsible for more than half of all stillbirths. Perinatal mortality accounts for 10%. [2,3] The survival rates of severely-growth-restricted fetuses that are very far from term (28 WEEKS FROM GESTATION) is poor.

II. PATHOPHYSIOLOGY OF IUGR / OLIGOHYDRAMNIOS AND THEIR OUTCOMES-

Perinatal deaths caused by IUGR account for the second highest rate of death after prematurity. It is associated with an increased risk of perinatal complications such as hypoxemia and low Apgar scores. There are also possible adverse effects on neonatal outcomes [3,4].

To determine if a fetus is at risk, an estimated fetal weight of at least 10th percentile must be used. This cannot be used as a cutoff for uteroplacental dysfunction. It is possible that a certain number of fetuses below the 10th per centile are constitutionally small. In terms of follow-up growth, the most popular and easiest method to measure the distance between the pubic bone and the mother's fundus is also a good option. This distance is usually measured in centimeters after the 20th week.

Growth-restricted fetuses increase the risk of intrauterine fatality (IUFD) and may even lead to sequels in childhood. [3].

This is a common problem in pregnancy and can lead to reduced fetal growth. Often, the etiology for IUGR is not known. However, it is possible to identify fetal (infections, malformations and chromosomal aberrations), placental (chorioangioma), infarctions, circumvallated or confined placentas, confined placental mosaicism, obliterative vasculopathy, etc.), In addition to maternal factors, external factors and genetic predetermination of fetal growth affect fetal outcomes, including chronic hypertension, pregestational diabetes, cardiovascular disease, substance abuse, and autoimmune conditions [6-8].

Hemodynamic modifications include maternal uterine, fetal umbilical and middle cerebral arteries, as well as precordial veins to treat cardiac effects of placental dysfunction [9-10]. Circulatory adaptation is characterized by an increase in umbilical artery blood flow resistance and a decrease in middle cerebral artery blood flow resistance [11].

Although the pathophysiology behind oligohydramnios remains elusive, it has been recognized as a sign that chronic suboptimal placental function is present when there is no rupture of membranes.²

III. EFFECT OF SILDENAFIL CITRATE IN IUGR/ OLIGOHYDRAMNIOS-

Despite the serious risks of IUGR-affected pregnancies there is no treatment. Clinicians have no other options but to deliver the baby early, which can lead to increased morbidity or mortality [11-12].

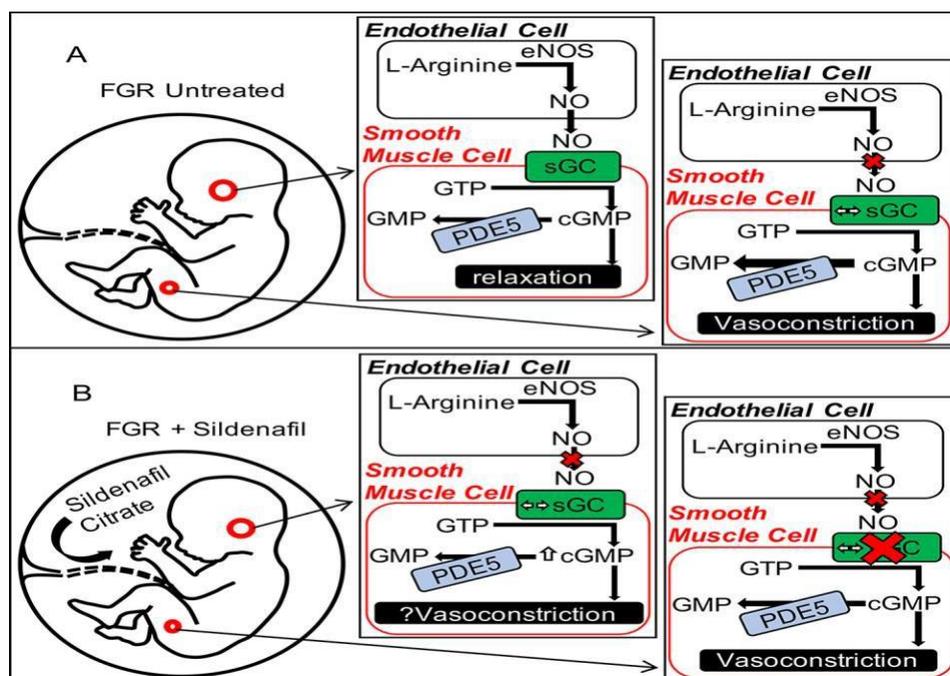
There are no drugs currently being developed for obstetrical conditions. This has led to the evaluation of drugs that are currently in clinical practice for other conditions, which will be evaluated on a re-purpose basis to assess their potential therapeutic value in the treatment of IUGR. [10, 11].

Normal pregnancy sees the release of nitric dioxide (NO), which is a powerful vasodilator. Pregnancies with pre-Eclampsia, IUGR or other complications may have a decreased release of NO.

Nitric oxide (NO), is made from L-arginine by nitric oxygen synthases. The NO increase in cyclic Guanosine Monophosphate (cGmp) causes relaxation of the blood vessels smooth muscle [4].

Potential therapeutic agents for IUGR include drugs that increase the NO effect.

Sildenafil citrate acts as a phosphodiesterase5 inhibitor, slowing down the breakdown of cyclic Guanosine Monophosphate (cGMP), and increasing nitric oxide-dependent vasodilatation. [fig1] Sildenafil is used to treat pulmonary hypertension during pregnancy. It is also being considered for treatment of intra-uterine development retardation (IUGR) and premature labour [5,6]. Sildenafil has been suggested as a possible therapeutic strategy for maintaining placental function during pre-eclampsia [5,6].



[fig1. Effect of sildenafil citrate on fgr, image courtesy: American heart association journals]

Recent research has shown that sildenafil citrate increases vasodilation in myometrial small arteries. It is also associated with fetal growth, which could be a therapeutic option for IUGR [6,7].

Sildenafil citrate can increase the amniotic fluid volume of pregnancies that are complicated by oligohydramnios.

IV. DISCUSSION

There seems to be an incessant discussion and review about sildenafil citrate use in IUGR/oligohydramnios. They supported its use and saw positive results. A few of them found no effect on birth weight or gestational age at delivery.

Von Dadelszen et al. In an open-label pilot trial, [7] examined the potential of sildenafil to increase fetal growth. Ten women who had pregnancies with severe early-onset FGR and where the chances of intact fetal survival were less than half of the expected, accepted 25-mg sildenafil TDS. The outcomes were compared to those of sildenafil-naive pregnancies that occurred contemporaneously (n=17). The AC showed a higher post-treatment fetal growth velocity (n=17) [9/10 (treated) and 7/17 (control); odds ratio was 12.9; 95% CI, 1.3,126]. It is not clear if higher termination rates and permissive stillbirths in sildenafil-naive patients are due to poorer management or a worse prognosis.

E. Ferreira et al. [8,9]. A retrospective and descriptive series of all pregnant women in hospital who were treated with sildenafil for severe IUGR. The study included 19 pregnant women in hospital who had received sildenafil to treat severe IUGR. Sildenafil was administered in an average of 25 weeks plus 3 days (median: 25, [20+1], 30+6]), at an average dose of 20 mg daily, from conception to delivery. The average fetal weight before sildenafil was 558g [237], 1208]. It increased to 807g at delivery (median 820, [320 and 1360]), and then gained 249g (median 123, [-46 732]). His study did not include a control arm. [10].

Trapani et al. Trapani et al. They compared maternal arterial blood pressure, Z-scores for the pulsatility indicator (PI) of UtA and UA, and fetal MCA, before and after applying a transdermal GTN patches (average dose, 0.4mg/h), oral Sildenafil citrate 50mg, or placebo.

After sildenafil citrate (20.4%) and GTN (21.0%), there was a marked decrease in UtA PI. GTN (19.1%), and sildenafil citrate (18.2%) both showed significant UA-PI reductions. When sildenafil and GTN groups were compared, there was no difference in UtA and UA-PI. In the placebo group, there were no changes in Doppler velocity and in any other group was no significant increase in MCA-PI. Pre-eclampsia patients with high maternal arterial blood pressure will see their maternal arterial blood pressure drop with both sildenafil citrate and GTN administration. In both groups, no effect was observed on birthweight.

Dastjerdi et al. A randomized, double-blinded, placebo-controlled trial was also conducted. It involved 41 pregnant women who had intrauterine growth retardation between 24-37 weeks gestation. They were evaluated for the effects of Sildenafil citrate in uteroplacental circulatory as determined by Doppler ultrasound of the umbilical arteries and the middle cerebral arteries. The Sildenafil-treated fetuses showed a significant drop in the systolic/diastolic ratios, pulsatility indicator for the umbilical and an increase in the middle cerebral artery pulseatility index (MCAPI). The researchers concluded that sildenafil citrate could improve fetoplacental flow in pregnancies with intrauterine growth restriction. It could be used as a therapeutic strategy to increase uteroplacental bloodflow in pregnancies that are affected by fetal growth restriction (FGR). This is in line with our research.

Amr El-Shalakany and colleagues. Tab sildenafil 25mg tds increased fetal birthweight, increased mean gestational time at delivery, and decreased NICU admissions. El-Sayed et. In a randomized controlled trial, 54 patients with FGR or abnormal Doppler indexes at 24 weeks were randomly assigned 1:1 to either an intervention (receive sildenafil citrate 50 mg) or control (receive placebo). There was significant pregnancy prolongation, increased GA at birth, and improved neonatal weight (p=. 0001) and less admission to neonatal intensive medical unit.

Also, Lin et al. Lin et al. [12] reported a decrease of uterine artery pulsatility, and resolution of uterine artery itching after sildenafil citrate administration to a case IUGR at 26 weeks gestation. They also found an increase in EFW, despite no maternal or neonatal adverse outcomes.

Despite some negative studies, sildenafil citrate has proven promising in vitro and in animal studies for the treatment of pre-eclampsia and IUGR.

Wareing et al. Wareing et al. The vessels were constricted (with U46619) or U46619), and then relaxed (with bradykinin), before and after being incubated with sildenafil citrate, a phosphodiesterase-5 inhibitor. The researchers concluded that sildenafil citrate

improved the endothelial function and myometrial vessels of women with intrauterine growth restriction. Sildenafil citrate could be a therapeutic option to increase uteroplacental bloodflow in FGR pregnancies.

Oral sildenafil 20 mg tablets twice daily for six weeks increased Doppler indexes in umbilical arterial and cerebroplacental ratios, but it had no effect whatsoever on gestational weight or gestational age at delivery.

V. CONCLUSION-

Sildenafil citrate treatment could offer a new hope for better perinatal outcomes in pregnancies that are complicated by IUGR or impaired placental circulation. However, further studies with large samples size are needed to confirm its effectiveness.

REFERENCES

- [1] Effects of a phosphodiesterase-5 (PDE5) inhibitor on endothelium-dependent relaxation of myometrial small arteries., Wareing M, Myers JE, O'hara M, Kenny LC, Warren AY, Taggart MJ, Skillern L, Machin I, Baker PN. *Am J Obstet Gynecol*. 2004 May;190(5):1283-
- [2] 90. doi: 10.1016/j.ajog.2003.12.024.PMID: 15167831
- [3] Phosphodiesterase-5 inhibitors and omental and placental small artery function in normal pregnancy and pre-eclampsia., Wareing M, Myers JE, O'Hara M, Kenny LC, Taggart MJ, Skillern L, Machin I, Baker PN. *Eur J Obstet Gynecol Reprod Biol*. 2006 Jul;127(1):41-9. doi: 10.1016/j.ejogrb.2004.06.014.PMID: 16815471
- [4] Characterisation of tone oscillations in placental and myometrial arteries from normal pregnancies and those complicated by pre-eclampsia and growth restriction., Sweeney M, Wareing M, Mills TA, Baker PN, Taggart MJ. *Placenta*. 2008 Apr;29(4):356-65. doi: 10.1016/j.placenta.2008.01.007. Epub 2008 Mar 11.PMID: 18336903
- [5] Sildenafil (Viagra) and ophthalmology., Marmor MF. *Arch Ophthalmol*. 1999 Apr;117(4):518-9. doi: 10.1001/archophth.117.4.518.PMID: 10206581.
- [6] Prenatal Use of Sildenafil in Fetal Growth Restriction and Its Effect on Neonatal Tissue Oxygenation-A Retrospective Analysis of Hemodynamic Data From Participants of the Dutch STRIDER Trial., Terstappen F, Richter AE, Lely AT, Hoebeek FE, Elvan-Taspinar A, Bos AF, Ganzevoort W, Pels A, Lemmers PM, Kooi EMW. *Front Pediatr*. 2020 Dec 3;8:595693. doi: 10.3389/fped.2020.595693. eCollection 2020.PMID: 33344386.
- [7] Antenatal sildenafil citrate treatment increases offspring blood pressure in the placental- specific Igf2 knockout mouse model of FGR., Renshall LJ, Cottrell EC, Cowley E, Sibley CP, Baker PN, Thorstensen EB, Greenwood SL, Wareing M, Dilworth MR. *Am J Physiol Heart Circ Physiol*. 2020 Feb 1;318(2):H252-H263. doi: 10.1152/ajpheart.00568.2019. Epub 2019 Dec 6.PMID: 31809211.
- [8] Maternal low molecular weight heparin versus sildenafil citrate for fetal growth restriction: a randomized, parallel groups, open-label clinical trial., Rasheedy R, El Bishry G, Tarek R. *J Perinatol*. 2020 May;40(5):715-723. doi: 10.1038/s41372-019-0544-1. Epub 2019 Nov 6.PMID: 31695136
- [9] Placental Origins of Preeclampsia: Potential Therapeutic Targets., Wu JL, Jia J, He MZ, Zeng Y, Zhang JY, Shi EJ, Lai SY, Zhou X, Sharifu LM, Feng L. *Curr Med Sci*. 2019 Apr;39(2):190-195. doi: 10.1007/s11596-019-2018-2. Epub 2019 Apr
- [10] 23.PMID: 31016509 Review.
- [11] Prenatal Sildenafil Therapy Improves Cardiovascular Function in Fetal Growth Restricted Offspring of Dahl Salt-Sensitive Rats., Terstappen F, Spradley FT, Bakrania BA, Clarke SM, Joles JA, Paauw ND, Garrett MR, Lely AT, Sasser JM. *Hypertension*. 2019 May;73(5):1120-1127.
- [12] Ballard SA, Gingell CJ, Tang K, Turner LA, Price ME, Naylor AM. Effects of sildenafil on the relaxation of human corpus cavernosum tissue in vitro and on the activities of cyclic nucleotide phospho-diesterase isozymes. *J Urol*. 1998;159(6):2164-7.
- [13] von Dadelszen P, Dwinell S, Magee LA, Carleton BC, Gruslin A, Lee B, et al. Sildenafil citrate therapy for severe early-onset intrauterine growth
- [14] restriction. *BJOG*. 2011;118(5):624-8.
- [15] Samangaya RA, Mires G, Shennan A, Skillern L, Howe D, McLeod A, et al. A randomised, double-blinded, placebo-controlled study of the phospho-diesterase type 5 inhibitor sildenafil for the treatment of preeclampsia. *Hypertens Pregnancy*. 2009;28(4):369-82.

AUTHORS

First Author – DR. NISHTHA GUPTA, SR. CONSULTANT OBS AND GYNAE THE GYNAE CLINIC, FARIDABAD

The Rare Cases of Mullerian Duct Anomalies and Pregnancy Losses

Dr. Nishtha Gupta

Sr. Consultant - Obs/Gny, The Gynae Clinic, Faridabad

DOI: 10.29322/IJSRP.12.10.2022.p13013
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13013>

Paper Received Date: 22nd August 2022
Paper Acceptance Date: 24th September 2022
Paper Publication Date: 6th October 2022

I. OVERVIEW

Mullerian anomalies (MDLs) refer to congenital abnormalities in which the Mullerian (paramesonephric) ducts do not develop properly. It could be due to complete agenesis or defective vertical or lateral fuse, or resorption failure.

The mullerian system developmental anomalies are some of the most interesting disorders that gynecologists and obstetricians come across. The primordial anlage of the female reproductive system is the mullerian. They divide to form the fallopian tubes and uterus. This system can lead to a variety of malformations. These malformations can range from uterine or vaginal agenesis, duplication of the vagina and uterus, to minor uterine cavities abnormalities and duplication of some uterine structures. Mullerian malformations often occur in association with abnormalities of the axial and renal skeletal systems. They are often first seen when patients are examined for other conditions. Mullerian duct anomalies (MDAs), in most cases, are associated with functioning ovaries or age-appropriate external genitalia. These abnormalities can be recognized as soon as puberty begins.

II. PREVELANCE-

The existence of mullerian defect dates back to antiquity around 300 BC. Columbo was the first to report a case of vaginal birth (uterus and vagina), in the 16th century. Uterine abnormalities often go unreported and are not recognized at birth. Reproductive malfunctions are often reported more frequently during childbearing years.

The study will determine the incidence rate. Incidence rates range from 0.1-3.5% according to most authors. The incidence of mullerian anomalies in women with fertility issues is slightly higher at 36%. Recurrent abortions are more common than 5-10% in women. Patients who have had third-trimester miscarriages are most likely to experience mullerian defects. [4,10] Septate, arcuate and didelphys are the most common mullerian-duct anomalies. The study and the geographical location will determine the exact distribution.

Reports varying from 0.16 to 10% indicate that mullerian anomalies are also common. [12, 13, 14, 15, 16, 17, 18] It has been found that 8-10% of women who undergo hysterosalpingography (HSG) with recurrent pregnancy loss have mullerian anomalies. [13 15.] This is in contrast to a prevalence rate of 2-3% among elective hysteroscopy patients, who are thought to be more representative of the general population. [16] A Danish study of 622 women aged 20-74 years, all of whom were subject to saline contrast sonohysterography revealed a 9.8% prevalence of mullerian anomalies in the general populace. This was especially true for nulliparous and oligomenorrhea.

III. EMBRYOLOGY

A pair of Mullerian tubes forms the female reproductive tract. These structures include the fallopian tube and uterus. The embryological origins of the ovaries and the lower third of the vagina are different. They were formed from germ cells that migrate from both the primitive yolk sac or the sinovaginal bulbs, respectively.

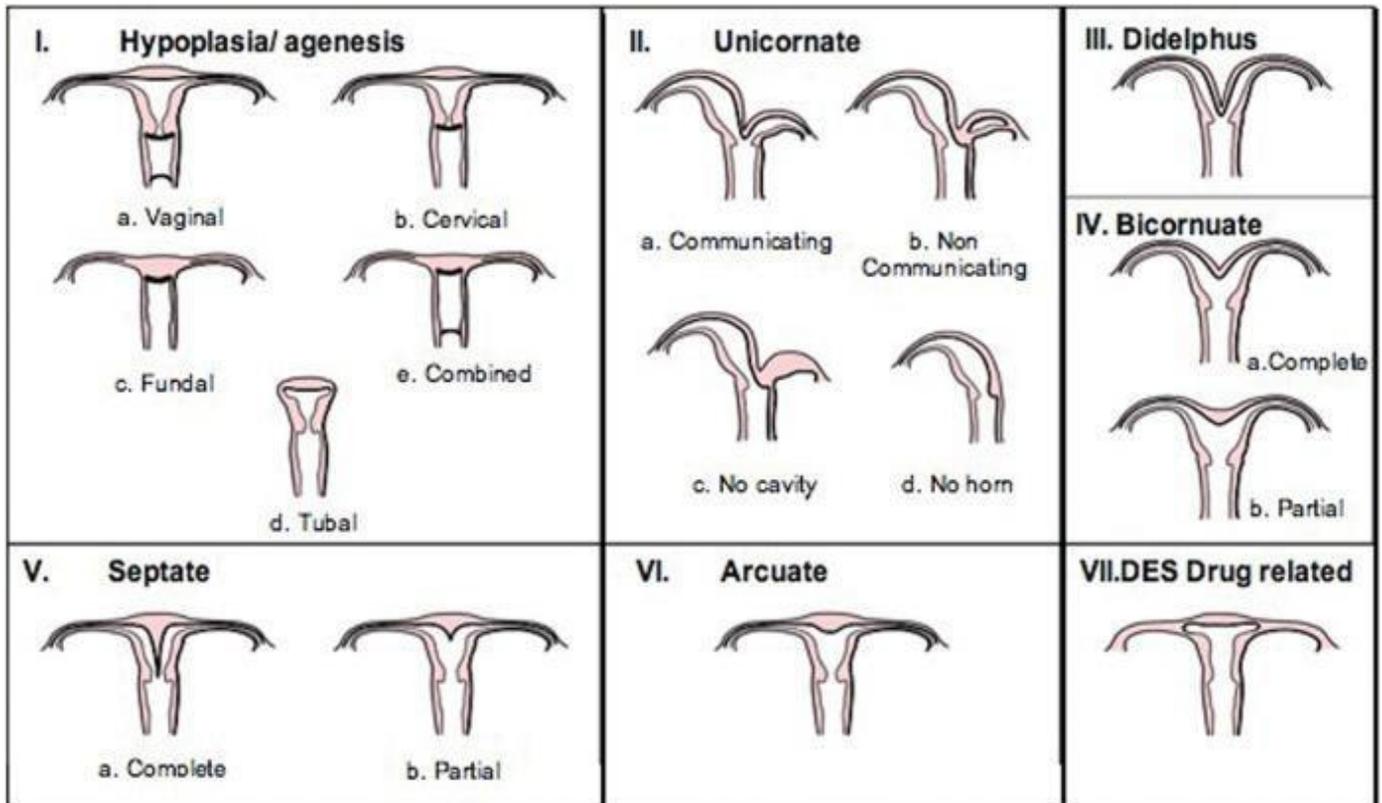
The normal development of Mullerian ducts is dependent on completion of three phases: organogenesis (fusion), and septal resorption. The formation of both Mullerian conduits is an indication that organogenesis has occurred. This can lead to uterine hypoplasia/uterine agenesis, or a unicornuate-uterus. Fusion refers to the fusion of the ducts that form the uterus.

This can lead to a didelphys or bicornuate. After the ducts have fused, septal resorption is the subsequent resorption. A septate or arcuate-uterus is formed when there are defects at this stage.

IV. CLASSIFICATION-

Because of the potential for poor pregnancy outcomes and treatment, it is crucial to properly classify MDA [1]. The American Society of Reproductive Medicine is the most commonly used classification system.

[1] (Figure 1.). This classification system is only a guideline. Not all anomalies will fit into any of the categories. It is important to describe each component of a case accurately in cases that don't fit within a particular category.



[FIGURE1- CLASSIFICATION OF MDA ACCORDING TO AMERICAN SOCIETY OF REPRODUCTIVE MEDICINE]

V. SURGICAL MANAGEMENT OF DEFECTS-

Each mullerian anomaly in the mullerian tube is described and organized according its AFS classification.

Class I - Vaginal Agenesis

Both surgical and nonsurgical treatment options have been tried. Gradually dilating devices are used to create a new vagina. It may take several months, or even years for a functional vagina to form. Surgery is the best treatment option for mullerian dysplasia.

It is crucial to choose the right time for a vaginoplasty. Only consider surgical treatment if the patient is able to participate in the decision-making process and is motivated to continue using a vaginal prosthesis for at least several months.

Class II - Unicornate Uterus

Unicornuate uterus is rare. This is evident in the lack of data in literature on surgical strategies, particularly for subtypes. The development of specific surgical management plans has not been significant. Reconstruction metroplasty is not recommended for women with unicornuate uterus. [6, 41, 25,] Endometrium found in the accessory horn is a sign that surgery should be performed. Laparoscopic hemihysterectomy is the best option. [20, 21] When the rudimentary endometrium is absent, surgical treatment is not recommended.

III - Uterus Didelphys

An indication to have the vaginal septum resected is an obstructed unilateral vulvum. To preserve reproductive ability and prevent damage to the uterus or tubes, surgery is required [9,17].

Surgical techniques-

- Uterine didelphys with obstructed unilateral vagina
 - The preferred method is to complete excision and marsupialization the vaginal septum. This is done as one procedure. Laparoscopy is possible to treat any adhesions or endometriosis that may be associated with the septum after it has been removed. [16, 37, 38]
 - To prevent bleeding from the vaginal mucosa, it is necessary to leave a large pedicle after removing an obstructed septum. [41, 32]
 - For the best chance of successful reproduction, neither a hemi-hysterectomy nor a salpingo-oophorectomy is recommended.
- Uterus didelphys, nonobstructed
 - There are very few indications for septum resection of the nonobstructed didelphys. These patients are not suitable for surgical unification. These patients are not likely to experience fertility-related problems. Obstetric complications can be minimal if the woman has a full-term pregnancy.
 - Metroplasty is a decision that must be made individually. Only selected patients may be eligible for surgical reconstruction. The benefits of surgery in this setting are unclear as most reports are speculative.
 - The Strassmann mesotherapy is recommended. [5] This procedure unites the uterine cavities at their fundus while leaving the cervix intact. Below is a detailed description of this procedure: Surgical techniques to bicornuate the uterus.

CLASS IV - BICORNUATE UTERUS

Rarely does a bicornuate uterus require surgical reconstruction.[14] Metroplasty's benefits have not been evaluated in prospective trials using data from observational studies.[12,35] Women who have had recurrent spontaneous abortions, birth defects, or midtrimester losses should not be considered for metroplasty.

There are many options for metroplasty, but the Strassmann method is the best option to unify the bicornuate & didelphys.

In this situation, transcervical lysis is not recommended for other anomalies. It can cause uterine perforation.[14] The Strassmann procedure involves the removal of the septum via wedge resection and subsequent unification.

CLASS V - SEPTATE UTERUS

Hysteroscopic metroplasty combined with concurrent laparoscopy is the preferred surgical procedure. [17, 14 and 37] Laparoscopy reduces the chance of uterine perforation after septal incision. [18] An alternative to hysteroscopic mesoplasty is transcervical ultrasound guidance.

- Laparoscopy
 - Double-puncture is used. A probe is passed through the inferior incision. To keep the uterine fundus visible, the probe is used.
 - An examination of the uterus may be helpful in confirming the septate uterus' concave exterior shape. This will help to distinguish it from a bicornuate. It can also be used to detect unexpected pelvic diseases.
- Hysteroscopy
 - The laparoscope and hysteroscopy begin. The cervix is dilapidated to 6 mm and the hysteroscope is inserted at the level of the external Os. Under direct vision, it is advanced into the cavity of the uterine lining. The instruments used to remove the septum will determine the distention media.
 - You can perform a hysteroscopic operation using microscissors or electrosurgery.

CLASS VI - ARCUATE UTERUS

Arcuate uterus can be managed in a similar manner to septate. Only patients with poor reproductive performance are eligible for surgery correction.

VI. CONCLUSION-

Mullerian anomalies, a group of developmental disorders affecting the female reproductive tract, are morphologically varied. It is important to make a diagnosis in order to plan treatment and manage strategies. Mullerian duct anomalies can be corrected using a surgical procedure that is specific to each type of malformation. This may differ for certain groups. The critical indicator of the surgical

procedure's worth is the ability of the patient to have healthy sexual relations after the procedure and to achieve successful reproductive outcomes.

REFERENCES

- [1] Litta P, Pozzan C, Merlin F, Sacco G, Saccardi C, Ambrosini G. Hysteroscopic metroplasty under laparoscopic guidance in infertile women with septate uteri: follow-up of reproductive outcome. *J Reprod Med.* 2004 Apr. 49(4):274-8.
- [2] Fedele L, Bianchi S. Hysteroscopic metroplasty for septate uterus. *Obstet Gynecol Clin North Am.* 1995 Sep. 22(3):473-89.
- [3] Donnez J, Nisolle M. Hysteroscopic surgery. *Curr Opin Obstet Gynecol.* 1992 Jun. 4(3):439-46.
- [4] Querleu D, Brasme TL, Parmentier D. Ultrasound-guided transcervical metroplasty. *Fertil Steril.* 1990 Dec. 54(6):995-8.
- [5] Parsanezhad ME, Alborzi S, Zarei A, Dehbashi S, Shirazi LG, Rajaefard A, et al. Hysteroscopic metroplasty of the complete uterine septum, duplicate cervix, and vaginal septum. *Fertil Steril.* 2006 May. 85(5):1473-7.
- [6] Rock JA, Murphy AA, Cooper WH 4th. Resectoscopic techniques for the lysis of a class V: complete uterine septum. *Fertil Steril.* 1987 Sep. 48(3):495-6.
- [7] Fedele L, Bianchi S, Marchini M, Mezzopane R, Di Nola G, Tozzi L. Residual uterine septum of less than 1 cm after hysteroscopic metroplasty does not impair reproductive outcome. *Hum Reprod.* 1996 Apr. 11(4):727-9.
- [8] Fayez JA. Comparison between abdominal and hysteroscopic metroplasty. *Obstet Gynecol.* 1986 Sep. 68(3):399-403.
- [9] March CM, Israel R. Hysteroscopic management of recurrent abortion caused by septate uterus. *Am J Obstet Gynecol.* 1987 Apr. 156(4):834-42.
- [10] Vercellini P, Fedele L, Arcaini L, Rognoni MT, Candiani GB. Value of intrauterine device insertion and estrogen administration after hysteroscopic metroplasty. *J Reprod Med.* 1989 Jul. 34(7):447-50.
- [11] Dabirashrafi H, Mohammad K, Moghadami-Tabrizi N, Zandinejad K, Moghadami-Tabrizi
- [12] M. Is estrogen necessary after hysteroscopic incision of the uterine septum?. *J Am Assoc Gynecol Laparosc.* 1996 Aug. 3(4):623-5.
- [13] Barbot J. Hysteroscopy and hystero-graphy. *Obstet Gynecol Clin North Am.* 1995 Sep. 22(3):591-603.
- [14] Valle RF, Sciarra JJ. Hysteroscopic treatment of the septate uterus. *Obstet Gynecol.* 1986 Feb. 67(2):253-7.
- [15] Lobaugh ML, Bammel BM, Duke D, Webster BW. Uterine rupture during pregnancy in a patient with a history of hysteroscopic metroplasty. *Obstet Gynecol.* 1994 May. 83(5 Pt 2):838-40.
- [16] DeCherney AH, Russell JB, Graebe RA, Polan ML. Resectoscopic management of mullerian fusion defects. *Fertil Steril.* 1986 May. 45(5):726-8.
- [17] Gray SE, Roberts DK, Franklin RR. Fertility after metroplasty of the septate uterus. *J Reprod Med.* 1984 Mar. 29(3):185-8.
- [18] Hickok LR. Hysteroscopic treatment of the uterine septum: a clinician's experience. *Am J Obstet Gynecol.* 2000 Jun. 182(6):1414-20.
- [19] Daly DC, Walters CA, Soto-Albors CE, Riddick DH. Hysteroscopic metroplasty: surgical technique and obstetric outcome. *Fertil Steril.* 1983 May. 39(5):623-8.
- [20] Zanetti E, Ferrari LR, Rossi G. Classification and radiographic features of uterine malformations: hysterosalpingographic study. *Br J Radiol.* 1978 Mar. 51(603):161-70.
- [21] Heinonen PK. Complete septate uterus with longitudinal vaginal septum. *Fertil Steril.* 2006 Mar. 85(3):700-5.
- [22] Rock JA, Zacur HA, Dlugi AM, et al. Pregnancy success following surgical correction of imperforate hymen and complete transverse vaginal septum. *Obstet Gynecol.* 1982 Apr. 59(4):448-51.
- [23] McKusick VA, Bauer L, Koap CE, Scott RB. Hydrometrocolpos as a simply inherited malformation. *JAMA.* 1964 Sep 14. 189:813-6.
- [24] Suidan FG, Azoury RS. The transverse vaginal septum: a clinicopathologic evaluation. *Obstet Gynecol.* 1979 Sep. 54(3):278-83.
- [25] Banerjee AK, Clarke O, MacDonald LM. Sonographic detection of neonatal hydrometrocolpos. *Br J Radiol.* 1992 Mar. 65(771):268-71.
- [26] Shatzkes DR, Haller JO, Velcek FT. Imaging of uterovaginal anomalies in the pediatric patient. *Urol Radiol.* 1991. 13(1):58-66.
- [27] Khunda SS, Al-Omari S. A new approach in the management of lower Mullerian atresia. *J Obstet Gynaecol.* 1998 Nov. 18(6):566-8.
- [28] Turner G. A second family with renal, vaginal, and middle ear anomalies. *J Pediatr.* 1970 Apr. 76(4):641.
- [29] Tugay M, Tugay S, Inan N, Ozkan SO, Anik Y. Distal vaginal agenesis in monozygotic twins: case report. *J Pediatr Surg.* 2008 Apr. 43(4):765-7.
- [30] Imamoglu M, Cay A, Sarihan H, Kosucu P, Ozdemir O. Two cases of pyometocolpos due to distal vaginal atresia. *Pediatr Surg Int.* 2005 Mar. 21(3):217-9.
- [31] Dursun I, Gunduz Z, Kucukaydin M, Yildirim A, Yilmaz A, Poyrazoglu HM. Distal vaginal atresia resulting in obstructive uropathy accompanied by acute renal failure. *Clin Exp Nephrol.* 2007 Sep. 11(3):244-6.
- [32] Scanlan KA, Pozniak MA, Fagerholm M, Shapiro S. Value of transperineal sonography in the assessment of vaginal atresia. *AJR Am J Roentgenol.* 1990 Mar. 154(3):545-8.
- [33] Tolhurst DE, van der Helm TW. The treatment of vaginal atresia. *Surg Gynecol Obstet.* 1991 May. 172(5):407-14.
- [34] Acien P, Acien M, Sanchez-Ferrer ML. Müllerian anomalies "without a classification": from the didelphys-unicollis uterus to the bicervical uterus with or without septate vagina. *Fertil Steril.* 2008 Mar 24.
- [35] Acien P, Sanchez-Ferrer M, Mayol-Belda MJ. Unilateral cervico-vaginal atresia with ipsilateral renal agenesis. *Eur J Obstet Gynecol Reprod Biol.* 2004 Dec 1. 117(2):249-51.
- [36] Chen YT, Mattison DR, Feigenbaum L, Fukui H, Schulman JD. Reduction in oocyte number following prenatal exposure to a diet high in galactose. *Science.* 1981 Dec 4. 214(4525):1145-7.
- [37] Cramer DW, Ravnikar VA, Craighill M, Ng WG, Goldstein DP, Reilly R. Müllerian aplasia associated with maternal deficiency of galactose-1-phosphate uridyl transferase. *Fertil Steril.* 1987 Jun. 47(6):930-4.
- [38] Davydov SN. [Colpopoiesis from the peritoneum of the uterorectal space]. *Akush Ginekol (Mosk).* 1969 Dec. 45(12):55-7.
- [39] Fedele L, Bianchi S, Frontino G. Septums and synechiae: approaches to surgical correction. *Clin Obstet Gynecol.* 2006 Dec. 49(4):767-88.
- [40] Fedele L, Zamberletti D, Vercellini P, Dorta M, Candiani GB. Reproductive performance of women with unicornuate uterus. *Fertil Steril.* 1987 Mar. 47(3):416-9.
- [41] Franz RC. Sigmoid colon vaginoplasty: a modified method. *Br J Obstet Gynaecol.* 1996 Nov. 103(11):1148-55.
- [42] Lavanya R, Urala MS. Segmental absence of the fallopian tube--a rare anomaly. *Int J Gynaecol Obstet.* 1994 Nov. 47(2):175-6.

AUTHORS

First Author – DR. NISHTHA GUPTA, SR. CONSULTANT - OBS/GNY, THE GYNAE CLINIC, FARIDABAD

Indonesian Language Teachers' Strategy in Applying Blended Learning

Rintani Hidayat

rintanihidayat.2021@student.uny.ac.id
Language and Arts Education. Yogyakarta State University. Indonesia

DOI: 10.29322/IJSRP.12.10.2022.p13014
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13014>

Paper Received Date: 18th August 2022
Paper Acceptance Date: 24th September 2022
Paper Publication Date: 6th October 2022

Abstract- This study discusses strategies by teachers in schools regarding blended learning at junior high school 4 Merangin. The purpose of this study was to determine the strategy of Indonesian language teachers in blended learning at junior high school 4 Merangin. This research method is a case study. The research approach used is qualitative. Data collection techniques are in-depth interviews and documentation. The results of the research on blended learning strategies are a combination of two or more strategies and learning methods to get the learning outcomes expected by the teacher. The strategies used by Indonesian language teachers in blended learning are as follows: youtube, videos, recordings, learning materials and, whatsapp. What has been found in indicators or in a theoretical concept.

Index Terms- Indonesian Language, Strategy, Blended Learning

I. INTRODUCTION

Education is the main vehicle and as the main key for the development of human resources, namely to improve the quality of oneself as an individual who has the ability, personality and skills in accordance with the demands of the times. Juhji (2016) the role of teachers as educators are roles related to tasks that provide assistance and encouragement (supporters), supervisory and coaching tasks (supervisor) and tasks related to disciplining children so that children it becomes obedient to school rules and norms of life in the family and society.

In teaching and learning activities that take place there is a purposeful interaction. Teachers and students are the ones who move it. This purposeful interaction is caused by the teacher who interprets it by creating an educational value environment for the benefit of students in learning. Djamarah & Zain (2010) teaching and learning activities are a process and teachers must sincerely behave and act, and understand their students with all the consequences. So the importance of correcting wrong views and assessing children in educating in learning.

Furthermore, based on a brief interview about the process of learning activities during the COVID-19 pandemic, researchers conducted with teachers at SMPN 4 Merangin that Indonesian language teachers have two ways to teach and learn, namely by taking turns offline and online. Meanwhile, in normal situations, Indonesian language learning hours are 6 hours per week. Therefore, teachers must be able to use platforms related to learning, so that teachers continue to pay attention to the development of students in order to carry out learning effectively. Thus, blended learning has been carried out by the Indonesian language teacher at junior high school 4 Merangin. Therefore, it is necessary for teachers to improve online learning methods so that they do not have an impact on students in effective learning.

One of the learning models that can be applied through technology-based media users is the blended learning model. Blended learning is learning that combines or combines various web-based technologies. Like, Meet, Zoom, Google Classroom, Edmodo, and so on to achieve educational goals. A blend of conventional learning where educators and students meet face-to-face with online learning. This strategy can be developed into a learning model that can make the learning atmosphere fun.

According to Utari, et al (2020) the blended learning strategy is an alternative learning in the new normal era and education must master technology and communication media in learning, educators also conduct online learning, but face-to-face learning is eliminated. Blended learning itself can combine learning technology with actual work assignments to create a good influence on learning and assignments given by educators. Through blended learning can create a positive learning environment for interaction even though space and time are limited.

Educators must master information and communication technology in learning in the new normal. Because blended learning is all approaches that teachers have. Therefore, blended learning is very directing teachers to be able to see the skills and preferences of

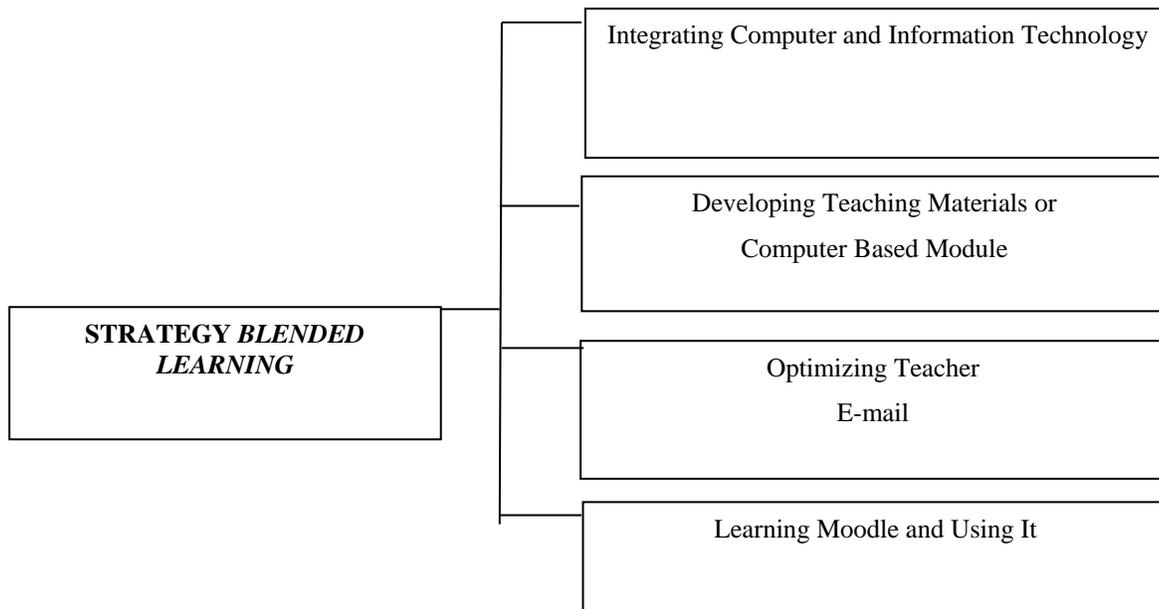
students until a desired goal is achieved. Based on the background described above, the authors are interested in discussing the research entitled Strategies of Indonesian Language Teachers in Implementing Blended Learning in Junior High School 4 in Merangin. In this research, I want to identify whether the application of blended learning can improve the learning process in the COVID-19 Pandemic Era, and what are the strategic findings obtained in this study for the application of blended learning. To find out the findings of the strategy in the application of blended learning, the following are the questions in this study.

1. What is the strategy of Indonesian language teachers in implementing blended learning at Junior High School 4 Merangin ?
2. How to implement a blended learning strategy in the era of the COVID-19 pandemic at State Junior High School 4 Merangin ?

II. RESEARCH METHODOLOGY

The method used in this research is to use the case study method which aims to determine the form, causes and impacts given by the teacher by the students. The approach used in this research is qualitative. The time used in this study was approximately four months carried out from February 28, 2022 - June for data collection. The place where this research was carried out was at Middle School 4 Merangin, Bangko District, Jambi Province. Data analysis in this study based on the theory of Stake (Wahyuningsih, 2013) reveals four forms of data analysis and their interpretation in case study research, namely: (1) Category collection, researchers look for a collection of data examples and hope to find meaning. Relevant to the issues that will arise; (2) Direct interpretation; (3) The researcher forms a pattern and looks for equivalence between two or more categories and the researcher develops it through data analysis.

Table 1. Blended learning strategy thinking framework



III. RESULTS AND DISCUSSION

Results

This section presents and analyzes the research results according to the research questions mentioned in the introduction. The purpose of this study was to determine the strategies used by Indonesian language teachers in implementing blended learning. The findings were analyzed qualitatively. The data that I collected was based on interviews with Indonesian language teachers at Middle School 4 Merangin, the following are the results of the interviews:

Table 2. Description of the overall Indonesian teacher interview data

NO	QUESTION	INTERVIEW DATA	KET
1.	How do teachers use videos in blended learning?	At Middle School 4 Merangin, during online learning during the COVID-19 period, some teachers used learning videos on YouTube to distribute learning materials to students at home. The videos that we take are in accordance with the theme and subject matter of each subject. Taken on youtube then edited and sent to students in their respective class groups.	GBI

2.	How do teachers use animation in blended learning?	In general, Indonesian language teachers at Middle School 4 Merangin use or take advantage of animations on YouTube.
3.	How do teachers use simulations in real situations in blended learning?	Simulations in online blended learning, the teacher records or teaches giving microteaching lessons in the form of recordings, then distributes them to students in Indonesian language learning and sends them to their respective groups. Simulations generally convey only the core learning, the important parts. The material presented, material that is considered important KD which is important is made a learning simulation and then distributed to students in the form of recordings or videos.
4.	How do teachers develop materials to help students who have problems in learning?	In delivering material during the covid-19 period, 4 Merangin Junior High School has 2 modes. The first mode is really online using students' smartphones. The material presented can be in the form of a summary and then shared in the WA group. While the second mode is for students who do not have cellphones, students pick up assignments and materials on a predetermined day for class 7 on Monday, for class 8 on Tuesday, and for class 9 on Wednesday. Materials and assignments for students to work on at home the following week, students collect assignments that have been determined by the teacher concerned with the time division system, each class is given 60 minutes.
5.	How do teachers optimize e-mail groups in learning as a place for discussion between teachers and students?	In Middle School 4 Merangin using e-mail to students, by means of the teacher distributing assignments and materials via e-mail and students giving answers, then students responding or providing answers via the e-mail that the teacher has given. Can be called a google form, which is via e-mail each student.
6.	How do teachers optimize e-mail groups in learning as a tool for collecting assignments/files?	Student assignments sent in e-mail later by the teacher in question will be formed or will be collected in a specific file. For example, using Google Drive, so that students can collect all the assignments given by the teacher concerned. So that it is easier for students to collect assignments in 1 file or 1 drive.
7.	How do teachers take advantage of available applications such as WA Group, Google Classroom, and others to improve the quality of learning?	At present, in a limited learning system, students are asked to meet face-to-face but in different times and shifts. So, some of the material that is not delivered in face-to-face meetings is through Whatsapp groups, the way is that every Indonesian teacher has a Whatsapp group with students. The material delivered in limited face-to-face meetings is continued through the Whatsapp group, both assignments and deepening of material. Indonesian teachers also use the Google Classroom and Google Form applications.

Information
GBI: Indonesian Teacher

Discussion

Category Collection

Data collection or category is a method used to collect information and facts that researchers have done in the field. These categories will later be useful as supporting facts in describing a research conducted. The following are the results of the category collection conducted for Indonesian language teachers at Middle School 4 Merangin. Based on the results of the interview description, they are as follows: (1) Youtube; (2) Videos; (3) Records; (4) Learning Materials and; (5) Whatsapp.

Live Interpretation

Based on the results of the categories that have been described, this has become one of the focuses of the research, namely the categories that have been interviewed with Indonesian language teachers at Middle School 4 Merangin. Furthermore, the categories that have been described will be interpreted directly to find a meaning to be conveyed, namely, as follows.

1. Youtube

Youtube is one of the social media developments that has the most opportunities in the world of education. Indonesian language teachers at Middle School 4 Merangin use YouTube as a teaching medium. Teachers can use YouTube as a teaching medium that is preferred by students in learning. Through learning media using YouTube, students can understand a material faster than studying a textbook, and the media does not bore students so that it is alleged to increase students' interest and motivation in learning in learning.

In the learning process, teachers and students are one component that of course cannot be separated. There must be interaction between teachers and students, so that learning outcomes can be achieved properly. With this YouTube, they will look for an explanation sent by the teacher to students and provide the tutorial needed to support a lesson to replace face-to-face learning. From YouTube, the teacher will get a video that is in accordance with the material that will be taught by educators to students. The Indonesian language teacher will send a link or direct video that has been downloaded or that has been downloaded on YouTube.

2. Video

The next category is video or animation. The way the Indonesian language teacher in Middle School 4 Merangin is by downloading one of the videos from youtube which will be sent to students, so that there is an animation in the video. The animation is an additional motion picture so that the video is more interesting to be seen or watched by students. The video is combined with animation in the form of a set of moving objects to improve a subject matter so that the student can turn on a learning material sent by the educator. So, it can be concluded that the video or animation video that gives motion to the image has a series of plots and displays a message from the part of an image to achieve a learning goal that has been given a material for the video or animation.

3. Recording

It can't be separated from youtube, videos, next is the recording of the learning process at school. We know that in online learning Indonesian language teachers use a learning simulation. The simulation itself is the Indonesian language teacher at Middle School 4 Merangin using voice or video recordings that the teacher has given to the students. We know that simulation is one method that provides a presentation in the form of lessons using a real situation or process.

With the recording, the learning process is the creation of a learning simulation on the material presented by an educator to his students so that it provides an convenience and to educators and students. Educators are an important part in supporting an order to realize the ideals of students and the nation. So that educators should be as much as possible so that students can receive lessons easily.

4. Learning Media

The teaching and learning process has a broader meaning and understanding than the notion of teaching. In the teaching and learning process, there is a single unit of activity that cannot be separated between students and educators who teach, namely learning materials. There is a mutually supportive interaction between these two activities. Educators can develop teaching materials well.

Educators can develop materials to help students who have difficulty during learning. From the categories described above, it can be seen that Indonesian language teachers have different ways to help students in the teaching and learning process for students who have difficulties in learning. Because every Indonesian teacher has a different character in teaching students to learn.

5. WhatsApp

Whatsapp is widely used among people. The use of whatsapp that helps learning to make it easier to create a group for learning. Whatsapp is an online messenger application that is currently widely used for chat, personal, online seminars, and others. Whatsapp is a platform that can be used for learning used by educators and students. To get this whatsapp application, one must download or download so that this whatsapp application is on a smart phone or cellphone.

Table 3. Category Equivalence

CATEGORY	DESCRIPTION
1. Youtube	a. The relationship between the two categories can be seen in

2. Video	<p>the description above. That youtube and video are very closely related in a social media. On YouTube there are videos that are considered to contain content. For example, content that has Indonesian language learning materials.</p> <p>b. The teachers will download the video on YouTube. Youtube is a form of video-based social media that uses new media in the form of the internet in delivering information or learning materials. On YouTube there is the word video blog. This vlog is called a video that contains opinions, stories, or other activities.</p> <p>c. Youtube is an online video whose site as a video on YouTube can be viewed as an online video whose site is a medium for searching. The video on youtube can be seen from the device, namely the cellphone, that is the relationship between the two categories.</p>
----------	---

IV. CONCLUSION

The results of research conducted by the writer of the Indonesian language teacher strategy in blended learning at Middle School 4 Merangin using a qualitative approach, case study method, based on data collection techniques and documentation that can be obtained as follows, (1) The results of the study found several strategies of Indonesian language teachers in implementing blended learning at Merangin 4 Junior High School, namely, Youtube, Video, Recording, Learning Materials, and Whatsapp. (2) Advances in technology provide a role in creating development as a step to improve learning. In integrating there are videos, animations, and simulations in learning. Here, the teacher is able to provide creativity in teaching the students. (3) In blended learning, teachers and students learn remotely or virtually. Teachers and students will discuss and send assignments/files through the group. (4) With this feature, teachers and students don't have to worry about learning. Teachers at Middle School 4 Merangin use the Whatsapp and google form features or applications as learning infrastructure. The whatsapp group feature can build an informative learning for teachers and students, and can be interactive related to various information, materials, discussions about the learning to be studied.

REFERENCES

- Arischa, Holy. *Workload Analysis in the Field of Waste Management, Pekanbaru City Environmental and Hygiene Service*. Let's Fisip, 6(1), 1-14. 2019.
- David Eribka Ruthellia, et al. *The Influence of Vlog Content on Youtube on the Attitude Formation of Communication Science Students, Faculty of Social and Political Sciences, Sam Ratulangi University*. Acta Diurna. 6(1), 1-18. 2017.
- Djalal, Fauza. *Optimizing Learning Through Approaches, Strategies, and Learning Models*. Sabilarraspad, 2(1), 31-51. 2017.
- Dwiyogo, Wasid D. *Blended Learning-Based Learning*. Malang: Wineka Media. 2016.
- Faiqah Fatty, et al. *Youtube as a Communication Tool for the Makassarvidgram Community*. Kareba, 5(2), 259-272. 2016.
- Fatimah & Sari. *Learning & Learning Strategies in Improving Language Skills*. Literacy Pen, 1(2), 108-115. 2018.
- Haidir & Malik. *Learning strategies*. Medan: Perdana Publishing. 2012.
- Hamalik, Oemar. *Teaching and learning process*. Jakarta: Earth Literature. 2013.
- Handoko & Waskito. *Blended Learning Theory and Its Application*. Field: LPTIK. 2018.
- Husama. *Mixed Learning (Blended Learning)*. Malang: Library Achievement. 2014.
- Boy, Ridwan. *Indonesian Language Learning Strategy at the Education Unit Level Curriculum (KTSP)*. Old Master, 1(1), 23-29. 2018.
- Mansour. *Sound Recording Evidence in Evidence of Corruption Crimes*. Legal Communications, 3(1), 105-116. 2017.

- Maya, Yuniarti. *The Use of Blended Learning in Industrial Age 4.0 Learning*. Bahastra, 4(2), 31-38. 2020.
- Pontangan, et al. *Learning Strategies Blended Learning Solutions for Lecturers' Limitations*. Learning Education and Counseling, 3(1), 19-25. 2020.
- Subana, et al. *Education Statistics*. Bandung: CV Pustaka Setia. 2000.
- Sugiyono. *Educational Research Methods*. Bandung: Cv. Alfabeta. 2008.
- Suyono & Hariyanto. *Learning and Learning*. Bandung: PT Pemuda Rosdakarya. 2014.
- Trisnani. *Utilization of Whatsapp as a Communication Media and Satisfaction in Delivering Messages Among Community Leaders*. Communication, Media and Informatics. 6(3), 1-12. 2017.
- Utari, et al. *Blended Learning: Alternative Learning Strategy in the New Normal Era*. National Seminar on Education, 2(1), 51-56. 2020.
- Wahyuningsih, Sri. *Case Study Research Methods*. Madura: UTM PRESS. 2013.

Author

First Author – Rintani Hidayat. Language and Arts Education. Yogyakarta State University. Indonesia.
rintanihidayat.2021@student.uny.ac.id

Autologous Platelet-Rich Plasma (PRP) Treatment To Optimize Endometrial Thickness

Dr. Divya Kumar

SR. Consultant Obs&Gynae, Accord Hospital, Faridabad

DOI: 10.29322/IJSRP.12.10.2022.p13015

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13015>

Paper Received Date: 18th August 2022

Paper Acceptance Date: 24th September 2022

Paper Publication Date: 6th October 2022

Abstract- The endometrium plays an important role in the success of a pregnancy. There have been many clinical treatments that have been tried to increase endometrial thickness. These include hormone replacement, growth hormone and aspirin. However, they face numerous difficulties. The platelet-rich plasma method (PRP), was therefore considered. Infertile women suffering from recurrent implantation loss (RIF) or thin endometrium have been treated with intrauterine autologous plasma (PRP). Twelve patients with infertility between the ages of 25 and 40 were chosen for PRP treatment. The data suggests that PRP treatment may improve endometrial thickness as well as receptivity. The study concluded that PRP is effective in increasing endometrium thickness, which can lead to clinical pregnancy.

Index Terms- Platelet-rich plasma (PRP); Thin endometrium; Recurrent implantation failure (RIF)

I. INTRODUCTION

Despite the many advances made in recent years, assisted reproduction techniques (ARTs) still have a low success rate. This shows the need to explore other options for ART cycles. A receptive and functional endometrium are essential for successful implantation. This is also required to ensure synchronized interactions between blastocyst, endometrium and blastocyst. There are many factors that can prevent normal implantation and pregnancy. Women's sperm count and pattern play a significant role in getting pregnant. The minimum endometrial thickness should not exceed 7 mm at the end of the follicular stage. Numerous studies have shown that a sub-optimal level of endometrium can prevent a woman from conceiving [2]. Numerous studies have shown that PRP can be used to increase endometrial growth in patients with thin ends. The use of autologous PRP is now being used in reproductive medicine. Numerous studies on autologous PRP have shown positive results for women suffering from thin endometrium or recurrent implantation failure [3].

There are many options for treating thin endometrium, including exogenous estrogen, low-dose aspirin and vitamin E. The blood levels of growth factors are much higher than normal. The administration of autologous PRP is safe and does not carry any transmissible diseases such as HIV/hepatitis [4].

A high level of platelet growth factors is found in autologous platelet rich plasma (A-PRP). PRP contains a large number of growth factors in biologically defined ratios. This distinguishes it from the recombinant factor. PRP contains platelet and growth factors in levels that range from 80% to 98% [5].

Thin endometrium is still a problem. Therefore, the purpose of this study was to assess the role of autologous plasma platelet-rich Plasma treatment in increasing thickness and receptivity of endometrium in persistently thin cases [6].

II. CASES DESCRIPTION

Twelve patients with poor endometrial development (less than 7 mm) were chosen for the study at Accord Superspeciality hospital. Summary data on patient characteristics and FET outcome is shown Table 1.

All participants received hormone replacement therapy (HRT). Estradiol valerate 6 mg/d started on the third day of the menstrual cycle. It was increased to 12 mg/d days 9-10 due to inadequate endometrial development (7 mm). Due to thin endometrium, PRP was performed on day 11. It was repeated on day 13. If the patient's endometrium was thicker than 7mm by day 11, PRP was performed. It was then repeated on day 13 [18] [7].

PRP preparation process-

PRP was made from autologous peripheral cells by centrifugation in two steps. About 8.5 ml blood was taken from 10 ml of a Syringe. It contained 1.5 ml Acid Citrate Anticoagulant Solution (ACD-A) pre-filled in it. Mix the blood in a tube. After 15 minutes, centrifuge at 1200-1500 RPM. RBC was separated, and the sample was again centrifuged at 3000 rpm for ten minutes. To provide growth factors, more concentrated blood was obtained [8]. An IUI cannula was used to inject PRP volume of approximately (0.5-0.8

ml) into the uterus. All aseptic protocols were followed during the slow intrauterine injection. Continued use of estradiol valerate. The same observer performed ultrasound after 48 hours and noted the endometrial thickness. After endometrial thickness was ≥ 7 mm, progesterone was initiated and FET was performed subsequently. Estradiol valerate was continued for two weeks after embryo transfer. Progesterone hormone supplements were continued for 12 weeks if serum b-HCG was within the normal range. To confirm the pregnancy, transvaginal ultrasound was performed. The primary outcome was an endometrial expansion. Secondary outcomes were chemical and medical pregnancies. They were determined by positive serum HCG 2 weeks after FET, and the presence or absence of fetal cardiac activity in the transvaginal ultrasound.

III. INCLUSION CRITERIA

1. Patients who have had their embryo transfers cancelled because of thin endometrium
2. Patients who have undergone frozen embryo transfer cycles.
3. All embryos that were transferred were day five embryos.
4. Culture of Negative Acid-fast Bacillus (AFB), for genital tuberculosis.
5. Normal transvaginal ultrasound in women with no clinically significant abnormalities in the uterus, adnexa or uterus.
6. Patients with a platelet count greater than 1 lac.

Table 1. Patients' characteristics

<i>Patient</i>	<i>Age (Year)</i>	<i>Diagnosis</i>	<i>Endometrium(mm) without/with PRP infusion</i>	<i>Embryo transfer</i>	<i>chemical pregnancy</i>	<i>clinical pregnancy</i>
<i>1</i>	<i>27</i>	<i>Male Factor, Borderline ovarian reserve, tubal factor</i>	<i>5.1/6.3/7.3</i>	<i>2</i>	<i>Yes</i>	<i>No</i>
<i>2</i>	<i>29</i>	<i>Endometriosis</i>	<i>4.3/6.2/8.4</i>	<i>2</i>	<i>No</i>	<i>No</i>
<i>3</i>	<i>38</i>	<i>PCOD</i>	<i>5.3/6.5/7.6</i>	<i>2</i>	<i>Yes</i>	<i>Yes</i>

4	40	Poor ovarian reserve, Endometrial factor	4.2/6.8/8.3	2	No	No
5	26	Endometriosis	5.3/6.7/8.6	2	Yes	Yes
6	34	PCOD, Tubal factor	5.3/5.5/7.5	2	No	No
7	32	Tubal factor	5.2/6.5/7.3	2	No	No
8	29	OD Tubal Factor, Mild male facts	5.4/6.7/7.9	2	Yes	Yes
9	40	Advance maternal age, PCOD	5.3/6.8/8.1	2	No	No
10	27	Endometrial factor	5.1/6.3/7.3	2	Yes	Yes
11	35	Poor ovarian reserve, Endometrial factor	4.7/5.4/6.1	cycle cancelled	No	No
12	37	Poor ovarian reserve, Tubal factor	5.1/5.4/5.7	cycle cancelled	No	No

*Endometrial thickness(mm): Before PRP/48 h after first PRP/48 h after second PRP

**PCOD: Polycystic ovary syndrome

IV. RESULTS

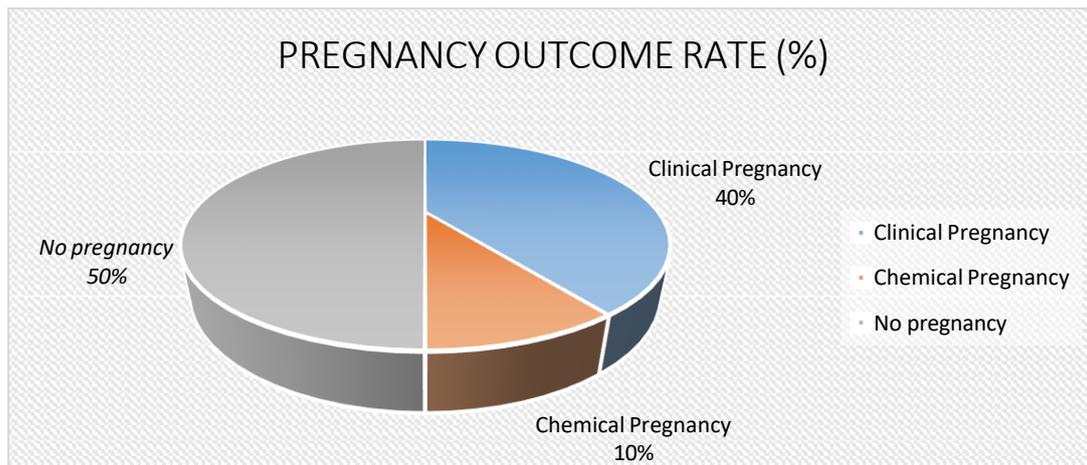


Figure 1- Pregnancy outcome in 12 patients who underwent frozen embryo transfer after platelet-rich plasma (PRP) instillation

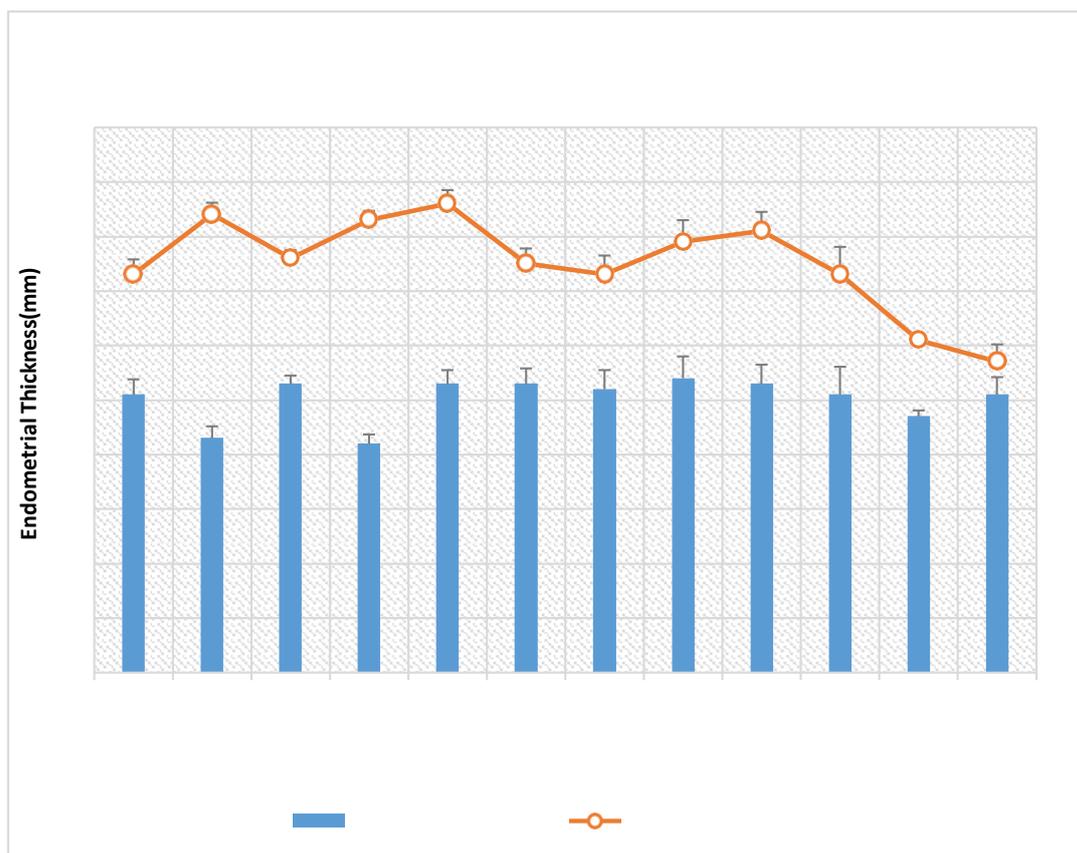


Figure 2- Endometrial thickness in women before and after PRP treatment

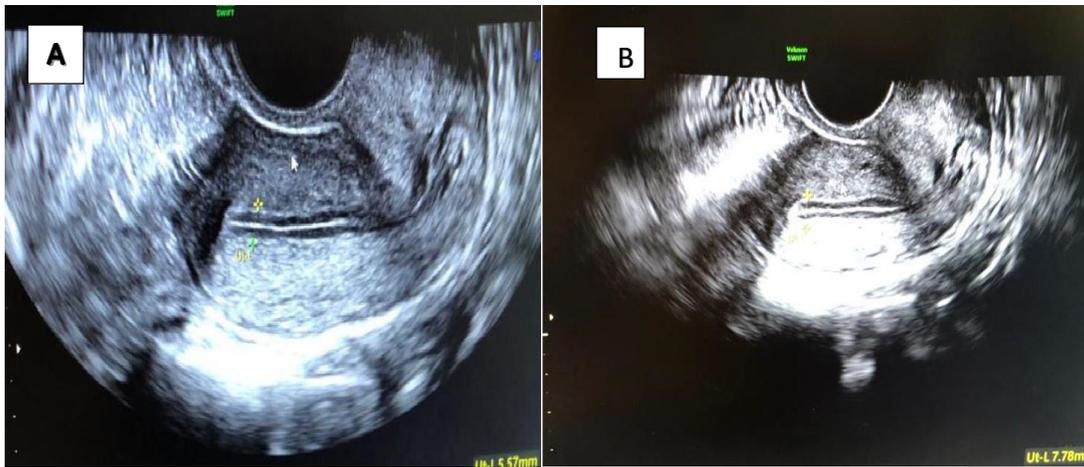


Figure 3 Ultrasonography in a patient. A. Quite a thin endometrium (only 5.57 mm) day 11 before PRP. B. Remarkable improvement in endometrial thickness after the infusion of PRP (7.78 mm)

In 10 patients, the endometrial thickness rose after PRP infusion and was >7 mm on day 10. After 5 days of progesterone administration, day 5 embryos were successfully transferred. Two blastocyst transfers were performed on 10 patients. Unfortunately, 2 of the cycles had to be cancelled due to persistently thin endometrium. Fourteen patients had clinical pregnancy (40%) out of a total of 10. One patient was diagnosed with biochemical pregnancy (10%). Age factors are very important in the development of endometrial thickening. Women who are 35 years old or older have difficulty getting pregnant.

Statistical analysis

For statistical analysis, IBM (r), SPSS (r), Statistics Version 20.0.0 was used. A one-way ANOVA was followed by LSD's new multiple range test and Duncan's new multivariate tests. Each experiment was performed in three copies and the average values were used for the calculations.

V. DISCUSSION

Despite all the progress made in embryo selection and quality improvements, many patients still experience repeated implantation failure (RIF). Poor endometrial responsiveness has become a major problem in the ART field. The lack of evidence-based treatments is a sign of the problem. Scientists and clinicians are still trying to find a solution. There are many drugs that can be used to improve thin endometrium. These include estrogen, gonadotropins and letrozole. [10].

Recent evidence is proving the positive effect of autologous platelet rich plasma (PRP), in treating thin endometrium. PRP uses autologous plasma from the donor that increases platelet count by about 4-5x more than the circulating blood. The PRP procedure results in regeneration and proliferation of the platelets with a wide range of growth factors and other cytokines. PRP is used in a variety of conditions that are not covered by existing effective treatments. These include osteoarthritis, ligament injuries, skin rejuvenation, hair loss, breast augmentation, wound healing in aesthetic surgery, and bone marrow transplants. In persistently thin cases of endometrial disease, PRP can also be used. [11].

This study was done to improve the success rate of the ART cycle and increase the endometrial thickness. It was successful in 10 patients, but there were 2 failed responses. One patient also experienced biochemical pregnancy. Although the exact cause of this condition is unknown, several factors such as Chromosomal or Genetic abnormalities have been suggested. One of the contributing causes of non-responsive and biochemically pregnant women is inherited or acquired thrombophilias. One reason for failure to respond may be advanced maternal age (≥ 35 years). The study showed that 4 out of 10 patients experienced a clinical pregnancy, which is a good sign. Patients with advanced maternal age can have PRP. Complex errors were seen in women of advanced maternal years. The use of PRP can allow women to have the chance to conceive. It also had a positive effect on women over 38 in our study. It is important to conduct larger trials and follow strict protocols[12].

This study supports the effectiveness of PRP in promoting endometrial development. Two PRP injections were able to produce adequate endometrial development in patients with thin endometrium. Because it was made using autologous blood, PRP is safe and has minimal risk of infection or immunological reactions. Two PRP injections were sufficient to increase the endometrium of patients with thin endometrium. Because it was done from autologous blood, PRP was safe and did not cause any immunological reactions or transmission of infection.

VI. CONCLUSION

The study suggests that PRP treatment can result in positive endometrial development in patients with thin endometrium. The use of PRP to increase endometrial thickness and receptivity for clinical pregnancy is a promising option in reproductive medicine. Because of its potential to promote endometrial renewal, PRP has been widely used in pregnancy. Our data show that PRP effectively increased the endometrium proliferation, implantation rate and clinical pregnancy rate.

REFERENCES

- [1] Gleicher, N., Kim, A., Michaeli, T., Lee, H. J., Shohat-Tal, A., Lazzaroni, E., & Barad,
- [2] D. H. (2013). A pilot cohort study of granulocyte colony-stimulating factor in the treatment of unresponsive thin endometrium resistant to standard therapies. *Human Reproduction*, 28(1), 172-177.
- [3] Chang, Y., Li, J., Chen, Y., Wei, L., Yang, X., Shi, Y., & Liang, X. (2015). Autologous platelet-rich plasma promotes endometrial growth and improves pregnancy outcome during in vitro fertilization. *International journal of clinical and experimental medicine*, 8(1), 1286.
- [4] Eftekhar, M., Sayadi, M., & Arabjahvani, F. (2014). Transvaginal perfusion of G-CSF for infertile women with thin endometrium in frozen ET program: A non-randomized clinical trial. *Iranian journal of reproductive medicine*, 12(10), 661
- Agarwal, M., Mettler, L., Jain, S., Meshram, S., Günther, V., & Alkatout, I. (2020). Management of a thin endometrium by hysteroscopic instillation of platelet-rich plasma into the endomyometrial junction: a pilot study. *Journal of Clinical Medicine*, 9(9), 2795.
- [5] Taniguchi, Y., Yoshioka, T., Sugaya, H., Goshō, M., Aoto, K., Kanamori, A., & Yamazaki, M. (2019). Growth factor levels in leukocyte-poor platelet-rich plasma and correlations with donor age, gender, and platelets in the Japanese population. *Journal of experimental orthopaedics*, 6(1), 1-8.
- [6] Singh, N., Shekhar, B., Mohanty, S., Kumar, S., Seth, T., & Girish, B. (2020). Autologous bone marrow-derived stem cell therapy for Asherman's syndrome and endometrial atrophy: a 5-year follow-up study. *Journal of human reproductive sciences*, 13(1), 31.
- [7] Du, J., Lu, H., Yu, X., Lü, Z., Mi, L., & Zhang, X. (2020). Efficacy and safety of platelet-rich plasma for the treatment of thin endometrium: a protocol for systematic review and meta-analysis. *Medicine*, 99(3).
- [8] Amable, P. R., Carias, R. B. V., Teixeira, M. V. T., da Cruz Pacheco, Í., Corrêa do Amaral, R. J. F., Granjeiro, J. M., & Borojevic, R. (2013). Platelet-rich plasma preparation for regenerative medicine: optimization and quantification of cytokines and growth factors. *Stem cell research & therapy*, 4(3), 1-13.
- [9] Dhurat, R., & Sukesh, M. (2014). Principles and methods of preparation of platelet-rich plasma: a review and author's perspective. *Journal of cutaneous and aesthetic surgery*, 7(4), 189.
- [10] Chang, Y., Li, J., Chen, Y., Wei, L., Yang, X., Shi, Y., & Liang, X. (2015). Autologous platelet-rich plasma promotes endometrial growth and improves pregnancy outcome during in vitro fertilization. *International journal of clinical and experimental medicine*, 8(1), 1286.
- [11] Eftekhar, M., Sayadi, M., & Arabjahvani, F. (2014). Transvaginal perfusion of G-CSF for infertile women with thin endometrium in frozen ET program: A non-randomized clinical trial. *Iranian journal of reproductive medicine*, 12(10), 661.
- [12] Lin, Y., Qi, J., & Sun, Y. (2021). Platelet-rich plasma as a potential new strategy in the endometrium treatment in assisted reproductive technology. *Frontiers in endocrinology*, 12, 707584.

AUTHORS

First Author – Dr. Divya Kumar, SR. Consultant Obs&Gynae, Accord Hospital, Faridabad

Infertility Management: What's the Latest ?

Dr Divya Kumar

* Sr Consultant OB&GYNAE, Department of OBS & GYNAE ACCORD HOSPITAL GREATER FARIDABAD

DOI: 10.29322/IJSRP.12.10.2022.p13016
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13016>

Paper Received Date: 23rd August 2022
Paper Acceptance Date: 24th September 2022
Paper Publication Date: 6th October 2022

I. INTRODUCTION

The number of babies born due to infertility treatment with in vitro fertilization (IVF) worldwide is estimated to be more than 8 million since the birth of the world's first IVF baby 43 years ago. IVF and other fertility treatments may enable 400 million people or 3% of the entire world's population to be alive by the year 2100.

As a result of the rapid growth of novel technologies in reproductive endocrinology and infertility (REI), such as intra-cytoplasmic sperm injection, oocyte cryopreservation, preimplantation genetic manipulation of embryos, and embryonic stem cell biology, assisted reproductive technology (ART) is catalyzing a "renaissance", a period of vigorous artistic and intellectual discourse concerning these fields.

Over the past four decades, IVF technology has developed beyond the imagination. The purpose of this article is to briefly describe and summarize the many advances seen in reproductive medicine in recent years.

Male Infertility: Advances in Treatment

ICSI (Intracytoplasmic sperm injection)

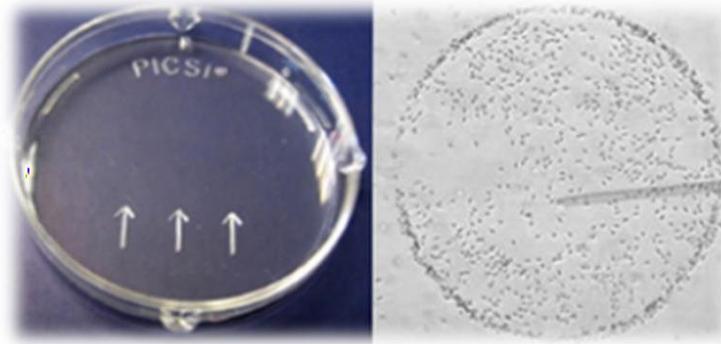
By injecting a single sperm into an ovary, couples with male factor infertility have been able to improve their fertility treatment outcomes, and in 1992, the first "ICSI baby" was born in Belgium.

The advent of ICSI has revolutionized assisted reproductive technology, enabling us to treat patients more efficiently with:

1. Oligoasthenoteratozoospermia
2. Testicular spermatozoa
3. Limited number of oocytes
4. Previous IVF failures

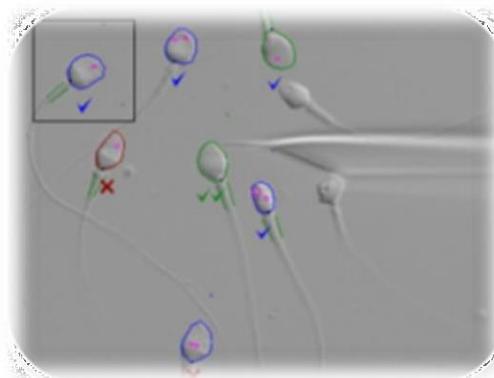
PICSI

In a physiological intracytoplasmic sperm injection (PICSI), sperm are selected before they are used in intracytoplasmic sperm injection (ICSI). In this procedure, the sperm is placed in a solution of hyaluronic acid (HA), a naturally occurring compound. A PICSI procedure identifies one sperm that is capable of binding to HA, and these sperm are chosen to be used in treatment. Even non-trained embryologists can recognize spermatozoa that have been bound by HA.



IMSI

A technique called IMSI, or Intracytoplasmic Injection of Morphologically Injected Sperm, consists of the injection of sperm from a male under very high magnification. This method has been shown to increase pregnancy rates and ICSI failure rates. When IVF is needed for male factor, unexplained infertility, and previous failed ICSI, the healthiest sperms are selected and are injected with the help of a machine. These sperms are then transferred into the eggs taken from the women. Moreover, it has been found to be effective in preventing recurrent abortions after IVF and ICSI procedures.



SURGICAL SPERM RETRIEVAL TECHNIQUES

In cases of azoospermia, the only hope is surgically removing the sperms from the testes or epididymis followed by ICSI.

When there is an obstruction (Obstructive azoospermia)

If sperm cells cannot be released because of an obstruction, there are four different techniques available for harvesting them. It is possible to perform three of these procedures under local anesthesia while the fourth is done under general anesthesia.

1. Testicular Sperm Aspiration (TESA)
2. A needle is used to withdraw sperm-containing fluid from the testicles.
3. Percutaneous Epididymal Sperm Aspiration (PESA)
4. As part of this procedure, a needle and syringe are also utilized to extract the sperm-containing fluid. The needle is, however, inserted into the epididymis in this case.
5. Percutaneous Biopsy of the Testis (Perc biopsy)
6. A larger needle is used to retrieve sperm in this method of sperm retrieval, which is similar to TESA. An area of testicular tissue is biopsied using a larger needle. This method allows for a greater amount of sperm to be obtained.
7. Microsurgical Epididymal Sperm Aspiration (MESA)
8. Operating microscopy is used during this open procedure in order to locate the tubules within the epididymis. Through this procedure, a large sample of sperm can be retrieved. In addition to producing large sperm samples, this procedure is also believed to produce motile sperm. IVF or ICSI techniques that use this technique likely achieve a greater success rate.

When there is No Obstruction (Non-obstructive azoospermia)

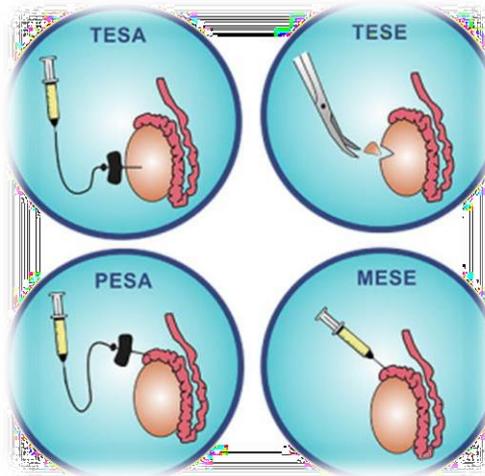
A man who has no obstruction in the vas deferens and whose sperm does not contain any sperm usually has difficulty producing sperm. When the quantity of sperm produced is relatively low, more invasive techniques are required to retrieve sperm. These techniques include:

- **Testicular Sperm Extraction (TESE)**

In this procedure, a needle is inserted into the scrotum and a small amount of testicular tissue is removed. This is usually taken from multiple parts of the testicles. The sperm are then identified by a microscope and isolated from the remaining tissue.

- **Microdissection TESE**

There are many similarities between this process and a TESE. The tissue that needs to be removed is located with the assistance of a micro-dissecting microscope. The objective is to limit damage to the testicles. As well, the procedure aims to reduce the risk of adverse effects, such as the possibility of cutting blood vessels, which might affect the blood supply. In addition, it is believed that it can increase the quantity of sperm retrieved.



Advances in Embryology

1. Assisted Hatching

Embryos must hatch out completely before they can implant. It is estimated that only 25-30% of embryos hatch under optimal in vitro conditions. The process of assisted hatching can be accomplished using several methods, including partial zona dissection (PZD), chemical opening through the use of acidic Tyrode's solution, and zona drilling. Laser systems have recently been developed as an excellent method for manipulating zones.

2. IVM

IVM involves the process of induced maturation of oocytes that have been collected at various stages during embryo development. Clinical sources provide immature oocytes that may develop into embryos and result in live births. Patients suffering from polycystic ovary syndrome (PCOS), ovarian hyperresponsiveness, or hyporesponsiveness may benefit from IVM treatments. Additionally, patients suffering from cancer may be able to preserve their fertility through IVM.

3. Embryoscope/Time Lapse Embryo Monitoring

An incubator with an integrated camera that captures pictures of developing embryos regularly is referred to as this type. An integrated camera system is connected to a microscope. Image-processing software is used to combine the captured images into a time-lapse video. An embryologist can thus assess the growth stages of an embryo and thus select the best without removing it from the incubator.

4. Chromosomal Screening by Preimplantation Genetic Testing (PGT)

PGT is a procedure used to detect genetic abnormalities in embryos developed through in vitro fertilization. The procedure is performed prior to embryo transfer to the uterus. In PGT, the objective is to minimize the likelihood that an embryo will transfer with a genetic abnormality or chromosome abnormality.

- **Preimplantation genetic testing for aneuploidy (PGT-A):**

During PGT, embryos are screened for certain types of chromosome abnormalities, such as missing or extra chromosomes (aneuploidy).

- **Preimplantation genetic testing for monogenic disorders (PGT-M):**

Embryos that are subjected to this type of PGT are at increased risk of developing a specific genetic disorder. PGT-M is recommended when there is a genetic condition that could pass from one generation to the next, for women who are carriers of X-linked conditions, or when both an individual and their partner or donation are carriers of an autosomal recessive condition.

- **Preimplantation genetic testing for structural rearrangements (PGT-SR):**

A patient or their partner may require this type of PGT when they have a rearrangement of their chromosomes, such as translocation or an inversion.

- **Omics-**

Proteomics, metabolomics, and secretomics are among the omics technologies that have already demonstrated that viable embryos possess unique molecular profiles and potential biomarkers that may be useful for embryo selection.

- **Polarization Microscope(Poloscope)-**

Oocyte, embryo, and sperm quality can now be determined using this revolutionary tool.

Current Therapies to Improve Endometrial Receptivity

1. Endometrial Scratching

The process of endometrial scratching, which is also called endometrial injury, involves the intentional disruption of the endometrium with the purpose of increasing the likelihood of implantation. This is done before the planned cycle. More evidence is needed in its favor.

2. G-CSF

The use of G-CSF (granulocyte colony-stimulating factor) may increase the thickening of the endometrium in patients with abnormally thin endometrium when other methods to improve its thickness are insufficient.

3. Platelet Rich Plasma (PRP)

A new treatment method for thin endometrium that utilizes Platelet-Rich Plasma (PRP) is available. Plasma is centrifuged blood that contains a large number of platelets. In PRP, the patient's blood is used. It contains many growth factors and cytokines, such as vascular endothelial growth factor (VEGF), platelet-derived growth factor (PDGF), epidermal growth factor (EGF), transforming growth factor (TGF), and many others that support wound healing and tissue regeneration. Instilled intrauterine or subendometrially.

4. Stem Cells

It is possible to isolate endometrial angiogenic stem cells using immuno-magnetic isolation from autologous stem cells derived from the patient's bone marrow. Following curettage, these cells can be placed under ultrasound guidance in the endometrial cavity to help regenerate the endometrium.

Cryopreservation

The cryopreservation of oocytes and ovarian tissue holds promise as a technique to make fertility preservation easier and more accessible to a wider population.

Uterine transplantation

A uterus transplant begins with a donor's uterus being removed. This surgical procedure involves the transplantation of a healthy uterus into an individual whose uterus has been removed or is incurably ill. All women undergoing a uterus transplant are required to freeze their eggs prior to the procedure. After the procedure, the couple will have to wait a year before they can undergo in vitro fertilization. It is expected that fertilized eggs will be implanted one at a time to achieve pregnancy and that the women will undergo cesarean delivery to avoid overstressing the transplanted uterus. An organ transplant may be complicated by complications such as bleeding and infection for the recipients. During the period in which the uterus is implanted, the patients will receive anti-rejection medications. The uterus will be removed after giving birth.

Future Trends Mitochondrial Replacement Therapy (Three- Parent Baby)-

Using this technique, the cytoplasm of the egg/embryo is replaced completely, preventing the transmission of undesired mitochondrial defects in patients with inherited mitochondrial diseases.

- **Gene editing (CRISPR-CAS9)**

The process of gene editing involves inserting, deleting, modifying, or replacing DNA at a specific site to modify the genome.

- **Stem cells**

Stem cells are being considered for the treatment of premature gonadal failure in both males and females, diminished ovarian reserve as well as regenerating endometrium in cases of persistently thin endometrium.

REFERENCES

- [1] Soules M.R. Assisted reproductive technology has been detrimental to academic reproductive endocrinology and infertility. 2. Trounson A, Mohr L (1983) Human pregnancy following cryopreservation, thawing and transfer of an eight-cell embryo. *Nature* 305: 707-709. (<https://www.ncbi.nlm.nih.gov/pubmed/6633637>) 3. Palermo G, Joris H, Devroey P, Van Steirteghem AC (1992) Pregnancies after intracytoplasmic injection of single spermatozoon into an oocyte. *Lancet* 340: 17-18.

(<https://www.ncbi.nlm.nih.gov/pubmed/1351601>) 4. Handyside AH, Kontogianni EH, Hardy K, Winston RM (1990) Pregnancies from biopsied human preimplantation embryos sexed by Y-specific DNA amplification. *Nature* 344: 768-770. (<https://www.ncbi.nlm.nih.gov/pubmed/2330030>) 5. Trounson A, Mohr L (1983) Human pregnancy following cryopreservation, thawing and transfer of an eight-cell embryo. *Nature* 305: 707-709. (<https://www.ncbi.nlm.nih.gov/pubmed/6633637>) 6. Palermo G, Joris H, Devroey P, Van Steirteghem AC (1992) Pregnancies after intracytoplasmic injection of single spermatozoon into an oocyte. *Lancet* 340: 17-18. (<https://www.ncbi.nlm.nih.gov/pubmed/1351601>) 7. Handyside AH, Kontogianni EH, Hardy K, Winston RM (1990) Pregnancies from biopsied human preimplantation embryos sexed by Y-specific DNA amplification. *Nature* 344: 768-770. (<https://www.ncbi.nlm.nih.gov/pubmed/2330030>) 8. Donnez J, Dolmans MM, Demylle D, Jadoul P, Pirard C, et al. (2004) Livebirth after orthotopic transplantation of cryopreserved ovarian tissue. *Lancet* 364: 1405-1410. 9. Brannstrom M, Johannesson L, Bokstrom H, Kvarnstrom N, Molne J, et al. (2015) Livebirth after uterus transplantation. *Lancet* 385 -616. 10. Callaway E (2014) Reproductive medicine: The power of three. (<https://www.nature.com/news/reproductive-medicine-the-power-of-three-1.15253>) 11. Trounson A, et al. Pregnancy established in an infertile patient after transfer of a donated embryo fertilised in vitro. *Br Med J (Clin Res Ed)* 286: 835- 838. 6 12. Shahbazi MN, Jedrusik A, Vuoristo S, Recher G, Hupalowska A, et al. (2016) Self- organization of the human embryo in the absence of maternal tissues. *Nat Cell Biol* 18: 700-708. 13. Cohen J, Elsner C, Kort H, Malter H, Massey J, Mayer MP, et al. Impairment of the hatching process following IVF in the human and improvement of implantation by assisting hatching using micromanipulation. *Hum Reprod.* 1990;5: 7-13. 14. Gordon JW, Talansky BE. Assisted fertilization by zona drilling: a mouse model for correction of oligospermia. *J Exp Zool.* 1986;239: 347-354. 15. Xiaolin La, Jing Zhao and Zhihui Wang, Application of In Vitro Maturation of Oocyte Submitted: January 9th 2019 Reviewed: June 6th 2019 Published: June 28th 2019 DOI: 10.5772/2015 Sep; 9(3): 107-112. PMID: 26622308 16. Ensieh Tehraninejad et al G-CSF Intrauterine for Thin Endometrium, and Pregnancy Outcome *J Family Reprod Health* v.9(3); 2015 Sep 17. Ahmed samy et al of autologous platelet-rich plasma transfusion in the treatment of infertile women with thin endometrium and its implications in IVF cycles: a literature review *Middle East Fertility Society Journal* volume 25, Article number: 5 (2020) 18. Chaitanya B Nagori 1 , Sonal Y Panchal Endometrial regeneration using autologous adult stem cells followed by conception by in vitro fertilization in a patient of severe Asherman's syndrome *Case Reports J Hum Reprod Sci* actions Search in PubMed Add to Search 2011 Jan;4(1):43-8. doi: 10.4103/0974-1208.82360 19. Kamini Rao -Principals and practice of Assisted Reproductive Technology volume 2

AUTHORS

First Author – Dr Divya Kumar (Sr Consultant OB&GYNAE}, Department of OBS & GYNAE, ACCORD HOSPITAL GREATER FARIDABAD

Cord Cells and Regenerative Medicine

Dr. Nishtha Gupta

The Gynae Clinic, Faridabad

DOI: 10.29322/IJSRP.12.10.2022.p13017
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13017>

Paper Received Date: 20th August 2022
Paper Acceptance Date: 24th September 2022
Paper Publication Date: 6th October 2022

Abstract- Regenerative medicine, a promising new interdisciplinary field, combines engineering and life sciences principles to promote healing. It can restore damaged and diseased tissues as well as whole organs. Tissue engineering, cell therapies, medical devices, and artificial organs are some of the tools that can be used in regenerative medicine. The goal is not to treat symptoms with medications and procedures but to replace damaged tissues and organs. [1] This presentation will discuss the various methods of regenerative medicine, with a special focus on stem/cord cells in regenerative medicines.

Index Terms- Cord blood, mesenchymal stem cells, spinal cord injury, stem cells, multipotent.

I. INTRODUCTION

Regenerative medicine, a branch of medical science that deals with the functional restoration of tissues and/or organs in patients with severe injuries and chronic diseases, is the most recent and rapidly growing branch of medical science. [2,3] Organ donation is not able to meet the growing transplantation needs of elderly and diseased populations. Stem cells, which have the ability to divide indefinitely and can be transdifferentiated into other types of cells, are being explored as an alternative. [4,5]

II. TYPES OF STEM CELLS:

Stem cells can be classified into four types based on their trans differentiation potential:

- Unipotent
- Multipotent
- Pluripotent
- Totipotent.

Stem cells can be used in regenerative applications :

- Embryonic stem cells (ESCs)
- Tissue specific progenitor stem cells (TSPSCs)
- Mesenchymal stem cells (MSCs)
- Umbilical cord stem cells (UCSCs)
- Bone marrow stem cells (BMSCs)
- Induced pluripotent stem cells (iPSCs)

III. ORIGIN OF STEM CELLS:

Although stem cells can be obtained from either bone marrow or umbilical blood, umbilical blood is easier to obtain and contains ten times as many stem cells than bone marrow. [6,7] Cord blood stem cells are less likely to carry infectious diseases than adult stem cells and are twice as likely to be rejected.

IV. CONDITIONS FOR WHICH STEM CELLS ARE USED:

1. Leukemias
2. Hodgkin's lymphoma
3. Neuroblastoma
4. Medulloblastoma
5. Anemias [8]
6. Inherited red cells abnormalities.
7. Inherited platelet abnormalities
8. Inherited immune system disorder.
9. Phagocyte disorders
10. Bone marrow cancers.
11. Inherited metabolic disorders.
12. Cartilage- hair hypoplasia
13. Gunther's disease.
14. Systemic mastocytosis.

V. CHALLENGES OF USING STEM CELLS:

It is difficult to obtain enough cord blood to transplant an adult. Cord blood stem cells can also be slower to engraft. [9] The versatility and durability of adult stem cells might not be the same as embryonic stem cells. It is possible that adult stem cells cannot be used to make all types of cells. They also have a higher chance of developing abnormalities from environmental hazards such as toxins or errors during replication. [10]

VI. CONCLUSION:

The spectacular progress in the field of stem cells research represents great scope of stem cells regenerative therapeutics. In the near future we will be able to produce wide array of tissues, organoid and organs from adult stem cells. There may also be new pharmaceutical compounds, that can alternate tissue specific stem cells, promote stem cells to migrate to the side of tissue injury and promote their differentiation to tissue specific cells.

REFERENCES

- [1] Thompson P. A., Perera T., Marin D., et al. Double umbilical cord blood transplant is effective therapy for relapsed or refractory Hodgkin lymphoma. *Leukemia & Lymphoma*. 2016;57(7):1607–1615. doi: 10.3109/10428194.2015.110537
- [2] Nathamgari S. S., Dong B., Zhou F., et al. Isolating single cells in a neurosphere assay using inertial microfluidics. *Lab on a Chip—Miniaturisation for Chemistry and Biology*. 2015;15(24):4591–4597. doi: 10.1039/c5lc00805k.
- [3] Ning B., Cheuk D. K., Chiang A. K., Lee P. P., Ha S. Y., Chan G. C. Autologous cord blood transplantation for metastatic neuroblastoma. *Pediatric Transplantation*. 2015;20(2):290–296. doi: 10.1111/ptr.12647.
- [4] Thomson J. A. Embryonic stem cell lines derived from human blastocysts. *Science*. 1998;282(5391):1145–1147. doi: 10.1126/science.282.5391.1145.
- [5] Hogan M. S., Parfitt D.-E., Zepeda-Mendoza C. J., Shen M. M., Spector D. L. Transient pairing of homologous Oct4 alleles accompanies the onset of embryonic stem cell differentiation. *Cell Stem Cell*. 2015;16(3):275–288. doi: 10.1016/j.stem.2015.02.001.
- [6] Shroff G., Gupta R. Human embryonic stem cells in the treatment of patients with spinal cord injury. *Annals of Neurosciences*. 2015;22(4):208–216. doi: 10.5214/ans.0972.7531.220404.
- [7] Zhou S., Flamier A., Abdouh M., et al. Differentiation of human embryonic stem cells into cone photoreceptors through simultaneous inhibition of BMP, TGF β and Wnt signaling. *Development*. 2015;142(19):3294–3306. doi: 10.1242/dev.125385.
- [8] Sluch V. M., Davis C.-H. O., Ranganathan V., et al. Differentiation of human ESCs to retinal ganglion cells using a CRISPR engineered reporter cell line. *Scientific Reports*. 2015;5 doi: 10.1038/srep16595.16595
- [9] Shiba Y., Fernandes S., Zhu W.-Z., et al. Human ES-cell-derived cardiomyocytes electrically couple and suppress arrhythmias in injured hearts. *Nature*. 2012;489(7415):322–325. doi: 10.1038/nature11317.
- [10] Fernandes S., Chong J. J. H., Paige S. L., et al. Comparison of human embryonic stem cell-derived cardiomyocytes, cardiovascular progenitors, and bone marrow mononuclear cells for cardiac repair. *Stem Cell Reports*. 2015;5(5):753–762. doi: 10.1016/j.stemcr.2015.09.011.

AUTHORS

First Author – DR. NISHTHA GUPTA, THE GYNAE CLINIC, FARIDABAD

A GIS Approach to Land Use and Land Cover Change Assessment from 2016 to 2020 in Teknaf and Ukhiya Upazila of Cox's Bazar District of Bangladesh Due to Rohingya Intrusion

Md. Shahjahan Ali¹, Mohammad Mahdi Hasan¹, Jagobandhu Some¹,
Muhammad Sharif¹

¹Bangladesh Space Research and Remote Sensing Organization (SPARRSO)
Agargaon, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh

DOI: 10.29322/IJSRP.12.10.2022.p13018
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13018>

Paper Received Date: 22nd August 2022
Paper Acceptance Date: 24th September 2022
Paper Publication Date: 6th October 2022

Abstract- Bangladesh is a small country located in South-East Asia in Ganges- Brahmaputra- Meghna basin. It shares its border with India in the West, North and East and with Myanmar in the South-East. The Rohingyas are an ethnic, righteous, and philologic minority in Myanmar who initially dwell in the three townships of North Arakan, which borders Bangladesh. They have experienced ethnic cleansing in Arakan Province by the Buddhist majority of Myanmar, compelling them to run away in search of relative safety in Bangladesh. The majority of this population settled in dilapidated makeshift camps, ruining the forested hills of Teknaf and Ukhiya. Rohingya refugee settlement in the Teknaf and Ukhiya areas made a big Stress on Bangladesh's Economy and had negative impacts on the environment and the ecology of the local areas and beyond. Their arrival into these areas has a visible effect on local forests and worsened human and wildlife struggles. This study attempts to identify and assess land use and land cover changes for the years from 2016 to 2020 by using the image of Sentinel-2 (10m resolution) satellite data after the Rohingya intrusion in Cox's Bazar in 2017.

Index Terms- Rohingya, Sentinel-2, GIS, Teknaf and Ukhiya.

I. INTRODUCTION

Teknaf and Ukhiya areas appear as varied types of land, with wet, forested, hilly, coastal and flat land found together within a small stretch of land. Most of these areas consist of hilly areas, which means that the region is not susceptible to vegetation (Mosleuddin & et al., 2018). So, the region is covered with forests, wildlife and natural resources. The effective utility of remote sensing information has been very much acknowledged in mapping and evaluating land attributes such as physiography, soils, land use, land cover, etc. (Solanke Preeti et al. 2005).

Environmental degradation is usually demonstrated through various indicators of environmental parameters i.e., loss of vegetation cover, increasing salinity covered bed of land, decreasing the agricultural land, etc. which might affect the local and regional climate (Gain 1998). Control of resource use, a proper course of action and the authoritarian body of human activities (extemporary settlement, land use, deforestation and underground water use) can enhance the way to deal with executing supportable development and management (Riches 2008).

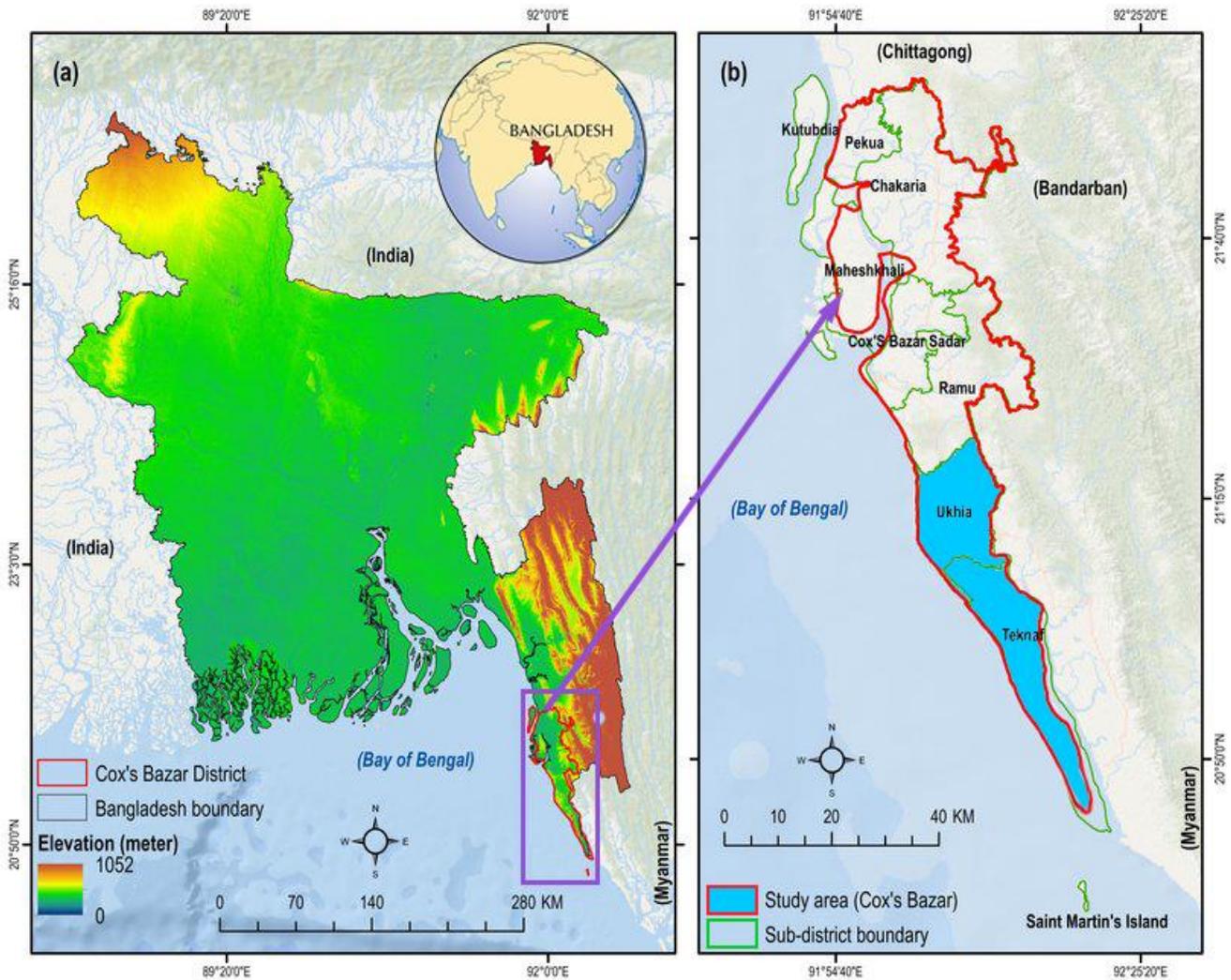
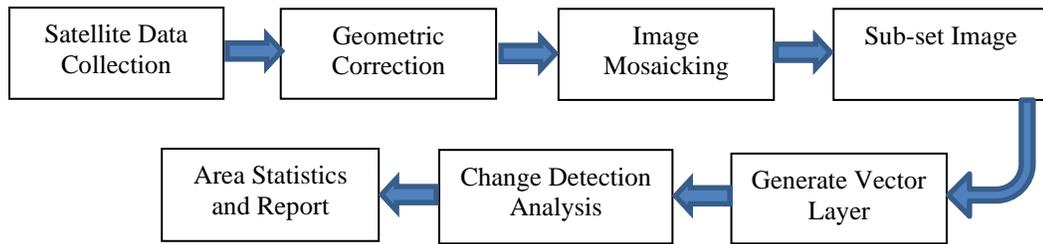


Figure 1: Location map of the study area

II. MATERIALS AND METHOD

Remote sensing data was Geo-referenced to Transverse Mercator (TM) projection system using Linear Transformation Matrix with Nearest Neighborhood re-sampling technique. Pre-processed data were characterized by utilizing on digitization procedure. Land-use changes are resolved between the years 2016 to 2020. Essential spectral bands in Satellite images were utilized for the study of land-use boundaries for the particular necessities of the investigation. ArcGIS and ERDAS Imagine software have been used for data processing, analysis and generation of products-supported data.



Flowchart of Research Methodology.

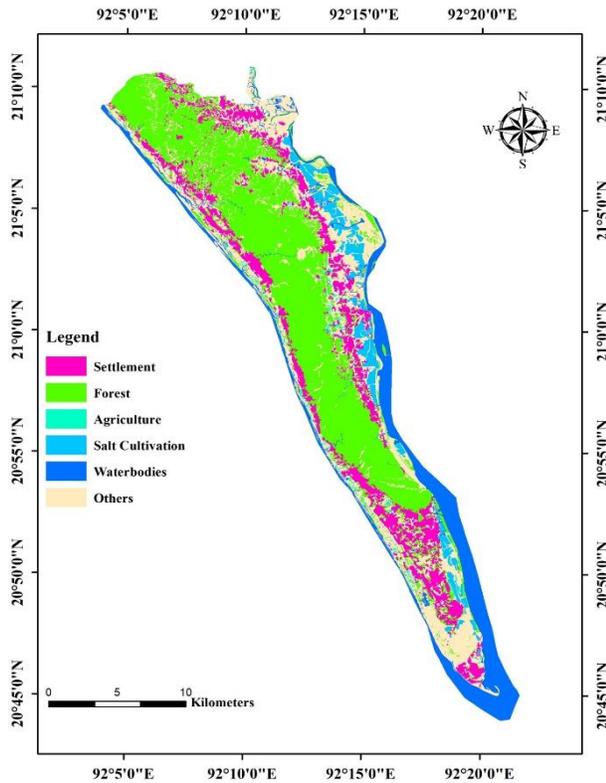
III. RESEARCH FINDINGS AND DISCUSSION

This research work examines the changes in land use and land cover from the year 2016 to 2020 for the Teknaf and Ukhiya Upazila. We found a significant alteration in land use and land cover of that region by satellite image processing. The information gained from the Satellite picture of Teknaf Upazila indicated that in 2016, there were 161.20 sq km of Forest and Shrubs which decreased to 129.32 sq km in 2020. We noticed that the agricultural region of 2016 is diminished by 1.91 sq km in 2020. Besides, land used for settlements in 2016 was 57.26 sq km, and in 2020 was 79.63 sq km showing an increase in the settlement area to 22.37 sq km. In 2016, there were no Rohingya settlements but in 2020 there is 8.44 sq km of Rohingya settlements present. In 2016, 17.72 sq km of land was used for salt cultivation but in 2020 it increased to 26.47 sq km. In 2016, 57.41 sq km of land was covered as water bodies but in 2020 it decreased to 55.82 sq km. It is found that in 2016, Bare Land, Roads and other areas were 91.38 sq km. But in 2020 it decreased to 87.20 sq km.

Class Name	Sentinel-2 Image 2016 (sq.km)	Sentinel-2 Image 2020 (sq.km)	Area Changed from 2016 to 2020 (sq.km)
Settlement	57.26	79.63	22.37 (Area Increased)
Rohingya	00	8.44	8.44 (Area Increased)
Forest and Shrub	161.20	129.32	31.88 (Area decreased)
salt cultivation	17.72	26.47	8.75 (Area Increased)
Agriculture	3.71	1.80	1.91 (Area decreased)
Waterbodies	57.41	55.82	1.59 (Area decreased)
Others	91.38	87.20	4.18 (Area decreased)

Table 1: Land use land cover changes in Teknaf Upazila from 2016 to 2020

Land Use and Land Cover Map of Teknaf Upazila for the Year 2016



Land Use and Land Cover Map of Teknaf Upazila for the Year 2020

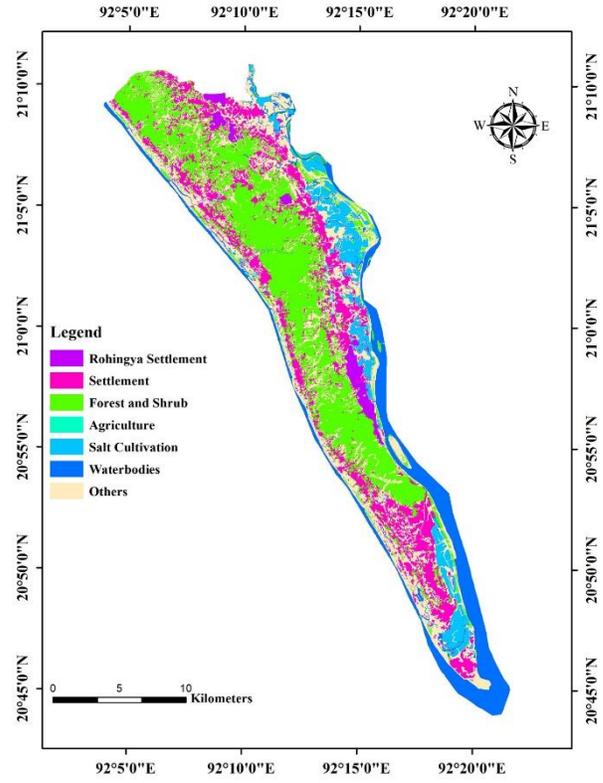


Figure 2: Land use and land cover changes in Teknaf Upazila from 2016 to 2020

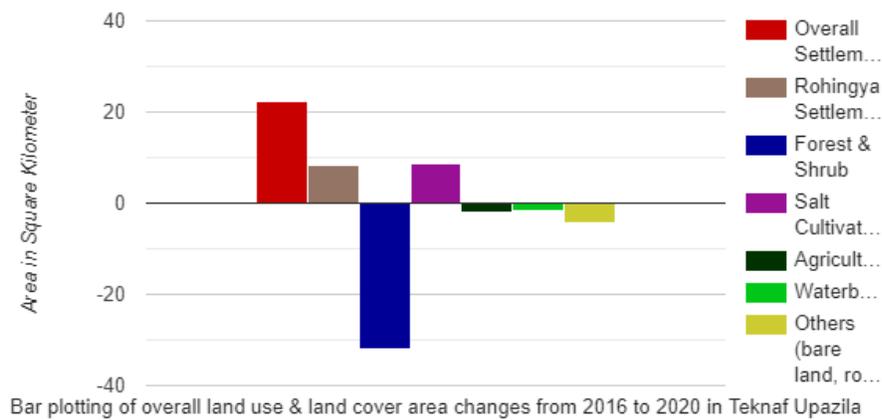


Figure 3: Bar plotting of overall change of land use and land cover area in Teknaf Upazila

Similarly, the information gained from the Satellite picture of Ukhiya Upazila indicated that in 2016, there were 128.13 sq km of Forest and Shrubs which decreased to 78.83 sq km in 2020. We noticed that the agricultural region of 2016 is diminished by 0.45 sq km in 2020. Besides, land used for settlements in 2016 was 61.75 sq km, and in 2020 was 100.98 sq km showing an increase in the settlement area to 39.23 sq km. In 2016, there were no Rohingya settlements but in 2020 there is 11.49 sq km of Rohingya settlements present. In 2016, 8.72 sq km of land was covered as water bodies but in 2020 it decreased to 4.24 sq km. It is found that in 2016, Bare Land, Roads and other areas were 59.29 sq km. But in 2020 it increased to 61.66 sq km.

Class Name	Sentinel-2 Image 2016 (sq.km)	Sentinel-2 Image 2020 (sq.km)	Area Changed from 2016 to 2020 (sq.km)
Settlement	61.75	100.98	39.23 (Area Increased)
Rohingya	00	11.49	11.49 (Area Increased)
Forest and Shrub	128.13	78.83	50.09 (Area decreased)
Agriculture	0.47	0.92	0.45 (Area Increased)
Waterbodies	8.72	4.48	4.24 (Area decreased)
Others	59.29	61.66	2.37 (Area Increased)

Table 2: Land use land cover changes in Ukhiya Upazila from 2016 to 2020

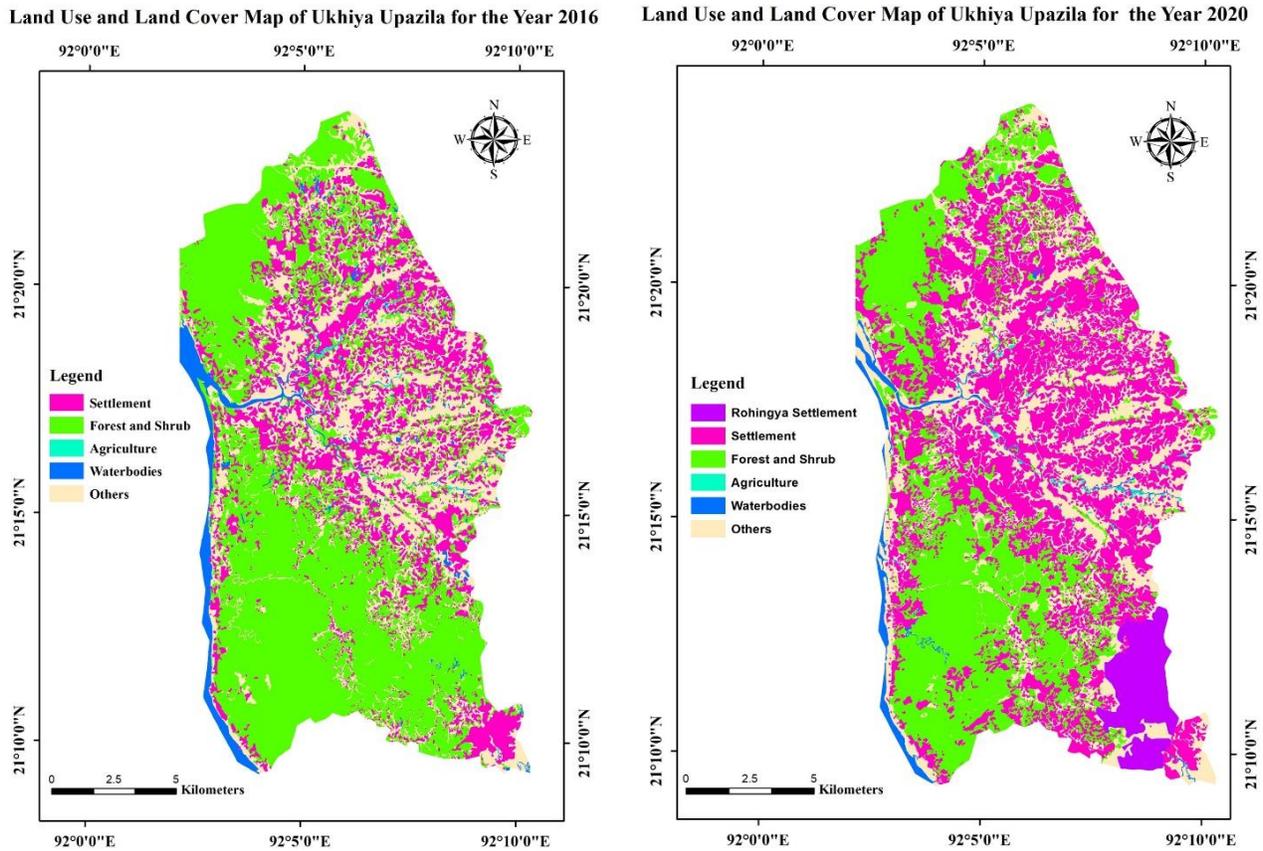


Figure 4: Land use land cover changes in Ukhiya Upazila from 2016 to 2020

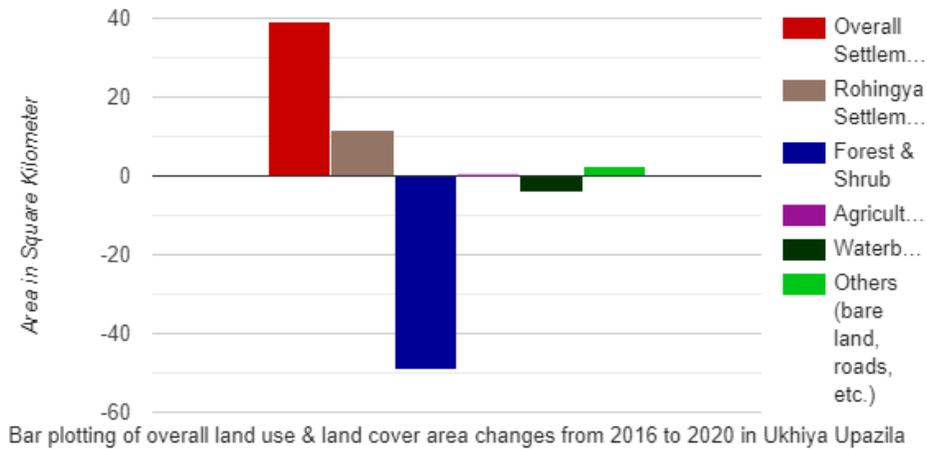


Figure 5: Bar plotting of overall change of land use and land cover area in Ukhiya Upazila

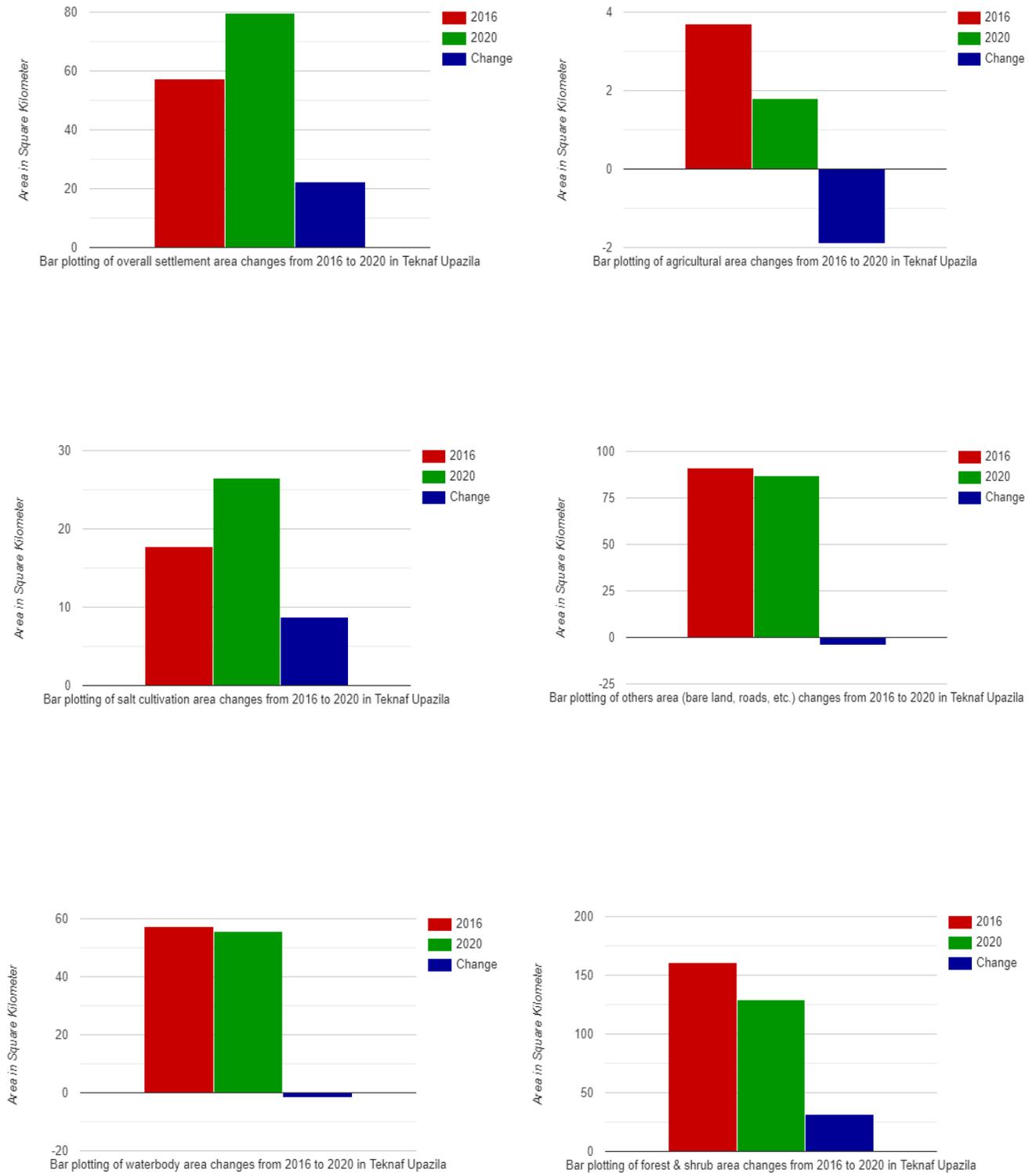


Figure 6: Changes in land use and land cover area in Teknaf Upazila of Cox's Bazar

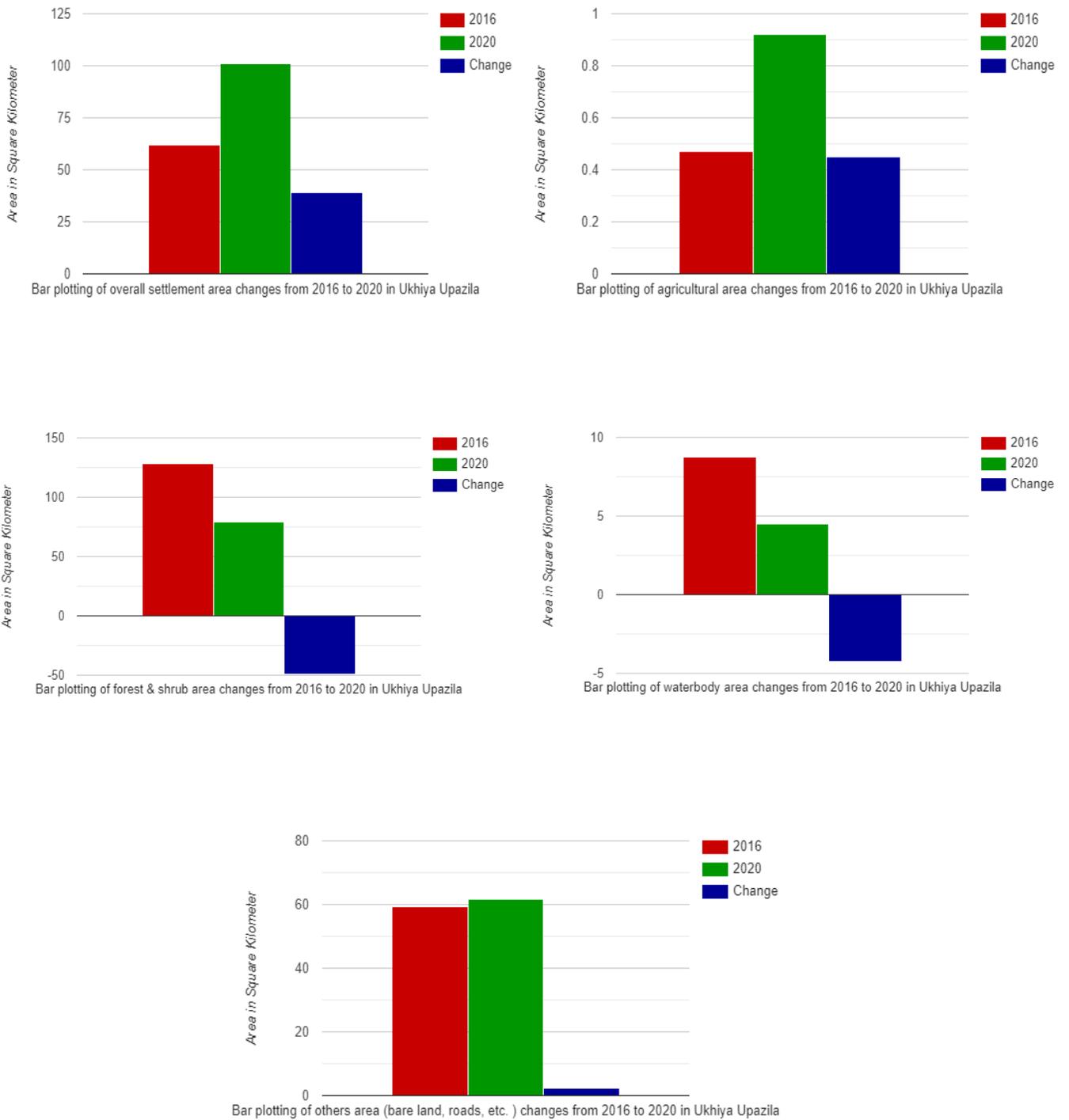


Figure 7: Changes in land use and land cover area in Ukhiya Upazila of Cox’s Bazar

IV. CONCLUSION

The study area in Teknaf and Ukhiya provides a critical home for large varieties of both forestland and wetland-dwelling species and avians (Moslehuddin et. Al. 2018). It provides a significant environment for a vast array of plants, including a number of medicinal plants that are used by the local communities (Karim et. al 2008. & Khan et. al 2009), as well as is a source of substantial carbon storage (Pan et. al. 2011). Moreover, this environment contains a sanctuary for wild Asian elephants, settling locales for the vast number of shore birds, and provides food and sanctuary to monkeys, snakes, bats, and other wild creatures. The preserved forest, with its wildlife habitat and other natural capital in the study region, is being ruined and debased at a dreadful rate mainly due to clear-cutting for agriculture, ranching and development, and logging for timber. However, degradation due to rapid conversion to refugee camps and makeshift settlements is the most impactful catalyst of environmental destruction occurring on a large scale in recent times (Rahman et. al. 2018). Assessment of Land Use and Land Cover Changes of Teknaf and Ukhiya Upazila might be helpful to make a proper plan for development activities in the area.

Acknowledgment

The authors would like to acknowledge SPARRSO for funding the research work and providing the affiliated facilities.

References

- Gain, P. 1998, Forests, In Gain, P. (Ed :), "Bangladesh Environment: Facing the 21st century, SEHD, Dhaka. Bangladesh." pp. 69- 93.
- Riches, C. R. 2008. The High Barind Tract: a challenging Drought- prone agricultural environment. In: Riches, C.R., Harris, D., Johnson, D.E. and Hardy, B., (Eds.) Improving agricultural productivity in rice-based systems of the High Barind Tract of Bangladesh. International Rice Research Institute, Los Banos (Philippines), pp.3-6.
- Solanke, P, R. Srivastava, J. Prasad, M, Nagaraju, R. Saxena & A. Barthwal, P. 2005, Application of remote sensing and GIS in watershed characterization and management, Journal of the Indian Society of Remote Sensing," Volume 33.
- Moslehuddin, A.Z.M.; Rahman, M.A.; Ullah, S.M.A.; Moriyama, M.; Tani, M. Physiography, Forests, and People in Teknaf. In Deforestation in the Teknaf Peninsula of Bangladesh; Tani, M., Rahman, M., Eds.; Springer: Singapore, 2018.
- Karim, M.N. Local knowledge of indicator birds: Implications for community-based ecological monitoring in Teknaf game reserve. In Connecting Communities and Conservation: Collaborative Management of Protected Areas in Bangladesh; Fox, J., Bushley, B.R., Miles, W.B., Quazi, S.A., Eds.; East-West Center: Honolulu, HI, USA, 2008; pp. 139–160.
- Khan, M.A.S.A.; Mukul, S.A.; Uddin, M.A.; Kibria, M.G.; Sultana, F. The use of medicinal plants in healthcare practices by Rohingya refugees in a degraded forest and conservation area of Bangladesh. *Int. J. Biodivers. Sci. Manag.* 2009, 5, 76–82.
- Pan, Y.; Birdsey, R.; Fang, J.; Houghton, R.; Kauppi, P.; Kurz, W.; Phillips, O.; Shvidenko, A.; Lewis, S.; Canadell, J.; et al. A large and persistent carbon sink in the World's forests. *Science* 2011, 333, 988–992.
- Alam, M.F.; Uddin, M.Z.; Hasan, M.A. Evaluation of Plant Biodiversity in Teknaf Wildlife Sanctuary, Bangladesh; LAP LAMBERT Academic Publishing: Saarbrücken, Germany, 2012. *Remote Sens.* 2018, 10, 689 19 of 20
- Rahman, M.Z. Livelihoods of Rohingyas and Their Impacts on Deforestation. In Deforestation in the Teknaf Peninsula of Bangladesh; Tani, M., Rahman, M., Eds.; Springer: Singapore, 2018.

AUTHORS

First Author- Md. Shahjahan Ali, Principal Scientific Officer, SPARRSO
and Email: shopanali65@yahoo.com

Second Author- Mohammad Mahdi Hasan, Scientific Officer, SPARRSO
and Email: mahdi.sparrso@gmail.com

Third Author- Jagobandhu Some, Assistant Engineer, SPARRSO
and Email: jagobandhusome@gmail.com

Fourth Author- Muhammad Sharif, Assistant Engineer, SPARRSO
and Email: sharif191294@gmail.com

Thomas Aquinas and “Ogden and Richards Triangle”: The reality, language and human being

Francesco Paolo Pinello

University of Enna “Kore”, Italy
Sciences of Man and Society

DOI: 10.29322/IJSRP.12.10.2022.p13019

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13019>

Paper Received Date: 21st August 2022

Paper Acceptance Date: 24th September 2022

Paper Publication Date: 6th October 2022

Abstract: Christianity is a matter of perception and conception of reality: of language (Word-words), of thought (intellect, *Fides et ratio*) and of referents (God the foundation of all created reality, the Church and the «Kingdom of God»). It is a matter of imaginary and collective imagination. Human beings have not only intelligence, but also imagination, creativity, emotionality and the ability to adapt. These are very high standards to achieve and to simulate (think of robots with artificial intelligence). If one assumes that, for a human being, there are socio-institutional constraints (of which language is among the most important), physical constraints (the physical materiality of the environment in which all human beings are immersed) and cognitive constraints (the brain-mind-body), the «Ogden and Richards Triangle» is a valid model for analysing these three constraints (language, thought and the referents of language and thought) and their relationships also with regard the analysis of Aquinas’s philosophy-theology. What was reality for Thomas Aquinas? And what was reality for his interlocutors, for those who saw, heard and read him? These questions are still relevant today and cannot be ignored, given the social force exerted by traditionalist Catholic culture (*i.e.* certain Catholic elites) within our disenchanting, secularised and re-enchanting societies. This article contains a reflection on «Ogden and Richards Triangle», Thomas’s philosophy and Marr’s «Three Levels Model». The application of Aquinas’s reflections on “*ens*” and “*essentia*” (I use the singular and plural nominatives of these Latin words for convenience) to the problem of referents and reference of «Ogden and Richards Triangle» shows the importance, for cognitive sociology, of the philosophy of mind and the problem of who, what, where, when, why, how reality.

Index Terms – ontology, social ontology, «Ogden and Richards Triangle», Marr’s «Three Level Model», cognitive sciences, sociology cognitive.

I. INTRODUCTION

Before starting, I would like to point out that the translations from Italian of the quotations in the article were done by me. In the *Appendix* of a 2014 book of mine, entitled «Il cognitivismo di S. Privitera e il modello di scienza cognitiva proposto da D. Marr. I limiti del modello cognitivista proposto da S. Privitera e i vantaggi dell’adozione, anche per l’etica, del modello di scienza cognitiva proposto da D. Marr» (The Cognitivism of S. Privitera and the Cognitive Science Model proposed by D. Marr. The limits of the cognitivist model proposed by S. Privitera and the advantages of adopting, also for ethics, the cognitive science model proposed by D. Marr, Pinello, 2014), to which I refer, with reference to the «Ogden and Richards Triangle» and Marr’s «Three Level Model» I have already addressed the question of the contribution to cognitive science that can come from certain theological themes treated by some authors who are more philosophers than theologians. In it, I tried to bring theology into dialogue with the cognitive sciences, in an extradisciplinary way. The interdisciplinary way in fact implies that theology is founded with other disciplines, a hypothesis that for the Catholic Church is radically to be excluded. The extradisciplinary way can be combined with the transdisciplinary way, *i.e.* with the mediations of the philosophy of mind, ontology, social ontology, general linguistics, cognitive psychology, cognitive anthropology, cognitive sociology, neuroscience, etc.

Theology, in my view, cannot [theologians cannot], directly, make its [make their] entry into «communities of people from different disciplines who are confronted with a series of common problems relating to intelligence [*i.e.* cognitive science, or the cognitive sciences]» (A.M. Collins), but it can be involved in this *challenge* [...] by psychology [...] by philosophy ([...] philosophy of mind [...]ontology [philosophy of language]) [by cognitive sociology] and by anthropology (theological [or Christian] and cognitive anthropology), should a real interest mature in such a community of people from different disciplines to research human intelligence [...] in relation to the question of the *dignity of human reason* [issue that has to do with the *dignity of reality* and with the *dignity of the human person*; on the critique of the concept of the human person and on the focus instead on the human being, see Pinello, 2021], theologically understood, and *reality*, theologically understood, and not only in relation to the simulation techniques of electronic computers (Pinello, 2014, p. 262).

One theme is certainly the realisation of the so-called «language of God» in human language, in the terms of Ogden and Richards' science of symbolism (*see* Pinello, 2022a; Pinello, 2022b), *i.e.* in terms of the influence of language on human thought, given that one of the three levels of Marr's «Model» is the realisation of computational theory, through representations and representation processes, in human hardware and computer hardware. The problem is also one of perceptions, reasoning and optical, perceptive and cognitive illusions, bearing in mind that the perimeter of hermeneutics has been, and continues to be, language. In this regard, I reproduce the abstract and some arguments of an article by Alessandra Jacomuzzi (*see* also Pinello, 2021; Pinello 2022a; Pinello 2022b) who cites, among others, two essays by Maurizio Ferraris, «*The Imagination*» (Ferraris, 1996) and «*Rational Aesthetics*» (Ferraris, 1998).

Common sense tends to believe in the existence of optical and perceptual illusions but it hardly supports the thesis of an illusory reasoning [cognitive illusions]. In the psychology of reasoning, one rather talks of errors of reasoning that experience can fix and change. For this reason, over the years, the belief that there is a clear distinction between optical and perceptual illusions has been reinforced [leaving out cognitive illusions]. The former [optical illusions] would be stronger, the latter [perceptual illusions] weaker and correctable. [On the contrary, it is possible] to demonstrate, through the presentation and analysis of a topology of illusions, that there is indeed a universal structure underlying every kind of illusion. This same structure allows us to talk about a universal criterion to identify illusions: a key part of the outside world [...] perceptual channels never provide us with a perfect copy of external reality. Perceived reality is constantly conditioned by states of mind, expectations and the percipient subject's aims [*see* Pinello, 2021] [...] even intuitive reasoning is not always correct [*see* Kahneman, 2019] [...] In both cases, perception and cognition, what are called illusions can occur; mistaken perceptions or reasoning that, unlike errors, can hardly be changed once detected [...] hermeneutics seemed to dominate [...] the contemporary philosophical landscape [in sociology the weight exerted by Max Weber continues to be imposing, *see* Pinello, 2022a and Pinello, 2022b] [...] [but it is not correct to say that] our experience [is] really a matter of interpretation [...] aesthetics is not the philosophy of art but rather the science of sensible things, of perceptions [...] «Illusion is not the same thing as an error, and it is not necessarily an error» [...] Common sense tends to believe in the existence of optical and perceptual illusions but hardly supports the thesis of illusory reasoning [cognitive illusions]. It speaks of errors in reasoning [in cognition] that can be modified through experience. This is why a distinction between perceptual illusions and cognitive illusions was thought to be possible. The former would be stronger, the latter weaker and with the possibility of correction. And I too, in line with common sense, have for many years accepted this thesis. Today, however, I believe I can argue that despite the undoubted difference between these different types, it is possible to derive a universal structure. And it is precisely this universal structure that allows us to affirm the existence of a criterion by which illusions can be identified. This criterion concerns the subject's awareness of an incongruity between two representations of reality [*i.e.* one must take into consideration two different representations of reality and argue, or demonstrate, their incongruity]. It is an apparently simple criterion, perhaps a trivial one, but one that allows us to bring together two domains hitherto studied separately, that of perceptual illusions and that of cognitive illusions; domains that constitute an important and fundamental part [of] the external world» (Jacomuzzi, 2015, p. 1-3 and 6).

As we will see by applying the «Ogden and Richards Triangle», these concepts and notions, although expressed differently, are fundamental in the philosophy-theology of Thomas Aquinas. Indeed, he compares his different representations of reality (in very general terms the Platonic and Neo-Platonic and the Aristotelian) and argues their incongruence. To introduce the arguments I am developing, I will begin by summarising the key points of the *Appendix* of my essay on theological cognitivism by Salvatore Privitera, adding that, as Federica d'Auria writes quoting Marco Iacoboni, «There are basically two ways of conceiving neuroethical enquiry [...] as either a collaboration between philosophers, moral psychologists and neuroscientists to discover the neural substrates of certain moral behaviours, or as a way of using neuroscience to resolve certain philosophical or psychological questions concerning, for example, the justifications for prosocial behaviour (*e.g.* why does a person perform an act of solidarity, a moral act?)» (*see* D'Auria, 2022). Referring again to my *Appendix*, in particular to a citation by Manuel Barbera, I also add that the model of the «Ogden and Richards Triangle» for some linguists (among them the Italian Tullio De Mauro) should not be used in general linguistics (general linguistics is one of the cognitive disciplines, since the official birth of cognitive science), because it would constitute, in their view, a considerable step backwards (ontological and metaphysical: philosophy of being) compared to Saussure and the semiological tradition that is linked to his theories. The limit of such a triangular model, again in their view, would consist precisely in the introduction of a sign/symbol referent (*see* Pinello, 2022b) understood as an indispensable element of signification, of the meaning of meaning. This, again in their view, would risk compromising Saussure's reductionist achievement of the abstractness of the linguistic sign. To reintroduce the referent into the model of signification, to reintroduce in general linguistics the problem of the meaning of meaning, would mean going back to the pre-Saussure conception of language understood (or easily misunderstood) as nomenclature, *i.e.* as a collection of names with which to refer to things, to material objects, of the world, of reality. Eliminating the referent (the right vertex of the «Triangle»), again in their view, means defending the persistence of the reductionist conception of language as an autonomous, conventional and unmotivated structure; while considering all three sides of the «Triangle» means taking into account what the sign refers to, in the sense that the sign refers to something, which can be perceived or imagined, and that this something, which exists independently of the sign, determines it (*see* Pinello, 2014, p. 249-250; Barbera).

The issue I have been dealing with, more philosophical than theological, is the who, what, where, when, why, how of reality, divine natural and social, *i.e.* the referents of thought and symbols and the processes of symbolisation, referencing and adaptation (*see* Pinello, 2019; Pinello, 2022a; Pinello, 2022b), in some authors, more philosophers than theologians. I begin with the summary of the *Appendix* (*see* Pinello, 2014, p. 233-292). The notion of theology is far from unambiguous. Indeed, there are many theological systems theorised from «collections of data» (*loci theologici*). Having said this, I attempt to propose a pragmatic and functional definition of it, in terms of cognitive science. That is, a functional definition for the application of the «Ogden and Richards Triangle» and Marr's «Three Level Model» to the problem of reality. «Theology is the discourse that the *believer* makes about the *reality of God* from the *reality of Creation* and the reality of his *self-Revelation* (divine Word in human words: the Word-words and the substantive Word of God)». The Word-words (and the substantive Word of God) reveals that God is the *unique and absolute foundation of reality* (this is the referent of the meaning of meanings of the philosophical and theological discourses of some authors, who in my opinion are first of all philosophers and then also theologians). I use the words signifier, signified and referent for convenience because I deal not only with the «Ogden and Richards Triangle» but (not in this article) also with Hjelmslev's biplanar theory of language (*see* Pinello, 2022b, with citation of Miceli, 2005, *see* also Hjelmslev, 1968),

for which language can be considered as an association of sensory expression (*i.e.* perceivable by the senses: phonemes, graphemes, gestures, facial expressions and microexpressions, proxemics, etc.; *order of expression*) and internal content by definition (*i.e.* not perceivable by the senses, but thought, conceived, by the brain-mind; *order of content*).

The meaning (or rather, the meaning of meaning) of reality (ontology and social ontology), understood in the manner of Thomas Aquinas and millions of human beings for generations and generations to the present day, albeit in a disenchanting and secularised and reenchanted manner, that is the problem of reality, is the problem of problems. What it is and how it is reality for Thomas Aquinas? How was it perceived, conceived, thought, spoken, lived, communicated, transmitted in its objectivity? What it is and how it is reality for us today? Is it a reality that no longer needs God, for which God is no longer necessary? Is it a reality still influenced by the theories of Thomas, albeit with weak thinking? As I wrote in my *Appendix*, citing other authors, for today's believers «the reality of God always comes too late with respect to man conceived as an autonomous nature. When one does not deny the affirmation of divine action [action] [the discourse is also valid for liturgical community action], it takes on the trait of a "second" intervention, which is superimposed on the consciousness of human action [increasingly understood, anthropologically, sociologically and psychologically, as originating from a (biological and psychological) urge to act, which can be a physiological or "spiritual" need, *see* Pinello, 2021]. [...] The gratuitousness of divine action runs the risk of being presented in extrinsic, added and even superfluous terms» (Brambilla, 2009, p. 19; *see also* Pinello, 2020; Pinello, 2022a).

What are the main theories, developed over centuries, not necessarily dating back to Thomas Aquinas, on ways of coming into contact with God-reality? There are those who insist on the senses, or rather pre-modern sensoriality, pre-modern perceptions, feelings and values. This is the emotional function of language (*see* Pinello, 2022b). It is a good thing to insist on the five senses and perceptions (to be nostalgic for lost pre-modern sensoriality), feelings and values (which are also sentimental and affective projections), that is, after all, aesthetics, but it is also necessary to understand (knowledge as the unifying consciousness of knowledge open to a foundation) that, to do this, reason and reality must be restored to dignity. The five senses, perceptions (primarily optical), and aesthetics are not an alternative to the weaknesses of reason and man and reality (in fact, by other means, they participate in the same weaknesses of reason and man and reality), but are intimately connected to reason and man and reality. There are theological ways that favour sensoriality (the five senses and perceptions) and aesthetics. This in no way means that they do not also take reason into account. How could this be, after all, since reason and the five senses and perceptions are intimately connected? *Verbis gestique! Per signa sensibilia!* «The privilege granted to them (five senses and perceptions and aesthetics) depends above all on the fact that they allow one to deal rationally with "things" that reason cannot account for. On such things reason prescribes silence [...], but if certainties come from sensoriality and perceptions and aesthetics, then reason can begin to build on such certainties, that is, to reflect on them" (Pinello, 2014, footnote no. 494 on p. 242, with reference to Cattorini, cited by Tomatis, 2010).

This thesis [with regard to Catholic communal liturgical action] can be expressed as follows: the liturgy is a mystery of the involvement of the senses in the surpassing experience of God's revelation. The liturgy is that action (in the order of poetics) that by virtue of the singular symbolic evidence of its languages "makes the senses enter" into an order of meaning (implication) at the same time as it "brings them out" of themselves, in order to open them up to perception (in the order of aesthetics) of the Trinitarian Mystery that makes itself present (surplus) (Tomatis, 2010, p. 21-22).

Clearly, this definition contains within itself the whole problem of perceptual and cognitive illusions. The risk, in fact, is precisely this. Some authors have argued that faith and reason (*Fides et ratio*) can perform the task in question concerning reality through intelligence (understood as *Intellectus fidei* founded by/"in the" faith, illuminated through faith), as distinct from reason (*see* Rossi, 2009). Others (*see* Sabetta, 2007, p. 125), helping to criticise the reason/intelligence distinction, have instead insisted on contemplation, subsequent to the activity of reason (*i.e.* subsequent to philosophy), whose task is to show and demonstrate the limit of rational necessity. In both cases, a prominent role is played by the natural-historical languages (the Word/words *i.e.* the Divine Word spoken through human words) of God's self-revelation in the history of human beings. Here again, the risk of cognitive illusions is constantly around the corner. The expression «The Word affirms that God is the unique and absolute foundation of reality» means that the Word/words (and the substantive Word of God) contains within itself (reveals) the foundation (this is why the sacred Scriptures that form the Canon of Orthodoxy cannot be changed), that reality has its foundation in God and that this foundation is unique and absolute. Reality, and the various cultures and societies, are therefore not the mere product of history, because history itself (and with it the various cultures and societies) has a foundation (God), which is given and said historically, culturally and socially, without however being merely history, or a mere historical product (*see* Pinello, 2014, p. 238).

God has spoken in Sacred Scripture through men and in a human manner [the Word-words and the substantive Word of God] (*Dei Verbum*, 12). Just as the substantive Word of God [Jesus Christ] has made itself similar to men in all points except sin [the intellect of the Father and the Son, in the Holy Spirit, is in fact pure, not corrupted by the limitations and weaknesses of human intellect and human reason], so God's words, expressed in human tongues [Word-words], have made themselves similar to human language, in all points except error (*Dei Verbum*, 13). As far as the *intellectus fidei* is concerned, it must be considered, first of all, that the divine Truth «proposed to us in the Sacred Scriptures, correctly interpreted by the doctrine of the Church» [authentic interpretation or Magisterium of the Church], enjoys an intelligibility of its own that is so logically coherent as to be proposed as authentic knowledge. The *intellectus fidei* makes this truth explicit, not only by grasping the logical and conceptual structures of the propositions in which the Church's teaching is articulated, but also, and primarily, by bringing out the meaning of salvation that these propositions contain for the individual and for humanity [...] If the important task of theology is the interpretation of the sources, a further and even more delicate and demanding task is the *understanding of revealed truth*, or the elaboration of the *intellectus fidei* [...] the *intellectus fidei* requires the contribution of a philosophy of being, which allows *dogmatic theology* to carry out its functions in an adequate manner. The theological pragmatism of the beginning [of the twentieth century], according to which the truths of faith are nothing more than rules of conduct, has already been rejected; nevertheless, the temptation to understand these truths in a purely functional manner always remains (*Fides et ratio*, 66 and 97). Theology is organised as a science of faith in the light of a dual methodological principle: the *auditus fidei* and the *intellectus fidei*. With the former, it comes into possession of the contents of Revelation as they have been progressively made explicit in Sacred Tradition, Sacred Scripture and the living Magisterium of the Church. With the second, theology seeks to respond to the demands of thought through speculative reflection (*Fides et ratio*, 65).

Applying Marr's «Three Level Model» by analogy (*see* Pinello, 2022b), we can state that God's language is realised in the human linguistic hardware and, by this means, in the human being in its totality, personal and communitarian (note the primary and fundamental role of announcement of the Gospel, of language). The way of considering and interpreting sacred scriptures (*see* the document of the Pontifical Biblical Commission, «The Interpretation of the Bible in the Church») has profound consequences on the way of understanding language (symbolisation), thinking, reference processes and referents, internal and external to the human being. Catholic exegesis does not turn its attention to the divine aspects of biblical revelation alone (in which case exegesis would be fundamentalist), nor to human aspects alone (in which case exegesis would be historicist, anthropological, sociological: that is why exegesis of the sacred Scriptures conducted with a critical historical method and with various anthropological, psychological, sociological approaches, is like the soul of theology). Instead, it seeks to highlight both the divine and human aspects, which are united together in the divine "condescension" (*Dei Verbum*, 13) that underlies the sacred Scriptures. It is in this sense that one can speak of theological anthropology, *i.e.* natural reason and divine reason (*i.e.* natural reason illuminated by grace, in faith), natural sensoriality and divine sensoriality (*i.e.* natural sensoriality illuminated by grace, in faith), natural affectivity and divine affectivity (*i.e.* natural affectivity illuminated by grace, in faith). Revelation is supernatural and historical at the same time and the economy of salvation, internal and external, is Trinitarian (the Father and the Son in the Holy Spirit and the Holy Spirit proceeding from the Father and the Son: first the sending of the Word-words, of the substantive language, and then the sending of Grace to understand Reality and Truth – the Kingdom of God – in faith).

«In a world where scientific research is becoming increasingly important in numerous fields, it is indispensable that exegetical science be placed at an appropriate level» (Pontifical Biblical Commission, «The Interpretation of the Bible in the Church», 6.16). For theology, scientificity consists in making explicit and defined its value relations (this is also the teaching of Max Weber, in the field of social sciences); in making explicit and defined its object of enquiry with respect to reality (Creation and the Church, which have their foundation in God); in making explicit and defined its model of enquiry; in being consistent about its object of enquiry and its model of enquiry (*see* Pinello, 2014, p. 240-241). As, in considering Revelation, theology, as it did with Augustine and Thomas, must equip itself with a philosophy of being (ontology and social ontology; today, for example, some theologians use Heidegger or Habermas, in the next section we will see how Thomas used Aristotelian philosophy), so, in considering nature, it cannot do without confronting the natural sciences. «With regard to the preparation for a correct *auditus fidei*, philosophy makes its peculiar contribution to theology when it considers the structure of knowledge and personal communication and, in particular, the various forms and functions of language» (*Fides et ratio*, 65). Rondinara identifies three different levels in the relationship between theology and the natural sciences: 1) ontological level (what is natural reality and what is theological reality? Is the reality being investigated the same? Rondinara answers in the affirmative); 2) the epistemological level; 3) the ethical level (*see* Rondinara, 2007, p. 38-39). In both the philosophy of being and the natural sciences, *i.e.* in the relationship between faith and reason, one must start from the assumption that faith does not originate in man. Instead, it is produced by the foundation of reality (God) that draws the human person to itself, involving him or her with the whole mind, the whole heart, the whole body and the whole soul, that is, totally (total experience of reality, in its foundation: the Kingdom of God). It is this foundation of reality (God) that "ignites", activates, faith in the human person and, with it, reality. With respect to the conciliar definitions given here, applying the «Ogden and Richards Triangle» (*see* Pinello, 2022b), there is a not insignificant problem, which has serious repercussions on reality that is grounded in God,

that of the perennial validity of the conceptual language used in the conciliar definitions [...] Reflecting on this topic is not easy, because one must seriously take into account the meaning that words acquire in different cultures and at different times. The history of thought, however, shows that through the evolution and variety of cultures certain basic concepts maintain their universal cognitive value and thus the truth of the propositions that express them [...] The realistic value of many concepts, on the other hand, does not exclude the fact that their meaning is often imperfect. Philosophical speculation could help a great deal in this field. It is desirable, therefore, that it should be particularly involved in the deepening of the relationship between conceptual language and truth [or the foundation of reality] and in the proposal of adequate paths for its correct understanding (*Fides et ratio*, 96).

Applying the «Ogden and Richards Triangle» (*see* Pinello, 2022b), the starting point is that some words, not all words but those of Revelation, the Word/words of the sacred Scriptures (the language of God, the Substantial Word of God, the tongues of fire of the Holy Spirit), contain an eternal, absolute meaning, unchanging in time. The meaning of that meaning is God and that is why they cannot be changed by human beings (on human beings *see* Pinello, 2021). By means of this triangular model, it becomes easier to understand and explain the difference between a reality, internal and external to human beings, cultural, social, political, that has its foundation in God and a reality instead that is entirely constructed by human beings (constructivism), between the "Great Awakening" and the "Great Reset" (*see* Dugin, 2022). The differences lie at the level of symbols (symbolisation/representation), at the level of thought and reference processes and at the level of referents.

A first problematic aspect concerns the relationship between meaning and truth. Like any other text, so too the sources that the theologian interprets transmit first of all a meaning, which must be revealed and exposed. Now, this meaning is presented as the truth about God, which is communicated by God himself through the sacred text [divine Word in human words: the Word-words and the substantive Word of God, the tongues of fire of the Holy Spirit]. In human language, therefore, the language of God takes shape, who communicates his own truth with the admirable "condescension" that reflects the logic of the Incarnation. In interpreting the sources of Revelation, therefore, it is necessary for the theologian to ask himself what is the profound and genuine truth that the texts wish to communicate, even within the limitations of language [of human beings]. As for the biblical texts, and in particular the Gospels, their truth is certainly not reduced to the narration of mere historical events or the revelation of neutral facts, as historicist positivism would have it. These texts, on the contrary, contain events whose truth lies beyond mere historical occurrence: it lies in their significance *in* and *for* salvation history. [It lies in the meaning of the meaning, in the full significance]. This truth finds full explicitness in the Church's perennial reading of these texts over the centuries, keeping their original meaning unchanged (*Fides et ratio*, 94).

I close the introduction with a quotation from Paolo Tomatis on the problem of the meaning of meanings of liturgical actions (Tomatis, 2010).

Giuseppe Busani writes in the Introduction to Tomatis' book: «In recent decades much research has been devoted to showing the centrality of the liturgy for the life of faith. [...] Perhaps the roots lie within the path of liturgical renewal itself. The "liturgical question", which arose as a problem of the meaning of celebrating that asks why and how to celebrate, has answers that initially placed too one-sided an emphasis on what to celebrate. A problem of significance was answered by dealing with meanings. [...] before the rite the question is still "what does it mean and not what happens" [...] Today [...] we are all aware that the liturgical question arises as a ritual question. [...] It is clear that it is insufficient to know the meaning of what one is doing, what counts is rather the act of doing it [...] For the Council Constitution [*Sacrosanctum Concilium*] it is evident how the ritual act needs the interweaving, or rather, the harmonious integration of different verbal and non-verbal codes, of word and gesture. It is about the interaction of sounds, images, movements, speech acts, scents, flavours that activate the different forms of human perception and allow the involvement of the totality of man in the experience of the Mystery [...] "*Accende lumen sensibus*", that is, to what extent and under what conditions our senses can make in the liturgy a living and real experience of the Word incarnate [...] Paolo Tomatis, in the Introduction to his work, writes: «*Accende lumen sensibus*: the wisdom of the ancient hymn to the Holy Spirit leaves no doubt about the full involvement of the senses in the liturgical experience of faith. The Holy Spirit, who is at work in the liturgy, does not extinguish the senses of the body: he kindles them. The spiritual senses, which the Christian tradition has investigated so much, are not an alternative to the material senses, but the refinement of those same senses, illuminated by the light of the Spirit». And Silvano M. Maggiani, in his *Preface*, in turn, writes: «More than once, in the path of research led by Paolo Tomatis, which I followed dialectically in the shadows, conscious of learning and of having to orientate, and more than once in the reading and re-reading of the text he weaved, and again in the final text, Gregory Bateson's challenge, taken up by his daughter Mary Catherine Bateson, came back to my mind, as it does at present, entrusted to me in an Italian translation, in an Adelphi edition, which bears the title: *Dove gli angeli esitano*, and as subtitle: *Verso un'epistemologia del sacro*. The title is taken from a verse by A. Pope: «For fools rush in where angels hesitate to set foot» [...] The author's courage is already evident in the *Introduction*, when, among other authors, he compares himself with the refined Cristina Campo who, in her Adelphi work *Gli Imperdonabili* (p. 231), notes: «He who approaches, attracted and terrified, the sacred precincts of the ways of the century, two complementary anxieties, always the same, seize him. The terror of "losing" his five senses (since implicitly or explicitly he was taught that he possesses nothing else) and, conversely, the fear of remaining too carnal for those precincts» (Pinello, 2017, p. 24-25).

II. THOMAS AQUINAS: THE REALITY, HUMAN BEING AND GOD THE PRINCIPLE OF ALL REALITY

Thomas Aquinas was and wanted to be a theologian [...] he was a theologian in his own way and not in the way of today's theologians [...] in his conception of theology rational enquiry (i.e. philosophy) has an essential place and function (Vanni Rovighi, 1973, p. 40).

For this paragraph I will use Sofia Vanni Rovighi's *Introduction to Thomas Aquinas* (see Vanni Rovighi, 1973). The problem, with reference to the «Ogden and Richards Triangle» (because it is this triangular model that I also apply in this paragraph), is that of *entiā, essentiae* (*De ente et essentia*), being, existence, matter, form, *substantia* (substance) and pure form, i.e. symbols (language), thought, referential processes, referents (Ogden and Richards, see Pinello, 2022b), reality, the foundation of reality (God the principle of all reality, as being) and human being (on the human being see Pinello, 2021).

I will quote *Summa theologiae* with *Summa* from here on. The Roman number refers to the *pars* (*prima, prima secundae, secunda secundae*), then come the *quaestio* number and the article number. I will then quote the *De ente et essentia* from the ROLAND-GOSSELIN edition (Le «*De ente et essentia*» de S. Thomas d'Aquin, «Bibliothèque thomiste», VIII, Paris 1926) indicating not only the chapter number but also the page and the lines (Vanni Rovighi, 1973, footnote 1 on p. 41).

What was Thomas' conception of reality, thought and language and their mutual relations (these are the three vertices and three sides of the «Ogden and Richards Triangle», see Pinello, 2022b)? Everything starts from God and this has lasted for centuries and, in some ways, still lasts today. That is why it is important to set the problem right, in order to understand it. We have an «Ogden and Richards Triangle» hinged on God, and thus symbols/signs, thoughts, referents, symbolisations, references and adaptations, meaning of meaning hinged on God. The existence of an entity (*ens*) is one thing, the ideas and thoughts we have about it are another thing, the words we use to speak and write about it are yet another thing. There is also the difference to be made between orality and writing (see Ong, 1970; Ong, 1986; Ong 1989).

For Thomas, who in this follows the teaching of Avicenna, who comments on Aristotle, it is not possible to affirm that the existence of God is immediately evident [to thought, to the mind], nor can the argument of Anselm of Aosta's *Proslogion* be used for this purpose. Using a concept, notion and assertion that are not Thomas', we can state that this would be a cognitive illusion, in the sense illustrated above. «The existence of God, in fact, is not immediately evident to the intellect nor can it be discovered only by reflection on the idea of God as Anselm said in the *Proslogion*» (Vanni Rovighi, 1973, p. 55). The existence of an entity cannot be derived from reflection on the idea of it, assuming we have the idea, because in fact we do not have an idea of God to reflect on. «For Thomas we form the idea of God as we prove his existence [the five ways, or evidences, of the existence of God] [...] Seeing sensible things we arrive at God by proceeding from them [...] we do not arrive at God except by reasoning, not by immediate evidence [...] Anselm, Bonaventure (and others later) could admit that the existence of God was an immediately evident truth, discovered in simple reflection on the idea of God, because they believed that the idea of God was somehow imprinted by God himself in our minds» (Vanni Rovighi, 1973, p. 56 and 55-56). Thomas' starting point is therefore sensible things, perceptions, human and social experiences, and, as we shall see, the assumption that in God (the Creator) being and essence are identified, whereas in every creature being and essence are not identified and are distinguishable. «All that is not God is not [...] being, but *has* it, receives it, participates in it, and cannot receive it except from the one who *is* the being (*Summa*, I, q. 44, 1) [...], that is, from God» (Vanni Rovighi, 1973, p. 67). Creation and creatures meaning that God is the total cause of being. It is in this sense that the «Ogden and Richards Triangle» is hinged on God. Reflecting on God's existence therefore means reflecting on God's being and conversely, as well as on being in its totality.

Sensible creation (created things: *entiā*) is composed of matter and form. However, there are creatures that are pure forms (see Vanni Rovighi, 1973, p. 18). This is why knowledge implies both a rational activity, since sensible creation is composed of

matter and form, and a reflection of the intellect on pure forms, on being that coincides with existence and on itself. Reason also reflects on its own act. Reason in fact is speculative (theoretical) and practical. The practical reason that reflects on its own act is free will.

The distinction between necessity (determinism, automatic choices and automatic actions, fast thinking, see Kahneman, 2019) and free will choices (that are the result of conscious reflection, of logical reasoning, slow thinking, see Kahneman, 2019) is interesting. «[...] natural facts are explained by nature and deliberate actions are explained by reason and the human will» (Vanni Rovighi, 1973, p. 58). Free will is being the master of one's own judgement and choices, reflecting on one's own rational act. Clearly, there are also automatic human actions for which it is not possible to speak of free will, i.e. conscious reflection of reason on one's choices and decisions. Since reason is the being master of one's choices, it is through reflection on one's acts that it knows the good in the universal, i.e. ultimately God. Thus God can be known, as intelligence, through reflection on the sensible creation (created things: *entiā*), and as will (Good), through reason reflecting on one's choices and decisions. «There are some [supernatural] truths that surpass all power of human reason [intellect] [...] Others [natural truths] are such that they can be reached by natural reason [intellect] [...] Man is man by reason [intellect] [...] "*intellectus et ratio est potissima hominis natura*" (*Summa*, I^a II^{ae}, q. 31, art. 7) even if reason is not the whole man (*potissima, not tota*) [...] the divine gift of grace does not destroy his nature, but elevates it: "Cum igitur gratia non tollat naturam sed perficiat, oportet quod naturalis ratio subserviat fidei sicut naturalis inclinatio voluntatis obsequitur charitati" (*Summa*, I, q. 1, art. 8)» (Vanni Rovighi, 1973, p. 24, 27 and 41).

That is, Thomas rejects (can we say because it is a cognitive illusion, in the sense specified above?) Boethius' Neo-Platonic doctrine of knowledge (*De Trinitate*) according to which there are two ways of knowledge: the first way is from below, the second way from above, «by intuition of the intelligible» (Vanni Rovighi, 1973, p. 24).

That is, he advocates intellectual knowledge by abstraction and not by illumination. [...] It is rather the sense of mystery, of the limit of human knowledge, the presentiment of an immense zone of reality and truth that eludes human intelligence and towards which, nevertheless, a secret aspiration of man is directed, that which reveals Thomas's religious attitude to those who read his writings [...] the difficulties of reason when approaching the truths that most affect the meaning of human life (Vanni Rovighi, 1973, p. 40). Thomas affirms that one must start from the truths accessible to reason because, in expounding and justifying Christian doctrine by arguing with heretics, one can assume the entire Bible as a presupposition, with Jews one can assume the Old Testament, but with Muslims and pagans one cannot assume as a presupposition except what is common to all men: reason. «Therefore it is necessary to return to reason, to which all must assent». But he immediately adds: «Quae [sc. *ratio*] tamen in rebus divinis deficiens est [*Contra Gentiles*, cap. 2; see In Boethium *De Trinitate*, q. II, art. 3]» (Vanni Rovighi, 1973, p. 28).

For Thomas, the concepts of real *ens* (entity of which one can have sensory experience, i.e. sensible creation, *entiā*, entities) and essence (*essentia*) are basic (*De ente et essentia*), because they are implied in all other concepts. What is the meaning of these two terms? In what way are different realities *entiā* and *essentiae* (*De ente et essentia*)? What is the relationship between genus, species and specific difference and logical *entiā*? *Ens* for Thomas is the concrete, the perceivable, the sensory-experiential; *essentia*, on the other hand, is the abstract, «because our [sensory] experience is of [*entiā*], of concrete things [external to the human being, not in the spatial sense but in the sense of other than itself], of which we then ask ourselves what constitutes them as such [...] we have experience of men [*ens- entiā*], for example, and then we ask ourselves what constitutes man's humanity, that is, what is his essence [*essentia*]». The *ens* (or *entiā*, plural), to be precise, can be both a real *ens* and a logical *ens*, i.e. it can be understood in two ways: 1) «uno modo quod dividitur per decem genera», 2) «alio modo quod significat propositionum veritatem» (*Opusculum De ente et essentia*, 1, p. 2, 9-11). Let us see the first way. The real *ens* «is of different genera, i.e. there are different ways of really being: it is a man and it is the colour of his skin; a man and the colour of his skin are [*entiā*], but in different ways, the man is as *substantia* (in Aristotelian terms), i.e. as a reality capable of existing for itself [*ens: substantia*], the colour of his skin is as an accident ([*accidens*] in Aristotelian terms), i.e. as a determination of man and more precisely as a quality [*ens* quality: this is the ten Aristotelian categories] [...] (ways in which being can be predicated of different realities and thus ways that define the supreme genera of reality) [...] Accident cannot be nor can it be conceived without the *substantia* to which it is inherent. Accident is not proper, but by accident a *substantia* is in a certain way (red or green, heavy or light)» (Vanni Rovighi, 1973, p. 42-43 and 53). Let us analyse the statement «Man is white-skinned, black-skinned, etc.». Let us now look at the second case. Man is the *substantia ens*, the colour of his skin [on the other hand] is the quality *ens* (the accident) the verb to be (the copula) is the logical *ens*. In fact, the verb «to be» is also used to express «connections of concepts». The real *ens* (we are at the ontological level) expresses the existence and truth of the concept. The logical *ens* (and here we are no longer at the ontological level but at the level of language, more precisely of verbs, of grammar), on the other hand, expresses the existence of connections of concepts, through the copula. It does not express the existence of concepts (which is expressed by real *entiā*) but the existence of connections between these concepts. It is therefore only the connection that is true, if it is correct. If we state that blindness is in the eye, this does not mean that blindness exists. «There are eyes [that ontologically exist] deprived of their normal function, but there is no such thing as blindness: blindness is the way the intellect expresses the fact that certain eyes do not see» (Vanni Rovighi, p. 43).

Alongside and together real *entiā*, which are material things external to human beings, there are also «objects of thought», which are internal to human beings, in their minds. «We must not [...] hypostatise our concepts and believe that every concept of ours corresponds to a thing», to a reality external to human beings, because «not everything that is an object of thought exists as it is thought. [...] The [*ens*] of which Thomas intends to speak [...] is the real [*ens*] [concrete, external to the human being], and only with respect to this [*ens*] can one speak of essence» (Vanni Rovighi, 1973, p. 43).

The real, concrete *ens*, external to the human being (applying the «Ogden and Richards triangle», it is the reference external to the human being) is a primordial concept which, as primordial, is implicit in every other concept, i.e. in the ten categories, and which, in terms of definition (i.e. posing the question of definition), can be called essence. Free will, on the other hand, is being the master of one's own social and moral and esthetic act. This is a characteristic of practical reason that reflects on its own act. On closer inspection, one can glimpse in this one of the embryos of the distinction between the natural sciences and the human

and social sciences. But let us proceed further. If the *ens* of which Thomas speaks is the real, concrete *ens*, external to the human being, if only with regard to this *ens* can one speak of essence, if *ens* is already implicit in any concept (but not everything that is the object of thought exists as it is thought), if all reality is *ens*, then, despite free will, nothing real can be added by the mind to this *ens* (*entiā*). This means that what mind adds to real *entiā* is the explication or expression of what was already implicit in the notion of the real *ens* and in the connections of the real *entiā*. «And this explication or expressing itself can take place in two ways: either so that the mode expressed specifies the [*ens*] [...] and then one goes from the [*ens*] to the different genera of [*entiā*] [the categories] [...] or so that the mode expressed universally belongs to every [*ens*] [...] Now there is no affirmative predicate that belongs to every [*ens*] except its essence» (Vanni Rovighi, 1973, p. 44). This second mode, namely predicates that belong universally to every *ens*, is the mode of *transcendentals*. They are called *transcendentals* because they transcend the categories. I will also discuss the question of human artefacts that are added to natural *entiā*.

At this point we can also define essence.

Essence (let us now return to *De ente et essentia*) is what is expressed in the definition, when it says “*what it is (quid)*” an [*ens*], so it is also called quiddity (*quidditas*), or, as Aristotle says, *quod quid erat esse* [...] «*id est hoc per quod aliquid habet esse quid* (*Opusculum De ente et essentia*, 2, p. 322) [The definition, when it says “*what it is (quid)*” a (*ens*), expresses its essence]. Essence is sometimes also called *form* because, in Aristotelian terminology, form is the determining element of the thing, that by which a thing is what it is, distinct from any other, while matter is the undifferentiated common element (Vanni Rovighi, 1973, p. 44).

Cotinuing on the real *entiā* (*i.e.*, applying the «Ogden and Richards Triangle», remaining on the ontological level of external referents to the human beings; I reiterate that “external” is not to be understood in the spatial sense but as other than oneself, for God is also external, just as his Word is external), we can now state that they are the combination (*synolon*) of a matter common to all real *entiā* and of different forms. Matter is also called nature. Which means that «an [*ens*] can exist, can have “being”, only insofar as it is something determinate», *i.e.* common matter that has its own form. «The every compound substance (body) form is the determining element, that by which the substance is a determinate substance (man, cat, horse) – and this is the substantial form» (Vanni Rovighi, 1973, p. 45). Form is the determinative element (substantial form) while matter is the determinable element. «As the accident, so also the substantial form, is not a thing in itself, and therefore does not have a complete essence» (Vanni Rovighi, 1973, p. 53). However, common matter, called nature, is not present in all *entiā*. In the definition of soul, for example, but the question of the soul as we shall see is much more complex (I will reduce and simplify for the moment), when considering it physically, one must also include the body. The soul, from a physical point of view, is the form of the body of a given human being, it is substantial form. But, as soul, *i.e.* not as substantial form, it is a separate *substantia*, *i.e.* without matter, and it is because of this that it cannot be destroyed and transformed, or perish. It is because of its matter that a *substantia* can be destroyed and transformed into another *substantia* (e.g. wood being turned into ashes by the action of fire). Form is the actual element, *i.e.* «that by which a body is in place and is what it is», matter is the potential element, identical in all bodies (nature), *i.e.* «that by which a body can be transformed into another body» (Vanni Rovighi, 1973, p. 45). Essence is primarily of *substantiae* and secondarily of its accidents. *Substantiae*, I repeat, are the *entiā* that exist for their own sake, e.g. a human being. *Substantia* can exist without a given accident, but a given accident cannot exist without a given *substantia*. Form, except as we shall see for separate pure forms (the soul, angels), is always the form of an *ens* and cannot exist separately from it. *Ens* that, always and in any case, is a compound of matter and form, in act.

At the level of thought, of mind, let us always remember that I am applying the «Ogden and Richards Triangle» (*see* Pinello, 2022b), Thomas not only considers concepts that are in the mind and correspond to real *entiā* (corporeal compound *substantiae* natural or created by artists) and concepts that are in the mind and do not correspond to real *entiā* (not all concepts that we have in the mind, in thought, correspond to real *entiā* existing in the world external to human beings), but also considers angelic *substantiae* (incorporeal simple *substantiae*) that are pure forms, *i.e.* not combined with matter (separate *substantiae*). With regard to the concepts that are in the mind, in general, «I can understand what man is or what the phoenix is and yet ignore whether they really exist or not. So it is clear that being is distinct from essence or quiddity [*quidditas*] [*De substantiis separatis*]» (Vanni Rovighi, 1973, p. 51). This concept is important because, in addition to essence, or quiddity (*quidditas*), one must consider being, namely God. Even for God, it is not enough to think of his idea in order to be able to say that he exists, because instead one must prove that he really exists. With regard to entities created by artists, it is possible to point out that «[...] the God of Thomas is an intelligent and free creator, he creates like an artist [*Summa*, I, q. 14, art. 8] with the difference that the human artist presupposes matter [created by God] and only transforms it, while God presupposes nothing, and is the cause of all being» (Vanni Rovighi, 1973, p. 67).

There remains the question of the “individuation principle” and the matter *signata* that is different from common matter (common matter, it is like saying: all things are formed of atoms, or all living things are formed of cells). So far we have spoken of common matter, of nature in general, but for Thomas there is not only common matter because there is also matter *signata*. It is not only man that exists because Socrates, the human being Socrates, also exists; indeed, man exists because the human beings Socrates, Santippe, Plato, Aristotle, Plotinus, Augustine, Anselm, etc. exist. If *substantia* is the compound of form and matter (*synolon*), then, for example, one can define the individual human being and not man as such (on these issues, *i.e.* the human being, which for Thomas is matter *signata*, *see* Pinello, 2021). Thomas, who is anti-realist on the subject of universals, adopts a Platonic solution for the principle of individuation. The principle of individuation is not common matter but rather matter *signata*: «et dico materiam signatam quae sub determinatis dimensionibus consideratur» (*De ente et essentia*, 2, p. 11, 2-3). It can be said, as Hjelmlev would say for language (*see* Miceli’s citation below), that it is possible to distinguish a distinct formal matter from a material matter (or matter *signata*). From this, Thomas deduces that in the definition of the universal – for example of man as such – matter is included, but not matter *signata*, *i.e.* the individual concrete and determinate human being. This is the problem of determination down to the individual, *i.e.* the principle of individuation:

This publication is licensed under Creative Commons Attribution CC BY.

«in the definition of man, in fact, these bones and this flesh are not included, but flesh and bones in general, which are the matter *non-signata* of man» [De ente et essentia, 2, p. 11] [...] «The difference between the essence of Socrates and the essence of man is thus manifest: the essence of Socrates is determined up to individuality whereas the essence of man is not determined [up to individuality] (*non differunt nisi secundum signatum et non signatum*)», just as the essence of the species (*e.g. man*) is nothing other than the essence of the genus (*animal*) which is further determined; only that the difference which determines the species with respect to the genus comes from the form, while the difference that determines the species up to individuality derives by the matter *signata* [...] it clearly turns out that [...] the individual [the concrete human being, real *ens*] [...] is conceived as the only true reality that only the inadequacy of our intellect makes us first know more indeterminately and which we then try to grasp more closely by means of the addition of one notion to another. Genera and species are nothing but the individual known indeterminately: «Sic ergo genus significat indeterminate totum id quod est species» [De ente et essentia, 2, p. 16, 1-2] [...] the genus is not a reality distinct from the species, but is only the species confusingly conceived, so too the species is not a reality distinct from the individual [*e.g. the concrete human being*], but is only the individual [*e.g. the concrete human being*] confusingly conceived [...] nothing can exist that is not the individual [*e.g. the concrete human being*] (Vanni Rovighi, 1973, p. 46-48).

With respect to the topics discussed in this article of mine, I can therefore state that the concept of human being I use (*see Pinello, 2021*) corresponds to Thomas' concept and notion of matter *signata*, *i.e.* the principle of individuation, while the idealtyp of man used by Max Weber corresponds to Thomas' concept and notion of matter *non-signata*. It remains to be clarified how it is possible, on the linguistic level, that two words "Socrates" and "man" are linked by the copula (logical *ens*), in the judgement, *i.e.* by a relation of identity: "Socrates [matter *signata*] is a man [matter *non-signata*]". In this regard, Thomas distinguishes between what the essence means (absolute), regardless of its mode of realisation (particular or universal, one or multiple) and the manner in which the essence is realised (Socrates).

If I have in mind the essence *man* as a synthesis of animality and reason, I still do not know whether it is one or multiple, whether there is only one man or there are many. If, on the other hand, I consider *man's* essence as realised in Socrates, Plato and others, I will say that man's essence is multiple; but reflecting on the fact that I conceive of these many under a common aspect, which is that of humanity in which we are alike, I will conclude that their various humannesses are present [to my mind] under one aspect. The essence of man, therefore, is realised as multiple in the various individuals, but [in my mind] and in the various individuals is present that [unique] essence, that quid, which abstracts from the mode of realisation [in the multiple individuals] (Vanni Rovighi, 1973, p. 49-50).

At the level of the mind, of thought, again with reference to the «Ogden and Richards Triangle», I note that that Thomas, resorting to Avicenna, speaks of spirit (*mens*) or intellect and adds «the human soul, which is called intellect or spirit [...] (*Summa*, I, q. 75, 2)» (Vanni Rovighi, 1973, p. 90) and distinguishes between «the intentional being of the object (*essence*) in spirit» and «the real being of the act that thinks that object». «[...] the first [the intentional being of the object (*essence*) in spirit] is universal, that is, it can be predicated about different *entiā*, the second [the actual being of the act that thinks that object] is an individual act [*i.e.* it can be predicated about a given *ens*]. What is common to different men is not the act by which I think them men (an act that is mine and not another's), but what I think» (Vanni Rovighi, 1973, p. 50). This concept can be useful in the field of *qualia* («What is it like to be a bat?», «What Mary did not know» etc., see De Palma and Pareti, 2015). Furthermore, it must be added that, according to Augustine, the soul is spiritual *substantia*. Vanni Rovighi also reports a passage by Alexander of Aphrodisias (but this is not Thomas' perspective) who identifies the active intellect (see also Averroes' possible intellect, also spiritual) with a separate *substantia* (*i.e.* without matter), which is God, that illuminates man's passive intellect, which is mortal in that it is the combination of the elements of the human body (*see Vanni Rovighi, 1973, p. 84*). The problem, as we shall see, is that there are not only mental concepts of which we do not know whether or not they correspond to real *entiā* and which are in the minds of human beings, but there are also spiritual *entiā*, which are also intelligent like the human mind, but which exist outside human beings. That is why the concept of spirit is more appropriate than the concept of mind, if by mind is meant the human mind. This can be a first criterion to distinguish the concept of spirit from the concepts of soul, intellect and mind, also taking into account the fact that the Latin term *ratio*, as Vanni Rovighi writes, is difficult to translate. I would add that it is to the Augustinian concept of soul that dualist theories of mind can be traced, even before the Cartesian distinction *res cogitans* and *res extensa*. For Augustine, in fact, the soul «is a *substantia* independent of the body, even if made to unite with it [...] At man's death, only the body properly dies, but the soul remains [...] The Augustinian definition of the soul is in fact: *substantia quaedam rationis particeps regendo corpori accomodata* (*De quantitate animae*, XIII, 22). The soul will continue to live after the death of the body and will then resume the body at the resurrection» (Vanni Rovighi, 1973, p. 83). The soul understood, at the same time, as the form of the body and as a *substantia* in its own right is a problem that Thomas resolves by stating that «the human soul is [...] pure form (not composed of matter and form), but subsistent form, even though it is the only form of man. [...] subsistent form [...] [meaning that] it has being in its own right [for itself, independently of the body] [...] [and that] it does not participate only in the being of the individual, like other forms of bodies. In a tree (and thus in every *infra-human* being) the one who exists is the tree, not its substantial form, which exists insofar as the tree whose form it is exists; in man, on the other hand, the soul exists [in its own right]» (Vanni Rovighi, 1973, p. 90).

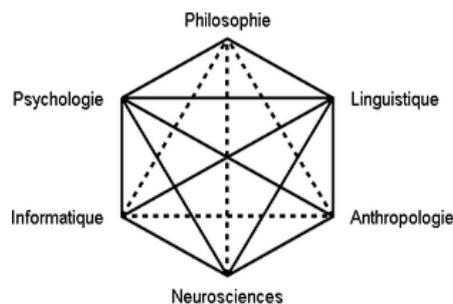
Averroes had also affirmed the spirituality and immortality of the possible intellect, but this was a unique and separate intellect; Thomas, on the other hand, [...] after saying that the human soul is a subsistent form, affirms that this soul, precisely that which is the principle of intellectual activity (the *mens*, as he called it [...] in Augustinian terms) is the form of the body. Form, in fact, is the determining principle of the essence of everything, it is that by which a thing is what it is, and therefore it is also that by which a thing has its own activity; now *intelligere*, intellectual knowing, is man's activity, therefore the intellectual principle is that by which man is man, it is his substantial form. The Platonic objection to this argument could be this: man is man because of the soul, indeed man is the soul – *ego animus*, Augustine said – a soul that then goes on to govern a body. «Either, therefore, one must say that Socrates, for example, knows with the intellect for his whole self, as Plato admitted when he said that man is the intellectual soul, or one must say that the intellect is a part of Socrates. But the first hypothesis does not hold up, because it is the same man who is conscious both of knowing intellectual and of feeling [sensoriality]; now feeling [the five senses] implies the body [*ipse idem homo est qui percipit se et intelligere et sentire: sentire autem non est sine corpore*]; and therefore the body is a part of man [*Summa*, I, q. 76, 1]». The claim that the intellectual soul is the substantial form of the body is not directed against a generic Platonism: it is historically directed against Averroes' theory. With Averroes, Thomas agrees in affirming the

independence from the body of the possible intellect, but he does not agree in affirming that it is a separate and unique intelligence for the human species (Vanni Rovighi, 1973, p. 92-93).

These arguments take on their own relevance if one considers Marr's three levels (*see* Pinello, 2022b). The human mind (*mens*) is indeed typical of man, but it can also be considered as a subsistent form (in its own right). Hence the possibility of identifying a computational theory, representations and representation processes that can also be realised in non-human hardware. It must be made clear, however, that

Thomas found it difficult to reconcile two apparently contradictory theses: the human soul is subsistent, the human soul is a form of the body. And all the more contradictory in that he asserts (a thesis that aroused scandal) that the soul, the *mens*, is the only form of man. That the *mens* was the only soul, that there were not three souls in man (vegetative, sensory, intellectual) was commonly admitted by the theologians of the 13th century, but all of them (except, I believe, Albertus Magnus) admitted that the intellectual soul was joined to an already formed body, that there were, precisely, soul *and* body in man. Thomas, on the other hand, asserted that the intellectual soul is the only substantial form in man, which meant that the intellectual soul is not only the principle by which man knows with the intellect, but is also what causes man to have a certain colour of eyes; this meant emphasising to the highest degree the unity of man in all his aspects. Thomas considers this to be the logical conclusion of the thesis that the soul is the first act, the substantial form of the body. Substantial form is in fact that which gives being *simpliciter*, makes a thing be, *is* a determinate *ens* [...] «It is necessary to say that for the substantial form, which is the human form, this individual has not only to be man, but must be animal, must be alive, must be body, must be *substantia*, must be something» (*Q. d. De spiritualibus creaturis*, art. 3) [...] the theory of the soul as the sole form of man had the advantage of eliminating many pseudo-problems of philosophical psychology, problems that also plagued modern philosophy after Descartes, namely all those that ask how the soul [the *mens*] is united with the body. Such problems in fact presuppose the conception of the soul [the *mens*] and the body as *two substantiae* that must in some way unite in man, whereas for Thomas man is *a substantia*, of which the soul [the *mens*] is the form, *i.e.* the determinant principle (Vanni Rovighi, 1973, p. 94-95).

These are dualist and monist theories of the brain-mind relationship, which today fall within the field of philosophy of mind (*Philosophie*, *see* the figure of the hexagon), which has been one of the disciplines of the «hexagon» of cognitive science since its inception as an interdisciplinary discipline (*see* Bechtel, 1992; Tabossi, 1998; De Palma and Pareti, 2015).



For Thomas, and this passage is very interesting because it gives a good understanding of how he sees the relationship between reality external to the human being (external not only in the spatial sense, but in the sense of other than oneself), the mind of the human being, the knowledge of which the human being is capable, and the knowledge of which God is capable,

The proper object of the human intellect [*mens*] is [...] the essence of corporeal things: *quidditas sive natura in materia corporali existens* (*Summa*, I, q. 84, 7), *quidditas rei materialis* (q. 88, 3), which means: corporeal reality considered in its essence. A statement that in no way contradicts that of the first question *De veritate*, according to which the first object of the intellect is being, since *quidditas rei materialis* is that in which the intellect first discovers being, that which it first grasps as an entity [*ens*] [or as non-being, as non-entity, *i.e.* not “an entity external to the human body”]. For we know things by proceeding from the most universal concepts to the least universal (*Summa*, I, q. 85, 3) and the most universal of concepts is each of being. [...] Being can be confusingly present as the background of each reality (*ens concretum quidditati sensibili*, as the Gaetano says) – and so it is in whatever physics – or it can be taken as the subject of research, as in metaphysics, asking what it means *to be*, under what conditions a thing can be etc. But metaphysics would be vain reverie if it did not refer to what is implicit in each our concepts [...] In the multi-coloured data offered to us by the senses (and everything the senses offer us is singular) we grasp the intelligible aspect first in a vague and confused way, then progressively trying to determine it better and better [*reflexio*]. We can see, therefore, how for Thomas Aquinas, knowledge of the universal is in a certain way the sign of man's greatness and misery, to use a Pascalian term; of greatness because it is the way in which man goes beyond the impact of the sensible to grasp an intelligibility, to respond to the *quid est*; of misery because knowledge of the universal is always a confused knowledge of reality, which is singular, individualised. The ideal would be an intellectual knowledge of the singular in its singularity [of the human being, for example, not through idealtypes and abstract models but precisely as a single human being], an intellectual intuition in the strong sense; but it is an ideal that is only realised in divine knowledge, not in human knowledge [...] What the intellect knows and intends to know is the individual (we know things and not concepts, *Summa*, I, q. 85, 2), but it does not come to know it in its individuality: it knows, for example, that existing men, whom it sees, encounters, knows from history, are rational, and it says – *this* one of whom I have an image, direct or indirect, is rational (and has many other predicates, but always universal) – but it does not know to the full, that is, to individuality, what this man is [...] There are [...] two reasons why Thomas denies that our intellect [*mens*] knows the individual: one, which we might call phenomenological, is that our intellect is imperfect, proceeding from the confused to the distinct, hence from the more universal to the less universal, without ever exhausting all the richness of the individual; the other is the residue of the Greek (Platonic and Aristotelian) conception of matter as an unintelligible reality (Vanni Rovighi, 1973, p. 100-102).

This passage in Thomas' argument is Copernican. For we believe that we know in a direct way, through our senses, perceptions, direct experiences. In reality, our intellect is imperfect, that is, it proceeds from the confused to the distinct, hence from the more universal to the less universal, to the singular, to the individual, without ever exhausting all the richness of the individual *ens*, for example of the individual human being. This helps us to understand why it is so much easier to proceed by Weberian idealtypes, or similar concepts and notions, and how the real challenge is to strive for an increasingly less confused and increasingly distinct knowledge, going from the confused to the distinct, from the universal to the singular (on the biographical method *see* Pinello 2022a; on the human being *see* Pinello, 2021). Now I want to take a gamble and compare “simple incorporeal

entiā of pure form” to natural laws (eternal laws): anthropomorphised “separate intelligences” (*substantiae* separated from matter), Aristotelian “pure forms per se subsisting”. «And since the principle of individuation is matter *signata*, in such *substantiae* there cannot be many individuals of the same species, but each of them is its own species» (Vanni Rovighi, 1973, p. 51). There may be some basis to my hazard if one considers that heavenly bodies are moved by angelic, *i.e.* spiritual, simple *substantiae* that have essences and are *substantiae* (pure forms, separate *substantiae*, *i.e.* without matter) capable of knowing with the intellect, *i.e.* acting intelligently, *i.e.* as if they responded to a rational, logical, intelligent scheme. A law of nature, after all, is as if it had to do with an intelligence and order within the *entiā*, within things: the sun rises and the sun sets, the moon has its own cycle, always the same, a living being that dies can no longer be brought back to life, etc. My hazard may also have some foundation if we consider Aristotle’s demonstration of the existence of a first motionless motor. For Aristotle, the immobile motor is “thought of thought” (for Thomas, the ideas that are in the mind of God) and is not an efficient cause of the world. However, it must be made clear that God for Thomas is not comparable to a natural law because instead he is the foundation (the unchanging and necessary principle) of all reality (he is the being of reality, that for which reality is) and of all its changes and, as such, he is free in his actions and endowed with intelligence and will. In this Thomas, for Vanni Rovighi, radically diverges from Avicenna, Averroes and pagan antiquity, for whom things derive from God by necessary, determined natural processes.

In the Thomistic concept of creation, Gilson has rightly and effectively emphasised the aspect whereby God is seen as the source of *being*, of all being, whereas Greek philosophy conceives of God as that which gives *form* to the world, which shapes pre-existing matter, and therefore does not give being, but only a certain mode of being (Vanni Rovighi, 1973, p. 70-71)

The God of Thomas, on the other hand, is anthropomorphised through through the human and divine Person of Christ, to mark the difference from pantheism, that is, from being diffused in all things, but not as a unique and immutable foundation. We do not yet have the mechanistic, no longer anthropomorphised, view of nature, for which God intervenes as a great watchmaker of the whole universe, of all reality and all change in reality. In Thomas’s vision, however, it is the things that have a clock inside them. «But this, [clock] intrinsic to the things of nature, [unlike God] is a non-intelligent principle, it is a pure life force [...] Among the divine attributes of particular importance to [Thomas] are [instead] intelligence and will [...] And after all it is the attributes that distinguish a theistic from a deistic conception» (Vanni Rovighi, 1973, p. 62 and 66).

To understand Thomas’s philosophy, his theological conception of God and his philosophical conception of reality, one must therefore start with the problem of being. How does one explain the being, separate from essence, of corporeal real *entiā* and incorporeal spiritual *entiā*? Thomas’ answer, philosophical and theological at the same time, is that the principle of being of all *entiā*, corporeal-reals and incorporeal-spirituals, is God (pure form), in whom, unlike in *entiā*, being and essence coincide. That is why the foundation of all reality (corporeal-real and incorporeal-spiritual *entiā*) is God: for it is God who is the separate foundation of the being of all *entiā*.

Continuing to apply the «Ogden and Richards Triangle», it is at this point that the problem of language intervenes (the symbols and symbolisation, again with respect to the «Ogden and Richards Triangle»). There is therefore a reality that has being and is being (God, the foundation of the being of all reality) and there is a reality that has being but is not being (the corporeal real *entiā* and the incorporeal spiritual *entiā*). «[...] every reality in which essence and being are distinguished, every reality that *has* being, but *is* not being itself, must have received being from something else, and precisely from that which has not received being, but *is* its own being. This is the reason for being, the *causa essendi* of all reality [...] “[...] what receives something from someone is in potency with respect to what it receives, and what is received in it is its act” [...] Being is that by which (*quo*) an essence actually exists (*subsistit in rerum natura*)» (Vanni Rovighi, 1973, p. 52). Every reality has the essence and receives being. With respect to each human being, the soul is the first act of a body that life in potency in the ontological foundation of all reality («*actus primus corporis physici potential vitam habentis*»). Thomas interprets «in his own way the Augustinian doctrine of the *rationes seminales* [...] Just as in the seed of a tree all the parts that will later develop are present invisibly, so were all the different bodies present virtually (*potentialiter atque causaliter*) in matter from the beginning [...] What exists is the compound, not the form for itself [...] the form begins to be when the compound (the body) passes from potency to act, and the act is the form» (Vanni Rovighi, 1973, p. 77-78). God is also the foundation of the movement-mutation of all reality. Things (thing in the sense of a thing in itself, of *ens*) are generatable and corruptible. All that can be and not be has a proximate cause and an immutable foundation (God), Every movement-movement has in fact a «*Primum movens quod in nullo moveatur*», *i.e.* an immutable (the being that coincides with existence and is not separate from it). Taking into consideration not infinite series of causes but very close relations of causes and effects, for generations from human beings of a human beings there are cause *essendi*. For natural things there are efficient causes because things produce other things. Since human reason and intellect (the mind) are weak and labefacts, it is necessary to refer to the proofs of God’s existence (the five ways) and to refer to the truths contained in the sacred Scriptures (the Word-words). Hence the distinction between *conclusio rationis* (truth known by man through his own reason and intellect) and *articulus fidei* (revealed truth).

I mean to say: just as philosophy in general and metaphysics in particular do not exhaust for Thomas all that man can and needs to know in order to make sense of his life, and must be supplemented by divine revelation, neither does philosophical ethics exhaust all that man needs to know in order to guide his conduct, and must be supplemented by revelation (Vanni Rovighi, 1973, p. 111).

That is to say, the Christian system is a system that, through God’s self-revelation (*Fides et ratio*), solves the problem of the incompleteness of system of knowledge, given the weaknesses of human reason and intellect and given the incompleteness and weakness of their systems of knowledge. The problem will reappear in the first decades of the 20th century, with Kurt Gödel (see Kline, 1985).

How the difference between philosophical theology and revealed theology lies not in the fact that the former knows some things and revealed theology (*sacra doctrina*) some others, but in the fact that the former is an imperfect and indeterminate knowledge of the same things that the latter teaches [...] On the other hand, in the Thomistic conception, theological discourse – in moral theology as in speculative theology – presupposes as *preambulum* a rational discourse (Vanni Rovighi, 1973, p. 111-112).

How do we reconcile the thesis that we can affirm something about God [affirmative theology] with the thesis that we only know God *via remotionis*, saying what he *is not* [negative theology]? [...] «The names we give to God signify him as our intellect knows him, and our intellect, which goes back to God from the creatures, knows him as the creatures represent him» (*Summa*, I, q. 13, VII, 5) [...], as well as bearing the simile [...] The «names» we give to God compete with him in what they signify, but not in the way they are signified by us (*Summa*, I, q. 13, 3) [...] Ours is therefore a knowledge of God by *analogy* [...] but our knowledge of him is a non-knowing: God is *Deus Absconditus*, just as the deep structure of things is hidden from us, which is also their essence (Vanni Rovighi, 1973, p. 65-66).

But the structure of language is also hidden from us. Going back to what I said at the beginning about Tullio De Mauro and other linguists, it is very interesting to relate what Silvana Miceli writes about Louis Hjelmslev with what Vanni Rovighi writes about Thomas. We are not dealing with the specific problem of revelation, of the Word/words, but with the problem of the matter (or *substantia*) of the content of language.

Hjelmslev [...] did not evade the problem of meaning at all, as some “formalistic” structuralisms do. Rather [...] he believed [...] that it was possible to account for it – for certain aspects of it – with instruments that are still structural. His structuralism attacked objects in their entire “semiotic” dimension, proposing, in line with his fundamental positions, the algebraisation of both the form of expression and the form of the content in their reciprocal relationship [...] Hjelmslev [...] is very prudent and shrewd in his formulations. He distinguishes, first of all, in language, the two *planes* of *expression* and *content* while still distinguishing, within each of them, the two *layers* of *form* and *substantia*. Language thus consists of four layers (form of expression and *substantia* of expression; form of content and *substantia* of content). It also recognises that the two *substantiae* are in turn articulated, each of them, in several *layers* (it identifies, for each, at least three). Of this complex object, he considers *only* the two layers that are the forms to be attackable by structural analysis: the content can (and must) therefore be studied structurally, but *limited* to that aspect of the system of internal dependencies (form) by which it is organised (naturally on the condition of working on the basis of a *hypothesis* – continually reaffirmed as such – that is structuralist on language). Hjelmslev’s position, as we can see, is not only extremely rigorous, but also extremely open; he by no means believes that he exhausts, through structural analysis, the entire semantic dimension of language: quite the opposite; and yet his rigorous «formalism» (unlike others) never forgets that the linguistic object can only ever be configured as a *sign* and that is, at the same time, expression and content: there is no linguistic analysis, however formalised, that can set aside the problems of semantics (Miceli, 2005, p. 33-34). [...] only matter is opacity, an obstacle to intelligence: form, the principle of being and actuality, is by its nature intelligible and intelligent when it is not bound to matter (Vanni Rovighi, 1973, p. 66).

The problem [of Thomas] is to demonstrate that the substantial form of man is a *forma sui generis*, capable of subsisting independently of the body. [...] Thomas, taking special advantage of Avicenna, [demonstrates] that the human soul [*mens*] is a *forma subsistens*; but he realises the difficulty of this demonstration when [...] he recognises the difficulty of thinking of a life of the soul [*mens*] separate from the body (*Contra Gent.*, II, c. 81). [That the knowing subject is corporeal is a *given*: «*percipit se intelligere et sentire, sentire autem non est sine corpore*»: that certain features of knowledge prove that there is an element independent of the body in man must be *demonstrated*; man’s naturalness is a *given*, his spirituality must be demonstrated. We are in a considerably different position from Augustine’s and even antithetical to the Cartesian one]. This is why Revelation is so necessary (Vanni Rovighi, 1973, p. 96).

III. CONCLUSION

Thomas’ vision, in terms of the philosophy of mind, is Copernican for its time, because we believe we know directly, through our senses, our perceptions, our direct experiences. In reality, our intellect is imperfect, that is, it proceeds from the confused to the distinct, then from the more universal to the less universal, to the singular, to the individual, without ever exhausting all the richness of the individual whole, for example of the individual human being. This view may be a useful hypothesis for understanding why it is so much easier to proceed by Weberian ideal-types, or similar concepts and notions, and how the real challenge is to strive for less and less confused and more and more distinct knowledge, moving from the confused to the distinct, from the universal to the singular, from the ideal type of man and social action to the individual human being in action (on the question of residues see Pinello, 2022a). For Thomas Aquinas, only matter is opacity, an obstacle to intelligence; form, the principle of being and actuality, is by its very nature intelligible and intelligent when not bound to matter (on this, as I have already mentioned, see Miceli, 2005, p. 33-34 also Hjelmslev, 1968). But what exists, physical reality, is in act matter and form: in physical reality there is no matter without form nor form without matter. A different question, with respect to the existence and definition of what exists, of physical reality, is the being of what exists and the possibility of complete knowledge about it. The Christian system is a system that, through the self-revelation of God (*Fides et ratio*), solves the problem of the incompleteness of knowledge systems, given the weakness of human reason and intellect. The problem will arise again in the first decades of the 20th century, with Kurt Gödel (see Kline, 1985; Miceli, 2005).

What is and how is reality for Thomas Aquinas? How was it perceived, conceived, thought, spoken, experienced, communicated, transmitted in its objectivity? What were and how were language, thought, referents and the relations between language, thought and referents for Thomas Aquinas? If one assumes that, for a human being, there are socio-institutional constraints (of which language is among the most important), physical constraints (the physical materiality of the environment in which all human beings are immersed) and cognitive constraints (the brain-mind-body), the «Ogden and Richards triangle», as I have shown in this article by applying it to the philosophy-theology of Thomas Aquinas, is a valid model for analysing these three constraints (language, thought and the referents of language and thought) and their relationships.

BIBLIOGRAPHIC REFERENCES

- Barbera M., *Introduzione alla linguistica generale. Materiali integrativi al corso di Didattica delle lingue moderne*, <http://www.bmanuel.org/corling/corling1-3.html>
- Bechtel W. (1992), *Filosofia della mente*, Bologna: il Mulino.
- Brambilla F.G. (2009), *Nuovo corso di teologia sistematica. Vol. 12: Antropologia teologica. Chi è l'uomo, perché te ne curi?*, Brescia: Queriniana.
- D'Auria F. (2022), *Le origini del senso morale. L'etica alla prova delle neuroscienze*, *Il Bo Live Università di Padova*, 26 Agosto 2022, <https://ilbolive.unipd.it/news/origini-senso-morale-letica-prova-neuroscienze>, consulted on 28/08/2022
- De Palma A., Pareti G. (2015), *Mente e corpo. Dai dilemmi della filosofia alle ipotesi della neuroscienza*, Torino: Bollati Boringhieri.
- Dugin A. (2022), *Contro il Grande Reset. Manifesto del Grande Risveglio*, Cusano Milanino: AGA.
- Ferraris M (1996), *L'immaginazione*, Bologna: il Mulino.
- Ferraris M. (1998), *Estetica razionale*, Milano: Raffaello Cortina.
- Hjelmslev L. (1968), *I fondamenti della teoria del linguaggio*, Torino: Einaudi.
- Jacomuzzi A. (2015), «Percezioni, ragionamenti e illusioni», *Rivista di estetica* [Online], 60 | 2015, online since 01 décembre 2015, consulted on 16 settembre 2022, URL: <http://journals.openedition.org/estetica/580>; DOI: <https://doi.org/10.4000/estetica.580>
- Kahneman D. (2019), *Pensieri lenti e veloci*, Milano: Mondadori.
- Kline M. (1985), *Matematica la perdita della certezza*, Milano: Arnoldo Mondadori.
- Miceli S. (2005), *In nome del segno. Introduzione alla semiotica della cultura*, Palermo: Sellerio.
- Ong W.J. (1970), *La presenza della parola*, Bologna: il Mulino.
- Ong W.J. (1986), *Oralità e scrittura. Le tecnologie della parola*, Bologna: il Mulino.
- Ong W.J. (1989), *Interfacce della parola*, Bologna: il Mulino.
- Pinello F.P. (2014), *Il cognitivismo di S. Privitera e il modello di scienza cognitiva proposto da D. Marr. I limiti del modello cognitivista proposto da S. Privitera e i vantaggi dell'adozione, anche per l'etica, del modello di scienza cognitiva proposto da D. Marr*, Vignate (MI): Lampi di stampa.
- Pinello F.P. (2017), *Sociologia della massoneria. Lavoro massonico, solidarietà e progettualità sociale*, Acireale-Roma: Tipheret-Gruppo Editoriale Bonanno.
- Pinello, F.P. (2019), «L'azione sociale e l'interazione sociale tra sociologia, filosofia della mente, scienze cognitive, neurodiritto e informatica giuridica»; *Mediascapes Journal* n. 13: 147, Editrice Sapienza: <https://ojs.uniroma1.it/index.php/mediascapes/article/view/16361/15783>.
- Pinello, F.P. (2020), «Uniformità e universali bio-storico-socio-culturali: l'antagonismo e gli ordini sociali, con alcuni riferimenti all'educazione alla legalità (in senso lato)» in Severino S., Malizia N., Pinello F.P., a cura di, *Educazione alla legalità: dalla conformità alla devianza*, Leonforte: Euno.
- Pinello F.P. (2021), *L'essere umano. La donna-l'uomo e i profili sociali della spiritualità umana (Interrogativi sulle scienze sociali, per una genealogia della morale, del diritto e della scienza)*, Cosenza: Luigi Pellegrini.
- Pinello F.P. (2022a), «The social act, the social action and the social interactions: a secure basis for social bonding»; *International Journal of Scientific and Research Publications (IJSRP)* 12(8) (ISSN: 2250-3153), DOI: <http://dx.doi.org/10.29322/IJSRP.12.08.2022.p12811>
- Pinello F.P. (2022b), «The "Verstehen" and the Meaning of Meaning: for a Sociology between the Cognitive Sciences»; *International Journal of Scientific and Research Publications (IJSRP)* 12(9) (ISSN: 2250-3153), DOI: <http://dx.doi.org/10.29322/IJSRP.12.09.2022.p12903>
- Rondinara S. (2007), *Interpretazione del reale tra scienza e teologia*, Roma: Città Nuova.
- Rossi R. (2009), *Ragione e intelligenza*, Todi (PG): Tau.
- Sabetta A. (2007), *Dal senso cercato al senso donato. Pensare la ragione nell'orizzonte della fede*, Città del Vaticano: Lateran University Press.
- Tabossi P. (1998), *Intelligenza naturale e intelligenza artificiale. Introduzione alla scienza cognitiva*, Bologna: il Mulino.
- Tomatis P. (2010), *Accende lumen sensibus. La liturgia e i sensi del corpo*, Roma: CLV - Edizioni Liturgiche.
- Vanni Rovighi S. (1973), *Introduzione a Tommaso d'Aquino*, Roma-Bari: Laterza.

Analysis Of The Influence Of Firm Size, Liquidity, And Leverage On Financial Distress

(Empirical Study on Transportation Sector Companies Listed on the Indonesia Stock Exchange in 2018-2021)

Jalu Aditya Nur Rochman¹, Noer Sasongko²

^{1,2} Muhammadiyah of Surakarta University

DOI: 10.29322/IJSRP.12.10.2022.p13020
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13020>

Paper Received Date: 18th August 2022
Paper Acceptance Date: 24th September 2022
Paper Publication Date: 6th October 2022

Abstract- Financial distress is a condition that shows the stage of decline in the company's financial condition that occurred before bankruptcy or liquidation (Plat and Plat, 2002, in Almilia, 2006). Thus, the purpose of this study is to analyze and seek empirical evidence regarding the effect of firm size, liquidity, and leverage on financial distress. The population used in this study is the transportation sub-sector companies listed on the Indonesia Stock Exchange during the 2018-2021 period. Samples were taken using purposive sampling with the final result obtained 42 samples that are ready to be processed by multiple linear regression analysis using SPSS 26 software. The results of this study indicate that leverage has an effect on financial distress in transportation sub-sector companies listed on the Indonesia Stock Exchange during the 2018-2021 period. Meanwhile, company size and liquidity have no effect on financial distress in transportation sub-sector companies listed on the Indonesia Stock Exchange during the 2018-2021 period.

Index Terms- financial distress, firm size, leverage, liquidity, transportation

I. INTRODUCTION

Economic conditions or developments are always changing which can affect a company's performance. One company with another company carries out very tight business competition, causing companies to compete to excel or be able to compete. Competition between companies is certainly a cost incurred by the company. If the company is not able to compete or lose in business competition, the company will experience losses and ultimately result in the company experiencing bankruptcy or financial distress.

Financial distress is a condition that shows the stage of decline in the company's financial condition that occurred before the occurrence of bankruptcy or liquidation (Plat and Plat, 2002, in Almilia, 2006). Bankruptcy is also often called company liquidation or company closure or insolvency. Bankruptcy as a failure is defined as financial failure and economic failure that occurs in the company. (Ramadhani and Lukviarman, 2009).

Financial distress can also be defined as the company's inability to pay financial obligations that have matured. (Beaver et al., 2011).

Damodaran (1997) says that there are several factors that cause financial distress in a company, namely cash flow difficulties, the amount of debt, and losses in the company's operational activities for several years. Financial distress can be experienced by all companies, especially if the economic conditions in the country where the company operates experience an economic crisis. To overcome or minimize the occurrence of bankruptcy in the company, the management must supervise the company's financial condition by using financial statement analysis (Ramadhani and Lukviam.an, 2009).

A transportation service company is a business field that provides transportation services or the transfer of goods or people with certain distances and modes used. The transportation sector is one of the sectors listed on the Indonesia Stock Exchange. In Indonesia, transportation is very important and plays a role in people's lives as a supporter of community activities because Indonesia has a fairly large area and has an effect on the Indonesian economy. However, due to several factors, one of which is the COVID-19 pandemic, many transportation sector companies have gone bankrupt. In this study, researchers focus more on three factors that influence financial distress, namely firm size, liquidity, and leverage.

The first factor that affects financial distress is the size of the company. Company size is a scale which can be classified as the size of the company in various ways, including the total assets of the company, log size, stock market value, and others. The size of the company can be measured by the total assets / large assets of the company by using the calculation of the logarithmic value of total assets (Hartono, 2015: 254). Aspects of company size are very influential on financial distress because from this it can be seen whether the company can survive in the face of losses.

The second factor that affects financial distress is liquidity. The liquidity ratio can be used to predict the occurrence of financial distress. The liquidity ratio is the ability of a company to meet its short-term obligations in a timely manner (Irham, 2014:121). Liquidity shows the ability of an entity to cover the company's current liabilities by utilizing its current assets. A company can be said to be liquid if the company can settle its short-term obligations

when it matures, but if the company cannot settle its short-term obligations when it matures, then the company is said to be illiquid or illiquid.

Companies that have a high level of liquidity indicate that the company has a number of current assets that are ready to pay off short-term debt so that the company can avoid financial distress conditions (Carolina et al., 2017). According to Kasmir (2017: 130), the liquidity ratio is a ratio used to measure how liquid a company is. By comparing the components on the balance sheet, namely total current assets with total current liabilities (short-term debt). The assessment can be carried out for several periods so that it involves the development of company liquidity from time to time.

The third factor that affects financial distress is leverage. Leverage is the use of debt or loan funds that are used to increase returns or profits. The leverage ratio measures how much the company is financed with debt. A company is said to have a high level of leverage, if the number of assets owned by the company is less than the total assets of its creditors. The greater the leverage ratio, the higher the risk of the company defaulting to creditors. The use of debt that is too high can harm the company because it will fall into the category of extreme leverage, namely the company is in a high level of debt and it is difficult to release the debt burden (Irham, 2015: 127).

II. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 Literature Review

a. Financial Statements

Financial statements describe the financial condition and results of operations of a company at a certain time or period of time. Financial reports are a medium that can be used to assess the company's achievements and economic conditions (Harahap, 2011). Financial statements can also be defined as reports that show the company's current financial condition or within a certain period, what is meant by the current condition of the company is the company's current condition, namely the company's financial condition at a certain time (for the balance sheet) and a certain period (for the income statement).) (Kasmir, 2014).

b. Company Size

Company size is a scale used to indicate how much assets a company owns to be used to finance its operational activities. The larger the size of the company, the greater the number of assets owned by the company.

c. Liquidity

Liquidity or often called the working capital ratio is a ratio used to measure how liquid a company is (Hery, 2015). In addition, liquidity can also be defined as a ratio that describes or a ratio that can be used to measure the company's ability to meet its short-term obligations that have matured.

d. Leverage

Leverage is a ratio used to measure how much debt is used in company spending (Sudana, 2015). In addition, leverage can also be interpreted as a ratio used to measure how far or how much the company has been funded or financed by debt. Leverage ratio

measures the extent to which the company finances its business by comparing its own funds (shareholder equity) that have been deposited with the amount of loans from creditors (creditors) (Raharjaputra, 2009).

e. Financial Distress

Financial distress is a condition of the company's inability to pay its financial obligations at maturity which causes the company's bankruptcy. The condition of the company's inability to pay its obligations can occur because the company is not able to manage and maintain stable financial performance, causing the company to experience operational losses and net losses for the current year (Darsono & Ashari, 2005).

2.2 Hypothesis Development

a. The Effect of Firm Size on Financial Distress

Company size is a scale that determines the size of a company that shows how big the total assets and capital owned by a company can be used to finance its operational activities (Setiawan, Oemar, & Pranaditya, 2017). Financial distress is the inability of a company to fulfill financial obligations that have matured in a timely manner which can lead to bankruptcy (Darsono & Ashari, 2005). The larger the size of a company, of course, it has a large number of assets, with a large number of assets, the company will be better able to solve the financial problems faced by the company and maintain its business continuity. However, a large company size can also make it easier for companies to obtain funding. so that later the greater the level of debt will cause the company difficulty in paying off the debt in the future so that it can cause financial distress. Previous research stated that the size of the company has an effect on the level of financial distress. The larger the size of the company, the possibility of financial distress that will be experienced by the company will decrease.

Companies with positive growth provide a sign that the company is growing and reduces the possibility of financial distress (Rahmawati & Khoiruddin, 2017). Based on the description above, the first hypothesis proposed in the study is: Previous research stated that the size of the company has an effect on the level of financial distress. The larger the size of the company, the possibility of financial distress that will be experienced by the company will decrease. Companies with positive growth provide a sign that the company is growing and reduces the possibility of financial distress (Rahmawati & Khoiruddin, 2017). Based on the description above, the first hypothesis proposed in the study is: Previous research stated that the size of the company has an effect on the level of financial distress. The larger the size of the company, the possibility of financial distress that will be experienced by the company will decrease.

Companies with positive growth provide a sign that the company is growing and reduces the possibility of financial distress (Rahmawati & Khoiruddin, 2017). Based on the description above, the first hypothesis proposed in the study is: Companies with

positive growth provide a sign that the company is growing and reduces the possibility of financial distress (Rahmawati & Khoiruddin, 2017). Based on the description above, the first hypothesis proposed in the study is:

H1: Firm size has an effect on financial distress.

b. Firm Size has an Effect on Financial Distress

The liquidity ratio shows the extent to which the company's ability to meet short-term financial obligations that have matured by utilizing the company's current assets (Raharjaputra, 2009). The greater the ratio of current assets to current liabilities, the higher the company's ability to cover its short-term liabilities. So the more liquid a company indicates the company is able to pay its maturing obligations and the less likely the company is to experience financial distress. However, liquidity that is too high cannot be said to be good, because there is a possibility that too high liquidity in the company's current assets contains uncollectible receivables. Previous research stated that liquidity has a negative effect on financial distress, If the company is able to finance and pay off its short-term financial obligations at maturity with well-available current assets, the potential for the company to experience financial

distress will be smaller (Hastuti, Triyono, & Achyani, 2014). Based on the description above, the second hypothesis proposed in the study is:

H2: Liquidity affects financial distress.

c. The Effect of Leverage on Financial Distress

Leverage describes the relationship between the company's debt to capital and assets. This ratio can see how far the company is financed by debt or external parties with the company's ability described by capital (Sartono, 2000). A company that relies too much on debt funds will result in greater liabilities in the future, and this will result in the company being vulnerable to financial difficulties or financial distress. The smaller the leverage, the better and safer for a company. Previous research stated that leverage has an effect on financial distress. Companies with debt that are greater than their total assets generally have negative equity, high leverage indicates a company's financial distress (Ananto, Mustika, & Handayani, 2017). Based on the description above, then hypothesis third proposed in the research are:

H3 : Leverage has an effect on financial distress.

III. METHODOLOGY

This type of research is a quantitative research. The population in this study is the financial statements of transportation companies listed on the BEI. The sampling technique used in this research is purposive sampling. Based on the sample selection, obtained 14 companies that meet the criteria in order to obtain 56 observational data and performed outliers as much as 6 data to obtain 50 observational data. The criteria used in the selection of the sample are as follows: (1) Transportation companies listed on the Indonesia Stock Exchange for the period 2018-2021; (2) Companies that have complete company data for the period 2018-2021; (3) Companies that use Rupiah in their financial statements; (4) Transportation companies that have an Altman Z-Score value of less than 1.1 or are said to be experiencing financial distress, Companies that have a value between 1.1 2.6 or are in the gray area and companies that have a Z-score value of more than 2.6 are selected as samples in this study. In other words, companies that experience and do not experience financial distress; (5) Companies that make financial statements in Rupiah (Rp). Data analysis in this study used multiple linear regression analysis with the help of SPSS 26 program, with operational definitions of variables as follows: Variable Operational Definition Table

Variable	Operational definition	Formula
Company Size (X1)	The company is able to show how big the size of the company is	Company Size = Ln Total Assets
Liquidity (X2)	Measuring the company's ability to pay obligations that must be met immediately with its current assets, namely total current assets with total current liabilities (short-term debt).	Current Ratio = Current Assets / Current Liabilities
Leverage (X3)	Measuring how much the company's assets are financed by debt or how much the company's debt affects asset management	Debt Ratio = Total Liabilities / Total Assets
Financial Distress(Y)	It is possible that the company is experiencing financial difficulties or is about to experience financial difficulties.	Z = 6.5 WC/TA + 3.26 RE/TA + 6.72 EBIT/TA + 1.05 MVE/BVD
This publication	is licensed under Creative Commons Attribution CC BY.	

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13020>

IV. RESULT AND DISCUSSION

4.1 Result

Test	N	K-SZ	Tolerance	VIF	Sig.
Normality	50	0.270			
Multicollinearity	50				
Company Size (X1)			0.994	1.006	
Liquidity (X2)			0.802	1.247	
Leverage (X3)			0.799	1.252	
Heteroscedasticity	50				
Company Size (X1)					0.784
Liquidity (X2)					0.840
Leverage (X3)					0.477
Auto correlation					2.038

Source: Data processed, 2022

Table of Multiple Linear Regression Analysis Test Result

Variable	Regression Coefficient	Tcount	Sig	Note:
Constanta	-18.518	-1,785	0.081	
Company Size	0.905	2,381	0.021	H1 accepted
Liquidity	0.085	0.224	0.824	H2 rejected
Leverage	-10,321	-8,750	0.000	H3 accepted
R2 = 0.700		Fcount=	35,798	
Adjusted R2 = 0.681		Sig =	0.000	

Source: Data processed, 2022

4.2 Discussion

a. The Effect of Firm Size on Financial Distress

Based on the t-test conducted, it obtained a significant value of 0.021 < 5%, so H1 is accepted, which means that the size of the company has an effect on financial distress. Company size is the size of the company can be measured by total assets or

company assets by using the calculation of the logarithmic value of total assets (Hartono, 2012). Companies belonging to the category of large companies will definitely be different from small companies in dealing with company problems, moreover the total assets owned are also different, so different policies will be determined. The size of the company also greatly influences the condition of the company on the economic policies carried out by the government. The results of this study are in line with previous research conducted by Rahmawati, D & Khoiruddin, M.

b. Liquidity Effect Against Financial Distress

Based on the results of testing the second hypothesis, the results for significant value of $0.824 > 5\%$, so H2 is rejected, which means that liquidity has no effect on financial distress. The liquidity of a company can be defined as the ability. The results of this study indicate that liquidity has no effect on financial distress. According to Kusuma (2017) liquidity cannot be total measure is caused by two things. First, the company's failure collect receivables from the parties. Second, there is a transfer of current assets which is more focused on the return of its long-term obligations and neglecting its short-term obligations. The higher the current ratio cannot be a benchmark for decreasing the level of financial distress so that the possibility or potential for the company to experience financial distress will Getting lower. The results of this study support the research conducted by Septiani (2019) that liquidity has an effect on financial distress.

c. The Effect of Leverage on Financial Distress

Based on the results of testing the third hypothesis, the results for significant value of $0.000 < 5\%$, so H3 is accepted, which means that leverage has an effect on financial distress. Leverage ratio is a ratio used to measure the company's long-term ability to meet its obligations (Ross et al., 2015). A high leverage ratio can lead to high financial risk, where this risk arises because the company has to bear large interest as well. The leverage variable has a positive effect on financial distress. According to the author, in carrying out its operations, the company does not use much funding from debt, so that with low debt, the possibility of the company's default is also low. Thus, the less financial distress occurs. The results of this study support research conducted by Ananto, Mustika & Handayani (2017) that leverage has an effect on financial distress.

V. CONCLUSION

Based on the research that has been done, it can be concluded that company size and leverage have an effect on financial distress in transportation companies listed on the IDX during the 2018-2021 period. Meanwhile, liquidity has no effect on transportation companies listed on the IDX during the 2018-2021 period.

REFERENCES

- Ananto, R., Mustika., & Handayani, D (2017). Effect of Good Corporate Governance (GCG), Leverage, Profitability and Company Size on Financial Distress in Consumer Goods Companies listed on the Indonesia Stock Exchange. *Dharma Andalas Economics & Business Journal* Vol 19 No.1 January 2017.
- Hastuti, I., Triyono, & Achyani, F (2014) Analysis of the Effect of Ownership Structure and Company Characteristics on the Possibility of Financial Distress. Thesis. Muhammadiyah Surakarta university.
- Rahmawati, D & Khoiruddin, M (2017) The Effect of Corporate Governance and Financial Performance in Predicting Financial Distress Conditions. *Management Analysis Journal* 6(1) 2017.
- Septiani, YA, & Fauzan (2019) Analysis of the Factors Affecting the Level of Financial Distress. Thesis. Muhammadiyah Surakarta university.
- Tjahjono, A., & Novitasari, I. (2016) Financial Ratio Analysis to Predict Financial Distress Conditions. *Widya Wiwaha College of Economics Business Studies*, 24(2), 131-143
- Burhanuddin, Ahmad, et al. 2019. Analysis of the Effect of Liquidity, Leverage and Sales Growth on Financial Distress. *UNIMUS Seminar Student Proceedings Vol.2 (2019): 2654-766X*
- Carolina, V., Marpaung, EI, & Primary, D. (2018). Financial Ratio Analysis to Predict Financial Distress Conditions (Empirical Study on Manufacturing Companies Listed on the Indonesia Stock Exchange Period 2014-2015). *Maranatha Journal of Accounting*, 9(2), 137-145.
- Simanjuntak, C., Titik, F., & Aminah, W. (2017). Effect of Financial Ratio Against Financial Distress (Study on a Transportation Company) Listed on the Indonesia Stock Exchange). *E-Proceedings Of Management*, 4(2)
- Urdi Anza, Anjasmara. (2020) Effect of Liquidity, Leverage, Profitability and Company Size on Financial Distress in Manufacturing Companies Listed on the IDX in 2016-2018. Thesis. Semarang State University.

AUTHORS

First Author – Jalu Aditya Nur Rochman, Muhammadiyah of Surakarta University, b200180209@gmail.com

Second Author – Noer Sasongko, Muhammadiyah of Surakarta University, ns243@ums.ac.id

Correspondence Author – Jalu Aditya Nur Rochman, b200180209@gmail.com

Repetitive Loss of Pregnancy in First Trimester

Dr. Deepa Sethiya

DOI: 10.29322/IJSRP.12.10.2022.p13021
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13021>

Paper Received Date: 20th August 2022
Paper Acceptance Date: 24th September 2022
Paper Publication Date: 6th October 2022

I. INTRODUCTION

Around 15 to 25 percentage of pregnancies experience an identifiable clinically (documented via histopathological or ultrasound test) the loss of physiological conditions. RCOG defines continuous physiological condition loss as the loss of more than 3 consecutive pregnancies after 20 weeks or less and an average vertebrate weight of 500 grams. ASRM defines continuous loss of pregnancy as 2 or more failed clinical pregnancies. It is possible that less than five percent of women experience two consecutive miscarriages only one suffers three or more. the risk of recurring miscarriage after two losses are around twenty-nine in comparison to thirty third for women who have three or more losses.

II. HOW COMMON IS RPL?

It is a problem that affects one in every 100 Chronicles and a significant portion of people. Prevalence ranges between zero.6% and 2.3% among couples. Nearly five hundredth of patients suffering from RPL the root reason is not known.

RISK FACTORS

- * Maternal age > 30 years
- * Maternal BMI > 30
- * Age of Paternal Grandparents > 40 years
- * Endocrine disruptors
- * Smoking, drinking, substances
- * Exposure to radiation
- * Exposure to pesticides, environmental toxins DDT Cleansing chemicals
- * Exposure to gaseous anesthetics.

III. CAUSES OF CONTINUAL MISCARRIAGES

1. Immunologic – automobile immune

- Primary antiphospholipid syndrome (PAPS)
- The secondary antiphospholipid syndrome (SAPS)Disseminated lupus thematosus, reaction to conditions
- Any type of autoimmune disorder, e.g. autoimmune diseases, may result in an abnormal immune response to physiological conditions

2. Immunologic – Alloimmune (Currently classified as Unexplained)

- The mother's system normally tolerates the vertebrate graft which is not native. In the absence of this tolerance, it can end in miscarriage. this could happen because of the immunotolerance.
- The mucous membrane. It can be seen as:
- Protein production abnormalities Lack of shift of Th1 to Th2 response
- The absence of Alpha V beta three integrins
- An increase in the levels of neoplasm death issue alpha (TNF) in the mucous membrane
- Female internal reproductive organs are growing more Natural Killer cells
- The phagocytes have a low repressive capacity. Cytokines (MIC)
- The simultaneous chronological order of organic processes and the window of Implantation as seen in PCOD and PCOD results in bad implantation and miscarriage

3. Genetic

- Fetal abnormal condition , translocations that are balanced, inversions, deletions duplicates
- Skewed activation of X Chromosome and Fragile X syndrome
- Single cistron defects e.g. Alpha Thalassemia, Retts syndrome etc.

4. Hormonal

- Female reproductive organs females are polycystic. syndrome
- Progesterone receptor cistron polymorphism & phase defects
- Hyperandrogenism
- Hypothyroidism/hyperthyroidism
- Hyperprolactinaemia
- Females with low AMH/poor reserve of the internal reproductive organ
- Adrenal hyperplasia/Addison's unwellness
- Vitamin D deficiency uncontrolled diabetes

5. Cum Factors

- A high level of sperm cell DNA index of fragmentation
- Male system infections

6. Infections

- Genital microorganism vaginosis, chlamydia, latent infectious disease.
- Chronic subclinical inflammation that is diagnosed with more plasma cells in the mucous membrane.

- Abnormal female internal reproductive organ microbiome -Non lactobacilli dominated microbiome.
- Lyme's disease, systemic VD and infection and the brucellosis.

7. General Conditions

- Hypertension
- Unwellness of the organs that excret it.
- Unwellness in the respiratory organs of the chronically ill
- Heart unwellness
- Severe macaque sensitisation
- Other conditions that are associated with RPL area unit anaemia of the red blood cells Steinert's Disease autosomal dominant disorder Homocystinuria, Hemofil deficiency, dysfibrinogenemia and Ehlers Danlos syndrome

IV. INFECTIONS

More severe forms can lead to an ongoing loss of physiological health e.g. microorganism vaginosis organ infection and non-specific microorganisms that cause inflammation after interventions like dilatation and operations. There is increasing evidence that alteration in the microbiome in the mucosa and canal could result in failure of implantation and miscarriages. While microbiome testing remains to be a tool for exploration and is not available within the clinical se-weight unit, probiotics such as lactobacilli may play a role in the correction of the female's intestinal reproductive system microbiome. General infections that are a part of the body like brucellosis as well as Lyme's illness and infections are also linked to miscarriages that are not atypical. They're extremely rare and are diagnosed through positive medical science when suspected. There is no evidence to suggest that infections can cause the loss of a physiological condition that is recurrent. Therefore it's not necessary to conduct regular TORCH examination or screening for sex organ infection screening isn't required for RPL.

V. GENETIC CAUSES

PARENTAL body REARRANGEMENTS

In a group, 2-5% of RPL occurs due the balanced translocations of parents. Balanced translocations can be described as translocated in a reciprocal manner or Robertsonian. When translocations are reciprocal, the body's parts split and reconnect at various places in the same way. Within the Robertsonian translocations, two body structure chromosomes bind near the region of structure, with the being rid of the arms with short arms. In all of the above translocations, the genetic material changes however the content is the same which means that they are typically traditional. The child could be considered to be traditional, but could also be the keeper of a balanced translocations, and the pregnancy is terminated by miscarriage, or the baby is born with multiple non-heritable abnormalities due to changes in the body.

VI. EMBRYONIC BODY ABNORMALITIES

They are caused by anomalies in the egg the sperm cell, egg or. the most frequent type is aneuploidies, monosomies, or trisomies.

A strong connection is observed with the maternal age. This can lead to accidental miscarriages.

VII. IMMUNOLOGICAL CAUSES

Antiphospholipid protein syndrome (APS) is is the most common immunologic explanation for persistent miscarriage. It's the most widely accepted method since the treatment isn't concerned. Antibodies are directed at charged phospholipids that constitute the main component of the membrane. They can cause impairment in performance of the tissue layer, irregular placental function, and placental occlusion or pathology. This could result in the development of cardiovascular disease in pregnant women, intrauterine growth slowdown (IUGR) and intrauterine vertebrate deaths and ongoing miscarriage. Every first trimester of pregnancy, losses and later third-trimester losses can occur. There is sometimes a confirmation by ultrasound of a valid physiological condition prior to the physiological loss occurs in the majority of trimester losses. The diagnosis of APS is determined by the presence of a single clinical criterion, and one-laboratory criteria, which must be positive twice months (12 weeks) separated.

VIII. CLINICAL CRITERIA

1. A few deaths that are not explained of a traditional morphological vertebrate that is more than 10 weeks gestation, confirmed through ultrasound or by direct examination.
2. Preterm births or other preterm births within or prior to 34 weeks of gestation due to severe pre-eclampsia or uterine insufficiency accompanied by evidence of IUGR;
3. Three or more consecutive miscarriages prior to 10 weeks' gestation, with the absence of any maternal secretion anatomical anomalies and conventional vertebrate genetic testing, and other causes of continuous losses that are being completely ruled out.

IX. LABORATORY CRITERIA

1. Lupus medicine using PTT, APTT, or DRVVT
2. Anticardiolipin antibodies
3. anti-lipoid antibodies that block lipoid synthesis
4. Opposing beta Two conjugated Protein antibodies
5. Ant phosphatidylserine antibody

Autoimmune diseases, including general autoimmune diseases general induration and response blood disorder are associated with miscarriage on a regular basis and are typically classed as secondary antiphospholipid syndrome (or SAPS). The causes of loss, and consequently the area of treatment is similar to that of primary APS.

The use of steroids is not recommended based on current evidence. A combination of anodyne low dosage as well as low relative molecular mass or unfractionated anticoagulant currently provides the most beneficial physiological result. Anticoagulant therapy isn't only associated medicine, it's also a potent anti-complement repressant that's effective in preventing the injury of the complement mediate during APS syndrome. Anodyne should be initiated before conception and then anticoagulant if there is the

bioassay is positive and continued until birth. The post-partum thromboprophylaxis should be administered for two weeks to avoid deep vein obstruction.

In the event of SAPS caused by general Lupus erythematosus the anti-inflammatory (HCQ) is used with a high success rate across all conditions. It's introduced in the preconception dosage and continues throughout the normal course of life at a dosage of 4100 mg every day or twice daily during eating. It's a physiological condition class C drug that manages all unwellness activities and can trigger in physiological conditions. It also helps prevent Stokes-Adams' syndrome in vertebrates. Blood vessel Immunoglobulins (IVIG) medical assistance is suggested for females who have a history of miscarriages and secondary miscarriages. very high amounts of antibodies when treatment with anodyne and a low molecular mass anticoagulant does not work to prevent a physiological loss.

X. AUTOIMMUNITY

Patients with any type of autoimmune disorder are susceptible to miscarriage due to the alteration of the T regulatory cells as well as natural killer cells in the mucous membrane. Therefore, the conditions of response should be controlled prior to deciding about a physiological state.

XI. UNEXPLAINED

Five hundredth of the continual miscarriages could not be explained with the help of standard physical activity. But, if we choose to examine all POCs using CGH microarray, we're likely to find a cause for miscarriage in more than 90 percent of patients.

XII. MANAGEMENT

Investigation Escher 2018

Screening for genetic influences To analyze the genetics of the tissue of a physiological condition the use of array-based comparative genomic interbreeding (array-CGH) is recommended.

ALPA : Antiphospholipid antibody (lupus medicine (LA) and anticardiolipin antibodies [ACA LgG and IgM[ACA IgG and IgM]),

B2 conjugated I antibody to protein

Screening for immunological issues: HLA determination, Antinuclear antibodies

Endocrinological abnormalities: Thyroid stimulating hormone (TSH)/diabetes/mellitus/prolactin/pcos syndrome

TORCH: Not counseled

XIII. TREATMENT

1. Progesterone's role in pregnancy - a brief proof to prevent miscarriage in women who have a history of miscarriage (RCOG) and according to consensus-based on mostly

recommendations, there is a reduction in the risk of miscarriage through the use of didrogestrone.

2. There is a small amount of evidence to suggest intralipid medical assistance for women who have a mystery RPL (ESHRE 2018).
3. There's a limited amount of evidence that suggests the leukocyte colony stimulating problem (G-CSF) for women suffering from unknown RPL (ESHRE 2018).
4. A woman who has chronic physiological conditions, they should to be screened for the products of conception using Array CGH for genetic anomalies. If a woman has a continuous abnormal miscarriages IVF using PGD or gametocyte donations are recommended.
5. Aspirin, a low dose anticoagulant, has been tested in response to to causes. It is preconceptual and remain until delivery, however the evidence is not there.
6. IVIg
7. Glucocorticoids
8. Deficiency in sustenance D3 must be rectified and should receive a regular dose of sixty thousand units of sustenance D3 daily throughout the physiological state.
9. Probiotics can be beneficial in the treatment of subclinical inflammation since they improve the female internal reproductive organ mycobiome , and produce lactobacilli dominating, which favors implantation.
10. Diet A vegetarian diet helps management response disorders. Eliminating food that triggers response disorders like eggs, protein dairy, soya, and even meat help to lessen the effect of the response.
11. The immunomodulation of dydrogesterone may provide some benefits.
12. Endocrinologic assessment - thyroid stimulating hormone Prolactin, Hyperglycemia, Prolactin targeted surgical or medical correction.
13. A tender adoring touch with support scans when in the beginning of a physiological condition can be effective in decreasing stress levels. In their study Brigham et al reported that hearing a heartbeat after a half dozen weeks of physiological conditions resulted in seventy-eight percent of the physiological conditions to persist thus, the heartbeat at 8 weeks led to ninety-eight of pregnancies continuing. This helps maintain the right level of protein in the mucous membrane. It also prevents the possibility of miscarriage.
14. Complementary therapies, such as treatments, reflexology, and other treatments for stress relief can also be attempted
15. Eliminating alcohol and smoking, and increasing the body mass index will benefit not only miscarriage but also the risk to a subsequent physiological condition.

AUTHORS

First Author – Dr. Deepa Sethiya

Correspondence Author – Author name, email

Ovulation Induction

Dr DEEPA SETHIA

(Sr Consultant OBS & GYNAE), Director: Getwell Nursing Home , Greater Faridabad Haryana

DOI: 10.29322/IJSRP.12.10.2022.p13022
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13022>

Paper Received Date: 18th August 2022
Paper Acceptance Date: 24th September 2022
Paper Publication Date: 6th October 2022

I. INTRODUCTION

OI medications can be used to promote the growth of dominant follicles. They may also act as estrogen antagonists or reduce insulin sensitivity. Laparoscopic ovarian drill (LOD), can be used as a second-line treatment for this condition.

General Physiology

About 25% of cases involving female infertility are caused by ovulatory disorders. A complex feedback mechanism is required to mature an oocyte. This requires coordination between the anterior pituitary and hypothalamus. Infertility patients often present with dysregulation in one or more of these pathways. This can lead to ovarian dysfunction and even ovarian failure.

Infertility Workup

Table 1
WHO Classifications of ovulatory dysfunction

Group	Gonadotropin levels	Estrogen secretion	Cause
I	Low	Low	Hypothalamic-pituitary failure
II	Normal	Normal	Hypothalamic-pituitary-ovarian axis failure
III	High	Low	Ovarian failure

Medications Used for OI

Clomiphene Citrate

To ensure that there aren't any underlying conditions, such as endocrine disorders, a complete evaluation must be done before initiating infertility treatment. A complete history of your menstruation, obstetrics and surgeries should be taken during the consultation. Also, any current medication or drug use that could affect fertility must also be assessed. A laboratory evaluation will include an assessment of thyroid function, hormonal levels, estrogen levels on day 3, day 21 and sexually transmitted infection, as well as hormone levels for ovarian function. Tubal patency can be confirmed by saline-infusion sonohysterograms or hysterosalpingograms. As approximately half of infertile couples are male, it would be negligent not to examine the men's semen.

Classification of Ovulatory Dysfunction

The World Health Organization (WHO) has developed a classification system to help with infertility. Gonadotropin levels and estrogen levels determine ovarian insufficiency.

Mechanism and Clinical Outcomes

Clomiphene citrate (CC) has been used to treat oligomenorrhea and anovulation for the past 40 years. It is a selective estrogen receptor modulator (SERM). CC competes with natural estrogen's receptors in the pituitary and hypothalamus,

interfering with negative feedback signalling. CC binds more strongly to the estrogen receptors of the hypothalamus than natural estrogen for a longer time, blocking estrogen replenishment in that area. GnRH, FSH, and other hormones are released in a hypoestrogenic state. This makes it essential that the HPO axis is

intact to ensure a proper response to CC administration. An excessive amount of FSH can cause the ovary hyper stimulated, causing multiple follicles and a number of follicles.

Ovarian Hyperstimulation Syndrome

Dr. Deepa Sethia

GetWell Medicenter, Faridabad

DOI: 10.29322/IJSRP.12.10.2022.p13023
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13023>

Paper Received Date: 19th August 2022
Paper Acceptance Date: 24th September 2022
Paper Publication Date: 6th October 2022

I. INTRODUCTION

Ovarian hyperstimulation syndrome (OHSS) is an iatrogenic side effect associated with assisted reproductive technology. The disorder is defined by enlargement of cysts in the ovaries, as well as fluid movement from the intravascular space to the third space due to an increase in capillary permeability as well as ovarian neoangiogenesis. The cause of the condition is being treated with human gonadotrophin chorionic (hCG). OHSS is very rare without the use of hCG. Its effect on the overall wellbeing of patients may be extremely detrimental and even tragic cases have been documented. The link with hCG OHSS is believed to be controlled by an increase in the expression of the angiogenic molecules VEGF. The frequency in moderate OHSS is thought to range somewhere between 3 to 6 percent, however the more severe form could be seen in 0.1-3 percent of cycles. OHSS is recognized in two different forms: The initial type that is OHSS, (within days after the ovulation-triggering injection of HCG) however, despite being triggered by hCG is linked to an overexaggerated response of the ovarian to gonadotrophin stimulation. On the other hand, the latter type (10 days following the injection of hCG)(after 10 days after hCG) [1 2] is linked to the secretion of the placental hCG.

II. PATHOPHYSIOLOGY

The underlying cause of OHSS is not known, however it is thought to be related to increased vascular permeability in area surrounding the ovaries as well as their vasculature. [3] The key is an equilibrium of proangiogenic and antiangiogenic elements present in the follicular fluid. B-hCG and its derivatives estrogen, estradiol prostaglandins, prolactin and histamine are all involved in OHSS however, it is becoming increasingly clear that vasoactive substances like interleukins, tumor necrosis factor (TNF)- α endothelin-1, and VEGF produced by the ovaries are associated with increasing the permeability of vascular blood vessels. [4]

III. PRIMARY RISK FACTORS

Factors that are likely to increase responses to stimulation of the ovary comprise an early age and a history of an elevated response to gonadotrophins, prior OHSS or polycystic Ovarian Syndrome (PCOS). [5]

IV. SECONDARY RISK FACTORS

Numerous Ovarian response parameters have been examined to determine their ability to determine the progression of OHSS and [6] which include absolute levels, or the rate of rise in Follicular volume, serum E2, the number and size of oocytes that have been collected.

V. CLINICAL FEATURES

- Abdominal pain, nausea, and vomiting
- Ascites and tension
- Peritonitis, whether generalized or localized.
- Acute abdominal pain
- Hypotension or hypovolemia
- Dyspnea
- Hypercoagulable state
- Electrolyte imbalance
- Acute renal failure

VI. CLASSIFICATION

Grades of OHSS are as follows [2]:

Mild OHSS

- Grade 1: Abdominal Distention, and discomfort
- Grade 2: Grade 1 Disease with nausea, vomiting or diarrhea, and/or the ovarian enlargement ranging from 5 to 12 cm. Moderate OHSS
- Grade 3 - Characteristics of moderate OHSS and the ultrasonographic proof of ascites

Severe OHSS

- Grade 4 - Symptoms of moderate OHSS, plus evidence of ascites or breathing difficulties and hydrothorax.
- Grade 5-All of these, plus an increase in blood volume, an increase in blood viscosity as a result of hemoconcentration, coagulation issues as well as a decrease in renal perfusion function.

VII. PREVENTIVE MEASURES:PRIMARY PREVENTION

Reducing exposure to gonadotrophins

- A. Cycle cancellation
- B. Coasting ("Soft landing") when high risk patients show an increase in (>3000 pg/mL) serum levels of estradiol

and high numbers (>20 per Ovary) of follicles stimulated gonadotrophin therapy, it can be reduced or stopped maintaining GnRH antagonist administration.

- C. Modification of the trigger for ovulation agent: Even though reliable information aren't available, it's possible that doses of hCG less than 10,000 or 5000 IU typically used could trigger adequate maturation of oocytes and reduce the risk of OHSS. Replacing hCG with either endogenous or exogenous LH as an ovulation trigger can significantly impact the risk of developing early forms of OHSS. Endogenous LH surge may be caused through the administration of a quick-acting GnRH antagonist. This can only be achieved in the absence of pituitary desensitization caused through the GnRH antagonist. Combination with antagonists remains possible.
- D. Administration of macromolecules Albumin administration. Administration of albumin on a regular basis can disrupt the progression of OHSS through increasing the plasma pressure oncotic and binding mediators from ovarian origin.
- E. All embryos can be frozen for cryopreservation: Instead of cancelling the cycle, it's also possible to inject HCG to reclaim the oocytes as well as freeze the embryos.
- F. GnRH antagonists - GnRH antagonists (GnRHa) are linked to an increased prevalence of OHSS. [7]
- G. The avoidance of hCG is for the support of the luteal phase
- H. in vitro maturation

For patients who are at a high risk for developing OHSS, in vitro maturation (IVM) of oocytes provides the potential to be a powerful tool to aid in OHSS prevention. Although it has many advantages for safety, IVM is not yet widespread due to the lower rate of live births as compared to conventional IVF. However, the clinical outcomes have been improving in recent years, and pregnancies of between 20 and 54 percentage have been recorded. [8]

I. Dopamine agonist administration

Cabergoline blocks VEGF receptor 2 phosphorylation level and the vascular permeability that is associated with it, but without affecting luteal angiogenesis. This reduces its incidence 'early'(within nine days following hCG) time of onset of OHSS. Although cabergoline is not used however, the OHSS prevalence could be up to 10.8% [9]

J. Nonsteroidal anti-inflammatory administration

A large-scale RCT showed that low-dose aspirin is linked to a reduction in OHSS prevalence (0.25 percent vs.8.4 percent) in a high-risk population with comparable pregnancy rates. 10. Meloxicam could reduce in the OHSS and ovarian burden as well as the expression of VEGF in a model animal. [11]

Treatment based on degree of hyperstimulation

Mild hyperstimulation

The treatment for OHSS is to be supportive, if needed. The mild ovarian hyperstimulation could develop into severe or moderate illness particularly if there is a chance of conception. So, women suffering from mild diseases should be watched for an increase in abdominal size and weight gain that is sudden and

abdominal pain in an ambulatory manner for at least two months or till menstrual bleeding is observed.

Moderate hyperstimulation

Treatment for moderate OHSS is based on observation, rest and providing adequate fluids and sonographic examination of the sizes of cysts. Concentrations of electrolytes in serum, hematocrits, and creatinine levels must also be examined.

A lower intake or output than 1000 mL/d, or a difference in fluid balance that is greater than 1000 mL/d are an indication of concern. The first sign of resolution for OHSS is evident when the cysts shrink as shown in two consecutive ultrasonographic studies and when the clinical signs disappear. However, the early detection of progress to the severe version of the disorder is characterized by a constant weight increase (>2 pounds/day) or a rise in the severity of symptoms that are already present or the appearance of new signs (eg diarrhea, vomiting and dyspnea). [13]

Severe hyperstimulation

Severe OHSS isn't often seen, but it can be risky. The severe and critical types of OHSS can be fatal as well as a history-taking and physical examinations are essential in the moment of admission. In the majority of clinical scenarios patients need to rest on their beds. Every day physical examination should include measuring the patient's weight as well as abdominal girth. The fluid balance should be evaluated every four hours.

Treatment of hyperstimulation that is severe is aimed at maintaining blood volume in the intravascular. In parallel, the aim is to restore the shaky electrolyte and fluid balance, reducing the secondary effects of ascites as well as hydrothorax, and preventing thromboembolic complications.

The most important treatments are for fluid management and the correction of hypovolemia. The first step is rapid infusion of intravenous normal Saline. Dextrose 5percent in normal saline, or normal Saline is infused at an amount of between 125 and 150 mL/h. This is followed by four hour tabulations for urine output. If the production of urine improves or is restored the maintenance program is implemented. The patient is examined for any clinical symptoms of excessive hydration. If urine output is not satisfactory Hyperosmolar intravenous therapy may be suggested by the infusion of 200mL of human albumin at 25. Diuretics are used for patients suffering from low production of urine and hypovolemia is ineffective and potentially dangerous. [13]

To avoid thrombosis Heparin ranging from 5000-7500 U/day is administered on the day of admission. The dose is removed after sufficient mobilization has been completed.

To manage ascites, ultrasonographic-guided paracentesis is indicated if the patient has severe discomfort or pain or if she has pulmonary or renal compromise.

Critical hyperstimulation

Critical OHSS could be caused by renal failure, hepatic damage, thromboembolic phenomenon, ARDS and multiorgan failure. Management and treatment is a need for the most intensive care in a critical care unit.

Resolution

After a few days, the third-space fluid is beginning to return to the intravascular space. Hemoconcentration decreases, and natural diuresis occurs. The intravenous fluids are tapered when

the amount of oral fluid consumed by the patient increases. A complete resolution usually takes between 10 and 14 days after the onset of the initial symptoms.

Surgical care

OHSS tends to self-limit the illness. Thus, treatment should be limited and targeted to the symptoms. Medical therapy is sufficient for the majority of patients. Women suffering from severe symptoms typically require medical treatment that is intensive. Surgery is required only in the most extreme circumstances like the event of tear-up in the cyst, an ovarian tumor and/or internal hemorrhage.

Prognosis

The outlook is favorable when OHSS is moderate or mild. In cases of severe OHSS the prognosis can be positive if proper treatment is offered.

VIII. RECOMMENDATIONS

- If gonadotrophin stimulation to induce an ovulation-inducing effect is necessary it is recommended to use "friendly" stimulation protocols aimed at (SOFT) one Ovarian Follicles. low-dose step-up routine and step-down regimens, the using antagonists, and using blood as well as sonographic monitoring of the the ovarian response.
- The ovulation trigger hCG should be replaced by more secure methods such as rLH or endogenous GnRH-surge with an antagonist.
- In IVF/ICSI, the concept of getting as many oocytes as is possible should be replaced with gentler stimulation strategies aiming at less Oocytes that are of high quality.
- In the event of a risk, patients should be aware of the possibilities including cancelling, coasting or freezing embryos to be used for replacement later on.
- When symptoms of OHSS are observed patients must be informed in a timely manner and hospitalization must be considered when there is a slight improvement.
- The patients require an ward in a hospital in which there is a clinical image recognized and the staff has the expertise to treat and follow-up. Admission to an intensive-care unit is required in the event that critical OHSS is observed.
- The recording of every case of severe OHSS and their results must be made mandatory for all ART programs. It should be mandatory following every ovulation induction.

REFERENCES

- [1] 1. Abramov Y, Elchalal U, Schenker JG. Severe OHSS: An 'epidemic' of severe OHSS: A price we have to pay? *Hum Reprod.* 1999;14:2181–3. [[PubMed](#)] [[Google Scholar](#)]
- [2] 2. Golan A, Ron-el R, Herman A, Soffer Y, Weinraub Z, Caspi E. Ovarian hyperstimulation syndrome: An update review. *Obstet Gynecol Surv.* 1989;44:430–40. [[PubMed](#)] [[Google Scholar](#)]
- [3] 3. Morris RS, Paulson RJ. Ovarian derived prorenin-angiotensin cascade in human reproduction. *FertilSteril.* 1994;62:1105–14. [[PubMed](#)] [[Google Scholar](#)]
- [4] 4. Elchalal U, Schenker JG. The pathophysiology of ovarian hyperstimulation syndrome-views and ideas. *Hum Reprod.* 1997;12:1129–37. [[PubMed](#)] [[Google Scholar](#)]
- [5] 5. Lee TH, Liu CH, Huang CC, Wu YL, Shih YT, Ho HN, et al. Serum anti-mullerian hormone and estradiol levels as predictors of ovarian hyperstimulation syndrome in assisted reproduction technology cycles. *Hum Reprod.* 2008;23:160–7. [[PubMed](#)] [[Google Scholar](#)]
- [6] 6. Delvigne A, Rozenberg S. Epidemiology and prevention of ovarian hyperstimulation syndrome (OHSS): A review. *Hum Reprod Update.* 2002;8:559–77. [[PubMed](#)] [[Google Scholar](#)]
- [7] 7. Forman RG, Frydman R, Egan D, Ross C, Barlow DH. Severe hyperstimulation syndrome using agonists of gonadotrophin-releasing hormone for *in vitro* fertilization: A European series and a proposal for prevention. *FertilSteril.* 1990;53:502–9. [[PubMed](#)] [[Google Scholar](#)]
- [8] 8. Sukuikkari AM. *in-vitro* maturation: Its role in fertility treatment. *Curr Opin Obstet Gynecol.* 2008;20:242–8. [[PubMed](#)] [[Google Scholar](#)]
- [9] 9. Carizza C, Abdelmassih V, Abdelmassih S, Ravizzini P, Salgueiro L, Salgueiro PT, et al. Cabergoline reduces the early onset of ovarian hyperstimulation syndrome: A prospective randomized study. *Reprod Biomed Online.* 2008;17:751–5. [[PubMed](#)] [[Google Scholar](#)]
- [10] 10. Varnagy A, Bodis J, Manfai Z, Wilhelm F, Busznyak C, Koppan M. Low-dose aspirin therapy to prevent ovarian hyperstimulation syndrome. *Fertil Steril.* 2010;93:2281–4. [[PubMed](#)] [[Google Scholar](#)]
- [11] 11. Quintana R, Kocpcow L, Marconi G, Young E, Yovanovich C, Paz DA. Inhibition of cyclooxygenase-2 (COX-2) by meloxicam decreases the incidence of ovarian hyperstimulation syndrome in a rat model. *Fertil Steril.* 2008;90(4 Suppl):1511–6. [[PubMed](#)] [[Google Scholar](#)]
- [12] 12. Whelan JG, 3rd, Vlahos NF. The ovarian hyperstimulation syndrome. *Fertil Steril.* 2000;73:883–96. [[PubMed](#)] [[Google Scholar](#)]
- [13] 13. Speroff L, Fritz M. 7th ed. Philadelphia, Pa: Lippincott Williams and Wilkins; 2004. *Clinical Gynecological Endocrinology and Infertility*; pp. 1999–200. [[Google Scholar](#)]
- [14] 14. Navot D, Bergh PA, Laufer N. Ovarian hyperstimulation syndrome in novel reproductive technologies: Prevention and treatment. *Fertil Steril.* 1992;58:249–61. [[PubMed](#)] [[Google Scholar](#)]

AUTHORS

First Author – Dr. Deepa Sethia, GetWell Medicenter, Faridabad

Evaluation of thyroid hormones in Alopecia Areata in Iraqi patients

Dr. Mohammad S. Nayaf*, Dr. Ehssan Dawood Muckhlif**, Dr. Abdul Karim Abdul-Jabbar khalaf***, Dr. Wisam Suhail Najem****

* MD,DDV,PhD

** M.B.Ch.B,H.D.D.V

*** M.B.Ch.B,H.D.D.V

**** M.B.Ch.B, F.I.C.M.S

DOI: 10.29322/IJSRP.12.10.2022.p13024

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13024>

Paper Received Date: 18th August 2022

Paper Acceptance Date: 24th September 2022

Paper Publication Date: 6th October 2022

Abstract- Alopecia is a general term for hair loss. Alopecia areata is a common cause of non-scarring hair loss that can occur at any age. It usually causes small, coin-sized, round patches of baldness on the scalp, although hair elsewhere such as the beard, eyebrows, eyelashes, body and limbs can be affected. In some people larger areas are affected and occasionally it can involve the whole scalp (alopecia totalis) or even the entire body and scalp (alopecia universalis).

It is not possible to predict how much hair will be lost. Regrowth of hair in typical alopecia areata is usual over a period of months or sometimes years, but cannot be guaranteed. The chances of the hair regrowing are better if less hair is lost at the beginning.

Most people, with only a few small patches get full regrowth within a year. If more than half the hair is lost then the chances of a full recovery are not good. The hair sometimes regrows white, at least in the first instance. Most people get further attacks of alopecia areata. In alopecia totalis and alopecia universalis, the likelihood of total regrowth is less.

Hair is lost because it is affected by inflammation with main cause of this inflammation is unknown but it is believed that the immune system, may attack growing hair. The disease of alopecia areata is considered more affected by autoimmune diseases such as thyroid disease, although the risk of developing these disorders is still very low.

In present study aimed To identify the correlation between thyroid function in alopecia areata patients and compare it with healthy control. And determined the prevalence of alopecia areata according to gender.

A Case control study carried out at the outpatient clinic of dermatology department in Salah Aldeen general hospitals during the period from 1st of October 2018 to 30th of April 2019. We selected 100 patients included 50 patients with alopecia areata as a cases and compared with 50 normal person. Then thyroid function test of cases was compared with that of equal number of age and sex matched healthy controls.

The result of study revealed a total of 100 patients were enrolled in both case and control groups. Mean age of case and control groups were 24.30±6.80 the most prevalent age group was <18 years 39%. The prevalence of thyroid disorder was significantly higher in alopecia areata group (34%) as compared to the control group (14%) (P=0.001).

The Conclusion of this study found a significant association between alopecia areata and thyroid dysfunction.

I. INTRODUCTION

Alopecia areata (AA) is a chronic autoimmune disease of the hair follicles and sometimes affected nails. It is characterized by non-scarring alopecia and can affect any hair-bearing area of the body. The loss of scalp and body hair by interruption of their synthesis, though without destruction or atrophy of the follicles and consequently can be reversible. The onset may be at any age and there is no known race or sex preponderance.¹

The affected skin that may be slightly reddened but otherwise appears normal. Short broken hairs (exclamation mark hairs) are frequently seen around the margins of expanding patches of alopecia areata.²

The most common pattern is a small annular or patchy bald lesion (patchy alopecia areata), usually on the scalp, that can progress to total loss of scalp hair only (alopecia totalis), and total loss of all body hair (alopecia universalis).³

This skin disease can begin at any time of life and the peak of incidence between 20 and 50 years of age, and other articles affirm 60% of the patients present the first episode of the disease before 20 years of age.² and according

to several study founded more than 70% of the cases occurred between 10 and 25 years., although it has been observed that with relation to the severe forms, 63% occur in men and 36% in women.⁴

Alopecia areata accounts for 2% of the first dermatological consultations in the United Kingdom and United States. as documented by several large epidemiological studies from Europe, North America, and Asia, the prevalence of alopecia areata in the early 1970s was reported to be between 0.1% to 0.2% with a life time incidence of 1.7%.^{5,3}. A follow-up study of this population form 1990–2009 found that the cumulative incidence increased almost linearly with age and that the lifetime incidence of alopecia areata was 2.1% .⁶

Some studies show that the prevalence seems to shift to women in patients >45 years of age¹. And another no sexual dichotomy. Most studies report no significant differences in the age of onset, duration, or type of alopecia areata by sex or ethnicity.⁷

The aim of study :

Identify the correlation between thyroid function test and alopecia areata and compare it with healthy control.

Objective

1.Evaluate the serum thyroid hormones (throxine) (T4), triiodothyronoie (T3) and thyroid stimulating hormone (TSH) level in both study groups (alopecia areata) and control group.

2.Identify the prevalence of alopecia areata according to gender.

II. PATIENTS AND METHODS

Ethical consideration

- Agreement of MOH-Iraq, and Salah Alden directorate of health.

The collection of data was kept confidential and not be divulged except for the purpose of the study.

The Participant's agreement will be considered and they will be informed that the participation is voluntary and they can withdraw from the study after having agreed to participate

A written informed consent from each participant was obtained after explaining the study objectives and prior to the start of data collection.

Study Design, Study setting and Study population

Hospital based case control study was conducted in Salah Alden general hospitals during the period from 1st of October 2018 to 30th of April 2019. The researcher visited the hospitals 5 times a week from 8:30 a.m. to 1:30 p.m. for four months .Target population in this study was the people who lived in Salah Alden governorate with different aged.

: *Data collection tools*

The data were collected by the researcher using the following tools :

Questionnaire

The questionnaire was prepared by the researcher. The data requested included: age, sex, and level of education, residency, occupational history, and family history of disease, history of systemic diseases (hypertension, DM, coronary artery disease (CAD), and AF, duration of disease and history of thyroid disorders.

About the past medical history regarding the systematic disease, the patient was regarded as positive history if the condition had been previously diagnosed by specialist physician, or if he was receiving medicine specified to the disease.

Physical examination

Physical examination was performed by the researcher for each patient .

Inclusion criteria

Cases:

Patients with (a alopecia areata) diagnosed by the consultant dermatology or dermatologists in dermatology department of Salah Alden general hospital.

Controls

Patients attending to the same hospital of the cases and without previous history of alopecia areata. Those participants matches the alopecia's cases in gender and age (± 5 years)

Exclusion criteria

Cases

- a) Patients not residing in Salah Alden governorate .
- b) Secondary type's alopecia areata
- c) Patients with any chronic diseases (like asthma, diabetes mellitus) or on chronic medication (like cortisone)
- d) Any Psychotic patients

.Those patients of chronic and critical disease were not include by the researcher for two reasons, ethically and scientifically. Ethically because those patients are tired and psychologically disturbed .

Laboratory investigations

A- Thyroid function test

This is done by measuring thyroid hormones level in blood that included
thyroxine (T4)
triiodothyronine (T3)
thyroid stimulating hormone (TSH) level

Collection of Blood Sampling

The patients in the word should be overnight fasting 12 hours then a sample of venous blood was drawn from the anticubital vein using disposable syringes by expert paramedical staff and taken 5 ml of blood from patients .
The blood samples were coded and sent to the lab of the hospital for testing the samples, then the results registered on the laboratory form to the patients' case sheet.

Methods

.Kit name was (ichromax)

Principal and procedure: after taken blood sample from patient, we separation blood serum by centrifuge and taken 0.75 ml by specific tube (small green tube) and added it to specific material in yellow tube after that mixed the material with serum and shaking it for 10 time, and put 0.75 ml from mixture on white slide, enter the slide to advice for 8 min for T3 and T4 but TSH 12 min. at temperature 20c. We calculated that by specific device and record the reading.

Statistical Analysis

The data were reviewed, cleaned with double check entry into the computer using Statistical Package for Social Sciences (SPSS) version 20; then, it was coded by the researcher under supervision of the academic supervisor and statistician .

- The data presented as frequency and percentages tables, pie and bar charts were used also.
- A chi – square test was performed to assess relations between categorical variables.
- T-test was used for testing significance of difference between different numerical variables.
- A level of p – value equal to or less than 0.05 was considered significant, while odds ratio (OR) with its 95% confidence interval (CI) was calculated.then had their blood tested for S. cholesterol , S.TG, and other lipid profiles tests and A1c. After completion of all anthropometric measures and blood tests. Subjects completed the demographic questionnaire.

III. RESULTS

The current study included 100 patients, 50 of them were suffering from alopecia areata to be compared with 50 normal individual. Out of total sample 55% were females and 45% were male.)Figure 1 (

The age of study sample included three category, the most prevalent age group was <18 years 39% and 34% at age 18-35 years, while the least was more than 35 years (27%) (figure 2).

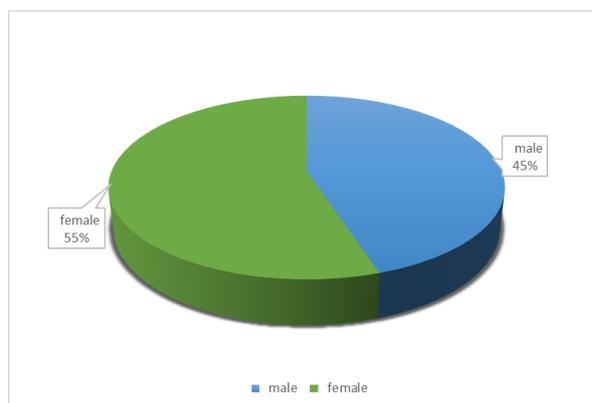


Figure 1: Distribution of study sample according to gender. N=100

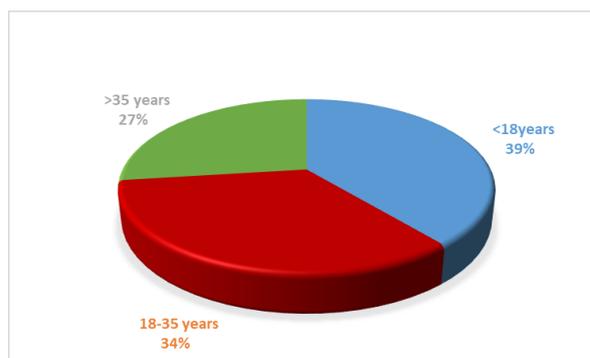


Table 1: Distribution of study sample according to sociodemographic characteristic

		group		Total
		case	control	
Age	<18years	17	22	39
	18-35 years	18	16	34
	>35 years	15	12	27
Total		50	50	100
Pearson Chi-Square 8.460a df=2		p=0.634		
		group		Total
		case	control	
Sex	male	24	21	45
	female	26	29	55
Total		50	50	100
Pearson Chi-Square 0.364		df=1		p=0.546
		group		Total
		case	control	
education	educated	18	13	31
	Non-educated	32	37	69
Total		50	50	100
Pearson Chi-Square 1.169		df=1		p=0.280
		group		Total
		case	control	
occupation	yes	31	23	54
	no	19	27	46
Total		50	50	100
Pearson Chi-Square 2.576		df=1		p=0.108

Figure 2: Distribution of study sample according to age. N=100

The current study also showed a difference in family history among cases groups; as the positive family history of cases' was 28% and 72% negative family history. While the duration of disease among patients of alopecia were 62% for less than one years and 38% with history of duration to more than years.

Regarding to severity of disease the study showed 68% have sever disease and 32% have mild to moderate disease. But the types of alopecia was most prevalent multilocularis (46%).as shown in table 2

Table 2: Distribution of study sample according characteristic of disease.

		Frequency
Family history	+ve	14 (28%)
	-ve	36 (72%)
	Total	50
		Frequency
duration	<1year	31 (62%)
	>1years	19 (38%)
	Total	50
		Frequency
severity	Mild –moderate	16 (32%)
	Sever	34 (68%)
	Total	50
		Frequency
Types	unilocularis	11 (22%)
	multilocularis	23 (46%)
	Totalis	10 (20%)
	Universalis	6 (12%)
	Total	50

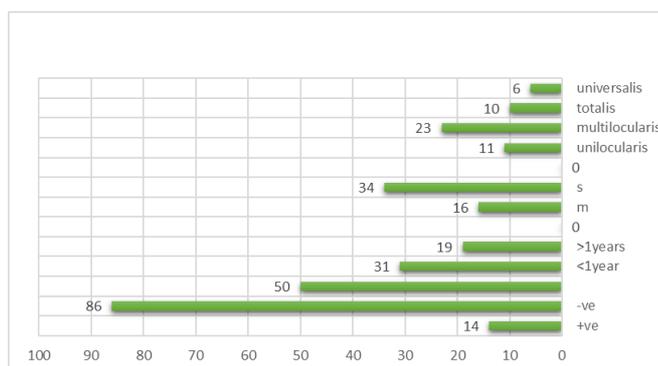


Figure 3: Distribution of study sample according characteristic of disease.

In a comparison of thyroid function test (TSH.T4.T3)between the study groups; the result of study showed increase abnormal level of TSH more in case group than among control group without significantly associated with alopecia areata ($p < 0.211$) and $OR = 0.506(0.157-1.63)$, while abnormal T3 level was found in the case group more than those who did not have alopecia areata so the chance of alopecia areata is among the case groups more than control group with a statically significant association ($p = 0.001$) and $OR = 0.316 (0.851-0.117)$

Regarding to abnormal T4 level was found in the case group more than those who did not have alopecia (normal group)but without any a statistically significantly associated ($p = 0.211$)and $OR = 0.352 (0.114-1.088)$.

Table 3: Relation between thyroid function test and groups (case and control)

		group		Total
		case	control	
TSH	normal	41	45	86
	abnormal	9	5	14
Total		50	50	100
Fisher's Exact Test =1.202 df= 1 p value = 0.211 OR= 0.506(0.157-1.63)				
		group		Total
		case	control	
T3	normal	33	43	76
	abnormal	17	7	24
Total		50	50	100
Pearson Chi-Square 10.363 df= 1 p=0.001 OR=0.316 (0.117-0.851)				
		group		Total
		case	control	
T4	normal	38	45	83
	abnormal	12	5	17
Total		50	50	100
Fisher's Exact Test =1.202 df= 1 p value = 0.211 OR=0.352 (0.114-1.088)				

Table 4: Relation between TSH and characteristic of disease. N=50

		TSH		Total
		normal	abnormal	
Types	unilocularis	11	0	11
	multilocularis	16	7	23
	totalis	10	0	10
	universalis	4	2	6
Total		41	9	50
Pearson Chi-Square 7.975 df=3 p=0.047				
		TSH		Total
		normal	abnormal	
severity	m	11	5	16
	s	30	4	34
Total		41	9	50
Pearson Chi-Square 2.799 df=1 p=0.094				
		TSH		Total
		normal	abnormal	
duration	<1year	25	6	31
	>1years	16	3	19
Total		41	9	50
Fisher's Exact Test 0.101a df=1 p=0.750				

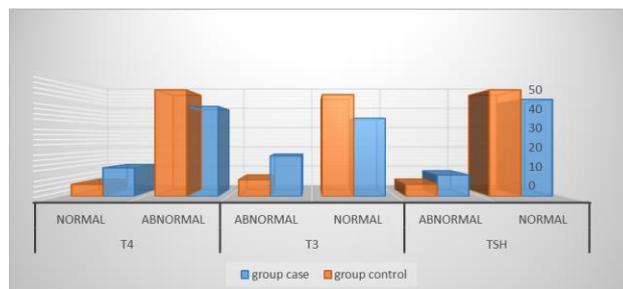


Figure 4: Relation between thyroid function test and groups (case and control).

Regarding to relation of TSH with classification of alopecia, the result of study found significant association between abnormal result of TSH with specific types of alopecia ($p= 0.047$). While the relation to relation of TSH with severity of alopecia, the result of study showed no any significant association between abnormal result of TSH and severity of alopecia ($p= 0.094$).

Also the relation of TSH with duration of alopecia, the result of study found no any statically difference between abnormal result of TSH with duration of alopecia ($p= 0.750$).

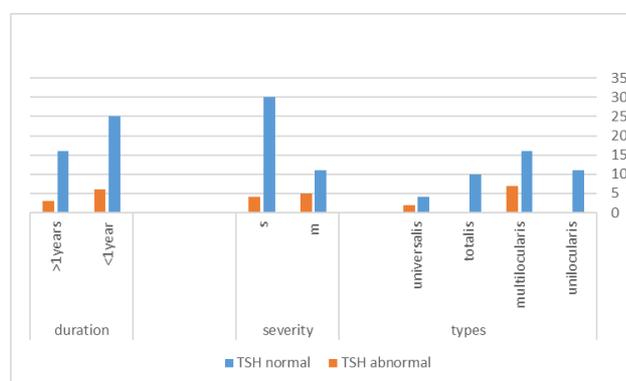


Figure 5: Relation between TSH and characteristic of disease .

Regarding to relation of T3 with classification of alopecia, the result of study found no any significant association between abnormal result of T3 with specific types of alopecia ($p= 0.101$).
 While the relation to relation of T3 with severity of alopecia, the result of study showed a significant association between abnormal result of T3 and severity of alopecia ($p= 0.004$).

Also the relation of T3 with duration of alopecia, the result of study found a statically difference between abnormal result of T3 with duration of alopecia, more than one years in duration ($p= 0.029$)

Table 5: Relation between T3 and characteristic of disease. N=50

		T3		Total
		normal	abnormal	
types	unilocularis	10	1	11
	multilocularis	14	9	23
	totalis	7	3	10
	universalis	2	4	6
Total		33	17	50
Pearson Chi-Square		6.236a df=3 p=0.101		
		T3		Total
		normal	abnormal	
severity	m	6	10	16
	s	27	7	34
Total		33	17	50
Pearson Chi-Square		8.517a df=1 p=0.004		
		T3		Total
		normal	abnormal	
duration	<1year	24	7	31
	>1years	9	10	19
Total		33	17	50
Pearson Chi-Square		4.741 df=1 p=0.029		

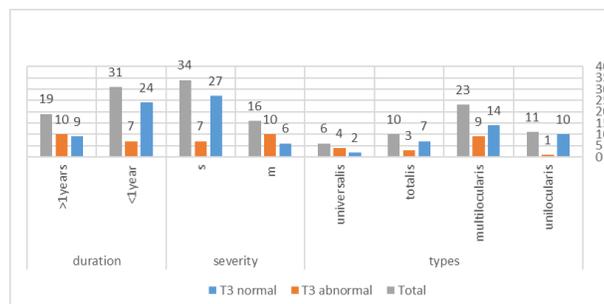


Figure 6: Relation between T3 and characteristic of disease.

Regarding to relation of T4 with classification of alopecia, the result of study found no any significant association between abnormal result of T4 with specific types of alopecia ($p= 0.099$).

While the relation to relation of T4 with severity of alopecia, the result of study showed no any significant association between abnormal result of T4 and severity of alopecia ($p= 0.192$).

Also the relation of T4 with duration of alopecia, the result of study found no any statically difference between abnormal result of T4 with duration of alopecia, ($p= 0.081$).

study also found a significantly higher HbA1c level among acanthosis nigricans patients in comparison to controls ($p<0.001$). This finding is similar to results of Rafalson et al¹ study in USA which stated that acanthosis nigricans is accompanied by 50-100% risk of developing diabetes mellitus and poor glycemic control. Studying demographic characteristics of AN patients in present study showed that mean age of AN patients was 39.4 years. This finding is similar to results of Sharquie et al⁸ study in Iraq which found that mean age of AN patients in Baghdad was 39 years.

Table 6: Relation between T4 and characteristic of disease. N=50

		T4		Total
		abnormal	normal	
types	unilocularis	6	5	11
	multilocularis	18	5	23
	totalis	10	0	10
	universalis	4	2	6
Total		38	12	50
Pearson Chi-Square		6.285	df=1	p=0.099
		T4		Total
		abnormal	Normal	
severity	m	14	2	16
	s	24	10	34
Total		38	12	50
Pearson Chi-Square		1.740	df=1	p=0.192
		T4		Total
		abnormal	normal	
duration	<1year	21	10	31
	>1years	17	2	19
Total		38	12	50
Pearson Chi-Square		3.051	df=1	p=0.081

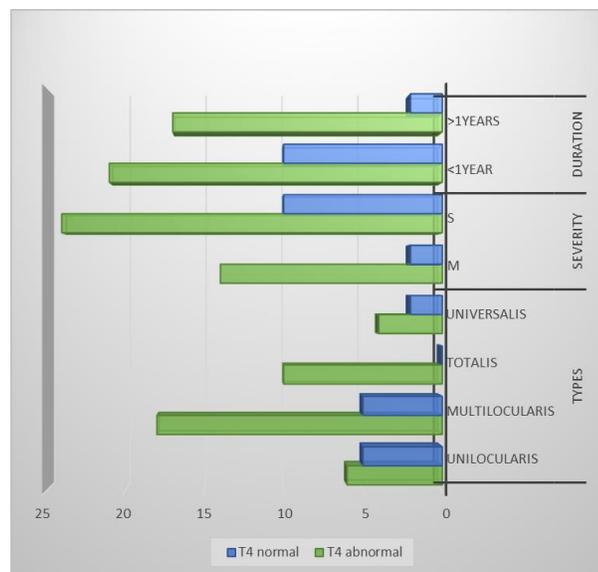


Figure 7: Relation between T4 and characteristic of disease.

IV. DISCUSSION

Alopecia areata is a disfiguring health problem. Most studies conducted in this area were to determine the prevalence of AA and they used the cross sectional design.

The aim of the present study was to identify the effect of thyroid dysfunction on alopecia areata by the case control design was used. The risk factors and causes of alopecia areata was very complex and include factors related to individual autoimmunity, families and society and it depends on cultural patterns in each society .

However, the present study has described the different patterns of alopecia seen among cases of alopecia patients and their relation to thyroid dysfunction, age, sex, and associated conditions. And comparison with a normal population.

Gender factor

In current study gender variable was female more than male, as they consist 55% and 45% respectively from the total sample. Female had higher prevalence of alopecia areata than male as 52% and 48% of total cases (50 patients), but this different it not a

statistically significant level. This result similar to study conducted for 158 adult Chinese patients diagnosed as AA in clinic of dermatology of Jinshan Hospital (2017).

But this result disagree with another study conducted in Nepal (2018).86 Male and female in the AA group were 40 (53.3%) and 35 (46.7%) with male: female ratio being 1.14:1. Similarly, male and female in the control group were 39 (49.4%) and 36 (50.7%) with male and female ratio of 1.08 (P=0.870) .

These variations might be attributed to the difference in settings of these studies , study design as a cross – sectional study. 85

Thyroid function test

The current study shown the prevalence of abnormal thyroid function was double in AA group compared to the control group. This result Similar to study conducted in Nepal (2018)86 and another study from India87 also observed that the thyroid disorder was the systemic disease with highest frequency in AA patients. Likewise, a recent Australian study also reported that almost one fourth (24%) of AA patients had thyroid abnormalities.88 Thyroid dysfunction was also found in AA patients in a study done in Pakistan but its prevalence was half (8.9%) as compared to our study.89

It has been observed that thyroid disease is the most common chronic disease in AA patients, including hypothyroidism, thyroiditis, Hashimoto's disease, Graves' disease, and simple thyroid gland.90

Previous studies have shown that the incidence of thyroid disease ranged from 8% to 28% in AA patients. In China91, thyroid disease occurs in AA patients were rarely reported and the only available data was based on non-controlled studies.

In the current study concentrations of T3, T4 and TSH were detected to evaluate thyroid function for AA patients and normal controls.

We did not find statistically significant differences in concentrations of T4 and TSH between AA patients and natural controls, suggesting no obvious damage. However, there were differences with statistical evidence in T3 concentration indicating a relationship between thyroid function in AA patients (p=0.034) and OR=0.316 (0.851-0.117)

Some researchers found many skin disorders such as AA can see in patients with autoimmune thyroid disease, Independently of thyroid function. Most of the time, there is no relationship between cause and effect, but the link may be part of the same weakness of immunity.92

Duration of disease

In present study, duration of disease (alopecia areata) among selected cases only was 62% less than one years while 38% more than one years. This result similar to study conducted in Korea (2017).56 it was retrospective study for 1137 cases of alopecia areata . That found 68% of cases have duration of disease less than one years while 32% more than one years .

Also another study conducted in Department of Dermatology, Jinshan Hospital of Fudan University in china that found 77% of cases have duration of disease less than one years while 23% more than one years.

In current study showed no any correlation between (TSH level, T4 level) and duration of disease (p=0.750,p=0.081 respectively) Regarding to relation between T3 level and duration of disease the result of study show the level of T3 more abnormal with increase duration of disease more than one year. With significant association (p=0.024) with OR =3.5. However the duration of disease as a risk factors by increase the level of T3 three times more than normal. This result similar to case control study conducted in china 85. (2017)

Severity of disease

In present study we found more than 68% of total cases have sever types of disease and 32% have moderate disease.

In current study showed no any correlation between (abnormal TSH level) and severity of disease (p=0.094) also the relation of abnormal T4 level) and severity of disease was not significant (p=0.192) in spite of the level of T4 was more in sever disease cases 48% than those have mild to moderate disease was 28%.

But the relation of T3 level with severity of disease was more level of abnormal T3 among moderate disease with significant association p=0.004 (OR=1.56).This result agree to study conducted in Nepal (2018)86 that found the relation between thyroid test and AA Severity: abnormal thyroid function test was increased once the AA disease severity grade was increased but they were statistically not significant (p=0.021). However, earlier report suggested that the frequency of thyroid hormone has no clinical correlation with AA severity 93. Serarslan et al. also did not find the correlation between AA disease severity and personal and family history of autoimmune disease 94. Kasumagic et al. compared the frequency of thyroid autoantibodies (TgAb, TPOAb) in 70 AA patients and 30 healthy volunteers. Thyroid functional abnormalities were found in 8 (11.4%) AA patients and positive autoimmune antibodies were associated with AA in 18 (25.7%) patients, with no significant association between the disease severity and presence of these antibodies 95. However, the possible explanation for this different could be the difference in sample size and study setting .

Types of alopecia areata

The present study show 22% of cases have unilocularis alopecia areata. and the most prevalence was multilocularis 46% and (20% ,12% were totalis and universalis respectively). This result similar to study conducted by by Emina Kasumagic- (2008)95. That f ound the most prevalence was also multilocularis 53% and 19% was uniocularis type while the totalis and universalis were (17% and 11% respectively).

Regarding to relation of TSH with classification of alopecia, the result of study found significant association between abnormal result of TSH with specific types of alopecia ($p= 0.047$) the result revealed that abnormal TSH level was more in multilocularis type of alopecia areata while there are no any significant association between classification of alopecia areata and T3,T4 level ($p=0.101$ and $p=0.099$ respectively).

Limitation

The present study has its limitations. Screening for thyroid was based on TSH and T3,T4 which are good markers for the purpose. It was not followed-up with additional tests as many of the patients could not afford the cost. Acanthosis nigricans patients in our study were commonly urban residents. Consistently, Dassanayake et al ¹¹ study in Sri Lanka stated that AN is highly predominant in urban areas with benefit of predicting the metabolic disorders.

V. CONCLUSION

There is significant association of alopecia areata with thyroid dysfunction, as evidenced by increased prevalence of thyroid dysfunction in individuals with alopecia areata compared to the healthy controls. Though thyroid dysfunction was more in individuals with mild to moderate form of alopecia areata.

REFERENCES

- [1] Rantuccio F, Mastrodonato M, Conte A. Area Celsi. Osservazioni personali e revisione della letteratura. *G Ital Dermatol Venereol*. 1995; 130:23-35
- [2] Dawber R. Alopecia areata. *Monogr Dermatol*. 1989; 2:89-102
- [3] Moreno GA, Ferrando J. Alopecia areata. *Med Cutan Ibero Latina Americana*. 2000; 28:294-312
- [4] Dawber RPR, de Berker D, Wojnarowska F. Disorders of hair. In: Champion RH, Burton JL, Burns DA, Breathnach SM, editors. *Textbook of dermatology*. Oxford: Blackwell Science; 1998. p. 2919
- [5] Ferrando Roqueta FJ, Corral Blanco C, Lobo Satue A, Grasa Jordan MP. Estudios clínicos y de laboratorios. Estudio de los fenómenos de estrés y su relación con variables psicopatológicas, clínicas e inmunológicas en pacientes con alopecia areata. *Actas Dermosifiliogr*. 1996; 87:597-609
- [6] Price V. Alopecia areata: clinical aspects. *J Invest Dermatol*. 1991; 96: 685
- [7] Camacho F. Alopecia areata: clinical features. *Dermatopathology*. In: Camacho F, Montagna W, editors. *Trichology: diseases of the pilosebaceous follicle*. Madrid: Aula Medica Group; 1997. p.417-40.
- [8] Buffoli B, Rinaldi F, Labanca M et al. The human hair: from anatomy to physiology. *Int J Dermatol* 2014;53: 331–341.
- [9] De Berker D, Higgins CA, Jahoda C et al. Biology of hair and nails. In: Bologna JL, Jorizzo JL, Schaffer JV, editors. *Dermatology*. 3 ed. Elsevier Saunders Ltd. 2012. pp.1075–1092.
- [10] Cotseralis G, Botchkarev V. Biology of hair follicle. In: Wolff K, Goldsmith LA, Katz SI, editors. *Fitzpatrick's Dermatology in General Medicine*. 7th ed. New York: Mc Graw Hill.2008. pp. 739–749
- [11] Hardy MH. The secret life of the hair follicle. *Trends Genet* 1992;8:55–61
- [12] Paus R, Cotseralis G. The biology of hair follicle. *N Engl J Med* 1999;341:491–497
- [13] Miller SE. Molecular mechanisms regulating hair follicle development. *J Invest Dermatol* 2002;118:216–225.
- [14] Andl T, Reddy ST, Gaddapara T et al. WNT signals are required for the initiation of hair follicle development. *Dev Cell* 2002;2:643–653
- [15] Krause K, Foitzik K. Biology of hair follicle: the basics. *Semin Cutan Med Surg* 2006;25:2–10. *Anatomy and Physiology of Hair* <http://dx.doi.org/10.5772/67269>
- [16] De La Mettrie R, Saint-Leger D, Loussouarn G et al. Shape variability and classification of human hair: a worldwide approach. *Hum Biol* 2007;79:265–281.
- [17] Otberg N, Richter H, Schaefer H et al. Variation of hair follicle size and distribution in different body sites. *J Invest Dermatol* 2004;122:14–19.
- [18] Sperling LC. Hair anatomy for the clinician. *J Am Acad Dermatol* 1991;25:1–17
- [19] Wolfram LJ. Human hair: a unique physicochemical composite. *J Am Acad Dermatol* 2003;48:S106–S114
- [20] Messenger AG, De Berker DAR, Sinclair RD. Disorders of hair. In: Burns T, Breathnach S, Cox N, editors. *Rook's Textbook of Dermatology*. 8 ed. Oxford:Wiley-Blackwell. 2010. pp.66.1–66.16
- [21] Jones LN. Hair structure anatomy and comparative anatomy. *Dermatol Clin* 2001;19:95–103
- [22] Randal VA, Botchkareva NV. The biology of hair growth. In: Ahluwalia GS, editor. *Cosmetic Application of Laser and Light based system*. Norwich, NY: William Andrew 2009. pp. 3–35.
- [23] Blume-Peytavi U, Vogt A. Human hair follicle: reservoir function and selective targeting. *Br J Dermatol* 2011;165:13–17
- [24] Oshima H, Rochat A, Kedzia C et al. Morphogenesis and renewal of hair follicles from adult multipotent stem cells. *Cell* 2001;104:233–245
- [25] Ito M, Kizawa K, Hamada K et al. Hair follicle stem cells in the lower bulge form the secondary germ, a biochemically distinct but functionally equivalent progenitor cell population, at the termination of catagen. *Differentiation* 2004;72:548–557
- [26] Peus D, Pittelkow MR. Growth factors in hair organ development and the hair growth cycle. *Dermatol Clin* 1996;14:559–572
- [27] Christoph T, Müller-Röver S, Audring H et al. The human hair follicle immun system: cellular composition and immun privilege. *Br J Dermatol* 2000;142:862–873
- [28] Stenn KS, Paus R. Controls of hair follicle cycling. *Physiol Rev* 2001;81:449–494
- [29] Kligman AM. The human hair cycle. *J Invest Dermatol* 1959;33:307–316
- [30] Paus R, Foitzik K. In search of the "hair cycle clock": a guided tour. *Differentiation* 2004;72:489–511
- [31] Greco V, Chen T, Rendl M et al. A two-step mechanism for stem cell activation during hair regeneration. *Cell Stem Cell* 2009;4:155–169.
- [32] Paus R. Principles of hair cycle control. *J Dermatol* 1998;25:793–802

- [33] 33.Smoller BR, Horn TD. *Dermatopathology in systemic disease*. Oxford: Oxford University Press, 2001. p. 183-5
- [34] 34.Odom RB, James WD, Berger TG. *Andrews' diseases of the skin*. Philadelphia: W.B. Saunders Company, 2000. p. 943-52
- [35] 35.Lookingbill DP, Marks JG. *Principles of dermatology*. Philadelphia: W.B. Saunders Company, 2000. p. 303-14
- [36] 36.Parker F. *Skin diseases*. In: Goldman L, Bennett JC, editors. *Goldman: Cecil textbook of medicine*. Philadelphia: W.B.Saunders Company, 2000. p. 2293-4.October 2002
- [37] 37.Pimentel ERA. Alopecia areata. Aspectos imunológicos e tratamento pelo DNCB. [Tese]. Universidade de São Paulo; 1988
- [38] 38.Safavi K. Prevalence of alopecia areata in the First National Health and Nutrition Examination Survey (letter). *Arch Dermatol*. 1992; 128:702.
- [39] 39.Rivitti EA. Alopecia areata: revisão e atualização Alopecia areata: a revision and update. *An Bras Dermatol*. 2005;80(1):57-68
- [40] 40.Safavi KH, Muller SA, Suman VJ, Moshell AN, Melton LJ. Incidence of alopecia areata in Olmsted County, Minnesota, 1975 through 1989. *Mayo Clin Proc*. 1995;70:628-33
- [41] 41.Shapiro J, Modani S. Alopecia areata: diagnosis and management. *Int J Dermatol*. 1999; 38:19-24
- [42] 42.Tosti A, Fanti PA, Morelli R, Bardazzi F. Trachyonichia associated with alopecia areata: a clinical and pathological study. *J Am Acad Dermatol*. 1991; 25:266-70.
- [43] 43.Bergner T, Donhauser G, Ruzicka T. Red lunula in severe alopecia areata. *Acta Dermato Venereol (Stockh)*. 1992; 72:203-5.
- [44] 44.Muller SA, Winkelmann RK. Alopecia areata: anevaluation of 736 patients. *Arch Dermatol*. 1963; 88:290-7
- [45] 45.Shellow WV, Edwards JE, Koo JY. Profile of alopecia areata: a questionnaire analysis of patient and family. *Int J Dermatol*. 1992; 31:186-9
- [46] 46.Scerri L, Pace JL. Identical twins with identical alopecia areata. *J Am Acad Dermatol*. 1992; 27:766-7
- [47] 47.Du Vivier A, Munro DD. Alopecia areata, autoimmunity and Down's syndrome. *Br Med J*. 1975; 1:191-4
- [48] 48.Zauli D, Veronesi S, Fusconi M, Lama L, Melino M, Tosti A. Autoantibodies in alopecia areata. *Br J Dermatol*. 1984; 111:247
- [49] 49.Hoffmann R, Eicheler W, Huth A, Wenzel E, Happle R. Cytokines and growth factors influence hair growth in vitro: possible implications for the pathogenesis and treatment of alopecia areata. *Arch Dermatol Res*. 1996; 288:153-6
- [50] 50.Tan, E., Tay, Y.-K., Goh, Ch.-L., et al, 2002. The pattern of alopecia areata in Singapore – a study of 219 Asians. *Int. J. Dermatol*. 41, 748–753.
- [51] 51 .Amin SS, Sachdeva S. Alopecia areata: A review. *Journal of the Saudi Society of Dermatology & Dermatologic Surgery*. 2013 Jul 1;17(2):37-45
- [52] 52.Al-refu K. Scalp Biopsy and Diagnosis of Common Hair Loss Problems. In*Skin Biopsy-Diagnosis and Treatment 2013* Jul 3. Intech Open.
- [53] 53.Olsen, E.A., Hordinsky, M.K., Price, V.H., Roberts, J.L., Shapiro, J., Canfield, D., et al, 2004. National alopecia areata foundation. Alopecia areata investigational assessment guidelines. Part II. National Alopecia Areata Foundation. *J. Am. Acad. Dermatol*. 51, 440–447.
- [54] 54.Ay Se, Kavak, Can, Baykal, Guzin, Ozarmagan, et al, 2000. HLA in alopecia areata. *Int. J. Dermatol*. 39, 598.
- [55] 55.Bark-Lynn Lew, M.D., Min-Kyung Shin, M.D., Woo-Young Sim, 2009. Acute diffuse and total alopecia: a new subtype of alopecia areata with a favorable prognosis. *J. Am. Acad. Dermatol*. 60 (1), 85–93
- [56] 56.Garcia-Hernandez, M.J., 2000. CFM. Atypical clinical forms of alopecia areata. In: Camacho Francisco, M.R., Price Vera, H. (Eds.), *Hair and its Disorders: Biology, Pathology, and Management*. Martin Dunitz, London, pp. 228–231.
- [57] 57.Ragunatha, S., Inamadar, A.C., Palit, A., Sampagavi, V.V., Deshmukh, N.S., 2008. Diffuse nonscarring alopecia of scalp: an indicator of early infantile scurvy? *Pediatr. Dermatol*. 25 (6), 644–646.
- [58] 58.Shimmer, B.P., Parker, K.L., 2001. Goodman's and Gillman's: the Pharmacological Basis of Therapeutics. McGraw-Hill, New York (pp. 1661–1663)
- [59] 59.Hunt N, McHale S. The psychological impact of alopecia. *BMJ*. 2005;331(7522):951-3. Epub 2005/10/22
- [60] 60.Maia CP & Fernandes NC. Tratamento da alopecia areata com corticóide tópico: Estudo prospectivo randomizado duplo cego em crianças. *An bras Dermatol*. 2003; 78:63-71
- [61] 61.Ross, E.K., Shapiro, J., 2005. Management of hair loss. *Dermatol. Clin*. 23, 227–243
- [62] 62.Tosti, A., Piraccini, B.M., Pazzaglia, M., et al, 2003. Clobetasol propionate 0.05% under occlusion in the treatment of alopecia totalis/universalis. *J. Am. Acad. Dermatol*. 49, 96–98
- [63] 63.Dickerman, R.D., Jaikumar, S., 2001. The hiccup reflex arc and persistent hiccups with high dose anabolic steroids: is the brainstem the steroid – responsive locus? *Clin. Neuropharmacol*. 24, 62–64
- [64] 64.Madani, S., Shapiro, J., 2000. Alopecia areata update. *J. Am. Acad. Dermatol*. 42, 549–566
- [65] 65.Buhl AE. Minoxidil's action in hair follicles. *J Invest Dermatol*. 1991; 96(Suppl):73S-4S
- [66] 66.Mohamed, Z., Bhourri, A., Jallouli, A., et al, 2005. Alopecia areata treatment with a phototoxic dose of UVA and topical 8- methoxypsoralen. *J. Eur. Acad. Dermatol. Venereol*. 19, 552–555
- [67] 67.Ellis CN, Brown MF, Voorhees JJ. Sulfasalazine for alopecia areata. *J Am Acad Dermatol*. 2002; 46:541-4
- [68] 68.Joshi SR. Laboratory evaluation of thyroid function. *JAPI* 2011; 59:14
- [69] 69.Larry-Jameson, J., and A. P. Weetman. "Harrison's Endocrinology" (2010)
- [70] 70.Di Lauro R, De Felice M. Thyroid gland: anatomy and development. *Endocrinology*. Philadelphia: Saunders. 2001:1268-78
- [71] 71.Bursuk E. Introduction to Thyroid: Anatomy and Functions. In*Thyroid and Parathyroid Diseases-New Insights into Some Old and Some New Issues 2012* Mar 7. IntechOpen
- [72] 72.Venter JC, Adams MD, Myers EW, Li PW, Mural RJ, Sutton GG, Smith HO, Yandell M, Evans CA, Holt RA, Gocayne JD. The sequence of the human genome. *science*. 2001 Feb 16;291(5507):1304-51
- [73] 73.Roy EW, Sharon YW, Samuel R. Diagnostic Tests of the Thyroid, In: De Groot LJ, Leslie J, Jameson JL et al, eds. *Endocrinology*, volume 2, 5th edition. USA: Elsevier Saunders, 2006, pp1899-1913
- [74] 74.Chonchol M, Lippi G, Salvagno G, Zoppini G, Muggeo M, Targher G. Prevalence of subclinical hypothyroidism in patients with chronic kidney disease. *Clin J Am SocNephrol* 2008;3:1296-300. CrossRef
- [75] 75.Ekins R. Measurement of free hormones in blood. *Endocrine Rev* 1990;1:5-6. –8
- [76] 76.Fitzgerald PA. Endocrinology, Disease of Thyroid gland. In: Maxin AP, Stephen JMP, Lawrence M et al, eds. *Current Medical diagnosis and treatment*, 49th edition. USA: McGraw Hill publication; 2007, pp 1138-1142.
- [77] 77.Koutras DA. Disturbances of menstruation in thyroid disease. *Ann NY AcadSci* 1997;816:280-284. CrossRef

- [78] 78.Welle S, O' Connell M, Danforth E Jr, Campbell R. Decreased free fraction of serum thyroid hormones during the carbohydrate overfeeding. *Metabolism* 1984;33:837-9. CrossRef
- [79] 79.Surks MI, Chopra IJ, Mariash CN, Nicoloff JT, Solomon DH. American Thyroid Association Guidelines for use of laboratory tests in thyroid disorders. *JAMA* 1990;263:1529-32. CrossRef
- [80] 80.Szkudlinski MW, Kazlauskaitė R, Weintraub BD. Thyroidstimulation Hormone and Regulation of thyroid Axis, In: DeGroot LJ, Leslie J, Jameson JL et al, 5eds. *Endocrinology*, volume 2. USA: Elsevier Saunders, 2006. pp1803-60
- [81] 81.Wartofsky L, Dickey RA. Controversy in clinical endocrinology: the Evidence for a narrower thyrotropin reference range is compelling. *J Clin Endocrin Metab* 2005;90:5483-8. CrossRef
- [82] 82.Haarburge D. Thyroid disease: thyroid function tests and interpretation *CMEJ* 2012;30. Available at URL <http://www.cmej.org.za/index.php/cmej/article/view/2515/2432>.
- [83] 83.Safer JD. Thyroid hormone action on skin. *Dermatoendocrinol*. 2011 Jul-Sep;3(3):211-15. doi: 10.4161/derm.3.3.17027.
- [84] 84.Shapiro J, Hordinsky M. Evaluation and diagnosis of hair loss. Callen J, ed. *UpToDate*. Waltham, MA: UpToDate Inc
- [85] 85.You HR, Kim SJ. Factors associated with severity of alopecia areata. *Annals of dermatology*. 2017 Oct 1;29(5):565-70
- [86] 86.Marhatta S, Agrawal S, Mehata KD. Alopecia Areata and Thyroid Dysfunction Association-A Study from Eastern Nepal. *Kathmandu University medical journal (KUMJ)*. 2018;16(62):161-5
- [87] 87.Thomas EA, Kadyan RS. Alopecia areata and autoimmunity: A clinical study. *Indian J Dermatol*. 2008;53:70-4
- [88] 88.Lyakhovitsky A, Shemer A, Amichai B. Increased prevalence of thyroid disorders in patients with new onset alopecia areata. *Australas J Dermatol*. 2015; 56: 103-6
- [89] 89.Ahmed I, Nasreen S, Jehangir U, Wahid Z. Clinical spectrum of alopecia areata and its association with thyroid dysfunction. *J Pak Assoc Dermatol*. 2012;22: 207-12
- [90] 90.Bakry OA, Basha MA, El Shafiee MK, Shehata WA. Thyroid disorders associated with alopecia areata in egyptian patients. *Indian J Dermatol* 2014; 59: 49-55
- [91] 91.Seyrafi H, Akhiani M, Abbasi H, Mirpour S, Gholamrezanezhad A. Evaluation of the profile of alopecia areata and the prevalence of thyroid function test abnormalities and serum autoantibodies in Iranian patients. *BMC Dermatol* 2005; 5: 11
- [92] 92.Jabbour SA. Cutaneous manifestations of endocrine disorders: a guide for dermatologists. *Am J Clin Dermatol* 2003; 4: 315-331
- [93] 93.Cunliffe WJ, Hall R, Stevenson CJ, Weightman D. Alopecia areata, thyroid disease and autoimmunity. *Br J Dermatol* 1969; 81: 877-881
- [94] 94.Serarslan G, Savaay N, Yenin JZ. Is atopy and autoimmunity more prevalent in patients with alopecia areata? A comparative study. *J Eur Acad Dermatol Venereol* 2012; 26: 720-723
- [95] 95.Kasumagia-Halilovia E. Thyroid autoimmunity in patient with alopecia areata. *Acta Dermatovenerol Croat* 2008; 16 123-12

AUTHORS

First Author – Dr. Mohammad S. Nayaf /MD,DDV,PhD

Second Author – Dr. Ehssan Dawood Muckhlif / M.B.Ch.B,H.D.D.V

Third Author – Dr.Abdul Karim Abdul-Jabbar khalaf / M.B.Ch.B,H.D.D.V

Fourth Author – Dr. Wisam Suhail Najem/ M.B.Ch.B, F.I.C.M.S

Affecting Capital Expenditure Allocation to Districts/Cities in The Provinces Of Central Java In 2016-2020

¹Rosalina Ayu Ketrin

²Noer Sasongko

^{1,2} Universitas Muhammadiyah Surakarta

¹b200180189@student.ums.ac.id

²ns243@ums.ac.id

DOI: 10.29322/IJSRP.12.10.2022.p13025

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13025>

Paper Received Date: 19th August 2022

Paper Acceptance Date: 24th September 2022

Paper Publication Date: 6th October 2022

Abstract: The purpose of this study is to analyze the effect of local revenue, general allocation fund, special allocation fund, profit sharing fund, and the remaining budget financing on the capital expenditure of regencies and cities in Central Java Province in 2016–2020. The population in this study was 35 regency/city governments in Central Java Province in 2016-2020. The samples collected in 175 samples from 35 regencies/cities in Central Java were multiplied by 5 years of research observation. The data analysis method uses multiple linear regression analysis with the help of the SPSS 26 program. The results of the study prove empirically that local original income and general allocation funds have a significant effect on capital expenditures, while special allocation funds, profit sharing funds, and the remaining more budgetary funds do not affect capital expenditures.

Keywords: Local Revenue, General Allocation Fund, Special Allocation Fund, Profit Sharing Fund, Remaining Over Budget Financing, and Capital Expenditure.

1. Introducing

The Regional Revenue and Expenditure Budget (APBD) plays an important role in the framework of fiscal decentralization adopted in the regional government system in Indonesia. Local governments must implement policies so that the APBD is realized effectively and efficiently in order to improve public services, which will have an impact as a stimulus for investors to open businesses in the region. This has become a new homework for fiscal financial management, given the different fiscal capacities of each region. The realization of capital expenditures is based on the need for local government infrastructure to support performance and improve public services. The implementation of local government budget management, which has often been used for routine consumptive expenditures, must be changed to productive things such as investment-oriented infrastructure development that will boost regional revenues.

Regulation of the Minister of Finance (PMK) No. 91/PMK.06/2007 concerning the Standard Chart of Accounts (BAS) states that capital expenditure is a budget expenditure used in order to acquire or add fixed assets and other assets that provide benefits for more than one accounting period and exceed the minimum capitalization limit for fixed assets or other assets set by the government. These fixed assets are used for the daily operations of a work unit and are not for sale (Susi and Heru, 2016). In addition, regional revenue can be sourced from local revenue (PAD), balancing funds, and other legitimate income. In Law No.33/2004 concerning Fiscal Balance between the Central Government and Regional Governments, it is stated that local revenue is income obtained by the region which is collected based on regional regulations in accordance with statutory regulations. PAD is one of the factors that greatly influences the allocation of capital expenditures. In addition to local revenue, other sources of local government spending are balancing funds, consisting of general allocation funds (DAU), special allocation funds (DAK), and profit-sharing funds (DBH). The Development Assistance Unit (DAU) is a fund sourced from APBD revenue which is allocated with the aim of an equitable distribution of financial capacity among regions, to fund regional needs in the context of implementing decentralization. Research conducted by Zais (2017) in North Sumatra Province found that general allocation funds had no effect on capital expenditures.

Then, special allocation funds are funds given to regions from the allocation of APBN revenues to fund special activities in accordance with national priorities in the regions. Filma and Sulardi (2018) say that DAK, which is a balancing fund from the center, is used in an effort to improve services to the public according to national priorities. Revenue-sharing funds are funds sourced from APBN revenues that are allocated to regions based on percentage figures to fund regional needs in the context of implementing decentralization. DBH is a potential source of regional income and is one of the basic capital of regional governments in obtaining development funds and meeting regional expenditures that are not derived from PAD other than DAU and DAK. Wandira (2013) said that profit-sharing funds have a significant influence on capital expenditures. Another source of funding for the allocation of capital expenditures is regional revenues from the Budget Financing Excess (SILPA) of the previous fiscal year. According to Permendagri No. 13 of 2006, SILPA is the difference between the realization of budget revenues and expenditures during one budget period. According to Tanjung (2009), the large excess of SILPA can indicate that the government is not right in budgeting the regional budget, so that the excess budgeting should be used to finance several capital expenditure activities that are useful for the provision of public services.

2. Literature Review and Hypothesis Development

Stewardship Theory

Stewardship theory is designed to explain situations where managers act as stewards and act according to owners (Donaldson & Davis, 1989, 1991). In the theory of stewardship, managers will behave in the common interest. The interests of the steward and the owner are not the same. The steward tries to cooperate rather than oppose it because the steward feels mutual interest and behaves in accordance with the owner's behavior. This is a rational consideration because the steward looks more at efforts to achieve organizational goals (Eko Raharjo, 2007).

Theory of Fiscal Federalism

Fiscal federalism is a study that discusses financial relationships between levels of government; in this system, government programs are placed at different levels of government. Fiscal federalism is used as a guide for governments to design finances at the national and subnational levels. A country that tries to apply fiscal decentralization in its government practices fiscal federalism. Basically, what the concept of fiscal federalism means is that the level II government (district/city) is the hand of the central government, or in other words, in some countries, in the form of a federal government where the state government is not an autonomous actor (Prasetya, 2013).

The Effect of Regional Original Income on Capital Expenditure

Regional Original Revenue (PAD) is the main source of regional government, which aims to provide opportunities for regions to maximize funding potential in carrying out their government. The allocation of capital expenditures is adjusted to regional needs and takes into account the PAD obtained. If you want to improve public services and public welfare through capital expenditures, then the regional government must explore the optimal potential of PAD. The local government is also responsible to the community because the community gives some of their money to the local government through taxes, levies, and others. Local revenue can be seen from the ability of local governments to receive mandates that provide information for the central government as well as improve the welfare of the community through the allocation of capital expenditures (Eko Raharjo, 2007). Regional original revenue plays a very important role in the implementation of regional autonomy because PAD is the main source of income for a region. As a source of income, PAD must be used as much as possible for capital expenditure. Thus, PAD has a positive effect on capital expenditures, namely the higher the acquisition of regional original income, the higher the allocation of funds to capital expenditures. Thus, PAD has a positive effect on capital expenditures, namely the higher the acquisition of regional original income, the higher the allocation of funds to capital expenditures. Research (Suryana, 2018; Mundiroh, 2019) shows that Regional Original Income positively affects capital expenditure allocation.

Based on this description, the researchers set the following hypothesis:

H₁: Regional Original Income has a positive effect on Capital Expenditure.

The General Allocation Fund's Impact on Capital Expenditure

Local governments can use financial balance funds from general allocation funds to provide services to the public that are realized through capital expenditures (Susi and Heru, 2016). General allocation funds can show the level of independence of a region. The more general allocation funds received indicate that the region remains heavily reliant on the central government to meet its expenditures. So, the greater the General Allocation Fund received by a region, the greater the capital expenditure that can be allocated by a region. so that the General Allocation Fund has a positive effect on Capital Expenditures. Research conducted by Astuti (2017) states that general allocation funds have a positive effect on capital expenditure. Based on this description, the researchers set the following hypothesis:

H₂: The General Allocation Fund has a positive effect on Capital Expenditure.

Effect of Special Allocation Funds on Capital Expenditures

The Special Allocation Fund is a balancing fund given to local governments to finance special matters, which are regional affairs and national development priorities. The goal is to reduce the cost of special activities that must be borne by local governments (Ardhini, 2011). Utilization of the Special Allocation Fund is directed to development investment activities, procurement, improvement of physical facilities and infrastructure of public services with a long economic life. According to Pohan (2018), the Special Allocation Fund is one source of funding for a capital expense. Therefore, there is a relationship between the provision of transfer funds from the central government (DAK) and the allocation of regional expenditure budgets through capital expenditures. Because with the optimal use of special allocation funds and according to the target, it can improve the quality of public services realized in capital expenditures. The larger the Special Allocation Fund provided by the central government, the greater the provision of public services and public facilities through capital expenditures. Research conducted by Putri (2021) shows that special allocation funds have a positive effect on capital expenditure. Based on this description, the researchers set the following hypothesis:

H₃: The Special Allocation Fund has an effect on Capital Expenditure.

Profit Sharing Fund's Impact on Capital Expenditure

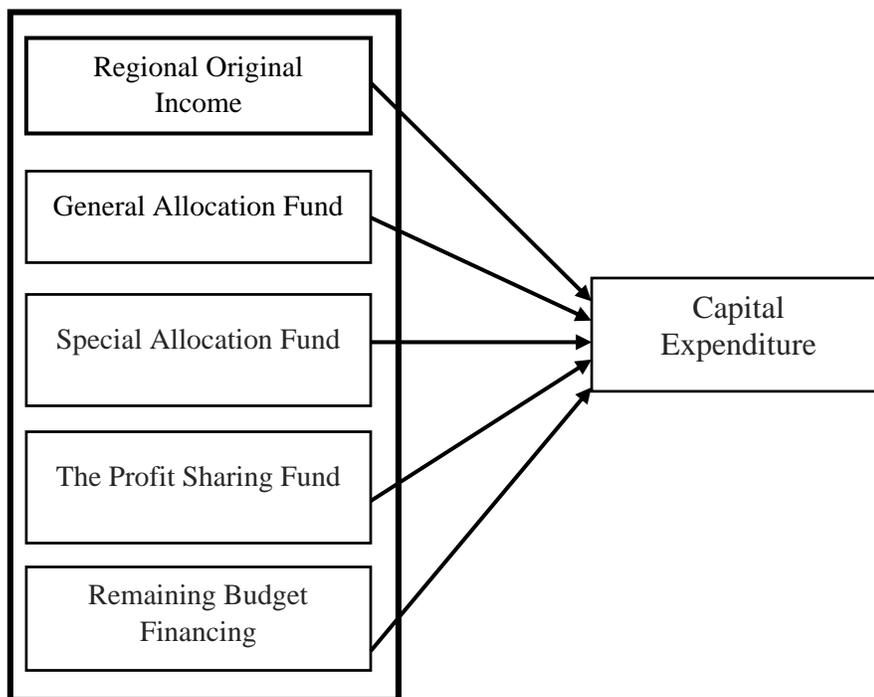
Revenue Sharing Funds (DBH) are funds originating from the APBN which are allocated to regions based on percentage figures to fund regional needs in the context of implementing decentralization. The Revenue Sharing Fund (DBH) transferred by the central government to the regional government consists of 2 types, namely the tax Revenue Sharing Fund and the non-tax Revenue Sharing Fund (Natural Resources). The purpose of the Revenue Sharing Fund is to improve the vertical balance between the center and the regions by taking into account the potential of producing regions. Sources of revenue-sharing revenue from SDA come from petroleum mining, natural gas mining, general mining, forestry, and fishing, as well as geothermal mining. So, the higher the revenue-sharing funds received by the regional government, the allocation of capital expenditures will also increase. The Revenue Sharing Fund is a potential source of regional income and is one of the basic capital of regional governments in obtaining development funds and meeting regional expenditures that are not derived from Regional Original Income (PAD) other than General Allocation Funds (DAU) and Special Allocation Funds (DAK). (Heliyanto and Hadiyante, 2016). Research conducted by Susanti (2016) and Junaedy (2015) shows a positive relationship between profit-sharing funds and capital expenditure variables. The higher the Revenue Sharing Fund (DBH) is obtained, the allocation of capital expenditure will also increase. Based on this description, the researchers set the following hypothesis:

H₄: The Profit Sharing Fund has a positive effect on Capital Expenditure.

The Effect of Excess Budget Financing on Capital Expenditure

According to Kusnandar and Siswanto (2012), remaining budget financing (SILPA) is an indicator that describes the efficiency of government spending. The size of SILPA and the presence or absence of SILPA depend on the level of spending made by the local government and the performance of regional revenues. If income is greater than expenditure, there is a surplus and a higher SILPA is likely to occur. On the other hand, if spending is greater than income, there is a deficit. The remaining excess budget financing can be used for consideration in making direct expenditure allocations and capital expenditures so that regional developments that have not been realized in the previous year or those that have been planned for the relevant year can be implemented. So, the use of SILPA in an area allocated through capital expenditure is expected to be able to improve the quality of human development in the area. According to Ardhini & Handayani (2011), the remaining budget financing has a positive effect on capital expenditure. While research and analysis by Bayu and Samoedra (2016) also convey the same thing, where the remaining excess budget financing has a positive impact on capital expenditure. Based on this description, the researchers set the following hypothesis:

H₅: Excess Budget Financing Has a Positive Effect on Capital Expenditure.



Thought Framework Image

3. Research Method

Population and sample

The population in this research sample is the Regency/City Government in Central Java in 2016-2020. The sampling method in this study used a purposive sampling technique with the following criteria:

- Local governments in Central Java include districts and cities.
- Local governments are defined as regions or cities that publish local government financial reports for the 2016-2020 study period.
- District/City Financial Reports that have been audited.
- District/City Government Financial Reports that present complete data.

Research method

Data analysis was performed using multiple linear regression (Multiple Linear Regression), which is used to determine the effect of local revenue, general allocation funds, special allocation funds, profit sharing funds, and the remaining excess budget financing on capital expenditures. The regression model in this study is formulated with the following equation:

$$BM = \alpha + \beta_1 PAD + \beta_2 DAU + \beta_3 DAK + \beta_4 DBH + \beta_5 SILPA + e$$

Variable Measurement

Dependent Variable

Fixed assets are budget expenditures for the acquisition of fixed assets and other assets that provide benefits for more than one accounting period. Capital expenditure can be measured using the following formula: The measurement uses the formula:

Capital Expenditure = Land Shopping+ Shop equipment and machinery+ Building and Building Shopping+Street Shopping, Irrigation and Networking+ Shop for Other Fixed Assets+ To Purchase Other Assets

Independent Variable

Locally-generated revenue

Regional Original Revenue is the income obtained by the region to be collected based on regional regulations in accordance with statutory regulations. Local revenue in this study is measured using the formula:

Locally-generated revenue = Regional Taxes+Regional Levies+Regional Company Profits+Other Legit Income

Special Allocation Fund

Regional Allocation Funds (DAU) are funds originating from the Central Government taken from the APBN and allocated for the purpose of financial equalization between regions to finance the needs of regional governments in the context of implementing decentralization. The Regional Government uses these funds to provide better services to the public (Nuarisa, 2013). The General Allocation Fund for each region/city can be seen from the balance fund post in the Budget Reality Report (LRA).

The General Allocation Fund

Special Allocation Funds (DAK) are funds sourced from the APBN that are allocated to certain regions with the aim of helping to fund special activities that are regional affairs and in accordance with national priorities (Tuasikal, 2008).

Profit-Sharing Trust

According to Law Number 33 of 2004 concerning Financial Balance between the Central Government and Regional Governments, Article 1 states that Revenue Sharing Funds are funds sourced from APBN revenues allocated to regions based on percentage figures to fund regional needs in the context of implementing Decentralization. DBH can be formulated as follows:

Profit-Sharing Trust = The Tax Revenue Sharing Fund + The Non-Tax Revenue Sharing Fund

Remaining Budget Financing (SILPA)

The remaining excess of budget financing is the remainder of last year's budget or the previous year's budget in the current budget year. SILPA's source of funds comes from the remainder of the previous year's budget. In calculating SILPA, it can be formulated as follows:

SILPA = Surplus Deficit + Net Financing

4. Results and Discussion

Descriptive statistics

Table of Descriptive Statistics Results

Variable	N	Minimum	Maksimum	Mean	Std.Dev
PAD	175	70.472.381.875	2.006.333.418.588	383.464.192.662	272.186.506.809
DAU	175	25.080.208.000	2.437.036.239.000	945.475.893.795	266.111.926.451
DAK	175	383.277.150	728.719.421.174	277.442.534.212	117.355.717.963
DBH	175	17.113.151.303	1.742.718.715.302	65.073.784.452	145.469.206.791
SILPA	175	40.143.795.817	5.452.937.774.926	229.048.374.265	411.169.572.580
BM	175	46.231.933.784	1.275.359.088.966	367.402.681.775	182.369.080.705
Valid N (listwise)	175				

Based on the results of the descriptive statistical test in the table above, it can be interpreted as follows:

- Regional Original Income (PAD) is all regional revenues originating from regional economic sources. Based on the table above, the average amount of PAD in the Regency/City of Central Java Province is 383,464,192,662 with the lowest number being 70,472,381,875 and the highest PAD amounting to 2,006,333,418,588 with a standard deviation of 272,186,506,809 from the average. In the long term, PAD is an important source of revenue for the region, which has a major impact on regional revenues.
- The General Allocation Fund (DAU) is a fund sourced from the State Budget for the purpose of equitable distribution of financial capacity among regions and to fund regional needs in the context of implementing decentralization. Based on the table, the average amount of DAU in the districts/cities of Central Java Province is 945,475,893,795 with the lowest amount being 25,080,208,000 and the highest amount of DAU being 2,437.036,239 with a standard deviation of 266,111,926,451 from the average.
- Special Allocation Funds (DAK) are funds sourced from the APBN that are allocated to certain regions with the aim of assisting special activities that are regional affairs and according to national priorities. Based on the table described above, the average amount of DAK in the districts/cities of Central Java Province is 277,442,534,212 with the lowest amount being 383,277,150 and the highest DAU amounting to 728,719,421,174 with a standard deviation of 117,355,717,963 from the average.
- Revenue Sharing Funds (DBH) are funds sourced from the APBN and then channeled to each region with a percentage of the regional funding in the context of implementing decentralization. Based on the table of descriptive analysis results that have been presented above, the average amount of DBH in the Regency/City of Central Java Province is 65,073,784,452 with the lowest amount of 17,113,151,303 and the highest amount of DBH of 1,742,718,715,302 with a standard deviation of 145,469,206,791 more than the average.
- Excess Budget Financing (SILPA) is the excess difference between the realization of LRA-income and expenditures, as well as receipts and expenditures of financing in the APBN/APBD for one reporting period. Based on the table of descriptive analysis results in this study, the average number of SILPA in the Regency/City of Central Java Province was 229,048,374,265 with the lowest number of 40,143,795,817 and the highest number of SILPA of 5,452,937,774,926 with a standard deviation of 411,169,572,580 from the average.
- A Budget Memorandum (BM) is a budget item to acquire fixed assets and other assets that provide benefits for more than one accounting period. Based on the table above, the average amount of capital expenditure in regencies/cities in Central Java province is 367,402,681,775 with the lowest amount being 46,231,933,784 and the highest total capital expenditure being 1,275,359,088,966 with a standard deviation of 182,369,080,705 from the average. flat.

Hypothesis test

Table of t-test hypotheses

Variable	Regression Coefficient	T-count	Sig	Information
Constant	26822749040,14	0,734	0,464	
PAD	0,368	9,462	0,000	H ₁ accepted

DAU	0,166	3,243	0,001	H ₂ <i>accepted</i>
DAK	0,153	1,377	0,170	H ₃ <i>rejected</i>
DBH	0,052	0,767	0,444	H ₄ <i>rejected</i>
SILPA	-0,024	-0,987	0,325	H ₅ <i>rejected</i>

Effect of Local Revenue on Capital Expenditure

Based on the results of research and analysis that have been carried out, it was found that the hypothesis that states that the original income of the region has a positive effect on capital expenditures is supported. These results are in line with those that have been carried out where the t test states that the significance value of PAD is 0.000, which can be interpreted to mean that the value is less than 0.05. This finding proves that the original income of the region has a positive effect on capital expenditure, which means that the higher the original income of the region received by the region, the greater the capital expenditure that can be allocated by the region. Regional original income is one of the optimization efforts in order to explore the capabilities of an area based on the sources and potential it has (Susanti & Fahlevi, 2016). If the local government is going to allocate a capital expenditure budget, it must be adjusted to the needs of the area by considering the original regional income received (Nuarisa, 2012). This shows that the more local revenues received by the regions, the more the regions can allocate funds for the regional capital expenditure budget. In addition, the higher the original income of the region received, the more it reflects the independence of the region, which means that the area is less dependent on the central government. Local revenue can be seen from the ability of local governments to receive mandates that provide information for the central government as well as improve community welfare through the allocation of capital expenditures (Eko Raharjo, 2007). This is in sync with the concept of *stewardship* theory, where local governments are responsible to the central government to be able to act responsibly, trustworthy, with high integrity, and honestly. The results of this study are in line with research conducted by Zais (2017), Santosa and Rofiq (2013), and Nuarisa (2012) that suggests local income has a positive effect on capital expenditure.

The General Allocation Fund's Impact on Capital Expenditure

Based on the results of research and analysis that has been carried out, it was found that the hypothesis that the general allocation fund has a positive effect on capital expenditures received. these results are in line with those that have been carried out, where in the t test it is stated that the significance value of the DAU of 0.001 can be interpreted to mean that the value is less than 0.05. This finding proves that the general allocation fund has a positive effect on capital expenditure, which means that the higher the general allocation fund received by the region, the greater the capital expenditure allocated by the region. The general allocation fund is related to capital expenditure because the general allocation fund received by local governments is intended to fund local government spending, especially in terms of improving public services that can be created through infrastructure and infrastructure development. The more the General Allocation Fund received, it means that the area is still very dependent on the Central Government in fulfilling its expenditure, this indicates that the area is not yet independent, and vice versa (Pambudi, 2007). The results of this study are in line with research conducted by Waksito (2019), Susi and Heru (2016), as well as Sugiarti and Supadmi (2014) that the general allocation fund has a positive effect on capital expenditure.

The Impact of the Special Allocation Fund on Capital Spending

Based on the results of research and analysis that have been carried out, it was found that the hypothesis that the special allocation fund has a positive effect on capital expenditure was rejected. These results are in line with those that have been carried out, where, among others, the t test stated that the significance value of the DAK is 0.170, which can be interpreted to mean that the value is greater than 0.05. These findings prove that the general allocation fund has no positive effect on capital expenditure. This means that if there is an increase in the special allocation fund, it will not affect the allocation of capital expenditures. So it can be concluded that although the special allocation fund is a special grant for infrastructure development, because the percentage is small, it is not a determining factor in the allocation of capital expenditure for the observation year 2016-2020. This is because the absorption of special allocation funds is more

for funding special activities that are in accordance with national priorities, so that their effect on the allocation of capital expenditure tends to be less. The results of this study are in line with research conducted by Hairiyah (2018) and Maria & Nur Handayani (2015) that showed that special allocation funds have no effect on capital expenditure.

Profit Sharing Fund's Impact on Capital Expenditure

Based on the results of research and analysis that has been carried out, it was found that the hypothesis that the profit sharing fund had a positive effect on capital expenditure was rejected. These results are in line with those that have been carried out where the t test stated that the significance value of DBH is 0.044, which can be interpreted to mean that the value is greater than 0.05. These findings prove that profit-sharing funds do not have a positive effect on capital expenditures, which means that the higher or lower the profit-sharing funds do not affect capital expenditures. The revenue sharing funds received by the regions are not the main source of funding for local governments for capital expenditures. The allocation of profit sharing funds is not used for capital expenditures but is more often used to finance other regional expenditures, namely more allocated to routine expenditures, employee expenditures, goods and services expenditures, and other shopping posts. The results of this study support the central government's Agency Theory to transfer state budget funds in the form of DBH to be given to local governments so that they can be used for capital expenditure or meet the needs of local governments. This research is in line with research conducted by Sulistyawati and Purwanti (2021) that found special allocation funds have no effect on capital expenditure.

Capital Expenditures: Effect of Remaining Over Budget Financing

Based on the results of research and analysis that has been carried out, it was found that the hypothesis that the remaining more budget financing has a positive effect on capital expenditures was rejected. These results are in line with those that have been carried out, where, among others, the t test stated that the significance value of the remaining budget financing is more than 0.325, which can be interpreted to mean that the value is greater than 0.05. These findings prove that the remaining budget financing has no effect on capital expenditures. The presence or absence of SILPA can be seen from the large level of spending carried out in the area. The remaining budget financing is not used to finance the allocation of capital expenditures in the following year because SILPA is used to cover the budget deficit if the realization of revenues in the area is smaller than its realization and to fund other obligations that until the end of the fiscal year have not been realized. So it can be concluded that if SILPA goes up or down, it does not affect the allocation of capital expenditure. The results of this study are in line with research conducted by Mahargono and Imaniar Putri (2017) that found the remaining budget financing does not affect capital expenditure.

5. Conclusion

This study aims to analyze the effect of local revenues, general allocation funds, special allocation funds, profit sharing funds, and the remaining budget financing on capital expenditures in regencies/cities in Central Java Province in 2016–2020. By using purposive sampling techniques and data processing using the SPSS 26 program, the conclusions in this study are that local original income and general allocation funds have a positive effect on capital expenditure. Furthermore, special allocation funds, profit-sharing funds, and the remaining budget financing have no effect on capital expenditures. The limitations of this study are that it only focuses on local original income, general allocation funds, special allocation funds, profit sharing funds, and more budget financing, even though in reality there are still many other factors that can affect capital expenditures that were not analyzed in this study. In this study, it only used samples located in regencies/cities in Central Java Province, where there are still many regencies/cities that can be added as research samples.

REFERENCES

- Ardhani, P. (2011) 'PENGARUH PERTUMBUHAN EKONOMI, PENDAPATAN ASLI DAERAH, DANA ALOKASI UMUM, DAN DANA ALOKASI KHUSUS TERHADAP PENGALOKASIAN ANGGARAN BELANJA MODAL (Studi Pada Pemerintah Kabupaten/Kota di Jawa Tengah)'.
- Mawarni, Darwanis and Abdullah, S. (2013) 'Pengaruh Pendapatan Asli Daerah dan Dana Alokasi Umum terhadap Belanja Modal serta Dampaknya terhadap Ekonomi Daerah', *Jurnal Akuntansi*, 2(2), pp. 80–90.
- Prastiwi, A., Nurlaela, S. and Chomsatu, Y. (2016) 'Pengaruh Pendapatan Asli Daerah, Dana Perimbangan Dan Belanja Pegawai Terhadap Belanja Modal Pemerintah Kota Surakarta', *Seminar Nasional IENACO-2016*, pp. 872–879.
- Sugiardi, N. and Supadmi, N. (2014) 'Pengaruh PAD, DAU, Dan Silpa Pada Belanja Modal Dengan Pertumbuhan Ekonomi Sebagai Pemoderasi', *E-Jurnal Akuntansi*, 7(2), pp. 477–495.
- Susanti, S. and Fahlevi, H. (2016) 'Pengaruh Pendapatan Asli Daerah, Dana Alokasi Umum, Dan Dana Bagi Hasil Terhadap Belanja

- Modal (Studi Pada Kabupaten/Kota Di Wilayah Aceh)', *Jurnal Ilmiah Mahasiswa Ekonomi Akuntansi (JIMEKA)*, 1(1), p. 1.
- Tuasikal, A. (2008) 'Pengaruh Dau, Dak, Pad, Dan PDRB Terhadap Belanja Modal Pemerintah Daerah Kabupaten/Kota Di Indonesia', *Jurnal Telaah dan Riset Akuntansi*, 1(2), pp. 124–142.
- Waskito, W., Zuhrotun, Z. and Ruserlisyani, R. (2019) 'Pengaruh Pertumbuhan Ekonomi, Pendapatan Asli Daerah, Dana Alokasi Umum, Dana Alokasi Khusus, dan Dana Bagi Hasil Terhadap Belanja Modal (Studi pada Pemerintah Kabupaten & Pemerintah Kota di Provinsi Aceh)', *Reviu Akuntansi dan Bisnis Indonesia*, 3(2), pp. 220–238. Available at: <https://doi.org/10.18196/rab.030247>.
- Zais, G.M. (2018) 'Faktor-faktor yang Mempengaruhi Belanja Modal pada Kabupaten atau Kota di Provinsi Sumatera Selatan', *BALANCE Jurnal Akuntansi dan Bisnis*, 2(1), p. 140. Available at: <https://doi.org/10.32502/jab.v2i1.1167>.

AUTHORS

First Author – Rosalina Ayu Ketrin, Muhammadiyah of Surakarta University, b200180189@student.ums.ac.id.

Second Author – Noer Sasongko, Muhammadiyah of Surakarta University, ns243@ums.ac.id.

Correspondence Author – Noer Sasongko, Muhammadiyah of Surakarta University, ns243@ums.ac.id.

Improving The Efficiency Of Vesa-2 To Maximize The Energy Utilization

Darmawi^{1,2)} Irwin Bizzy¹⁾ Ellyanie¹⁾ Jimmy D Nasution¹⁾

¹⁾Lecturer of Mechanical Engineering Department of Engineering Faculty of Sriwijaya University
Palembang - Indonesia

²⁾Corresponding author email: darmawi@unsri.ac.id

DOI: 10.29322/IJSRP.12.10.2022.p13026

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13026>

Paper Received Date: 20th August 2022

Paper Acceptance Date: 24th September 2022

Paper Publication Date: 6th October 2022

Abstract: Kemplang is a crunchy traditional snack of the common people in Palembang, South Sumatra, Indonesia. Normally, it roasted on an open charcoal furnace, where the smoke, the heat and the combustion gases spread out in all directions. Vertical Energy Saver (VESA) is an equipment that has already patented created to accomodate the heat, the gas, fly ash and particulate matters from charcoal furnace used for roasting and preheating the kemplang in VESA and dispose the residual heat and gases to a place that is safe for humans breath. . VESA-2 is a VESA that already developed due to improve the effectiveness and the efficiency of equipment.. The air flew from the bottom of VESA-2 through the charcoal furnace to the top by a suction fan. VESA-2 is still developed and improved. It is completely work on the base of forced convection. Some tests are carried out to improve performance and the energy efficiency of equipment. The results of tests conducted on the base of enlargement the volume of VESA-2 is presented here. All measurements are carried out at no load. Test results show that the energy efficiency of original VESA-2 is 20.61%, the energy efficiency of VESA-2 with 30 centimeters height addition is 27.05% and the energy efficiency of VESA-2 with height addition and 28% of cross section area enlargement is 28.18%. The height addition and the cross section area enlargement are significantly increase the energy efficiency of VESA-2.

Keywords: VESA-2, suction fan, force convection, charcoal furnace, energy efficiency

1. INTRODUCTION

An appropriate equipment has been developed and already patented, called Vertical Energy Saver (VESA). VESA is used to bake kemplang which is a traditional food of people in Palembang, South Sumatra - Indonesia. Conventionally, kemplang roasting is conducted on an open charcoal furnace where the heat, the fly ash, particulate matters and combustion gases spread in all directions. This equipment is created considering the health of moms who roast the kemplang and environmental friendly for the community around the furnace (Darmawi, 2020). This system works entirely on the principle of forced convection. The air is heated by the live charcoal is passes through. The air is inhaled by a suction fan flows from the bottom of the VESA-2 upwards and exits to the atmosphere (Darmawi et al., 2020). The size of VESA is (30 x 30 x 90) cm..VESA is currently undergoing the developments which aim to improve the construction and increase the energy efficiency. The Vertical Energy Saver discussed on this occasion is referred to as the Second Generation of Vertical Energy Saver or abbreviated as VESA-2.

The heat source comes from the charcoal furnace, where the air passing through the furnace is mostly used for burning wood charcoal or coal briquettes in the furnace. The heat generated in furnace is used to roast kemplangs. The rest heat is used to dry or to preheat the kemplangs before roasted. The dryness of kemplang is necessary due to get the quality of roasted products (Darmawi et al., 2021).

From the results of previous measurements and analysis (Darmawi et al., 2021), the problem with the current prototype of VESA-2 is the exit temperature which is relatively high, which is around 76 - 81 °C. This shows that the heat content in the exhaust air is still high, so it is deemed necessary to carry out further development to make the exhaust air temperature being lowered and the thermal content in the VESA-2 is utilized more for drying and roasting process.

For this purpose, modifications were made to VESA-2 by increasing the volume of the VESA-2 room. Both of these tests is carried out under no-load conditions, where there is no roasting and no drying. So that in this way, it can be ascertained that the temperature of the exhaust air when it is loaded will be even lower due to the absorption of heat in the room for roasting and drying. So that the efficiency of the tool will increase more than at no load measurements. The presence of roasting and drying in the VESA-2 will have an impact on increasing the moisture content in the exhaust air. The addition of the room volume is intended to increase the air volume so that there is a decrease in enthalpy in the VESA-2 and at the same time lowering the exit temperature. The second way is to change the air intake method from the suction principle to the exhale principle. This second method will have implications for decreasing the velocity of the VESA-2 exit air. However, the results of the second method experiments is not reported.

2. LITERATURE REVIEW

This publication is licensed under Creative Commons Attribution CC BY.

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13026>

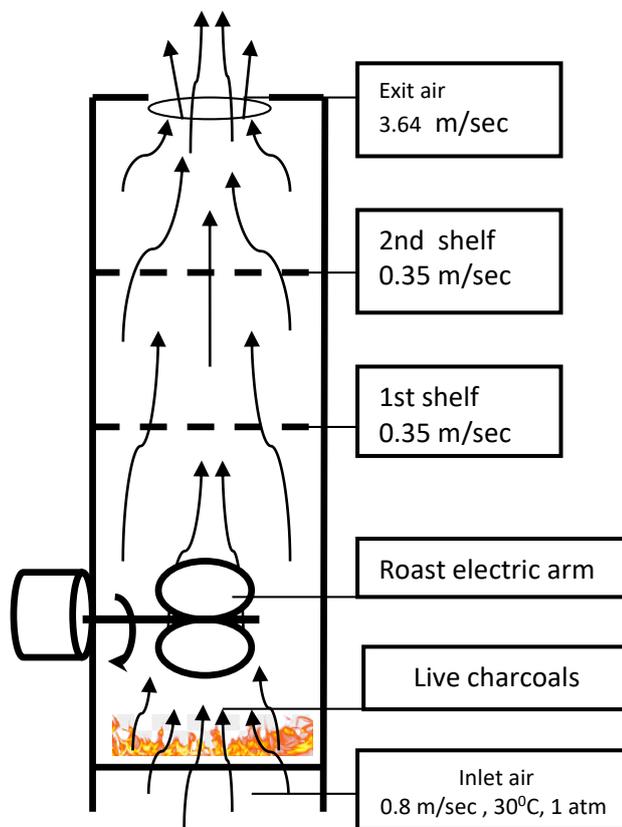
www.ijsrp.org

The review is including the profile of air flow in VESA-2, the roasting process and the drying process in VESA-2.

2.a. Air speed profile in Vesa-2

This paper will discuss the temperature distribution in VESA-2 where the heat transfer process takes place completely by forced convection (Wahyu Setiawan, 2021). The airflow pattern in VESA-2 does not follow the pattern as we know it in constant cross-sectional flow (Wijiati & Widodo, 2019), because there are obstacles at three points, namely: at the air inlet position, at the 1st shelf position and at the 2nd shelf position and finally going out into the atmosphere. Figure 1 shows the variation of flow velocity at each positions on the VESA-2.

At the air intake position, the resistance occurs because the flow surface area is not as wide as the VESA-2 cross-section, where the air passage area is 56.71 cm² and the inlet airflow velocity is 0.8 m/sec and the total intake airflow volume is equal to the incoming air from the bottom of the furnace 0.004536 m³/second plus air entering from the front door by 0.027 m³/second to 0.031536 m³/second (Darmawi et al., 2021). On the other hand, at the air exit position, the surface area of the exit door is the area of the door entering the exhaust fan, which is 0.008654625 m², the velocity of the outgoing air flow is 3.6438 m/second and the volume of air exiting per unit time is: 0.031536 m³/second (Darmawi et al., 2021). There is a difference in the volume of intake air and outflow air of about 8% due to air entering the gaps and holes that have not been completely closed in the tool.



Gambar 1. Schematic image of air flow in VESA-2

2.b. Roasting process

Roasting is a way of cooking process, using an indirect and diffused heat to cook kemplang a traditional snack of Palembang people of South Sumatra Indonesia. Roasting is a dry-heat cooking method where hot air is in the vicinity of kemplang and heating it evenly on all sides at a temperature of about 150 °C (Lecreuse, 2021). The heat is generated from an open flame placed at the bottom of Vesa-2 , where the hot air is flowing from the furnace at the bottom of VESA-2 to the top by an induced draft fan. Kemplang is placed at the tip of electronic arm which turn slowly back and forth as an act of roasting. The electronic arm movement is completely simulate the manual roasting of kemplang as it traditionally done by the UMKM moms in Palembang.

2.c. Drying Process

Theoretically, the drying process requires heat energy to evaporate the water in the kemplang. Drying is a preheating process before kemplang is roasted. According to the principle of equilibrium, the water vapor pressure in the commodity to be dried is the same as the water vapor pressure of the air around the object before drying. When drying begins, hot air that flows through the surface of the kemplang will increase the pressure of water vapor on the surface of kemplang. When hot air flows through the

surface of the kemplang, mass transfer occurs from the surface of kemplang in the form of water vapor. In this way the drying process occurs followed by the entry of water pavor from the surface of the kemplang into the atmosphere air (Sary, 2017).

However, evaporation of surface water can only occur under one condition, namely that the air must not be saturated with vapor. Vapor-saturated air is air that contains so much vapor that it can no longer accept additional vapor. The drier the air, the easier it is for surface water of kemplang to evaporate. On the other hand, the more humid the air conditions, the more difficult it will be for water on the surface of commodity to evaporate (Muamar Syaidar, 2019). To find out the pressure and the temperature aspects in the drying process of food commodities, we need to understand the Hertz-Knudsen formula, or often called the Knudsen-Langmuir equation.

Irving Langmuir's basic assumption is that the number of water molecules lost due to evaporation is the same as the number of water vapor molecules in the air hitting the water surface when an equilibrium state occurs. In an equilibrium state, the rate of evaporation and the rate of condensation are the same (Heru Maruza, 2013). Formulatively written:

$$\frac{dM}{dt} = (p_v - p_p) \sqrt{\frac{m}{2\pi RT}}$$

where:

dM/s = mass flow rate (kg) over a given surface area (m^2) in one second (second, s^{-1}), so the unit is $kg/m^2/s$.

P_v = vapor pressure at a certain temperature, or boiling point pressure at temperature specified, in units of pascals (pa).

P_p = vapor partial pressure of the substance in the gas mixture, for example the vapor pressure of water in air at a certain temperature, in units of pascals (pa).

m = molecular weight of water (0.01801528 kg/mol).

R = ideal gas constant or Mendeleev's constant = 8.314 Joules/(mol Kelvin).

From the above formula it can be understood that if the vapor pressure (P_v) is greater than the partial pressure (P_p) of water vapor in the commodity, evaporation will occur. On the other hand, if the partial pressure of water vapor in the commodity (P_p) is greater than the vapor pressure (P_v), condensation will occur (Heru Maruza, 2013).

The weakness of the Irvin-Langmuir formula above is that the drying rate is only viewed from the aspect of pressure and temperature. Meanwhile, in the forced convection process, there are other factors that are no less important, namely: the speed of the drying air flow, the temperature of the drying air and the relative humidity of the drying air (Dina et al., 2019)(Henderson & R.L. Perry, 2009).

3. MATERIAL AND METHOD

Two method of experiments were carried out, basically base on the volume of the VESA-2 enlargement.

Diagrammatically, it can be sorted as shows in figure 2.

To calculate the efficiency and effectiveness of equipment, tests and measurements are carried out at no load. This means that no roasting and drying takes place in the VESA-2. This is done to measure the performance of the VESA-2 at the worst performance, where all heat is considered unused.

$$q_{conv} = \dot{m}c_p(T_{m,o} - T_{m,i})$$

where T_m denotes the average air temperature and the subscription i and o denote inlet and outlet air condition respectively. It is important to note that the above equation is a general expression of energy balance in VESA-2 (Sinaga, 2019). C_p is a contant of air heat capacity, 1.005 kJ/kg.K at room temperature (G.F.C. Rogers & Y.R. Mayhew, 1996).

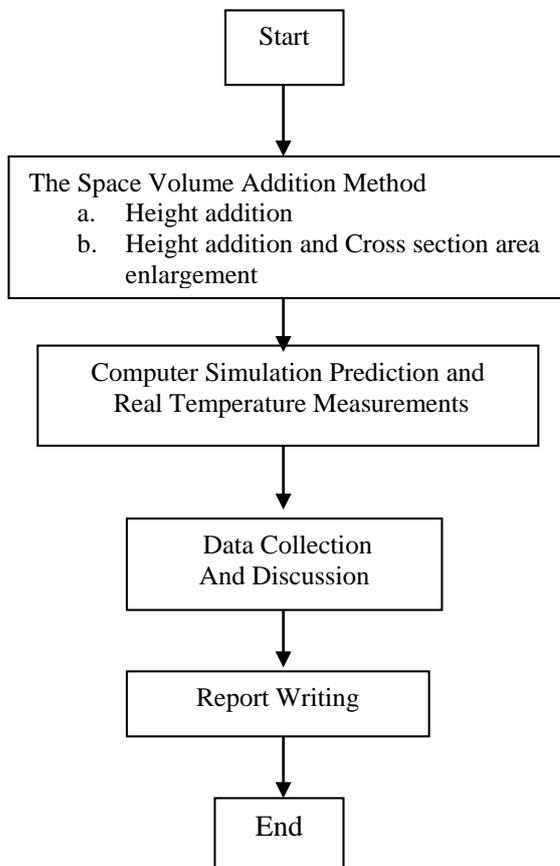


Figure2. Flowchart of the experiments

4. COMPUTER TEMPERATURE DISTRIBUTION PREDICTIONS AND REAL TEMPERATURE MEASUREMENTS

4.a. Computer Temperature Distribution Predictions

Prediction by computer simulation have been carried out using the flow simulation program as a technical reference. Assuming the fluid is compressible. Solid particles such as particulate matters are not considered specifically. The flows are laminar and steady. Temperatur distribution in VESA-2 are as follows:

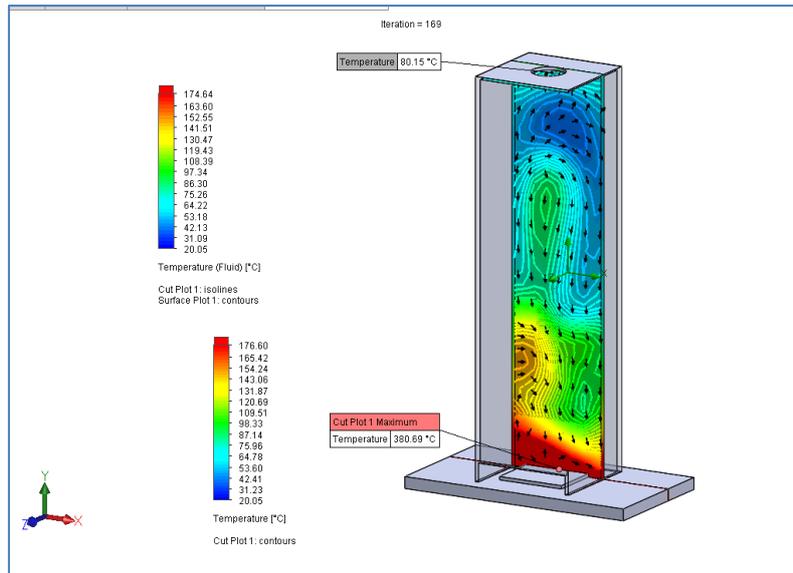


Figure 3. Temperature distribution at VESA-2 where the temperature at live charcoal is of 380.9 °C and exit temperature is 80.15 °C

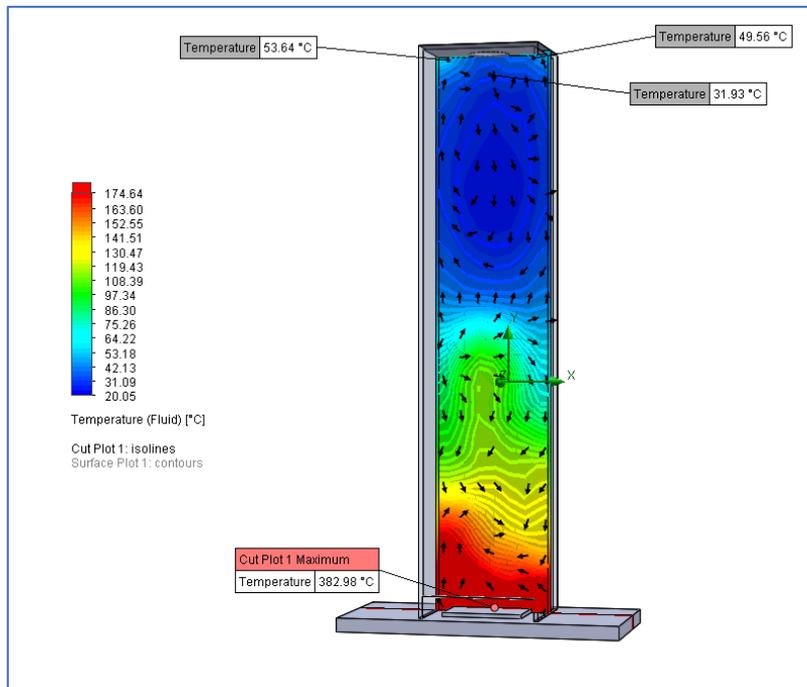


Figure 4. Vesa-2 with height addition, where the live charcoal temperature is 382.98 °C and exit temperature is 53.84 °C

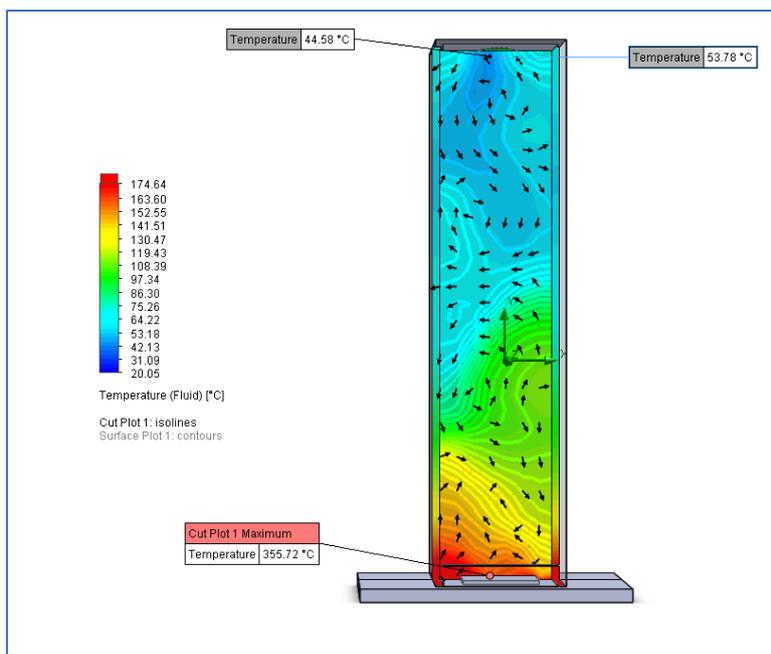


Figure 5. Vesa-2 with height addition and 28% cross section area enlargement, where the live charcoal temperature is 355.72 °C and exit temperature is 44.58 °C

4.b. Average Actual Temperature Distribution Measurements in VESA-2

Real measurements are already carried out at VESA-2. In this paper we present three modification of VESA-2. The three of them are Vesa-2 with no size modification is called Original Vesa-2, Vesa 2 with 30 cm height addition, and Vesa-2 with 30 cm height addition and 28% cross section area enlargement. The average actual temperature measurements of related VESA-2 as presented in Table 1.

Tabel 1. Average actual temperature in VESA-2

	Original Vesa-2	Vesa-2 With Height Addition (°C)	Vesa-2 With Height and Cross Section Area Enlargement (°C)
Point 1	104,57	104,6	102,3
Point 2	86,14	82,4	81,5
Point 3	82,85	74,3	70,1
Point 4	79,91	51,3	44,6

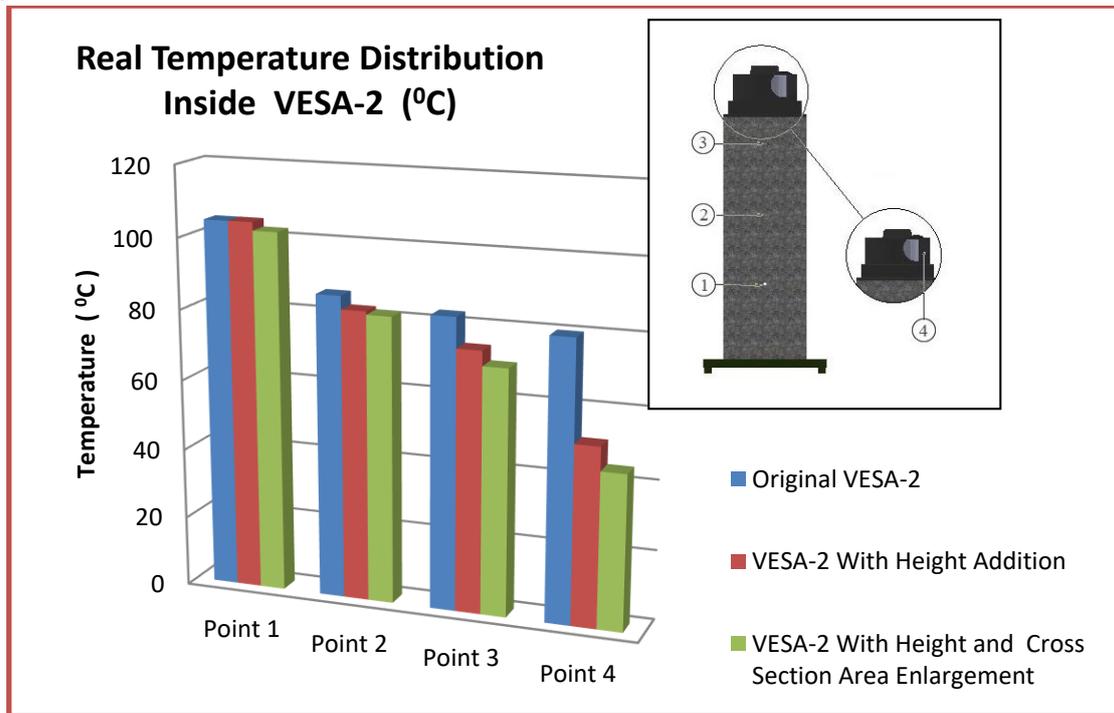


Figure 6. Real temperature of VESA-2 at varying size modification.

5. THERMAL ENERGY EFFICIENCY OF MODIFIED VESA-2

Thermal energy efficiency of VESA-2 at no load operation. This is the worst efficiency VESA-2 would make. The thermal efficiency of VESA-2 is defined as the energy out of VESA-2 per second divided by the energy produced by the live charcoal at the bottom of VESA-2 per second.

Tabel 2. Thermal energy efficiency of VESA-2

	\dot{m}_{out} (Kg/sec)	\dot{m}_{in} (Kg/sec)	Q_{in} (Kj/sec)	Q_{out} (Kj/sec)	η_{th} (%)
Original VESA-2	0,0378432	0.03214	14.37418	11.41058	20.61
VESA-2 with Height Addition	0.0378432	0.03214	14.37532	10.48554	27.05
VESA-2 with Height Addition and Cross Section Area Enlargement	0,0378432	0.03214	14.28776	10.26030	28.18

The calculation is based on the quantity of air intake and exit VESA-2 as measured previously. $C_p = 1,005$ (Kj/Kg.K). Air density is 1.2 kg/m^3 (John Twidell & Tony Weir, 2006).

6. DISCUSSION

Comparison between the computer temperature prediction and the real temperature measurements are tend to similar or a tiny different. It is because the dynamic flow of air inside VESA-2 and the dynamic fluctuation of energy supply to VESA-2 regarding the quantity and the quality of charcoal burnt at the furnace. Charcoal is a hydroscopic matter, the higher the moisture contents in the charcoal, the lower the thermal energy produced in furnace. The charcoal water contents can not accurately detected or measured, so it is considered the same.

From the data analyzing and the results presented above, we can see the improvements of VESA-2 energy efficiency. The energy efficiency tend to increase by the addition VESA-2 body volume. This body volume is enlarged by VESA-2 size modification. The measurements show clearly that the height addition of VESA-2 and the cross section area enlargement significantly lowering the air exit temperature of VESA-2. This phenomenon indicating that the height addition or the cross section area enlargement is encourage the better energy accomodation inside VESA-2. It means, the more energy will be utilized. The lowest energy efficiency is found at original VESA-2 where no size modification was made. It is mainly because there is a window at the bottom of the equipment where the air could enter. This window is used to roast the kemplang manually. A part of air is partially not absorb the heat from the furnace because rapidly inhaled by the top fan. This is the one of the causes of low efficiency. Modified VESA-2 has better efficiency because the size of the window already

reduced, even at the next experiments VESA-2 has no more window. The manual roasting act is already replaced by an electronic arm. It is hoped that a better thermal efficiency will got.

7. CONCLUSIONS

From the data found and the above analysis we can conclude the followings:

- The volume enlargement will maximize the heat accomodated and will increase the heat utilization of VESA-2
- The height addition significantly increase the thermal energy efficiency, meanwhile, the cross section area enlargement of VESA-2 support slightly.
- The combination between height addition and cross section area enlargements is considered as a wise decision to downgrade the heat loss and increase the thermal efficiency of VESA-2.

ACKNOWLEDGEMENT

Thank you very much to Universitas Sriwijaya, especially the Faculty of Engineering who already financed the series of research, testing and measurements. Thanks also extended to Mechanical Engineering Department, which has been allowing the research handled at home due to prevent the spread of covid-19 from 2018 to 2021.

REFERENCES

- Darmawi, Hadi, Q., Ellyanie, & Bizzy, I. (2021). Analisis aliran udara alat penghemat energi vertikal generasi kedua untuk masyarakat Tebing Gerinting kecamatan indralaya selatan kabupaten Ogan Ilir. *Jurnal Rekayasa Mesin*, 21(2), 75–78. <https://jrm.ejournal.unsri.ac.id/index.php/jrm/article/view/156>
- Darmawi, Sipahutar, R., Hadi, Q., & Ellyanie. (2020). *Evaluasi kualitatif Alat Penghemat Energi Vertikal bagi usaha kecil mikro di desa Tanjung Gelam Kabupaten Ogan Komering Ilir*. November, 4.
- Dina, S. F., Rambe, S. M., Sipahutar, E. H., Naufa, M., & Zupri Adi Irhamsyah Tanjung. (2019). Kinetika Pengeringan Asam Gelugur (*Garcinia atroviridis*) menggunakan pengering surya tipe kolektor tabung vakum dengan konveksi paksa dan alami. *Jurnal Dinamika Penelitian Industri* Vol 30 No.1 Tahun 2019, 30(1), 21–29. <https://123dok.com/document/ye3o4g4q-kinetika-pengeringan-garcinia-atroviridis-menggunakan-pengering-kolektor-konveksi.html>
- G.F.C. Rogers, & Y.R. Mayhew. (1996). *Engineering Thermodynamic, Work and Heat Transfer*. Longman Publisher Group. <https://www.amazon.com/Engineering-Thermodynamics-Work-Heat-Transfer/dp/0582045665>
- Henderson, S. M., & R.L. Perry. (2009). *Agricultural Process Engineering*. John Willey & Sons. <https://babel.hathitrust.org/cgi/pt?id=mdp.39015021218170&view=1up&seq=8>
- Heru Maruza. (2013). *Laju Penguapan Air Per Luas Permukaan*. Web Page. 2013. <https://www.atsunday.com/2013/06/laju-penguapan-cairan-per-luas-permukaan.html>
- John Twidell, & Tony Weir. (2006). *Renewable Energy Resources*. https://www.google.co.id/books/edition/Renewable_Energy_Resources/vCC_z54FyXkC?hl=en&gbpv=1&dq=renewable+energy+resources&printsec=frontcover
- Lecreuse. (2021). *What is Roasting?* Lecreuset. https://www.lecreuset.ca/en_CA/glossary/Roasting.html
- Muamar Syaidar. (2019). *Mengapa air menguap padahal tidak 100 derajat celcius*. QUORA Website. <https://id.quora.com/Mengapa-air-selalu-menguap-padahal-air-tersebut-belum-mencapai-titik-didihnya-saat-tekanan-ruang>
- Sary, R. (2017). Kaji eksperimental pengeringan biji kopi dengan menggunakan sistem konveksi paksa. *Jurnal POLIMESIN*, 14(2), 13. <https://doi.org/10.30811/jpl.v14i2.337>
- Sinaga, N. (2019). *Internal Forced Convection*. http://eprints.undip.ac.id/80594/1/Course6-7a_Heat_Transfer.pdf
- Wahyu Setiawan. (2021). *Pengertian Konveksi, Mekanisme dan Contoh Pemanfaatannya*. Web Page. <https://caramesin.com/pengertian-konveksi-adalah/>
- Wijiati, L., & Widodo, B. U. K. (2019). Studi eksperimen perpindahan panas Konveksi Paksa pada berkas pin fin berpenampang circular dengan susunan aligned. *Jurnal Teknik ITS*, 8(1). <https://doi.org/10.12962/j23373539.v8i1.42376>

Authors:

First author – Darmawi, Mechanical Engineering of Faculty of Engineering of Universitas Sriwijaya Indonesia, darmawi@unsri.ac.id.

Second author – Irwin Bizzy, Mechanical Engineering of Faculty of Engineering of Universitas Sriwijaya Indonesia, irwinbizzy@unsri.ac.id

Third author – Ellyanie, , Mechanical Engineering of Faculty of Engineering of Universitas Sriwijaya Indonesia, ellyanie@unsri.ac.id

Fourth author – Jimmy D Nasution, , Mechanical Engineering of Faculty of Engineering of Universitas Sriwijaya Indonesia, jimmynasution@unsri.ac.id

Corresponding author – Darmawi, lecturer of Mechanical Engineering Department of Engineering Faculty of Universitas Sriwijaya – Indonesia. Phone: +628127886884

Flexible Human Resource Leadership Style On Performance of Kuppet Principals in Trans-Nzoia County, Kenya.

Msc Bridgit K. Chebet and Dr. Anthony Osoro

Jomo Kenyatta University Of Agriculture And Technology, Nairobi, Kenya

DOI: 10.29322/IJSRP.12.10.2022.p13027
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13027>

Paper Received Date: 4th September 2022

Paper Acceptance Date: 5th October 2022

Paper Publication Date: 13th October 2022

Abstract- This study was to ascertain the flexible human resource leadership style and performance of KUPPET principals in Trans Nzoia County, Kenya. This study manifestly Therefore, KUPPET principals in Trans Nzoia County, Kenya should endeavor to have smart policies that are aimed to facilitate the pre-deployment with clear identification of roles and further ensure that there is movement re-alignment through cascading of goals throughout the firming systems.

Index Terms- Democratic Leadership Style, Autocratic Leadership Style, Laisser Faire, Paternalistic Leadership Style and performance of KUPPET Principals

I. INTRODUCTION

KUPPET Principals, as instructional leader, focus on helping teachers to improve their classroom performance and make academic instruction as their schools' top priority. It was argued that principals need to have the theoretical knowledge, skill and adequate experiences in school leadership and management and/or should have a profile of possession of various trainings on school leadership and management so as to play active and effective leadership style in school improvement programs (Al Khajeh, 2018). Therefore, Principals as educational leader play a pivotal role in the success of the school. In build a strong culture of collaboration and creative problem solving, set appropriate curriculum implementation mechanism, and possess an instructional leadership quality that takes responsibility for students' achievement, develop and Communicate plans for effective teaching, among all staff members and monitor students learning progress and closely work with parents. But it was argued that most schools are characterized by delay; in the beginning time of the instructional process, problem of curriculum coverage, burden of makeup class around the end of the semester, were noticed (Aristovnik, Aleksander; Jaklič, Ksenja, 2013)

Thus, this could contribute to reduce the level of teachers' performance. In supporting this, Bhargavi and Yaseen (2016), where they observed that fruitful application of the curriculum it depends to a large extent, on delegation and sharing decision styles

of principals that boost teachers' job opportunities, satisfaction, career commitment and intention to complete the syllabus contents on terms scheduled. In this regard Boeh, Dwertmann, Bruch and Shamir (2015), argued that most principals are hardly seen in their offices executing their duties, they neither delegate duties nor fully communicate to their teachers. Furthermore, it was argued that much of their time was spent on political duties unrelated to the education of students at their school, and requiring much absence from the school site. This seems to reduce the level of performance affecting the teaching and learning process and/or cause undesirable outcome such as failure of student in examination, repetition rate drops out as well as other instructional activities at schools. Hence, the collision of principals' leadership style and teachers' performance as has been a subject of disagreement by researchers.

1.2 Trait Theory

Trait theory is thought to be relevant for this study in order to understand the effect of Democratic autocratic leadership style on performance of KUPPET principals in Trans Nzoia County in Kenya, hence it gives a theoretical background for this study. Trait theory is the approach to study a human personality that identifies & measures the degree to that convinced personality traits; very often recurring patterns of thoughts and behavior of any human, like anxiousness, shyness, pessimist thought, optimist thought, openness to new things that exist from individual to individual (Boeree & George, 2009). Trait theorists believe personality can be understood by positing that all people have certain traits, or characteristic ways of behaving'. As per the Analytical and Algebraic Manual (AAM) of the American Psychiatric Association, Personality traits are protuberant facets of personality that are unveiled in a extensive range of imperative social and personal circumstances. 'In other words, every individual has certain physiognomies that moderately regulate his/her behavior; these features or traits are drifts in assertiveness of humans that tend to be current irrespective of the state or changing environment (Chiappori & Salanie, 2003).

The early philosophers harangued that born leaders were brilliant with convinced bodily traits and personality features which illustrious them from non-leaders. Trait concepts

overlooked the expectations about whether leadership traits were hereditary or developed. Jenkins recognized two traits; embryonic traits such as those which are deeply reliant on upon heredity as tallness, intelligence, allure, and self-confidence and efficiency traits based on skill or information, with charisma, as essential constituent of leadership (Christopher, 2009)). Max Weber labeled charisma as “the utmost groundbreaking force, accomplished of creating entirely new orientation over followers and comprehensive personal devoutness to leaders they professed as brilliant with nearly enchanted paranormal, prodigious qualities and authorities”. This original focus on scholarly, corporeal and personality traits that illustrious non-leaders from leader’s foreshadowed consideration that upheld that only negligible variances exist amongst followers and leaders (McGregor, 2003). The catastrophe in sensing the traits which each solitary real leader had in common, occasioned in development of trait theory, as an unreachable constituent, dwindling into discredit. In the late 1940s, intellectuals studied the traits of soldierly and non-soldierly leaders correspondingly and bare the justification of certain traits emerging at certain eras (Daft, 2000).

1.2.1 Style and Behavior Theory

Style and Behavior Theory is thought to be relevant for this study in order to understand the effect of democratic leadership style on performance of KUPET principals in Trans Nzoia County in Kenya, hence it gives a theoretical background for this study. Style and Behavior Theory, the style theory recognizes the implication of certain essential leadership skills that serve as enabler for a leader who makes an act though drawing its equivalent with preceding size of the leader, previous to that precise act while portentous that each discrete has a divergent style of management with which she textures most pleased. Like one that fixes not appropriate all heads, likewise one stylishness cannot be actual in all circumstances. Christopher (2009) announced three diverse leadership styles. The employees plateful with democratic leaders exhibited high degree of gratification, ingenuity, and motivation; working with inordinate passion and energy notwithstanding of the incidence or nonattendance of the leader; upholding better acquaintances with the leader, in terms of efficiency whereas, autocratic leaders mostly fixated on healthier quantity of output. Laissez faire leadership was solitary careful relevant while leading a team of extremely skilled and inspired individuals who excellent track-record, in the ancient (Feidler & House, 1994).

According Feidler and House (1994), they recognized two extra leadership styles focusing efficacy of the leadership. These scholars harangued that echo such as concern for people and association behaviors and initiation structure anxiety for production and duty behaviors were very energetic variables. The thought is mentioned to the amount of sureness and rapport, a leader stimulates in his juniors. Whereas, introducing structure, on the other hand, imitates the extent, to which the leader edifices, directs and defines his/her own and the juniors’ roles as they have the participating role to organizational performance, profit and achievement of the mission (Christopher, 2009). Diverse scholars projected that three types of leaders, they were; autocratic, democratic and laissez-faire. Without including juniors, the autocratic leader makes decisions, laissez-faire leader lets juniors make the choice and hence incomes no real

leadership role other than presumptuous the place and the democratic leader admittances his juniors then receipts his result. “He further expected that all leaders could appropriate into one of these three groups” Style and Behavior Theory, the style theory concedes the implication of certain essential leadership skills that assist as enabler for a leader who performs an act while drawing its equivalent with preceding ability of the front-runner, preceding to that particular act while signifying that each discrete has a divergent style of leadership with which he textures most pleased. Like one that does not appropriate all heads, likewise one style cannot be real in all circumstances. MSG Experts (2015), presented three diverse leadership styles.

The employees portion with democratic leaders exhibited high degree of gratification, inspiration, and motivation; working with inordinate eagerness and energy notwithstanding of the existence or absence of the leader; upholding better networks with the leader, in terms of output whereas, autocratic leaders chiefly fixated on better quantity of output. Laissez faire leadership was only careful pertinent while leading a team of extremely skilled and motivated individuals who admirable track-record, in the historical. According to Feidler & House (1994), acknowledged two extra leadership styles converging efficacy of the leadership. These scholars harangued that contemplation such as anxiety for people and relationship behaviors and instigation structure e.g. anxiety for production and task behaviors were very essential variables. The contemplation is mentioned to the extent of confidence and rapport, a leader stimulates in his juniors. Whereas, introducing structure, on the other hand, replicates the scope, to which the leader edifices, directs and defines his own and the juniors’ roles as they have the partaking role near organizational performance, profit and triumph of the mission (Goldsmith & Yamane, 1968). Diverse scholars projected that three types of leaders, they were; autocratic, democratic and laissez-faire. Without including juniors, the autocratic leader sorts choices, laissez-faire leader lets juniors make the choice and hence receipts no real leadership role other than presumptuous the site and the democratic leader admittances his juniors then takes his choice. “He additional implicit that all leaders influence adequate into one of these three categories” Style and Behavior Theory.

The style theory concedes the implication of assured essential leadership skills that serve as enabler for a leader who achieves an act while drawing its equivalent with preceding size of the leader, previous to that particular act while signifying that each distinct has a diverse style of leadership with which he textures utmost pleased (McGregor, 2003). Like one that does not fitting all heads, likewise one style cannot be real in all circumstances. Daft (2000), familiarized three dissimilar leadership styles. The employees share with democratic leaders established high degree of agreement, innovation, and motivation; working with inordinate passion and energy notwithstanding of the occurrence or nonattendance of the leader; upholding. Better networks with the leader, in standings of output whereas, autocratic leaders mostly fixated on superior quantity of output.

Laissez faire leadership was only measured significant while important a team of highly expert and motivated individuals who brilliant track-record, in the past. Feidler &

House (1994), recognized two extra leadership styles converging efficacy of the leadership. These scholars discoursed that reflection of individuals and affiliation behaviors and origination edifice of production and chore behaviors were actual vibrant variables (Chiappori & Salanie. 2003). The contemplation is mentioned to the quantity of self-assurance and affinity, a leader stimulates in his juniors. Whereas, starting edifice, on the other hand, replicates the magnitude, to which the leader edifices, guides and defines her own and the juniors' roles as they have the participating role to organizational performance, yield and achievement of the mission. Diverse scholars projected that three types of leaders, they were; autocratic, democratic and laissez-faire. Without including juniors, the autocratic leader brands choices, laissez-faire leader lets juniors make the choice and hence receipts no real leadership role other than presumptuous the site and the democratic leader admittances his juniors then proceeds his choice. "He additional implicit that all leaders might adequate into one of these three groups" (McGregor, 2003).

1.2.2 Transformational Theory

Transformational Theory is thought to be relevant for this study in order to understand the effect of laissez faire free leadership style on performance of KUPET principals in Trans Nzoia County in Kenya, hence it gives a theoretical background for this study. Transformational Theory Transformational leadership extricates herself from the respite of the preceding and contemporary theories (Chiappori & Salanie. 2003). The foundation of its configuration to a superior good as it necessitates participation of the followers in procedures or actions interrelated to individual factor to the institute and a progression that will produce positive superior communal surplus. The transformational leaders increase the motivation and ethics of both the supporter and the leader (Daft, 2000). It is careful that the transformational leaders "participate in interfaces with followers founded on communal standards, principles and goals". This influences the performance foremost to the accomplishment of goal. As per Bass, transformational leader, "efforts to persuade followers to rearrange their desires by exceeding self-interests and endeavor for sophisticated order needs". This theory imitate the Maslow (1954), complex order desires theory. Transformational leadership is a sequence that changes and approach targets on beliefs, values and attitudes that enlighten leaders" performs and the size to main change (McGregor, 2003). The literature proposes that groups and leaders set apart personal benefits for the assistance of the group. The leader is then requested to emphasis on groups' wants besides input in directive to transform all into a leader by enabling and motivating them. Weight from the earlier defined leadership theories, the virtuous extents of leadership additional segregates the transformational leadership (Chiappori & Salanie. 2003).

The transformational leaders are measured by their ability to identify the necessity for revolution, gain the arrangement and pledge of others, create a vision that monitors revolution and implant the revolution. These types of leaders treat juniors separately and pursue to improve their realization, morals and assistances by providing justification to their work and challenge. These leaders yield an entrance of undoubted and fortified vision of the forthcoming. They are "visionary leaders who pursue to appeal to their supporters" improved nature and move them to

sophisticated and more worldwide needs and resolutions" (Feidler & House, 1994). Process Leadership Theory ;Added leadership theories with a procedure emphasis include servant leadership, inclined governments, principal aligned leadership and magnetic leadership, with others developing every year. Greenleaf announced servant leadership in the early 1970s. A renaissance of the conversation of servant leadership was famous in the early 1990s. Process Leadership Theory Added leadership theories with a procedure emphasis include servant leadership, inclined administrations, principal aligned leadership and magnetic leadership, with others developing every year (Christopher, 2009). Greenleaf announced domestic leadership in the early 1970s. A renaissance of the conversation of domestic leadership was distinguished in the early 1990s.

1.2.3 Process Leadership Theory

Process Leadership Theory is thought to be relevant for this study in order to understand the effect of paternalistic leadership style on performance of KUPET principals in Trans Nzoia County in Kenya, hence it gives a theoretical background for this study. Further leadership theories with a procedure emphasis include domestic leadership, exit administrations, principal aligned leadership and magnetic leadership, with others developing every year (McGregor, 2003). Greenleaf announced domestic leadership in the early 1970s. A renaissance of the conversation of help leadership was distinguished in the early 1990s. Retainer leaders were invigorated to be fixated to the concerns of the groups and the leader ought to empathize with them take-care of and cherish them. The leadership was conveyed on a person who was by fauna a servant (Christopher, 2009).

"The retainer leader emphases on the wants of the supporter and assistances them to become more independent freer and conversant". The retainer leader is also more anxious with the "have-nots" and distinguishes them as equivalent (Christopher, 2009). The leaders in important officialdoms are to be the go-between of the vision of the institute and not a retainer of the individuals within the group. Leaders in knowledge officialdoms clarify and cherish the vision and contemplate it to be superior to one-self. The leader bring into line themselves or their vision with others in the institute at large. These procedure leadership theories and others that have arose often propose that the work of leaders is to sponsor to the comfort of others with a emphasis on some form of communal accountability (McGregor, 2003). There seems to be a vibrant progress in the study of leadership. Leadership theory has enthused from birth traits and privileges, to assimilated traits and styles, to situational and affiliation types of leadership, to the purpose of clusters besides group procedures and, presently, to the interface of the cluster members with an prominence on personal and institutional purpose of clusters and cluster procedures and, presently, to the interface of the cluster members with an prominence on personal and institutional moral perfections.

2.1 Autocratic Leadership Style

In Autocratic style of leadership, the leader is the sole determinant of what is done: his main contact with his subordinate occurs when he is giving them instructions. It is a very popular style among manager commanding subordinates and it is still used around the world (Armstrong, 2012). This style basically comes

natural to many leaders and brings many benefits, thus many managers start to lead using this style and try to improve on it when pursuing their own development. The style is used when leaders inform their employees what they want done and how they want it attained, without being advised by their followers (Nyoti & Bhau, 2015). Excessive use of authority will decrease productivity in the long-term in the academic library. People either get fed up and leave or fall into malice without creativity and innovation. This style got work done through fear and this style of leadership tells workers what to do and how to do it. According to (Elliott, 2015), he observed that dictatorial leadership is a nowadays obsolete form of administration that, particularly in modern eras, is sure to generate a lot of confrontation amongst employees (Ombima, 2014).

The feedback this leader stretches to their employees is frequently undesirable, not very productive and is occasionally escorted by evident annoyance nonexistence of inspiration since the authoritarian leader chooses everything themselves and implements it in their peculiar way, they don't give the employees the chance to give their gyration on the errands to be performed (Nwaigwe, 2015). This way, the inspired aptitude of the employee is never industrialized or exposed and that is a wasted opportunity for equally the employee and the corporation (Akor, 2014). After all, inspiration rouses progress and modernism within an institutional and also ensures augmented efficiency. The need that every individual has to do expressive work is also pleased by emergent inspiration on the work movement. Disheartening the discouraging sensitivity that occurs amongst individuals who work under a dictatorial leader is partially due to the absence of imaginative progress and comparatively due to distress of endorsements. The distress of endorsements reasons them to be extrinsically damagingly motivated. The discouraging conditions ensure that individuals under a dictatorial leader frequently walk away from it (Boehm, Dwertmann, Bruch & Shamir, 2015).

2.1.2 Democratic Leadership Style

The school principal delegates work to teachers according to experience and knowledge. He or she utilizes teamwork, empowerment and collaboration. Democratic leadership style has been observed to be more effective since all are involved in decision making (Boit & Osoro, 2021). However, it is not an appropriate leadership style to be used in time of crisis since it is time consuming due to many meetings and may lead to confusion. Consulting amongst teachers may be misinterpreted to mean that the school principal is unable to make decisions and persuading teachers to work can negatively impact on school performance. Different situations require different leadership techniques and therefore the school principal should employ a leadership style that is relevant to the situation (Elliott, 2015).

One leadership style cannot handle all types of subordinates and therefore the school principal assesses the situation and adapt appropriate behavior which suites at that time. Different schools vary in structure and therefore to achieve academic performance the school principal should assess the situation, study the psychology of subordinates and adapt appropriate leadership style (Otieno, 2016). He or she should consider the school culture which can be fine-tuned to the unique circumstances as well as the school environment. According to Akor (2014) in the study on people

management impact on organizational performance established a positive relationship whereas Elliott (2015) conducted a study on challenges faced by school principals when dealing with sponsors in secondary schools discovered a negative relationship thus the focus of this study on leadership styles and performance of secondary schools in Trans-Nzoia County, Kenya.

2.1.3 Laissez Faire

According to Puni Ofei and Okoe (2014), they observed that although laissez fair leadership style gives the employees opportunity to make decisions, it has been described as a negative style of leadership by some scholars, because it indicates absence of leadership, delayed decision making and a lack of effort to encourage employees, motivate them, listen to them or to meet up with their needs. Laissez-fair leaders are leaders who take up leadership positions but have relinquished the duties and the responsibilities they have been assigned Regarding laissez-faire leadership styles, Elliott (2015) highlighted that Laissez-faire leaders do not deliver enough information and resources to their staff which results in employee to employee exchange concerning the job necessities understanding, rules, regulations, policies, and the processes of the job, employees will rarely be directed or motivated, the leader do not hold the responsibility of introducing the plan and the methods of reaching the plan's goals. As the results of the previous studies, the most of the discussions on leadership styles were rehearsed on nongovernment organizations but examine this issue on the government organization is lacking, and the significance of this study is trying to fill this gap in knowledge and find out this kind of leadership style which is more practice in the government organization in Sulaimani city (Haque, Faizan, Zehra, Baloch, Nadda, & Riaz, 2015).

Laissez-faire is alternative leadership style, which is resulting from the French stint that means "to let it do". In best managing and leadership styles, employee involvement is of supreme prominence. The laissez-faire style is well-thought-out to be at the life-threatening end of the democratic-style range. Laissez-faire leaders delegate policymaking powers to supporters. This procedure makes good knowledge chances for supporters (Igbaekemen & Odivwri, 2015). The style develops more real when employees are highly expert and motivated, which is when it assistances employees embellishment at work. Nature traits that inspiration leadership style are significant factors that eventually affect flourishing at work. Meticulousness explains the wish for triumph and its chase. This trait is achievement-oriented and is associated with a sense of accountability. Since the foremost theme of assiduousness is achievement-oriented, it would be powerfully linked and connected to flourishing in the workstation (Elliott, 2015).

2.1.4 Paternalistic Leadership Style

International leadership research is at a major crossroads. The quest to define effective leadership has long been an important topic of discussion, but when these discussions drift into different cultural contexts, our current knowledge and insights appear rather limited (Igbaekemen & Odivwri, 2015). One such area in leadership research is paternalistic leadership. Paternalistic leadership is a flourishing. Research area in management literature, but there is still considerable disparity among authors with respect to the definition and effectiveness of paternalistic

practices. More than eight decades ago, the human relations movement suggested that if managers focused on employees rather than on mechanistic production, workers would be more satisfied and more productive. These early behavioral management theorists believed that managers should be paternalistic and nurturing to build work groups that are productive and satisfied. On the other hand, at roughly the same time, paternalistic practices would become obsolete as organizations became more bureaucratic and relied on rules and the protection of individual rights (Iqbal, Anwar & Haider, 2015). According to Sadia and Aman (2018), they suggested within a paternalistic system, obedience is owed to the leader only by virtue of his or her status, and he described paternalism as one of the most elementary types of traditional domination (Khan, Asghar & Zaheer, 2014). He further argued that the rational-legal model of bureaucracy would replace traditional forms of control such as paternalism and that the shift from paternalism based traditional organizations to rational-legal organizations would produce better performance. Studies on paternalism emerging from Asia opposed Weber's purely authoritarian view and argued that paternalistic managers provide support, protection, and care to their subordinates. Zareen Razzaq and Mujtaba (2015) defined paternalism as a father like leadership style in which strong authority is combined with concern and considerateness. More recent research from India, Turkey, China, and Pakistan also suggests that paternalism does not connote "despotism" but rather a relationship in which subordinates willingly reciprocate the care and protection of paternal authority by showing conformity. Recently, Robertson, Birch and Cooper (2012) claimed that paternalism is never completely removed from even the most rational legal organizations and that the benevolent aspect in paternalism may be underappreciated in the Western literature.

2.1.5 Performance of KUPPET Principals

KUPPET is a professional teacher trade union for secondary school teachers and lecturers. It was registered on 26th November 1998 with the registrar of Trade unions under the Trade Unions Act, Cap 223 of the laws of the Republic of Kenya (Saleem, 2015). KUPPET was registered to represent teachers in secondary and tertiary institutions in Kenya who had been agitating for a Union since 1957; it was argued that the Kenya National Union of Teachers had too much on its hands to be of specific value to the needs of post primary teachers (Holmberg et al. 2016). Currently KUPPET has at least thirty Thousand (2072) members in Trans Nzoia, from secondary school teachers, the fraternity of tutors and lecturers in the various tertiary institutions such as polytechnics, technical and primary teacher training colleges. KUPPET represents an attempt by post primary school teachers to make their concerns known. It should aim at influencing instructive procedures and norms in the way that is adequate by its members, towards the improvement not only on issues of remuneration but also on ethical and moral ones, that are critical to any profession (Uchenwamgbe, 2013).

In their comprehensive summary of performance appraisals in the United States of America (USA), Teachers Service Commission (2016), argued that the history of the USA and its fundamentally individualistic culture has had a significant impact on the workplace and performance management practices. Thus, individual performance,

accountability and performance linked rewards, form an integral part of the process (Tummers & Knies, 2016). In the USA, appraisals are primarily used for administrative purposes such as awarding merit raises and informing promotion decisions with the use of performance appraisals for developmental purposes remaining rather limited (Sofi & Devanadhen, 2015). The realization that the system for teacher appraisal is skewed against favoring the teacher motivated this research and the subsequent recommendations that the study made. Previously, the teaching service has been under a closed performance appraisal system, where the school head appraised the teacher confidentially. This was shrouded in secrecy as the teacher was not involved in the process. This situation informed the need to review the appraisal process and introduce a more inclusive system (Boit & Osoro, 2021).

3.1 Research Methodology

Research design is the framework of research methods and techniques chosen by a researcher (Kothari, 2011). The design allowed the researcher to hone in on research methods that are suitable for the subject matter and set up their studies up for success. This study used Correlational research design: Correlational research is a non-experimental research technique that helps researchers establish a relationship between two closely connected variables. This type of research requires two different groups. There was no assumption while evaluating a relationship between two different variables, and statistical analysis techniques calculate the relationship between them. A correlation coefficient determines the correlation between two variables, whose value ranges between -1 and +1. If the correlation coefficient was towards +1, it indicates a positive relationship between the variables and -1 means a negative relationship between the two variables.

3.1.1 Democratic leadership style on performance of KUPPET principals in Trans Nzoia County

When the respondents were asked whether they agree there is limited employee input on performance of KUPPET principals in Trans Nzoia County. Majority 62 (38.8%) of the respondents agreed, while 35 (21.6%) of the respondents were neutral, also 29 (18.1%) of the participants strongly agreed, a few 20 (12.4%) of the participants were asked whether they agreement that the work environment had little flexibility make democratic leadership style processes, Majority 51 (32.1%) of the respondents indicated they strongly agree, also 54 (33.8%) of the respondents indicated they agree, while 29 (18.1%) of the respondents indicated they disagree, a few 20 (12.5%) of the respondents indicated they strongly disagree and the remaining 6 (3.5%) of the respondents indicated they were neutral. The researcher asked the respondents to show their level of agreement about their rules adherences in a well-defined democratic leadership style, Majority 58 (36.1%) of the participants agreed, while 42 (26.4%) of the participants strongly agreed, also 27 (17.1%) of the participants disagreed, a few 24 (14.8%) of the respondents strongly disagreed and the remaining 9 (5.6%) of the respondents were neutral. When the researcher also asked the respondents to show their level of agreement regarding the commitment of all KUPPET Principals working as a teamwork, Majority 49 (30.7%) of the respondents strongly agreed, also 42 (26.1%) of the respondents agreed, further

38 (23.8%) of the respondents disagreed, a few 22 (13.6%) of the respondents strongly disagreed, and finally 9 (5.8%) of the respondents were neutral respectively. When the researcher asked the respondents to show in their own opinion whether they agree that the democratic leadership style can have an effect on performance of KUPPET principals in Trans Nzoia County, Kenya, Majority 77 (59 %) of the respondents indicated that democratic leadership style were the main constraints to most of KUPPET principals poor performance by ticking Yes, while the

remaining 54 (41%) of the respondents indicated No. When asked to explain most 97(73.9%) of the respondents indicated that democratic leadership style being the main cause of poor performance but also there is need to have an expertise in the area of democratic leadership style management so as to drive the implementation process hence continuous improvement True North. The rest 34 (26.1%) of the respondents abstain from explaining.

Table 1.1: Democratic leadership style on performance of KUPPET principals in Trans Nzoia County, Kenya

Statements	%	SA	A	N	D	SD
Do you agree there is limited Employee inputs in the county	%	18.1	38.8	21.6	9.1	12.4
Are you in agreement that work environment gives little flexibility make democratic leadership style processes.	%	32.1	33.8	3.5	18.1	12.5
Are you in agreement that rules adherence affect democratic leadership	%	26.3	36.1	5.6	17.1	14.8
Are you in agreement that there is commitment from all employees to all Kuppet principal of teamwork.	%	30.7	26.1	5.8	23.8	13.6

Autocratic Leadership Style

3.1.2 Autocratic leadership style on Performance of KUPPET principals in Trans Nzoia County, Kenya

When the respondents were asked whether they were in agreement that their process listening to teachers views can result to better performance to KUPPET principals in Trans Nzoia County, Majority 80 (50.1%) of the respondents strongly agreed, also 61 (38.4%) of the respondents agreed, a few 13 (8%) of the respondents disagreed, further 8 (5%) of the respondents were neutral and the remaining 2 (1.5%) of the respondents strongly disagreed. When asked whether they are in agreement that their balance group and leader on performance based have identified autocratic leadership style options while emphasizing better performance towards continuous improvement, of education in the county Majority 98 (61.2%) of the respondents strongly agreed, while 65 (40.8%) of the respondents agreed, a few 13 (7.9%) of the respondents were neutral, further 7 (4.1%) of the respondents disagreed and the remaining 2 (1%) of the respondents strongly disagreed. This echoes the finding of Olang (2017) who observed that performance is key for any investment.

When the research also asked the respondents to indicate their level of agreement whether their kuppet principals embrace all teachers participation leading to the most promising performance in their future endeavors, Majority 70 (43.5%) of the respondents strongly agreed, while 50 (31.2%) of the respondents

agreed, few 15 (9.1%) of the respondents were neutral, further 14 (8.5%) of the respondents strongly disagreed and the remaining 12 (7.8%) of the respondents disagreed. The researcher further asked the respondents to show their level of agreement as to whether their Kuppet principals always endeavors to achieve the best autocratic leadership style goals for future growth, Majority 64 (40.3%) of the respondents indicated that they agreed, while 51 (32.1%) of the respondents indicated that they agree, a few 20 (12.3%) of the respondents indicated neutral, further 16 (9.7%) of the respondents indicated they strongly disagreed and the remaining 12 (7.6%) of the respondents disagreed.

Further when the researcher asked the respondents about their own opinion on whether autocratic leadership style can have an effect on the performance of KUPPET principals in Trans Nzoia County, Kenya, most 73.2% of the respondents were in agreement ticking Yes. While 26.8% of the respondents ticked No. When asked if Yes, they explain 58.3% of the respondents were of the opinion that autocratic leadership style is not the only tool to measure the performance in all KUPPET principals but there are indicators which can also impressed the level of performance such as good customer service, online services and modern technology towards better autocratic leadership style towards achieving more returns on investment hence customer satisfaction.

Table 1.2: Autocratic leadership style on performance of KUPPET principals in Trans Nzoia County, Kenya

Statements	SA	A	N	D	SD
Are you in agreement that employee inputs can result to better performance to KUPPET principals in Trans Nzoia County.	% 50.1	38.4	5	8	1.5
Are you in agreement that performance based has identifying autocratic leadership style options towards better performance	% 61.2	40.8	7.9	4.1	2
Are you in agreement that kuppet principals has the best flexibility leading to the most promising performance in the county	% 40.5	31.2	9.1	7.8	8.4
Are you in agreement that kuppet principals always endeavors to achieve the best performance	% 32.1	40.3	12.3	7.6	9.7

3.1.3 Regression Analysis

To establish the degree of effect of employee motivation for a regression analysis was conducted, with the postulation that: variables are normally dispersed to avoid distortion of associations and significance tests, which was achieved as outliers were not identified; a linear relationship amongst the autonomous and reliant on variables for accurateness of approximation, which was attained as the standardized coefficients were used in clarification. The expression of multiple regression model was as follows:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3 X3+ \beta_4 X_4 + \epsilon$$

Performance of all KUPPET principals = β_1 (democratic leadership style) + β_2 (autocratic leadership style) + β_3 (laissez faire leadership styles) + β_4 (strategy development + error term). Regression analysis produced the coefficient of purpose and analysis of variance (ANOVA). Analysis of variance was completed to show whether there is a significant mean variance among dependent and independent variables. The ANOVA was conducted at 95% confidence level.

3.1.4 Model of Goodness Fit

Regression analysis was used to generate the strengths of relationship amongst the performance of all KUPPET principals (dependent variable) and the predicting variables; democratic leadership style, autocratic leadership style, laissez faire leadership styles and paternalistic leadership style (independent variables). The outcomes displayed a correlation worth (R) of 0.759 which displays that there is a good linear dependence between the autonomous and reliant on variables. These discoveries concur with the findings of Teachers Service Commission (2016). This is in stroke with the discoveries of Mutai and Osoro (2021), who’s experiential that this also portrayed the insinuation of the regression analysis completed at 95% confidence level. This proposes that the multiple regression model was imperative and can thus be rummage-sale to measure the affiliation amongst the reliant on and autonomous variables. This reverberations the discoveries of Kiplang’at (2016), who detected that analysis of variance statistics scrutinizes the differences among group means and their related procedures.

Table 1.3 Model Goodness of Fit

R	R ²	Adjusted R	Std. Error of the Estimate
0.759	0.706	0.629	0.069

With an R-squared of 0.706, the model shows that democratic leadership style, autocratic leadership style, laissez faire leadership styles and paternalistic leadership style can boast up to 70.6% of the differences on performance of KUPPET principals while 29.3% is explained by other indicators which are not inclusive in this study or model. A measure of goodness of fit synopsis the discrepancy between observed values and the values anticipated under the model in question. This finding is in line with the findings Mbombua (2015).

4.1 Conclusion

Manifestly, this study concludes that human resource management have ostensibly impacted on the performance of KUPPET principals in Trans Nzoia County, Kenya. The findings realized that KUPPET principals should endeavor to embrace the best motivation that are aimed at propelling their firming systems with a view to satisfy their clients, increase performance and overall enhances their confidence. Hence, democratic leadership style, autocratic leadership style, laissez faire leadership styles and paternalistic leadership style can boast up to 70.6% of the differences on performance of KUPPET principals as explained by other indicators which are inclusive in this study or model. When KUPPET principals deployed human resource management occasioned through democratic leadership style, autocratic leadership style, laissez faire leadership styles and human resource performance of all of KUPPET principals in Trans Nzoia County, Kenya was wedged.

REFERENCES

[1] Akor, P. U. (2014). Influence of autocratic leadership style on the job performance of academic librarians in Benue State. *Journal of Educational and Social Research*, 4(7): 148-152.

- [3] Amanchukwu, R. N., Stanley, G. J. & Oloube, N. P. (2015). Principles and Styles and their Relevance to Educational Management. *Management*, 5(1): 6-14.
- [4] Al Khajeh, E. H. (2018). Impact of Leadership Styles on Organizational Performance. *Journal of Human Resources Management Research*, 2018, Article ID: 687849.
- [5] Aristovnik, Aleksander; Jaklič, Ksenja (31 July 2013). "Job Satisfaction of Older Workers as a Factor of Promoting Labour Market Participation in the EU: The Case of Slovenia". *Revija za socijalnu politiku*. 20 (2): 123–148.
- [6] Armstrong, M. (2012). *Armstrong's Handbook of Management and Leadership: Developing Effective People Skills for Better Leadership and Management* (3rd ed.). London: Kogan Page.
- [7] Bhargavi, S., & Yaseen, A. (2016). Leadership Styles and Organizational Performance. *Strategic Management Quarterly*, 4, 87-117.
- [8] Boeree, C. George, (2009), *Trait Theories of Personality*, General Psychology.
- [9] Boehm, S. A., Dwertmann, D. J., Bruch, H. & Shamir, B. (2015). The Missing Link? Investigating Organizational Identity Strength and Transformational Leadership Climate as Mechanisms That Connect CEO Charisma with Firm Performance. *The Leadership Quarterly*, 26(1): 156–171
- [10] Boit, J.S & Osoro, A. (2021), Factors Affecting Women in Strategic Management on Performance of County Government in Trans Nzoia, Kenya. *The International Journal of Business & Management* ISSN 2321–8916 October 2021 Vol 9 Issue 1
- [11] Chiappori, P. & Salanie, B. (2003). Testing Contract Theory: A Survey of Some Recent Work". In *Advances in Economics and Econometrics*. Cambridge University Press.
- [12] Christopher L. (2009). Towards a "theoretical toolbox" for strategic sourcing. *Supply Chain Management: An International Journal*, 14(1): 3-10. CIPS (2007). *Contract Management Guide*.
- [13] Daft, R. L. (2000). *Organization, Theory and Design* (7th ed.). Thomson Learning USA: South-Western College Publishing.
- [14] Elliott, K. (2015). Teacher performance appraisal: More about performance or development? *Australian Journal of Teacher Education*, 40(9), 12-19.
- [15] Feidler, F., & House, R. (Eds.). (1994). *Leadership theory and research: A report of progress*.
- [16] Gill, E. (2014). What Is Laissez-Faire Leadership? How Autonomy Can Drive Success.
- [17] Goldsmith, P. L., & Yamane, T. (1968). Elementary sampling theory. *Applied Statistics*, 17(3), 296. Hallinger P., Heck, R. H., & Murphy, J. (2014). Teacher evaluation and school improvement: an analysis of the evidence. *Educational Assessment, Evaluation and Accountability*, 26(1), 5–28
- [18] Haque, A. U., Faizan, R., Zehra, N., Baloch, A., Nadda, V., & Riaz, F. (2015). Leading Leadership Style to Motivate Cultural-Oriented Female Employees in IT Sector of Developing Country: IT Sectors' Responses from Pakistan. *International Journal of Academic Research in Business and Social Sciences*, 5, 280-302.
- [19] Igbaekemen, G. O., & Odivwri, J. E. (2015). Impact of Leadership Style on Organization Performance: A Critical Literature Review. *Arabian Journal of Business and Management Review*, 5, 1-7.
- [20] Iqbal, N., Anwar, S., & Haider, N. (2015). Effect of Leadership Style on Employee Performance. *Arabian Journal of Business and Management Review*, 5, 1-6.
- [21] Khan, S., Asghar, M., & Zaheer, A. (2014). Influence of Leadership Style on Employee Job Satisfaction and Firm Financial Performance: A Study of Banking Sector in Islamabad Pakistan. *Actual Problems in Economics*, 155, 374-384.
- [22] Kiplang'at, J. (2016) How TSC will appraise teachers' performance. *Daily Nation*.
- [23] Kothari, C.R (2011). *Research Methodology. Methods and Techniques*. New Delhi: New Age International Publishers. (2nd Edition).
- [24] Mbombua, D. (2015). Perceived factors affecting employee job satisfaction in the energy regulatory commission of Kenya. Nairobi: Masters Thesis, School of Business, University of Nairobi.
- [25] McGregor, D. M. (2003). *The human side of enterprise*. New York: McGraw-Hill.
- [26] Mokaya, S. O., Musau, J. L., Wagoki, J., & Karanja, K. (2013). Effects of organizational work conditions on employee job satisfaction in the hotel in Kenya. *International Journal of Arts and Commerce*, 2(2), 79-90.
- [27] Mutai, V. K and Osoro, A.(2021) Strategic Engineering Management on Performance of all Commercial Banks in Nyeri County, Kenya. *International Journal of Scientific and Research Publications*, Volume 11, Issue 10, October 2021 530 ISSN 2250-3153.
- [28] Nyoti, J., & Bhau, S. (2015). Impact of Transformational Leadership on Job Performance: Mediating Role of Leader-Member Exchange and Relational Identification. *SAGE Open*, 5, 1-13.
- [29] Nwaigwe, U. (2015.) The Influence of Head Librarians' Leadership Styles on Job Satisfaction of
- [30] Librarians in Tertiary Institution Libraries in Imo State, Nigeria. *Open Access Library Journal* 2, 1-9. .
- [31] Ombima, H. P. (2014). Factors affecting employee job satisfaction in the institutions of higher learning in Kenya: A case of United International University (USIU). Nairobi: Masters Thesis, Chamdaria School of Business, USIU.
- [32] Otieno, J. (2016). Factors influencing satisfaction of management employees in state corporations: A case of Postol Corporation of Kenya. Nairobi: Masters Thesis, School of Business, Strathmore Univeristy.
- [33] Puni, A., Ofei, S. B. & Okoe, A., (2014). The Effect of Leadership Style on Firm Performance
- [34] Ghana. *International Journal of Marketing Studies*, 6(1): 177-185.
- [35] Sadia, A., & Aman, A. (2018). Transformational Leadership and Organizational Performance; the Mediating Role of Organizational Innovation. *SEISENSE Journal of Management*, 1, 59-75.
- [36] Saleem, H. (2015). The Impact of Leadership Styles on Job Satisfaction and Mediating Role of Perceived Organizational Politics. *Procedia-Social and Behavioral Sciences*, 172, 563-569.
- [37] Kendra, Cherry,. (2014) *Psychology Expert, Trait Theory of Personality*, about health online portal, Dec 20, 2014
- [38] Northouse, P. G. (2007). *Leadership: theory and practice*. 4th ed. Thousand Oaks, CA: Sage Publications.
- [39] MSG Experts, (2015) *Trait Theory of Leadership, Management Study Guide*
- [40] Sethuraman, K., & Suresh, J. (2014). *Effective Leadership Styles*. *International Business Research*, 7, 165-172.
- [41] Sofi, M. A., & Devanadhen, D. K. (2015). Impact of Leadership Styles on Organizational Performance: An Empirical Assessment of Banking Sector in Jammu and Kashmir. *IOSR Journal of Business and Management*, 17, 31-45.
- [42] Encyclopedia of Management (2009). *Leadership Theories and Studies*. In *Encyclopedia of Management*.
- [43] Tummers, L., & Knies, E. (2016). Measuring Public Leadership: Developing Scales for Four Key Public Leadership Roles. *Public Administration*, 94, 433-451.
- [44] Uchenwamgbe, B. B. P. (2013). Effects of Leadership Style on Organizational Performance in Small and Medium Scale Enterprises (Principal) in Nigeria. *European Journal of Business and Management*, 5, 53-73.
- [45] Holmberg, C.; et al. (2016). "Job Satisfaction Among Swedish Mental Health Nursing Staff: A
- [46] Cross-Sectional Survey". *International Journal of Public Administration*. 39 (6): 429–436.
- [47] Robertson, I. T.; Birch, A. J.; Cooper, C. L. (2012). "Job and work attitudes, engagement and employee performance: Where does psychological well-being fit in?". *Leadership & Organization Development Journal*. 33 (3): 224–232.
- [48] Teachers Service Commission (2016). *The Journey to Performance Management for Teachers*. *Daily Nation*, February 22, 2016. 38-39
- [49] Zareen, M., Razaq, K. & Mujtaba, B., 2015. Impact of Transactional, Transformational and Laissez- Faire Leadership Styles on Motivation: A quantitative study of banking employees in Pakistan. *Public Organization Review*, 15(4): 531-549.

AUTHORS

First Author – Msc Bridgit K. Chebet, JOMO KENYATTA
UNIVERSITY OF AGRICULTURE AND TECHNOLOGY,
NAIROBI, KENYA

Second Author – Dr. Anthony Osoro, JOMO KENYATTA
UNIVERSITY OF AGRICULTURE AND TECHNOLOGY,
NAIROBI, KENYA

Working Capital Management And Financial Performance Of Technical Vocational Education And Training Institutions In Meru County, Kenya

Msc Ringera J. Mugambi, Dr. Anthony Osoro & Dr. Julius Miroga

Jomo Kenyatta University of Agriculture and Technology, Nairobi in Kenya

DOI: 10.29322/IJSRP.12.10.2022.p13028

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13028>

Paper Received Date: 5th September 2022

Paper Acceptance Date: 5th October 2022

Paper Publication Date: 13th October 2022

Abstract- This study examined the effect of working capital management on financial performance of selected technical vocational education and training institutions in Meru County, Kenya. Working capital management's main goal was to ensure continued operations of the organization with sufficient ability to satisfy both maturing short-term debt and upcoming operational expenses. This implied that working capital management of working capital involves managing inventories, accounts receivable and payable and cash.

Index Terms- cash conversion cycle period, accounts receivable period, accounts payable period and inventory turnover period and financial performance of TVETs

I. INTRODUCTION

Working capital is the capital that a company needs in order to run its operations, i.e. the that is, short-term financing of the company. Proper management of working capital levels help companies ensure provision of sufficient company profits since working capital does not earn interest, for example capital tied up in inventories (Abdulazeez, Baba, Fatima & Abdulrahman, 2018). Working capital contrasts with the long-term financial decisions since it only deals with the short-term financing issues. For example, decisions concerning credit levels to clients as well as credit levels/periods the company should negotiate from suppliers. Working capital management is the management of the short-term investment and financing of any organization. It is a category of resources that includes cash, inventory and receivables, minus what a company owes in the short terms (Adamu, 2016). Working capital comes straight from the statement of financial position (previously referred to as balance sheet) of the firm, and it is often calculated according to the formula: Working capital = Current Assets – Current Liabilities or Inventories + Accounts receivables – Accounts payables – Advances received = Working capital.

According to Enekwe (2015) defined working capital as the excess of current assets over current liabilities. This definition actually brought together the basic tenets of working capital (current assets and current liabilities). There is a consensus among

scholars with respect to the definition of working capital which is an amount of money available to finance the organization's short term debt obligation. The availability of this short term fund is a function of excess of current assets over current liabilities. The suggested study will endeavour to establish the effect of working capital management in Kenya and specifically, Meru County.

2.1 Liquidity Theory

Liquidity Theory is thought to be relevant for this study in order to understand the effect of cash conversion period on financial performance of technical and vocational education and training in Meru County, Kenya, hence it gives theoretical background for this study. The study will be guided by liquidity theory (Donaldson & Preston, 1995). According to the studies, liquidity theory as a function of current assets and current liabilities is an important factor in determining working capital policies and indicates firm's capability of generating cash in case of need. Current ratio, acid-test and cash ratios as traditional measures of liquidity are incompetent because these balance sheet-based measures cannot provide detailed and accurate information about effectiveness of working capital management. Formulas used for calculating these ratios consider both liquid and operating assets in common. Besides, mentioned traditional ratios are also not meaningful in terms of cash flows (Jensen, 2001).

According to Jensen (2001) he insisted on using ongoing liquidity measures in working capital management. Ongoing liquidity refers to the inflows and outflows of cash through the firm as the product acquisition, production, sales, payments and collection process take place over time. As the firm's ongoing liquidity is a function of its cash conversion cycle, it would be more appropriate and accurate for this study to evaluate effectiveness of working capital management by cash conversion cycle, rather than traditional liquidity measures (Donaldson & Preston, 1995). This theory will therefore go a long way in enabling the researcher carry out the exercise from data collection to drawing the analysis for the study in an accurate and with a future impact to other researchers.

2.1.1 Financing Advantage Theory

Financing advantage theory is thought to be relevant for this study in order to understand the effect of accounts payable period on financial performance of technical and vocational education and training in Meru County, Kenya, hence it gives theoretical background for this study. In the business set up where a firm transacts with the suppliers and buyers to accentuate the level of working capital management and make it optimal, a supplier due to the relationship created in the transactions, may have advantage over traditional business partners in investigating the credit worthiness of his clients, as well as a better ability to monitor and force repayment of the credit (Donaldson & Preston, 1995). This will give a number of several cost advantages over other firms in offering credit to the buyer in several ways. The buyer has a huge chance of getting inside information as he is able to visit the premises of the sellers which gives him a very big discretionary assessment of the business. The buyer's inability to take advantage of early payment discounts may serve as a tripwire to alert the supplier of deterioration in the buyer's creditworthiness (Jensen, 2001).

The firm has also another discretionary power of controlling the buyer by threatening to reduce credit opportunities in future or withdrawing it altogether (Donaldson & Preston, 1995). This tight control will make the buyer pay up or switch to another seller with more friendly credit terms as he envisages. This threat may especially be credible if the buyer accounts for a small portion of the firms' sales. But by contrast a financial institution may have more limited powers, as the threat to withdraw future finance may have little immediate effect on the borrowers' operations as they may have many choices for financing, for instance other financial institutions (Jensen, 2001).

2.1.2 Stakeholder Theory

This theory will be relevant to this study in order to understand the effect of accounts receivable period on financial performance of technical and vocational education and training in Meru County, Kenya. The stakeholder theory highlights the relevance of the symbiotic association of firm and various stakeholders, the creditors for instance, provides source of finance to the firm and in exchange expects repayment of their loans on schedule (Jensen, 2001). The stockholders supply the firm's capital and in return expects a maximized risk-adjusted return from their investment. Employees and manager help firms with required skills, time, as well as human capital requirements in exchange they anticipate good working condition, fair income and remunerations. Customers provide the source of revenue to the firms and in exchange expect to have value for money and satisfactory services. Suppliers are input providers to the firm, and hence expect fair prices and dependable buyers (Keynes, 1936). Stakeholders normally differ with respect to their stake size in firms. The level of individual's stake depends on the extent of his exchange of relationship and commitments with the firm which is based on specific asset investments (Donaldson & Preston, 1995). The stakeholder theory was advanced by Jensen (2001) and presents a model describing what the corporation as a constellation of cooperative and competitive interests possessing intrinsic value. It establishes a framework for examining the connections, if any, between the practice of stakeholder management and the achievement of various corporate performance goals (Donaldson & Preston, 1995). The stakeholder theory is intended both to

explain and to guide the structure and operation of the established corporation. Toward that end, it views the corporation as an organizational entity through which numerous and diverse participants accomplish multiple, and not always entirely congruent, purposes. The stakeholder theory argues that managers should make decision so as to incorporate the interest of all stakeholders in a firm (including not only financial claimants, but also employees, customers, communities, governmental official and under some interpretations the environment (Jensen & Meckling, 1976).

2.1.3 Baumol Model of Cash Management

This theory will be relevant to this study in order to understand the effect of accounts receivable period on financial performance of technical and vocational education and training in Meru County, Kenya. Baumol model of cash management helps in determining a firm optimum cash balance under certainty. It is extensively used and highly useful for the purpose of stock and cash management. The Baumol model is based on the Economic Order Quantity (EOQ). The objective is to determine the optimal target cash balance (Keynes, 1936). Baumol made the following assumptions in his model; the firm is able to forecast its cash requirement with certainty and receive a specific amount on regular intervals; the firm's cash payments occur uniformly over a period of time that is; a steady rate of cash outflows; the opportunity cost of holding cash is known and does not change over time; cash holdings incur an opportunity cost in the form of opportunity foregone; the firm will incur the same transaction cost whenever it converts securities to cash; cash transactions incurs at a fixed and variable cost (Donaldson & Preston, 1995).

According to Schwartz (1974), the limitation of the Baumol model are as follows; assumes a constant disbursement rate; in reality cash outflows occur at different times, different due dates; assumes no cash is coming in and out on a frequent basis; no safety stock is allowed for reason being it only takes a short amount of time to sell marketable securities (Petersen & Rajan, 1997). According to Baumol (1952), the Baumol model assumes the cash manager invests excess funds in interest bearing securities and liquidates them to meet the firm's demand for cash. As investment returns increase, the opportunity cost of holding cash increases and the cash manager decreases cash balances. As transaction costs (cost of liquidating short-term investments) increase, the cash manager decreases the number of times he liquidates securities, leading to higher cash balances. Managing the cash - short-term investments mix involves determining the optimal frequency for replenishing cash and the amount of securities to liquidate (Bastos & Pindado, 2007).

2.2 Cash Conversion Period

Studies by Wambia and Jagongo (2020), in Istanbul Turkey, registered a significant and negative relationship between CCC, and return on assets (ROA) and return on equity (ROE). However, the study observed a positive relationship between return on assets (ROA) and firm size while there is a negative and significant relationship between debt ratio (DEBT) and return on assets (ROA). Whereas this study done in Istanbul Turkey has generated information on the relationship between CCC and firm performance, there is paucity of information of such relation especially in-service provision sector like tertiary institutions

locally in Kenya hence, the gap this variable proposes to fill. According to Yator (2018) cash conversion circle has nonlinear significant effect on Gross Profit Margin and Earnings before interest and tax margin, whereas, among its components, only accounts payable days has significant effect on gross profit margin and earnings before interest and tax margin.

However, the study established a negative no relationship between return on assets cash conversion circle and returns on assets. Whereas this study, done in Omani and looked at the relations of cash conversion circle and commercial listed firms, there are limited studies locally in Kenya done on the public good service sector to establish the relationship between cash conversion circle from the perspective of tertiary institutions: a gap this study will endeavor to fill. According to Kiprotich (2017), study of the listed firms in Vietnam stock market covering 2006 to 2008 and on the effect of CCC on profitability revealed that cash conversion cycle had a negative effect on profitability. They propose that when CCC increases, it affects firms profitability by reducing it. As such the managers could create a positive value for the shareholders by handling the adequate cash conversion cycle and keeping each different component to an optimum level (Macharia, 2017).

2.2.1 Accounts Receivable Collection Period

Accounts receivable management is a critical component for the company or organization to achieve its financial dreams (Mbula, Memba & Njeru, 2016). This argument is further augmented by Ahmet (2012) who states that even the most financially sound company can go under if the component of account receivables is not handled with care. Therefore, they urged organizations to put in place a sound policy on account receivable period if they have to remain financially viable in achieving their vision, mission and objectives. The proposed study will therefore endeavor to establish the effect of account receivables on the financial wellbeing of the TVET institutions in Meru County. Accounts receivable are those customers who have not yet paid for goods or services which the firm has supplied. The accounts receivable is done to reduce the time laps between completion of sales and receiving payment. Accounts receivables can be seen as short-term loans to customers given by the supplying firm. Giving these credit terms to customers are an important way of securing sales (Macharia, 2017).

According to Mesut and Kevser (2020) opines that companies can sometimes use their receivables as collateral for borrowing money. She continues by saying that the level of accounts receivable also affects several important financial-performance measures, including WC, days payable, the current ratio, and others. Firms should also operate a cash discount policy in order to attract customers who will opt to enjoy the benefits that entice them to pay in advance thereby shortening the average collection period of the firm. According to Mbula et al. (2016) explored the association between efficiency ratios and the profitability, stock market value and operational cash flow of 215 non-financial firms listed on Italian Stock Exchange. It was found that there is highly significant association between measures of profitability related to operating activities, such as earnings before interest, taxes, depreciation, and amortization to asset ratio, and proxies of efficiency, such as total asset turnover ratio, inventory turnover ratio and accounts receivable turnover ratio (Le, Vu, Du

& Tran, 2018). However these efficiency ratios showed a weak association with profitability measures such as ROA and ROE. A strong association was found between measures of cash flow and efficiency ratios such as total asset turnover and account receivables turnover. However the efficiency measures did not have significant association with stock market value (Mesut & Kevser, 2020).

2.2.2 Accounts Payable Payment Period

According to Mutai and Osoro (2021) study found that lease option had positively affected the profit of the SME's as did a similar examination in Bangladesh on the performance of Medium enterprises SMEs. The investigation on the Bond to Total Debt Ratio on Firms' Performance and found an insignificant relationship between the bond-to-total debt ratio and firm performance. Several researchers have tested the effects of profitability on firm leverage. According to Mesut and Kevser (2020), they found weak to no influence, debt was positively and strongly associated with financial performance and significant negative relationship between debt ratio and financial performance, respectively, as measured by profitability.

Another similar study by Mutai and Osoro (2021), revealed a negative and insignificant relationship between Short term debt to total assets and Long term debt to total assets, and ROA and profit margin. In their study they stated that there the suitability of management of the credit portfolio in Nigerian Banks had a positive relationship with financial performance. The study looked at the performance of banks in respect to the management of bad loans and concluded that managers have a duty in managing credit portfolios. Whereas the study was based in the relationship between accounts receivables and financial management in banks, the proposed study will more look into the effect of such relationships but in the education sector in Kenya and Meru County in specific (Nandom & Mubarik, 2017).

2.2.3 Inventory Turnover Period

Efficient inventory management practices involve knowing how much should be ordered and when should it be ordered. This relates to determining the economic order quantity and analysis of the costs of maintaining certain levels of inventory (Mesut & Kevser, 2020). The costs involved in inventory management are those of holding too much stock and those of holding too little, hence the need to put in place an effective inventory management system to ensure reliable sales forecasts to be used in inventory ordering purposes. Maintaining optimal inventory levels reduces the cost of possible interruptions or loss of business due to the scarcity of products, reduces supply costs and protects against price fluctuations (Mutai & Osoro, 2021). The time taken to convert inventory held into sales is known as Inventory Conversion Period and is used as a proxy for inventory management policy. Inventory Conversion Period is calculated as inventory divided by cost of sales multiplied by 365 days (Zainudin, Ibrahim, Hussain & Hadi 2017a).

According to Nandom and Mubarik (2017), they researched about Inventory management and its effect on Financial Performance of Firms which are provided funds by the Government Venture Capital in the country. Most of the firms which are provided funds by government venture capital have proper practices that enhance working capital management.

However, a lot has to be done in Kenya on the management of working capital especially in the management of accounts which are overdue as well as review and adherence to sound credit management policies. The research suggests that more studies should be done on firms which have a firm size that is extended. This can also be integrated in other components of working capital management such as accounts payable and working capital levels that the current study emphasizes. A strong positive relationship was established between inventory and financial performance of small businesses in Nigeria (Mesut & Kevser, 2020). The current study is based on 31 supermarkets based in Nairobi County they found contradicting evidence with the management of inventories in Kenya.

2.2.4 Financial Performance of TVETs

Financial performance is a subjective measure of how well a firm can use assets from its primary mode of business and generate revenues (Odhiambo, 2016). The term is also used as a general measure of a firm's overall financial health over a given period of time and can be used to compare similar firms across the same industry or to compare industries or sectors in aggression. She continues quipping that financial performance can be measured by the rate of return on investment. The firm's performance encompasses three specific areas which include accounting measures, market measures and some firms use both of them. According to Yilmaza and Goksel (2019), stated that accounting measurement is the computation of economic/financial activities in terms of money, hours and other units or a measurable element that is used to compare and evaluate accounting data. He further said that the different accounting measurements provide a better view of the overall health of the firm by allowing varying methods of comparison and evaluation.

According to Ross, Westerfield and Jordan (2016), Most investors and analysts tend to focus on financial performance indicators such as return on asset, return on equity, return on sales, and the retained earnings ratio related to equity in measuring the sustainable growth but also looking at these following other potential indicators for companies success such as: advertising expenditures, research and development, cash conversion cycle, and earnings volatility. Many studies conducted on performance of corporate institutions, most of them were concentrated on financial performance impact on different entities. Whereas these studies have recorded information on the effect of accounts payable and profitability of firms, the proposed study will more look into the financial performance from educational service providers' perspective. According to Subhi (2017) studied Nigerian firms and the results suggested a significant correlation between cash management and performance of manufacturing companies.

3.1 Research Methodology

This study used a descriptive research design given that the design too helped the study to make both arithmetical and evocative statistics that was used in gaging the connection among the variables to be studied thus producing arithmetical data. According to Bryman and Bell (2015) states that a research design is a strategy that a study can adopt to data collection which can generate answers to a research problem.

3.1.1 Cash Conversion Period on performance of TVETs

When the respondents were asked whether they agree that there days stock outstanding is affecting the performance of TVETs in Meru County towards better performance. Majority 31(48.8%) of the respondents agreed, while 14 (22.6%) of the respondents were neutral, also 11 (17.1%) of the respondents strongly agreed, a few 8 (12.4%) of the respondents strongly disagreed and finally 6 (9.1%) of the respondents disagreed. When the respondents were asked whether they agreement that the days sales outstanding gives them ability and willingness to make Cash conversion period processes, Majority 21 (33.1%) of the respondents indicated they strongly agree, also 21 (32.8%) of the respondents indicated they agree, while 11 (18.1%) of the respondents indicated they disagree, a few 8 (12.5%) of the respondents indicated they strongly disagree and the remaining 2 (3.5%) of the respondents indicated they were neutral. The also researcher asked the respondents to show their level of agreement about their days payable outstanding is doing good, Majority 22 (35.1%) of the respondents agreed, while 17 (27.4%) of the respondents strongly agreed, also 11 (17.1%) of the respondents disagreed, a few 9 (14.8%) of the respondents strongly disagreed and the remaining 4 (5.6%) of the respondents were neutral. .

When the researcher also asked the respondents to show their level of agreement regarding the commitment of all financial management in Meru county, Majority 20 (31.7%) of the respondents strongly agreed, also 16 (25.1%) of the respondents agreed, further 15 (23.8%) of the respondents disagreed, a few 9 (13.6%) of the respondents strongly disagreed, and finally 4 (5.8%) of the respondents were neutral respectively. When the researcher asked the respondents to show in their own opinion whether they agree that the Cash conversion period can have an effect on performance of TVETs in Meru County, Kenya, Majority 37 (59 %) of the respondents indicated that Cash conversion period were the main constraints to most of TVETs colleges poor performance by ticking Yes, while the remaining 26 (41%) of the respondents indicated No. When asked to explain most 47 (73.9%) of the respondents indicated that Cash conversion period being the main cause of poor performance but also there is need to have an expertise in the area of Cash conversion period management so as to drive the implementation process hence continuous improvement True North. The rest 16 (26.1%) of the respondents abstain from explaining.

Table 1.1: Cash Conversion Period on Performance of TVETs

Statements	%	SA	A	N	D	SD
Do you agree there is enough days stock outstanding	%	48.8	17.1	12.6	9.1	12.4
Are you in agreement that days sale outstanding giving them ability and willingness to make Cash conversion period processes.	%	33.1	32.8	18.1	12.5	3.5
Are you in agreement that days payable outstanding framework systems.	%	35.1	27.4	17.1	14.8	5.6
Are you in agreement that there is effect on performance	%	31.7	25.1	23.8	13.6	5.8

of the

3.1.2 Accounts Receivables Collection Period on Performance of TVETs

When the respondents were asked whether they were in agreement that average days delinquent can result to better performance of TVETs in Meru County, Majority 30 (48.1%) of the respondents strongly agreed, also 22 (35.4%) of the respondents agreed, a few 6 (9%) of the respondents disagreed, further 4 (6%) of the respondents were neutral and the remaining 1 (1.5%) of the respondents strongly disagreed. When asked whether they are in agreement that there are collection effectiveness index on performance have identified accounts receivables collection period options while emphasizing better performance towards continuous improvement, Majority 32 (51.2%) of the respondents strongly agreed, while 19 (30.8%) of the respondents agreed, a few 5 (7.9%) of the respondents were neutral, further 3 (4.1%) of the respondents disagreed and the remaining 4 (6%) of the respondents strongly disagreed. This echoes the finding of Mutai and Osoro (2021) who observed that performance is key for any investment. When the research also asked the respondents to indicate their level of agreement whether their percentage current account receivable can leading to the most promising performance in their future endeavors in TVETs in Meru county, Majority 27 (42.5%) of the respondents strongly agreed, while 20 (32.2%) of the respondents agreed, few 6 (9.1%)

respondents were neutral, further 5 (8.5%) of the respondents strongly disagreed and the remaining 5 (7.8%) of the respondents disagreed. The researcher further asked the respondents to show their level of agreement as to whether their collections are good leading to endeavors of achieving the best accounts receivables collection period goals for future growth, Majority 24 (38.3%) of the respondents indicated that they agreed, while 20 (32.1%) of the respondents indicated that they agree, a few 8 (12.3%) of the respondents indicated neutral, further 7 (9.7%) of the respondents indicated they strongly disagreed and the remaining 5 (7.6%) of the respondents disagreed.

Further when the researcher asked the respondents about their own opinion on whether accounts receivables collection period can have an effect on the performance of TVETs in Meru County, Kenya, most 71.2% of the respondents were in agreement ticking Yes. While 28.8% of the respondents ticked No. When asked if Yes, they explain 71.2% of the respondents were of the opinion that accounts receivables collection period is not the only tool to measure the performance in TVETs colleges but there are indicators which can also impressed the level of performance such as good customer service, online services and modern technology towards better accounts receivables collection period towards achieving more returns on investment hence customer satisfaction.

Table 1.2: Accounts Receivables Collection Period on performance of TVETs

Statements	%	SA	A	N	D	SD
Are you in agreement that days average delinquent can result to better performance Of TVETs in Meru County.	%	48.1	35.4	9	6	1.5
Are you in agreement that better performance of TVETs in Meru County is because of accounts receivables collection period options	%	65.2	30.8	7.9	4.1	6
Are you in agreement that percentage of current account receivables can lead to the most promising performance in future to all TVETs in Meru County	%	42.5	32.2	9.1	8.5	7.8

Are you in agreement that TVETs are endeavoring to achieve the best performance % 58.3 32.1 12.3 9.7 7.6

3.1.3 Accounts Payable Payment Periods on Performance of TVETs

When the respondents were asked whether they agree that invoice processing time on accounts payable payment periods have clearly solved the objective of performance of TVETs in Meru County, Kenya, Majority 35 (54.8%) of the respondents agreed, while 8 (13.2%) of the respondents strongly agreed, a few 9 (14.7%) of the respondents were neutral, further 8 (12%) of the respondents disagreed and the remaining 3 (5.3%) of the respondents strongly disagreed. The researcher also asked the respondents whether they agree that their school has the best peer recognition has enhanced performance of TVETs in Meru County, Kenya, Majority 20 (32.3%) of the respondents strongly agreed, while 18 (28%) of the respondents were neutral, a few 10 (16.1%) of the respondents disagreed, further 10 (15.7%) of the respondents agreed and the remaining 5 (7.9%) of the respondents strongly disagreed. This is in line with the findings of Mutai and Osoro (2021)

When the researcher also asked the respondents to indicate their level of agreement as to whether their invoicing exception rate was embracing better performance in Meru County, Majority 27 (42.7%) of the respondents agreed, while 17 (27.3%) of the respondents were neutral, further 16 (26%) of the respondents strongly agreed, also 2 (3.1%) of the respondents disagreed and the remaining 1 (0.9%) of the respondents disagreed. Finally When the respondents were asked to indicate whether their level of agreement whether their average approval time on accounts payable payment period in Meru county has improved performance for all TVTs in Meru County, Majority 32 (51.4%) of the respondents agreed, while 16 (26.1%) of the respondents were neutral, further 6 (9.6%) Of the respondents disagreed, also 5 (7.9%) of the respondents strongly disagreed and the remaining 3 (5%) of the respondents strongly agreed.

Further the researcher wanted the respondent to indicate whether accounts payable payment periods has an effect on performance of TVETs in Meru County, Kenya, Majority 74.2% of the respondents ticked Yes, while 25.8% of the respondents ticked No. The researcher requested who ticked Yes to explain why they agree that accounts payable payment periods has an impact on performance of TVETs in Meru County, Kenya, nearly 69.1% all the respondents who had ticked Yes explained precisely that accounts payable payment periods is the only driver towards childcare that can be impressed to improve performance of modern TVETs colleges by being pro-active in alternative scheduling. Only 6.1% of the respondents abstained from explaining even though they have ticked yes.

Table 1.3: Accounts Payable Payment Periods on Meru County, Kenya, hence high performance. Majority of the respondents gave a mean (M) of 4.028 and standard deviation (SD) of .6723

3.1.4 Statements		SA	A	N	D	SD
Are you in agreement that invoice processing time can clearly articulated objectives of accounts payable payment periods?	%	54.8	13.2	14.7	12	5.3
Are you in agreement that invoice exception rate can lead to performance of TVETs in Meru County	%	32.3	28	16.1	15.7	7.9
Are you in agreement that average approval time is resulting to better performance	%	42.7	27.3	26	3.1	0.9
Are you in agreement that improving accounts payable payment period can lead to performance of TVETs in Meru County.	%	51.4	26.1	9.6	7.9	5

Inventory Turnover Period on Performance of TVETs

From table 1.4. below, the respondents concurred that sales costs can clearly articulated the need for better performance of TVETs in Meru County. Most of the respondents gave a mean (M) of 3.831 and a standard deviation (SD) of .7106 respectively; when the respondents were asked whether they are in agreement that their receiving costs can lead to long term achievement of goals in the TVETs colleges, most of the respondents gave a mean (M) of 3.472 and a standard deviation (SD) of .7843 respectively; also when the respondents were asked whether they are in agreement that their TVETs had clear operational costs, most of the respondents gave a mean (M) of 4.381 and a standard deviation (SD) of .7066 respectively; further when the respondents were asked whether they were in agreement that their TVETs always endeavors to improve their balanced financial constraints to both internal and external client leading to performance of TVETs in

respectively; the respondents also were requested to state their level of agreement regarding their own opinion in relation to inventory turnover period on performance of TVETs in Meru County, Kenya. majority of the respondents gave Yes response which is equivalent to mean (M) of 4.201 and a standard deviation (SD) of .8203 respectively; when the respondents were asked if they gave Yes they explain majority of the respondents gave a mean (M) of 4.003 and a standard deviation (SD) of .8013 respectively. These findings concur with Wambani (2016) that the goal of inventory turnover period was to improve performance of TVETs in Meru County, Kenya. This is in line with the finding of Kothari (2011). It is essential for inventory turnover period managers to comprehend the provisions of policies to be enhanced towards performance of TVETs in Meru County, Kenya.

Table 1.4: Inventory Turnover Period on Performance of TVETs

Statement	Mean	Std. Dev.
Are you in agreement that their sales costs can lead to good inventory turnover period and better performance	3.831	.7106
Are you in agreement that receiving costs can enhance inventory costs and better performance in TVETs colleges	3.472	.7843
Are you in agreement that your college performance can improve through inventory turnover	4.380	.7066
Are you in agreement that your operational costs can lead to better performance of TVETs in Meru County.	4.028	.6723
In your own opinion do you agree that inventory turnover period has an effect on performance of TVETs in Meru County, Kenya.	4.0218	.8203
When the respondents were asked to explain Their response was;	4.203	.8013

3.1.5 Performance of TVETs

These results are in table 1.5 below: when the respondents were asked whether in their TVETs college they have parent's satisfaction on performance of TVETs in Meru County. Majority of the respondents gave a mean (M) of 3.186 and a standard deviation (SD) of 0.7311 respectively; also when the respondents were asked whether they are in agreement that KNEC better results have a good return on performance of TVETs in Meru County, Majority of the respondents gave a mean (M) of 3.814 and a standard deviation (SD) of 0.7134 respectively; further when the respondents were asked whether they agree that their student's enrolment are as results of performance of TVETs in Meru County, most of the respondents responded with a mean (M) of 4.147 and a standard deviation (SD) of 0.5972 respectively; when the respondents were asked whether they are in agreement that their college have a good motivation style on performance of TVETs in Meru County, most of the respondents gave a mean (M) of 4.101 and a standard deviation (SD) of 0.7611 respectively;

finally when the respondents were asked in their level of opinion whether they are in agreement that performance can be embraced by college policy, most of the respondents ticked Yes with a mean (M) of 3.671 and a standard deviation (SD) of 0.8133 respectively; further when the respondents who ticked Yes were requested to justify their response, and majority of the respondents gave a mean (M) of 4.168 and a standard deviation (SD) of .6920 respectively.

These findings are in line with the finding of Jones Osasuyi and Mwakipsile (2017), who contended that it is critical to monitor performance of TVETs in Meru County at regular intervals so as to guarantee parents satisfaction and continuous improvement in the TVETs institutions hence, more return on enrollment. These include recognizing the importance of employee motivations in the area of performance of TVETs in Meru County, also to implement the True North of TVETs in Meru County.

Table 1.4: Performance of TVETs

Statement	Mean	Std. Dev.
Are you in agreement that their net profit margin is embracing good performance of TVETs in Meru County	3.186	.7311
Are in agreement that their return on investment can give good performance to all TVETs in Meru County.	3.814	.7034
Are you in agreement that their operational cash flow can be the cause of non-performance of TVETs in Meru County	4.147	.5972
Are you in agreement that performance of TVETs in Meru County is being affected	4.101	.7601
In your own opinion performance can be enhanced by financial management	3.671	.8133
When the respondents were requested to explain if they indicated Yes	4.168	.6921

3.2 Regression Analysis

To establish the degree of effect of employee motivation for a regression analysis was conducted, with the postulation that: variables are normally dispersed to avoid distortion of associations and significance tests, which was achieved as outliers were not identified; a linear relationship among the independent and dependent variables for accurateness of approximation, which was attained as the standardized coefficients were used in clarification. The expression of multiple regression model was as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \epsilon$$

Performance of all TVETs = β_1 (Cash conversion period) + β_2 (accounts receivables collection period) + β_3 (accounts payable payment periods) + β_4 (inventory turnover period + error term).

Regression analysis produced the coefficient of purpose and analysis of variance (ANOVA). Analysis of variance was completed to show whether there is a significant mean variance among dependent and independent variables. The ANOVA was conducted at 95% confidence level.

4.14 Model of Goodness Fit

Regression analysis was used to create the strengths of relationship among the performance of TVETs in Meru County (dependent variable) and the predicting variables; Cash conversion period, accounts receivables collection period, accounts payable payment periods and inventory turnover period (independent variables). The results showed a correlation value (R) of 0.729 which shows that there is a good linear dependence between the independent and dependent variables. These findings concur with the findings of Mutai and Osoro (2021). This is in line with the findings of Kothari, (2014), who observed that this also depicted the significance of the regression analysis done at 95% confidence level. This implies that the multiple regression model was important and can thus be used to assess the relationship among the dependent and independent variables. This echoes the findings of Musah (2018), who detected that analysis of variance statistics scrutinizes the differences among group means and their related procedures.

Table 1.5 Model Goodness of Fit

R	R ²	Adjusted R	Std. Error of the Estimate
0.729	0.789	0.739	0.068

With an R-squared of 0.789, the model shows that Cash conversion period, accounts receivables collection period, accounts payable payment periods and inventory turnover period can boast up to 78.9% of the differences on performance of TVETs in Meru County while 21.1% is explained by other indicators which are not inclusive in this study or model. A measure of goodness of fit synopsis the discrepancy between observed values and the values anticipated under the model in question. This finding is in line with the findings Mutai and Osoro (2021)

Conclusion

Manifestly, this study concludes that human resource management have ostensibly impacted on the performance of TVETs in Meru County, Kenya. The findings realized that college lectures should endeavor to embrace the best motivation that are aimed at propelling their school systems with a view to satisfy their customers, increase productivity and overall enhances their profitability. Hence, when TVETs deployed financial management occasioned through Cash conversion period, accounts receivables collection period, accounts payable payment periods and human resource performance of all of TVETs in Meru County. By TVETs in Meru County, Kenya, embracing accounts receivables collection period, it benefited from promoting the best human resource options and identified viable processes that ensured proper allocation of resource allocation and fulfilment of the set goals, hence ensuring that TVETs college leveraged their performance. Therefore, this study concludes that TVETs in Meru County, Kenya experienced a significant increase in growth, through embracing all the objectives in this study

REFERENCES

- [1] Abdulazeez, D. A., Baba, N. A., Fatima, K. R., & Abdulrahman, Y. (2018). Working Capital Management and Financial Performance of Listed Conglomerate Companies in Nigeria. *Journal of Accounting, Finance and Auditing Studies*, 4(2) 49-66.
- [2] Adamu, Y. (2016). Effects of Working Capital Management and the Financial Performance of the Pharmaceutical Firms in Nigeria, *Journal of Economics, Commerce and Management*, Vol. 10, Issue 4.
- [3] Bastos, R. & Pindado, J. (2007). An agency model to explain trade credit policy and empirical evidence. *Applied Economics Journal*, 39, 2631-42.
- [4] Baumol, W. (1952). The Transaction Demand for Cash: An inventory theoretic approach. *The Quarterly Journal of Economics*, 6(4), 25-30.
- [5] Bryman, A., & Bell, E. (2015). *Business Research Methods*. Oxford University Press, USA.
- [6] Donaldson, T., & Preston, L. E. (1995). The stakeholder theory of the corporation: Concepts, evidence, and implications. *Academy of management Review*, 20(1), 65-91.
- [7] Enekwe, C. I. (2015). The Relationship between Financial Ratio Analysis and Corporate Profitability: A Study of Selected Quoted Oil and Gas Companies in Nigeria. *European Journal of Accounting, Auditing and Finance Research*, 3(2), 17-34.
- [8] Hamzah, L. U. (2018). BILATERAL INVESTMENT TREATIES (BITS) IN INDONESIA: A PARADIGM SHIFT, ISSUES AND CHALLENGES. *Journal of Legal, Ethical and Regulatory Issues*, 21(1).
- [9] Haron, R., & Nomran, N. M. (2016). Determinants of working capital management before, during and after the global financial crisis of 2008: Evidence from Malaysia. *The Journal of Developing Areas*, 50(5), 461-468.
- [10] Haseeb, M., Abidin, I. S. Z., Hye, Q. M. A., & Hartani, N. H. (2018). The Impact of Renewable Energy on Economic Well-Being of Malaysia: Fresh Evidence from Auto Regressive Distributed Lag Bound Testing Approach. *International Journal of Energy Economics and Policy*, 9(1), 269- 275.
- [11] Haseeb, H. Z., G. Hartani, N.H., Pahi, M.H. Nadeem, H. . (2019). Environmental Analysis of the Effect of Population Growth Rate on Supply Chain Performance and Economic Growth of Indonesia. *Ekoloji*, 28(107)
- [12] Jakpar, S., Tinggi, M., Siang, T. K., Johari, A., Myint, K. T., & Sadique, M. S. (2017). Working capital Management and profitability: Evidence from manufacturing sector in Malaysia. *Journal of Business & Financial Affairs*, 6(2), 1-9.
- [13] Jensen, M. (2001). Value maximization, stakeholder theory, and the corporate objective function. *European financial management*, 7(3), 297-317.
- [14] Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), 305- 360.
- [15] Jones Osasuyi, O., & Mwakipsile, G. (2017). Working Capital Management and Managerial Performance in some Selected Manufacturing Firms in Edo State Nigeria. *Journal of Accounting, Business and Finance Research*, 1(1), 46-55.
- [16] Keynes, J. M. (1936). *The general theory of employment, interest and money*. New York: Harcourt Brace and World.
- [17] Kiprotich, R., C. (2017). Determinants of Working Capital Management on profitability of Small and Medium Enterprises in County. *International Journal of Recent Research in Commerce Economics and Management (IJRRCEM)*. ISSN 2349-7807 Vol. 4, Issue 4, pp: (290-313). Available at: www.researchpublish.com
- [18] Le, H. L., Vu, K. T., Du, N. K., & Tran, M. D. (2018). Impact of Working Capital Management on Financial Performance: The case of Vietnam. *International Journal of Applied Economics, Finance and Accounting*, 3(1), 15-20.
- [19] Macharia, H., K. (2017). Effect of Working Capital Management on Financial Performance of Listed Non-Financial Firms in Kenya. *International Journal of Management and Commerce Innovations*. ISSN 2348-7585 (Online) 5, (1), pp: (360-369). Available at: www.researchpublish.com
- [20] Mbula, K. J. Mamba S. F. & Njeru, (2016). A. "Effect of Accounts Receivable on Financial Performance of Firms Funded By Government Venture Capital in Kenya," *IOSR Journal of Economics and Finance*, vol. 7(1), 62-69.
- [21] Mesut, D., & Kevser, K. (2020). The determinants of cash conversion cycle and firm performance: an empirical research for Borsa Istanbul Turkey. *Management and Economics Review*, 5(2), 197-206.
- [22] Musah, A. (2018). The Impact of Capital Structure on Profitability of Commercial Banks in Ghana. *Asian Journal of Economic Modelling*, 6(1), 21-36.
- [23] Mutai, V.K., & Osoro, A. (2021) Strategic Engineering Management on Performance of all Commercial Banks in Nyeri County, Kenya. *International Journal of Scientific and Research Publications*, Volume 11, Nandom, Y. I., Mubarik, M. A. (2017). The impact of working capital management on corporate performance: evidence from listed non-financial firms in Ghana. *European Journal of Accounting, Auditing and Finance Research*, 5 (3), 68-75.
- [24] Odhiambo, V. E. (2016). Role of working capital management practices on financial performance of private colleges in Nairobi County. *Strategic business and change and journal of management*, 3(8), 128 – 143.
- [25] Padachi, K. (2016). Trends in Working Capital Management and its Impact on Firms Performance: An Analysis of Mauritian Small Manufacturing Firms, *Interdisciplinary Journal of Contemporary Research in Business*.
- [26] Petersen, M. A. & Rajan, R. G. (1997). Trade credit: theories and evidence. *Review of Financial Studies*, 10(3), 661-691.
- [27] Ross, S. A., Westerfield, R. W., & Jordan, B. D. (2016). *Fundamentals of Corporate Finance*. New York: McGraw-Hill Irwin Publications.
- [28] Schwartz, R. A. (1974). An economic model of trade credit. *Journal of Financial and Quantitative Analysis*, 9, 643-657.
- [29] Subhi H. (2017). Relationship between cash conversion cycle with Firm Size and Profitability. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, 7(4), 296-304.
- [30] Wambani, I., S. (2016). Effect of Strategy Implementation Practices on Employee Performance in County Government, Kenya. *International Journal of Research and Review*. E-ISSN: 2349-9788; P-ISSN: 2454-2237 Vol. 4, Issue 5, pp:(290-313). Available at: http://www.ijrrjournal.com/IJRR_Vol.4_Issue.5_May2017/IJRR0024.pdf
- [31] Wambia, W. O. & Jagongo, A. (2020). The effects of working capital management practices on the financial performance of insurance companies in Kenya. *International Academic Journal of Economics and Finance*, 3(5), 103-120.
- [32] Yator, P. (2018). Effects of receivables management practices on financial performance of private TVET institutions in Eldoret Town, Kenya, *Journal of Business and Management*, 20, (7)13-19.
- [33] Yilmaza, I., & Goksel, A. (2019). The effect of cash conversion cycle on profitability in Omani companies. *International Journal of Economics, Management and Accounting*, 27 (2), 269-290.
- [34] Zainudin, Z., Ibrahim, I., Hussain, H. I. & Hadi, A.R.A (2017a) Debt and Financial Performance of REITs in Malaysia: An Optimal Debt Threshold Analysis, *Jurnal Ekonomi Malaysia (Malaysian Journal of Economics)*, 51, (2), 63 – 74.

AUTHORS

First Author – Msc Ringera J. Mugambi, Jomo Kenyatta University of Agriculture and Technology, Nairobi in Kenya
Second Author – Dr. Anthony Osoro, Jomo Kenyatta University of Agriculture and Technology, Nairobi in Kenya
Third Author – Dr. Julius Miroga, Jomo Kenyatta University of Agriculture and Technology, Nairobi in Kenya

Employees Job Satisfaction And Performance Of High School Teachers In Trans Nzoia County, Kenya

Msc Patience N. Kwamboka and Dr. Anthony Osoro

Jomo Kenyatta University of Agriculture and Technology, Nairobi in Kenya

DOI: 10.29322/IJSRP.12.10.2022.p13029
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13029>

Paper Received Date: 6th September 2022
Paper Acceptance Date: 5th October 2022
Paper Publication Date: 13th October 2022

Abstract- This study aimed at recognizing the effect of employee job satisfaction and performance of high school teachers in Trans Nzoia County, Kenya. How teacher's work motivation was an effective response to his work situation. Thus, teacher job satisfaction refers to the teacher's actual relationship with his or her role as a teacher. The most important information about an employee are an interpreter of his work satisfaction as people join organizations, to satisfy their personal needs.

Index Terms- Employee pay, employee bonus, employee recognitions and employee promotion and performance of high school teachers.

I. INTRODUCTION

According to Walker and Czajkowski (2019), the observed that high job satisfaction will retain workers in the organization, this calls for the organizational management to be considerate of job satisfaction in their workforce. Many studies on the topic of job satisfaction mainly relies on motivation theory developed by Ariani (2015) argued that those variables which may bring job satisfaction include good pay, good working environment, good organizational policies and administration, while those that may contribute to job dissatisfaction include lack of recognition, lack of advancement, work itself among others. Also according to Polit and Beck (2017), Kenya teachers' job dissatisfaction indicators may comprise of poor transport network, poor housing, work place conflicts, inadequate working resources, which reduce teachers' devotion to their work. According to Madi Assal, Shrafat and Dia (2017), the motivation of the work of the teacher was an exceptional answer to his situation at work. The most important information about an employee are an interpreter of his work satisfaction as people join organizations, to satisfy their personal needs. According to Abid and Barec (2017), they also insisted that favorable conditions are necessary for any effective work to take place. Therefore, an individual must be provided with an environment that enables him to perform and produce the desired results. They also noted that teachers working in rural centers are more disadvantaged than their counterparts due to the underdevelopment of their schools.

1.1.1 Affect theory

This publication is licensed under Creative Commons Attribution CC BY.

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13029>

Bassett-Jones, Nigel; Lloyd, Geoffrey (2005) is arguably the most famous job satisfaction model. The main premise of this theory is that satisfaction is determined by a discrepancy between what one wants in a job and what one has in a job. Further, the theory states that how much one values a given facet of work (e.g. the degree of autonomy in a position) moderates how satisfied/dissatisfied one becomes when expectations are/aren't met. When a person values a particular facet of a job, his satisfaction is more greatly impacted both positively (when expectations are met) and negatively (when expectations are not met), compared to one who doesn't value that facet. To illustrate, if Employee A values autonomy in the workplace and Employee B is indifferent about autonomy, then Employee A would be more satisfied in a position that offers a high degree of autonomy and less satisfied in a position with little or no autonomy compared to Employee B (Christopher, 2005).

This theory also states that too much of a particular facet will produce stronger feelings of dissatisfaction the more a worker values that facet. Dispositional approach; The dispositional approach suggests that individuals vary in their tendency to be satisfied with their jobs, in other words, job satisfaction is to some extent an individual trait (Dugguh & Dennis, 2014). This approach became a notable explanation of job satisfaction in light of evidence that job satisfaction tends to be stable over time and across careers and jobs. Research also indicates that identical twins raised apart have similar levels of job satisfaction. A significant model that narrowed the scope of the dispositional approach was the [Core Self-evaluations Model](#), proposed by x argued that there are four [Core Self-evaluations](#) that determine one's disposition towards job satisfaction: [self-esteem](#), general [self-efficacy](#), [locus of control](#), and [neuroticism](#). This model states that higher levels of self-esteem (the value one places on his/her self) and general self-efficacy the belief in one's own competence lead to higher work satisfaction. Having an internal locus of control (believing one has control over her/his own life, as opposed to outside forces having control) leads to higher job satisfaction. Finally, lower levels of neuroticism lead to higher job satisfaction (Christopher, 2005).

1.1.2 Equity Theory

Equity Theory shows how a person views fairness in regard to social relationships such as with an employer. A person identifies the amount of input things gained from a relationship

compared to the output (things given) to produce an input/output ratio. They then compare this ratio to the ratio of other people in deciding whether they have an equitable relationship. Equity Theory suggests that if an individual thinks there is an inequality between two social groups or individuals, the person was likely to be distressed because the ratio between the input and the output are not equal (Ewen, Smith & Hulin, 1966). For example, consider two employees who work the same job and receive the same pay and benefits. If one individual gets a pay raise for doing the same work as the other, then the less benefited individual will become distressed in his work place. If, on the other hand, both individuals get pay raises and new responsibilities, then the feeling of equity was maintained. Other psychologists have extended the equity theory, suggesting three behavioral response patterns to situations of perceived equity or inequity (. These three types are benevolent, equity sensitive, and entitled. The level by each type affects [motivation](#), job satisfaction, and job performance. Benevolent-Satisfied when they are under-rewarded compared with co-workers, Equity sensitive-Believe everyone should be fairly rewarded and Entitled-People believe that everything they receive is their just due (Fishman & Husman, 2017).

The first test of equity that needs to be considered is the relationship between an individual's contributions and their rewards. For individuals to feel a sense of fairness, they need to perceive that the benefit they receive from their organization is appropriate for the level of input that they've contributed to their work (Gannon & Boguszak, 2013). The sense of what a makes a fair reward is probably shaped by societal and social norms. When individuals consider the fairness of their reward they probably make comparisons to other careers and industries. These are sensible comparisons as these are other ways they could choose to allocate their time and effort. When an individual feels that their rewards are commensurate with their contributions, they will feel they are being fairly treated. As a result, they will probably be motivated. The second test of equity that needs to be considered is the relationship between an individual's return on contribution, and that for their peer group. This process of benchmarking is known as social comparison. For individuals to feel that things are fair, they need to feel that the benefits they receive per unit of contribution are similar to the benefits that their peers receive for a comparable unit of contribution. When this is the case, individuals may feel that they are being treated fairly and be appropriately motivated (Gelso, 2006a).

1.1.3 Discrepancy Theory

The concept of discrepancy theory is to explain the ultimate source of anxiety and dejection. An individual who has not fulfilled his responsibility feels the sense of anxiety and regret for not performing well. They will also feel dejection due to not being able to achieve their hopes and aspirations. According to this theory, all individuals will learn what their obligations and responsibilities are for a particular function, and if they fail to fulfill those obligations then they are punished. Over time, these duties and obligations consolidate to form an abstracted set of principles, designated as a self-guide. Agitation and anxiety are the main responses when an individual fails to achieve the obligation or responsibility (Gyurko, Madison, Martinko, Crook & Crook, 2014). This theory also explains that if achievement of the obligations is obtained then the reward can be praise, approval, or

love. These achievements and aspirations also form an abstracted set of principles, referred to as the ideal self-guide. When the individual fails to obtain these rewards, they begin to have feelings of dejection, disappointment, or even depression (Heller, 2018).

According to Stam (2000a), the discrepancy theory regarding satisfaction is a comparative process through which the individual determines a measure of evaluation and express a level of satisfaction by comparing that measure to a perceived state. A discrepancy is a perceived difference between an adopted anchor and a personal understanding of accomplishment along the same dimension (House & Wigdor, 1967). The anchor can be set by social pressure, established employment goals, personal expectations, threshold requirements, free markets, or any agency or existing bias. This theory argues that job satisfaction hinge on if the employee perceives that their job conveys the extent that he/she values (Kopelman, Protas & Davis, 2008). Value-percept theory also suggests that people evaluate job satisfaction according to specific "facets" of the job relating to pay, promotion, colleague and managers, and work itself, described as follows: Pay Satisfaction, refers to employees' feelings about their pay; Promotion Satisfaction, refers to employees' feelings about the company's promotion policies and their execution, including fairness, occurrence, Supervision Satisfaction, reflects employees' feelings and overall and professional evaluation about their boss; Coworker Satisfaction, refers to employees' feelings and professional/relational evaluation about their fellow employees, Satisfaction with the Work Itself, reflects employees' feelings about the nature and the characteristics of their actual work tasks (Khan, Khan, Nawaz & Qureshi, 2010).

1.1.4 Two-factor Theory

According to [Frederick Herzberg's](#) two-factor theory also known as motivator-hygiene theory attempts to explain satisfaction and motivation in the workplace. This theory states that satisfaction and dissatisfaction are driven by different factors motivation and hygiene factors, respectively. An employee's motivation to work is continually related to job satisfaction of a subordinate. Motivation can be seen as an inner force that drives individuals to attain personal and organizational goals (House & Wigdor, 1967). Motivating factors are those aspects of the job that make people want to perform, and provide people with satisfaction, for example achievement in work, recognition, promotion opportunities. These motivating factors are considered to be intrinsic to the job, or the work carried out. Hygiene factors include aspects of the working environment such as pay, company policies, supervisory practices, and other working conditions (Kopelman, Protas & Falk, 2010).

In the 1970s, researchers were unable to reliably empirically prove the model however, with Lindsay, Marks and Gorlow (1967), they suggested that Herzberg's original formulation of the model may have been a methodological artifact. However, emerging studies have a new-found interest in the theory, particularly among employees in the public sector and among certain professions such as nurses. The theory has been criticized because it does not consider individual differences, conversely predicting all employees will react in an identical manner to changes in motivating/hygiene factors. The model has also been criticized in that it does not specify how motivating/hygiene

factors are to be measured. Most studies use a quantitative approach by for example using validated instruments such as the Minnesota Satisfaction Questionnaire. There are also studies that have utilized a qualitative methodology such as by means of individual interviews (Locke & Latham, 2019).

Intrinsic Factors are the actually factors that contribute to employees' level of job satisfactions. It has widely being known as job content factors which aim to provide employees meaningful works that able to intrinsically satisfy themselves by their works outcomes, responsibilities delegated experience learned, and achievements harvested (Malik & Naeem, 2012). Intrinsic Factors are very effective in creating and maintaining more durable positive effects on employees' performance towards their jobs as these factors are human basic needs for psychological growth. Intrinsic Factors will propel employees to insert additional interest into their job. When employees are well satisfied by motivational needs, their productivity and efficiency will improved. This theory further proposed the Intrinsic and Extrinsic Factors are interdependence to each other. Presence of Extrinsic Factors will only eliminate employees' work dissatisfaction; however, it will not provide job satisfaction. On the other hand, sufficient supply in Intrinsic Factor will cultivate employees' inner growth and development that will lead to a higher productivity and performance; however, absent of this factor will only neutralize their feeling neither satisfy nor dissatisfy on their jobs. Extrinsic Factors only permit employees willingness to work while Intrinsic Factors will decide their quality of work. These two groups of Extrinsic and Intrinsic Factors are not necessary opposite with each other, as opposite of satisfaction are not dissatisfaction, but rather no satisfaction. Similarly, opposite of dissatisfaction are not satisfaction, but no dissatisfaction. For instance, a study by Maidani (1991) among 124 employees from electronic companies in Malaysia revealed the employees have some differences in their intrinsic and extrinsic motivation factors. Hence, organizations should modulate their operations and procedures to satisfy both intrinsic and extrinsic motivation factors of their employees (Mathibe, 2008).

2.1 Employee Pay

Besides expectations, social comparison processes also impact employees' pay satisfaction. This showed that the amount of pay received only has a marginally impact on pay satisfaction, whereas relative pay comparing the own pay to others seems to play a much stronger impact on how satisfied individuals are with their pay (Mutai & Osoro, 2021). Social comparisons on pay disparities impacts greatly on the internal relations within the organizations. Employer-employee relations play a strategic role in improving workers' involvement, high performance, commitment and retention. This pointed out that poor relationship with a line manager can be the push factor behind an individual's decision to quit the job or leave the organization. The concept of productivity of work is divided into two parts: Individual productivity and organizational productivity (Mni, 2015). One of the purposes of someone being the employee or a labor of a company was to earn an income in the form of wages or compensation. Wages are earned can fulfill basic necessities such as food, clothing and housing. Every company in setting the amount of the wage paid to an employee must be viable, so that

the lowest wage given to meet the needs of their life (Mutai & Osoro, 2021). The calculation of wage increases not only the necessities of worth living but also inflation, economic growth, and productivity. The concept of productivity of work was divided into two parts: Individual productivity and organizational productivity. Individual dimension associated with the characteristics of the personality characteristics of the individual appears in the form of mental attitude and individual efforts to improve the quality of life. Organizational dimensions look productivity within the framework of the relationship between input and output techniques (Migwe, Gachunga & Iravo 2017). One of the purposes of someone being the employee or a labor of a company was to earn an income in the form of wages or compensation. Wages are earned can fulfil all basic necessities such as food, clothing and housing. Every company in setting the amount of the wage paid to an employee must be viable, so that the lowest wage given to meet the needs of their life. The calculation of wage increases not only the necessities of worth living but also inflation, economic growth, and productivity. The concept of productivity of work was divided into two parts: Individual productivity and organizational productivity. Individual dimension associated with the characteristics of the personality characteristics of the individual appears in the form of mental attitude and individual efforts to improve the quality of life. Organizational dimensions look productivity within the framework of the relationship between input and output techniques (Mutai & Osoro, 2021).

One of the purposes of someone being the employee or a labor of a company is to earn an income in the form of wages or compensation. Wages are earned can fulfill basic necessities such as food, clothing and housing (Mutai & Osoro, 2021). Every company in setting the amount of the wage paid to an employee must be viable, so that the lowest wage given to meet the needs of their life. The calculation of wage increases not only the necessities of worth living but also inflation, economic growth, and productivity. Individual dimension associated with the characteristics of the personality characteristics of the individual appears in the form of mental attitude and individual efforts to improve the quality of life (Al Khajeh, 2018). Organizational dimensions look productivity within the framework of the relationship between input and output techniques. Aspects of wages becomes important because to be effective if linked to performance for real (Linh, Jin, Kiong & Fah, 2016).

Paying employees fairly is considered to be also in a company's best interest. There is a significant body of research suggesting that organizations with a more engaged workforce outperform their peers on a number of organizational performance metrics (Mutai & Osoro, 2021). Organizations may also save money through reduced work stress, which leads to improved psychological and physical health, which means fewer absences and better focus. Turnover intentions may also be reduced, and the hefty cost of replacing an employee may be avoided by paying employees fairly. Employees' work performance can be analyzed by gauging the level of their commitment and the level of satisfaction that they derive from doing the job. Work commitment and attitude is related to the employees' behaviour and their performance efficiency. Organizational commitment is multi-dimensional in nature, encompassing workers' loyalty, their willingness to exert more effort on behalf of the organization,

adherence to organizational values, and desire to remain in the organization (Nyoro & Jayne, 2019).

An effective wage strategy is expected to contribute on the viability of the unit of work, the realization of the vision and mission, as well as for the achievement of the targets of work (Mutai & Osoro, 2021). Employee productivity measurement using the net value added shows wages and employee performance has a positive correlation, but the rate of growth of net value added per worker is faster than the rate of growth of wages per worker (Otieno, 2016). Means that there are factors other than wages in improving employee performance that is non-monetary factors. Wage flexibility is the main topic of the economy, are mostly found in the literature related to the provision of incentives provided by the company. A number of theoretical models have developed an explanation of how the company should design compensation schemes to encourage employees to work for the benefit of the company. The conclusion is put some effort into their work to maximize corporate profits (Waiyaki, 2017). Wages become an important aspect of being effective if linked to the performance significantly. Granting wages remuneration is the most complex task for the industry, is also the most significant aspects for workers, because of the amount of wages reflects the size of the value of their work among the workers themselves, their families and communities.

2.2 Employee Bonus

In any business scenario, bonuses and incentives are two essential elements that the employers and the management team need to consider. Incentives and rewards are given to employees who perform exceptionally well and work beyond their limitations (Widhianingrum, 2018). These factors act as a form of motivation for the workers. The employees whose performance is better than other employees receive a bigger bonus or incentive than the others. The 'built-in incentive' for any workers or the employee's demands high performance from the business or the organization. Gifts can be of various types (Bawa, 2017). Performance bonuses are given to employees who perform well in the organization; year-end bonuses are given to employees who worked dedicatedly throughout the year and do not change the organization. These bonuses are given for their loyalty.. Bonuses and employee help the organizations or businesses to retain their employees. Gifts will ensure that employ the polemic between proponents and opponents a key question regarding bonuses is often overlooked: How important is handing out bonuses for an organization to become and stay successful for a longer period of time? One way to obtain an answer to this question is by studying the results of research into the characteristics of "high-performance organizations" (HPOs) (Mutai & Osoro, 2021). These characteristics that explain the sustainable success of an organization. This paper discusses the set-up and the results of this HPO research, and describes in more detail the findings in the field of reward systems and bonuses.

The consequences of the research results for the role of reward systems in creating and maintaining HPOs are also discussed (Bhatti, Nawaz, Ramzan, & Ullah, 2017). Finally a conclusion, practical implications and limitations of the research are given eyes and workers get a feeling of attachment with the company. On the other hand, individual incentives; such as large bonuses are often surprisingly ineffective in increasing employee

morale and productivity (Mutai & Osoro, 2021). Rewarding individual employees can produce negative outcomes by eroding workplace cohesion, as employees become reluctant to share information with others even at the expense of reduced output. Relative comparisons at the individual level create competition which results in decreased trust, sharing and teamwork; in Drago and Turnbull, for example, tournament-based compensation led to decreased helping behavior and increased the potential for sabotaging other workers. In an effort to prevent such negative competitive dynamics that can result from individual-based bonuses, organizations often turn to incentivizing employees for their collective performance, encouraging cooperation and teamwork rather than competition (Doshmanziari, 2018).

Ever since the financial scandals that rocked the business world and the worldwide financial crisis that followed, the debate on the effects of bonuses on the performance of especially managers and the role of reward systems in organizations has divided academics and practitioners alike (Mutai & Osoro, 2021). The divergence of opinion among academics becomes clear when studying scientific research into bonuses and reward systems. On the one side are the proponents of bonuses who state that use of bonuses and emphasis on monetary rewards increases productivity and organizational performance. For instance, Yao (1997) studied the impact of profit sharing and bonus payment on the performance of Chinese state industries and concluded that over half of the value-added growth of these industries could be explained by bonus incentives. Further, El Achi and Sleilati (2016) found, while studying the data of the 1998 Workplace Employee Relations Survey conducted in England, strong evidence that the use of performance related pay enhances performance outcomes, although this relationship is influenced by the structure of workplace monitoring environments.

We suggest that prosocial bonuses offer an alternative approach that has the potential to provide some of the same benefits as team-based compensation increased social support, cohesion, and performance while carrying fewer drawbacks (Mutai & Osoro, 2021). Research suggests that the desire to help others is a need deeply rooted in human nature, and that giving to others has a causal impact on increasing happiness and life satisfaction. At the organizational level, previous correlational research suggests that prosocial behavior in the workplace often termed citizenship behaviors is linked to employee morale and performance: the extent to which employees perceive themselves and their organizations as prosocial predicts organizational commitment. We suggest that prosocial bonuses can have a causal impact on employee satisfaction and performance, such that providing employees with money to help others would have a greater organizational impact than providing employees with money to spend on themselves. We note that we are not the first (Hashim, Ullah & Khan, 2017).

2.3 Employee Recognition

According to Hussein and Simba (2017), recognition programs should be balanced between performance-based and value based initiatives, but the programs should be comprised of three methods: formal, informal and day-to-day recognition. Similarly he, has also mentioned that there are three types of recognition such as organization-wide formal recognition, departmental-specific informal recognition and everyday

spontaneous recognition. Formal recognition consists of structured recognition programs with clearly defined objectives, processes, and criteria linked to rewarding and recognizing individuals, teams, or departments on a companywide level for achieving specific business targets, exemplifying specific organizational values, or performing actions that go above and beyond normal work expectations. This approach is extremely organized recognition involving recognizing employees who have done so many years of service at the organization. Informal recognition focuses primarily on performance achievements, goal accomplishments, and other milestones by individuals or teams that may occur monthly or quarterly (Mutai & Osoro, 2021). It may include low-cost awards, refreshments, point-value incentives, gift cards, and certificates.

Informal recognition programs have been identified to point out employee value and contribution at the right moment as a result of its instantaneous nature and the continuous changing work environment (Mutai & Osoro, 2021). Day-to-day recognition is a type of recognition practices that are frequent (daily or weekly), low or no cost, often intangible and often reliant on interpersonal skills for positive feedback that can be given to all employees. The day-to-day recognition brings the benefit of immediate and powerful reinforcement of desired behavior and sets an example to other employees of desired behavior that aligns with organizational objectives. To him, it gives individuals and teams at all levels, the opportunity to recognize good work by other employees and teams, and it also gives the opportunity for them to be recognized on the spot for their own good work. According to Kumari (2016), he stressed that the conceptual differentiation between formal recognition and social recognition informal and day-to-day recognition is very important. Although social recognition has been given relatively less attention than formal recognition, considerable research has shown that if social recognition is provided on a contingent basis in managing employee behavior, it can be a powerful incentive motivator for performance improvement.

Benefits of Employee Recognition; Employee recognition has been identified to be a highly effective motivational instrument, that can have significant positive impact on employee job satisfaction and performance as well as overall organizational performance. From the perspective of Mutai and Osoro (2021), when effective recognition is provided in the workplace, favourable working environment is produced, which motivates employees to become committed to their work and excel in their performance. Highly motivated employees serve as the competitive advantage for an organization because their performance leads an organization to well accomplishment of its goals and business strategy as well as achieve growth and prosperity. However, a demotivated environment has been identified to produce low or courage less employees who hardly practice their skills, lack innovativeness and not fully commitment to the extent an organization needs. Non-financial rewards such as recognition have been highlighted to have positive relationship on employee job satisfaction and organizational performance. Satisfied employees have positive attitude towards organization and their jobs thereby increasing the quality and quantity of employee performance (Nabi, Waslam & Hossain, 2017).

Ghanaian universities are expected to serve as a repository of knowledge for nurturing the manpower requirements of the

country. The realization of this goal depends to a greater extent on the critical roles of management is to create a work environment that will motivate to employees to be committed and perform at their best (Mutai & Osoro, 2021). The work environment of Universities in Ghana has undergone significant changes over the years in terms of the nature and scope of work. The changing nature of the work environment has necessitated the use of various approaches to motivate university staff to service an ever-growing student population and manage new initiatives. Attractive remuneration packages have been cited as very crucial to high perform because it fulfills financial and material desires. Dissatisfaction with salaries is one of the key factor undermining the commitment of academics to their institutions and careers. According to Omulo and Kumeh (2020) in their study also provided that the African worker is more interested in financial reward and may not be affected by the absence of nonfinancial reward.

However, Management of Ghanaian universities have long expunged the erroneous belief that highly motivated employees are those who have received financial rewards in a form of high salary and other benefits. Ghanaian universities have a long history of celebrating excellent performance and meritorious work of staff through awards and recognition (Mutai & Osoro, 2021). The recognition programs in place seek to praise efforts, reward results, honour achievements and increase influence of employees at all levels (senior members, senior staff and junior staff) to enhance performance and productivity. Most of these programs are in the form of cash awards, symbolic awards, spot programme and verbal recognition (Otieno, 2016). The corporate strategic plans of most Ghanaian universities have captured the need to give meaningful recognition and budget allocations are earmarked for such purposes. Recognition of employees in Ghanaian universities seemed to take place during graduation ceremonies to make the contributions of employees overtly made known to other employees and the general public. Employees who get recognized for doing good work feel a greater sense of self-esteem. These positive feelings play a significant role in how they view themselves and work with others (Oruko, Tibbs & Maniagi, 2020).

2.4 Employee Promotion

One effort that can be done is to do a promotion program. Promotion is a move that enlarges the authority and responsibility of employees to higher positions in an organization so that obligations, rights, status, and producers the greater the (Ongeri & Osoro, 2021). The importance of developing human resources was done to create better employee performance than before so that the objectives of the organization can be achieved. Efforts to improve employee performance are not easy, and therefore there is a need for employee motivation by career development, one of which is by promoting positions. This is evidenced by the previous research conducted by other scholars "where the results of his research indicate that the promotion variable has a significant effect on employee performance (Mutai & Osoro, 2021). The potential of its human resources as a very valuable asset. One effort that can be done is to do a promotion program.

Promotion is a move that enlarges the authority and responsibility of employees to higher positions in an organization so that obligations, rights, status, and producers the greater the. The

importance of developing human resources was done to create better employee performance than before so that the objectives of the organization can be achieved (Otieno, 2016). Employee development through job promotion programs was intended to provide experience in carrying out management functions at a higher structural level than before, where the new position has broader and heavier responsibilities, so employees are required to work harder to improve their abilities so that their duties and responsibilities can be carried out successfully. Job promotion programs can be implemented if there are positions that have not been filled or there are vacancies as well as the re-evaluation of old positions (Mutai & Osoro, 2021).

The opportunity to fill a position was first given to those who have fulfilled all the requirements regarding the implementation of the promotion. According to Otieno (2016) regarding several criteria that need to be considered before conducting promotions, namely seniority, quality of education, work performance and level of loyalty. Placement of employees is done by making adjustments to the needs of the organization associated with planning to get the right people in the right position as well or commonly known as "right man on the right place". To get a good and professional, responsible, honest and fair state civil apparatus, a recruitment system based on open capability based on capability is needed. In theory, the application of a merit system is still not optimal and optimal to be implemented. According to Law Number 5 of 2014, the implementation of a merit system is a necessity that needs to be done by the government (Mutai & Osoro, 2021).

2.5 Performance of High School Teachers

Measurement of employee performance is an activity that is very important because it can be used as a measure of success in supporting the success of the high school teacher's results. Factors used in the measurement of labor productivity include the quantity of work, quality of work and timeliness (Mutai & Osoro, 2021). Individual characteristics that affect performance include age, gender, education, length of employment, job placement and work environment. Performance is influenced by two factors: Factors of self-acting self and external factors acting. Factors that is in the position holders are competence, skills, knowledge, motivation, attitude and experience. External factors are environmental organization office holders, including surveillance, communication, training and performance assessment in an organization. Human productivity has a major role to determine the success of the company (Shah, Khattak & Shah, 2020). Human productivity is often referred to as mental attitude always had the view that today is better than yesterday and tomorrow.

Pay and incentives linked to long-term performance: in a literature review into characteristics of high-performing organizations, Mutai and Osoro (2021) found that linking employee pay and incentives to long-term performance of the organization had a positive relationship with productivity. In the light of the recent recession and ponderous economic recovery, a better balance in the incentives for short-run and long-run performance has to be achieved as currently corporate managers have stronger incentives to pursue short-term profit-seeking activities than to invest in longer-term productive activities This is also an issue in the public sector, while researching the introduction of performance pay in England's National Health

Service, that the new reward system in theory was viewed favorably but that there was a big fear that the system would not be used fairly and equitably and therefore would be ineffective. This found that good performing international companies used reward systems that value their employees. According to Shah, Khattak and Shah (2020), in their research of what motivates employees to excel, discovered that equity was very important to them: to be treated justly in relation to the basic conditions of employment and having a sense of elemental fairness in the way they are treated, which could be achieved by for employees satisfactory compensation and fringe benefits. This is called "a fair employee deal" which is important for creating the impression of a fair compensation system among employees, as the reward structure directly to a strategic performance measurement system increases the feeling of fairness employees have toward the reward system.

Rewards for results, not efforts or seniority: Shah Khattak and Shah (2020), they concluded that for a company to become a responsive organization it among others has to install incentive systems that reward for performance and not for effort. According to Otieno (2016) in a study of New Zealand businesses which used high-involvement work practice found that they specifically rewarded employees for their results, not for their seniority in the company. The same result was found by among successful Australian companies, and in a review of the world's most admired companies. Tanoli MF (2016), in his study of Dutch high-performing organizations, stated that these companies used incentive systems that specifically rewarded employees for their performance and punished them for poor results. According to Onger and Osoro (2021), in their research of what motivates employees to excel, found that high-performing employees take pride in their accomplishments by doing things that matter and doing them

3.1 Research methodology

This study used descriptive research design: In a descriptive design, a researcher is solely interested in describing the situation or case under their research study. It is a theory-based design method which was created by gathering, analyzing, and presenting collected data. This allowed a researcher to provide insights into the why and how of research (Kothari, 2011). Descriptive design helps others better understand the need for the research.

3.1.1 Employee Recognitions on Performance high school teachers in Trans Nzoia County

When the respondents were asked whether they agree that in their high school on employee recognitions have clearly articulated the objective of performance of high school teachers in Tran Nzoia County Kenya, Majority 46 (44.8%) of the respondents agreed, while 43 (23.2%) of the respondents strongly agreed, a few 19 (14.7%) of the respondents were neutral, further 16 (12%) of the respondents disagreed and the remaining 7 (5.3%) of the respondents strongly disagreed. The researcher also asked the respondents whether they agree that their school has the best peer recognition has enhanced performance of high school teachers in Trans Nzoia County, Kenya, Majority 42 (42.3%) of the respondents strongly agreed, while 37 (18%) of the respondents were neutral, a few 21 (16.1%) of the respondents disagreed, further 21 (15.7%) of the respondents agreed and the

remaining 10 (7.9%) of the respondents strongly disagreed. This is in line with the findings of Mutai and Osoro (2021)

When the researcher also asked the respondents to indicate their level of agreement as to whether their school have been involving their family towards embracing high performance, Majority 56 (42.7%) of the respondents agreed, while 36 (27.3%) of the respondents were neutral, further 34 (26%) of the respondents strongly agreed, also 4 (3.1%) of the respondents disagreed and the remaining 1 (0.9%) of the respondents disagreed. When the respondents were asked to indicate whether their level of agreement whether high school immediate gratification on employee recognition in their schools performance in Tran Nzoia County, Majority 67 (51.4%) of the respondents agreed, while 34 (26.1%) of the respondents were neutral, further 13 (9.6%) Of the respondents disagreed, also

10(7.9%) of the respondents strongly disagreed and the remaining 7 (5%) of the respondents strongly agreed.

Further the researcher wanted the respondent to indicate whether employee recognitions has an effect on performance of high school teachers in Trans Nzoia County, Kenya, Majority 71.2% of the respondents ticked Yes, while 28.8% of the respondents ticked No. The researcher requested who ticked Yes to explain why they agree that employee recognitions has an impact on performance of high school teachers in Trans Nzoia County, Kenya, nearly 69.1% all the respondents who had ticked Yes explained precisely that employee recognitions is the only driver towards childcare that can be impressed to improve performance of modern high school teachers by being pro-active in alternative scheduling. Only 2.1% of the respondents abstained from explaining even though they have ticked Yes.

Table 1.1: Employee Recognitions on performance in high school teachers in Trans Nzoia County

Statements	SA	A	N	D	SD	both
Are you in agreement that in your school human interaction had clearly articulated objectives of employee recognitions?	44.8	23.2	14.7	12	5.3	
Are you in agreement that school has the best peer recognition approaches and tactics towards performance of high school teachers in Trans Nzoia County.	42.3	18	16.1	15.7	7.9	
Are you in agreement that school has a good family involvement towards better performance	42.7	27.3	26	3.1	0.9	
Are you in agreement that immediate gratifications goals always endeavour to improve employee recognition on performance of high school teachers in Trans Nzoia County.	51.4	26.1	9.6	7.9	5	

Employee Promotion

3.1.2 Employee promotion on Performance high school teachers in Trans Nzoia County

From table 1.2 below, the respondents concurred that high salary regular had clearly articulated the need for better performance of high school teachers in Tran Nzoia. Most of the respondents gave a mean (M) of 3.801 and a standard deviation (SD) of .7126 respectively; when the respondents were asked whether they are in agreement that their firm had the best movement of two way conversations leading to long term achievement of goals in the high school teachers, most of the respondents gave a mean (M) of 3.072 and a standard deviation (SD) of .7543 respectively; also when the respondents were asked whether they are in agreement that their school had preferred major titles to all high school teachers, most of the respondents gave a mean (M) of 4.380 and a standard deviation (SD) of .7066 respectively; further when the respondents were asked whether they were in agreement that their high school teachers always endeavors to improve their balanced psychological well-being to

internal and external client leading to performance of high school teachers in Tran Nzoia County, Kenya, hence high performance. Majority of the respondents gave a mean (M) of 4.028 and standard deviation (SD) of .6723 respectively; the respondents also were requested to state their level of agreement regarding their own opinion in relation to employee promotion on performance of high school teachers in Trans Nzoia County, Kenya majority of the respondents gave Yes response which is equivalent to mean (M) of 4.201 and a standard deviation (SD) of .8203 respectively; when the respondents were asked if they gave Yes they explain majority of the respondents gave a mean (M) of 4.003 and a standard deviation (SD) of .8013 respectively. These findings concur with Mutai and Osoro (2021) that the goal of employee promotion was to improve performance of high school teachers in Trans Nzoia County, Kenya. This is in line with the finding of Kothari (2011). It is essential for employee promotion managers to comprehend the provisions of policies to be enhanced towards performance of high school teachers in Trans Nzoia County, Kenya.

Table 1.2: Employee Promotion

Statement	Mean	Std. Dev.
Are you in agreement that in high school earn high salary toward employee promotion and better performance	3.801	.7126
Are you in agreement that in high school teachers prefer major job title to realign both short term and long term achievement of goals in their high school	3.072	.7543
Are you in agreement that your firm has well cascaded goals throughout the high school teachers	4.380	.7066
Are you in agreement that in their high school teachers psychological wellbeing leading to better performance of the high school teachers, hence performance of high school teachers in Trans Nzoia County.	4.028	.6723
In your own opinion do you agree that employee promotion has an effect on performance of high school teachers in Trans Nzoia County, Kenya.	4.201	.8203
When the respondents were asked to explain Their response was;	4.003	.8013

3.1.3 Regression Analysis

To establish the degree of effect of employee motivation for a regression analysis was conducted, with the postulation that: variables are normally dispersed to avoid distortion of associations and significance tests, which was achieved as outliers were not identified; a linear relationship among the independent and dependent variables for accurateness of approximation, which was attained as the standardized coefficients were used in clarification. The expression of multiple regression model was as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \epsilon$$

Performance of all high school teachers = β_1 (employee pay) + β_2 (employee bonus) + β_3 (employee recognitions) + β_4 (employee promotion) + error term.

Regression analysis produced the coefficient of purpose and analysis of variance (ANOVA). Analysis of variance was completed to show whether there is a significant mean variance among dependent and independent variables. The ANOVA was conducted at 95% confidence level.

3.1.4 Model of Goodness Fit

Regression analysis was used to create the strengths of relationship among the performance of all high school teachers (dependent variable) and the predicting variables; employee pay, employee bonus, employee recognitions and employee promotion (independent variables). The results showed a correlation value (R) of 0.759 which shows that there is a good linear dependence between the independent and dependent variables. These findings concur with the findings of Mutai and Osoro (2021). This is in line with the findings of Kothari, (2011), who observed that this also depicted the significance of the regression analysis done at 95% confidence level. This implies that the multiple regression model was important and can thus be used to assess the relationship among the dependent and independent variables. This echoes the findings of Nyoro and Jayne (2019), who detected that analysis of variance statistics scrutinizes the differences among group means and their related procedures.

Table 1.3 Model Goodness of Fit

R	R ²	Adjusted R	Std. Error of the Estimate
0.759	0.786	0.739	0.068

With an R-squared of 0.786, the model shows that employee pay, employee bonus, employee recognitions and employee promotion can boast up to 78.6% of the differences on performance of high school teachers while 21.4% is explained by other indicators which are not inclusive in this study or model. A measure of goodness of fit synopsis the discrepancy between observed values and the values anticipated under the model in question. This finding is in line with the findings Mutai and Osoro (2021).

Summary

Summarizing results based on each of the specific objective of this study. The specific objectives of the study were as follows; employee pay, employee bonus, employee recognitions and employee promotion respectively on performance of High school teachers in Trans Nzoia County, in Kenya. Therefore, an individual must be motivated so as to provide him with an environment that enables him to perform and produce the desired results. They also noted that teachers working in rural centers are more disadvantaged than their counterparts due to the underdevelopment of their schools.

REFERENCES

- [1] Madi FN, Assal H, Shrafat F, Dia Z (2017) The Impact of Employee Motivation on
- [2] Organizational Commitment European. Journal of Business and Management 9(15): 134.

- [3] Abid and Barec (2017). The Effect Of Flexible Working Hours On The Employees Performance. *International Journal of Economics and Commerce Management* 5: 450-466.
- [4] Ariani, D. W. (2015). Employee satisfaction and service quality: Is there relations? *International Journal of Business Research and Management*, 6(3), 33-44. .
- [5] Bassett-Jones, Nigel; Lloyd, Geoffrey C. (2005). "Does Herzberg's motivation theory have staying power?" *Journal of Management Development*. 24 (10): 929– 943. doi:10.1108/02621710510627064.
- [6] Bawa, M. A. (2017). Employee motivation and productivity: a review of literature and implications for management practice. *International Journal of Economics, Commerce and Management United Kingdom*, 5 (12), 662-673.
- [7] Bhatti, G. A., Nawaz, M., Ramzan, B., & Ullah, S. (2017). Impact of peer relationship and organizational culture on organizational commitment through job satisfaction: Moderating role of psychological capital. *Management and Administrative Sciences Review*, 6(3), 145-160.
- [8] Christopher, M. (2005). Meaningful motivation for work motivation theory. *Journal of Management Review*, 2, 235–238.
- [9] Creswell, J. W., and Plano Clark, V. L. (2013). *Designing and conducting mixed method research* (2nd Ed.). Thousand Oaks, CA: Sage.
- [10] Dugguh, S. I., & Dennis, A. (2014). Job satisfaction theories: Traceability to employee performance in organizations. *Journal of Business and Management*, 16(5), 11-18
- [11] Doshmanziari, E. (2018). Identifying and ranking factors effecting innovation and innovation through employees training in Kian Tire Industrial Plant, Iran. *International Journal of Economics, Commerce and Management*, 525–539. <http://ijecm.co.uk/>.
- [12] El Achi S, Sleilati E (2016) The effect of coaching on employee performance in the human resource management field: the case of the Lebanese banking sector. *Int J Trade and Global Markets* 9(2): 137-169.
- [13] Ewen, R. B., Smith, P. C., & Hulin, C. L. (1966). An empirical test of the Herzberg two-factor theory. *Journal of Applied Psychology*, 50(6), 544–550
- [14] Fishman, E. J., & Husman, J. (2017). Extending attribution theory: Considering students' perceived control of the attribution process. *Journal of Educational Psychology*, 109(4), 559.
- [15] Gannon, D., & Boguszak, A. (2013). Douglas McGregor's theory x and theory y. *CRIS Bulletin of the Centre for Research and Interdisciplinary Study*, 2013(2), 85-93.
- [16] Gelso, C. J. (2006a). *Applying Theories to Research. The psychology research handbook: A guide for graduate students and research assistants*: (pp. 455-464). Thousand Oaks, CA: SAGE Publications, Inc.
- [17] Gyurko, P., Madison, K., Martinko, M., Crook, T. R., & Crook, T. A. (2014). Theory in the organizational sciences: The road travelled and the path ahead. *Academy of Management Perspectives*, 28(2), 128-146.
- [18] Heller, A. (2018). *The theory of Need in Marx*. Verso Books. Herzberg, F. (1959). Herzberg's Motivation-Hygiene Theory (Two Factor Theory). Arab British Academy for Higher Education: London, UK, 1-2.
- [19] Hashim, M., Ullah, M., Khan M. A. (2017). Effect of time flexibility on employee performance: a study of teaching faculty in government colleges of management sciences Peshawar.
- [20] House, R. J., & Wigdor, L. A. (1967). Herzberg's dual factor theory of job satisfaction and motivation: A review of the evidence and a criticism. *Journal of Personnel Psychology*, 20, 369–390.
- [21] Hussein IA, Simba F (2017) Effect of Employee Motivation on Organizational Performance of Mogadwashu Al Port in Somalia Strategic. *Journal of Business and Change management* 4(2).
- [22] Khan, A. S., Khan, S., Nawaz, A., & Qureshi, Q.A. (2010). Theories of job-satisfaction: Global applications & limitations. *Gomal University Journal of Research*, 26(2), 45- 62
- [23] Kothari, C. R. (2011). *Research Methodology: Methods and Techniques* (2nd Ed.). New Delhi: New Age International limited.
- [24] Kumari, N. (2016). Study of parameters affecting employee satisfaction. *Journal of Business and Management Sciences*, 4(2), 34-42.
- [25] Kopelman, R. E., Protas, D. J., & Davis, A. L. (2008). Douglas McGregor's Theory X and Y: Toward a construct-valid measure. *Journal of Managerial Issues*, 255-271.
- [26] Kopelman, R. E., Protas, D. J., & Falk, D. W. (2010). Construct validation of a Theory X/Y behavior scale. *Leadership & Organization Development Journal*.
- [27] Locke, E. A., & Latham, G. P. (2019). The development of goal-setting theory: A half-century retrospective. *Motivation Science*, 5(2), 93.
- Lunenburg, F. C. (2011). Goal-setting theory of motivation. *International Journal of Management, Business and Administration*, 15(1), 1-6.
- [28] Malik, M. E., & Naeem, B. (2012). Towards Understanding Controversy on Herzberg Theory of Motivation. *Journal of Basic and Applied Scientific Research*, 2(11)11936-11941
- [29] Maidani, E. A. (1991). Comparative study of Herzberg's two-factor theory of job satisfaction among public and private sectors. *Public Personnel Management*, 20(4), 441–448.
- [30] Mathibe, I. (2008). Expectancy theory and its implications for employee motivation. *Academic Leadership: the Online Journal*, 6(3), 8.
- [31] Mni, S. O. (2015). Work design and job satisfaction. *International Journal of Humanities and Social Science*, 5(10), 202-207.
- [32] Migwe WG, Gachunga HG, Iravo MA (2017) Perceived Influence of Employee Counselling on the Performance of Youth Development Officers in Kenya. *International Journal of Economics, Commerce & Management, United Kingdom* 5(1): 128-165.
- [33] Mutai, V. K and Osoro, A.(2021) Strategic Engineering Management on Performance of all Commercial Banks in Nyeri County, Kenya. *International Journal of Scientific and Research Publications, Volume 11, Issue 10, October 2021* 530 ISSN 2250-3153.
- [34] Linh, N. T., Jin, T. C., Kiong, T. P., & Fah, B. C. (2016). Wor-family conflict and employee job satisfaction: A comparison of state owned and foreign investment enterprises in Vietnam. *Asian Economic and Social Society*, 6(4), 63-72.
- [35] Nabi N, Waslam M, Dip TM, Hossain AA (2017) Impact of Motivation on Employee Performances: A Case Study of Karmasangsthan Bank Limited Bangladesh. *Arabian J Bus Manag Review* 7(1): 293.
- [36] Nyoro, K. J., & Jayne, T. S. (2019). Trends in regional agricultural productivity in Kenya.
- [37] Ojeleye YC (2017) The Impact of Remuneration on Employees' Performance (A Study of Abdul Gusau Polytechnic, Talata-Mafara and State College of Education Maru, Zamfara State): Arabian. *Journal of Business and Management Review* (Nigerian Chapter) 4(2): 1-10.
- [38] Omulo, G., & Kumeh, E. M. (2020). Farmer-to-farmer digital network as a strategy to
- [39] strengthen agricultural performance in Kenya: A research note on Wefarm*platform. *Technological Forecasting and Social Change*, 158, 120120.
- [40] Onger, N.V. and Osoro, A. (2021) Effect of Warehouse Consolidation on Performance of Regwastered Dwastribution Firms in Nairobi City County, Kenya. *The international journal of business & management Publications*.
- [41] Oruko, F., Tibbs, C., & Maniagi, M. (2020) Influence of Financial Rwask on Financial Performance of high schools Lwasted on Nairobi Securities Exchange in Kenya. *Journal of Economics and Finance (IOSR-JEF)*. 11(4), 05-12.
- [42] Otieno, J. (2016). Factors influencing satisfaction of management employees in state corporations: A case of Postol Corporation of Kenya. Nairobi: Masters Thesis, School of Business, Strathmore Univeristy.
- [43] Shah MW, Khattak P, Shah MH (2020). The Effect of Flexible Working Hours and Psychological Empowerment on Team Performance with the Mediating Role of Work Engagement. *Br J Res Vol.7 No.1:49*.
- [44] Stam, H. (2000a). Theoretical psychology. In K. Pawlik & M. Rosenzweig (Ed.) *The international handbook of psychology*: (pp. 551-569). London: SAGE Publications Ltd. doi: 10.4135/9781848608399.n29.
- [45] Waiyaki EW (2017) Effect of Motivation on Employee Performance: A Case of Pam Golding Properties Limited Nairobi. *Research Project Report-United States International University- Africa Nairobi* p. 1-92.
- [46] Widhianingrum, W. (2018). The effect of giving incentives to employee performance pt. Bpr ekadharma magetan. *International Journal of Economics, Business and Accounting Research Peer Reviewed International Journal*, 2(4), 21-29.

AUTHORS

First Author – Msc Patience N. Kwamboka, Jomo Kenyatta University of Agriculture and Technology, Nairobi in Kenya.

Second Author – Dr. Anthony Osoro, Jomo Kenyatta University of Agriculture and Technology, Nairobi in Kenya.

The Accounting and mathematical methods of the economy in Libya

Dr, Husein El Hadi Sherif and Dr, Khalid Mohamed Reeh

Libya State - Ministry of education
Libyan center for biotechnology research
Email box: 30313 – Tajoura
Email: info@btc.org.ly

DOI: 10.29322/IJSRP.12.10.2022.p13030

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13030>

Paper Received Date: 4th September 2022

Paper Acceptance Date: 5th October 2022

Paper Publication Date: 13th October 2022

Abstract: The paper aims to some economists' state that accounting and mathematical economics deserve support just like other forms of mathematics, particularly its neighbors in mathematical optimization and mathematical statistics and increasingly in theoretical computer science. Mathematical economics and other mathematical sciences have a history in which theoretical advances have regularly contributed to the reform of the more applied branches of economics. In particular, following the program of John von Neumann, game theory now provides the foundations for describing much of applied economics, from statistical decision theory as games against nature and Econometrics to general equilibrium theory and industrial organization. In the last decade, with the rise of the internet, mathematical economics and optimization experts and computer scientists have worked on problems of pricing for online services, their contributions using the mathematics from cooperative game theory.

Keywords: Mathematical Economics, Accountant, Statistical methods, Economic Models, Linear Models, Equilibrium analysis, Matrix Algebra.

Introduction

Mathematical economics Accountant is the application of mathematical methods to represent theories and analyse problems in economics. By convention, the applied methods refer to those beyond simple geometry, such as differential and integral calculus, difference and differential equations, matrix algebra, mathematical programming, and other computational methods (1, 2). An advantage claimed for the approach is its allowing formulation of theoretical relationships with rigor, generality, and simplicity. Most of the economic analysis of the time was what would later be called classical, economics of behaviour to apply the tools of mathematics (3).

It is argued that mathematics allows economists to form meaningful, testable propositions about wide-ranging and complex subjects which could less easily be expressed informally. Further, the language of mathematics allows economists to make specific, positive claims about controversial or contentious subjects that would be impossible without mathematics (4). Much of economic theory is currently presented in terms of mathematical economic models, a set of stylized and simplified mathematical relationships asserted to clarify assumptions and implications (5).

Broad applications include: optimization problems as to goal equilibrium, whether of a household, business firm, or policy maker static (or equilibrium) analysis in which the economic unit (such as a household) or economic system (such as a market or the economy) is modelled as not changing comparative statics as to a change from one equilibrium to another induced by a change in one or more factors dynamic analysis, tracing changes in an economic system over time, for example from economic growth (2,6,7).

The Nature of Mathematical Economics Accountant

According to Hal R. Varian, "Mathematical economics is not a distinct branch of economics in the sense that public finance or international trade is. Rather, it is an approach to economic analysis," (8) in which the economy makes use of mathematical symbols in the statement or the problem and draws upon known mathematical theorems to aid in reasoning (9, 10).

As far as the specific subject matter of the analysis, then goes, it can be micro- or macroeconomic theory, public finance, urban economics, or what not. Using the term mathematical economics in the broadest possible sense, one may very well say that every elementary textbook of economics today will

exemplify mathematical economics in as geometrical method are frequently utilized to derive theoretical results. "More commonly, however, mathematical economics are reserved to describe cases employing mathematical techniques beyond simple geometry, such as matrix algebra, differential and integral calculus, differential equations difference equations, etc."(10).

In addition, the goal of Mathematical Economics and economic analysis; according to Lord Keynes, not to provide us with a machine or blind solution method gives us the answers does not accept the error, but it gives us a structured way of thinking helps us in the study of the problems and find a solution (11). This analysis depends on the style of abstraction which isolates complex factors one by one, and then re-installs the interaction between these various factors, to determine the effect of each of them in the course of activity the subject of analysis (12).

Mathematical Methods in an Economic Setting

Economy mainly depends on the academy as a sports style, along with its reliance on literary styles. The adoption of mathematical and quantitative methods for the purposes of analyzing an economy accurately, or to analyze specific areas within the economy. These models and methods in the analysis area involve following examples:

Mathematical Economics

The term "athlete's economy" on the application of mathematical methods means the explanation and interpretation of economic theory or mathematical ways to resolve economic issues at hand. Mathematical Economics and uses the analysis of differentiation and integration and curriculum matrix algebraic methods. Lord Keynes praised the book economist's big benefits of this method of providing the formulation and derivation of key relationships clearly in the economic model, and tougher, and simplicity (11). The Select (Paul Samuelson) in his book, "Economic Analysis Basics" in 1947, the structures of public sports in several economic areas through which the analysis of issues and economic issues, the amount of a way that can be expressed theories and equations as some scientists do economics Nobel prize in economics as the world John Forbes Nash for his theory of «equilibrium theory» a primary dependence aside purely mathematically (11).

Econometrics is one of the mathematical and statistical methods to analyze economic models derived from the data. For example, you may assume that the theory of what an educated person earns income -palmed- higher than the income earned by someone similar to him all the properties but uneducated (or lower level of education). Here come econometric measures the strength of the relationship and statistical significance. And using econometric methods to infer the number of generalizations, as finding a relationship

between pre-existing data and predict what will be the case in the future (11).

The Economic Models

As mentioned before, any economic: theory is necessarily an abstraction from the real world. For one thing, the immense complexity of the real economy makes it impossible for us to understand all the interrelationships at once; nor, for that matter, are all these interrelationships of the equal importance of the understanding of the particular economic phenomenon under study. The sensible procedure is, therefore, to pick out what appeals to our reason to be the primary factors and relationships relevant to our problem and to focus our attention on these alone. Such a deliberately simplified analytical framework is called an economic model, since it is only a skeleton and rough representation of the actual economy (10, 13).

Ingredients of a Mathematical Model

An economic model is merely a theoretical framework, and there is no inherent reason why it must be mathematically. If the model is mathematical, however, it will usually consist of a set of actions designed to describe the structure of the model. By relating a number of variables to one another in certain ways, these equations give the mathematical form of the set of analytical assumptions adopted. Then, through application of the relevant mathematical operations to these equations, we may sock to derive a set of conclusions which logically follow from those assumptions (10, 8, and 13).

Equilibrium Analysis in Economics

The Meaning of Equilibrium

What is known as static analysis? Also, like any economic term. Equilibrium can be defined in various rays. According to one definition, equilibrium is "a constellation of selected interrelated variables so adjusted to one another that no inherent tendency to change prevails in the model which they constitute" (10, 14).

Frist, the word interrelated suggests that, in order for equilibrium to occur all variables in the model must simultaneously be in a state of rest. Moreover, the state of the rest of each variable must be compatible with that of every other variable; otherwise, some variable(s) will be changing, thereby also causing the others to change in a chain reaction, and no equilibrium can be said to exist (10).

Second, the word inherent implies that, in defining an equilibrium, the state of rest involved is based only on the balancing of the internal forces of the model, while the external factors are assumed fixed. Operationally, this means that parameters and exogenous variables are treated as

constants. When the external factors do change, there will be a new equilibrium defined on the basis of the new parameter values, but in defining the new equilibrium, the new parameter values are again assumed to persist and stay unchanged (10).

The generation of equilibrium

In essence, the equilibrium of a specified model is a situation characterized by a lack of a tendency to change. It is for this reason that the analysis of equilibrium (more specifically, the study of what the equilibrium state is like) is referred to as statics.

The fact that an equilibrium implies no tendency to change may tempt one to conclude that an equilibrium necessarily constitutes a desirable or ideal situation, on the ground that only in the ideal state would there be a lack of motivation for change (10).

Such a conclusion is unwarranted. Even though a certain equilibrium position may represent a desirable state and something to be striven for, such as a profit maximizing situation, from the firm's point of view, another equilibrium position may be quite undesirable and therefore something to be avoided, such as an underemployment equilibrium level of national income.

Linear Models and Matrix Algebra

The linear Models and Matrix Algebra for the one-commodity model the solutions p and Q as expressed respectively, are relatively simple, even though several parameters are involved. As more and more commodities are incorporated into the model, such solution formulas quickly become cumbersome and unwieldy.

Matrices and Vectors

Matrix algebra enables users to do many functions. In the first place, it provides a compact way of writing an equation system. Even an extremely large one. Second, it leads to a way of testing the existence of a solution by evaluation of a determinant—a concept closely related to that of a matrix. Third, it gives a method of finding that solution (if it exists). Since equation systems are encountered not only in static analysis, but also in comparative static and dynamic analyses and in optimization problems, you will find ample application of matrix algebra in almost every chapter that is to follow. Therefore, it is desirable to introduce matrix algebra early (10).

Identity Matrices and Null Matrices

The identity Matrices and Null Matrices, one slight catch is that matrix algebra is applicable only to linear equation systems. How realistically linear equations can describe actual economic relationships depends, of course, on the nature of the

relationships in question. In many cases, even if some sacrifice of realism is entailed by the assumption of linearity, an assumed linear relationship can produce a sufficiently close approximation to an actual nonlinear relationship to warrant its use (10). In other cases, while preserving the nonlinearity in the model, we can affect a transfer motion of variables so as to obtain a linear relation to work with, for example, the nonlinear function.

Summary

In fact, it is undoubtedly the best way to proceed, require the use of advanced mathematical methods in the economics, language the distinction is worth emphasizing, an analytical approach to economics is one that uses rigorous, logical reasoning of mathematics certainly helps to ensure a rigorous analysis and using it. Mathematical Economics at a lot of diagrams of shifting curves, but they don't see much algebra, or much calculation of any sort for that matter. But it is the algebra that is used to solve problems in practice. Graphs can provide insight, but the real power of economic analysis comes in calculating quantitative answers to economic problems. Every economics and Economic analysis of the different levels and methods and modalities, in addition to offer explanations of what is happening in the economic world, it offers the following benefits for each of the decision makers, owners of economic actors and consumers.

It should be noted that the results of the economic analysis do not enjoy the highest degree of reliability because the world is very complex economy, and the subject of economics deals with human behaviour, which begins economics than as rational people always act with wisdom and logic, which in fact is not free of emotions and expectations in its decision-making and economic.

References

- [Samuelson, Paul](#) ((1947) [1983]). [Foundations of Economic Analysis](#). Harvard University Press. ISBN 0-674-31301-1.
- [Debreu, Gérard](#) ([1987] 2008). "Mathematical economics", *The New Palgrave Dictionary of Economics*, 2nd Edition. [Abstract](#). Republished with revisions from 1986, "Theoretic Models: Mathematical Form and Economic Content", *Econometrical*, 54(6), pp. 1259-1270. Cited in [Von Neumann, John](#), and [Oskar Morgenstern](#) (1944). [Theory of Games and Economic Behavior](#). Princeton University Press.
- Schumpeter, J.A. (1954). Elizabeth B. Schumpeter, ed. [History of Economic Analysis](#). New York: Oxford University Press. pp. 209–212.
- Schumpeter (1954) p. 212-215
- Schneider, Erich (1934). "Johann Heinrich von Thune". [Econometrical](#) (The Econometric Society) 2 (1):PP. 1–12.
- Schumpeter (1954) p. 465-468
- [Philip Murkowski](#), 1991. "The When, the How and the Why of Mathematical Expression in the History of Economics Analysis", *Journal of Economic Perspectives*, 5(1) pp. [145-157](#).

Hal R. Varian, 1992, *Intermediate Microeconomics. A Modern Approach*, Eighth Edition, University of California at Berkeley, W. W. Norton & Company New York, London

[Weintraub, E. Roy](#) (2008). "Mathematics and economics", *The New Palgrave Dictionary of Economics*, 2nd Edition.

Angel de la Fuente: *Mathematical Methods and Models for Economics*, The Press Syndicate of the University of Cambridge, 2000.

<http://ar.wikipedia.org/wiki>, Economic methods, mathematical methods of economic quantity of the Web page as it appeared on 12/20/2014.

Chiang, Alpha C.; Kevin Wainwright (2005). *Fundamental Methods of Mathematical Economics*. McGraw-Hill Irwin. pp. 3-4.

D .N: 2003, *Basic Econometrics*, 4th ed., McGraw Hill Companies.

Fritz Machlup. "Equilibrium and Disequilibrium: Misplaced Concreteness and Disguised Politics," *Economic Journal*, March 1958, p. 9.

The International Fisher Effect on Accounting and Technology Between, Theory and Application of Empirical Testing of International Fisher Effect in (Libya, and Euro Countries)

Dr, Husein El Hadi Sherif and Mr, Akram Abdulla Eldawi

Libya State - Ministry of education
Libyan center for biotechnology research
Email box: 30313 - Tajoura
email: info@btc.org.ly

DOI: 10.29322/IJSRP.12.10.2022.p13031

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13031>

Paper Received Date: 3rd September 2022

Paper Acceptance Date: 6th October 2022

Paper Publication Date: 13th October 2022

Abstract: In a simplified statistical test of the International Fisher Effect (IFE), a regression analysis was applied to historical exchange rates and interest differential data for some selected countries; namely, Libya and the Euro countries. Also, Fisher's international impact on accounting and technology has been somewhat positive and good in some years in terms of impact. Each of these countries was interchangeably used as the home country, and foreign country to track the trail of the effect. While caution must be exercised in applying and assessing the theory, the IFE model may not be realistic to put into practice in daily currency transactions, but its value lies in its ability to illustrate the expected relationship between interest rates, inflation and exchange rates. This information is helpful in appraising the price competitiveness of foreign imports and in exploring export opportunities for countries.

Key Words: Accounting and Technology, IEF, Inflation, Interest Rates, Exchange Rates, Regression Analysis.

Introduction

The appreciation or depreciation of currency prices is proportionally related to differences in nominal rates of interest. The International Fisher Effect (IFE) theory is an important concept in the fields of economics and finance that links interest rates, inflation and exchange rates. Similar to the Purchasing Power Parity (PPP) theory, IFE attributes change in the exchange rate to interest rate differentials, rather than inflation rate differentials among countries. Nominal interest rates would automatically reflect differences in inflation by a purchasing power parity or no-arbitrage system. The two theories are closely related because of the high correlation between interest and inflation rates. The IFE theory suggests that the currency of any country with a relatively higher interest rate will depreciate because high nominal interest rates reflect expected inflation.

Assuming that the real rate of return is the same across the study's selected countries, differences in interest rates between countries may be attributed to differences in expected inflation rates. For example, between the Libyan and the Euro Countries' currencies, the LBY/EU spot exchange rate of 2022 was 1.6438. The interest rate at that time was 3.4% in Libya and 2.5% in Euro countries. The IFE predicts that the country with the higher nominal interest rate (Libya in this case) will see its currency depreciate. The expected future spot rate is calculated by multiplying the spot rate by a ratio of the foreign interest rate of domestic interest rate: $(1.6438 \times (1.034/1.025)) = 1.6582$. The IFE expects the LBY/EU to appreciate to 1.6582. The IFE expects the LBY to depreciate against EU (it will only cost 1.6582 to purchase one LBY compared to 1.6582 before) so that investors in

either currency will achieve the same average return; i.e. an investor in the EU will earn a lower interest rate of 3.40%, but will also gain from appreciation of the EU.

A final example Interchangeably the EURO/LBY spot exchange rate of 2022 was 1.7290. The interest rate at that time in Libya was 3.4% and 2.5% in Euro countries. The IFE predicts that the country with the lower nominal interest rate (Euro countries, in this case) will see its currency to appreciate. The expected future spot rate is calculated by multiplying the spot rate by a ratio of the foreign interest rate of the domestic interest rate: $(1.7290 \times (1.025/1.034)) = 1.7139$. The IFE expects the EU/LBY to depreciate to 1.7139. In the end, investors in either currency will achieve the same average return, i.e. an investor in the EU will earn a lower interest rate of 2.5%, but will also gain from appreciation of the EU.

(LBY= Libya. EU= Euro Countries)

Also, changes in the exchange rate can have a powerful effect on the macro-economy, affecting variables such as the demand for exports and imports, real Gross Domestic Product (GDP) growth, inflation and unemployment, but as with most variables in economics, there are time lags involved. For the shorter term, the IFE has proven to be unpredictable because of the various short-term factors that affect exchange rates and the predictions of nominal rates and inflation. Longer-term International Fisher Effects have on the other hand appeared to be better, but not by very much. Exchange rates eventually offset interest rate differentials, but prediction errors often occur when the objective is to try to predict the spot rate in the future.

One of the problems affecting consumers and the world economy is exchange rate fluctuations and interest rate disparities. Among others, exchange rate fluctuations can create inefficiency and distort world prices. Moreover, the long-term profitability of investment, export opportunities and price competitiveness imports are all impacted by long-term movements in exchange rates; hence, international investors/companies usually have to pay very close attention to countries' inflation. International businesses engaging in foreign exchange transactions on a daily basis could benefit from knowing some short-term foreign exchange movements. Those that rely on exports can find their products suddenly competitive - or prohibitively expensive - in overseas markets as exchange rates fluctuate. Similarly, companies that rely on imports can see the costs of these imports rise and fall with the exchange rate. In an extension of capital preservation, companies may use information at hand to decide how much more derivative securities such as options, forwards, and futures to hedge in order to mitigate risk arising from exchange rate movements. In addition, investors and fund managers often use these very tools to speculate as well, hoping to profit from fluctuations in exchange rates. Also, exchange rates directly affect the realised return on an investment portfolio with overseas holdings. If you own stock in a foreign company and the local currency goes up a percentage, the value of your investment goes up the same percentage even if the stock price does not change at all. The IFE theory is very attractive because it focuses on the interest-exchange rates relationship.

Literature Review

The International Fisher Effect (IFE) theory suggests that foreign currencies with relatively high interest rates will tend to depreciate because higher nominal interest rates reflect expected rate of inflation (Madura, 2016). Does the interest rate differential actually help predict future currency movement? Available evidence is mixed as in the case of PPP theory. In the long run, a relationship between interest rate differentials and subsequent changes in the spot exchange rate seems to exist but with considerable deviations in the short run (Hill, 2004). The International Fisher Effect is known not to be a good predictor of short-run changes in spot exchange rates. Using quarterly and yearly data for the interest rates, inflation rate differentials, and changes in exchange rates over a five-year period (2013-2018), Suit and Enol (2019) applied a test of the IFE to four "foreign countries"; namely, the USA, Japan, Singapore, and the UK. Indonesia was the home country.

In this study, regression results showed that interest rate differentials had positive but no significant effect on changes in exchange rate for the Empirical Testing of the International Fisher Effect (2012). The relationship between the nominal interest rates and the expected inflation is of crucial importance in the financial markets. The Fisher Effect postulated that the real interest rate is constant and that nominal interest rates and expected inflation move one-for-one together. The paper examines the existence of an International Fisher Effect in the United States and selected Asian countries like India, Korea and Japan, by regressing interest rate differential on inflation rate differential during the period, 8/2022: Q1 of 2012: Q2. The estimated slope coefficients in regressions of nominal interest rate differential on expected inflation rate differential are significantly different than the theoretical value of unity as is evident in our study. The finding lends support to the existence of a partial Fisher Effect on USA because both interest rates and inflation rate move in a positive direction but do not move with one-for-one. However, in the case of India, Japan and Korea, there do not exist any signs of International Fisher Effect. When each country is treated interchangeably as home country and foreign country to show the direction of International Fisher Effect, the result shows a mixed picture. The theory holds when some countries were used as home country, but was disproved when they were used as foreign countries. In a nutshell, the study suggests that it finds evidence of a positive long run relationship between interest rate and inflation rate for the countries undertaken in our study, but the notion of a full International Fisher Effect is rejected.

Regression results showed an examination of the Fisher Effect for selected new EU member states, (2014). The relationship between interest rates and inflation, which is called Fisher Effect has been investigated in both theoretical and empirical economics vast literature. The contribution of this paper to the literature is to test the Fisher Effect for the selected four transition economies that are also new EU member states. The empirical analysis is conducted by allowing for a structural break that takes place in the year 2012. In this study, a case-wise bootstrap approach empirical method which was developed by Hatemi - J and Hacker (2015) is used and the results support a tax adjusted Fisher Effect in the presence of a structural break.

Another paper empirically investigated the existence of the Fisher Effect in Nigeria under a title of Cointegration Causality and Fisher Effect in Nigeria (2014): An Empirical Analysis (1970-2011). Specifically, it sought to: examine the relationship between expected inflation and nominal interest rates in Nigeria; and determine the nature and direction of causality between expected inflation and nominal interest rate in Nigeria. Employing Cointegration, Granger causality and error correction techniques and using data spanning the period of 1970-2011, the results indicate the existence of long run partial Fisher Effect in Nigeria. Specifically, there exists a long run positive and significant relationship between inflation and interest rates in Nigeria. Furthermore, there exists a unidirectional causality running from inflation to interest rate in Nigeria. The paper recommends amongst others that, given the crucial role of interest rates in determining savings and investment which are necessary for economic growth and development, policy makers and relevant monetary authorities should employ measures that will prevent the inflation rates from rising to alarming heights in order to ensure that interest rates are maintained at reasonably low levels in Nigeria.

A Panel Analysis of the Fisher Effect with an Unobserved World Real Interest Rate (December 6, 2017). The Fisher Effect states that inflation expectations should be reflected in nominal interest rates in a one-for-one manner to compensate for changes in the purchasing power of money. Despite its wide acceptance in theory, much of the empirical work fails to end strong favorable evidence. This paper examines the Fisher Effect on a panel of 21 OECD countries over the period 1983-2010. A standard panel test ends cointegration between nominal interest rates and inflation. However, a small non-stationary common component in the error terms of this alleged cointegrating relation is detected using the PANIC approach. This implies the regression results to be spurious. One possible interpretation for the non-stationary common factor is that it reflects permanent common shifts in the real interest rate induced by, e.g., shifts in time preferences, risk aversion and the steady-state growth rate of

technological change. We next control an unobserved non-stationary common factor using both the Common Correlated Effects (CCE) estimation approach and the Continuously Updated Bias-Corrected (CupBC) estimator. The estimated slope coefficient on inflation is found to be insignificantly different.

Another paper studied the impact of the exchange rate, the international prices, the demand shocks, and the devaluations done in different years, on inflation in the Fiji Islands for the years (annual data) 1975-2010 using cointegration and Vector Error Correction (VEC) approach. The main purpose of this study is to examine the effects of the exchange rates, international prices, and the demand shocks on inflation in Fiji. How the domestic inflation in a pegged exchange rate system is aligned with international price shocks is an important monetarist idea, and this is tested in this study. In addition, this study employs annual data from 1975 to 2010. The multivariate cointegration tests are done after the unit root tests, and further, the Vector Error Correction (VEC) model shows that the changes in Fiji's CPI are Granger caused by the long-term trends in all other variables, and the CPI in Australia, and devaluation-year dummies are used as exogenous variables in the VEC model. Also, the changes in exchange rate and changes in demand shocks are the independent variables, but made endogenous in the VEC model. The impulse response function also shows that due to the exchange rate depreciation, inflation has increased for many years in Fiji. The policy implication of our study is that as a monetary policy instrument, the flexibility of the exchange rate policy is indispensable for Fiji to appropriately absorb the international supply and price shocks.

A study was recently conducted by Maurice (2012) at Columbus State University in the United States of America. In a simplified statistical test of the IFE (International Fisher Effect), a regression analysis was applied to historical exchange rates and interest differential data for eight selected Asian countries; namely, China, India, Japan, South Korea, Malaysia, Thailand, Vietnam, and Indonesia. Each of these countries was interchangeably used as the home country, and foreign country to track the trail of the effect. While caution must be exercised in applying and assessing the theory, the IFE model may not be realistic to put into practice in daily currency transactions, but its value lies in its ability to illustrate the expected relationship between interest rates, inflation, and exchange rates. This information is helpful in appraising the price competitiveness of foreign imports and in exploring export opportunities for countries.

In this study, the empirical evidence of international Fisher Effect is investigated among The Association of Southeast Asian Nations (ASEAN) member countries and assuming Malaysia as the home country. In general, the results of this study indicated that exchange rate movements do not follow the international Fisher Effect theory and nominal interest rate differentials cannot completely offset the currency value changes among ASEAN countries in the long run except the fact that this theory is partially held in the Malaysian-Indonesian case for the surveyed period.

In Malaysia, empirical studies of Fisher Effect have focused the relationship on stock and bond market, leaving the money market with no or very few interests as it shows rapid growth in the transaction volume. This paper aimed at investigating the validity of the Fisher Effect on the Malaysian money market. The timeframe (2000-2012) is chosen as the study duration. Three variables were targeted in this study, including an inflation rate (INF), 3- months treasury bill rate (MTB) and the interbank rate (IBR). To study the relationship, this paper employed Autoregressive Distributed Lap (ARDL) bounds test that is capable of testing for the existence of a long-run relationship between the variables irrespective of whether the time series are $I(0)$ or $I(1)$, by Ray S, (2012). The estimation results indicated the presence of long run cointegration among the variables. Overall, the study provides evidence on the Fisher Effect in Malaysia.

In view of the above, it is the objective of this paper to examine the International Fisher Effect theory as relevant to some selected nations and the governments of the selected countries in attempting to influence the values of their currencies. Analysis of the results will be made, and suggestions offered where necessary.

Methodology and Data Collection

Various secondary data were collected for the following countries: Libya, Euro Countries. The data include quarterly money market interest rates and percentage change in the exchange rates. The data which range from the year 2012 to the year 2022 were obtained from various sources, including International Financial Statistics, published by the World Bank, data from databases: World development Indicators (Last Updated: 12/19/2020), Central Bank of Libya, and the International Monetary Fund (IMF).

Following Thomson analysis (2003), statistical tests of international Fisher Effect among selected countries were conducted. Ordinary least squares regressions were run on the historical exchange rates and the nominal interest rate differential. The equations follow from the assumptions that the effect (exchange rate adjusted) return on a foreign bank deposit (or any money market security) is:

$$r = (1 + if) (1 + ef) - 1 \quad (1)$$

Where if is the foreign interest rate, and ef is the percentage change in the value of the foreign denominating the security. The equation as Ray S, (2012), states that the actual or effective return on a foreign money market security depends on the foreign interest rate (if), as well as the percent change in the value of foreign currency (ef) denominating the security. Furthermore, the investors who invest in the money market in the home country are expected to receive the actual rate of return which is simply the interest rate offered on those securities. In accordance with the IFE, the effective return on a home investment (ih) should be on average equal to the effective return on a foreign investment (r), $r = ih$. Substituting equation (1) for r , the equation becomes:

$$(1 + if) (1 + ef) - 1 = ih \quad (2)$$

Solving for ef :

$$ef = [(1 + ih)/(1 + if)] - 1 \quad (3)$$

When $ih > if$, ef will be positive. This means that the foreign currency will appreciate when the home interest rate is greater than the foreign interest rate. Conversely, when $ih < if$, ef will be negative. In other words, the home currency will appreciate when the home interest rate is smaller than the foreign interest rate. It should be recalled that the difference in the nominal interest rate between countries is due to differences in expected inflation rates, assuming that the real rate of return is equal across countries. It should also be recalled that the PPP theory suggests that the currency of a country with a higher inflation rate will depreciate by the amount of inflation differential. Therefore, the country with a higher interest rate will experience depreciation in the value of its currency by the amount of interest rate differential which will consequently negate any gains by investors who invested in the securities of those countries due to a higher interest rate. Eventually, the return on investment in respective countries will be similar. For detailed information on the derivation of this equation, Thomson analysis (2003) in the spreadsheets to accompany this paper.

Table 1: Regression Results of International Fisher Effect for Selected Countries.

Investors Residing in home countries	Attempt to invest in	ih	if	Spot rate (So)	ef	Future spot rate (St)	Regression Results
Euro Countries 2012 to 8/2022	Euro Countries	1.75%	3.20%	1.773	-1.45	1.74809	0.0250
	Libya	57.80%	3.20%	1.7694	56.05	2.71105	-0.9385
Libya 2012 to 8/2022	Euro Countries	25%	8.00%	1.7290	17.00	1.7007	-0.2723
	Libya	3.40%	25%	1.6438	-21.60	1.6544	0.2198

Source: Author’s own estimate

Currency of foreign country

if = Interest rate in a foreign country (if)

ih = Interest rate in home country (ih)

So = Spot rate (S0) -Dollars per unit of foreign currency

ef = Adjustments in foreign currency exchange rate (ef) = $[(1 + ih) / (1 + if)] - 1$

St = Future spot rate (St) = $S0 (1 + ef)$.

Regression Results = $S0 - St$

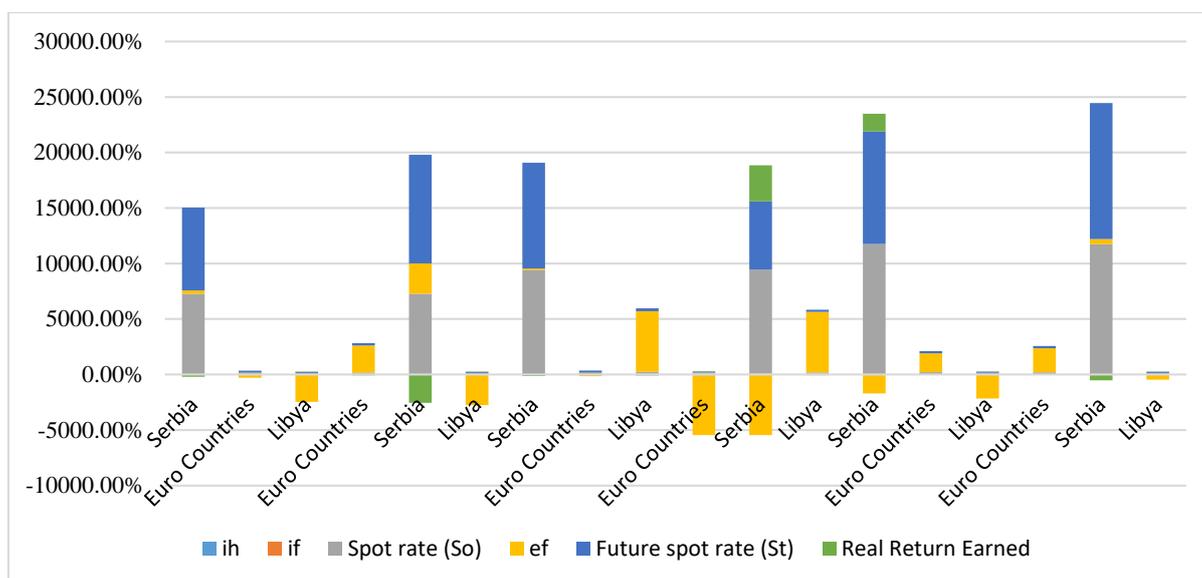


Figure 1: Regression Results of International Fisher Effect for Selected Countries.

Source: Author’s own estimates.

Test For International Fisher Effect

To test for international Fisher Effect, the percentage change in currency is regressed against the nominal interest rate differential among the selected countries.

Thus, the regression equation is as follows:

$$ef = a_0 + a_1 [(1 + i_h)/(1 + i_f)] - 1 + \mu \tag{4}$$

Where, a_0 = constant, a_1 = slope coefficient, and μ = error term.

The hypothesized values of a_0 and a_1 are 0 and 1, respectively, implying an equal offsetting average percentage change in the exchange rate for a given interest rate differential. Each coefficient is divided by its standard error. The level of significance is determined by the critical t-value from the table based on the number of observations and degrees of freedom (Thomson analysis, 2003, pp. 30).

To test the direction of IFE, each country is used as home country and then foreign country respectively. This will make it possible to investigate if the International Fisher Effect is unidirectional or not.

Results and Discussion

Table 2 provides the regression results for the International Fisher Effect. As shown in this table, the results are mixed. While the theory holds for some countries, it does not hold for others. In other words, for some countries, the coefficients imply that a given differential in nominal interest rates on the average is offset by an equal percentage change in the exchange rates. For other countries, this may not be true. The coefficients obtained in table 2 must be tested to determine if the IFE theory holds or not. The statistical tests are described below (Thomson analysis, pp. 6-30):

(a) Test for $a_0 = 0$

$$t = (a_0 - 0) / \text{s. e. of } a_0$$

(b) Test for $a_1 = 1$

$$t = (a_1 - 1) / \text{s. e. of } a_1$$

Table 2: Regression Results of International Fisher Effect for Selected Countries

Home Country	Foreign Country	
Euro Countries	Euro Countries	Libya
2012		
1	0.137595841	-0.494792621
2	0.046304155	-0.028441269
2017		
1	0.069855535	0.266127692
2	0.024911337	0.433720532

2022		
1	0.007635427	0.016040527
2	-0.272157407	-0.361183752
Libya		
2012		
1	0.377576854	0.295423228
2	0.056733641	0.02153309
2017		
1	-0.275158537	-0.477878906
2	-0.663188953	-0.938578923
2022		
1	-0.00623896	-0.011906604
2	0.054156481	0.2197152

1- **Table 1:** Real Return Earned, International Fisher Effect for Selected Countries
 2- **Table 2:** Regression Results of International Fisher Effect for Selected Countries.

Source: Author’s own estimates

Each regression coefficient is compared to its hypothesized value, divided by its standard error. The significance of the test is determined by the procedure described in the previous section. If either hypothesis is rejected, then IFE theory is refuted. The results of the test are presented in Table 3.

When Libya is used as the home country, the theory holds between Libya and the selected countries. When the Euro Countries are used as the home country, the theory holds between the Euro Countries and Libya, but does not hold between the Euro Countries and Libya. The theory holds between Libya and the Euro Countries. However, it does not hold between Libya and Euro Countries. Between, the theory holds except for Euro Countries the selected countries. When Libya is used as the home country, the theory holds between Euro Countries and Libya. In most cases, the theory holds except for a few instances. It is intriguing to note that the theory holds between all other countries except Libya, when Euro Countries was used as the home country. However, when Libya is used as the home country, the theory holds between Euro Countries and the selected Libya, but the theory holds except for Euro Countries. This suggests that the exchange rate adjustment may not be a reciprocal phenomenon. Other reasons are that the exchange rate may not fully offset the interest rate differential in some cases; while in others, the exchange rate may more than offset interest rate. However, the results balance out such that interest rate differentials are on the average offset fluctuation in the exchange rate over time. This is in accordance with the suggestion by measure that the IFE theory does not suggest that the relationship will exist over each time period, but periodic investments that attempt to capitalize on the higher interest rate would achieve a similar yield on the average if they were simply made domestically and periodically.

Table 3: Test of International Fisher Effect Theory between Countries

Home countries	Foreign countries		
	Year	Euro countries	Libya
Euro countries	2012		nh
	2017		H
	2022		nh
Libya	2012	H	
	2017	nh	

	2022	H	
--	------	---	--

H: Theory holds

nh: Theory does not hold

Source: Maurice k. S. Test of the IFE in Selected Countries, Columbus State University, (2020).

Whether the test holds or not, also depends on other factors, such as the period of time under study. While it may hold for a certain period, it may not hold for another. Another limitation of the theory is that exchange rate determination is not affected primarily by inflation alone. There are other psychological factors, as opposed to macroeconomic fundamentals, that play an important role in determining the likely future exchange rates. The bandwagon effects which are difficult to predict should not be ignored (Allen and Taylor, 2009). The exchange rate is also influenced by the markets for exchange rate. It should also be noted that different functional forms or estimating techniques may produce different results.

Conclusion

The International Fisher Effect theory and application of Empirical Testing International Fisher Effect theory was conducted in two selected industrialized nations, namely Libya, and Euro Countries. Each of these countries was used interchangeably as the home country, and foreign country so as to investigate the direction of the parity. The results are mixed. While the theory holds for some countries, it does not hold for others. The theory holds when some countries were used as home country, but was refused when they were used as foreign countries. This suggests that there may be some impediments to foreign trade that may affect exchange rate adjustment apart from interest and inflation rate differentials. While caution must be exercised in applying or interpreting the theory, this information is useful in international business in terms of export opportunities and price competitiveness of foreign imports. Also, Fisher's international impact on accounting and technology has been somewhat positive and good in some years in terms of impact. Also, this is the results why the inflation rate in Libya has doubled more than five times (5) during the current world compared to the inflation rate in the European Union three times (3) during the year and warnings of economic recession if inflation continues to rise.

References

Alizadeh H, Nassir A, and Masoudi Y. February, 2014, ***an empirical investigation of international fisher effect on 10 Asean Countries.***

Central Bank of Libya, 2004, access on Feb 2015, available at
{http://cbl.gov.ly/ar/index.php?option=com_content&view=article&id=260&Itemid=169}

Central Bank of Libya, 2004, access on Feb 2017, available at
{http://cbl.gov.ly/ar/index.php?option=com_content&view=article&id=260&Itemid=169}

Central Bank of Libya, 2004, access on Feb 2019, available at
{http://cbl.gov.ly/ar/index.php?option=com_content&view=article&id=260&Itemid=169}

Central Bank of Libya, 2004, access on Feb 2021, available at
{http://cbl.gov.ly/ar/index.php?option=com_content&view=article&id=260&Itemid=169}

Central Bank of Libya, 2004, access on Feb 2022, available at
{http://cbl.gov.ly/ar/index.php?option=com_content&view=article&id=260&Itemid=169}

Harun UCAK, 2014, ***An Examination of Fisher Effect for Selected New EU Member States.*** Mugla, Turkey, International Journal of Economics and Financial Issues Vol. 4, No. 4, 2014, pp. 956-959, ISSN: 2146-4138.

Hill, Charles W.L. 2014 ***"International Business Competing in the Global Market Place"***. McGraw-Hill College; 5 edition (January 2014).

Inam S, 2014, *Department of Economics, Faculty of Social Sciences*, University of Uyo, P.M.B 1017, Uyo, Akwa Ibom State, Research in Humanities and Social Sciences www.iiste.org, ISSN (Paper) 2224-5766 ISSN (Online) 2225-0484 (Online), Vol.4, No.24, 2014, Nigeria,

INDEX Key Economic, Monetary **Indicators**, Exchange Rates in the Libya, 2014, access on Feb 2015, available at {<http://cbl.gov.ly/ar/images/stories/bohot/INDICATORS.pdf>}.

Madura, Jeff. (2010). "*International Financial Management*", 10th Edition, *South-Western, College Publishing*.

Paul T, Tang Y, Bhatt M, 2013, *A STUDY OF THE RELATION BETWEEN INFLATION AND EXCHANGE RATES IN THE FIJI ISLANDS: A COINTEGRATION AND VECTOR ERROR CORRECTION APPROACH*, University of the South Pacific, Fiji.

Sarbapriya Ray, 2012, *Empirical Testing of International Fisher Effect in United States and Selected Asian Economies*, Advances in Information Technology and Management (AITM) 216 Vol. 2, No. 1, 2012, ISSN 2167-6372, University of Calcutta, India.

Sherpa, 2011, *A Panel Analysis of the Fisher Effect with an Unobserved I(1), World Real Interest Rate*, Gerdie Everaert, Ghent University, December 16, 2011.

Sherpa, 2017, *A Panel Analysis of the Fisher Effect with an Unobserved I(1), World Real Interest Rate*, Gerdie Everaert, Ghent University, December 6, 2017.

Siti Rahmi Utami, Eno L. Inanga.2009, "*Exchange Rates, Interest Rates, and Inflation Rates*. In Indonesia": The International Fisher Effect Theory, *International Research Journal of Finance and Economics* ISSN 1450-2887 Issue 26.

The World Bank Group, 2015, access on Feb 2015 available at {<http://data.worldbank.org/indicator/FR.INR.RINR>.}

The World Bank Group, 2015, access on Feb 2016 available at {<http://data.worldbank.org/indicator/FR.INR.RINR>.}

The World Bank Group, 2015, access on Feb 2018 available at {<http://data.worldbank.org/indicator/FR.INR.RINR>.}

The World Bank Group, 2015, access on Feb 2021 available at

The World Bank Group, 2015, access on Feb 2022 available at {<http://data.worldbank.org/indicator/FR.INR.RINR>.}

The World Bank Group, and the world Development indicators, 2015, access on Feb 2015, available at {http://databank.worldbank.org/data/views/variableselection/selectv_ariables.aspx?source=world-development-indicators#s_i }

The World Bank Group, and the world Development indicators, 2015, access on Feb 2015, available at {http://databank.worldbank.org/data/views/variableSelection/selectvariables.aspx?source=world-development-indicators#c_e }.

The world Development indicators, 2015, access on Feb 2015, available at {http://wdi.worldbank.org/table/4.15.Economy.Monetary_indicators.2014}.

Thomson Learning © 2003, *Relationships between Inflation, Interest Rates, and Exchange Rates*.. *South-Western*. Pp 2-36.

Windows live space, posted on 14/ Nov, 2013, access on Mar 2015, available at request

{<http://cbl.gov.ly/ar/images/stories/banks/Masarf%2022.pdf>}

Zainal N, Nassir A, Yahya M, 2014. *Fisher Effect: Evidence from Money Market in Malaysia*, Journal of social science studies.

Prospects And Possibilities To Spur Productivity In The Informal Economy Of Nigeria

Nzenwata Beauty Chisom¹

beanze@yahoo.com

P.M.B 174 Garki, G.P.O
Abuja, Nigeria.

Bimba Gana²

bimbagana@gmail.com

P.M.B 174 Garki, G.P.O
Abuja, Nigeria.

Alhassan Amina Binta³

allbrightbe@gmail.com

P.M.B 174 Garki, G.P.O
Abuja, Nigeria.

DOI: 10.29322/IJSRP.12.10.2022.p13032

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13032>

Paper Received Date: 4th September 2022

Paper Acceptance Date: 5th October 2022

Paper Publication Date: 13th October 2022

Abstract: *More than 20 million Nigerians and their families are left without food because they are unemployed, have no source of income, and are suffering from rising food prices, insecurity, and a lack of any kind of government assistance. The informal economy is the easiest sector that helps with apprenticeship training and entrepreneurship that takes citizens out of unemployment due to its low entry requirements. Consequently, it is anticipated that promoting small-scale firms in the Informal economy will spring forth indigenous processes that will foster the growth of local technology, skills and employment. Sadly, the informal sector has met with minimal success due to several enduring issues that have plagued the sector's productivity growth. The research aims to study Nigeria's informal economy's productivity and its human capital development, the key issues and challenges faced by the sector. The survey research method was incorporated to capture the responses of 100 informal workers cut across informal sectors, through a face-to-face interview to aid in a basic understanding of the informal sector, its role in output and the challenges they face as an unrecognized sector. The study was supported by existing data from the National Bureau of Statistics, ILO, IMF and many more. The overall result of the survey was not impressive, as there are daunting issues which the government are yet to fix. Our findings indicate that the problems obstructing the productivity improvement of the informal economy of Nigeria span from financial support, human capital development, digitalization, infrastructural facilities, training and many more. Finally, the study recommended applicable strategies to spur the productivity of the informal economy, this can be achieved if followed strictly.*

Keywords: *Informal economy, productivity, Nigeria, unemployment, government*

1. INTRODUCTION

The COVID-19 pandemic has brought negative economic consequences in the form of job losses, threatened the sustainability of firms and depressed growth in GDP. Nigeria has the challenge of a large informal sector that is most vulnerable to the effects of the pandemic. Nigeria's informal sector is also the employer of the largest number of labour in the economy. Considering the ongoing economic and financial crisis that characterizes the economies of many African countries, including Nigeria, the informal sector has the potential to provide the needed impetus for employment generation. The sector is expected to serve as a viable mechanism for the creation of jobs for both rural and teaming urban populations in Nigeria. This has been the case in Nigeria over the years. Employment in the Nigerian informal sector is characterized by variable hours of work over some time, due to a lack of contractual relationships in the sector, as well as the prevalence of self-employment and home-based family workers. It, therefore, appears an average worker in the Nigerian informal sector suffers from a significant degree of under-employment. The result is a differential in the average earnings between the formal and informal sectors. The informal economy workers include small-scale manufacturers, services providers (like furniture makers, chefs, and fashion designers) farmers, small business owners (like street traders, and market traders) and so on. Many groups in the informal economy have unique requirements or encounter significant obstacles when trying to gain the skills necessary to maximize their potential for productivity. When it comes to getting access to education and training, women frequently find themselves at a distinct disadvantage.

A Fifty billion MSME loan package supported by the Central Bank of Nigeria (CBN) was announced during the lockdown in May 2020, the ability of the majority of informal workers to apply for these schemes is severely constrained because the application procedures are not only overtly digitalized, but also opaque, time-consuming, and cumbersome. Due to the Covid -19 containment

measures, only a very small number of informal workers, who were undoubtedly the most traumatized group of local producers, were able to access these "interventions" while also having to deal with the worst aspects of the new regime's rising costs for social services, fuel and electricity, food, and essential consumer goods. Failure to pay attention to the needs of the informal sector will worsen what is already a precarious economic situation for Nigeria grappling with high unemployment and poverty rates. The National Bureau of Statistics (NBS) report in 2019 put Nigeria's unemployment rate at 23.1 per cent and half of Nigeria's population currently lives below the poverty line (\$381.75).

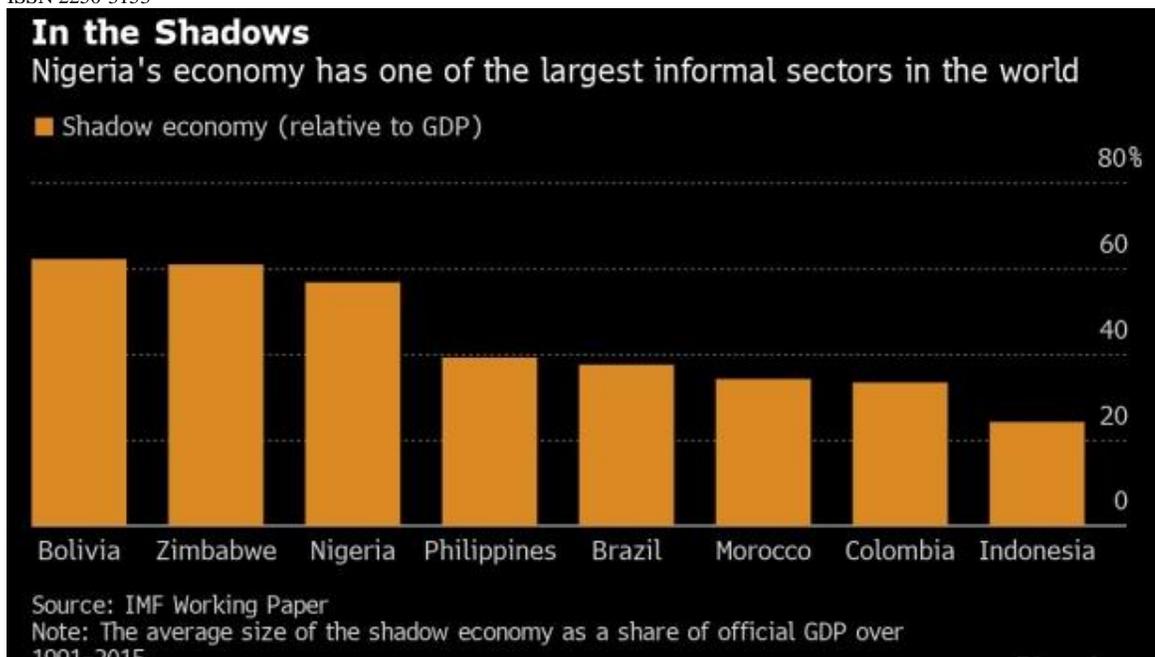
Notwithstanding the growth of interest globally, there seems to be a dearth of research work on the specific size, data and overall contribution of the informal sector of Nigeria. Except for Friedrich, and Schneider who have both made a remarkable research impact on the informal economy, we, therefore, postulate that most of the studies on the informal economy of Nigeria are theoretical reviews or descriptive analyses of the sector which do not have enough data to prove certain issues. Using the existing literature on informal economies, data from the National Bureau of Statistics (NBS) and a field survey which was specifically obtained for this study. The paper examines Nigeria's informal economy's productivity and the human capital development's key issues and challenges faced by the sector are the main goals of this study. The research aims to provide an overview of the informal economy's size utilizing prior data that were available at the time of the research, despite the lack of current statistics on its size. Although the informal sector is a huge contributor to national economies the government policy continues to be inadequate in this area. This study emphasizes the need for policies or programs that recognize the importance of the informal sector in Nigeria to spur productivity. To address the issue of the informal economy's low productivity in Nigeria, this article will highlight numerous ways in which the operations of the informal sector might be improved. The paper is organized into five sections, the first is the introduction; the second part is synthesizing Productivity in the Nigeria Informal Economy. The third part is the methodological and discussion of the survey, the fourth is the recommendation of the key strategies to spur productivity in the informal economy and the fifth is the conclusion.

1.1 Nigerian Informal Economy

In a very general term, Becker (2004) defines the informal sector as the unregulated, non-formal portion of the market economy that produced goods and services for sale or other forms of remuneration. The simple definition of the informal economy is "...a varied variety of economic activities, enterprises, jobs, and people that are not regulated or protected by the state." At first, the concept was applied to small, unregistered enterprises where employees worked for themselves. Now, it also includes paid work in non-protected positions. It is common to label the informal economy as "illegal," "underground," "black market," or "grey market." It is frequently referred to as the "shadow economy" and is considered to be unlawful or unethical activities. However, this generalization is incorrect. The majority of informal workers struggle mightily to make an honest living. Many people labour in public settings and significantly improve communities and economies rather than operating covertly, Martha Alter (2012). Another helpful definition of the informal sector in Nigeria is provided by the Nigeria Bureau of Statistics (NBS). The informal sector is also defined as one that "functions without binding regulations (but may or may not regulate itself internally) as well as one that operates under official norms but does not need the deliverance of official returns on its operation or process" (NBS, 2010)

It comprises people who work in unregistered or undeclared employment in formal enterprises, as well as people who work outside of unregistered or undeclared employment in informal companies (e.g., employers, own account operators, street vendors, unpaid family workers, apprentices, etc.). (Including domestic workers, casual or day labourers, industrial outworkers, homeworkers, etc.). The informal economy can be thought of as a continuum with lower productivity, more survivalist activity at one end (the working poor) and more dynamic higher productivity activities at the other (ILO, 2005). It's commonly claimed that the informal sector has a "woman's face," because, in the majority of countries, women account for between 60 to 80 per cent of all informal work. The majority of women work in low-productivity, lower-skill jobs (including food processing, garment sewing, and domestic services), and/or they are paid less for doing labour that is equivalent to or less valuable to their jobs than men. Men and women both face barriers to accessing resources, markets, and services in the informal economy, as well as those brought on by ineffective regulatory frameworks, but "women face additional gender-specific barriers, which include restrictions on entering into contracts, insecure land and property rights, and the constraints of household and childcare responsibilities," according to a study (ILO 2005).

1.2 Size of the Informal Economy



Sources: [bnnbloomberg](#)

The context is that the informal sector is a significant contributor to the Nigerian economy, accounting for a substantial portion of employment and national GDP. According to the International Monetary Fund (IMF), the informal sector accounts for approximately 65 per cent of economic activities in Nigeria. In sub-Saharan Africa, the informal sector contributes about 72 per cent to employment, excluding agriculture. When agriculture is included, it should put figures at around 90 per cent.

According to a recent World Bank survey, 80.4% of jobs in Nigeria were in the informal sector, compared to 10% in the formal sector and 9.6% in households. Men made up 78.8% of the workforce in the informal sector, 12.9% in the formal sector, and 8.3% in households. According Franziska Ohsorge et al (2021) survey, opined that in Nigeria, 82.1% of women work in the informal sector, 6.9% in the formal sector, and 11% are housewives. 90% of all MSMEs worldwide, or 285–345 million out of 365–445 million MSMEs in developing countries, are informal micro, small, and medium-sized businesses (MSME). Out of these informal MSMEs, 12-16% have access to credit but have financing challenges, whereas 70-78% lack access to credit and need credit. According to another survey by IFC, 55% of informal firms in developing nations, lack access to finance or lack the funding to expand (ILO, 2016)

1.3 The Informal Economy's Contribution

An enormous amount of employment and the country's GDP is generated by the Nigerian informal sector, which is a significant contributor to the country's economy. The IMF estimates that in 2017, the informal sector in Nigeria contributed 65% of the country's GDP, Leandro Medina et al (2017). However, the NBS calculations are a little more conservative, placing its projections at 41.4%. (NBS:2016). Whatever estimate we use, there is no doubt that the informal economy's contribution to the national economy is substantial. The majority of developing nations see the informal market as the main option for both graduates and out of school. It frequently offers both chances for skill development and a chance to create or make a living.

Regarding the contributions to national output, it has been noted that the informal sector, even in developing nations like Nigeria, where productivity is poor, makes up a sizeable portion of the Gross Domestic Product (GDP). Neglecting the requirements of the unorganized sector will exacerbate Nigeria's already fragile economic situation, which is characterized by high unemployment and poverty rates. The unemployment rate in Nigeria was 23.1 per cent according to the National Bureau of Statistics (NBS).

ILO Recommendation asserts that education and training have the power to fundamentally alter how business is conducted in the informal economy because members should identify human resources development, education, training, and lifelong learning policies that "address the challenge of transforming activities in the informal economy into decent work. It further opined that informal work that is fully integrated into mainstream economic life; policies and programmes should be developed to create decent jobs. The majority of informal businesses struggle with low productivity and poor product quality, in a large number of developing nations in Asia, Latin America, and Africa (ILO, 2005).

2. PRODUCTIVITY IN THE NIGERIA INFORMAL ECONOMY

In general, productivity gauges how well resources are used. The output or value added, divided by the amount of labour employed to produce the output is the simplest definition of labour productivity. Low productivity is one of the main characteristics of informality. As a result, Nigeria's economy is dominated by the informal sector, which means that the country's overall capacity for value creation

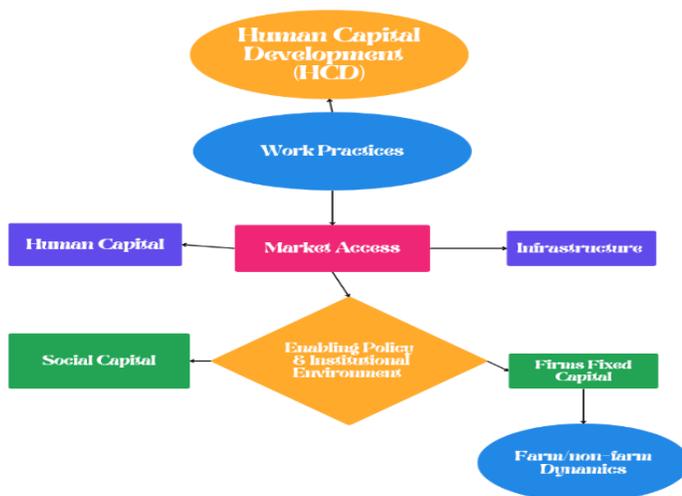
is limited. Unfortunately, contrary to what was anticipated during the oil boom of the 1970s, the informal sector has proven to be durable rather than deteriorating and giving way to more contemporary, established employment arrangements. A commentator asserts that a simple miraculous regulatory change won't make it go away. Its excessive size is a sign of economic weaknesses caused by low entrepreneurial capacities, low financial, technological, and human resources, as well as a poor institutional environment, which together result in low economic productivity. The majority of entrepreneurs in the informal economy are born out of necessity rather than an opportunity. Public policy should work toward enhancing each of these areas, but doing so requires patience and persistence, Surdej (2017)

There are various productivity metrics, and the decision between them depends on the goal of the assessment and/or the availability of data. Gross Domestic Product (GDP) per hour worked is one of the most popular productivity metrics. If the quantity of hours worked by more than 80% of the working population is divided by production, the Nigerian economy's productivity quotient would be very low indeed.

2.1 Human Capital Development

A major factor in productivity is the development of human capital, improvements in the following eight major (interrelated) areas are typically made to raise productivity in the informal economy:

Fig 2. Human Capital Development Drivers



Source: Author C.B Nzenwata

One of the important factors that determine how and for whom productivity growth leads to increased employment, better work in the informal economy, and migration from the informal to the formal economies is improvements in human capital via skill development, Palmer (2008). Making the transition from the informal to the formal sector easy for both employees and businesses is a cross-cutting strategy for increasing the informal economy's productivity. Palmer (2008) avers that many times, policymakers in developing nations prioritize formalization issues related to taxation and registration over easing the majority's access to traditional economic and social resources.

2.2 Human capital development in the informal economy; Key Issues and Challenges

i. Challenges facing policymakers: This includes aligning the goal of skill development with that of economic development, the provision of adequate work opportunities, and initiatives for reducing poverty. This includes tackling the issue of the enormous number of people employed in the informal economy, which is exacerbated by the diversity of informal businesses and employment.

ii. Challenges with coordination: Diverse institutions, including numerous ministries, non-governmental organizations (NGOs), and the commercial sector, supply skills for the informal economy frequently without proper strategic collaboration. For supplied skills to influence productivity, it is crucial to ensure that skill provision for the informal economy is integrated and in line with a national skills development policy. Employers must be prominently represented in coordinating councils or national training authorities (NTAs), which must be endowed with legitimate authority.

Targeting issues: Three general target categories within the informal economy can be identified to aid in program and project design: A) **Business** owners and employees of unofficial MSEs, this target audience is also highly diverse. Therefore, it is crucial to identify sub-groups including entrepreneurs, unpaid family workers, apprentices, and informal wage employees. B) **Programs** for skill development aimed at increasing the productivity of informal enterprises with a focus on sustenance vs expansion have different objectives. C) **Those employed** by non-formal businesses (including casual workers, home workers, domestic workers, casual or day laborer's, temporary or part-time workers, and industrial outworkers).

iv. Problems with the data: There is generally a dearth of information on technical and vocational education and training (TVET). When attempting to measure the relationship between productivity, skills, and the informal economy, the issue is exacerbated, Ashley (2008).

2.3 Low productivity and the vicious cycle of poverty

Most Nigerians (and/or their parents) inability to pay for proper education, skill development, and healthcare, for instance, lowers their (potential) productive capacity. Low productivity may result from an inefficiently planned work process caused by a lack of abilities. Due to their reduced income and lack of productive labour, they are unable to invest in more profitable companies or enhance the quality of their jobs, which in turn results in stagnant output. Because of the general lack of purchasing power of the population, low incomes are maintained in the informal economy, which limits the market's ability to grow. The markets in the informal economy can also become saturated or dispersed due to the large number of people engaging in similar low-return activities (especially in rural areas). Therefore, low productivity may not always result from "poorly organized work, but rather from a lack of resources and incentives to keep everyone working efficiently." (ILO, 2005). In other words, underemployment is a result of underutilizing labour and capital resources, which is a concern for microbusiness owners. There is a market for budget or inexpensive goods, but they are typical of inferior quality. Therefore, on-the-job learners typically only pick up skills to create inexpensive, low-quality goods (on occasion) and end up caught in a vicious cycle of low skill and low production. A large portion of the working poor are also "without security and control over their life" (Palmer, 2008)

3. METHODOLOGY

The methodological approach looks at the available literature on such relevant issues as definitions, the informal sector contributions and the productivity level of the informal workers in Nigeria. The study showcased the views of Informal workers (e.g., enterprise owners, managers, and workers) via an interview method that got them to unveil their challenges and issues that impedes their productivity in the informal economy. The survey research method was incorporated which captured the responses of 100 informal workers cut across informal sectors. The interview method was used to capture an accurate response as some of them are school dropouts, and their responses were analyzed and presented in a table. The survey went around the informal economy such as hairdressers, mechanics, barbers, petty traders and so on. The purpose of the circulation was to capture and analyze the response of Informal workers in the Nigerian economy. This will also aid in a basic understanding of the informal sector, its role in output and the challenges they face as an unrecognized sector.

Table 1: Demographic Distribution of the Respondents

Variable	Frequency N=100	Percentage
Gender		
Male	43	43.0
Female	57	57.0
Age group		
18 – 30 years	19	19.0
31-40 years	42	42.0
41-50 years	27	27.0
51-60 years	12	12.0
Work status		
Employer/Owner	39	39.0
Manager	17	17.0
Employee	43	43.0
Years of Work		
1-5 years	27	27.0
6-10 years	18	18.0
11-15 years	22	22.0
16-20 years	20	20.0
21-35 years	13	13.0
Educational status		

This publication is licensed under Creative Commons Attribution CC BY.

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13032>

www.ijsrp.org

School drop-out	19	19.0
Secondary graduate	28	28.0
Diploma	15	15.0
First Degree	22	22.0
Postgraduate	16	16.0

Source: Researchers Field Survey, 2022

The results of the study showed that there are more women in the informal economy with 57%, most of the respondents were between 31-40 years, and they are more Employees who work in the informal sector than employers. And, most of the respondents have worked for 1-5 years, while most of them are secondary school graduates.

Table 2. View of the Informal Sector

Informal Sector	Yes	No
Are you happy with your work?	69	31
Did you start your work out of passion?	52	48
Did you start your work out of unemployment/poverty?	48	52
Did you have other job opportunities?	15	85
Does your earning sustain you and your family?	62	38
Are you digitalized?	25	75
Did you get any form of training?	33	77
Do you wish to be trained?	81	19
Would you like to upgrade your skills?	85	15
Did you get any financial support from the government?	5	95
Did you ever sort for financial support?	78	22
Do you have the infrastructural development required for your work?	16	84
Did covid-19 pandemic affect your work?	90	10
Are there any occupational health challenges involved in your work?	59	41
Do you intend to employ manpower, if you have the capacity?	84	16

Source: Researchers Field Survey, 2022

As seen in Table 2, 69% of the respondent are happy with their respective work, while 31% are unhappy when we asked why, they assert that they were forced to venture into the informal sector due to challenges and hunger. Entry obstacles to the formal economy are another factor that has continued to contribute to the growth of the informal economy. This has taken many different forms, Verick (2006) corroborates that starting a new business in the formal economy is very expensive and time-consuming. When we queried the respondent 52% acknowledged joining the informal economy out of the passion they had for their business and 48% started unemployment and poverty. The response of the respondent confirms Arosanyin (2011) study which states that the Nigerian economy is faced with two main problems namely poverty and unemployment. 15% of the respondent had other job opportunities before they decided to work in the informal economy while 75% lamented that they could not find a job rather they had to create jobs for themselves and some of them opined that the informal economy was the easiest sector to get a job, they accepted the offer in other to take care of their families. 62% agreed that their earnings sustain their families but 38% of the employee averted that the earnings are not enough

they had to do extra petty jobs which in turn affects their health. The use of technologies is the trend of this present age, we got a big shock at the low response on digitalization, 75% of the respondent are not aware of how digital system work and how they can improve their productivity. Nzenwata (2019) discovered that workplace digital transformation has a lot of benefits such as increased workers' productivity, she opined that it is a stepping stone to a successful business strategy, it intensifies alliance and leads to effective service delivery in any organization. 77% of the respondent stated that training was another problem they faced in the informal economy as it involves a lot of monetary investment, they further argued that all they learnt was from the job which is not sufficient enough for productivity growth. 81% of our respondents yearn to be trained in their field, they are not satisfied with their overall output, we also got 85% that wish to upgrade their skills if they have an enabling platform or opportunity. One significant contribution that the sector also makes to economic growth and development is in terms of apprenticeship training and entrepreneurship which are developed within it Omisakin (1999). Out of 100 respondents, only 5% got financial support from the government, the other 95% opined that they see most of the government acclaimed initiatives as a scam because 78% sort for support but was disappointed at the huge turned down while the remaining 22% claimed that they never heard or knew that government can support their business. According to Eghosa (2014), insufficient commitment from various governments has been recognized as another factor that influences the growth of the informal sector. As a result, the government neglects the informal economy because it is unaware of its potential, contributions, and issues. I strongly concur, that when the problems are unknown to the government, how will they solve the problem? Even the informal workers involved in this web do not know the opportunities mapped for them due to a lack of orientation. 84% of the respondent were very bitter as they narrate their ordeal in terms of infrastructural development, it has cost some informal sector workers their lives due to bad roads, and they spend so much fuel/diesel to power their generator due to lack of electricity and many more. 90% corroborate that the Covid-19 pandemic negatively affected their work, some had to lay off their workers while others are still struggling to get on their feet, this has caused a huge gap in the productivity of the informal economy of Nigeria. 59% agreed that their work involves many occupational health challenges, example a welder confirmed that his eyes are almost gone due to the effect of light that reflects on his eye during work, according to the respondent he has spent so much to get treatment but his doctor told him that his eye can never be the same again, this one out of many. 84% agreed that they wish they could employ more labour but there are lots of constraints impeding them. The informal economy is the highest employer of labour in Nigeria and other countries. If they are empowered with the right training, financial support etc I believe that it will spur productivity in the economy and also alleviate unemployment in Nigeria.

4. KEY STRATEGIES TO SPUR PRODUCTIVITY IN THE INFORMAL ECONOMY

This research contributes to the body of knowledge already available on the informal economy and provides information on this crucial but frequently ignored component of developing Nigeria's economy. The purpose was to highlight the crucial contribution of the informal sector to the growth of the Nigerian economy in particular and the necessity of policies that take this role into account.

4.1. New technologies and skill adaption

New technologies and skill adaption can be applied to change workplace procedures, this one of the pillars to spur informal economy's productivity. Palmer (2008) what is meant by "work quality" Workplace health and safety as well as increased access to technology are improvements. The degree of skill adaptation determines how much new technology, notably information and communication technologies (ICTs), biotechnologies, and microelectronics, are incorporated into the informal sector and how much they contribute to that economy's increasing productivity (Singh, 2000). Workers in the informal economy must learn "new skills" that are becoming more and more prevalent in the formal economy, like computer and technology skills. Because of the large number of apprentices involved, the fact that younger people are likely more able to learn than older people, the fact that they will be the backbone of tomorrow's societies, and the potential to increase productivity and incomes in self-employment, it is crucial to improve the current apprenticeship training systems, Johanson et al (2004). In many nations, informal apprenticeship training is still the main source of skills, but it has poor quality.

a. Upgrade the skills of master-craftspeople

"Upgrading the skills of MCs may be the most appropriate training intervention, anticipating that greater skills will make them more productive and have a trickle-down effect on apprenticeships" Johanson et al (2004). Apprentices should never be trained alongside master artisans; instead, master craftspeople should be trained first.

b. Provide supplementary training for apprentices

Literacy instruction is a crucial prerequisite for successful business development as well as a necessary complement to technical and vocational training. (Palmer,2008)

4.2. using digital technologies to boost productivity

New chances for gradual formalization are brought about by digitalization. The digitalization of financial services and other government services (e-government) affects how the informal and formal economies interact: it opens up new channels for collaboration among various operators through e-clustering, and lowers the direct and indirect costs of formalities (for example, by streamlining procedures), and lowers barriers to borrowing money.

a.MOOCs

Massive Open Online Courses (MOOCs) provide access to digital training materials for new target audiences (MOOCs). Since 2008, universities have only offered these courses online. They are often certified if a price is paid and are generally free to attend. The enormous hope that this strategy initially inspired, especially for university education, needs to be tempered in light of the continents' and regions' high dropout rates of over 90% and comparably low participation rates.

b. M-Learning

M-learning, or learning through mobile devices like smartphones, is thought to offer great potential for developing nations and population groups that are underserved or challenging to reach. This is primarily because of the technology's increased adoption, which gives access to the internet to many more people than computers do. However, there is still insufficient research on the effects of mobile learning on users and their learning outcomes. M-learning is comparatively popular in the informal economy when it comes to agriculture. The distribution of information, audio lectures, and text message services, which also provide structured forms of learning with assessments and interactive formats, are only a few of the ways shown in an overview of established learning applications for small farmers in Kenya.

4.3. Access to finance and the quest for productivity in the informal sector

Although informal firms are varying in their characteristics, one area that most enterprises require support is access to financial services. The biggest barrier to expansion for micro and small businesses continues to be a lack of access to financial services. Only about 11% of informal firms use loans, and only 23% have bank accounts, according to the World Bank's Informal Enterprise Survey. Among the surveyed enterprises 80% and 84% of the informal firms employ internal funds, family, and moneylenders for working capital finance and investment finance, respectively. Financial institutions and policymakers have a significant opportunity to use formal financial service providers to encourage informal enterprises to formalize, acquire new knowledge, new equipment, and new markets, and produce better quality and quantity outputs because of the substantial share of informal finance WorldBank, (2015).

a. Government Financing in the Informal Sector

Government initiatives aimed at targeting the informal economy have taken many different forms over time. Unfortunately, the majority of them were abandoned since they didn't succeed in meeting their intended goals. Community banking was one of the final initiatives to meet this fate, and in its place, the microfinance banking program was introduced in 2005 (Onah, 2020).

The National Social Investment Program is the Federal Government's most ambitious financial intermediation program in recent years (NSIP). The primary critique of the NSIP program is that the program's fundamental goals have been severely hampered by politics and antecedent issues.

A World Bank representative in the Social Investment Programme expressed regret about the "exceptional lack of openness and accountability" she saw in fund applications, particularly concerning the Trader Moni element of GEEP, in 2019, according to Onah et al.

Politicization, ethnicity, favoritism, and nepotism, which are frequently brought to bear on the generation of data and other crucial indicators, are the main reasons why previous poverty alleviation programs and social policies in Nigeria failed, as demonstrated by Onah and Olise in the work cited above. Finances are still another important limitation. Only 15.8% of the program's 2016 and 2017 appropriations, according to the National Director of NSIP, have been distributed (Onah, 2020)

b. Microfinance Banks

The microfinance banks (MFB), which replaced the People's Bank of Nigeria and Community Banks in 2005, are the fundamental business assistance system accessible to informal employees. MFBs were created to fill the funding gap for the working poor and micro-producers. In Osun state, there are numerous MFBs functioning, with about 20 of them based in Osogbo and providing savings and loan services to informal employees and micro businesses.

MFBs, on the other hand, are frequently used as a last resort, which hasn't increased the access to finance for informal workers. This is a result of their severe loan recovery techniques, exorbitant interest rates, and operational practices that resemble those of commercial banks.

c. Cooperative Organizations

The self-organized and socially based business support networks that have historically been relevant for informal workers still exist today. Informal workers rely on locally self-organized organizations including community associations, cooperative societies, faith-based support groups, and rotatory savings and credit associations (ROSCAs). Since state-sponsored and official business financing programs like the MFBs continue to fail, ROSCAs and other Informal Financial Institutions (IFIs) maintain their attractiveness. The majority of new businesses in the unorganized sector still rely on personal resources, family assistance, financial institutions, cooperatives, and other sources like neighborhood and faith-based organizations. According to a survey by Gasu et al. (2020), in Osun state, 32.72% of respondents said they obtained their capital through family, 29.01% from friends, 14.81% from cooperatives, and only 8.41% from other sources. 4.94% from bank loans.

The cooperative movement and other self-regulatory financial intermediation practices have shown to be more effective and durable viable ways for entrepreneurs to acquire financing, respond to crises, acquire finance, and expand a firm. The government is urged to pay closer attention to this area to make actions that will have a greater impact on the informal economy's growth, development, and productivity.

4.4. Creating a supportive institutional and policy environment

Some or all of the aforementioned strategies could be used in such a framework. A key component of creating an enabling environment is to prioritize employment development so that there are more work options in the formal economy and individuals do not continue to

overstuff the informal market. The ILO supports the creation of an environment that encourages employees in the informal economy to increase their productivity, gain access to decent jobs, and formalize their businesses.

5. CONCLUSION

As a result, the government at all levels needs a wide range of carefully coordinated interventions to support a process of gradual transition from a low productivity informal sector to a highly productive economy. This is due to the heterogeneity of informal work in Nigeria, the sheer diversity, enormous size, and the number of Nigerians active in it, as well as its enormous contribution to the national economy.

In particular, existing and new structures must be optimized to foster effective interventions in the areas of training, funding, the introduction of new, appropriate technologies, work-space and cluster development, occupational health and safety training, and facilities within an overall policy and legal framework that reflects our realities and promotes cost-effective, socially acceptable, and more sustainable development paradigm that aid processes of necessary transitions to a more productive work culture in Nigeria informal Economy.

Nigeria faces the difficulty of a sizable informal economy that is particularly susceptible to the pandemic's effects. The majority of Nigerians are employed in the country's informal economy. The federal government and other stakeholders must implement measures to give the informal sector assistance. Nigeria must develop and implement policies to assist certain persons and groups in this area.

REFERENCE

- [1] G. T Arosanyin, A. T Olowosulu, G. M Oyeyemi, "Employment Generation and Earnings in the Informal Transport Sector in Nigeria," *International Business and Management*, Vol.2, No.2, 2011.
- [2] K.F. Becker, "The Informal Economy: A Fact-Finding Study," Swedish International Development Cooperation Agency (Sida), Stockholm Sweden. 2004.
- [3] O. S. Eghosa, "The Nigerian informal economy: a regional analysis," 2014 Available: https://irep.ntu.ac.uk/id/eprint/81/1/219391_Eghosa.Igudia-2014.pdf
- [4] F. Ohnsorge & Y. Shun, "The Long Shadow of Informality, Challenges and Policies," World Bank 2021 Available: <https://www.worldbank.org/en/research/publication/informal-economy>
- [5] M.B. Gasu, R. B. Ibrahim, & D. A. Yakubu, "An Appraisal of Informal Commercial Activities in Osogbo, Osun State Nigeria," *UNIOSUN Journal of Engineering and Environmental Sciences*, Vol. 2, No. 1. March 2020.
- [6] International Labour Organization, (ILO) Measuring the informal economy: From employment in the informal sector to informal employment Working Paper No. 53 https://www.ilo.org/wcmsp5/groups/public/---dgreports/---integration/documents/publication/wcms_079142.pdf
- [7] M. Leandro, W. J. Andrew, C. Mehmet, "Informal Economy Sub Sahara Africa; Size and Determinants," 2017 <https://www.imf.org/en/Publications/WP/Issues/2017/07/10/The-Informal-Economy-in-Sub-Saharan-Africa-Size-and-Determinants-45017>
- [8] M. Singh, "Combining Work and Learning in the Informal Economy: Implications for Education, Training and Skills Development," *International Review of Education*, Volume 46, pages 599–620, 2000.
- [9] A.C. Martha, "The Informal Economy: Definitions, Theories and Policies," 2012. https://www.wiego.org/sites/default/files/publications/files/Chen_WIEGO_WPI.pdf
- [10] National Bureau of Statistics, NBS, Nigeria poverty profile 2010 <https://www.nigerianstat.gov.ng/pdfuploads/nigeria%20poverty%20profile%202010.pdf>
- [11] National Bureau of Statistics, Formal and Informal Sector Split of Gross Domestic Product, (NBS) 2015 <https://www.nigerianstat.gov.ng/download/403>
- [12] Nigeria-Enterprise Survey 2014, Nigeria, World Bank, 2014 – 2015 <https://microdata.worldbank.org/index.php/catalog/2361>
- [13] C. B. Nzenwata, "Digital Transformation a Panacea to Workforce Low Productivity," *International Journal of Scientific and Research Publications*, Volume 9, Issue 9, pp 466-472, September 2019.
- [14] I.S. Omisakin, "Factors influencing success or failure of an enterprise in informal sector," *NISER Monograph series*, No.6, p.p 11-54, 1999.
- [15] R. C. Onah., Olise, & N. Charles, "National Social Investment Programme (NSIP) and Sustainable Poverty Reduction in Nigeria: Challenges and Prospects," *IOSR Journal of Humanities and Social Science (IOSR-JHSS)* Volume 24, Issue 10, Series. 11, pp 20-31, October. 2019.
- [16] R. K. Johanson, A. Adams, "Skills development in Sub-Saharan Africa," 2004 <https://www.semanticscholar.org/paper/Skills-development-in-Sub-Saharan-Africa-Johanson-Adams/8d1fa8404af4b9e7147a1358195c2274998e0bb4>
- [17] R. Palmer, "Skills and productivity in the informal economy: International Labour Organization", 2008 https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---ifp_skills/documents/publication/wcms_103983.pdf
- [18] S. Verick, "The Impact of Globalization on the Informal Sector in Africa." *Conference Papers*, 2006. www.iza.org/conference_files/worldb2006/.

Impacts Of Dilapidated Buildings On Secondary School Students' Academic Performance In Ogun State, Nigeria

Saheed AbiolaOLASUNKANMI¹
saheedola2030@gmail.com

Ifeoluwa AKANDE²
i_akande@bellsuniversity.edu.ng

Daniel AdebowaleADELANI³
adelanidaniel@gmail.com

^{1,2&3}Department of Architecture, Bells University of Technology, Ota Ogun State, Nigeria.

DOI: 10.29322/IJSRP.12.10.2022.p13033
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13033>

Paper Received Date: 5th September 2022
Paper Acceptance Date: 5th October 2022
Paper Publication Date: 13th October 2022

Abstract: Education is the process of knowledge impartation either through formal or informal methods. School is generally an environment for learning and is of different types, these include crèche, nursery, primary, secondary, vocational, and tertiary learning environments. Secondary school is the stage following primary school and precedes vocational or tertiary education. Learning environment building maintenance considers adequate repairs attention to buildings to avoid falling into a state of disrepair. Lack of good maintenance process and activity of school buildings often results in building deterioration and dilapidation. The paper assesses the effects of dilapidated buildings on the student's academic performance in selected secondary schools in Ado-Odo Ota Local Government Area. A survey design research strategy was adopted and the target population is students of public secondary schools in Ado-Odo/Ota Local Government Area, Ogun State. A total of one hundred and twenty junior and senior secondary school students were selected for the study. The paper revealed that most of the classroom buildings in the selected secondary school have varied levels of classroom building obsolescence; schools' classrooms are in poor condition and noticeable across the selected school. The paper recommends the adequate provision of well-equipped and functional classrooms to promote effective teaching and learning experience among the teachers and students of secondary schools in Ado-Odo/Ota Local Government Area, Ogun State, this is expected to boost student academic performance and increase the productivity of the teaching staff among others.

Keywords: Education, Educational Facilities, School, School Building, Academic Performance

1.0 INTRODUCTION

Education is an important aspect of every society in developing and developed countries (Malik, 2018). Education serves the purpose of developing human beings 'physical, social, emotional, and intellectual aptitudes. Studies in the past have defined education as a process by which any society through schools, colleges, universities, and other institutions deliberately transmits knowledge, values, and skills from one person to another (Manolescu, Florea, & Arustei, 2018). Education could be formal or informal education and could further be broadly categorized into the public education system and private educational system. One of the education settings is the formal school environment.

Schools are generally environments for learning and are of different types, these include crèche, nursery, primary, secondary, vocational and tertiary school and learning environments (Olowonefa & Ogunode, 2021). Secondary school is the level of education following primary school and precedes vocational or tertiary education. A school environment is a place where the learner learns and interacts with other learners and learning facilities to improve themselves and impart positively to society. The school environment comprises two different segments, the spaces for learning and the space spaces dedicated for complimentary

activities such as recreation, cafeteria, and convenience among others. The school learning environment includes buildings for the classroom, library, technical workshop, laboratory, and studio.

School learning environment characteristics include building type, building size; the arrangement of spaces; available internal facilities such as chairs, and desks. Also the cooling system; ventilation level; temperature level; the form of lighting; condition of the building such as the wall, floor, and ceiling; nature of acoustic, and availability of instructional materials. The learning environment is important in schools, it is the area where core academic activities occur (Louis & Kruse, 2021). The nature and condition of these school environment features impact the quality of learning obtainable in the environment and could impact the nature of learner's performance. The condition of the school learning environment could be improved through maintenance activities.

Maintenance is an act to keep an item in good working condition or to main the item's initial state while building maintenance is the process of engaging in giving adequate building care, engaging in prompt repairs of defective sections, and also engaging in proper building usage (Ifeoluwa, Edikan, Oke, & Atirolaoluwa, 2021). School building facilities maintenances activities that involve the repairs and replacement of school buildings and equipment to keep them in near their original conditions as possible (Momoh & Ofoegbu, 2020). Lack of good maintenance process and activity of school buildings often results in building deterioration and dilapidation. The poor state of the school environment and building dilapidation has implications on the learning activities within the school environment including academic exercise, extra-curricular activities, and the performance of both teachers and students (Eric & Ezeugo, 2019). Student academic performance is the assessment of a student's ability to pass and accomplish a given academic task, it could be based on specific subject areas or overall academic performance which combines both curricular and extra-curricular activities.

Recently, there has been a continuous lamentation of parents about the poor academic performance of their wards in secondary schools within Ogun State with specific reference to Ado-Odo/Ota Local Government Area. The poor academic performance has agitated education stakeholders with increased concern to address the decline in academic performance in secondary schools. One of the major indicators of this poor academic performance is the low pass rate at both junior and senior secondary school terminal examinations. This paper examines the implications of dilapidated buildings in an educational learning environment on secondary school student's academic performance.

2.0 RESEARCH METHODOLOGY

Ado-Odo/Ota Local Government Area is one of the 20 Local Government Areas of Ogun State, Nigeria. Ogun State. Ado-Odo/Ota Local Government Area covers an area extend of 1,460 square kilometres and is located 6°41'00"N 3°41'00"E to the North with a total land area of 878 km². It shares a boundary with metropolitan Lagos State in the East and South, Yewa South and Ifo Local Governments in the North, and Ipokia Local Government in the West. The Local Government Area is the second largest in Ogun State (Izobo-Martins, 2020). The Local Government Area is divided into Ota 1, Ota 2, Ota 3, Ilogbo, Atan, Alapoti, Ado-Odo (I), Ado-Odo/Ota (II), Ere, Igbesa, Ketu, Adie Owe, Agbara 1, Agbara 2, and Iju. Ado-Odo\Ota Local Government Area has a total of forty-seven (47) public secondary schools, a total of eighteen schools are junior secondary schools, eighteen senior secondary schools, and eleven are both junior and secondary schools combined.

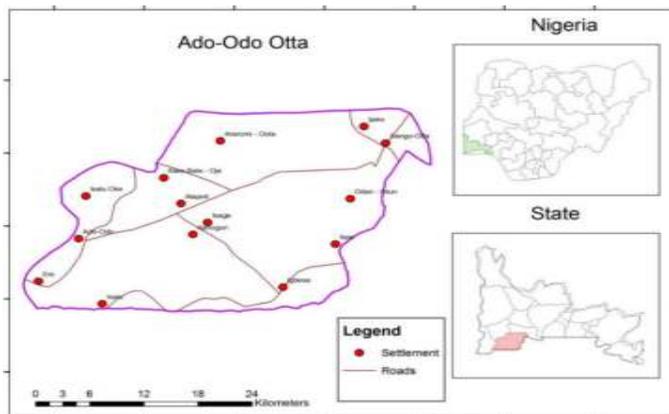


Figure 1: Ado-Odo/Ota Local Government Area
 Source: Ogunyemi, Ajileye, Samson, Muibi, Alaga, Eguaroje, Ogunjobi, Adewoyin, Popoola, Omisore and Oloko-Oba, 2017

Research design provides a process by which the research is conducted. This paper adopts an inductive research approach which seeks to interpret study data to address the research problem. Furthermore, the study adopts a survey research design. The adoption of a survey research design strategy is due to the quantitative nature of the study. Data were derived from primary and secondary sources. Primary sources are survey questionnaires and checklists while secondary data sources are journals, published and unpublished thesis, official statistics, working papers, and research reports. and internet sources.

The data required for this study include variables on available school facilities including classroom, nature of school facilities, condition of school facilities, the ratio of students to a classroom, student academic performance, and the effects of school building conditions on the academic performance of students population. The study population is students of public secondary schools in Ado-Odo/Ota Local Government Area, Ogun State. The study sample frame consists of all the student population of the selected junior, senior, and combined public secondary schools in Ota central area in Ado-Odo/Ota Local Government Area. Seven secondary schools in Ota were selected for the study, and a sample of five students was selected for each arm of the junior and senior class, thus a total of fifteen students were selected for the junior class and also fifteen students for the senior secondary school class. Together, a total of one hundred twenty junior and senior secondary school students were selected for the study. The selection of respondents was conducted using a systematic random sampling method. Data were analyzed and presented using descriptive statistical methods.

Table 1: Research Objectives, Data Collection and Analysis Methods

Research Objectives	Data Collection Method	Data Analysis Method
To document the extent of classroom dilapidation in selected secondary schools	Checklist	Descriptive analysis
To highlight the variation in dilapidated classroom buildings to good classroom buildings in the selected secondary schools	Questionnaire	Descriptive analysis
To evaluate the indicators of a conducive learning environment	Literature review	Descriptive analysis
To determine the impacts of dilapidated classrooms on students' academic performance in selected secondary schools;	Questionnaire	Descriptive and inferential analysis
To suggest viable strategies for building maintenance in Ado-Odo/Ota Local Government Area secondary schools.	Content analysis	Design

Source: Author's Design, 2022

3.0 RESULTS

An assessment of the extent of classroom building's state of disrepair level across the selected secondary schools in Ado-Odo/Ota Local Government Area was conducted using a checklist. It was revealed that most of the classroom buildings in the selected secondary school for the study have varied levels of structural defect and obsolescence with moderate and low classroom dilapidation (See Table 2 and Plates 1-6).

Table 2: Extent of Classroom Building Dilapidation

Classroom Buildings Elements	High Dilapidation				Moderate Dilapidation				Low Dilapidation				No Dilapidation			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Wall (partly broken down, non-structural cracks., no defect)						✓	✓	✓	✓							
Floor (structural cracks, Non-structural cracks., No defect)						✓	✓	✓	✓							
Window (no louvres, partly broken down, completely broken down, no defect)				✓		✓	✓			✓						
Door (No door, partly broken down, completely broken down, no defect)							✓	✓		✓					✓	
Roofing (No roof, partly broken down, completely broken down, no defect)							✓	✓		✓					✓	
Electrical Wiring (Poor Electrical Wiring, Loose electrical cables, Damaged electrical plugs/sockets, Functional)				✓			✓			✓	✓					

Source: Authors Field Survey, 2022

1. AUD Comprehensive College; 2. Anglican Grammar School, 3. Iganmode Grammar School; 4. St. Michael's High School, Ota



Plate 1 & 2: Anglican Grammar School, Ota Classroom, Buildings and General Learning Environment Condition



Plate 3 & 4: AUD Comprehensive College, Classroom, Buildings and General Learning Environment Condition



Plate 5 & 6: St. Michael's High School, Ota Classroom, Buildings and General Learning Environment Condition

An academic performance rating scale (APRS) was prepared and used to assess student academic performance; this was completed by teachers for the respective class. Six major segments were identified to assess the student's academic performance, these are arithmetic skills, language arts, general subjects, quality of reading, and quality of speaking. The mean score shows a value of 2.56, 2.85, 2.56, 2.45, and 3.6 for arithmetic skills, language arts, general subjects, quality of reading, and quality of speaking respectively (Table 3). A total of 38 (33.33%) of sample students believe the classrooms are in good condition, 44 (38.60) of total sampled students believed that the classrooms are in fair condition while a total of 32 (28.07%) think otherwise. This set of people believed the school's classrooms are in poor condition. Sampled students highlighted the level of deterioration of specific buildings within the school and the most declined school facilities, school classroom (51.75%) was identified as the deteriorated building within the school environment. Other buildings identified as most deteriorated include technical workshops (19.29%) and libraries (15.79%).

The extent school physical environment and school buildings affect the academic performance of students was determined using elements such as offices for staff; general convenience (toilet, etc.); cafeteria; recreational area/sport; facilities; fencing of the school/security and school health facilities, the assessment indicates mean score value of 4.12, 4.09, 4.34, 4.38, 4.53 and 4.14 respectively with an overall mean score value of 4.27 (Table 4). The assessment of classroom condition impact on the learning process and academic performance of the student environment indicates a mean score value of 4.22, 4.26, 4.5, 3.94, 3.71, and 3.80 with an overall mean score value of 4.07 (Table 5).

Table 3: Student Academic Performance Assessment

Academic Item	Academic Performance Rating					Mean Score
	Very High (5)	High (4)	Moderate (3)	Low (2)	Very Low (1)	
Arithmetic skills	12 (10.5%)	18 (15.8%)	9 (7.9%)	58 (50.9%)	17 (14.9%)	2.56
Language arts	24 (21.1%)	13 (11.4%)	17 (14.9%)	43 (37.7%)	17 (14.9%)	2.85
General subjects	14 (12.3%)	21 (18.4%)	4 (3.5%)	51 (44.7%)	24 (21.1%)	2.56
Quality of reading	8 (7.0%)	28 (24.6%)	13 (11.4%)	24 (21.1%)	41 (35.9%)	2.45
Quality of speaking	42 (36.8%)	29 (25.4%)	10 (8.8%)	26 (22.8%)	7 (6.1%)	3.6

Source: Authors Field Survey, 2022

Table 4: School Physical Environment/School Buildings Effects

School Physical Environment/School Buildings	VGE (5)	GE (4)	ME (3)	LE (2)	VLE (1)	Mean Score
Offices for staff	54 (47.37%)	42 (36.84%)	2 (1.75%)	10 (8.77%)	6 (5.26%)	4.12
General convenience (toilet etc)	43 (37.72%)	51 (44.73%)	7 (6.14%)	13 (11.40%)	0 (0%)	4.09
Cafeteria	68 (59.65%)	23 (20.18%)	17 (14.91%)	6 (5.26)	0 (0%)	4.34
Recreational area/sport facilities	55 (48.25%)	47 (41.23%)	12 (10.53%)	0 (0%)	0 (0%)	4.38
Fencing of the school/security	71 (62.28%)	32 (28.07%)	11 (9.64%)	0 (0%)	0 (0%)	4.53
School health facilities	41 (35.96%)	55 (48.25%)	11 (9.65%)	7 (6.14%)	0 (0%)	4.14
	Grand mean weighted value					4.27

Very Great Extent (VGE), Great Extent (GE), Moderate Extent (ME),

Low Extent (LE), Very Low Extent (VLE)

Table 5: School Facilities (Classroom) Effects

School Facilities (Classroom)	VGE	GE	ME	LE	VLE	Mean Score
Well-furnished classroom for students' comfortability	59 (51.75%)	38 (33.33%)	0 (0%)	17 (14.91%)	0 (0%)	4.22
Classroom teaching aids	64 (56.14%)	28 (24.56%)	10 (8.77%)	12 (10.53%)	0 (0%)	4.26
Alternative power supply for classroom	71 (62.28%)	29 (25.44%)	14 (12.28)	0 (0%)	0 (0%)	4.5
Functional blackboard for classroom	37 (32.46%)	53 (46.49%)	4 (3.51%)	20 (17.54%)	0 (%)	3.94
Well-equipped laboratory for science subjects	50 (43.86%)	31 (27.19%)	10 (8.77%)	23 (20.18%)	10 (8.77%)	3.71
Lecture hall spaces for teaching & learning process	32 (28.07%)	49 (42.98%)	15 (13.16%)	14 (12.28%)	4 (3.51%)	3.80
Grand mean weighted value						4.07

Very Great Extent (VGE), Great Extent (GE), Moderate Extent (ME),
 Low Extent (LE), Very Low Extent (VLE)

4.0 DISCUSSION AND CONCLUSION

Based on the review literature where it was established that there is a relationship between the condition of school facilities and buildings and student academic performance (Mishra, 2020). It has become obvious that the dilapidating condition of the schools under study would impact negatively on the learning experiences and students' academic performance both at the junior and senior class levels. Assessment of student academic performance confirms that there is low academic performance among the selected public secondary schools in the study area. The condition of the classroom was confirmed to be in a poor condition as stated by sampled secondary schools considering both internal and external fixtures of the classroom.

Assessment of the level of deterioration of specific buildings within the schools shows a high level of deterioration of facilities across the school and this calls for concerted efforts to address the challenges of school facilities and the learning environment. The assessment of the extent of school physical environment and school buildings 'implications on students' academic performance indicates that student academic achievement of students is affected by school physical environment and school buildings. It could therefore be strongly inferred that school physical environment and school buildings of the selected secondary schools in the study area impact negatively on the student academic performance.

Based on the outcome of the assessment across the selected secondary schools it could be concluded that school buildings (classrooms), school environment, and school facilities had impacts on academic learning and student academic performance. This paper has shown a clear linkage between the selected school's physical environment, facilities, and student performance. Therefore, it has become imperative that these issues be looked into by stakeholders to enhance students' academic performance and improve academic learning environment conditions. The paper recommends that there should be adequate provision of well-equipped and functional classrooms to promote effective teaching and learning experience among the teachers and the students of secondary schools in Ado-Odo/Ota Local Government Area; provision of a conducive office facility for teaching staff to enable a relaxed academic atmosphere; classrooms should be fitted with the necessary equipment, made more spacious as this would promote a conducive learning environment, development and inculcation of good facilities maintenance culture across secondary schools in the local government area and the state.

REFERENCES

- Eric, A., & Ezeugo, C. R. (2019). Physical resources availability and the academic performance of students in the universal basic education scheme, Rivers State. *International Journal of Innovative Development and Policy Studies*, 7(1), 13-23.
- Ifeoluwa, A., Edikan, M. O., Oke, T., & Atirololuwa, D. O. (2021). Evaluation of Building Maintenance Strategies in Public Buildings: A Case of Onikan Area of Lagos State Nigeria. *International Journal of Research Publication and Reviews*, 20-29.
- Izobo-Martins, O. (2020). *Assessing Users' Perceptions of the Current Maintenance Disorder of Public Secondary School in Ogun, Nigeria*. Ota.
- Louis, K. S., & Kruse, S. D. (2021). Creating Community in Reform: Images of Organizational Learning in Inner-City Schools 1. *Taylor & Francis*, 17-45.
- Malik, R. S. (2018). Educational challenges in 21st century and sustainable development . *Journal of Sustainable Development Education and Research* , 2(1), 9-20.
- Manolescu, I. T., Florea, N., & Arustei, C. C. (2018). Forms of learning within higher education. blending formal, informal and non-formal. *Cross-Cultural Management Journal*, 20(1), 7.
- Mishra, S. (2020). Social networks, social capital, social support and academic success in higher education: A systematic review with a special focus on 'underrepresented' students . *Educational Research Review*, 29, 100307.
- Momoh, U., & Ofoegbu, F. I. (2020). Assessment of School Plant Maintenance Practices in Renovated Public Secondary Schools in Edo State . *KIU Journal of Social Sciences*, 6(1), 345-350.
- Olowonefa, G. S., & Ogunode, N. J. (2021). Quality Assurance Programme in Public Secondary Schools in Nigeria: Problems and Way Forward. *Middle European Scientific Bulletin*, 19, 46-57.

E-Banking Services and Performance of Cooperative Bank of Oromia

Tagay Mifta Aba-Bulgu*

* MBA, Atlas Business and Technology College

DOI: 10.29322/IJSRP.12.10.2022.p13034

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13034>

Paper Received Date: 4th September 2022

Paper Acceptance Date: 6th October 2022

Paper Publication Date: 13th October 2022

Abstract

Electronic banking service is growing rapidly in the world, Cooperative bank of Oromia is putting its maximum exertion to travel with technology of E- banking services. E-banking has its own effect on financial performance of the bank. This research mainly investigates the effect of E- banking on the financial performance of the Cooperative Bank of Oromia by focusing on the bank's performance and size. For primary data collection branch staffs and managers will be interviewed while secondary data will be collected from branch documents like report of daily transactions, profit of branch and customer related data will be reviewed.

Keywords: Mobile Banking, Performance, Bank

1. Introduction

Globally, banking service providers saw an opportunity in the unbanked rural population and went on to exploit this opportunity by creating agencies down to the village level. This gave the banking sector a chance to create new possibilities, the chance to offer the market a fresher, more affordable pie. E-banking banking in Ethiopia has an infant stage. The Ethiopian commercial banking system is composed of two state owned commercial banks and 16 private banks. Though it is true that traditional banking has grown steadily over the years, in terms of technological based financial service/product the Ethiopian banking sector didn't fully benefit from ICT in general and M-banking in particular. Currently there are six commercial banks that commenced M-banking service, albeit the M-banking regulation directive was issued in January 2013.cooperative bank of Oromia is one of private bank that launched mobile banking service for its customer to improve their operation and to reduce costs. The bank launched the service by name of "COOPAY" in March 2019.

2. Statement of problem

Banking industry has been changing rapidly and radical change came after introduction of technology like internet and mobile. Electronic Banking has been widely used in developed countries and is rapidly expanding in developing countries. Information communication technology play important role in the development of banking industry. As technology becomes the order of the day and new development in the economy creates new opportunities which are hard to assume, many organization are looking for ways on how to embrace technology as way of survival. Increasing competition among banks and from non-bank financial institutions also raises concerns as to why some people adopt one distributional channel and others do not, and that identifying the factors that may influence this decision is vital for service providers. Mobile banking is seen as an extension to the payment system of bank which enables mobile network to extend its services in reach of customer (Krugel, 2007).

All of this study show various results in each countries therefore this study intended to fill the bank in local context. There is no known study that has considered the impact of mobile banking on financial while research has been made on factors influence the usage of mobile banking in Ethiopia (kalkidan 2016) and challenges of introducing Electronic banking in Ethiopia (Ayana 2012) there is no study conducted on impact of mobile banking on financial bank of Oromia therefore this study aims at filling gap by studying the impact of mobile banking on financial performance of cooperative bank of Oromia.

3. Objective

The objective of this study is to determine the effect of E-banking services on financial Performance of cooperative bank of Oromia.

4. Research Methodology

This part of the study aimed at explaining research design and data collection method, population, sample technique, sample analysis and data analysis method.

4.1. Data collection method

In order to achieve the objective of this study the researcher used both primary and secondary data collection methods.

4.2. Research Design

Research design is a comprehensive plan for data collection in an empirical research project. It is a “blueprint” for empirical research aimed at answering specific research questions or testing specific hypotheses. (Bhattacharjee, 2012). The main objective of this study is to examine the impact of e-banking services on performance of cooperative bank of Oromia. To achieve this objective explanatory type of research design with a quantitative approach is used.

4.3. Sampling Technique

This study used purposive sampling method to draw the sample from the population. Purposive sampling enables to use a judgment to select cases that will best enable you to answer your research question(s) and to meet your objectives. (Saunders et al 2009).

4.4. Analytical Model

For this study, return on asset was used as a dependent variable which is determined by many factors. And those factors have chosen by taking in to account the availability of data and its influence on bank performance.

The analytical model was as follows

$$ROA = \alpha_0 + \beta_1 NATM + \beta_2 NPOS + \beta_3 NMBU + \beta_4 BS + \varepsilon$$

Where:

ROA is the dependent variable (Performance i.e. Return on Asset)

α_0 is the regression constant

β_1 , β_2 , β_3 , and β_4 are the coefficients of independent variables, NATM is Number of ATM terminals

NPOS is Number of POS terminals

NMBU is Number of Mobile banking users

BS is the Bank Size

ε is the Error Term.

5. Data analysis, Results and Discussion

5.1. Introduction

This part covers the analysis of the data concerning the effect of e-banking services, the effect of mobile banking, the influence of agent banking, the influence of internet banking, and the impact of automated teller machines on the cooperative bank of Oromia' performance. This part also presents the research findings organized into the following sections: response rate, reliability tests, demographic characteristics, descriptive statistics, diagnostic tests, and inferential statistics.

5.2. Response Rate

The researcher administered questionnaires to participants who were from the targeted population of senior managers and operations managers. Logistical and financial constraints reduced the sample size respondents. However, some of the questionnaires were returned, which represents 83.33% response rate.

Table 5.1: Response Rate

Target Population	Questionnaires administered	Questionnaires filled and returned	Percentage
Senior Managers	40	40	40%

Operations Managers	80	60	60%
Total	120	100	100.0

(Survey Data, 2019)

5.3. Reliability Test

The reliability of the data was checked using Cronbach’s alpha (Table 5.2).

Scale	Cronbach's Alpha	N of Items
Mobile Banking	0.883	7
Agency Banking	0.781	4
Internet Banking	0.825	5
ATM Banking	0.723	4
Performance	0.845	4

(Survey Data, 2019)

In this case, all variables (Table 5.2) had Cronbach’s alpha values that are greater than the threshold of 0.7. This finding implies that the variables used in the study are reliable and valid for regression analysis.

5.3 Descriptive Statistics

5.3.1 Mobile Banking and Performance

This section focuses the level of agreement on the impact of mobile banking on the banks’ performance using a scale of 1-5 where 1 represents not at all (NAA) and 5 represents strongly agree (SA). The analysis was carried out using mean (M) and standard deviation (SD). The study results are as shown in Table 5.4.

Table 5.4: Mobile Banking and Performance

Statements	Mean	SD
Increases customers` patronage or loyalty and reduces transaction cost	4.21	0.80
Increases bank volume of sales	4.14	0.91
Improves general customer satisfaction	4.15	0.96
Quick response to customers` requirements/enquires	4.03	0.99
Increases efficiency in service delivery	4.10	0.91
Customers have ease of using the mobile banking app	4.00	1.19
Reduces the time involved in bank transactions	4.14	0.91

(Survey Data, 2019)

As shown in Table 5.4, most of the respondents agreed that mobile banking increases customers` patronage or loyalty and reduces transaction cost (M = 4.21, SD = 0.8), increases bank volume of sales (M = 4.41, SD = 0.91), improves the general customer satisfaction (M = 4.15, SD = 0.96), quickens response to customers` requirements/enquires (M = 4.03, SD = 0.99). The results also indicate mobile banking increases efficiency in service delivery (M = 4.10, SD = 0.91), eases use of mobile banking app (M = 4.00, SD = 1.19), and reduces the time involved in bank transactions (M = 4.14, SD = 0.96). These findings concur with those of Johnstone (2010), which indicated that mobile banking is competitive strategy that allows banks to penetrate diverse markets.

5.3.2 Internet Banking and Performance

The research sought to establish the level of agreement on the effect of internet banking on the performance of cooperative bank of Oromia using a scale of 1-5 where 1 represents not at all (NAA) and 5 represents strongly agree (SA). The study results are as presented in Table 5.6.

Table 5.6: Internet Banking and Performance

Statements	Mean	SD
Increased trust in transacting online	3.99	1.04
Improved internet banking access and transactions	3.97	1.04
Improved customer satisfaction by using internet banking	4.02	0.87
Reduction in customer complaints	3.92	1.25
Increased costs in maintaining online platforms	4.07	0.90

(Survey Data, 2019)

From Table 5.6 the study findings show that majority of the respondents agree that there were increased trust in transacting online (M = 3.99, SD = 1.04) and improved internet banking access and transactions (M = 3.97, SD = 1.04). Moreover, frequency distribution showed that there were improved customer satisfaction by using internet banking (M = 4.02, SD = 0.87), a reduction in customer complaints (M = 3.92, SD = 1.25), and increased costs in maintaining online platforms (M = 4.07, SD = 0.90). The findings are consistent with those of Furst et al. (2015) who found out that banks that adopted and utilized online strategies performed better than banks that restricted to traditional banking strategies.

5.3.3 Automated Teller Machine and Performance

The research sought to establish the level of agreement on the effect of automated teller machine on the performance of CBO using a scale of 1-5 where 1 represents not at all (NAA) and 5 represents strongly agree (SA). The study results are as presented in Table 4.7

Table 5.7: Automated Teller Machine and Performance

Statements	Mean	SD
Increased ATM withdrawal transactions	4.08	1.08
Increased costs in maintaining ATM machine infrastructure	4.16	1.12
Customer trust and ease in using ATMs has improved	4.07	0.90
Improved customer satisfaction	4.02	0.87

(Survey Data, 2019)

The study findings as shown in Table 5.7 indicate that most respondents agreed that there were increased ATM withdrawal transactions ($M = 4.08$, $SD = 1.08$), increased costs in maintaining ATM machine infrastructure ($M = 4.16$, $SD = 1.12$), customer trust and ease in using ATMs has improved ($M = 4.07$, $SD = 0.90$), and enhanced customer satisfaction ($M = 4.02$, $SD = 0.87$). These findings are in agreement with Kato et al. (2014) who advised that banks to improve comfort, quality, convenience, protection, satisfaction, security, and responsiveness to enhance delivery of banking services through ATM.

5.3.4 Performance

Concerning measuring the performance, the respondents were asked to indicate whether on average the bank performance parameters were improving over the past 5 years. Table 5.8 illustrates these findings.

Table 5.8: Performance Parameters

Performance Parameters	Mean	SD
Customer's numbers	3.88	1.22
Profitability	4.14	0.75
Number of branches	3.92	1.25
Number of employees	4.07	0.90

(Survey Data, 2019)

As shown in Table 5.8 the study findings indicate that the majority of respondents agreed that customer's numbers ($M = 3.88$, $SD = 1.22$), profitability ($M = 4.14$, $SD = 0.75$), number of branches ($M = 3.92$, $SD = 1.25$), and the number of employees ($M = 4.07$,

SD 0.90) improved over the past five years.

This section investigates how respondents rate statements on the performance of CBO.

Table 5.9: Rate of Performance of CBO

Statements	Mean	SD
There is a good improvement in ROE in the last 3 years	4.02	0.97
There is a good improvement in ROA in the last 3 years	4.27	0.69
There is better ROE than the industry average	4.08	1.08
There is better ROA than the industry average	4.02	0.87

(Survey Data, 2019)

The study findings as shown in Table 5.9 indicate that most of the respondents stated that there were good improvements in ROE (M = 4.02, SD = 0.97) and ROA (M = 4.27, SD = 0.69) in the past three years. Furthermore, respondents indicated that ROE was better than the industry average (M = 4.08, SD = 1.08) and ROA was better than the industry average (M = 4.02, SD = 0.87).

5.4. Diagnostic Tests

Diagnostic tests were performed to check if the data meet the assumptions of linearity, reliability, and collinearity, which are necessary for robust regression analysis (Field, 2017). In this view, tests of linearity.

5.4.1 Linearity Test

Table 4.10 indicates outcomes of the linearity tests of the performance the bank and its connection with ATM banking, internet banking, mobile banking, and agency banking.

Table 5.10: Linearity Test

		Sum of Squares	df	Mean Square	F	Sig.
Performance of Banks * Mobile Banking	Deviation from Linearity	9.595	9	2.177	11.455	.465
Performance of Banks * Internet Banking	Deviation from Linearity	23.211	11	3.928	12.517	.231
Performance of Banks * ATM Banking	Deviation from Linearity	14.505	10	4.651	18.247	.091

(Survey Data, 2019)

Results indicates that mobile banking ($p = 0.065$), agency banking ($p = 0.068$), internet banking ($p = 0.231$), and ATM banking ($p = 0.091$) do not deviate significantly from the linearity. According to Field (2017), variables for regression analysis must exist on a continuous scale and exhibit linear relationships. In this case, mobile banking, agency banking, internet banking, and ATM banking met the assumption of linearity.

5.6.2 Collinearity Tests

Table 5.11 shows collinearity tests of agency banking, mobile banking, internet banking, and ATM banking.

Table 5.11: Collinearity Statistics

Model	Collinearity Statistics	
	Tolerance	VIF
Mobile Banking	.393	2.542
Internet Banking	.566	1.766
Automatic Teller Machine	.498	2.007

(Survey Data, 2019)

Collinearity statistics (Table 5.11) indicates that mobile banking, agency banking, internet banking, and ATM banking have tolerance values greater than 0.3 and variance inflation factor (VIF) less than 3. According to Field (2017), tolerance values less than 0.2 and VIF values greater than 5 show the existence of the problem of multicollinearity.

In this case, all variables do not have multicollinearity problem, and thus, meet the assumption of regression analysis.

5.6.3. Regression Analysis

Multiple regression analysis was used to develop a model that predicts the effect of e- banking strategies on the performance of cooperative bank of Oromia. The regression model was used to test the following null hypotheses in line with the research objectives and questions.

H01: Mobile banking is not a statistically significant predictor of the cooperative bank of Oromia’ performance in Ethiopia.

H02: Agency banking is not a statistically significant predictor the cooperative bank of Oromia’ performance in Ethiopia.

H03: Internet banking is not a statistically significant predictor of the cooperative bank of Oromia’ performance in Ethiopia.

H04: ATM banking is not a statistically significant predictor of the cooperative bank of Oromia’ performance in Ethiopia.

Table 5.12 shows the outcomes of multiple regression analysis examining the impact of internet banking, agency banking, mobile banking, and ATM banking on the performance of cooperative bank of Oromia.

Table 5.12: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.843 ^a	.710	.698	.4992

(Survey Data, 2019)

The regression model indicates that mobile banking, agency banking, internet banking, and ATM banking have a very strong relationship with the performance of banks (R =0.843). Moreover, R-square indicates that these e-banking strategies account for 71% of the variation in the performance of banks (R = 0.710). This variance implies that e- banking strategy accounts for most of the effects, leaving about 29% of the variance unexplained. Consequently, banks should adopt and implement e-banking services to boost their performance in the banking industry.

Table 5.13 indicates the Analysis of Variance (ANOVA) outcomes of the regression model in predicting the influence of internet banking, mobile banking, and ATM banking on the performance of banks.

Table 5.13: ANOVA of the Regression Model

Model	Sum of Squares	Df	Mean Square	F	Sig.	
	Regression	57.972	4	14.493	58.155	.000 ^b
1	Residual	23.675	95	.249		
	Total	81.648	99			

(Survey Data, 2019)

The ANOVA shows that the regression model is statistically significant in forecasting the combined influence on e-banking strategies on the performance of cooperative bank of Oromia, $F(4,95) = 58.155$, $p = 0.000$. This shows that the model is fit for predicting the combined influence on strategies of e-banking on the performance of cooperative bank of Oromia.

6. Conclusions and Suggestions for further study

6.1. Conclusions

The study established that e-banking services predict cooperative bank of Oromia’s performance in Ethiopia. As the study revealed agency banking and mobile banking are statistically significant predictors, it suggests that effective utilization of these- e-banking strategies would drive the growth and performance of banks in Ethiopia. Since the study found that internet banking and ATM

banking are insignificant predictors, it implies that banks should not rely on them as e-banking strategies to improve financial performance. For instance, limited numbers of customer have access to the internet, while ATM banking is prone to fraud and inconveniencing long queues.

6.2. Suggestions for Further Study

Since e-banking services account for 71% of the variance in the cooperative bank of Oromia's' performance in Ethiopia, further research should consider ascertaining other factors that explain the remaining 29% of the variation in the performance.

REFERENCES

1. Ayana G. (2012), Adoption of Electronic banking system in Ethiopian Banking industry: Barriers and Drivers, A Thesis Submitted to the School of Graduate Studies of Addis Ababa University.
2. Bhattacharjee A. (2012). Social Science Research: Principles, Methods, and Practices. USA University of South Florida, Global Text Project.
3. Kalkidan, (2016). Challenges and Opportunities of Electronic Banking in Ethiopian Banking Industry (Evidence from Selected Private Commercial Banks). Thesis. Addis Ababa.
4. Kurgel, (2008), Smart ATM card holders Attitude and usage level: A study of Sungai petani residents.
5. Saunders et al, (2009). Research methods for business students. England, London, Pearson.
6. Venter, R. and Rwigema, H. (2004). *Advanced entrepreneurship*. Capetown: Oxford University Press. World Bank Publications.

Recovery of gold by activated carbon from ammoniacal thiosulphate solution

Saira Sehar*¹, Muhammad Mohsin Sher Ali Khan*², Waqas Saif³, Yasmeen Iqbal⁴, Kashaf Sehar⁵, Tayyaba Nasreen⁶, Ghulam Murtaza⁷, Amiza⁸

* Represents main authors

¹ Department of Industrial Engineering, Padua University Italy

^{2,3} Department of Chemistry, Government College University Faisalabad, Pakistan

^{4,6,7} Department of Chemistry, University of Agriculture Faisalabad, Pakistan

⁵ Department of Chemistry, Quaid-i-Azam University Islamabad, Pakistan

⁸ Department of Chemistry, University of Management and Technology Lahore, Pakistan

DOI: 10.29322/IJSRP.12.10.2022.p13035

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13035>

Paper Received Date: 4th September 2022

Paper Acceptance Date: 5th October 2022

Paper Publication Date: 13th October 2022

ABSTRACT— A novel study has been done to investigate the recovery of gold by using activated carbon from ammoniacal thiosulphate solution. For recovery of gold, 0.1 gm ore was taken and added 100 ml thiosulfate solution of 5% concentration in a pyrex beaker was placed on a magnetic stirrer for 120 minutes at 150 degrees temperature. The next step is to recover gold from the thiosulphate solution. 0.3 g prepared column of activated carbon is used for 1 hour. The recovery method will be adsorption and gold get recovered on the surface of activated carbon. This dissolution is used for AA (atomic absorption) analysis. The absorption of standards and ore solutions are checked by the AA (atomic absorption). The graph of absorption vs concentration in ppm is obtained. The unknown concentration of gold before adding activated carbon is known and represented by C_0 . Then a prepared column of activated carbon is dipped in the above solution of concentration C_0 . Then gold from the solution gets adsorbed over the surface of activated carbon. Now, the concentration of gold C_t (after adding activated carbon) in that solution needs to be known. Place this solution in AAs (atomic absorption spectrometry), then concentration after activated carbon is known. Now it will be less than concentration C_0 . Gold recovery will be 33.33 %. Only 33.33 % of gold is recovered. Different factors that influence the % recovery of gold have been studied.

Index Terms— Complex, Gold, Hydrometallurgy, Recovery, Thiosulphate

1. INTRODUCTION

Gold has been recognized as a prehistoric condition and has become one of the first metals to be mined, mainly because it is

found as notes or as rubble within streams. That becomes a call for that with the help of 2000 BC the Egyptians began to mine gold. The demise mask of Tutankhamun has a hundred iron ore. The king monuments of old Ur (modern-day Iraq), have a high percentage of gold. Gold extraction processes start in the kingdom of Lydia by using, a mixture of gold and silver. Gold coins of 24 carats are developed in the time of King Croesus, whose government ruled out from 561-547 BC. (Hudson et al., 2009). It is a soft yellow metal. It does not react with chemicals, although it does well with Regia aqua. We mostly used gold in different fields like catalysis, nanotechnology, and electroplating with excellent properties such as chemical inertness, and ductility. Different extraction techniques are used but for the reason that the cyanidation process in 1887 is used to extract gold. As a result of its use, animals and humans are at stake. (Crespo, Gimeno, Laguna, Kulcsar, & Silvestru, 2009)

The mining of gold destroys by attracting natural scenes infecting the source of water and leading to important degradation. Other toxic substances are introduced into our surroundings as a result of poor gold mining. Modern commercial gold mines pollute the environment and create toxic waste. Due to the usage of polluting species have open holes in mines and cyanide can keep those mining companies from producing 20 tons of radioactive waste containing a 0.333-ounce gold ring as a result of the leaching process. (Gock, Cordova Equivar, & Review, 1995). Different metals, such as zinc, arsenic, antimony, and nickel, may affect the return of gold and silver to ores in the traditional cyanide processes. Leaks with thiosulfate reduce disturbance to these external surfaces. Cyanide can be a lixiviant, or a reagent used for leaks, often in tanks, gold in solids and forms a cyanide structure of gold. Leaching takes put in tanks devoted for leaching taken after by adsorption onto carbon in tanks devoted for adsorption.

(Zagury, Oudjehani, & Deschênes, 2004).

Active carbons (ACs) are overcrowded building materials with a unique structure: well-designed microscope structure, wide internal space, long recurrence distance, dynamic advertising power, and flexible advertising. In the gold hydrometallurgy industry, activated carbon is used for gold adsorption in the form of AuCN₂ particles that kicks inside the cyanide filter mixers with a minimum volume of 10 mg of gold. Within the gold industry, two AC-based advances are broadly utilized, and within the world, 80% of the gold generation utilizes one of these strategies. (Tsang et al., 2007).

Activated carbons adsorption capability can be exploited by a variety of methods. Adjusted pore structure and adjustable working groups on a given carbon surface determine the performance of active carbon. Recently, the commercial potential of carbon dioxide activated in the system of thiosulfate has been improved with the conversion of cupric ferrocyanide or silver ferrocyanide, or (MBT). (Shafeeyan, Daud, Houshmand, Shamiri, & Pyrolysis, 2010).

For recovery of gold, gold ore was taken and added thiosulfate solution in a pyrex beaker placed on a magnetic stirrer for 120 minutes at 150 degrees temperature. The next step is to recover gold from the thiosulphate solution. 0.3 g prepared column of activated carbon is used for 1 hour. The recovery method will be adsorption and gold get recovered on the surface of activated carbon. These dissolution experiments are carried out for AA analysis. The purpose of this study is to investigate different factors that influence the adsorption of gold and to investigate the drawbacks of cyanide leaching.

2. HYDROMETALLURGY

It is a process in which precious metals are extracted from ores by using different aqueous solutions as leaching solutions. It involves two main steps:

1. Leaching or dissolution
2. Recovery of metal

Hydrometallurgy could be a procedure inside the field of extractive metallurgy, the getting of metals from their minerals. Hydrometallurgy includes the utilization of aqueous solutions for the recuperation of metals from metals, concentrates, and reused or leftover materials. The treatment of gold-carrying materials can be done by using:

2.1 Leaching or Dissolution

The primary method of extracting gold from ores is cyanidation. Hard-to-handle materials are those in which extraction of gold is difficult and have required examination of other extraction methods for substances. less expensive substances are chloride, thiosulfate, sulfide, ammonia, and sulfites, the initial two are a lot of significant for wellbeing and security issues and have a low

ecological effect. Taking all things together the above specialists, thiosulfate has a lot of significance, as it can extract gold and can form a gold thiosulphate complex. Precious metals in WPCBs obtain by pyrometallurgy, hydrometallurgy, and electrometallurgy because toxic compounds are released. The techniques of hydrometallurgy (leaching, solvent extraction, ion exchange, etc.) are used for the recovery of metal. It is a favorable experiment. A large number of effluents are generated by hydrometallurgical treatment, if discharged into the environment, they can cause harmful diseases. (Ventura, Futuro, Pinho, Almeida, & Dias, 2018). Therefore, only thiosulphate solutions are used as leaching solutions to dissolve gold from gold-bearing ore.

The leaching of ammoniacal thiosulfate plays a potential role as a protective and non-toxic process (than cyanide) for the separation of gold in different ores. On the other hand, we faced different problems like the lack of an effective method for gold recovery. It has its main applications in the extraction of chlorine on paper and in-house textiles, mechanical repairs, soap storage, and chemical reagent. Thiosulfate has many applications to treat skin worms such as worms. For centuries, ammonium thiosulfate has been used as a sulfur soil fertilizer. In nature, there are different advantages to cyanide because it is low toxic and environmentally friendly. Because high convergences of ammonium thiosulfate in water cause the development of green growth in waterways and lakes. (Meyer, DeAngelis, & Heineman, 1977).

The thiosulphate solution is preferred because of:

- It could provide far faster recovery than cyanide in mining exploiting “preg-robbing” ore deposits.
- Since thiosulfate leaching is a hydroxide mechanism (generally in the pH range of 8 to 10), there are also no issues with product corrosion mostly during the process of recovery.
- The copper-catalyzed thiosulfate leaching process has many advantages over the traditional cyanidation process.
- Thiosulfate draining of complicated and carbonaceous-type minerals can be ordered as a non-harmful cycle; gold disintegration rates can be more prominent than past cyanidation, and high gold recuperations can be acquired from thiosulfate filtering and carbonaceous-type metals because of lower obstruction from unfamiliar cations.

2.2 Recovery of metal

For the recovery of gold from the gold complex, a 0.3 g prepared column of activated carbon is used for 1 hour. The recovery method will be adsorption and gold get recovered on the surface of activated carbon. The adsorption detachment innovation is viewed as the most effective technique since it is exceptionally proficient and harmless to the ecosystem. Numerous adsorbents have been concentrated to get metal particles, for example, cell

sorbent, zeolites, and activated coal. Nonetheless, these things have restricted publicizing limits or are costly. In this way, analysts have been endeavoring to build up a compelling and reasonable adsorbent. (Xiang et al., 2020).

Gold adsorption by using activated carbon in ammoniacal solution is studied here. Some factors that depend upon the adsorption of gold are temperature, concentration, pH, etc. The reaction has activation energy which is 19.4 KJ/mol. Initially, the rate of adsorption increases but decreases at the end. pH value increases as the rate of adsorption also increases. When the concentration of gold increases, the rate also decreased but when the concentration of thiosulphate increases, the initial rate also increased but in the end rate decreases. The concentration of ammonia also increases and its rate of adsorption also increases. Other factors also take part in the increasing rate of gold adsorption. To increase the rate of gold adsorption, we prefer the ammonium solution. As the rate of gold adsorption increases, more gold is extracted from gold-bearing ore. The optimum pH will be 9.5 and activation energy will be 19 KJ/mol. If we required gold in a greater amount, used a different type of solution. This recovered gold will be used in different fields. Gold is used in different fields i.e., in aerospace, medical field, coinage making, and in jewelry making. It is used worldwide in making jewelry almost 73 percent of total production. In Pakistan, most deposits of gold are found in Baluchistan. (Hammer & Norskov, 1995).

In a leaching solution, we also compare the rate of gold dissolution. The rate of cyanide dissolution in carbonaceous gold ores from gold strike deposits was less than in thiosulphate solution because of the preg-robbing phenomenon. Cyanide has a greater attraction with preg-robbed carbonaceous ores leading to the removal of gold from the gold cyanide complex back and resulting in poor dissolution. Due to the low attraction of carbonaceous materials for gold thiosulfate complex, this process does not occur through thiosulfate leaching. This also suggests that active carbon adsorption, which is the most popular process for recovering pregnant cyanide solution, would be ineffective in recovering the dissolved gold in thiosulfate solution. The rate of dissolution of cyanide in non-carbonaceous ores was greater than in the thiosulphate solution. In short, thiosulphate solution has less rate of dissolution than cyanide.

Extraction of gold by a cyanide solution	Extraction of gold from ammoniacal thiosulphate solution
A greater amount of gold is recovered by using cyanide because the gold cyanide complex has a strong affinity with activated carbon sites.	Less amount of gold is recovered from the gold thiosulphate complex. Because this complex has less affinity with active sites of carbon.

Its strong affinity will be due to its small size and less charge of gold cyanide complex. Therefore, it has a high rate of recovery or adsorption.	Less affinity will be due to the large size and large charge of the gold thiosulphate complex. Therefore, it has less rate of adsorption than cyanide.
---	--

TABLE 1: Compares the rate of gold adsorption or recovery on AC (activated carbon)

3. MATERIALS, METHODS, AND EXPERIMENTAL WORK

3.1 Materials

3.1.1 Chemicals

Activated carbon and ammoniacal thiosulphate solutions are purchased from the chemical lab center in Anarkali Bazar Lahore. Activated carbon has a length of 5mm, a diameter of 3 mm, and a surface area of 930 m². The micropores of 96% ammonium hydroxide solution and reagent-grade chemicals are used.

3.1.2 Apparatus & Equipment

The following apparatus is used for both experimental techniques which consist of roasting, leaching, and analysis.

- 1ml pipettes for delivery of less than 1ml reagent
- 5ml and 10 ml pipettes for the introduction of reagent up to 5 and 10 ml.
- Graduated cylinder (25ml & 100ml)
- Measuring flasks (25ml & 100ml)
- Beaker (125ml)
- Graduated test tube (25ml)
- A test tube stands with simple test tubes
- Vacuum desiccator
- Glass reactor (500ml)
- Distill and deionized water

3.1.3 Sample Collection

Sample ore is taken from Dr. Mustansar, former Head of Geology, PU Lahore.

3.2 Methodology

Step I Dissolution:

0.1 gm ore was taken and added 100 ml thiosulfate solution of 5% concentration in a pyrex beaker placed on a magnetic stirrer for 120 minutes at 150 degrees temperature. The next step is to recover gold from the thiosulphate solution.

Step II Recovery:

For recovery of gold from the gold complex, 0.3 g prepared column of activated carbon is used for 1 hour. The recovery method will be adsorption and gold get recovered on the surface of activated carbon.

3.3 Experimental work

Solution preparation for characterization:

Solution preparation:

Recovery of gold is done by using activated carbon from a solution of ammoniacal thiosulphate, a stock solution of gold needs to prepare for characterization.

Standard Stock Solution Preparation:

0.1M gold solution in 100 ml prepared by weighing 0.1 grams of gold and adding it into 100 ml flask. Add aqua regia in it as a standard solution to make it up to 100 ml.

Working Solution:

- Take a stock solution of different concentrations of 10, 20, 40, 80, 200, 400 ppm and add water to it and find absorption against known concentration. This dissolution is used for AA analysis. Then find the absorption of a sample before and after adding activated carbon.
- Absorption of standards and ore solutions are checked by the AA. Graph of absorption vs concentration in ppm is obtained.
- These solutions are also subjected to activated carbon for adsorption for 1 hour and 8 hours to find percentage recovery.

Analyze % Recovery of gold:

- The test of gold recovery is proceeded out in a glass reactor of 500ml reactor bath having a shaking mechanism, with constant temperature in the water bath. Different experiments have different concentrations of gold sample solution + ammoniacal thiosulphate solution at a 500 min⁻¹ stirring point at different temperatures of 10,....,200 degrees temperature and reaction time is 15,...., 200 minutes. Gold dissolves in thiosulphate solution and a graph of different concentrations of gold vs absorption is obtained. The unknown concentration of gold before adding activated carbon is known and represented by C₀.
- Then a prepared column of activated carbon is dipped in the above solution of concentration C₀. Then gold from the solution gets adsorbed over the surface of activated carbon. Now, the concentration of gold C_t (after adding AC) in that solution needs to be known. Place this solution in AAs, then concentration after activated carbon is known. Now it will be less than concentration C₀.
- The concentration of unknown is found by calibrating the curve. Follow Bear Lambert's law:

$$A = \epsilon cl$$

<i>A</i>	Absorbance	
ϵ	Molar absorption coefficient	M ⁻¹ cm ⁻¹
<i>c</i>	Molar concentration	M
<i>l</i>	optical path length	cm

Figure 1: Bear Lambert's law

A= 0.6 nm, C of unknown will be 6ppm before adding activated carbon → C₀

A= 0.4 nm, C of the unknown will be 4 ppm after adding activated carbon → C_t

$$A = (C_0 - C_t) / C_0 \times 100$$

By putting values, % recovery of gold is found: % recovery will be 33.33 %. Only 33.33 % of gold is recovered.

Concentration (ppm)	Absorption (nm)
0	0
10	0.4
20	0.6
30	0.8
40	1
50	1.2
60	1.4
70	1.6
80	1.8
90	2

TABLE 2

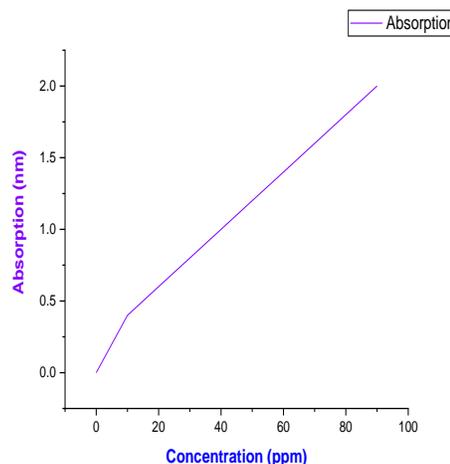


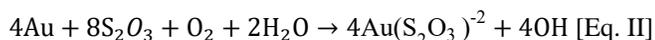
Figure 2: Graph showing the relation between concentration (ppm) and absorption (nm)

Reaction Mechanism Followed:

In an aqueous phase, gold forms a strong complex with thiosulphate, as seen in Eq I.



Eq II depicts the complex redox reaction in an alkaline thiosulphate solution with oxygen as an oxidant.



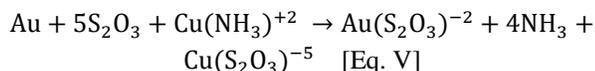
Due to its slow rate of thiosulphate gold leaching in oxygen, a proper catalyst is needed. Copper (II) is a highly accurate catalyst that keeps copper (II) in solution as the Cu (II) tetra-amine complex when combined with ammonia, as shown in Eq III.



Gold produces stable complexes not only in thiosulphate solutions but also in ammonia solutions.



In an ammoniacal copper-thiosulphate solution, Eq V depicts the complete gold dissolution reaction:



Cu (II) should be stable as the Cu (II) tetraamine ion in the presence of ammonia in the solution.

4. FACTORS DEPEND UPON ADSORPTION OR RECOVERY OF GOLD

Some factors that depend upon the adsorption or recovery of gold are temperature, concentration, pH, etc. which are discussed here:

4.1 Effect of ammonium hydroxide:

The results of these experiments show that at shorter times, the adsorption of gold on the carbon increased with increasing ammonium hydroxide concentration up to 0.6 mol/l and then remained constant, while the effect of ammonium hydroxide concentration is less significant at longer reaction times, at which the percentage of gold adsorbed onto the carbon is practically the same at the three different ammonium hydroxide concentrations used. This result may be attributed to the competitive adsorption of ammonium ion with gold ion on the carbon surface, i.e., an increase in ammonium hydroxide concentration results in a decrease in activity and diffusivity of gold ion, leading to a

decrease in gold adsorption.

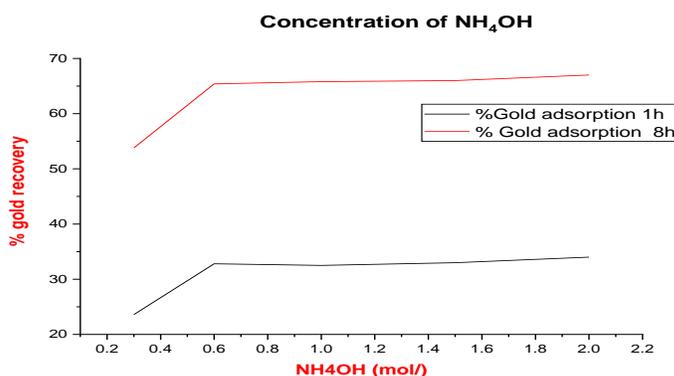


Figure 3: Graph showing the concentration of NH4OH on % of gold recovery

4.2 Effect of pH:

As can be seen from the results shown in Fig 4, the pH variation did affect the gold adsorption, i.e., it is severely retarded at the lower and higher pH values, with optimum gold adsorption taking place at the pH of 10.5. As pH increases, the rate of adsorption also increases. This effect is dominant at the start but at the end of the reaction, further increases in pH lead to a decrease in adsorption behavior.

pH	% Gold adsorption (1 h)	% Gold adsorption (8h)
8.5	11.3	26
9.5	18.5	29.5
10.5	31.5	55.4
11	4.4	23.3

TABLE 3: Effect of pH on & gold recovery

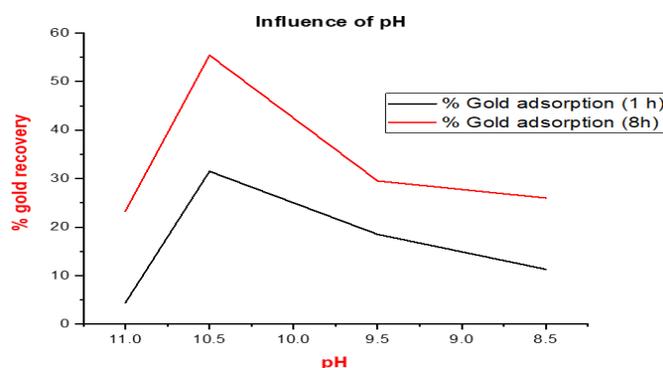


Figure 4: Graph showing the effect of pH on % gold recovery

4.3 Effect of temperature:

Figure 5 shows the effect of temperature on the adsorption of gold. It is seen that, within the range of temperature investigated, the adsorption of gold on activated carbon increased with increasing temperature. The activation energy was estimated at 19.4 kJ/mol.

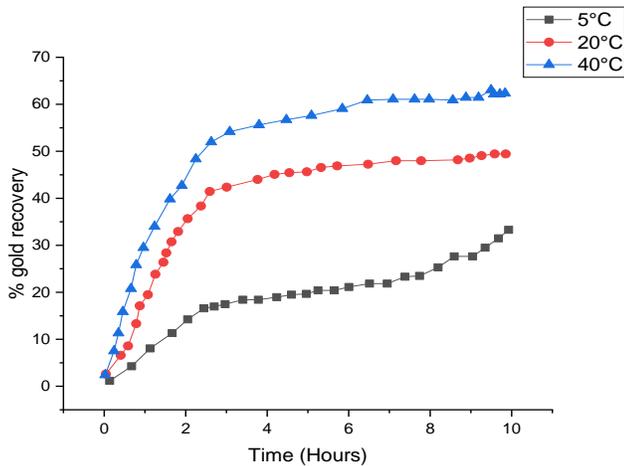


Figure 5: Graph showing the effect of temperature on % gold recovery

4.4 Effect of thiosulfate concentration:

Figure 6 plots the percentage of gold adsorption vs time for experiments performed with various initial thiosulfate concentrations. It can be seen that the presence of this anion in the aqueous solution influences the adsorption of gold onto the activated carbon. Two effects can be seen: first, the adsorption rate increases with increasing initial thiosulfate concentration, and second, the percentage of gold adsorbed during a given length of time decreases with increasing thiosulfate concentration. This is a serious drawback because practical leaching is expected to contain an excess of thiosulfate.

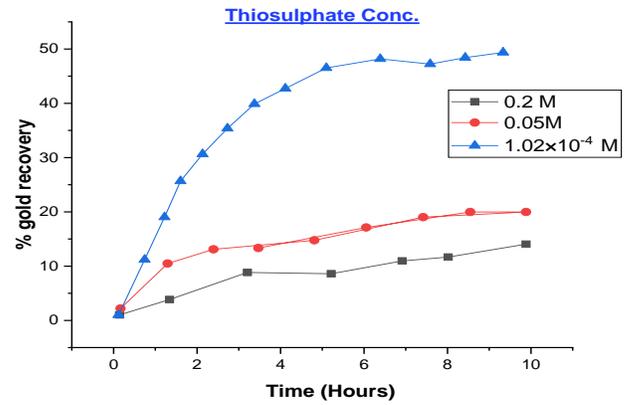


Figure 6: Graph showing the effect of thiosulfate concentration on % gold recovery

4.5 Effect of gold concentration:

As can be seen from Figure 7, the initial gold concentration has a significant influence on the adsorption of gold. It is clear that the higher the initial concentration of gold, the lower the adsorption rate. Moreover, the percentage of gold adsorbed onto the carbon increased as the initial gold concentration decreased. This result can be understood by assuming that the available active sites are insufficient to increase gold loading proportionately to the increase of gold in the initial aqueous solution, thus decreasing the percentage of gold adsorption onto the carbon.

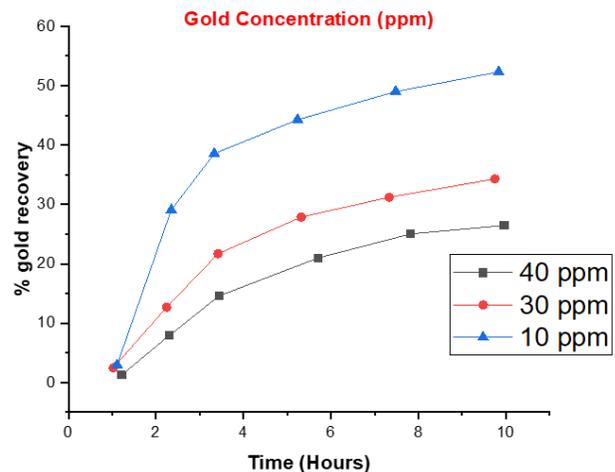


Figure 7: Graph showing the effect of gold concentration on % gold recovery

4.6 Effect of activated carbon:

In figure 8, it can be seen that the recovery of gold increases with a decrease in the above ratio, while the adsorption rate is only slightly affected by the variation of the amount of carbon added to the solution. It can be deduced that the surface area of the carbon

plays an important role in the adsorption, because the more carbon used, the greater the surface area. Typical metal loadings of the carbon after the reaction time of 8 h were found to be 2g, 6g, and 3 g carbon, respectively for the solution volume to weight of carbon ratios of 1600, 800, and 480 (ml solution/g carbon), respectively.

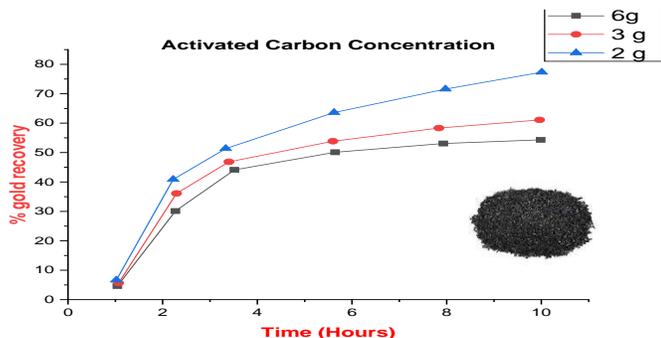


Figure 8: Graph showing the effect of activated carbon % gold recovery

5. CONCLUSION

Gold has been recovered from the ammoniacal solution by activated carbon. Different solutions to gold have been investigated. Different parameters are also observed. The influence of temperature, pH, and concentration of gold has been investigated. An increase in ammonium hydroxide concentration results in a decrease in activity and diffusivity of gold ions, leading to a decrease in gold adsorption. An increase in pH leads to a decrease in adsorption behavior. The adsorption of gold on activated carbon increased with increasing temperature. The activation energy is estimated at 19.4 kJ/mol. The adsorption rate increases with increasing initial thiosulfate concentration. The decrease in gold adsorption in the presence of these anions is also attributable to a decreased diffusivity of gold species caused by the anions. The higher the initial concentration of gold, the lower the absorption rate. As the concentration of copper increased, the percentage of gold recovered became less. Only 33.3% of gold has been recovered.

ACKNOWLEDGMENT

The authors wish to thank Prof. Dr. Izhar-ul-Haque Khan from Minhaj University Lahore, Pakistan for his valuable guidance and support.

REFERENCES

- [1] Crespo, O., Gimeno, M. C., Laguna, A., Kulcsar, M., & Silvestru, C. J. I. c. (2009). Gold Complexes with the Selenolate Ligand [2-(Me₂NCH₂)₂C₆H₄Se]⁻. 48(9), 4134-4142.

- [2] Gock, E., Cordova Equivar, J. J. M. P., & Review, E. M. (1995). Processing of Gold Bearing Antimony Ore. 15(1-4), 135-135.
- [3] Hammer, B., & Norskov, J. K. J. N. (1995). Why gold is the noblest of all the metals. 376(6537), 238-240.
- [4] Hudson, Z. D., Sanghvi, C. D., Rhine, M. A., Ng, J. J., Bunge, S. D., Hardcastle, K. I., . . . Eichler, J. F. J. D. T. (2009). Synthesis and characterization of gold (III) complexes possessing 2, 9-dialkylphenanthroline ligands: to bind or not to bind? (36), 7473-7480.
- [5] Meyer, M. L., DeAngelis, T. P., & Heineman, W. R. J. A. c. (1977). Mercury-gold mini-grid optically transparent thin-layer electrode. 49(4), 602-606.
- [6] Shafeeyan, M. S., Daud, W. M. A. W., Houshmand, A., Shamiri, A. J. J. o. A., & Pyrolysis, A. (2010). A review on surface modification of activated carbon for carbon dioxide adsorption. 89(2), 143-151.
- [7] Tsang, D. C., Hu, J., Liu, M. Y., Zhang, W., Lai, K. C., Lo, I. M. J. W., air, & pollution, s. (2007). Activated carbon produced from waste wood pallets: adsorption of three classes of dyes. 184(1), 141-155.
- [8] Ventura, E., Futuro, A., Pinho, S., Almeida, M., & Dias, J. J. J. o. E. M. (2018). Physical and thermal processing of Waste Printed Circuit Boards aiming for the recovery of gold and copper. 223, 297-305.
- [9] Xiang, Y., Ding, S., Chen, X., Cao, C., Sun, J., Xu, L., & Liu, G. J. H. (2020). Recovery of gold from waste solutions using a new RFB resin. 198, 105516.
- [10] Zagury, G. J., Oudjehani, K., & Deschênes, L. J. S. o. t. E. (2004). Characterization and availability of cyanide in solid mine tailings from gold extraction plants. 320(2-3), 211-224.

AUTHORS

First Author – Saira Sehar*, Department of Industrial Engineering, Padua University, Italy. E-mail: saharana111@gmail.com

Second Author – Muhammad Mohsin Sher Ali Khan*, Department of Chemistry, Government College University Faisalabad, Pakistan. Email: mohsinsheralik@gmail.com

Third Author – Waqas Saif, Department of Chemistry, Government College University Faisalabad, Pakistan. Email: waqassaif@yahoo.com

Forth Author – Yasmeen Iqbal, Department of Chemistry, University of Agriculture Faisalabad, Pakistan. Email: jasminiqbal6@gmail.com

Fifth Author – Kashaf Sehar, Department of Chemistry, Quaid-i-Azam University Islamabad, Pakistan. Email: kashaf.rana201@gmail.com

Sixth Author – Tayyaba Nasreen, Department of Chemistry, University of Agriculture Faisalabad, Pakistan. Email: tayyabahaq08@gmail.com

Seventh Author – Ghulam Murtaza, Department of Chemistry, University of Agriculture Faisalabad, Pakistan. Email: murtazakhan785@gmail.com

Eighth Author – Amiza, Department of Chemistry, University of Management and Technology Lahore, Pakistan.

Correspondence Author: Muhammad Mohsin Sher Ali Khan
Email: mohsinsheralik@gmail.com

Quantify Carbon Emission for Employees Working from Home

Varun Gaur

Managing Director at De Calorie Energy Consultant LLP
* Master's in Energy Management • B. Tech. Honors in Electrical
WELL AP • LEED AP • IGBC AP • GRIHA CP
CII Certified GreenCo Facilitator • Auditor - Carbon Footprint & ISO 14064

DOI: 10.29322/IJSRP.12.10.2022.p13036
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13036>

Paper Received Date: 3rd September 2022
Paper Acceptance Date: 5th October 2022
Paper Publication Date: 13th October 2022

Abstract- This research paper is one of the first type of paper which mention about the methodology of quantifying the GHG emission while working from home. It can be very helpful for several companies who are still trying to figure out that how to quantify the carbon emission of working from home.

Index Terms- Carbon Emissions, Work from Home, COVID Impact, Global Warming, Methodology of Calculating Carbon emissions, Sustainability

I. INTRODUCTION

Coronavirus, which spotted in china and exceed its range to over all the countries around the world. The economic and social disruption caused by the COVID pandemic is devastating: tens of millions of people are at risk of falling into extreme poverty, while the number of undernourished people, currently estimated at nearly 690 million, could increase by up to 132 million by the end of the year.

As the Indian government announced the Lockdown of first phase for 21 days and then phase two till 3rd May to limit and trace the local spread of the novel coronavirus, it is badly impacting on economy.

The working methods of millions of us around the world changed dramatically after pandemic lockdowns went into effect globally in March of 2020. Suddenly, working from home (WFH), which was a relative uncommon practice, become essential to limit the spread of the virus; people who reported doing at least some WFH jumped from 5% to nearly 90% in the India and global offices of major tech companies between typical 2019 practices and April 2020.

Working from home CO2 emissions calculation methodologies are not much available and most of the companies are struggling to calculate their actual Carbon emission for the same. Many tech giant companies claimed that they noticed major reduction in carbon emissions as 95% of their employees working from home (WFH) because of Covid-19.

II. DOES REMOTE-WORKING IS ACTUALLY SAVING CARBON FOOTPRINT?

In order to confirm, it is very necessary to evaluate a firm's carbon footprint reduction due to remote-working arrangements. Some say's that it can be quantified very easily by subtracting a company's carbon footprint based on a hybrid working model, that is, combination of office- and remote-working, from the carbon footprint based on the traditional working model. This hybrid model needs to quantify this carbon footprint may serve as a new methodology tool for evaluation.

This proposed methodology for remote-working carbon emission quantification not only focus on India specific carbon emission but also measure individual carbon emission of the employees who work remotely in other parts of the world for a company.

III. CALCULATION OF CARBON EMISSIONS DUE TO WORK FROM HOME

Major tech companies have done the survey with a mix of work-from-home patterns by the support of survey firms and using extrapolated data and finalised the carbon emission numbers. In USA, a research and development organization focused on residential

energy consumption, to estimate the rebound effects on home electricity and energy use from remote work. For each of the responding participants, they looked at residential energy data over a full year. From this data, they concluded that for an average participant, working from home resulted in an increase in electricity usage of 6.34 kWh per day worked. To calculate a per employee number, they multiplied the average number of work-from-home days per month per employee by the expected uplift in home electricity consumption.

They then converted this to an annual number and multiplied by an EPA emissions conversion factor for electricity use to get to an annual estimate for additional emissions.

While some other companies calculated by using the average U.S. household energy per day times the IEA worldwide electricity conversion factor of 478.7 grams of CO₂ per kWh.

While other company installed smart home monitors in the homes of three employee volunteers based in Texas and Florida in the United States. That data was used to construct a remote office baseline.

They estimated 84% reduction in carbon emissions per person compared to the emissions for the same person that would commute and work in an office building.

More or less every methodology works around in of course 4 parameters – Number of employees, Working Hours, Cooling or Heating Load, Machine load etc.

The best method is to conduct work from home survey for all the employees. Based on the results, estimate the number of employees working from home, their electricity consumption to calculate the average work from home emissions for India, and the rest of the world separately.

In India, there is not such established methodology available to calculate work from home emissions to date whereas such methodology exists outside India.

Therefore, one can use the Carbon Trust methodology for India and the “Anthesis” methodology for the rest of the world. This two are the best methods to calculate carbon emissions of a company appropriately.

A. India – Calculation of Carbon Emission

Carbon Trust has done the assessment of the impact of working on carbon savings and the longer-term effects on infrastructure services based on an impartial analysis of primary and secondary sources, including expert interviews.

It provides a working methodology to complement the Greenhouse Gas (GHG) Protocol for remote workers.

The carbon trust methodology calculate work from emissions in detail considering additional kWh load of laptop/desktop, monitor screen, light, kettle, printer and cooling load.

-  1. Energy use from home-office equipment such as laptops, lighting and screens,
-  2. Heating energy consumption,
-  3. Cooling energy consumption

Appliance	Power Draw (watt)	Additional Operational Time per day (hours)	Additional energy Use (kWh/day)
Laptop/desktop	38.6	8	0.31
Computer Monitor Screen	30	8	0.24
Printer	0.5	7.9 hrs. Standby & 0.1 hrs. Printing	0.04
Office Light	15	8	0.12
Kettle	0.1kWh per 3min boil	6min	0.20
			0.91

Domestic energy calculation approach:

$$\text{additional kWh/day} \times \text{Electricity grid emission factor kgCO}_2\text{e/kWh}_{\text{by country}} \\
 \times \text{Days per year worked from home}_{\text{by scenario, by country}}$$

$$\begin{aligned} & ((kWh.home.day_{by\ emissions\ source} \times kgCO_2e.kWh_{by\ emissions\ source}) \\ & \quad \times (1\% \text{ households with ability to heat single rooms})) \\ & + ((kWh.room.day_{by\ emissions\ source} \times kgCO_2e.kWh_{by\ emissions\ source})) \\ & \quad \times (\% \text{ households with ability to heat single rooms})) \end{aligned}$$

$$\begin{aligned} & (Average\ AC\ kW/hr \times 4\ \text{hours per day}) \times (\text{Number of days worked from home}_{by\ scenario, by\ country} \\ & \quad \times 50\% \text{ cooling season days per year}) \end{aligned}$$

Company has the data of percentage of employees worked from home during pandemic time. Then, calculate using above methodology to calculate actual carbon emissions. Note that you need to consider the rest of employee travelled to office, let's say 10%, this carbon emission due to employee commute will be calculated separately.

B. Global Locations – Calculation of Carbon Emission

Rest of the world, one can use the “Anthesis” methodology to calculate the work from home emission for the rest of the world. They have collected and analyzed actual consumption data for 2019 and 2020 in three regions globally (North America, Europe and Asia Pacific) based on International Energy Agency (IEA) data.

Survey questions included several variables that could influence energy consumption patterns (i.e., hours and days worked, primary energy sources, number of others at home, other high energy-using sources, size of home/ workspace, regional nuances, etc.)

There are three specific methods to calculate the carbon emissions for global countries.

3.2.1. No Survey Method – This approach uses the number of remote workers by country or geographic region and recommended regional energy intensities (i.e., energy consumed per person per day) to estimate the amount of electricity and natural gas consumed. The energy consumption is then multiplied by appropriate emission factors to calculate the GHG footprint of remote workers.

This option is the easiest of the three to implement as it requires minimal information from a company (likely obtained from the human resources department) and uses several assumptions for key factors that drive emissions.

The participating company will only need to provide the number of full-time employees (FTEs) working from home by electricity grid region or, at minimum, by region.

3.2.2. Basic Survey Method – This approach also uses the number of remote workers by country or geographic region and same recommended regional energy intensities. In addition, minimal data are collected via survey to adjust certain assumptions regarding energy use, such as the specific energy types used. While this approach relies on fewer assumptions and is slightly more accurate than the No Survey approach, it requires more time and resources to implement because of the need to develop, issue and manage the survey and to clean, assimilate and analyze the survey responses.

3.2.3. Enhanced Survey Method – This approach also uses a survey but with questions designed to gather actual consumption data by energy type and to provide more in-depth insights into variables that may influence consumption. The energy data gathered can be classified by country, geographic region and energy type, and are then multiplied by appropriate emission factors to calculate the GHG footprint of remote workers. This approach uses the fewest assumptions and is the most accurate. However, it is also the most time- and resource-intensive of the three approaches because it requires significant time to clean, assimilate and analyze more extensive survey responses. As a result, it should be combined with existing commute surveys (or conducted at least every two to three years).

Methodology	Recommended Data Requests	Assumptions
No Survey	<ul style="list-style-type: none"> Full Time Employees (FTEs) per region General business hours (e.g. 5 days/week and 48 weeks/year) 	<ul style="list-style-type: none"> Energy types consumed, by region Percentage split in energy type, by region No renewable energy used, Renewable Energy Credits (RECs) purchased, nor emissions offset
Basic Survey	<ul style="list-style-type: none"> Region / Country of work Energy types consumed (i.e., electricity, natural gas, other) Average days/year worked at home Number of others sharing home during work hours 	<ul style="list-style-type: none"> 8 hours/day worked from home No renewable energy used; RECs purchased nor emissions offset
Enhanced Survey	<ul style="list-style-type: none"> All similar data requests for Basic Survey Hours/year worked from home Total electricity consumed Total natural gas / other fuel consumed Control-level for heating/cooling (i.e., centrally or zone-specific) Other high-energy using devices/appliances in home Renewable energy purchases (incl. RECs) and carbon offsets purchases 	

Percentage Ratio Explanation

- The ratios are incremental to baseline energy intensity by region and energy type. The incremental energy intensities are an average of select countries covered by the various studies on remote work.
- As a result of the shift towards remote work, the ratio of incremental energy to baseline energy is a metric that compares the increase in energy consumption relative to the baseline energy use per person per day in a home. Or we can say, it's a diversity factor.

Region	Baseline Energy Intensity (kWh/person/day)		Ratio of Incremental to Baseline	
	Electricity	Natural Gas	Electricity	Natural Gas
AMER	12.50	14.05	62.57%	38.39%
APAC	3.62	2.58	26.24%	60.10%
EMEA	4.00	8.02	57.79%	70.68%

Let's understand this with an example of an office in APAC region.

A	B
Remote workers	Location
2000	INDIA
C	D
Electricity intensity (kWh/person/day)	Natural Gas intensity (kWh/person/day)
3.62	2.58
E	F
Electricity Ratio of Incremental to Baseline	Natural Gas Ratio of Incremental to Baseline
0.26	0.60
G	H
Working days/week	Working weeks/year
5	48
I	J
Electricity consumption for the full year	Natural gas consumption for the full year
$I=A*C*E*G*H$	$J=A*D*F*G*H$
455946	744278

IV. CONCLUSION

This research paper is very much valid and helpful in quantification of work from home carbon emission for all the companies. I am a sustainability advocate and understand the vision of several companies to become carbon neutral. This study is really important as it captures both India and Global countries for work from home emission calculations.

V. REFERENCES

- [1] Van der Geer J, Hanraads JAJ, Lupton RA. The art of writing a scientific article. J Sci Commun 2000;163:51-9.
- [2] Strunk Jr W, White EB. The elements of style. 3rd ed. New York: Macmillan; 1979.
- [3] Mettam GR, Adams LB. How to prepare an electronic version of your article. In: Jones BS, Smith RZ, editors. Introduction to the electronic age. New York: E-Publishing Inc; 1999. p. 281-304.
- [4] Carbon Trust and Anthesis Team.

AUTHORS

Author –

Mr. VARUN GAUR, Master's in Energy Management, B. Tech. Honors in Electrical, and Managing Director at De Calorie Energy Consultant LLP.

More than 20 sustainability credentials and globally recognized - WELL AP • LEED AP • IGBC AP • GRIHA CP • CII Certified GreenCo Facilitator • Auditor - Carbon Footprint & ISO 14064

varungaur1989@gmail.com

Prediction of Preterm Labour

Dr. Sheetal Sachdeva

Sr. consultant Obs & Gynae Apollo Cradle, Moti Nagar, Delhi

DOI: 10.29322/IJSRP.12.10.2022.p13037
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13037>

Paper Received Date: 4th September 2022
Paper Acceptance Date: 5th October 2022
Paper Publication Date: 13th October 2022

I. INTRODUCTION

Preterm delivery (PB) is a significant topic because it is among the main causes of mortality in neonates and its long-term neurologic and developmental challenges [11]. It is linked to cerebral palsy and bronchopulmonary dysplasia, prematurity retinopathy, and many other diseases associated with prematurity [1].

In 2010, it was reported that there had been 15 million premature births (<37 weeks gestation) all over the world, with the prevalence between 5 and 18% of live births [2], [3], [33].

The condition of PB is complex that is caused by multiple etiologic routes. It is a complex condition that has multiple etiologic causes

Iatrogenic factors could cause PB due to medical interventions that address pregnant and fetal reasons, and 80% of PB is spontaneous; and while one million children die due to prematurity, many more suffer the effects of PB [3], [43].

The ability to anticipate preterm labor allows the early intervention for preterm birth, including in the utero transfer into tertiary care centers, appropriate administration of corticosteroids while avoiding excessive use of magnesium sulfate for neuroprotection, as well as antibiotic therapy in the event of infections. Because the cause of preterm labor is not fully understood, identifying risk factors and determining the individual risk of pregnant women is crucial in managing obstetrics for women who could benefit from the current treatment methods. [6] (List 1).

List 1

- Risk factors for preterm birth (adopted from Koulali and Frey) [5, 6].
- Maternal characteristics
- Family history of preterm birth
- Low socioeconomic status
- Low educational attainment
- Maternal age (low and high)
- Ethnicity
- Stress
- Depression
- Tobacco use

- Low body mass index
- Infections (genitourinary or extra genital)
- Periodontal disease
- Uterine anomalies
- History of cervical excisional procedures/surgery (LEEP/conization)
- Reproductive history
- Prior preterm birth
- Prior stillbirth/ Pregnancy loss >16 weeks GA
- Induced abortion
- Cervical insufficiency
- Current pregnancy characteristics
- Vaginal bleeding
- Use of assisted reproductive technologies
- Multiple gestations
- Polyhydramnios
- Short cervical length

II. METHODOLOGY

Ultrasound Markers Cervical Length

Screening cervical length using transvaginal ultrasound can be a reliable indicator of PB risk for singleton pregnancies. The threshold of cervical length at 24 weeks gestation to determine the risk of PB was determined to be 25 millimeters (10 Th percentile) (percentile), with 37.3 percent sensitivity and 92.2 percent of specificity [7]

In a 3-week time frame, an increase in cervical length of >10 percent was associated with an increased likelihood of PB [8]. A cervical length of fewer than 15 millimeters was identified as the ideal cut-off, with 81% accuracy and 83 percent of positive predictive value when predicting the actual preterm labor [9].

There is a lack of evidence regarding cervical screening length during the initial third trimester (11-13 weeks) [10] [11]

Cervical Consistence

The length of the cervical spine is an analysis of morphology, and the cervix exhibits consistency and structural modifications during labor. Two approaches have been suggested to assess cervical elastography: strain elastography and shear wave elastography [12]. The methods are promising, but there are some limitations to their technical implementation. So cervical elastography, which is not yet a well-defined topic, is suggested as a possible option shortly, which could be coupled with the length of the cervical spine [13].

Newer Tools

In the population with low risk at 20-24 weeks of gestation, an association of cervical length, angle anterior to the cervical canal as well as maternal traits was found to have a possibility to predict around 40% of severe preterm births [14]. Uterocervical angle (between the lower uterine segment and cervical canal) greater than 95deg or >105deg during the second trimester showed an increased risk of PB at 37 weeks and 34 weeks, respectively [15].

Pulsatility of the uterine artery in the peak of uterine contractions in women at risk of having preterm labor was significantly higher for women who had their baby after seven days of gestation [16], [17].

The strain ratio of the placenta, determined using real-time sonoelastography, was found to be negatively associated with gestational age at birth, and it was suggested that it could be a reliable predictor for PB [17].

The measurement of the central zone of the fetal adrenal gland was proved to be reliable in forecasting PB after seven days, with similar precision to the measurement of cervical length [18]. The central zone of the fetal adrenal gland was found to be accurate in predicting.

The lower middle cerebral arterial pulsatility (MCA-PI) value was a predictor of an earlier start of labor that could be due to hypoxemia in the fetus unrelated to placental disease. However, the cerebroplacental ratio did not correlate with the PB [19]. However, MCA-PI was described as an ineffective indicator of PB and was not likely to be helpful in clinical practice. [19].

Biomarkers Cervical Fluid

Fetal fibrin is a glycoprotein made by amniocytes and the cytotrophoblasts, which bind the chorionic membranes to the decidua of the mother. It is typically found in cervicovaginal blood before the 22nd week of pregnancy, but its presence in the cervicovaginal liquid between the ages of 24-34 weeks gestation is a sign of high risk for PB. A systematic review found that, although its accuracy in predicting fetal fibronectin in predicting spontaneous PB differs, it is the most reliable in predicting preterm births in women who have a high risk of having preterm labor that does not have advanced cervical dilatation, which occurs within 7-10 days of testing [20]. However, a meta-analysis of the past few years revealed that the fetal fibronectin test in singleton pregnancy did not result in any reduction in PB or better birth outcomes. The study found that PB rates between 28 and 32, 33, and 37 weeks were not affected despite the increased cost [21].

When testing for fetal fibronectin, blood-stained swabs still worked in predicating PB, but they also had greater false positive rates [21].

In the study, IL-6 and levels of IL-8 in the cervicovaginal fluid were linked to PB after seven days. They were also efficient

in conjunction with the length of the cervical cervix. However, it is not yet available for usage in clinical trials.

III. CONCLUSION

It is possible to predict and avoid preterm labor precisely, and birth is one of the most important issues modern obstetrics faces. Finding out which women are most likely to experience preterm birth could allow the individualized treatment of medical issues and targeted treatments for therapeutic purposes that aim to improve the outcomes of both fetuses and mothers. Proteomic, genetic and metabolomic methods can eventually lead to the discovery of new biomarkers on the molecular level that is involved with the labor physiology as well as the pathophysiology behind preterm birth; however, it is becoming clear that different types of biomarkers (perhaps comprised of risks factors, length of the cervical as well as molecular indicators) could be needed to differentiate between pregnancies that experience spontaneous preterm labor, preterm PROM and symptoms of (threatened) preterm labor regardless of whether they are present or not of a genital tract infections.

REFERENCES

1. Blencowe H., Cousens S., Oestergaard M. Z., et al. National, regional, and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990 for selected countries: a systematic analysis and implications. *The Lancet*. 2012;379(9832):2162–2172. doi: 10.1016/s0140-6736(12)60820-4. [PubMed] [CrossRef] [Google Scholar]
2. Torchin H., Ancel P.-Y. Epidemiology and risk factors of preterm birth. *Journal de Gynécologie Obstétrique et Biologie de la Reproduction*. 2016;45(10):1213–1230. doi: 10.1016/j.jgyn.2016.09.013. [PubMed] [CrossRef] [Google Scholar]
3. WHO. Preterm birth 2016 [updated November 2016/2017] <http://www.who.int/mediacentre/factsheets/fs363/en/>
4. Hamilton B., Martin J., Osterman M. Births: Preliminary Data for 2015. *National Vital Statistics Reports*. 2016;66(3) [PubMed] [Google Scholar]
5. Frey H. A., Klebanoff M. A. The epidemiology, etiology, and costs of preterm birth. *Seminars in Fetal & Neonatal Medicine*. 2016;21(2):68–73. doi: 10.1016/j.siny.2015.12.011. [PubMed] [CrossRef] [Google Scholar]
6. Koullali B., Oudijk M. A., Nijman T. A., Mol B. W., Pajkrt E. Risk assessment and management to prevent preterm birth. *Seminars in Fetal & Neonatal Medicine*. 2016;21(2):80–88. doi: 10.1016/j.siny.2016.01.005. [PubMed] [CrossRef] [Google Scholar]
7. Iams J. D., Goldenberg R. L., Meis P. J., et al. The Length of the Cervix and the Risk of Spontaneous Premature Delivery. *The New England Journal of Medicine*. 1996;334(9):567–573. doi: 10.1056/NEJM199602293340904. [PubMed] [CrossRef] [Google Scholar]
8. Blanc J., Bretelle F. Outils prédictifs de l'accouchement prématuré dans une population asymptomatique à haut risque. *Journal de Gynécologie Obstétrique et Biologie de la Reproduction*. 2016;45(10):1261–1279. doi: 10.1016/j.jgyn.2016.09.009. [PubMed] [CrossRef] [Google Scholar]
9. Kunzier N. B., Kinzler W. L., Chavez M. R., Adams T. M., Brand D. A., Vintzileos A. M. The use of cervical sonography to differentiate true from false labor in term patients presenting for labor check. *American Journal of Obstetrics & Gynecology*. 2016;215(3):372–372.e5. doi: 10.1016/j.ajog.2016.03.031. [PubMed] [CrossRef] [Google Scholar]
10. Parra-Cordero M., Sepulveda-Martinez A., Rencoret G., Valdes E., Pedraza D., Munoz H. Is there a role for cervical assessment and uterine artery Doppler in the first trimester of pregnancy as a screening test for spontaneous preterm delivery? *Ultrasound in Obstetrics & Gynecology* : The

- Official Journal of The International Society of Ultrasound in Obstetrics and Gynecology. 2014;43(3):291–296. [PubMed] [Google Scholar]
- [11] 11. Greco E., Gupta R., Syngelaki A., Poon L. C. Y., Nicolaides K. H. First-trimester screening for spontaneous preterm delivery with maternal characteristics and cervical length. *Fetal Diagnosis and Therapy*. 2012;31(3):154–161. doi: 10.1159/000335686. [PubMed] [CrossRef] [Google Scholar]
- [12] 12. Fruscalzo A., Mazza E., Feltovich H., Schmitz R. Cervical elastography during pregnancy: a critical review of current approaches with a focus on controversies and limitations. *Journal of Medical Ultrasonics*. 2016;43(4):493–504. doi: 10.1007/s10396-016-0723-z. [PubMed] [CrossRef] [Google Scholar]
- [13] 13. Kim H., Hwang H. S. Elastographic measurement of the cervix during pregnancy: Current status and future challenges. *Obstetrics & Gynecology Science*. 2017;60(1):1–7. [PMC free article] [PubMed] [Google Scholar]
- [14] 14. Sepúlveda-Martínez A., Díaz F., Muñoz H., Valdés E., Parra-Cordero M. Second-Trimester Anterior Cervical Angle in a Low-Risk Population as a Marker for Spontaneous Preterm Delivery. *Fetal Diagnosis and Therapy*. 2017;41(3):220–225. doi: 10.1159/000447588. [PubMed] [CrossRef] [Google Scholar]
- [15] 15. Dziadosz M., Bennett T.-A., Dolin C., et al. Uterocervical angle: a novel ultrasound screening tool to predict spontaneous preterm birth. *American Journal of Obstetrics & Gynecology*. 2016;215(3):376–376.e7. doi: 10.1016/j.ajog.2016.03.033. [PubMed] [CrossRef] [Google Scholar]
- [16] 16. Olgan S., Celiloglu M. Contraction-based uterine artery Doppler velocimetry: novel approach for prediction of preterm birth in women with threatened preterm labor. *Ultrasound in Obstetrics & Gynecology*. 2016;48(6):757–764. doi: 10.1002/uog.15871. [PubMed] [CrossRef] [Google Scholar]
- [17] 17. Albayrak E., Dogru H. Y., Ozmen Z., et al. Is evaluation of placenta with real-time sonoelastography during the second trimester of pregnancy an effective method for the assessment of spontaneous preterm birth risk? *Clinical Imaging*. 2016;40(5):926–930. doi: 10.1016/j.clinimag.2016.04.006. [PubMed] [CrossRef] [Google Scholar]
- [18] 18. Lemos A. P., Feitosa F. E., Araujo Junior E., Feitosa H. N., Pereira J. G., Mota R. M., et al. Delivery prediction in pregnant women with spontaneous preterm birth using fetal adrenal gland biometry. *The Journal of Maternal-Fetal & Neonatal Medicine : The Official Journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the International Society of Perinatal Obstet*. 2016;29(23):3756–3761. [PubMed] [Google Scholar]
- [19] 19. Morales-Roselló J., Khalil A., Salvi S., Townsend R., Premakumar Y., Perales-Marín A. Abnormal Middle Cerebral Artery Doppler Associates with Spontaneous Preterm Birth in Normally Grown Fetuses. *Fetal Diagnosis and Therapy*. 2016;40(1):41–47. doi: 10.1159/000441519. [PubMed] [CrossRef] [Google Scholar]
- [20] 20. Honest H. Accuracy of cervicovaginal fetal fibronectin test in predicting risk of spontaneous preterm birth: systematic review. *BMJ*. 325(7359):301–301. doi: 10.1136/bmj.325.7359.301. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
- [21] 21. Berghella V., Saccone G. Fetal fibronectin testing for prevention of preterm birth in singleton pregnancies with threatened preterm labor: a systematic review and metaanalysis of randomized controlled trials. *American Journal of Obstetrics & Gynecology*. 2016;215(4):431–438. doi: 10.1016/j.ajog.2016.04.038. [PubMed] [CrossRef] [Google Scholar]
- [22] 22. Hezelgrave N. L., Kuhrt K., Cottam K., Seed P. T., Tribe R. M., Shennan A. H. The effect of blood staining on cervicovaginal quantitative fetal fibronectin concentration and prediction of spontaneous preterm birth. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 2017;208:103–108. doi: 10.1016/j.ejogrb.2016.11.027. [PubMed] [CrossRef] [Google Scholar]

AUTHORS

First Author – Dr. Sheetal Sachdeva, Sr. consultant Obs & Gynae Apollo Cradle, Moti Nagar, Delhi

The Role of Somali Woman in East Africa Regional Peace Building: A Case of Wadajir District in Mogadishu, Somalia

Musa Mohamed Ali

Mount Kenya University, P.O Box 342-00100, Thika, Kenya School of Social Sciences, Humanities Department and Social Science

DOI: 10.29322/IJSRP.12.10.2022.p13038

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13038>

Paper Received Date: 3rd September 2022

Paper Acceptance Date: 5th October 2022

Paper Publication Date: 13th October 2022

Abstract- War has a disproportionately negative impact on women, and their experiences are uniquely different from those of men's. In spite of the fact that women may carry a heavier load than men during times of conflict, their experiences, views, and skills are frequently undervalued and underutilized in efforts to resolve conflict. This is despite the fact that women may bear a heavier burden than men during times of conflict. Because of this, women continue to be vastly underrepresented in positions of authority all over the world. In order to investigate the role that Somali women play in the process of regional peace building in East Africa, the Wadajir district of Mogadishu, which is located in Somalia's capital city of Mogadishu, was selected as the focus area for this research. The research was directed by the following specific goals: to investigate the role that Somali women play in contributing to the security forces in the Wadajir district of Mogadishu; to determine the role that Somali women play in resolving conflicts in the Wadajir district of Mogadishu; and to assess the role that Somali women play in bringing about social reconciliation in the Wadajir district of Mogadishu, Somalia. The study will adopt a correlation design that is descriptive in nature, employing both qualitative and quantitative approaches. Sloven's formula was used to select a sample of one hundred respondents from the target population of one hundred and thirty-five respondents in order to conduct the research. The population of 135 respondents was chosen for the study. Data from primary sources as well as secondary sources were gathered for the study. The techniques of purposive and simple random sampling were utilized for the research.

Index Terms- women, peace agreements, peacebuilding, Political participation, wars, conflict

I. INTRODUCTION

G 1.1 BACKGROUND OF THE STUDY

Gender-based literature on wars and social conflict in Africa focuses disproportionately on women's suffering. Because more Africans are women. This is because women are a vulnerable group in conflict settings and need more attention. Comparatively,

the study of women's roles in post-conflict settings has received less attention.

In most conflicts, women and children are viewed as victims, while men are both perpetrators and peacemakers. Women and children are seen as victims, while men are perpetrators and peacemakers. 80% of refugees and displaced people are women and children, according to Puechguirbal (2004). Considering these numbers, it seems the statement is true, at least partially. This preconceived notion has even crept into post-conflict reconstruction. During this stage, women (and their challenges) are often ignored. This is the current state of peacebuilding in Liberia. Women fought vehemently against it and won. They helped bring peace and rebuild the country.

Women can be conflict victims or peacemakers. Women have traditionally prevented and resolved conflicts. Women must build peace from the ground up. During violent conflict and war, women often become family leaders, providers, soldiers, and freedom fighters. These roles include those above. Women's roles in bringing peace to conflict zones over the past decade show how important it is to move them beyond the "humanitarian front of the story." Women have been influential in peacebuilding processes, and they can continue to be so to ensure that these processes go beyond defining peace as the absence of violent conflict and emphasize inclusion, good governance, and justice. Women have been influential in peacebuilding, and they can remain so to ensure that these processes go beyond defining peace as the absence of violent conflict. To build a just and lasting peace, women must participate in discussions about genocide, impunity, and security. This goal requires these conversations.

Since the beginning of violent conflict, women have been active in resolving it. Women aren't "naturally" calm. Women have supported war and other violence throughout history. Soldiers and spies are examples. Women have been warriors, supportive wives and mothers, and battle callers throughout history. Because of how they express their gender identities, they can do some peace-building work that men can't. Some women have realized it's to their benefit to use the information, resources, and capabilities available to them within oppressive patriarchal systems to promote peace. They've done this because they realize it's to their benefit.

The 1995 Fourth UN World Conference on Women in Beijing, China sparked new ideas and conversations among civil society women worldwide. UN held the conference. Civil society's campaign on the role of women in building peace led to the passage of UN Security Council Resolution 1325 on Women, Peace, and Security in October 2000. Women and children are the most vulnerable members of civilian populations during conflict, and this threatens peace and security. Women and children are the most vulnerable civilians, the resolution says. Resolution 1325 calls for women's participation in conflict prevention and resolution initiatives, gender integration in peace building and conflict prevention missions, and protection of women in armed conflict zones. In armed conflicts, women account for a disproportionate number of deaths and injuries. Resolution 1325 has mobilized women around the world to recognize the important roles they play in peacebuilding and to "mainstream gender in peacebuilding." UN sets these goals. "Mainstreaming a gender perspective" is a term coined by the UN to describe analyzing the potential effects of new legislation, policies, or programs on women and men. It aims to include women's and men's concerns and experiences in policy design, implementation, monitoring, and evaluation across political, economic, and social spheres. This ensures women and men benefit equally from policies and programs.

East African women have a greater stake in reconciling differences and building peace than ever before. They expect their country to learn from its mistakes and enter a prosperous and secure era. Women were underrepresented in 1999 and 2006 high-level dialogue initiatives to end violence. These initiatives aimed to end violence. However, things may be changing. East Africa is seeing an increase in the number of women in power, and these women are leading grassroots reconciliation initiatives. East African women have the highest political participation in central and east Africa. In Rwanda and Kenya, they make up 30% of parliamentarians. East Africa has the highest percentage of women in political leadership positions in Africa. Women lead the finance, justice, and social solidarity ministries. Domestic violence, economic hardship, and other issues affecting women and the population at large are topics women are addressing across the country as they carve out a space for themselves at the national, district, and village levels. Women are addressing domestic violence, economic hardship, and other issues that affect women and the population (Douglas, 2012).

Integrating women into all aspects of peacekeeping operations, including the military, police, and civilian sector, has improved their environments. This includes promoting women's role in establishing and maintaining peace and defending women's rights. Female peacekeepers can perform the same roles as men, to the same high standards, and under the same trying conditions. This applies to all peacekeeping efforts. Female peacekeeper recruitment and retention are operational necessities (Douglas, 2012). In 1993, only 1% of uniformed personnel was female. By 2020, women will make up 4.8% of UN Peacekeeping military contingents, 10.9% of police units, and 34% of justice and corrections personnel. Peacekeepers number 95,000. Member states are responsible for deploying women in the police and military, despite UN encouragement. The UN encourages and

advocates for women in uniformed roles. Despite the UN's encouragement of women in uniformed roles, this is the case. The UN Police Division has launched "the Global Effort" to increase the number of female officers in national police forces and UN police operations around the world. By 2028, only 15% of women will serve in military contingents, while 25% will serve as observation and staff officers. By 2028, 20% of women will serve in formed police units and 30% as individual officers (Diehl, 1993).

The US Institute of Peace launched a project in Colombia in 2015 to support a network of women peace builders and nonviolent, mediation-focused organizations led by women. This network, which included people from all walks of life, aided the official peace process as it began. Hostages were released after women negotiated local ceasefires with armed groups. The women's groups' efforts led to this. They used pressure to remove roadblocks and document human rights violations. They fought drug trafficking and other crime while opposing local spending priorities. During the Colombian peace talks in Havana, a few of these women were invited to the table. Three women were talking at the table. They were essential in ensuring that the concerns of war victims were reflected in the final agreement's mechanisms for reconciliation and accountability. They contributed to the peace process in many ways (Goulding, 2003).

1.2 STATEMENT OF THE PROBLEM

Resolution 1325 of the United Nations Security Council was passed in the year 2000. It relates to issues concerning women, peace, and security. The resolution is built on a foundation of four pillars: prevention, participation, protection, and the building of peace and healing. After coming to terms with the frequency with which women are excluded from peace processes following armed conflict, this resolution was drafted. The resolution was created in order to acknowledge the part that women play in the process of avoiding and resolving conflict (UN Women, 2016). The new resolution was the first of its kind to be passed, and it focused on women and the role that they play in achieving and building peace. Its purpose was to encourage the participation of women and men on an equal basis in the process of constructing peace, as well as in the activities of preserving and advancing peace (Tryggstad, 2009). It is traditional practice to disregard the contributions of women to the processes of conflict resolution and peacebuilding. Their work in preventing and resolving conflicts is never recognized or rewarded, despite the positive impact it has on society. Women played a significant role in the upkeep of peace in Somalia; however, very little is known about this topic, and the majority of the information available is anecdotal. In this context, the study intends to analyze and document the Somali woman's role in promoting a culture of peace. The study looked into the role of women in formal peace processes, traditional conflict resolution mechanisms, women's role in governance, and the challenges women confront in peace building.

1.3. OBJECTIVE OF THE STUDY

The general objective of the study is to establish the role of Somali woman in East Africa Regional Peace Building: A case of Wadajir District in Mogadishu, Somalia.

1.3.1. SPECIFIC OBJECTIVES

- i. To examine the role of Somali woman's contributions towards security forces in Wadajir district in Mogadishu, Somalia.
- ii. To establish the role of Somali woman in conflict resolution in Wadajir district in Mogadishu, Somalia.
- iii. To evaluate the role of Somali woman in social reconciliation in Wadajir district in Mogadishu, Somalia.

II. THEORETICAL FRAMEWORK

This sub-section discusses the theories that contend to correlate with research topic of the study. This theory is known as socialist feminism.

1.3 SOCIALIST FEMINISM

Socialist feminism contends that women can only be liberated once efforts are made to end both economic and cultural oppression of women. This theory guided the study. The socialist feminist theory extends feminism into theoretical or philosophical fields, including women's roles. The 1970s brought this theory. It focuses on gender politics, power dynamics, and sexuality to explain inequality.

The theory examines gender inequality and women's rights and concerns. Socialist feminists say women's current predicament can be traced to the structure of social relations that upholds male dominance. Socialist feminists say Marxism and Marxist feminism misrepresent women's status. They say radical feminists' analysis of patriarchy is historical and universalistic. When discussing women's oppression, socialist feminists insist on a materialist analysis. The analysis focuses on production and reproduction within the family and the larger political economy; patriarchal oppression is tied to the need to control women's fertility, sexuality, and labor. (Cite)

In this context, the Gender and Development (GAD) theory, one of the major feminist development theories that focuses on unequal power relations and gender inequalities that prevent women's full participation in development, provides a substantive and holistic conceptual structure for examining men and women's participation as central to social and economic development of the community. The GAD perspective is based on social feminism and calls for a synthesis of materialistic political economy and radical feminism issues of patriarchy and patriarchal ideology. GAD, drawing heavily from socialist feminists, argues that women's social status is affected by their material conditions and position in the national, regional, and global economies. It recognizes that patriarchal power affects women at the household and national levels. Norms and values that define community roles define women's material conditions and patriarchal authority.

The theory reminds policymakers and development practitioners to focus on women's and men's practical and strategic needs. This framework aims for equitable, sustainable development with women and men as decision-makers. The theory sees women as change agents, not development recipients. In this study, the Gender and Development theory is more applicable than Women in Development (WID) because it focuses more on gender relations, women's subordination, and women's inequality and empowerment as key change strategies. WID views

the absence of women in development plans as a problem and only focuses on women because they make up more than half of the population. It advocates for the integration of women into existing development plans with a focus on women's projects or components in mainstream plans. WID focuses on women's practical needs and increases their ability to care for their families. GAD identifies cultural values and social institutions that empower men as needing change. GAD advocates addressing root causes for long-term change. It helps relate an issue to others in society, leading to effective solutions. This theoretical framework is relevant to this research because it focuses on women, social relations, and unequal power relations that limit women's development participation.

III. RESEARCH METHODOLOGY

Descriptive research design was adopted, since it is capable of presenting detailed information about a given social system. It thus allowed for an in depth explanation. The design was selected because it makes it possible to generate descriptive responses regarding the phenomenon under study in a short amount of time while also making comparison simple.

3.1 LOCATION OF THE STUDY

Wadajir District in Mogadishu, Somalia, was the location of the study. The study's location was ideal because it was accessible to the study population, as opposed to other areas that were more unstable and difficult to reach.

3.2 SAMPLING TECHNIQUE

According to Bhattacharjee (2012), a sampling technique is the process that a researcher follows in order to collect individuals, locations, or things for the purpose of research. It refers to the process of selecting a number of individuals or objects from a population in such a way that the selected group contains elements representative of the characteristics found in the characteristics found in the entire population. Methods of sampling that were both probabilistic and non-probabilistic were used in the study.

The majority of purposeful samples were taken from prominent members of the community that is women groups and association's government officials in the Wadajir district youth and members of security forces. This is supported by Gall and Meredith (2003), who argued that specific information can be obtained by employing purposive sampling in any study. This supports the claim that specific information can be obtained.

3.3 SAMPLE SIZE

A sample constituted a population that was representative of the entire population. Sampling is a way of gathering statistical information using a few elements chosen out of the study population to represent the whole population.

The sample size of 100 respondents was selected from the target population of 135 respondents. The 100 respondents were distributed to the number of respondents in each category; the sample size was got using sloven's formula.

3.4 RESEARCH INSTRUMENTS

Data was gathered from two sources, that is primary data and secondary data.

Primary data was collected by the used of interview guides, questionnaires. Secondary data will be got from textbooks, magazines, journals, and organisational manuals. The questionnaire was accompanied by a response option ranging from, strongly disagree, disagree, Neutral, agree and strongly agree.

The interview guide used in the study was semi-structured, that is, with a list of fixed questions to be asked to respondents.

3.5 DATA ANALYSIS AND PRESENTATION

In this study, the Wadajir district in Mogadishu, Somalia, was used as a case study to examine the role of Somali women in regional peacebuilding in east Africa. The statistical package for social science was used to analyze the information gathered from the respondents (SPSS). Charts, pie charts, frequency tables, and percentage charts were used to display the data.

IV. RESEARCH FINDINGS

Research was carried on the role of Somali women in east Africa regional peacebuilding: a case of Wadajir area in Mogadishu, Somalia. This study had three aims. To analyze Somali women's contributions to security forces in Mogadishu's Wadajir district, to determine their participation in conflict resolution, and to evaluate their position in societal reconciliation.

Both qualitative and quantitative methods were used in the correlational design. From 135 responders, 100 were chosen as the sample. Simple and selective sampling was employed to pick respondents. Primary and secondary data were used. Two analyses were done, qualitative and quantitative, and responses were presented in frequency tables for easy interpretation

4.1.1 THE ROLE OF SOMALI WOMAN'S CONTRIBUTIONS TOWARDS SECURITY FORCES IN WADAJIR DISTRICT IN MOGADISHU.

From the table 4.3.1 above the results indicates that women have contributed towards security forces in Wadajir district by 48.5% and other factors are responsible for 51.5%. Women have supported the security forces in various ways first of all they have been recruited to work as security personnel, women provide care to men in security forces, they organize clan conferences to advocate for peace, women also mobilize themselves together to collectively urge the traditional leaders to resolve the conflict, they have shared food with the security personnel, women have actively participated in demonstration to stop the war.

4.1.2: TO EXAMINE, SOMALIA, TO ESTABLISH THE ROLE OF SOMALI WOMAN IN CONFLICT RESOLUTION IN WADAJIR

The study found out that the role played by women predicted about 56.4% of the observed variance on conflict resolution. This implies that there are other factors that explain variations in conflict resolution other than only the role played by women they account for 43.6%. women have helped in conflict resolution by; women have been recruited in the army as soldiers, they pass on information to alert others about the conflict, they wage the conflict non-violently, they have worked as mediators to

bring about peace and Women act as policy makers in ensuring peace in restored in their country and they act as counselors.

4.1.3ROLE OF SOMALI WOMAN IN SOCIAL RECONCILIATION IN WADAJIR DISTRICT IN MOGADISHU, SOMALIA.

The results indicate that women's role predicted about 69.5% of the observed variance on social reconciliation. This implies that there are other factors that explain variations in social reconciliation apart from women's roles and they account for 30.5%.

Somalia women helped in social reconciliation by carrying on mass campaigns in the district, women signed peace agreements, consulted religious leaders and indigenous people on easing community fears and also provided support to victims of rape and property loss.

V. CONCLUSION

The purpose of the study was to identify the role of women in peace building in Wadajir District in Somalia. The study concludes that women contribute towards security forces in Wadajir. Also, it can be concluded that women play a big role in conflict resolution and lastly women are instrumental in social reconciliation.

5.3. RECOMMENDATIONS

According to the findings of the study, the participation of women in the process of constructing peace is met with a fair amount of resistance. As a result, the researchers suggest that the African Union should revise its design for providing support for peace in order to incorporate men and women into operations on an equal footing in order to foster inclusive security apparatus in Somalia. With the assistance of the African Union mandate, both men and women are able to achieve equal representation in governing bodies such as the Police and the Army.

The Federal Government of Somalia has an obligation to emancipate women who have been marginalized for a significant amount of time, despite the fact that the indigenous culture and religion do not condone gender discrimination. According to the Provisional National Constitution, the government should work to strengthen existing institutions and implement interventions to promote gender equality in all aspects of the process of building peace.

It is necessary that human rights be guaranteed, that social rehabilitation be carried out, that negotiations be held in conflicts, and that other paths leading to peace be developed. Additionally, it is necessary that work efforts be made to improve the functionality of the peace process. The country has an ongoing requirement for furthering its interests in both the consolidation of peace and the advancement of development.

The local cultural institutions, such as clan leadership, need to be organized, sensitized, and supported in order to have an effective and useful gender mainstreaming. This will help to enhance the peace building process. This intervention has the potential to be formalized through the relevant government agencies related to culture and gender, such as line Ministries. This would help to promote the appropriate cultural gender ideals that

do not discriminate against women but rather advance women's empowerment, including participation in all of the tenets of peace building.

Incorporating their agency into the peace agreements is necessary because it will enable women to work with peace building further and implement an even further change. This is why the inclusion of their agency is necessary. The handling of the implementation of the policy on women can be of assistance in the process of designing the peace process, as well as in facilitating the participation of women in discussions and encouraging their active engagement with the reconciliations during the process of peace development and the process of constructing a robust environment for the reconciliations.

5.4. AREAS FOR FURTHER RESEARCH

This study suggests the following areas for further research: Challenges to women's participation in peace building.

REFERENCES

- [1] Agbalajobi, D.T. (2009). 'The Role of African Women in Peace Building and Conflict Resolution: The Case of Burundi', *Global Media Journal*, Vol. 8, No. 15.
- [2] Anderlini, S. N., Jarhum, R., Allam, R., and Cowick, D. (2017), 'Women, Peace and Security', U.S. CSWG policy brief.
- [3] Athie, A. (2017). 'Women, Tribal Leaders Key to Rebuilding Libyan State', *the Global Observatory*.
- [4] Ayoub, M. (2006). 'Land and conflict in Sudan, Piece by piece Addressing Sudan's conflicts.
- [5] Bell, C., & O'Rourke, C. (2010). Peace Agreements or Pieces of Paper? The Impact of UNSC Resolution 1325 on Peace Processes and Their Agreements', *The International and Comparative Law Quarterly*, Vol. 59, No. 4, pp. 941-980.
- [6] Bem, S.(1981). Gender schema theory: A cognitive account of sex typing', *Psychological review*, Vol. 88, No. 4 pp. 354.
- [7] Bennett, A., & George, L. A.(2005), *Case Studies and Theory Development in the Social Sciences*. MIT press, Cambridge.
- [8] Bernard, H. R., & Ryan, G.(1998). *Text analyses, Handbook of methods in cultural anthropology*, pp. 595-645.
- [9] Bradbury, M.& Healy, S.(2010). *Whose Peace is it Anyway: Connecting Somali and International Peacemaking*, Conciliation Resources.
- [10] Bromley, J., Davies, O.,V. & Limo, I.,(2016). Protecting the rights of women: through community-focused approaches to strengthening gender in African peace support operations in the Democratic Republic of the Congo and Central African Republic', *Accord*, South Africa.
- [11] Council on Foreign Relations (2017). *Women's Participation in Peace Processes*, viewed 15December,(2017),<https://www.cfr.org/interactive/womens-participation-in-peace-processes-Introduction>.
- [12] El-Bushra, J. (2007). Feminism, gender, and women's peace activism', *Development and Change*, Vol: 38, No. 1, pp. 131-147.
- [13] Elo, S., & Kyngäs, H. (2008). The qualitative content analysis processes, *Journal of advanced Nursing*, Vol. 62, No. 1, pp. 107-115.
- [14] ElSawi, Z. (2011). *Women Building Peace: The Sudanese Women Empowerment for Peace in Sudan*, AWID–Association for Women's Rights in Development, Toronto.
- [15] Gichuru, J. (2014). Participation of Women in Peace Building in Somalia: A Case Study of Mogadishu, *International Peace Support Training Centre (IPSTC)*.
- [16] Heinze, M. C. & Baabbad, M. (2017), 'Women Nowadays Do anything', Safer world, available at: <http://www.saferworld.org.uk/resources/view-resource/1118-awomen-nowadaysdo-anything-women-s-role-in-conflict-peace-and-security-in-Yemen>.
- [17] Hitlin & Elder, (2007). Time, self, and the curiously abstract concept of agency', *Sociological theory*, Vol. 25, No. 2, pp. 170-191. Itto, A., (2006). *Guests at the table? The role of women in peace processes*, Conciliation resources, United Kingdom.

AUTHORS

First Author – Musa Mohamed ali Mount Kenya University, P.O Box 342-00100, Thika, Kenya, Email arbushmusa@gmail.com

TABLES AND FIGURES

Table4.2.1: Gender

Indicators	Frequency	Percentage
Male	40	40%
Female	60	60%

Table 4.2.2 Age

Indicators	Frequency	Percentage
20 years below	20	20%
21-35 years	60	60%

46 years above	15	15%
36-45 years	5	5%

Table4.2.3: Period of time taken in Wadajir District in Mogadishu, Somalia.

Indicators	Frequency	Percentage
Less than 1 Year	15	15%
2– 4 Years Female	15	15%
5 – 7 Years	25	25%
8 – 10 Years	45	15%

Figure 4.2.2

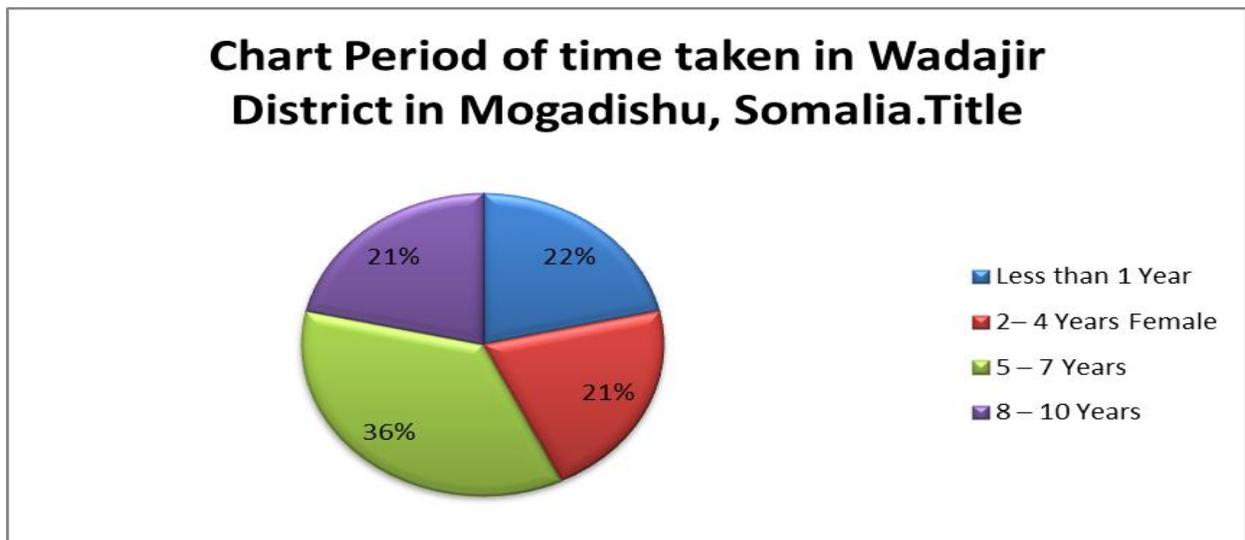


Table 4.3.1 Women are recruited to work as security personnel

Indicators	Frequency	Percentage
Strongly Disagre	2	2%

Disagree	8	8%
Undecided	0	0
Agree	70	70%
Strongly Agree	20	20%

Table 4.3.2 Women provide care to men in security forces

Indicators	Frequency	Percentage
Strongly Disagree	0	0%
Disagree	7	7%
Undecided	3	3%
Agree	50	50%
Strongly Agree	40	40%

Table 4.3.3 Women organize clan conferences to advocate for peace.

Indicators	Frequency	Percentage
Strongly Disagree	20	20%
Disagree	70	70%
Undecided	10	10%
Agree	0	0%
Strongly Agree	0	0%

Figure 4.3.3 Women organize clan conferences to advocate for peace

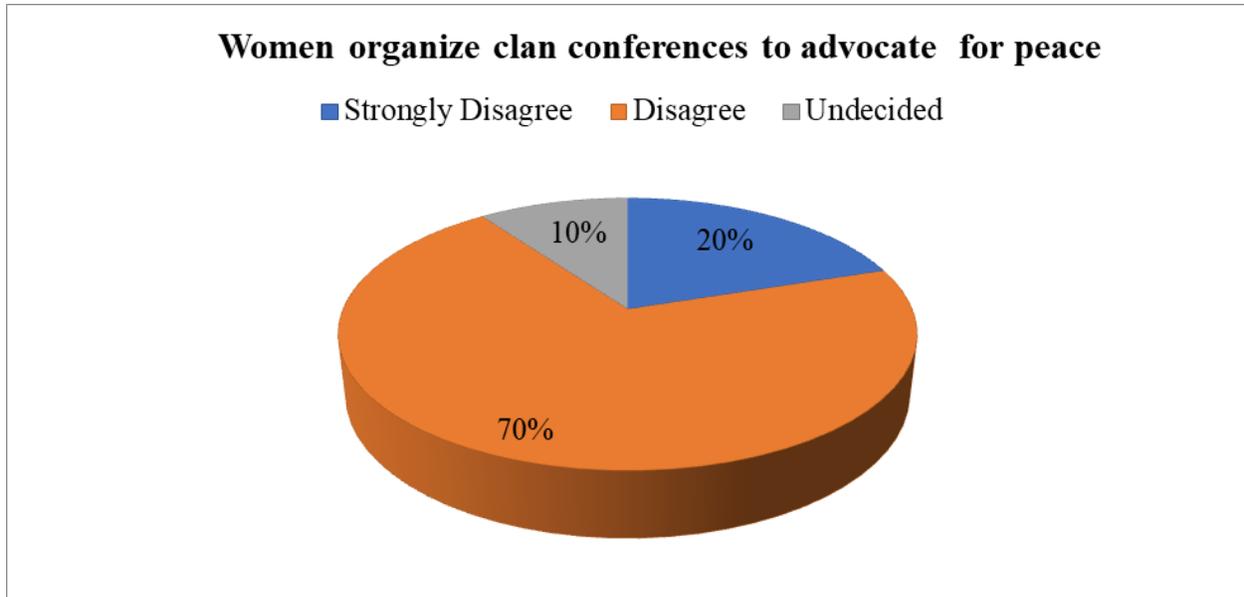


Table 4.3.4 Women also mobilize themselves together to collectively urge the traditional leaders to resolve the conflict

Indicators	Frequency	Percentage
Strongly Disagree	26	26%
Disagree	64	64%
Undecided	0	0%
Agree	8	8%
Strongly Agree	2	2%

Figure 4.3.4 Women also mobilize themselves together to collectively urge the traditional leaders to resolve the conflict

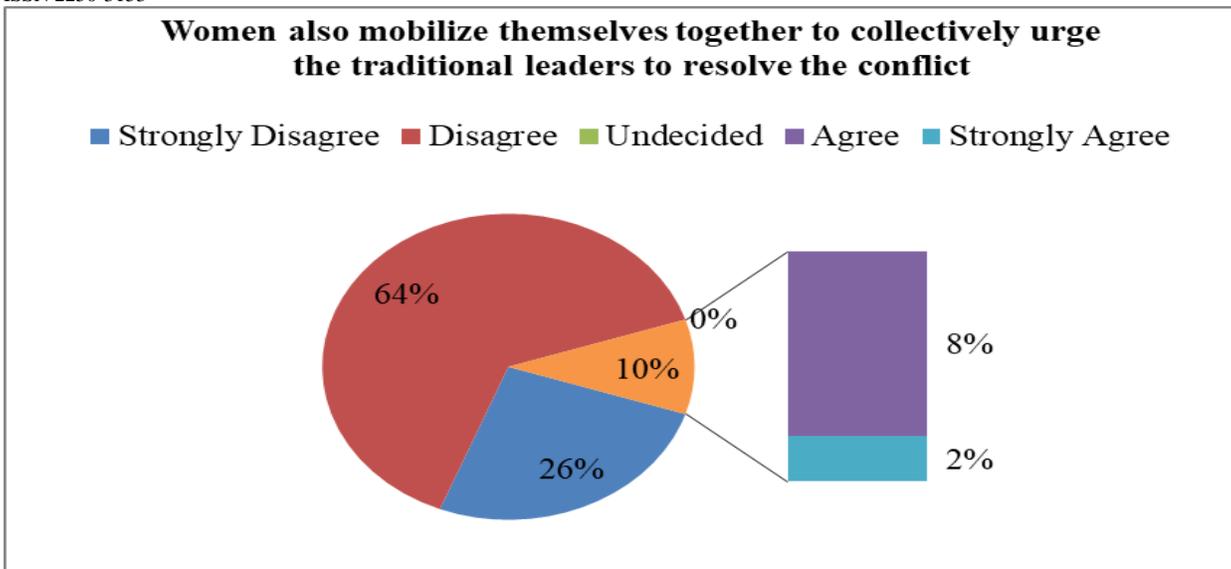


Table 4.3.5 Women share food with the security personnel.

Indicators	Frequency	Percentage
Strongly Disagree	5	5%
Disagree	15	15%
Undecided	0	0%
Agree	55	55%
Strongly Agree	25	25%

Figure 4.3.5 Women share food with the security personnel

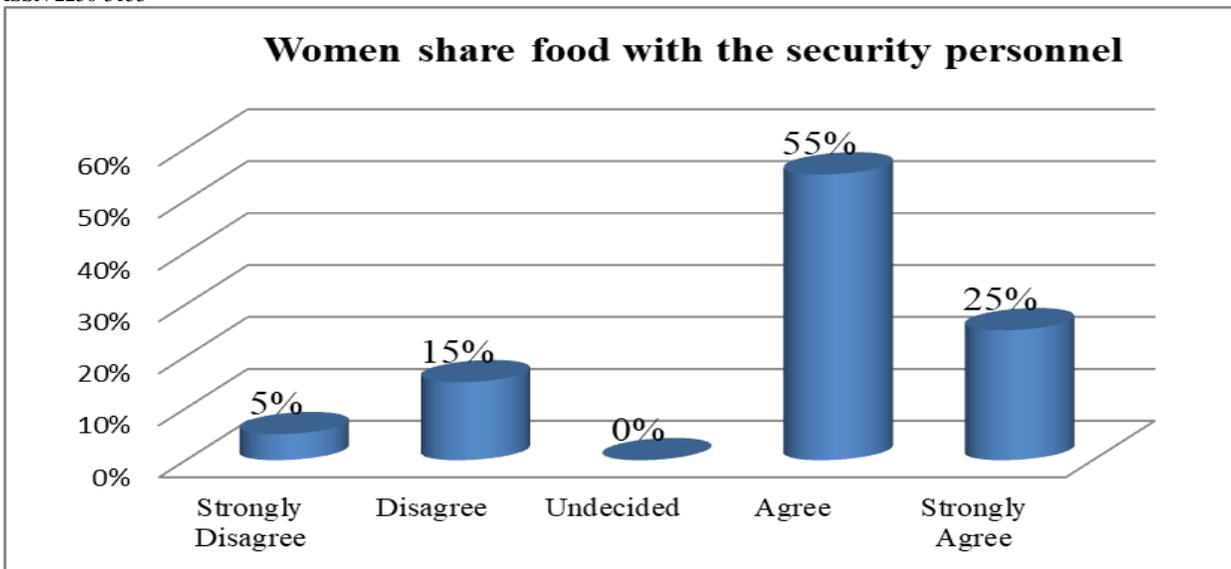


Table 4.3.6 Women have actively participated in demonstration to stop the war.

Indicators	Frequency	Percentage
Strongly Disagree	20	20%
Disagree	60	60%
Undecided	10	10%
Agree	10	10%
Strongly Agree	0	0%

Figure 4.3.6 Women have actively participated in demonstration to stop the war.

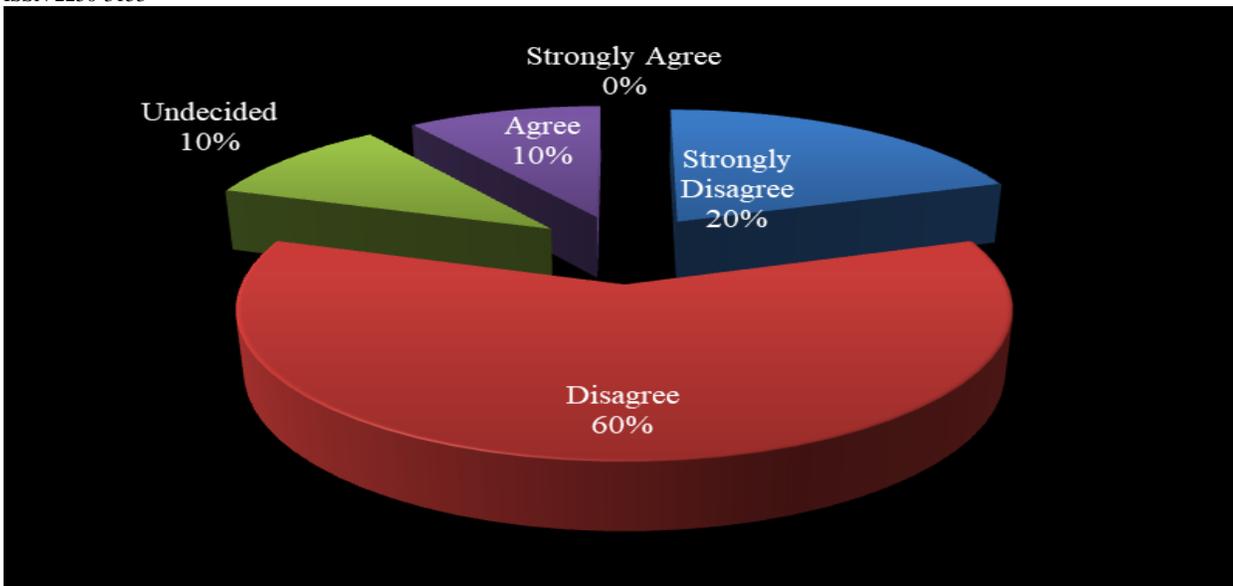


Table 4.3.7 Women have composed songs and poems that talk about the conflict.

Indicators	Frequency	Percentage
Strongly Disagree	15	15%
Disagree	55	55%
Undecided	5	5%
Agree	20	20%
Strongly Agree	5	5%

Figure 4.3.7 Women have composed songs and poems that talk about the conflict.

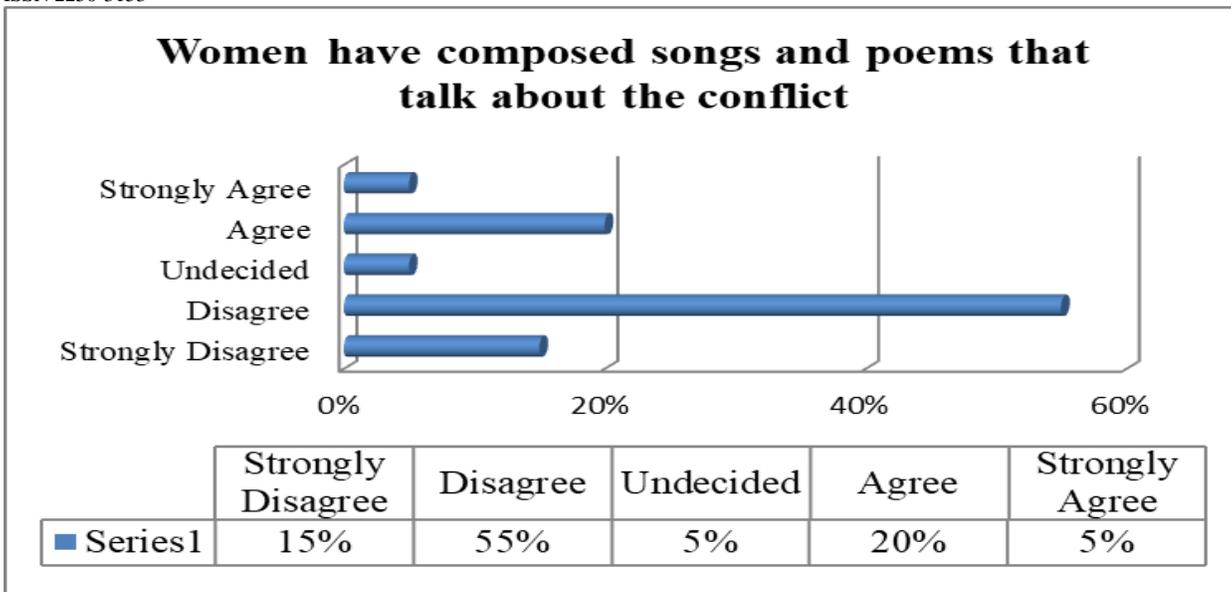


Table 4.4.1 Women have been recruited as soldiers to help in conflict resolution.

Indicators	Frequency	Percentage
Strongly Disagree	5	5%
Disagree	10	10%
Undecided	5	5%
Agree	70	70%
Strongly Agree	10	10%

Figure 4.4.1 Women have been recruited as soldiers to help in conflict resolution

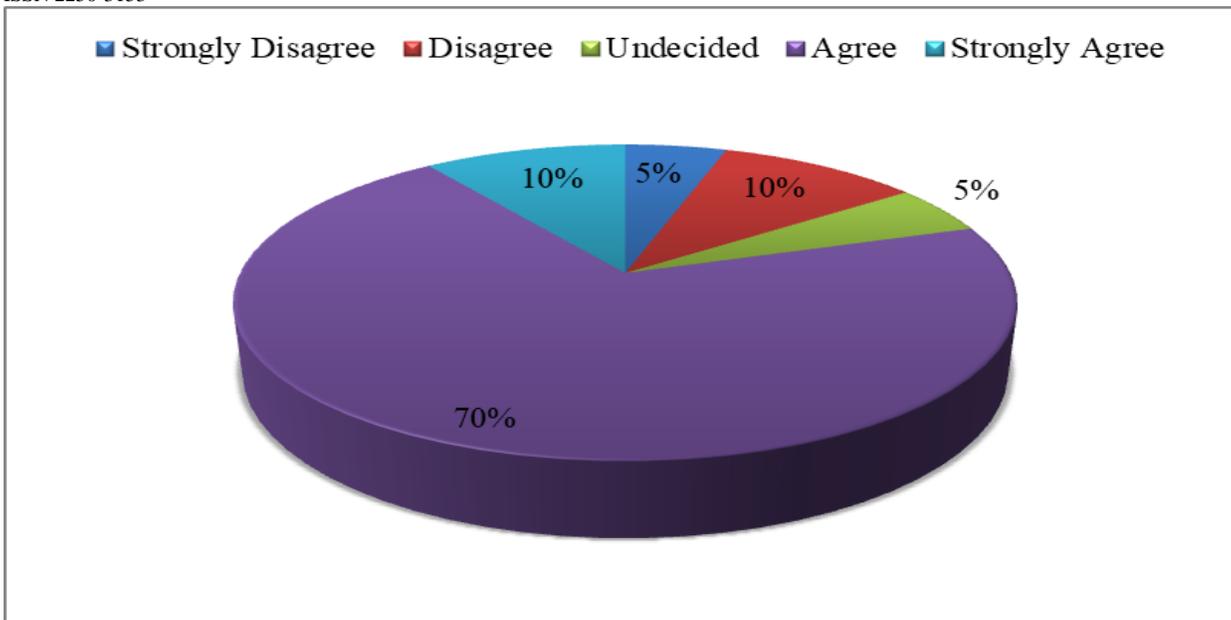


Table 4.4.2 Women pass on information to alert others about the conflict.

Indicators	Frequency	Percentage
Strongly Disagree	4	4%
Disagree	6	6%
Undecided	0	0%
Agree	60	60%
Strongly Agree	30	30%

Table 4.4.3 Women wage the conflict non-violently.

Indicators	Frequency	Percentage
Strongly Disagree	21	21%
Disagree	29	29%
Undecided	5	0%

Agree	35	35%
Strongly Agree	10	10%

Table 4.4.4 Women work as mediators to bring about peace.

Indicators	Frequency	Percentage
Strongly Disagree	14	14%
Disagree	46	46%
Undecided	0	0%
Agree	30	30%
Strongly Agree	10	10%

Figure 4.4.4 Women work as mediators to bring about peace

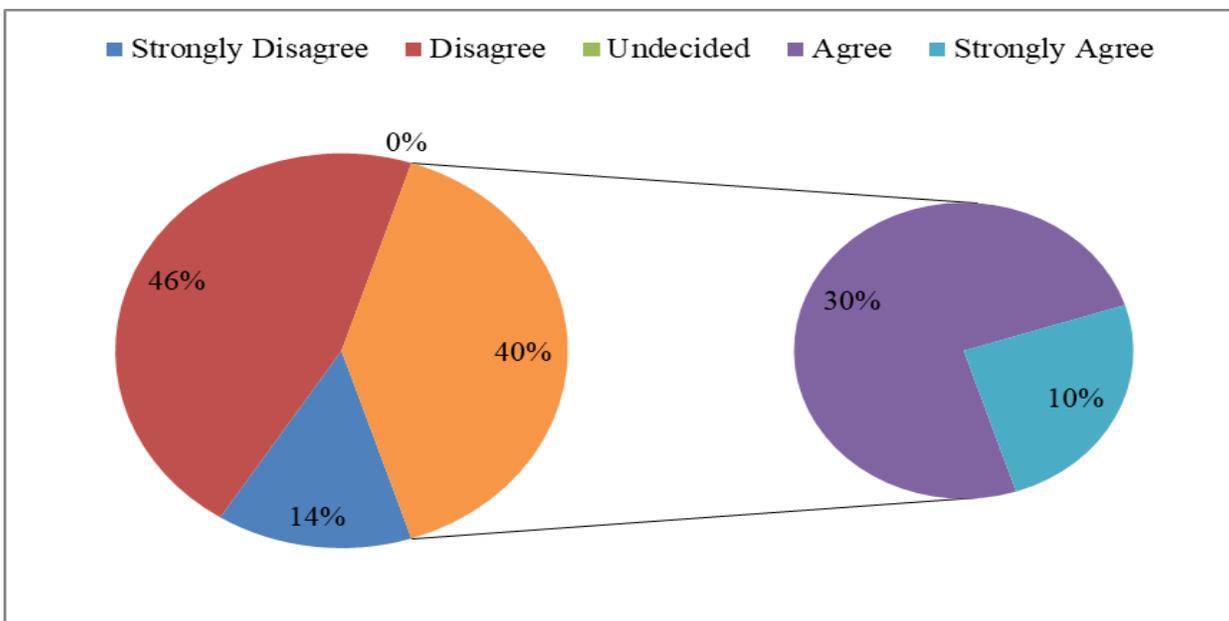


Table 4.4.5 Women act as policy makers in ensuring peace in restored in their country.

This publication is licensed under Creative Commons Attribution CC BY.

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13038>

www.ijsrp.org

Indicators	Frequency	Percentage
Strongly Disagree	10	10%
Disagree	20	46%
Undecided	10	10%
Agree	50	30%
Strongly Agree	10	10%

Table 4.4.6 they act as counselors.

Indicators	Frequency	Percentage
Strongly Disagree	20	20%
Disagree	70	70%
Undecided	0	0%
Agree	10	10%
Strongly Agree	0	0%

Table 4.4.7 Women act as agents of peace.

Indicators	Frequency	Percentage
Strongly Disagree	15	15%
Disagree	65	65%
Undecided	0	0%
Agree	13	13%
Strongly Agree	7	7%

Table 4.5.1 Women carry on mass campaigns calling for peace.

Indicators	Frequency	Percentage
Strongly Disagree	0	0%
Disagree	10	10%
Undecided	0	0%
Agree	70	70%
Strongly Agree	20	20%

Figure 4.5.1 Women carry on mass campaigns calling for peace

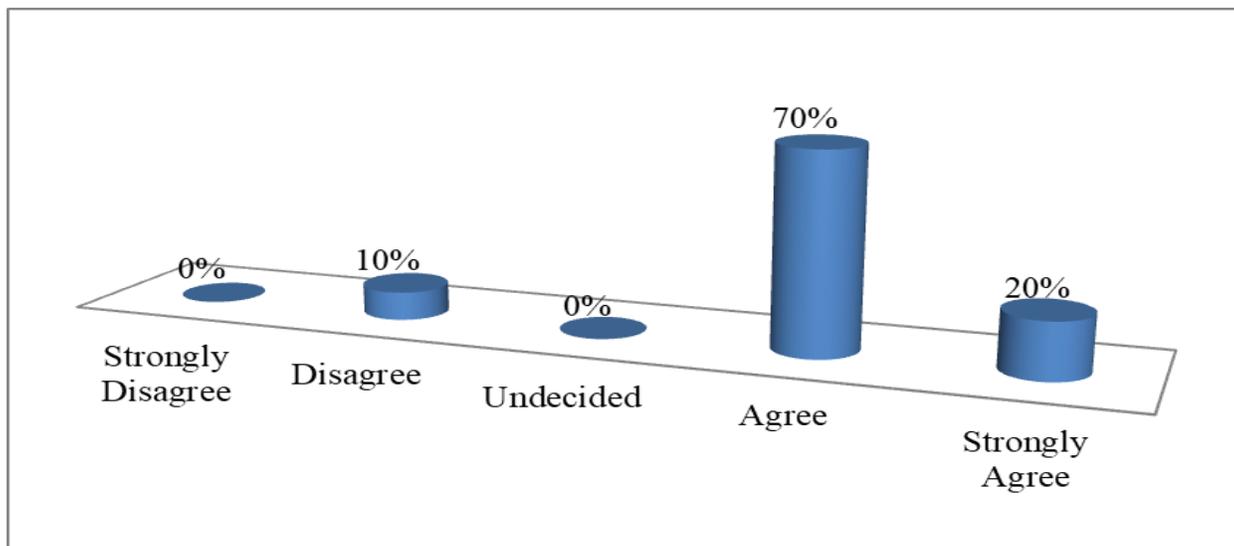


Table 4.5.2 Women have also signed peace agreements to bring about peace in their societies.

Indicators	Frequency	Percentage
Strongly Disagree	20	20%

Disagree	70	70%
Undecided	0	0%
Agree	10	10%
Strongly Agree	0	0%

Table 4.5.3 Women have fought for their involvement in politics and economic planning of their communities.

Indicators	Frequency	Percentage
Strongly Disagree	20	20%
Disagree	70	70%
Undecided	0	0%
Agree	6	6%
Strongly Agree	4	4%

Figure 4.5.3 Women have fought for their involvement in politics and economic planning of their communities.

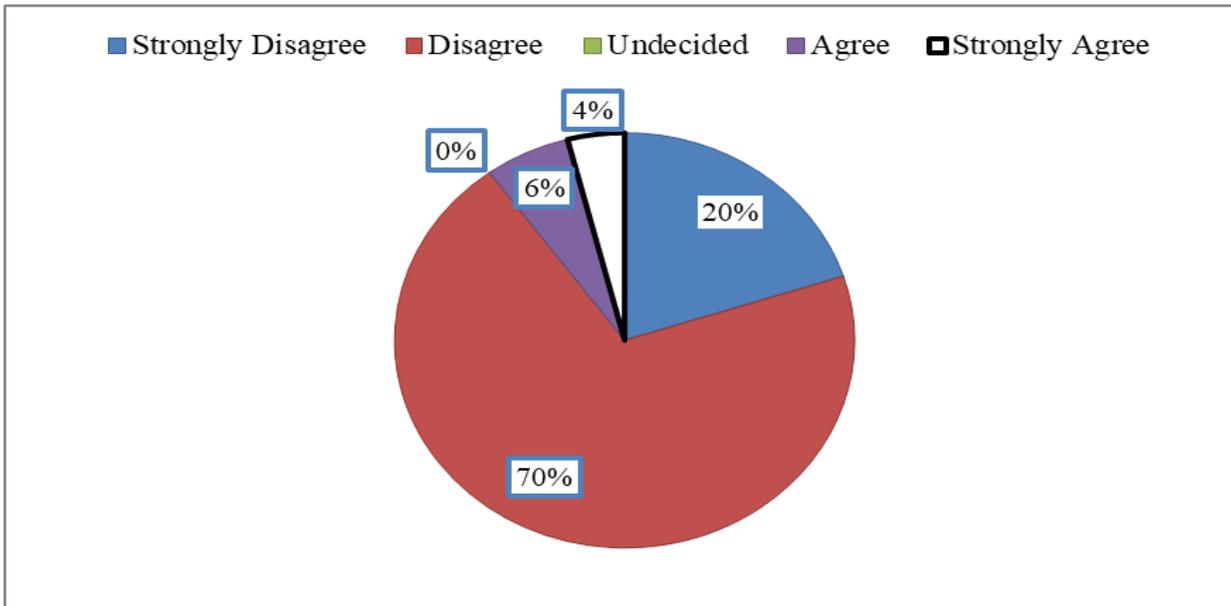


Table 4.5.4 they have consulted with religious leaders and indigenous people on easing community fears.

Indicators	Frequency	Percentage
Strongly Disagree	15	15%
Disagree	60	60%

Undecided	5	5%
Agree	15	15%
Strongly Agree	5	5%

Table 4.5.5 Women have acted as mediators for peace in their areas.

Indicators	Frequency	Percentage
Strongly Disagree	10	10%
Disagree	20	20%
Undecided	0	59%
Agree	59	59%
Strongly Agree	11	11%

Figure 4.5.6 Women have acted as mediators for peace in their areas.

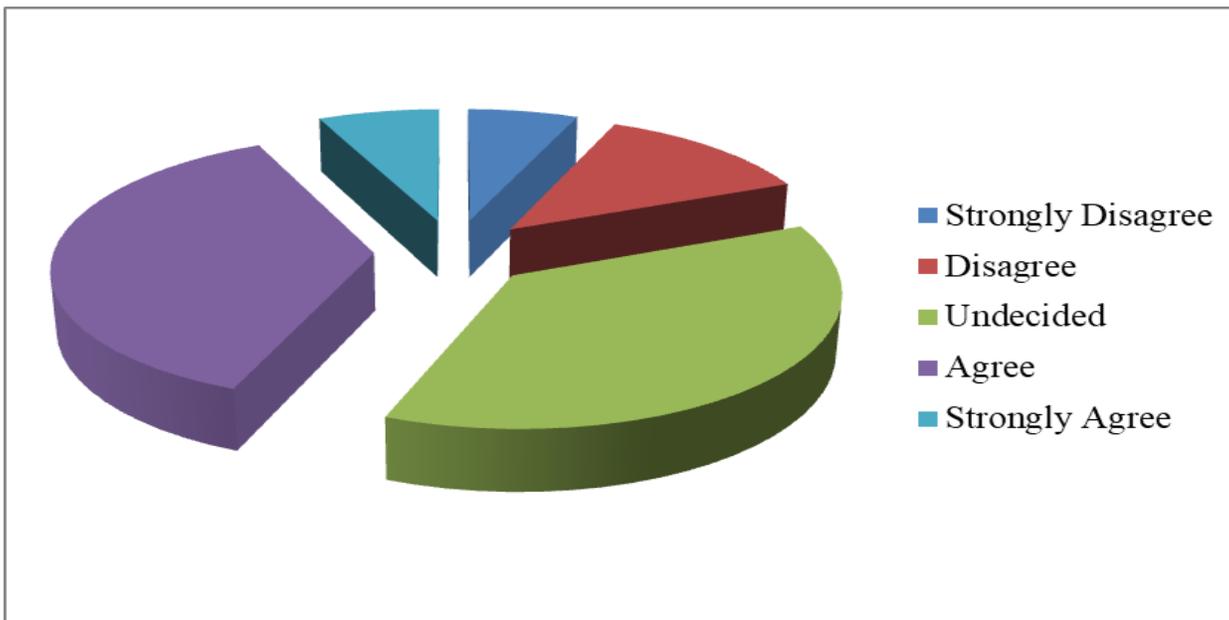


Table 4.5.7 Women have created groups consisting if women and youth that works for peace and security in their community.

Indicators	Frequency	Percent
Strongly Disagree	5	5%
Disagree	15	15%
Undecided	5	5%
Agree	60	60%
Strongly Agree	15	15%

Autopsy Case Of Head Injury In Decomposing Corpse

Reza Priatna¹, Adriansyah Lubis¹, Zulfia Retnanti Marissa¹

¹ Department of Forensic and Medicolegal, Medicine Faculty University of North Sumatra
RS. H. Adam Malik 20136, Medan, Indonesia.

DOI: 10.29322/IJSRP.12.10.2022.p13039
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13039>

Paper Received Date: 5th September 2022
Paper Acceptance Date: 5th October 2022
Paper Publication Date: 13th October 2022

Abstract- Traumatology is the study of aspects of injury and its relationship to various types of violence. Injuries have become a major public health problem in all countries and most of them occur in developing countries. In the case of death from injury, head trauma is the most common type of trauma. Around 69 million people worldwide experience head injuries every year. Currently, the homicide rate is increasing. The target most often involved in murder cases is the head. The body of an adult male was found in a house. On examination, it was found that the wound was predominantly on the head. There is a fracture at the top of the skull. Infiltration of blood is seen in the inner scalp and meninges. Brain tissue liquefies due to decay. The cause of death is bleeding in the head cavity due to blunt trauma.

Index Terms- Head trauma, Brain Hemorrhage, Blunt Trauma.

I. INTRODUCTION

Wounds are one of the frequent cases that occur in life. Wound is a break in a continuity of any bodily tissue due to violence. Wounds can happen to living victims as well as the dead.¹ Wounds can be happen on the whole part of body human. However, most frequent deaths occur because of wound in the area of head. Head injury or traumatic brain injury defined as injuries involving skin of head, skull, and the bones that make up the face and brain.²

Traumatic brain injury is main reason of disability and death worldwide in individual with age under 45 years. In the United States from 1997 to 2007, total of patient who went to hospital and diagnosed as traumatic brain injury was 1,365,000 people a year, 275,000 people need to stay at hospital and numbers average death due to traumatic brain injury brain reach 52,000 people (18.4 per 100,000 population).³

There is a number cause of death by head injury. It can be occurs on brain tissue that cause contusion or laceration and blood vessels of the brain cause epidural, subdural, subarachnoid or intercerebral hemorrhage. If not handled quickly, will cause a number of secondary damage such as brain edema, brain ischemia, brain infection and increased of intracranial pressure which will lead to respiratory failure.⁴

Head injury has long been considered as the most common mechanics cause of death. Head injury also becomes most common cause of deaths in accident. Similar injury pattern could

caused by different mechanisms, while same mechanism could cause different injuries pattern.⁵

Linear fracture is the most common type of skull fracture, consisting of from 70%-80% head injury, and often related with accident like falls, while depressed fractures show more correlation with interpersonal violence.⁵

II. CASE REPORT

The male corpse sent by investigator with a letter to request Visum et Repertum. The corpse found inside a room in body condition is supine, covered blood and excrete bad smell. Only the victim stays at that home. The victim is 40 years old based on information from identity card.



Image 1. Male corpse 40 years old in condition already on decay process.

External Examination

- The body is unlabeled and unsealed.
- Corpse wearing a t-shirt and short pants.
- No post mortem lividity and rigidity were found. Already found signs of decay like change of skin color, bulging on stomach, and bubbles of decay below the skin.
- Found maggots with largest size is 10mm.
- Corpse is a male, 166 cm length, the color of skin is yellow bright.
- Head:
 - Shape: symmetrical. Hair: straight, black, short hair.

- At the head, there are bruises colored dark red and swollen with size 5cm x 4cm.
- On the right side of forehead, there are 2 stab wound, size 4 cm and 6 cm long. Around wound, there are redness bruises.
- Eyes: right and left eyes comes out consequence of decay .
- Nose: symmetrical, bleeding from the right and left nostrils.
- Mouth: Tongue was bitten and sticking out.

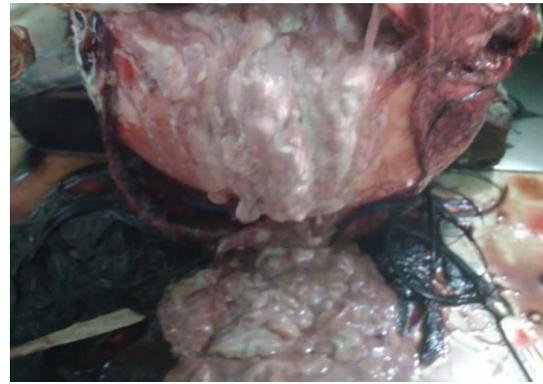


Figure 2. Stab wound on forehead

g. Stomach: looks bloated, there are no signs of violence.

Internal Examination

- chest cavity
 - Tardieu's spot on both lungs, chewy consistency, dark red color. Right lungs was 350 gr and left lung left was 300 gr
- Stomach Cavity
 - There is no food in the stomach.
 - There were no abnormalities in the small intestine, large intestine, pancreas, spleen and kidney.
- Cavity Head
 - On the inner surface of head skin, there were large area of blood absorption.
 - Skull suffered a comminuted fracture at the apex of the head, linear fracture of frontal bone to occipital bone.
 - **Figure 3.** Fracture of the skull
 - Brain tissue seen melt due to the decay process .



- **Figure 4.** Brain tissue that has melt as a result of the decay process

Conclusion on Visum et Repertum

1. The corpse is a male.
2. On external examination: There were signs of the decay process. A stab wound was found on the left side of the forehead due to sharp violence. Bruises with swelling on the top of the head due to blunt force.
3. On internal examination: There were bleeding spots in the lungs and heart, blood absorption on the inner side of the scalp, fractures in the skull, and blood absorption in piamater.
4. Estimated time of death of the victim is 2-4 days. The cause of death of the victim because of blunt trauma of the head that lead to cerebral hemorrhage.

III. DISCUSSION

The case above is a case of the body of an adult male in the house. According to the family, the victim lives alone in his house. From the examination of the body, several things were found. The first is the estimated duration of death of the victim.

As an forensics, we could not determine the time of death a person (*postmortem interval*) for sure. However, in tanatology, we could estimate the time of death by measuring corpse temperature, post mortem lividity, rigidity and decay process.⁶

In this case, we found decomposition processes such as a greenish discoloration of the skin of the abdomen, abdominal bulging, exfoliation of the epidermis and bubbles of decay below the skin were found in the bodies. This indicates that the estimated duration of death is more than 24 hours. In this case also found maggots with the largest length is 10 mm (instar II) so it can be concluded that the estimated death of the victim is 2-4 days.

Death is a process that can known by clinical through inspection from changes that occur in the body corpse. Symptom will could seen after a number of minutes, hours and so on. Lost oxygen can becomes reason of death. This thing because the obstacle of oxygen enter lungs (hypoxia).⁷ In this case we found a number of sign asphyxia like bluish on finger of the hands and feet. Internal examination shows petechiae in lungs and heart.

Injuries to the victim were more experienced in the head area. From the examination, injuries outside the head area were only found in the knees and lower legs. Injuries to the head are caused by sharp and blunt force. On the forehead, an open wound was found with flat wound edges, sharp wound angle and no tissue bridge. The characteristics of this wound are more towards sharp

violence. Sharp violence is divided into 2 types, namely stab wounds and incisional wounds. It could be that the death of the victim in this case was the result of blood loss from this open wound, but if seen from the other findings, one of which was a bluish fingertip, then this did not match. If the death is due to heavy blood loss, the fingertips should appear pale.

Signs of blunt trauma to the victim's head were seen on the top of the head where there was bruising and swelling. As with the bruises, on the inner side of the scalp layer was found extensive blood infiltration. Just below the bruise, a comminuted fracture was also found. The bone is split into several pieces which, if the shards are removed, will reveal a hole at the top of the head. From the front side of the orifice a linear fracture leading to the frontal bone was seen and from the back side of the orifice there was also a linear fracture leading to the occipital bone. From the shape of the fracture, it can be concluded that the cause of fracture is the result of blunt force. This is reinforced by the absence of lacerations on the scalp where the fracture is located.

On examination of the piamater found blood absorption. However, the brain tissue has melted due to the process of decay. Absorption of blood in the piamater indicates that intracranial hemorrhage has occurred leading to subarachnoid hemorrhage. However, it is possible that it can also be exacerbated by direct damage to brain tissue in the form of lacerations or brain bruises, considering the shape of the fracture which indicates the presence of a large amount of energy hitting the victim's head. However, due to the decay process, the complete macroscopic picture of the brain cannot be assessed.

Brain hemorrhage is one of the primary brain injuries. Concurrent primary injury with change metabolic and mobile trigger cascade biochemistry, causes secondary wave or secondary brain injury. Manifestation from secondary brain injury are cerebral edema and increased intracranial pressure. And if not handled with quick will make happening stem brain ischaemic so that result in respiratory failure.⁸

According to information from the police, the victim was found in the victim's room, lying on the floor. No tools were found which were thought to cause injuries to the victim's head. Therefore, it is very unlikely that the victim's death was caused by suicide or an accident. The criminal articles related to this case are about severe persecution resulting in death in Pasal 351 line (3) and Pasal 354 of the KUHP and murder case in Pasal 338 and 340 of the KUHP.

IV. CONCLUSION

This report contains cases of blunt force head injury with suspected homicide. On autopsy examination, it was found that there were signs of asphyxia with the cause of intracranial bleeding exacerbated by skull fractures due to blunt force and injuries to the head caused by sharp and blunt force. The criminal articles that can be imposed are acts of severe abuse that result in death in Pasal 351 line (3) and Pasal 354 of the KUHP or concerning murder in Pasal 338 and 340 of the KUHP.

REFERENCES

- [1] [1] Satyo AC. Aspek Medikolegal pada Forensik Klinik. Majalah Kedokteran Nusantara Vol 39 No 4; 2006.
- [2] [2] Snell RS. Clinical Anatomy for Medical Student (6th ed). Jakarta: EGC; 2006.
- [3] [3] Irianto K. Anatomi dan Fisiologi. Bandung: Alfabeta; 2012.
- [4] [4] Basmatika, I. SECONDARY BRAIN INJURY. E-Jurnal Medika Udayana, 444-464; 2013.
- [5] [5] Kranjoti E. Forensic investigation of cranial injuries due to blunt force trauma: current best practice. Research and Reports in Forensic Medical Science; 2015.
- [6] [6] Dix J, Graham M. Time of Death. Decomposition and Identification An Atlas. CRC Press LLC; 2000.
- [7] [7] Budiyo. Kematian Akibat Asfiksia Mekanik. Ilmu Kedokteran Forensik. Edisi 1. Jakarta: Fakultas Kedokteran Universitas Indonesia; 1997.
- [8] [8] Stippler M. Craniocerebral Trauma. Bradley's Neurology in Clinical Practices. London: Elsevier; 2015.

AUTHORS

First Author – Reza Priatna, Department of Forensic and Medicolegal, Medicine Faculty University of North Sumatra RS. H. Adam Malik 20136, Medan, Indonesia., Email: rjpr11111@gmail.com

Second Author – Adriansyah Lubis, Department of Forensic and Medicolegal, Medicine Faculty University of North Sumatra RS. H. Adam Malik 20136, Medan, Indonesia.

Third Author – Zulfia Retnanti Marissa, Department of Forensic and Medicolegal, Medicine Faculty University of North Sumatra, RS. H. Adam Malik 20136, Medan, Indonesia.

Inventory Ownership Analysis And Its Influence On Performance Of Manufacturing Firms In Kenya

Benedict Mutinda Kimwaki *, Prof. Patrick Karanja Ngugi **, Prof. Rommanus Odhiambo **

* PhD Candidate, JKUAT, Kenya

** MUST, Kenya

DOI: 10.29322/IJSRP.12.10.2022.p13040

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13040>

Paper Received Date: 6th September 2022

Paper Acceptance Date: 5th October 2022

Paper Publication Date: 13th October 2022

Abstract- The study sought to establish the influence of inventory ownership analysis on the performance of manufacturing firms in Kenya. The study was anchored upon the theoretical foundation of the transaction cost theory. The study reviewed both theoretical and empirical literature and then proposes the research methodology that addressed the gaps identified in literature as well as to validate the research hypotheses. Descriptive and cross-sectional research designs were adopted. The researcher preferred this method because it allows an in-depth study of the subject. The 2020 KAM directory has listing of members (firms) by sectors which contains a register of 12 sectors of those in manufacturing firms spread all over the country. KAM membership comprises of small, medium and large enterprises. The size is measured by their total assets. The population of the large sized registered members as per the directory is 461. This study employed Cochran's formula to sample 160 large manufacturing firms from the total population. A semi-structured questionnaire was administered to collect qualitative and quantitative data. Secondary data was collected from firm's reports and websites. Quantitative data was analyzed using both descriptive and inferential statistics and with the help of SPSS. Multiple regression model was used to show the relationship between the dependent variable and the independent variable. The findings revealed that Inventory ownership analysis influenced the performance of the manufacturing firms in Kenya. The study concluded that through adoption of inventory ownership analysis, the operational costs were reduced as well as the reduction of lead time.

Index Terms- Inventory Ownership Analysis, Supply Chain Alignment, Manufacturing Firms

I. INTRODUCTION

1.1 Background to the Study

Inventory ownership analysis is the process of establishing all lifecycle costs that follow from inventory ownership. Besides obvious purchase costs, these can also include substantial costs for installing, deploying, operating, and maintaining the same inventory. Inventory ownership analysis often finds large differences between purchase price and total life cycle costs (Mokadem, 2016). According to Milligan (2012) inventory

ownership analysis involves continuous delivery of materials, component or subassemblies in a supply chain is very different and much more demanding than the total cost of ownership of equipment (for example computers and printers). In these cases, inventory ownership analysis is essentially a lifecycle cost computation adding to the acquisition cost of the equipment, the expected amount of operation and maintenance costs in order to compare better different alternatives.

The concept of inventory ownership analysis is well developed and widely used (Ellram, 2013), in particular in some industries, such as information technology, where the purchasing cost can be very low if compared to maintenance, service and all other costs occurring during the life time of the system. However, evaluating TCO remains a delicate task, which requires both recognizing hidden costs and gathering enough data to estimate them (Hines, 2015). At the same time, since more and more transactions involve both goods and services, a simultaneous evaluation of the complete package cost is required. Furthermore, inventory ownership analysis is becoming not only a purchasing tool, but also a selling one, since vendors are using it to demonstrate how their products, which are more expensive if compared to competitors, in the long-run imply a lower inventory ownership analysis (Rezaei et al., 2017).

Moreover, because of supply chains complexity, today transactions do not often involve only a buyer and a seller, but also a third or even a fourth party, who can be intermediaries, service providers, end users, value added resellers, etc. (Milligan, 2012). If it is the case, inventory ownership analysis can result in different values for each of the actors involved. As a consequence, it would be of great interest being able to evaluate inventory ownership analysis, in order to help buyer doing the right choice and sellers improving their product offering (Swenson, 2014).

Inventory ownership analysis is an aspect of supply chain alignment, which is the process of integrating the activities in a supply chain framework to incorporate all the main stakeholders ranging from customers, employees and the suppliers (Melnyk, Stewart & Swink, 2014). Through inventory ownership analysis as a component of supply chain alignment, consistency and fit in strategic goals, metrics and activities between firms is enhanced through the interlinked upstream and downstream processes of supply chain.

The manufacturing sector being the third biggest industrial sector, contributes significantly to GDP in Kenya. The growth in the Kenyan manufacturing industry has declined to 3.3 per cent in 2011 as compared to 4.4 per cent in the year 2010 mainly due to a challenging operating environment (KNBS, 2012). Furthermore, the manufacturing sector has high yet untapped potential to contribute to employment and GDP growth. Embracing inventory ownership analysis remains integral in enhancing the success of the manufacturing sector.

1.2 Statement of the Problem

Despite the complexity and length of manufacturing firms' supply chains, continuous improvement and alignment to the overall organizational goals is integral to the sustainability and overall performance of the firm in a competitive environment. However, this desired optimality in alignment and performance is seldom attained (World Bank, 2013). Inventory ownership analysis as one of the components of supply chain alignment is therefore paramount to any organization since it leads to improved product design, quality and cost consciousness, which means an improvement in the performance of a firm.

Large scale manufacturers operating in Kenya have been continuously registering stagnation and declining profits for the last five years due to a turbulent operating environment as well as non-alignment of their respective supply chains. There has been a rise in complaints by the public, professionals and other stakeholder's about the manufacturing firms' performance (Mohiuddin & Su, 2013; Muthoni & Nyakagwa, 2014; Mwirigi & Were, 2014). Several studies have shown the need for properly managed inventory and aligned supply chain processes through inventory ownership analysis in order to enhance the performance of the manufacturing industry (Skipworth & Julien, 2015; Kaplan & Norton, 2014; Attia, 2015; Mokadem, 2016). These studies, however, have focused on different contexts, and their findings may not be generalized to manufacturing sector in Kenya. This study therefore sought to assess the role played by inventory ownership analysis on the performance of manufacturing industry in Kenya.

1.3 Study Objectives

2.2 Conceptual Framework

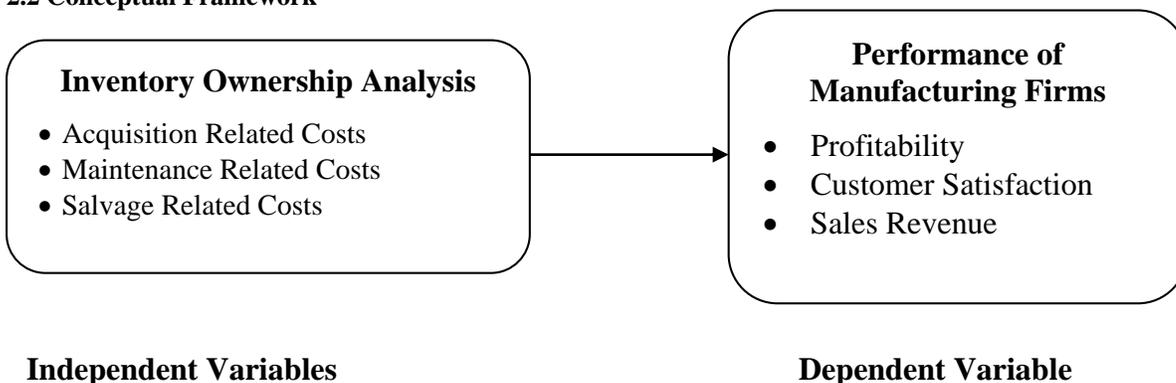


Figure 1: Conceptual Framework

The aim of this study was to examine the influence of inventory ownership analysis on performance of manufacturing firms in Kenya.

II. LITERATURE REVIEW

2.1 Theoretical Review

This paper was anchored on transaction cost theory. This theory was put forward by Coase (1998) where he specified that in procurement these costs may include among others; life cycle related costs of inventory, equipment or property. Transaction cost theory tries to explain how companies compete cost-wise and why companies expand or source out activities to the external environment (Bharadwaj & Matsuno, 2012). Transaction cost theory supposes that a company will try to minimize the cost of exchange with the environment and the bureaucratic cost of exchange within the company. This may entail minimizing acquisition related costs (Carr & Smeltzer, 2012).

When external transaction costs are higher than the company's internal costs then the company will grow because the company is able to perform its activities more cheaply than if the activities were performed in the market place (Luzzini, Caniato, Ronchi & Spina, 2012). This means keeping the maintenance and acquisition related costs at a minimum. According to Gonzalez-Benito and Spring (2010) transaction cost arises every time a product or service is being transferred from one stage to another where new sets of capabilities are needed to make the products or services. Here acquisition and salvage costs may arise.

Companies will therefore look at the inventory ownership analysis of the entire process. Based on this theory, Fredikind (2014) argues that supply chain alignment lowers the cost of inventory ownership through looking at the total costs involved. Chae, Yen and Sheu (2015) says that transaction costs relating to procurement are those costs that enterprises incur in trying to acquire inventory and the overall procurement costs involved. This theory supports the variable inventory ownership analysis by linking the values of acquisition, maintenance and salvage costs to essential metrics that can be managed to ensure achievement and effective supply chain alignment.

2.3 Review of Empirical Literature

According to Carr and Ittner (2012) in their study, they used a questionnaire to enumerate the major cost factors that affect the inventory ownership analysis of the companies surveyed. This questionnaire was sent to members of the Institute for Supply Management. In summary, their study reported that the criteria for the selection of suppliers who are total cost of ownership compliant are divided into thirteen categories: operating costs, quality, customer-related costs, logistics, technological advantages, starting price, opportunity cost, capacity and reliability, maintenance, inventory costs, transaction costs, lifecycle costs, and others.

Dumond and Siferd (2010) opine that inventory ownership analysis facilitates companies in dealing with pressure in their own customer markets and making the purchasing function more value oriented. Inventory ownership analysis also can be viewed as extending ABC to a boundary-spanning context, where the firm is reliant on cooperation and information provided by suppliers, or inferences drawn from alternative prices quoted by suppliers for changes in their market offerings (e.g., changes in materials in the core offerings, changes in supplementary services, programs, and systems).

Cliff and Siferd (2013) conclude that for accounting to support sourcing decisions, the “value chain perspective of strategic cost management with its focus on ‘cost of ownership’ rather than supplier price is essential.” Milligan (2012) discusses that accounting information is one of the inter-organizational design instruments that must be considered to stimulate cooperation between firms in the supply chain.

According to Swenson (2014), organizations are largely in the dark when it comes to making total cost calculations. Ellram (2013) identified some factors that act as barriers to the adoption of inventory ownership analysis, such as user resistance and complexity of cost data. The intent of inventory ownership analysis analyses is to improve mutual profitability for the supplier and customer by modifying how they do business together (such as, which firm undertakes certain activities, or what the effects are of using certain materials).

III. RESEARCH METHODOLOGY

3.1 Research Design

The study used descriptive and cross-sectional research designs. Descriptive research enabled collection and analysis of quantitative and qualitative data, while giving the study an ability to intensively answer the research questions. Cross-sectional research design was on the other hand used to establish the relationship between the study variables.

3.2 Population of the Study

The study targeted large manufacturing firms in Kenya. There are 461 large manufacturing firms in Kenya according to KAM (2020). The unit of observation is selected because they are the ones involved in execution of the firms’ supply chain management practices and thus stands high chances of providing reliable information on influence of supply chain alignment on performance of manufacturing firms in Kenya.

3.3 Sampling

Using Cochran (1977) formula, a sample size of 160 respondents was obtained from the 461 firms. The respondents

were picked through stratified random sampling, where the 12 sub-sectors of the manufacturing firms were the strata. A proportionate number was picked from each of the stratum and the respondents picked randomly.

3.4 Data Collection and Data Analysis

The research utilized a structured questionnaire to collect data. The collected data was analysed through SPSS. This study adopted a descriptive data analysis and inferential data analysis. Descriptive data analysis was adopted for this study because descriptive analysis was used to describe the basic features of the data in a study. Inferential statistics through multiple regression model was used to test for the hypothesis.

IV. RESEARCH FINDINGS AND DISCUSSIONS

4.1 Response Rate

The number of questionnaires that were administered to all the respondents was 160. A total of 127 questionnaires were properly filled and returned from the manufacturing firm’s employees. This represented an overall successful response rate of 79.4%, which was considered adequate for analysis.

4.2 Inventory Ownership Analysis

The study sought to assess the relationship between inventory ownership analysis and performance of manufacturing firms in Kenya. The main aspects of inventory ownership analysis focused on the study were: acquisition related costs, maintenance costs, and salvage related costs. The results as shown in Table 1 revealed that majority of the respondent (3.76) agreed that their respective organizations had a framework for reducing the costs of acquiring inventory. The results were varied as shown by a Standard deviation of 0.84. Further results indicated there were limits set on the levels of acquisition costs for the companies’ inventory as evidenced by a mean of 3.54 and a standard deviation of 0.99. The results further indicated that most of the companies had put measures to ensure any additional cost of acquiring inventory is justifiable as evidenced by a mean of 3.76 and a standard deviation of 0.84. According to Semchenkova, Chulkova, and Lukashva (2019), putting the appropriate measures for controlling inventory ownership costs is essential for maintaining a proper flow of inventory and reducing costs. The findings imply that the maintenance of inventory is a cost that most of the companies incurred and felt the urge of minimizing this cost as a way of ensuring minimal costs of owning inventory. Tinkham et al. (2018) alludes that the inventory maintenance is essential for organizational performance but it is essential to minimize the costs of maintaining the inventory in order to reduce the entire cost of owning inventory.

The findings imply that inventory ownership has been upheld by most of the surveyed manufacturing firms and this could be a significant driver to their performance. The findings are in line with those by Dobos and Vörösmarty (2019) who found out that through enhanced means of reducing the costs of inventory ownership, companies are able to save on the costs of operation and this significantly contributes to firm performance and competitiveness.

Table 1: Descriptive Results on Inventory Ownership Analysis

Statement	N	Mean	Std. Dev.
The organization has a framework for reducing the costs of acquiring inventory	1273.76	0.87	
There are limits set on the levels of acquisition costs for the company's inventory	1273.54	0.99	
The company has put measures to ensure any additional cost of acquiring inventory is justifiable	1273.76	0.84	
There are significant costs incurred in maintaining inventory in our company	1273.81	0.89	
The company has put measures to control and minimize the inventory maintenance costs	1273.69	0.94	
Audits are carried out to establish which inventory should be maintained and those that should be disposed	1273.97	0.80	
The company has at times incurred costs on recouping its inventory	1273.83	0.81	
There have been strategies by the company to minimize the costs of salvaging inventory	1273.83	0.92	
Measures have been taken to reduce incidences where the company is at risk of losing inventory	1274.09	0.88	

4.3 Performance of Manufacturing Firms

The study sought to establish the performance of the manufacturing firms in Kenya. The respondents were asked to indicate their level of agreement on specific statements regarding the performance of their respective firms. This was based on a five-point Likert's scale. The findings as shown in Table 2 revealed that majority of the respondents disagreed that their company has been committed to reduce the costs of operations in all its activities. Majority of the respondents disagreed that the customer waiting time had been reduced continuously over the

years in their respective firms, and a further majority disagreed that the positive customer feedbacks had been increasing in their respective companies for the past five years (Mean =2.51; standard deviation = 1.28). It was further established that most of the organizations recorded high returns from their customers, as a result of not meeting the needs and specifications of the customers (35.7%; disagree = 21.6%). The respondents further disagreed that there were stable revenue flows in their respective companies' operation framework over the years.

Table 2: Descriptive Results on Organizational Performance

Statement	Mean	Std. Dev.
Our company has been committed to reduce the costs of its products	2.61	1.35
The customer waiting time has been reducing continuously over the years in our firm	2.46	1.35
The positive customer feedbacks have been increasing in our company for the past five years	2.51	1.28
There are fewer returns/rejections by our customers than it was in the past	2.39	1.47
The company has been recording sustainable profit margins in the past five years	2.41	1.46
The attained profits have been adequate for re-investment in other ventures by our company	3.21	1.27
There are stable revenue flows in the company's operation framework over the past five years	2.18	1.29

4.4 Correlation Analysis

Correlation analysis was used to determine both the significance and degree of association of the variables and predict the level of variation in the dependent variable caused by the independent variables. Table 3 shows the findings. The correlation analysis to determine the association between inventory ownership analysis and performance of manufacturing firms in Kenya, Pearson correlation coefficient computed and tested at 5%

significance level. The results indicate that there was a positive relationship and strong relation as shown by Pearson correlation coefficient of 0.642 between Inventory Ownership Analysis and performance of manufacturing firms in Kenya. In addition, the researcher found the relationship to be statistically significant at 5% level (p=0.000, <0.05).

Table 4: Summary of Pearson's Correlations

		Performance
Performance		1
Inventory Ownership Analysis	Pearson Correlation	.642
	Sig. (2-tailed)	.000

4.5 Hypotheses Testing

H02: Inventory ownership analysis has no significant relationship with performance of manufacturing firms in Kenya

The third objective of the study was to examine the relationship between inventory ownership analysis and performance of manufacturing firms in Kenya. The linear

regression model analysis was carried out to establish the relationship between inventory ownership analysis and performance of manufacturing firms in Kenya and the output included the model summary, the ANOVA results and the regression coefficients. The model summary results are as shown in Table 5. As the findings portray, the R² for the variable was

0.412. This implies that inventory ownership analysis influences up to 41.2% variation of the performance of manufacturing firms in Kenya.

The ANOVA results are as shown in Table 5. As the results portray, the F-statistics for the model was 87.594 at a significant level of $0.000 < 0.05$. This implies that inventory ownership analysis significantly influences the performance of manufacturing firms in Kenya.

The regression coefficients on the other hand are as shown in Table 5. As the results portray, the Beta coefficient for inventory ownership analysis was 0.657. This implies that a unit change in inventory ownership analysis would lead up to 65.7% increase in

the performance of manufacturing firms in Kenya. The p-value was 0.000 which is less than the standard p-value of 0.05. This means that there is a significant influence of inventory ownership analysis on the performance of manufacturing firms hence the rejection of the null hypothesis that there is not significant influence of inventory ownership analysis on the performance of manufacturing firms in Kenya. The findings are in line with those by Lambert and Croxton (2015) who indicate that inventory ownership analysis is critical in enabling the company to establish how much inventory it owns, thus they are able to strategies for their management of the inventory for enhanced performance.

Table 5: Hypothesis Testing

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.642 ^a	.412	.407	.52326

a. Predictors: (Constant), Inventory Ownership Analysis

ANOVA Results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	23.983	1	23.983	87.594	.000 ^b
	Residual	34.225	125	.274		
	Total	58.208	126			

a. Dependent Variable: Performance of Manufacturing Firms

b. Predictors: (Constant), Inventory Ownership Analysis

Regression Coefficients

Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Coefficients Beta		
1	(Constant)	1.089	.244		4.459	.000
	Inventory Ownership Analysis	.657	.070	.642	9.359	.000

a. Dependent Variable: Performance of Manufacturing Firms

V. CONCLUSION AND RECOMMENDATIONS

The study sought to determine the relationship inventory ownership analysis on performance of manufacturing firms in Kenya. The findings of the study revealed that the relationship between inventory ownership analysis and performance was significant at 5% level of significance. The p-value was 0.000 which indicated that the null hypothesis failed to be accepted at 5% level of significance hence inventory ownership analysis have a significant influence on performance of manufacturing firms in Kenya.

The study also concluded that inventory ownership analysis has a significant relationship with performance of manufacturing firms in Kenya. The sub-constructs of inventory ownership analysis namely acquisition related costs, maintenance related costs, salvage related costs influence performance positively.

The study recommends that manufacturing firms should invest in acquisition related costs, maintenance related costs, salvage related costs since it influences performance positively. Inventory ownership analysis being the ability to integrate, build and reconfigure internal and external expenses to address rapidly-changing customer needs, can also take the form of various ways apart from the ones discussed in the current study and hence the future scholars can seek to explore other measures of this factor.

The study findings can also be linked to the transaction cost theory. Transaction cost theory tries to explain how companies compete cost-wise and why companies expand or source out activities to the external environment. Transaction cost theory supposes that a company will try to minimize the cost of exchange with the environment and the bureaucratic cost of exchange within the company. This may entail minimizing acquisition related costs.

REFERENCES

- [1] Attia, A. (2015). Testing the effect of marketing strategy alignment and triple-A supply chain on performance in Kenya. *Euro Med Journal of Business*, 10(2), 163–180.
- [2] Bharadwaj, N., & Matsuno, K. (2012). Investigating the antecedents and outcomes of customer firm transaction cost savings in a supply chain relationship. *Journal of Business Research*, 5(9), 62-72.
- [3] Carr, A.S. & Smeltzer, L.R. (2012). The relationship between information technology use and buyer-supplier relationships: an exploratory analysis of the buying firm's perspective. *IEEE Transactions on Engineering Management*, 49(3), 293-304.
- [4] Carr, L. P., & Ittner, C. D. (2012). Measuring the cost of ownership. *Journal of Cost Management* 7(2), 42-51.
- [5] Chae, B., Yen, R.H. & Sheu, C. (2015). Information technology and supply chain collaboration: moderating effects of existing relationships between partners. *IEEE Transactions on Engineering Management*, 52(4), 440-458.

- [6] Cliff, M., & Siferd, S. P. (2013). Total cost of ownership: a key concept in strategic cost management decisions. *Journal of Business Logistics*, 19 (1), 55-84.
- [7] Dobos, I., & Vörösmarty, G. (2019). Inventory-related costs in green supplier selection problems with Data Envelopment Analysis (DEA). *International Journal of Production Economics*, 209, 374-380.
- [8] Dumond, L., & Siferd, S. P. (2010). Purchasing: the cornerstone of the total cost of ownership concept. *Journal of Business Logistics*, 14(1), 163-184.
- [9] Ellram, L. M. (2013). Total cost of ownership: elements and implementation. *International Journal of Purchasing and Materials Management*, 29(3), 3-11.
- [10] Ellram, L.M. (2015). Early Supplier Involvement and Procurement effectiveness in Public Entities in London. *European Journal of Purchasing & Supply Management* ;3(1):21–31.
- [11] Fredikind, T. (2014). Transaction Cost Economics as a contributing theory to Supply Chain Management: an assessment and application on theoretical basis.
- [12] Gonzalez-Benito, J., & Spring, M. (2010). Complementarities between JIT purchasing practices: An economic analysis based on transaction costs. *International Journal of Production Economics*, 6(1), 279-293.
- [13] Hines, D., (2015). Activity-based costing and total cost of ownership: a critical linkage. *Journal of Cost Management*, 4(2), 63-84.
- [14] Kaplan, R.S. & Norton, D.P. (2014). The strategy map: guide to aligning intangible assets. *Strategy & Leadership*, 32(5), 10-21.
- [15] Luzzini, D., Caniato, F., Ronchi, S. & Spina, G. (2012). A transaction costs approach to purchasing portfolio management. *International Journal of Operations and Production Management*, 32(9), 1015-1042.
- [16] Melnyk, S.A., Stewart, D.M. & Swink, M. (2014). Metrics and performance measurement in operations management: dealing with the metrics maze. *Journal of Operations Management*, 22(3), 209-220.
- [17] Milligan, B. (2012). Tracking total cost of ownership proves elusive. *Purchasing*, September. 2(3), 22-23.
- [18] Mokadem, M. (2016). ISO 9000 moderation role over supply chain alignment in manufacturing context. *Journal of Manufacturing Technology Management*, 27(3), 338-363.
- [19] OECD. (2010). Integrity in Public Procurement: Mapping out Good Practices for Integrity and Corruption Resistance in Public Procurement.
- [20] PPOA. (2010). Assessing Procurement Systems in Kenya Report. Nairobi: Public Oversight Authority.
- [21] Rezaei, M., Shirazi, M. A., & Karimi, B. (2017). IoT-based framework for performance measurement: A real-time supply chain decision alignment. *Industrial Management & Data Systems*.
- [22] Semchenkova, S. V., Chulkova, G. V., & Lukasheva, O. L. (2019). Use of data of inventory and monitoring of lands in the complex development program of territories. *International agricultural journal*, (2).
- [23] Skipworth, H., Godsell, J., Wong, C. Y., Saghiri, S., & Julien, D. (2015). Supply chain alignment for improved business performance: an empirical study. *Supply Chain Management: An International Journal*.
- [24] Swenson, D. (2014). The benefits of activity-based cost management to the manufacturing industry. *Journal of Management Accounting Research*, 7(4), 167-177.
- [25] Tinkham, W. T., Mahoney, P. R., Hudak, A. T., Domke, G. M., Falkowski, M. J., Woodall, C. W., & Smith, A. M. (2018). Applications of the United States Forest Inventory and Analysis dataset: A review and future directions. *Canadian Journal of Forest Research*, 48(11), 1251-1268.
- [26] World Bank. (2013). "Reducing Supply Chain Barriers Could Increase Global GDP Up To 6 Times More Than Removing All Import Tariffs Report", Switzerland.

AUTHORS

First Author – BENEDICT MUTINDA KIMWAKI, PhD
Candidate, JKUAT, Kenya

Second Author – PROF. PATRICK KARANJA NGUGI
JKUAT, Kenya

Third Author – PROF. ROMMANUS ODHIAMBO
MUST, Kenya

An Impact Of Mutual Funds In Long Term Investments

Dr.R. Sangeetha¹|Ms.V. Arthi²| Ms.T. Harini Nivetha³

¹Associate professor of Sri Krishna Arts and Science College, Coimbatore

²Master of international business, Sri Krishna Arts and Science College, Coimbatore

³Master of international business, Sri Krishna arts and science college, Coimbatore

DOI: 10.29322/IJSRP.12.10.2022.p13041

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13041>

Paper Received Date: 6th September 2022

Paper Acceptance Date: 5th October 2022

Paper Publication Date: 13th October 2022

Abstract- Mutual funds are the most famous venture instruments in the monetary market. Putting resources into share implies that you're investing straightforwardly in equity markets. While mutual funds investment means an appointing a professional fund manager is investing for the investor in either equity funds or debt funds. This is significant research of mutual funds and their importance. This study aims to get a clarified knowledge towards the investment opportunities in mutual fund investments and plans. This is likewise showed by means of the development of the enterprise general and emergence of quantity of schemes. The human beings which influence the buyers in investing in mutual fund are sellers, relatives and those.

Index Terms- mutual funds, importance, classification and categories of mutual funds and compound interest calculations in mutual funds

I. INTRODUCTION OF MUTUAL FUND

An investor in a mutual fund scheme conspire gets units which are as per the quantum of cash contributed by him. These units address an investor proportionate proprietorship into the resources of the plan and his obligation in the event of misfortunate to the asset is restricted to the degree of sum contributed by him.

The pooling of assets is the biggest strength for mutual funds. The generally lower amount expected for investing into a mutual fund scheme empowers little retail investors enjoy the advantages of expert money management and give allowance to different markets which who were not able to access. The professional manager who accesses a mutual fund shall put away the cash on behalf of investors in the investment scheme under such equity bonds or debt bonds.

II. LITURATURE REVIEW:

William F. (1966) suggested a measure for the evaluation of portfolio performance. Drawing on results obtained in the field of portfolio analysis, economist Jack L. **Treynor** has suggested a new predictor of mutual fund performance, one that differs from virtually all those used previously by incorporating the volatility of a fund's return in a simple yet meaningful manner.

Michael C. Jensen (1967) derived a risk-adjusted measure of portfolio performance (Jensen's alpha) that estimates how much a manager's forecasting ability contributes to fund's returns. As indicated by Statman (2000), the e SDAR of a fund portfolio is the excess return of the portfolio over the return of the benchmark index, where the portfolio is leveraged to have the benchmark index's standard deviation.

This paper uses a technique called conditional performance evaluation on a sample of eighty-nine Indian mutual fund schemes. This paper measures the performance of various mutual funds with both unconditional and conditional form of CAPM, UTADIS multi-standards choice useful resource method is hired so that you can develop mutual fund's performance fashions. Goal programming version is employed to decide percentage of selected mutual funds inside the very last portfolio.

OBJECTIVE OF THE STUDY:

- ❖ To identify the factors, differentiation and challenges faced in mutual funds.
- ❖ To know the merits and demerits in the various investment options like mutual funds and calculation strategy in mutual funds.
- ❖ This gets a clarified knowledge towards the difference between mutual funds and other investment options.

TYPES OF MUTUAL FUNDS:

• EQUITY MUTUAL FUNDS

It is the most familiar fund used in investment. It allows investors invest in stock market with the professional manager appointed in the mutual fund. Though it involves higher risk share market will gives a higher return potential in long run.

• SECTOR SPECIFIC FUNDS

It is a sector like infrastructure banking, mining etc, or customised segments like large cap, mid cap and small cap. It will be suitable for investors who is having an attitude to take higher risks with higher returns.

• INDEX FUNDS

Index funds are not similar as equity funds because there is no more dependence of investment managers. It gives the guarantee to the return in line with the index they assure. It is flexible to face the loss but there is the limit for the proportional loss of their index. It is suitable for the investors who is ready to accept the medium risk.

- **TAX SAVING FUND**

Tax saving fund offer a benefit to the investors in the tax. These tax payers are also investing in equities are also called as **Equity linked saving scheme (ELSS)**. This type of fund has 3-year lock in period.

- **LIQUID FUND**

Money market fund is like a short-term debt instrument analysing to give a reasonable return to investors within a short period of time. These funds will suitable for the investors who are looking for a low-risk attitude with the parking surplus funds over a short term.

- **DEBT MUTUAL FUNDS:**

These funds invest in majority of money in debt fixed income like government securities, treasury bill, commercial papers. They have a lower risk of outlook and have a ideal for investors who has a low risk attitude towards generating a steady income in the investing methods.

- **HYBRID MUTUAL FUND**

Hybrid mutual funds involves both equity funds and debt funds. It involves in a minimum risk towards the procedural data analytics. It gives a long-term capital gain with the returns of 7%.

FACTORS OF MUTUAL FUND:

1. FUND MANAGEMENT TEAM:

The fund supervisor and the fund management group can considerably impact the fund's overall performance. The fund manager and their group of professionals manage investors' cash by investing them throughout securities that align with the fund's investment objective. In addition, they actively manipulate the fund portfolio thru periodic critiques and analysis. Thus, the fund supervisor's security selection and investment timing have a huge impact on the fund's performance.

Therefore, fund managers with accurate industry enjoy and tune facts tend to be extra efficient in coping with traders' cash. Hence, it's miles recommended to choose budget managed through skilled fund managers.

2. ECONOMIC CHANGES:

In mutual fund investments, one of the most crucial matters to keep in mind is how properly the fund invests in a sure zone or industry. This is due to the fact a few policy changes made by using the authorities will have a sizable impact on exceptional parts of the economy in one-of-a-kind ways. For instance, at some stage in the covid19 pandemic, the healthcare industry wasn't hit as tons as the opposite sectors.

The shares costs have been greater or less stable and feature carried out well as compared to other industries. Similarly, one

quarter can carry out well during a period and sometime may additionally witness some stiffness.

3. EXPENSE RATIO:

All of the costs and fees that go into running and managing a mutual fund, such as management fees, distribution fees are included in the expense ratio of a mutual fund. As per SEBI guidelines, mutual fund houses cannot change a total expense ratio of more than 2,25%. A higher expense ratio can reduce your net profit. Thus, it is ideal to find funds with low expense ratio.

BENEFITS OF MUTUAL FUNDS:

1. LIQUIDITY:

Liquidity is the ease in which the asset or security can be easily bought or sold without causing a major change in the asset or securities price. Unless the scheme you have chosen is a close ended one, buying and selling mutual funds is easy. If there is an urgent money requirement the investor can sell their units quickly. When excess money is available investment can be made at any time. The investor isn't bound by fixed investment at regular intervals.

2. DIVERSIFICATION:

Various instruments are invested in mutual funds. A fund can invest in equity market, debt market, money, market instruments etc. this leads to diversification. It protects the fund when one instruments performs poorly.

3. PROFESSIONAL COMMITMENT:

The time you save is the biggest benefits of mutual funds. You don't have to do the research and analysis to find the best holdings of your portfolio if you give the work to pro. You most likely lack of skill, patience and passion to do the job well. You should spend your time in wherever you wish.

4. FLEXIBILITY:

All the benefits of mutual funds cross over into effortlessness and adaptability you can invest into only one fund in a wide assortment. Programmed stored systematic withdrawal annuity sub accounts dividends, short term savings, long term savings, these strategies make mutual funds the best in regular speculation type for both beginners and high level financial investors.

DEMERITS OF MUTUAL FUNDS:

1. LOCK IN PERIOD:

Before investing in mutual funds, it is important to check the lock-in period. Different mutual fund schemes have different lock-in periods, and many of them have long lock-in periods. It's an advantage to invest in mutual funds. You can buy and sell funds at your convenience. Some funds will not allow you to redeem the sum before a certain time. If you redeem before the lock-in period, you have to pay the exit load.

2. HIGH CAPITAL GAIN DISTRUBUTIONS:

If all mutual funds sell holdings and pass the capital gains on to the investors as a taxable event, then we have found a winner for the list of disadvantages of mutual funds. Tax efficient mutual

funds don't make distributions every year. They must give gains to shareholders.

Another disadvantage of investing in mutual price range is the over- diversification of the portfolio. Diversification of portfolio might also bring about the spreading of hazard however the return cannot be maximized. Also, the management of a relatively diversified portfolio becomes pretty difficult.

3. OVER DIVERSIFICATION:

DIFFERENCE BETWEEN MUTUAL FUNDS AND OTHER INVESTMENT SECTORS:

MUTUAL FUNDS	INVESTMENT OPTIONS
A mutual fund is a model of a economic group that accumulates cash from numerous buyers	An investment fund is a pool of money from a group of human beings pooled collectively to gather belongings, with every investor retaining manipulate and possession of their shares
A mutual fund is a criminal entity as well as a monetary funding.	Investors picks a investment fund depending on its dreams, risk, charges, and other elements.
More choices	A Scarcity of picks
Lower value	High costs
Falls on variables	Increases on variables

CALCULATION ANALYSIS OF MUTUAL FUNDS:

Compound interest calculation:

Compound interest begins when your investment earns interest. The premium interest is added to the initial investment amount. At the point when its revenue procures revenue again it will decide the recently added interest by calculating the initial capital contributed and earned interest.

Here are the factors that impact your compound interest returns:

1) TIME:

You need to permit your investments to develop with time, the additional time will empower, the more development you will see.

1) RATE OF INTEREST:

A higher rate of interest create a higher equilibrium when compounding the investment.

You can choose the investment priorities and goals, remembering the different situations and avenues and how it will impact your life.

The compound interest formula is:

$$A = P(1 + r/n)^{nt}$$

The values are:

A = Future worth of the speculation P = Principal amount invested

r = The pace of interest (decimals)

n = Number of times interest gets accumulated per period t = Number of periods the cash is contributed

FINDINGS:

- ❖ Mutual funds give a higher corpus. Mainly mutual funds will be calculated through compounding calculation.
- ❖ It will be guided by a professional manager in mutual funds so the risk is within the limit. And it will be manageable by the investors.
- ❖ In mutual funds long term investments gives a higher return because of compounding effect.

SUGGESTIONS:

- ❖ Before investing in mutual funds an investor should have a clarified knowledge towards the company and schemes provided by them.
- ❖ They do not enter into the investment area with the influence of their friends, families or their well-wishers. Beyond their influence they need an interest to invest.
- ❖ Investors need a herd mentality to invest. They would be ready to take a risk in an investment. Higher risks with potential scheme give a higher return.

CONCLUSION:

A mutual fund is a potential investment option that generates a long-term wealth to investors. It is important to achieve an individual goal. Thus, the mutual funds deal with short term and long-term goals of the investors towards the investment without necessarily taking more finance risk.

REFERENCES

- [1] Abdullah, F., Hassan, T. and Mohamad, S. (2007), "Investigation of performance of Malaysian Islamic unit trust funds: comparison with conventional unit trust funds",
- [2] Managerial Finance, Vol. 33 No. 2, pp. 142-53. Bauman, W.S. and Miller, R.E. (1995), "Portfolio performance rankings in stock market cycles", Financial Analysts Journal, Vol. 51, pp. 79-87.
- [3] Bogle, J. and Twardowski, J. (1980), "Institutional investment performance compared: banks, investment counsellors, insurance companies and mutual funds", Financial Analysts Journal, Vol. 36 No. 1, pp. 33-41. Capon, N., Fitzsimons, G.J. and Prince, R.A. (1996), "An individual level analysis of the mutual fund investment decision",
- [4] Journal of Financial Services Research, Vol. 10, pp. 59-82. Capon, N., Fitzsimons, G.J. and Weingarten, R. (1994), "Affluent investors and mutual fund purchases",
- [5] Grinblatt, M. and Titman, S. (1992), "The persistence of mutual fund performance", The Journal of Finance, Vol. 47 No. 5, pp. 1977-84. Hendricks, D., Patel, J. and Zeckhauser, R. (1993), "Hot hands in mutual funds: short-run persistence of relative performance, 1974-1988", Journal of Finance, Vol. 48, pp. 93-130. Hoepner, A.G.F.
- [6] Rammal, H.G. and Rezac, M. (2011), "Islamic mutual funds' financial performance and international investment style: evidence from 20 countries", The European Journal of Finance, Vol. 17 Nos 9-10, pp. 829-50. 150 ARA 20,2 Downloaded by Universiti Malaysia Terengganu At 18:20 16 January 2017 (PT) Indro, D., Jiang, C., Hu, M. and Lee, W. (1999), "Mutual fund performance: does fund size matter?", Financial Analysts Journal, Vol. 55 No. 3, pp. 74-87.
- [7] (The) International Organisations of Securities Commission (IOSCO) (2008), Islamic Finance Report was taken from Analysis of the Application of IOSCO's Objectives and Principles of Securities Regulation for Islamic Securities Products, September.

AUTHORS

First Author – Dr.R. Sangeetha, Associate professor of Sri Krishna Arts and Science College, Coimbatore
sangeethark@skasc.ac.in

Second Author – Ms.V. Arthi, Master of international business, Sri Krishna Arts and Science College, Coimbatore
arthiv21mib004@skasc.ac.in

Third Author – Ms.T. Harini Nivetha, Master of international business, Sri Krishna arts and science college, Coimbatore
harininivethat21mib028@skasc.ac.in

Electrical and Thermal performance analysis of a 1000W monocrystalline solar PV Power generator in Eastern Uganda

David Kibirige*, Afam Uzorka*, Ukagwu Kelechi John**, Mustafa Mundu Muhamad**

*Department of Physical Sciences, School of Natural and Applied Sciences, Kampala International University Uganda

** Department of Electrical, Telecommunication and Computer Engineering, School of Engineering and Applied Sciences, Kampala International University Uganda

DOI: 10.29322/IJSRP.12.10.2022.p13042

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13042>

Paper Received Date: 6th September 2022

Paper Acceptance Date: 5th October 2022

Paper Publication Date: 13th October 2022

Abstract- Renewable energy in form of PV solar technology is the fundamental source of electrical power used in present days and nearly eighty percent of the energy is absorbed by the surrounding environment. In other to design a PV system, it is necessary to carry out an electrical and thermal performance analysis of the solar PV power generator to know how efficient the PV cell and the system will be. Electrical and thermal performance analysis of a solar PV power generator includes both energy and exergy analysis. The modeling of both energy and exergy analysis can be done using mathematical concepts. To come up with modeling of energy and exergy both the thermal and electrical quality of the Monocrystalline PV module has been entailed under different seasonal climatic circumstances of eastern Uganda, Busoga region districts. Various parameters such as converted power, exergy, and energy efficiencies have been projected. The simulation results elucidate that the efficiency of the said parameters is altering with respect to the dissimilarity in the solar insolation, temperature, and wind speed. The energy and exergy analysis has been performed by using PV SIM. Time, solar radiation, wind speed, ambient temperature, and cell temperature are used as the input; thermal and electrical efficiencies are the outputs in PV SIM Architecture. It has been evidently observed that the efficiencies are higher in the months of the dry season compared to the month in the rainy season.

Index Terms- Photovoltaic, module energy, exergy, wind speed, PV SIM, solar radiation.

I. INTRODUCTION

Fossil fuels will completely be replaced with renewable energy resources in the near future for electrical power generation due to their free pollution techniques and advancement in technology [1, 2, 3]. Solar energy technology using Photovoltaic cells is one of the most common types of renewable sources commonly used [4, 5]. These cells are made from semiconductor materials namely Germanium and Silicon of group 4 in the periodic table [6, 7]. These two elements have photoelectric properties hence capable of converting sunlight energy into electric energy [8, 9, 10]. The performance of these solar panels made depends on a number of factors namely insulation, temperature, direct radiation, solar cell arrangements .design constraints, weather conditions, heat, and area of the PV panel [11, 12, 13]. The exergy and energy analysis are so important that they need further investigations. Both the energy used and the process efficiency are very much required to carry out the energy analysis and balance. It is important to note that the efficiency is calculated from the ratio of solar power output to the actual power supplied to the PV system [14, 15]. During the process of energy analysis validation, there are many deficiencies for instance it is difficult to differentiate power quality and quantity during the performance of the PV cell.

Exergy techniques use the law of conservation of energy and the law of non-conservation of entropy in particular, the conservation energy law is defined by the first law of thermodynamics and non- conservation entropy law is defined by the second law of thermodynamics these help in explaining the details of the losses related to the system.

The analysis of Exergy finds its recarrying application previously due to its many advantages as compared to conventional energy analysis. For this matter, we are capable of getting many outputs and inputs in order to evaluate and complete both Exergy and energy analysis mechanisms. It is worth noting that exergy is easily achieved throughout the process and this helps to put the system in equilibrium when considering its environment just as heat is found in the reservoirs of systems. Exergy is zero when the surroundings

and the system are at equilibrium, when the selection of the sources is appropriate and its magnitude made irreversible then it is possible to improve the efficiency of the system [16, 17, 18].

Several people have conducted research on energy and exergy analysis using experimental data. Badescu et al. [19] made the discussion on chemical and physical properties of a PV energy conversion technique and further provided the details that the open circuit voltage of a solar cell has a dependence on statistical factors and Carnot factors. Lima et al. [20] continued with the investigations about the Carnot factor theorem of solar cells and they were able to establish that multiplication of band gap energy and the Carnot efficiency greatly determine the size of the open circuit voltage. Panwaret al. and Saidur et al. [21, 22] carried out exergy and energy analysis using data from an experiment of 36W PV modules, it is clearly seen that the efficiency of exergy is greatly affected by the temperature of the PV module. The efficiency can be improved if the heat is separated from the photovoltaic panel surfaces. Ghoneim delivered information that the thermal properties, orientation, and optimum values for sizing of the PV modules used for different applications can be redefined hence he developed a computer simulation program for solar water pump systems for Kuwait climatic conditions [23]. Abdallah et al. [24] presented the PV module thermal properties subjected to various conditions of the environment estimating both connective and radiative heat losses in these panels, making comparisons of the analysis of both measured values under the different speeds of wind and the constant forecasted times. However, Idzkowski came up with a mathematical model in relation to studying the significance of solar insolation, air temperature and wind velocity on the solar cell temperature, and also overlooked free convection and radiation losses from the PV module to the environment [25].

Rukman *et al.* also confirmed the efficiency of exergy and thermal for both PV-T and PV systems, they discovered the exergy efficiency of PVT systems (11.6–16%) as compared to the exergy efficiency of an only PV system (8–14%), this was achieved by using Petela’s formula [26]. Dubey et al. have analyzed both the energy and exergy of PV/T air collectors connected in a series arrangement. The cell efficiency and hourly variation of cell temperature have an inverse relationship. Experiments have shown that the solar cell efficiency reduces by 1.6% then the temperature of the solar cell increases by 24.40C [27]. Caglar et al. also experimented with photovoltaic modules for thermal analysis especially exergy efficiency based on the chemical strength of the element. At different operating conditions, they provide a comparative analysis of energy, electrical, and exergy efficiencies [28].

This research work mainly focuses on the thermal performance assessment of the monocrystalline Silicon photovoltaic module on the basis of energetic and exergetic analysis for two seasons (rainy, and dry) of the year, under the climatic conditions of Eastern Uganda The case study is at 1.0⁰ latitude and 33.2⁰ longitudes, Elevation 1070.0 m time zone GMT +3. The experiments have been conducted for the months of January to October 2022 in actual atmospheric environments from 8.00 AM to 5.00 PM.

A mathematical model has been established to investigate the exergy efficiency using exergy destruction. The experimental factors like wind speed, solar irradiance, short circuit current, open circuit voltage, voltage and current with respect to filling factor, ambient temperature, maximum power point, minimum temperature, maximum temperature, and an average temperature of the photovoltaic module have been considered.

II. Methodology

1. Energy analysis

The energy produced due to the solar radiation (G_s), which is incident upon the solar photovoltaic module having area A_m is estimated according to the formula given below in equation (1).

$E_{IN} = G_s A_m$	(1)
--------------------	-----

The power generated from the solar PV panel E_{spv} is expressed in the mathematical model as given below in equation (2).

$E_{spv} = V_{oc} I_{sc} FF$	(2)
------------------------------	-----

Where V_{oc} is the voltage at open circuit condition, I_{sc} is the current available in a short circuit situation, and FF is the fill factor of the solar PV module. The fill factor of the solar photovoltaic system is normally defined as the ratio of maximum power ($V_{mp} I_{mp}$) to the power obtainable due to the multiplication of both open circuit voltage (V_{oc}) and short circuit current (I_{sc}) and may be expressed as in equation (3).

$FF = \frac{V_{mp} I_{mp}}{V_{oc} I_{sc}}$	(3)
--	-----

The energy efficiency is defined in equation (4).

$\eta = \frac{V_{oc} I_{sc}}{G_s A_m}$	(4)
--	-----

2. Exergy Analysis

The exergy efficiency is defined as the output exergy divided by the input exergy as expressed in equation 5.

$$\eta_{EX} = \frac{EX_{OUT}}{EX_{IN}} = 1 - \frac{CV_{IN}}{EX_{IN}} \quad (5)$$

Where EX_{IN} , EX_{OUT} and CV_{IN} are the exergy as input, exergy as output, and irreversibility in the control volume correspondingly. The input exergy includes the intensity exergy of solar radiation. Conferring to R Petela, the input exergy is specified in equation (6).

$$EX_{IN} = EX_{IN} \left[1 - \left(\frac{4}{3}\right) \frac{T_{Amb}}{T_{Solar}} + \left(\frac{1}{3}\right) \left(\frac{T_{Amb}}{T_{Solar}}\right)^4 \right] \quad (6)$$

Where T_{Solar} is the temperature of the sun in Kelvin. The irreversibility in the control volume is given in equation (7).

$$CV_{in} = \sum (EX_{Loss} + EX_{Dest}) \quad (7)$$

The losses produced by the heat leakage are specified by equation (8).

$$EX_{Loss} = H_{Loss} A_m (T_c - T_{Amb}) \left(\frac{T_c - T_{Amb}}{T_c} \right) \quad (8)$$

The entire total heat loss coefficient of the photovoltaic panel consists of the losses due to radiation and convection. The convective heat transfer coefficient as in equation (9).

$$H_{Convection} = 2.8 + 3V_{WIND} \quad (9)$$

Where V_{WIND} is the speed of the wind. The radiative heat transfer coefficient could be expressed as in equation (10)

$$H_{Convection} = \epsilon_g \delta (T_{SKY} + T_c) \{T_{SKY}^2 + T_c^2\} \quad (10)$$

Where ϵ_g and δ are the emissivity of the PV panel and the Stefan-Boltzmann constant respectively. The effective temperature of the sky (T_{SKY}) is normally lesser than 5-6°C than the ambient temperature. The exergy destruction losses are due to heat caused by temperature deviation of the photovoltaic array and reference environmental state. The exergy destruction is expressed by equations (11) - (14).

$$EX_{DEST (opt)} = EX_{IN} \left(\frac{T_{Solar} - T_{Amb}}{T_{Solar}} \right) \{1 - (\tau\alpha)\} \quad (11)$$

$$EX_{DEST (\Delta T_{Solar})} = E_{IN} (\tau\alpha) \left(\frac{1}{T_c} - \frac{1}{T_{Solar}} \right) T_{Amb} \quad (12)$$

$$EX_{DEST (\Delta T_m)} = \frac{m_c T_{Amb} C_P}{\Delta t} \left\{ \ln \left(\frac{T_c}{T_{Amb}} \right) - \frac{T_c - T_{Amb}}{T_c} \right\} \quad (13)$$

$$EX_{DEST (elect)} = V_{oc} I_{sc} - V_{mp} I_{mp} \quad (14)$$

Where m_c and Δt are the array mass and time interval of the photovoltaic module respectively. The time interval is based on the time step of experimental durations. The specific heat of silicon solar cells (C_P) has been taken in the range of 0.8 to 1.0. The exergy efficiency could be expressed as in equation (15).

$$\eta_{EX} = 1 - \left[\{1 - (\tau\alpha)\} + \frac{EX_{Loss}}{EX_{IN}} + \frac{EX_{DEST (\Delta T_{Solar})}}{EX_{IN}} + \frac{EX_{DEST (\Delta T_m)}}{EX_{IN}} + \frac{EX_{DEST (elect)}}{EX_{IN}} \right] \quad (15)$$

III. Results and Discussions

Weather-related different parameters such as the ambient temperature, wind speed, and solar radiation have been obtained using PV SIM, then the measured parameters such as maximum current, maximum voltage, short circuit current, open circuit voltage, solar cell temperature, fill factor, solar cell temperature of the photovoltaic module has been collected. Similarly, power conversion efficiency with the energy and exergy efficiencies for monocrystalline.

Silicon photovoltaic panels have also been considered. Their performances have been plotted against the experimental time from 8 AM to 5 PM. The variation in different parameters of the polycrystalline solar photovoltaic modules against time intervals for January and February has been displayed in figures 1 and 2.

Table 1: Monthly average daily solar energy and weather data for Eastern Uganda

Month	Number of the days	Representative days of the month	Av. wind speed (m/s)	Av. instant Solar radiation (W/m ²)	Sunshine duration (hours)	Average ambient temp. (°C)
January	31	5,16,25	4.75	490.33	3.46	5.00
February	28	5,17,26	4.79	500.12	4.43	5.10
March	31	4,15,28	4.32	671.05	5.32	7.80
April	30	2,15,21	4.00	650.18	6.85	13.00
May	31	3,15,23	3.80	601.95	8.61	15.70
June	30	1,11,27	3.19	870.14	10.51	20.40
July	31	6,17,31	3.78	920.70	11.17	22.80
August	31	3,16,29	4.70	900.83	10.14	22.80
September	30	7,15,22	4.80	662.55	7.83	21.10
October	31	4,15,30	4.30	800.00	5.22	16.70

Table 2: Electrical and thermal performance of the proposed system

Month	Top PV temp. (°C)	Bottom PV temperature after cooling (°C)	Total Instant Pout (W)	Daily Thermal Energy (kWh/d)	Daily Electrical Energy (kWh/d)
1	37.6	28.0	1000.1	3.5	13.9
2	37.8	29.0	900.2	4.5	17.9
3	49.2	37.9	995.7	7.1	33.2
4	51.1	39.6	1000.3	8.9	45.9
5	51.5	40.9	900.8	10.6	59.0
6	49.2	39.8	1000.2	11.5	68.2
7	47.8	38.3	800.0	11.5	69.2
8	47.4	38.9	1010.4	10.3	62.0
9	47.7	39.0	1004.1	8.6	47.8
10	49.6	38.9	1110.2	6.3	33.6

Table 3: Thermal, Electrical, and overall efficiency of the system

Month	Thermal Energy Efficiency (%), η_{pv}	Electrical Energy Efficiency (%), η_{th}	Overall system efficiency (%), η_s
1	20.9	47.9	68.8
2	20.6	46.6	67.2
3	20.6	53.9	74.5
4	19.5	58.9	78.4
5	19.9	63.3	83.2
6	19.7	67.8	87.5
7	20.9	65.7	86.6
8	19.8	70.8	90.6
9	20.6	64.1	84.7
10	20.5	61.4	81.9

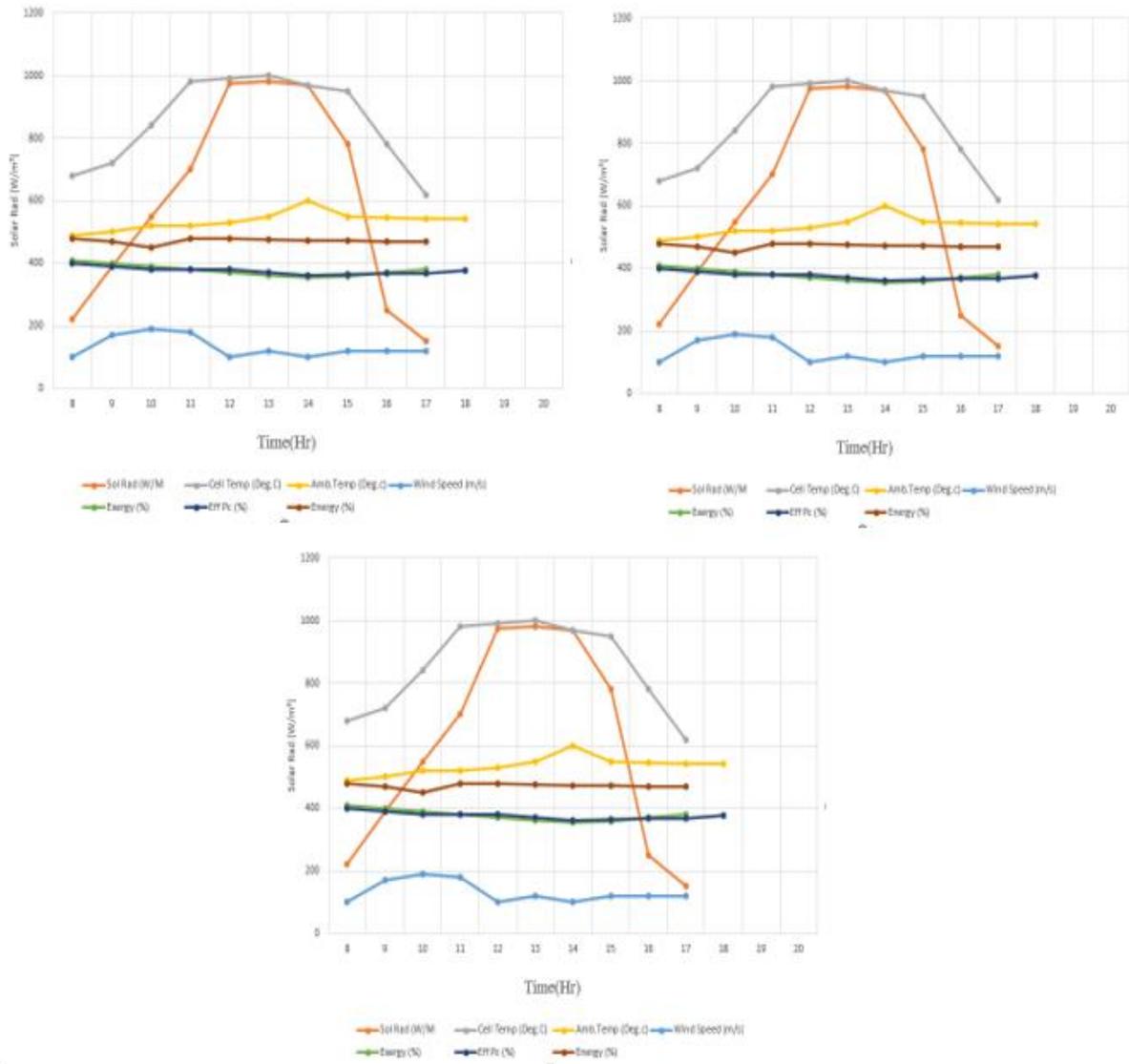


Figure 1: Time-dependent variations of the parameters for three days of January

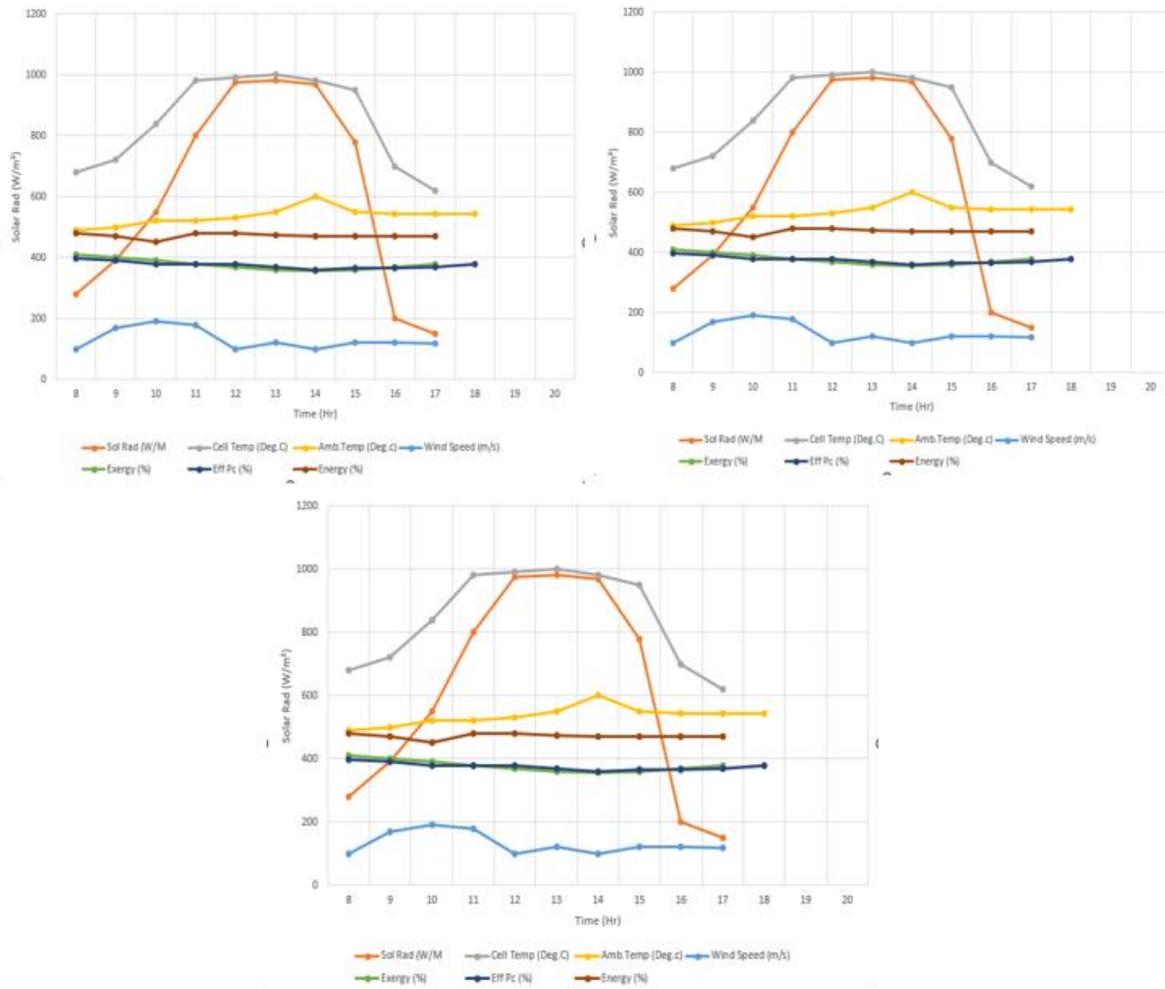


Figure 2: Time-dependent variations of the parameters for three days of February

It has been perceived from the figures that the solar irradiance varies slowly and reaches the peak value at mid-day and then reduces slowly during afternoon. Therefore, the efficiencies have been observed to be changing for the entire day. Therefore, the disparities of all these three efficiencies have been found to have an inverse proportional relationship between solar radiation and the temperature of the solar cell.

The growth in solar cell temperature significantly influences the output of the solar photovoltaic modules. The exergy efficiency fluctuates more often than that of energy efficiency when the wind speed increases beyond the cut-in speed. During day time, the energy efficiency rises more compared to the exergy efficiency. From the first law of thermodynamics the energy efficiency indicates the quantity of energy rather than the quality of energy. The power conversion, average energy, and exergy efficiencies are found to be 13.15%, 18.11%, and 13.05% respectively for January month.

The same type of change has occurred in all the parameters which are described in figure 2. There is less fluctuation in the month of February compared to the month of January. Also, the average energy, power conversion, and exergy efficiencies for the month of February have been found to be 18.75%, 13.68%, and 13.52%. From figures 1 and 2, it is also evident that all the efficiencies for February are higher than those in January.

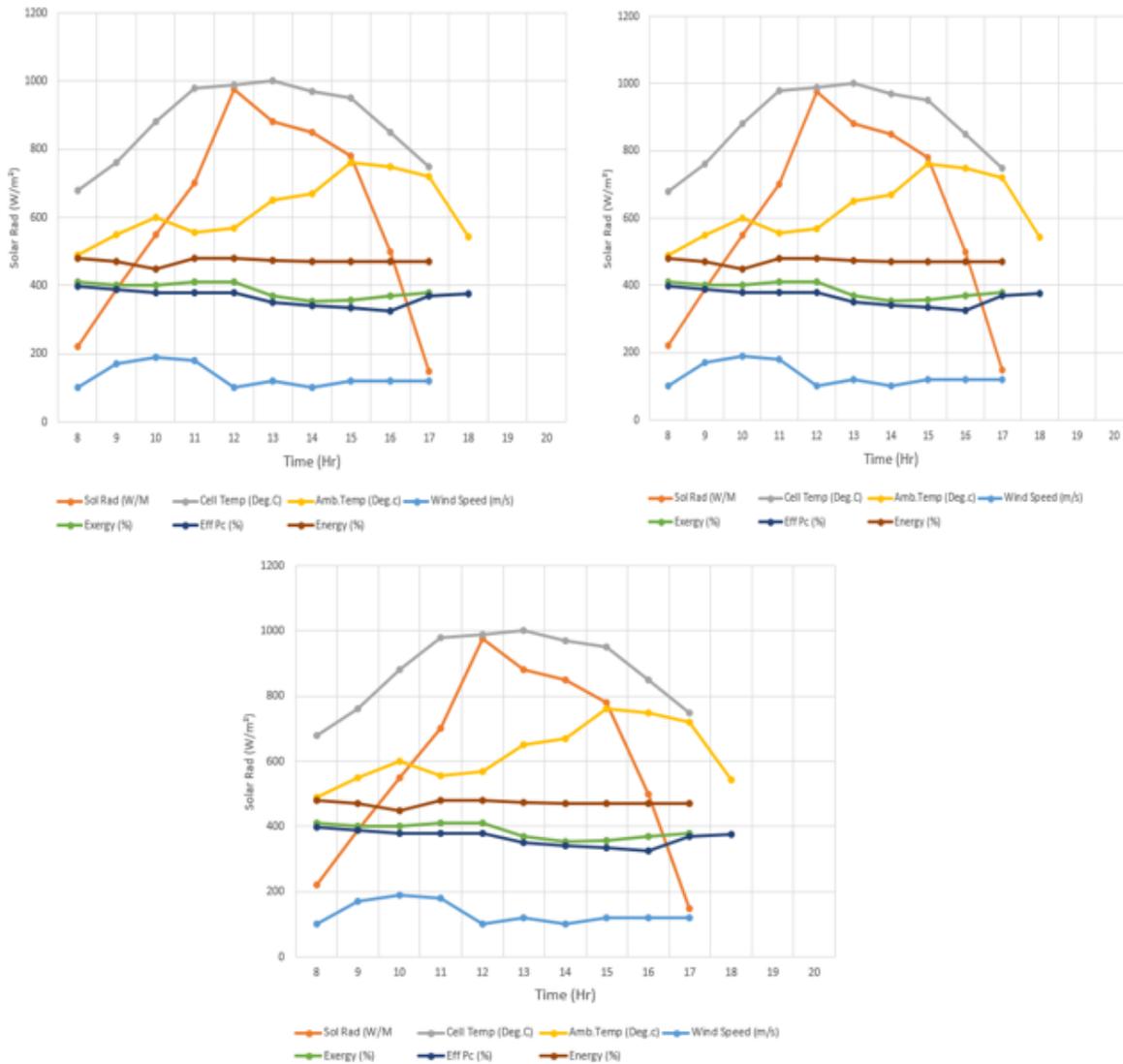


Figure 3: Time-dependent variations of the parameters for three days of April

Furthermore, the energy efficiency and power exchange efficiency of April month are higher in magnitude as compared to the month of May. Likewise, the oscillation in the exergy efficiency and the energy efficiency during 10.30–3.00 hrs, is found to increase as compared to that of 11.30- 01.30 hrs, during the May month that is expressed in terms of ambient air temperature, solar cell temperature, and wind speed as mentioned in the next sections. The power conversion, average energy, and exergy efficiency are 11.57%, 17.27%, and 10.00% for April, but they are around 11.71%, 6.74%, and 10.11% for May.

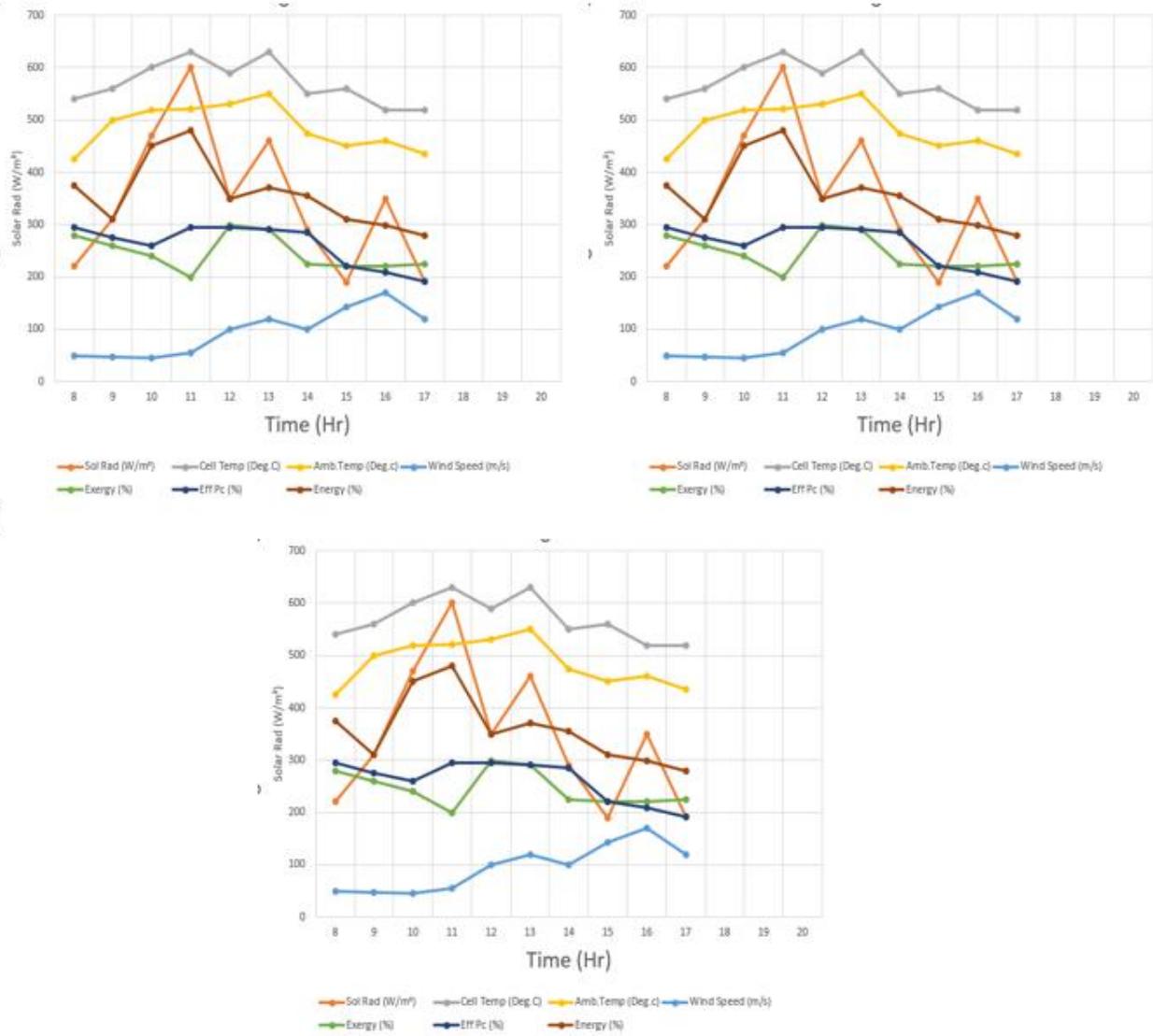


Figure 4: Time-dependent variations of the parameters for three days of May

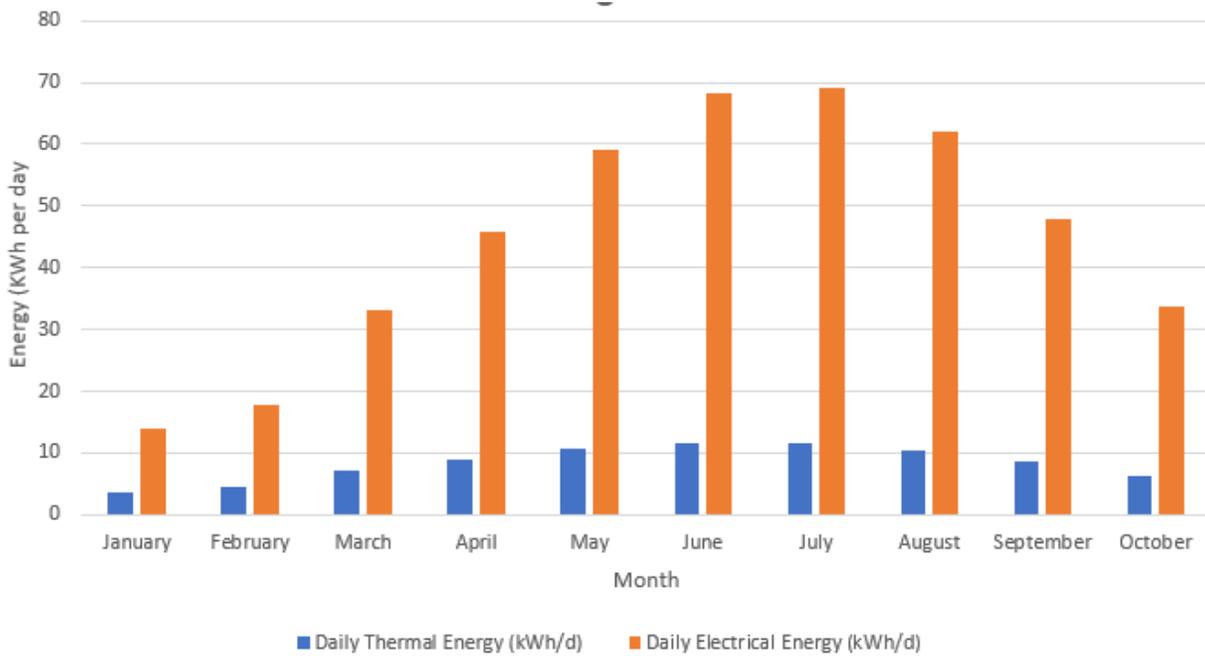


Figure 5: The daily average monthly total produced Electrical and Thermal Energy

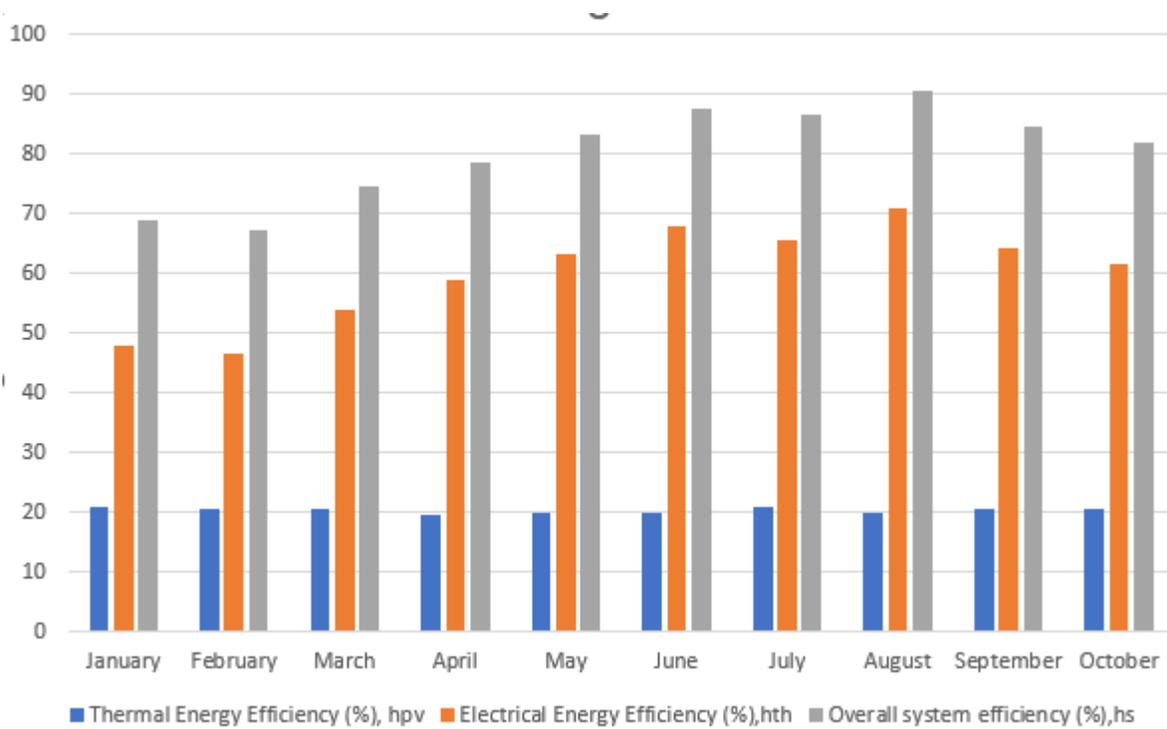


Figure 6: Efficiency Analysis of the system

The shift in solar irradiance and three types of efficiencies versus experimental time duration for the Monocrystalline photovoltaic module during the months of July and August have been depicted in figures 5 and 6 respectively. It has been clearly demonstrated that a severe depression has occurred in all three efficiencies at 11.20 A.M. for the month of July and at around 9.30 A.M. for the month of

This publication is licensed under Creative Commons Attribution CC BY.

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13042>

www.ijsrp.org

August and again at around 3.00 P.M. The sharp fall in solar radiation at that particular instant produces a sudden dip in, efficiencies, thereby resulting in a sharp decrease of output to input ratios. The efficiencies of power exchange, energy, and exergy are 16.22%, 11.31%, and 10.70% respectively for July month, but they are in the range of 11.12%, 16.30%, and 9.03% respectively for August month.

IV. Conclusions

The performance analysis based on energy and exergetic analysis of polycrystalline solar photovoltaic modules has been carried out during specific months of the year 2022. Due to the irregular manner of wind speed and solar radiation, there is a greater variance in all the efficiencies during different months. From the results of different analyses from the graph, evidence shows that the efficiencies are attaining their highest values during the month of February 2022, while the lowest value is attained during the month of August 2022. Consequently, the performance of the Monocrystalline silicon photovoltaic panels has been observed to be highest in the month of February. In this paper, the data and performance analysis is done by using the PV SIM model for the solar PV module. It is clearly observed from the simulation results, that the efficiency is higher in the months of the dry season when compared to the months of the wet season. Additionally, it has also been found that it is rewarding to employ PV SIM compared to the traditional methodologies because of its betterment in simplicity, speed, and accuracy.

References

- [1] Ellabban, O., Abu-Rub, H., & Blaabjerg, F. (2014). Renewable energy resources: Current status, future prospects and their enabling technology. *Renewable and Sustainable Energy Reviews*, 39, 748-764.
- [2] Milano, J., Ong, H. C., Masjuki, H. H., Chong, W. T., Lam, M. K., Loh, P. K., & Vellayan, V. (2016). Microalgae biofuels as an alternative to fossil fuel for power generation. *Renewable and Sustainable Energy Reviews*, 58, 180-197.
- [3] Ang, T. Z., Salem, M., Kamarol, M., Das, H. S., Nazari, M. A., & Prabaharan, N. (2022). A comprehensive study of renewable energy sources: classifications, challenges and suggestions. *Energy Strategy Reviews*, 43, 100939.
- [4] Fashina, A., Mundu, M., Akiyode, O., Abdullah, L., Sanni, D., & Ounyesiga, L. (2018). The drivers and barriers of renewable energy applications and development in Uganda: a review. *Clean Technologies*, 1(1), 9-39.
- [5] Ahmad, L., Khordehghah, N., Malinauskaite, J., & Jouhara, H. (2020). Recent advances and applications of solar photovoltaics and thermal technologies. *Energy*, 207, 118254.
- [6] Nurilla, Z., Elyor, S., Bozorbek, B., Bakhodir, N., Yunus, K., Farxodjon, T., & Nozina, S. (2019). Study of the results of diffusion doping technique for producing heterostructures (Si-Ge) using microprobe analysis. *Austrian Journal of Technical and Natural Sciences*, (1-2), 56-61.
- [7] Lv, J., Zhang, T., Zhang, P., Zhao, Y., & Li, S. (2018). Review application of nanostructured black silicon. *Nanoscale research letters*, 13(1), 1-10.
- [8] Liang, H., Wang, F., Yang, L., Cheng, Z., Shuai, Y., & Tan, H. (2021). Progress in full spectrum solar energy utilization by spectral beam splitting hybrid PV/T system. *Renewable and Sustainable Energy Reviews*, 141, 110785.
- [9] Pandey, J., Khare, R., Khare, S., & Singh, D. (2015). Solar cell harvesting: Green renewable technology of future. *International Journal of Advanced Research in Engineering and Applied Sciences*, 4(11), 93-103.
- [10] Shittu, S., Li, G., Akhlaghi, Y. G., Ma, X., Zhao, X., & Ayodele, E. (2019). Advancements in thermoelectric generators for enhanced hybrid photovoltaic system performance. *Renewable and Sustainable Energy Reviews*, 109, 24-54.
- [11] Nnamchi, S. N., Sanya, O. D., Zaina, K., & Gabriel, V. (2020). Development of dynamic thermal input models for simulation of photovoltaic generators. *International Journal of Ambient Energy*, 41(13), 1454-1466.
- [12] Nnamchi, S. N., Nnamchi, O. A., Sanya, O. D., Mundu, M. M., & Gabriel, V. (2020). Dynamic analysis of performance of photovoltaic generators under moving cloud conditions. *Journal of Solar Energy Research*, 5(2), 453-468.
- [13] Gorjian, S., Ebadi, H., Calise, F., Shukla, A., & Ingraio, C. (2020). A review on recent advancements in performance enhancement techniques for low-temperature solar collectors. *Energy Conversion and Management*, 222, 113246.
- [14] Ahmadi, M. H., Ghazvini, M., Sadeghzadeh, M., Alhuyi Nazari, M., Kumar, R., Naeimi, A., & Ming, T. (2018). Solar power technology for electricity generation: A critical review. *Energy Science & Engineering*, 6(5), 340-361.
- [15] Bayrak, F., Oztop, H. F., & Selimefendigil, F. (2019). Effects of different fin parameters on temperature and efficiency for cooling of photovoltaic panels under natural convection. *Solar Energy*, 188, 484-494.
- [16] Rosen, M. A. (2021). Exergy analysis as a tool for addressing climate change. *European Journal of Sustainable Development Research*, 5(2), em0148.
- [17] Sohrabi, A., & Behbahaninia, A. (2022). Conventional and Advanced Exergy and Exergoeconomic Assessment of an Optimized System Consisting of Kalina and Organic Rankine Cycles for Waste Heat Recovery. *Journal of Energy Resources Technology*, 144(11), 112103.
- [18] Casisi, M., Khedr, S., & Reini, M. (2022). The Thermoeconomic Environment and the exergy-based cost accounting of technological and biological systems. *Energy*, 125117.
- [19] Landsberg, P. T., & Badescu, V. (2000). Carnot factor in solar cell efficiencies. *Journal of Physics D: Applied Physics*, 33(22), 3004.
- [20] Lima, F. M., Nunes, V. F., Freire, F. N. A., & Almeida, A. F. L. (2017). "A theoretical model relating to the chemical and electrical power in a dye-sensitized solar cell (DSSC)," in *Electrical Measurements: Introduction, Concepts and Applications*.
- [21] Panwar, N. L., Kaushik, S. C., & Kothari, S. (2012). A review on energy and exergy analysis of solar drying systems. *Renewable and Sustainable Energy Reviews*, 16(5), 2812-2819.
- [22] Saidur, R., BoroumandJazi, G., Mekhlif, S., & Jameel, M. (2012). Exergy analysis of solar energy applications. *Renewable and Sustainable Energy Reviews*, 16(1), 350-356.
- [23] Ghoneim, A. A. (2006). Design optimization of photovoltaic powered water pumping systems. *Energy conversion and management*, 47(11-12), 1449-1463.
- [24] Aly, S. P., Ahzi, S., Barth, N., & Abdallah, A. (2018). Using energy balance method to study the thermal behavior of PV panels under time-varying field conditions. *Energy Conversion and Management*, 175, 246-262.
- [25] Idzkowski, A., Karasowska, K., & Walendziuk, W. (2020). Analysis of Three Small-Scale Photovoltaic Systems Based on Simulation and Measurement Data. *Multidisciplinary Digital Publishing Institute Proceedings*, 51(1), 19.
- [26] Rukman, N. S. B., Fudholi, A., Taslim, I., Indrianti, M. A., Manyoe, I. N., Lestari, U., & Sopian, K. (2019). Energy and exergy efficiency of water-based photovoltaic thermal (PVT) systems: an overview. *International Journal of Power Electronics and Drive Systems (IJPEDS)*, 10(2), 987-994.
- [27] Dubey, S., Solanki, S. C., & Tiwari, A. (2009). Energy and exergy analysis of PV/T air collectors connected in series. *Energy and buildings*, 41(8), 863-870.
- [28] Caglar, B., Araz, M., Ozcan, H. G., Calisan, A., & Hepbasli, A. (2021). Energy and exergy analysis of a PV-T integrated ethanol PEM electrolyzer. *International Journal of Hydrogen Energy*, 46(24), 12615-12638.

AUTHORS

First Author – David Kibirige, Department of Physical Sciences, School of Natural and Applied Sciences, Kampala International University Uganda.

Second Author – Afam Uzorka, Department of Physical Sciences, School of Natural and Applied Sciences, Kampala International University Uganda

Third Author – Ukagwu Kelechi John, Department of Electrical, Telecommunication and Computer Engineering, School of Engineering and Applied Sciences, Kampala International University Uganda

Fourth Author – Mustafa Mundu Muhamad, Department of Electrical, Telecommunication and Computer Engineering, School of Engineering and Applied Sciences, Kampala International University Uganda

Correspondence Author – Afam Uzorka, Department of Physical Sciences, School of Natural and Applied Sciences, Kampala International University Uganda.

Effect of Covid19 on Elementary Education in Odisha and Government Policy Response

Swetapadma Nayak¹ Dr. Lipishree Das²

¹PhD Scholar, Ravenshaw University, Cuttack, Email:nayaksweta2010@gmail.com .Contact no:9178992302

² Associate Professor. Ravenshaw University, Cuttack. Contact No. 861460154, Email Id: drlipi_dsa@yahoo.co.in

DOI: 10.29322/IJSRP.12.10.2022.p13043

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13043>

Paper Received Date: 6th September 2022

Paper Acceptance Date: 5th October 2022

Paper Publication Date: 13th October 2022

Abstract- COVID-19 is considered as a public health emergency of International concern (PHEIC) and thus a pandemic with an explosive increase rate of infection worldwide. The whole educational system from elementary to tertiary level has been collapsed during the lockdown period of the novel coronavirus disease 2019 not only in India but across the globe. Based on secondary sources of data the intended purpose of this paper seeks to study how the elementary education system in Odisha is facing the impact of COVID-19 and the steps taken by the Government to combat the negative impact of the pandemic for continuous smooth education of elementary school students. This paper addresses the advantages and disadvantages related to online learning in elementary education in Odisha during covid19 for providing quality education. The present paper also tries to study the changes in the trend of enrolment and dropout rate in Elementary Education in Odisha during covid19. So, some of the post Covid-19 trends which may allow imagining new ways of teaching learning of elementary education in Odisha are outlined. Some fruitful suggestions are also pointed to carry out educational activities during the pandemic situation.

Index Terms- Covid19, Elementary Education, online learning, Enrolment & Drop out

JEL Codes: I2,I21, I28

I. INTRODUCTION

The whole educational system from elementary to higher level has been collapsed due to COVID 19 lockdown not only in India but across the globe (Mishra et al., 2020). COVID- 19 is referred as pandemic due to its severity and fierceness also as the greatest global health crisis since after centuries in human civilization. The onset of the novel corona virus made everything from world economies to social rituals devastated. (Mishra et al., 2020). The spread of pandemic Covid-19 has drastically disrupted every aspects of human life including education. It has created an unprecedented test on education. In many educational institutions around the world, campuses are closed and teaching-learning has moved online. In India, about 32 crore learners stopped to move schools/colleges and all educational activities came to an end. On March 11, 2020 World Health Organisation (WHO) declared Covid-19 as a pandemic. Covid-19 has affected more than 4.5 million peoples worldwide (WHO). In India, the first affected case of Covid-19 was detected on 30 January 2020 in the state of Kerala and the affected had a travel history from Wuhan, China.

In India, the first death was reported on March 12, 2020 and the nation observed Janta Curfew for a day on March 22, 2020. India again observed 14 hours Janta Curfew on March 24 to combat the Corona virus pandemic and assess the country's ability to fight the virus. Then, the 1st phase of lockdown was announced by the Prime Minister on March 25, 2020 for 21 days. Monitoring the effects of the virus, Indian Government has been extending the lockdown period in different phases and the lockdown 5.0 was declared on April 30 which is effective from 1st June to 30th June 2020. In all the phases of lockdown starting from lockdown1.0 to lockdown 5.0, the educational institutions throughout the nation have never got any relaxation to start their educational activities. Thus, pandemic Covid-19 impacted significantly on the education sector. According to the UNESCO report, Covid-19 has affected nearly 68% of total world's student population as per the data taken during first week of June 2020. Outbreak of Covid-19 has impacted about 1.2 billion students and youths across the globe by school and university closures. Several other countries have also implemented localized closures impacting millions of additional learners. In India, more than 32 crores of students have been affected by the various

restrictions and the nationwide lockdown for Covid-19. Most Governments around the world have temporarily closed educational institutions in an attempt to control the spread of the pandemic. This worldwide closure has impacted drastically the world's student population. Governments around the world are making efforts to diminish the immediate impact of closure of educational institutions particularly for more vulnerable and disadvantaged communities and trying to facilitate the continuity of education for all using different digital modes of learning. Even though the country has been adapting to the new-age learning, but there still lies an obstacle in achieving entire success as only 45 crore people of our total population of the country have access to the internet/e-learning. The people residing in rural areas are still very much deprived of the technologies and therefore hampering the cause of online education. The Covid- 19 pandemic taught the entire society on how necessity is the mother of invention by allowing educational institutions to adopt online learning and introduce a virtual learning culture. The pandemic has been routing the education sector forward with technological innovation and advancements. The pandemic has significantly disrupted the school education sector particularly elementary education. Schools have been closed and examinations postponed. Classrooms are going virtual and admissions for the upcoming academic year are fraught with confusion. According to UNESCO, over 320 million students in Indian schools are currently impacted the pandemic has pushed the world to drastically reinvent ways of coping with the 'new normal'. After the initial phase of complete revamp, it is critical to understand the short and long-term impact and future measures.

An immediate and effective response to the crisis was to go digital. Developing strong online platforms has become necessary for steadiness in learning. Yet in a developing country like India with vast disparity in socio-economic backgrounds of students and the quality of educational institutions, the change has not been easy. The digital divide has been a constraint widening the gap, and needs urgent attention from both public and private sector players as the crisis continues. Good teachers, refreshed curricula and effective tools will ensure students stay involved and active in the learning process. (Ramakrishna, 2021).

The mobilization of resources to prevent and treat COVID-19 infections is unparalleled in the history of public health. Different measures have been adopted by the different states to fight against COVID-19. Odisha also has not escaped from this COVID-19 disaster at present and as of August 31, 2020 Odisha has reported 1,03,536 confirmed cases, 25,705 active cases, 545 deaths from COVID-19. To minimize the infection and controlling the COVID-19 disaster, Odisha was the first state to announce lockdown 2.0, following strict quarantine guidelines, community monitoring for home quarantine people, and extending care by establishing COVID hospital. (Swain & Das 2021).

Since its outbreak in late December 2019, COVID-19 has wreaked havoc across the world and like any critical sector, education has been hit hard. Students, schools, colleges and universities have been deeply impacted. According to the United Nations Educational, Scientific and Cultural Organisation (UNESCO), over 800 million learners from around the world have been affected, 1 in 5 learners cannot attend school, and over 102 countries have ordered nationwide school closures while 11 have implemented localized school closure. The COVID-19 pandemic will adversely impact the progress as some governments were increasing the education budget. Therefore, this is a crisis that requires urgent attention and collective action by all Governments, stakeholders and communities. Each day millions of children do not go to school due to emergencies and ongoing humanitarian crises. (March 18, 2020). Amid a sharp rise in COVID-19 cases, the Odisha government said that it was withholding its decision to reopen elementary schools for students of Classes 1 to 5. School and mass education minister S R Dash, in a statement, said the decision was taken after officials visited various primary schools across the state and held discussions with the stakeholders. "Keeping in view the rise in number of daily cases and based on the feedback provided by parents across the state, we have decided not to reopen schools for students of Classes 1 to 5 from January 3," he stated. He also said that offline examination, as scheduled earlier, will be conducted adhering to COVID-19 protocols. Odisha on 2.1.2022 registered 424 more corona virus cases. Sixty-seven of the new patients are children below 18 years of age. (Hindustan times Jan 06, 2022).

The outbreak of COVID-19 has compounded the plight of learners in countries affected and or emerging from conflict and disaster. While the Global Campaign for Education (GCE) acknowledges the public health decision to close schools. GCE is convinced that all learners no matter where they live and circumstances have a right to education. Education is indispensable for children, young and adults in emergencies and must be a priority in any emergency responses. (Global Campaign for Education (GCE) March 18, 2020). On the above backdrop this paper looks at the impact of the pandemic on the elementary education sector in Odisha.

II. REVIEW OF LITERATURE

1.1 Impact of COVID-19 on Education

UNICEF (2020) in its paper "Education and Covid -19 Response" has found that the countries in the East Asia and Pacific region were the first to be impacted by Covid-19 and ensuring major public health emergency caused by the pandemic. This situation has affected education provision in all of the 27 countries supported by UNICEF programs since late January 2020. Approximately 325 million children had been affected by COVID-19 school closure and 80 million were not able to continue learning remotely throughout 2020. Prolonged school closures predicted to result in a large increase in

children and adolescents dropping out of school, late enrollment of young children, and significant learning loss. The secondary impacts of the crisis, and especially the economic and financial fallout, are expected to negatively impact the education system in the mid and long term and put education gains achieved pre-COVID-19 at risk. So what is suggested is safe school reopening ensuring schools having protective measures in place to receive children including wash facilities, nutritional support and PSS services. Continuity of learning with access to quality high-tech, low-tech and no-tech learning materials during school closures, continued learning during pandemic. Addressing learning loss with availability of essential learning recovery packages to mitigate learning loss. Building back better by increasing education system resilience and better learning outcomes for children is inevitable.

More than 1 billion children in the world over are at risk of falling behind due to school closures aimed at containing the spread of COVID-19. To keep the world's children learning, countries have been implementing distant education programmes. Yet many of the world's children – particularly those in poorer households – do not have internet access, personal computers, TVs or even radio at home, that increases the existing learning inequalities. Students lacking access to the technologies needed for home-based learning have inadequate means to continue their education. As a result, many face the risk of never returning to school, undoing years of progress made in education around the world (UNICEF, 2020).

Mishra, et al.(2020). In their paper “Online teaching-learning in higher education during lockdown period of Covid-19 pandemic” authors seek to address the necessity of online teaching-learning in education amid the COVID-19 pandemic and how can existing resources of educational institutions effectively transform formal education into online education with the help of virtual classes and other pivotal online tools in this continually shifting educational landscape (Mishra, et al.2020). It is found that three relevant stakeholders, namely, academicians, technicians and students, started effort to experience and utilize the transition. Students faced specific problems like connectivity issues due to the remoteness of their location and could not compromise the quantum of time required for machine learning. Again, several available online teaching-learning tools like Zoom, Google Meet, Facebook and YouTube streaming available for both teachers and students were put to need-based use. Most of the teachers were trained by institutions to gain hands-on experiences. There is a difference between online and face-to-face mode of teaching. It was an arduous task for them to use new teaching approach. At the very onset of the lockdown, teachers intended to use WhatsApp, Email and telephonic conversation for imparting teaching. But gradually, as the lockdown period extended from time to time, WhatsApp, email, and telephonic conversation proved inadequate. Teachers and students started installing online learning platforms such as Zoom, Google meets, Webex, LinkedIn learning, Solo Learn, Udemy, and many more to widen their academic exposure and understanding to deal with the complexity of online education.

Global Campaign for Education (GCE) (March 18, 2020), has outlined in the article “*Corona Virus: Don't Let Our Children Down!*” that each day millions of children do not go to school due to emergencies and ongoing humanitarian crises. The outbreak of COVID-19 has multiplied the plight of learners in countries affected. While the Global Campaign for Education (GCE) acknowledges the public health decision to close schools, still contingency plans should be in place to ensure the right to education even in times of crisis. GCE is convinced that all learners no matter where they live have a right to education. So it is suggested that as Education is an essential right for children, young and adults in emergencies and must be a priority from the very beginning and all emergency responses.

Ramakrishna (2021) in his article “Impact of Covid-19 on Higher Education in India” highlights on major impacts of Covid-19 on HEIs in India. The study found that Virtual education is the most preferred mode of education at this time of crisis due to the outbreak of Covid-19. The post Covid-19 education seems to be an education with widely accepted online/virtual education which may perhaps be a parallel system of education. As there is no certainty with regard to how long the pandemic situation will continue, a gradual move towards the online/virtual education is the requirement of the current crisis. Thus to know about the impact of COVID on education the paper outlined the following Objectives.

Objectives

The overall objective of this study is to analyze the Impact of COVID-19 on Elementary Education System in Odisha.

- i. To find out the impact of COVID-19 on the elementary education in Odisha.
- ii. Advantages and disadvantages related to online learning in elementary education in Odisha during Covid19.
- iii. To study the change of trend of enrolment and dropout rate in Elementary Education in Odisha during Covid19
- iv. To examine the steps taken by the Govt. to combat the negative impact of the pandemic on the students for continuity of education.

Methodology

This publication is licensed under Creative Commons Attribution CC BY.

The present study is purely based on secondary data. Various reports of national and international and state agencies on Covid-19 pandemic are referred to collect data for current study. Information are collected from different authentic websites, journals and e-contents relating to impact of Covid-19 on elementary educational system of Odisha. Certain observations are made by enquiring school teachers and parents.

Analysis and Findings

1. Effect of COVID-19 on the Elementary education system in Odisha

- Due to Covid Schools were closed. As the pandemic’s devastating effects were being felt in our nation’s economy and loss of life , It is also felt in education sector . Particularly primary education is affected most as children are not coming to school till now. In response, educators, staff, and school leaders at all educational levels and in all parts of the state have made commitments and dedicated their talents, energy, and resources to address the needs of students.
- Students are also being imparted online classes through smart phones. However with poor mobile connectivity in some parts of Odisha, online classes failed to reach many students of the State. Of the 60 lakh students, the Department could hardly reach 22 lakh students during the lockdown. The situation worsened further when the lockdown was lifted. Many parents returning to their workplaces took the only smartphone in the family with them. As per the Department’s assessment, the number of students taking online class dropped to 6-7 lakhs after the lockdown measures were eased.
- The following table shows the percentage of elementary schools and students access to online learning in Odisha during COVID19.

Table.1. Percentage of elementary schools and students access to online learning in Odisha during COVID19.

Year	Total number of government elementary schools in the State	Percentage of schools access to online education	The number of children who attend online classes through the Smartphone
2020	67,128	27.68%	31.95%

Source: <https://www.thestatesman.com/cities/online-learning-initiative-odisha-fails-reach-disadvantaged-children-27-68-schools-initiated-online-education-1503009260.html>

The above table states that out of 67,128 government elementary schools in the State, only 27.68% have initiated online education so far. The number of children who attend online classes through the Smartphone was 31.95% per cent.

2. Advantages and disadvantages related to online learning in elementary education in Odisha during covid19 for advancing quality education

Advantages: Launching of several online platforms like you tube classes, e-pathasala and e- Mulyankan facilitates elementary education in the state. These online platforms will benefit students, teachers and district education officers (DEOs).The e-pathasala is an online learning platform that have repositories of e-contents in the form of documents, audios and videos. The e- contents support different areas of online learning like self-learning, online classes, assignments and evolution of the learners’ progress. The e-Mulyankan platform is designed to act as a digital bank practice for examinations and final examinations through the e-Mulyankan platform. These e-learning facilities were created as long term solution for any difficult situation by the odisha Govt. The school and mass education department also signed an MOU with central square Foundations to achieve foundational literacy and numeracy among children in class 1 and 3.Teachers have been identified for this programme and it has been taken up in a mission mode. The department has also started identifying dropouts and migrant children through door-to-door surveys. Mainstreaming the children is also a priority for the department. The department also plans to activate the Odisha Siksha Sanjog, a whatsapp based programme that allows the teachers to share e-content and materials with students. So learning is encouraged during lockdown period for Covid-19.

- i. Online learning encourages more productive use of time which keep individuals safe from pandemic situation like spread of Covid-19.
- ii. It has greater access to experts/specialists (nationally and internationally) and Learners can access 24/7 at their own pace and time. It allows geographical reach even to rural or remote locations.

- iii. Cost-effective technologies are quite affordable and enhance communication between educators and students. One teacher educator can teach in various virtual classes simultaneously which reduces travelling time and not risky. These can accommodate more learners at a particular time.
- iv. Online class/conference session can be saved for future reference e.g. class notes can be saved and distributed via network for references by students. The digital recordings of the classes/meetings can be uploaded in website to access later.
- v. In order to conduct exams, institutions may consider using online examination software which may help for conducting online examinations. This will prevent institutions delaying in its annual academic calendar for lockdown.
- vi. Useful for girl child and physically handicapped learners who can learn at home.

Disadvantages of online learning during lockdown:

Contrary to the government claim that 33 per cent of the 60 lakh students in the age group of 6 to 14 years pursuing elementary education in Odisha are attending online classes, a survey has revealed that only about 6 lakh students are getting access to digital learning. The survey titled 'Paused Classrooms', carried out by Save the Children and Odisha RTE Forum, was released recently. The study aimed at understanding the education scenario, particularly pre-school and elementary education during Covid-19 in Odisha, stated that pandemic has not only slowed down the learning process among children but also created a digital disparity among students in urban and rural parts of the State. The survey pointed out that the School and Mass Education department did not take into consideration the infrastructure and connectivity issues in rural parts of the State before launching the online education programme.

The study revealed that the Odisha Shiksha Sanjog programme that aimed at e-learning during the pandemic, has not been able to cover even 50 per cent of the school students except in Khurda district. The programme was launched by the School and Mass Education department in the year 2020 to engage students in the learning process through WhatsApp groups. Apart from this, the pandemic has brought to a complete halt to mother tongue-based learning for tribal children. While children of 22 among 63 tribal communities in the State are learning the curriculum in their mother tongue till Class V and Odia and English are subsequently added to it, the study found out that there was no specific planning by the government to develop online learning materials in their language. "No tribal student of primary grades is currently receiving learning materials in his/her mother tongue", it claimed.

Convenor of Odisha RTE Forum Anil Pradhan said online education was also a new concept for a majority of teachers who were technically weak. In a survey which is carried out in 15 districts the online learning process has also been affected during the pandemic because teachers were not habituated to e-learning and often found it difficult to communicate with students. Hence, they were unable to conduct online classes regularly and properly. Besides, the online learning process has remained one-sided with no scope for interactions or doubt-clearing sessions and follow-up by the teachers.

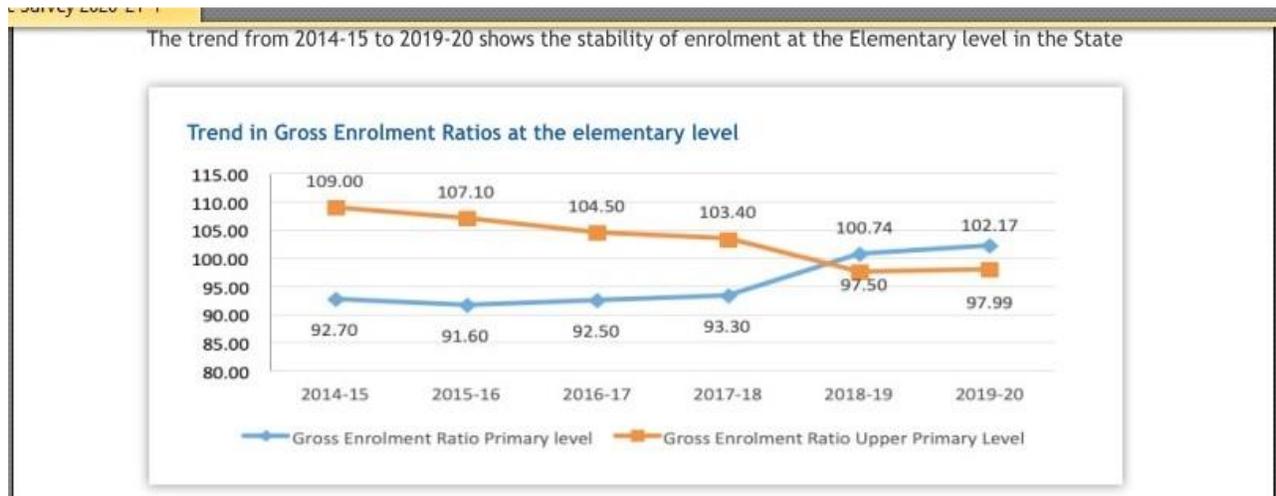
So following are demerits of online learning of elementary education during the pandemic.

- i. Not all children have the necessary knowledge, skills and resources to go through online classes. Spending more time on virtual platforms can have health impact on them.
- ii. Learners from low-income families and disadvantaged groups are the more likely to suffer during online learning as they may not afford high-speed internet connection and required technical gadgets. It widens gap between privileged and unprivileged learners.
- iii. It may lead to laziness with some students being at their home and may lack self discipline.
- iv. The atmosphere of a face-to-face meeting is lost. Interpersonal relationship between students and teachers or between students may hamper.
- v. The security of personal data may be compromised as one can hack the digital devices without latest software updates and antivirus programs.

3. The trend of enrolment and dropout rate in Elementary Education in Odisha

The trend of enrolment and dropout rate in Elementary Education in Odisha during Covid19 and whether the enrollment & dropout patterns has changed as a result of the covid19 pandemic. According to the Odisha Economic Survey Report(2020-2021) the Gross enrolment ratios at primary and upper primary level stood at 102.17% and 97.99% respectively. The trend from 2014-15 to 2019-20 shows the stability of enrolment at the Elementary level in the State. Dropout rates for primary education improved to 1.55 in 2019-20 from 5.42 in 2018- 19. As shown in the figure.

Figure 1 Stability of enrolment at the Elementary level in the State (2014-15 to 2019-20)



Source:Odisha Economic Survey(February2021)

But according to another report published in The Indian Express on January 7, 2022, [in the pandemic-hit 2020-21, 49,098 students dropped out of school before entering higher secondary level, including 15,792 tribal and 11,045 students from the Scheduled Caste (SC) category. In 2019-20, 8,168 students dropped out after secondary school, shared School and Mass Education Minister Sameer Ranjan Dash in a reply in the assembly. According to the data, at 6,731, the highest dropouts were in Kalahandi district, including 2,086 ST and 905 SC students, followed by Koraput district, 3,587, including 1,821 ST and 618 SC. The lowest was recorded in Mayurbhanj district with 13 students, followed by Cuttack, where only 19 dropped out. Among the coastal districts, 2,363 students in Ganjam, 1,822 in Bhadrak, 1,734 in Khurda, 1,592 in Balasore, 1,364 in Jagatsinghpur and 1,255 in Puri dropped out. In Sundargarh, 3,426 students and in Angul 2,715 left. Similarly, 2,679 students left education midway in Bargarh, 2,350 in Nuapada, 2,020 in Malkangiri and 2,011 in Keonjhar. As per data accessed by the (Mohanty,2021) while the dropout rate decreased for primary, upper primary and elementary sections to six per cent in 2018-19, it drastically increased to 23.39 per cent in 2019-20. The Net Enrollment Ratio (NER) also dropped for secondary sections from 57.51 per cent in 2018-19 to 54.62 in 2019-20.

In another response furnished by the minister, only 29 per cent students from across the state have access to smart phones. For maximum reach, the school and mass education department even started lessons through Doordarshan, YouTube and radio.

Through YouTube, the state could only reach out to 33.52 per cent of the total students, while only 22.46 per cent attended classes broadcast by Doordarshan under the Shiksha Darpan initiative.

The figures were further low for radio pathshala for classes I -VIII, which was only attended by nine per cent students. Of the 43.72 lakh students enrolled at the elementary level (from Class I to VIII), only 15.92 lakh, 36.42 per cent, watched live YouTube classes when school remained shut. At secondary level, the percentage who attended live YouTube classes was only 33.52.

The Shiksha Darpan programme on *Doordarshan* was attended by 20.10 per cent students at elementary and 24.8 per cent at secondary levels. The radio pathshala was attended by 9.47 per cent students. Of the 43.72 lakh elementary students, a little over 4 lakh attended radio classes in the previous academic session.

In the last one year, the department has initiated various schemes to curtail and check dropout rates. “As schools are now reopening, we will ensure all students are tracked and enrolled in school. We already have an initiative where teachers and principals visit dropout students and their families to convince and provide them help to continue school.

4. Government Policy Initiatives

Odisha is alone state which is recurrently affected by natural disasters and is therefore experienced the greatest human and economic impacts. The COVID -19 pandemic is the greatest disaster of 2020 not only in our State but over the globe. Odisha government created a historic mile stone in facing the challenge of COVID 19. After the GOI announced the complete nation-wide lockdown on 23rd March 2020, all educational institutions in Odisha were shut to contain the spread of the virus and to abide by the lockdown norms.

The following initiatives taken by School and Mass education for prevention of the negative impact of the pandemic on the students of elementary schools for continued education and supplementary nutrition for vulnerable students.

- (a) Continuation of Mid-Day meals: The Department of School and Mass Education, Government of Odisha (GoO) instructed all Collectors to provide Mid-Day meal dry rations to school children for the period 16th March to 13th June 2020 through fair price shops or PDS retailers. In June 2020, the Department of School and Mass Education, GoO invoked Section-145 of MDM Rules (2015) to pay the food security allowance consisting of food grains as per entitlement of the child and prevailing cooking cost. This was also in line with the GOI's order that the Food Security Allowance under the Mid-day Meal Scheme be provided during the lockdown, summer vacation and later when schools had not reopened. The money was transferred to the student's or parent's account by DBT mode.
- (b) School syllabus reduced by 30 percent for this academic year: In August 2020, the School and Mass Education Department of the GoO reduced the syllabus for the academic year 2020-21 by 30 per cent, in view of ongoing COVID-19 pandemic. The state government's decision is applicable for classes I to XII.
- (c) 'Radio Pathsala' and 'Radio Surbhi': With schools closed since 17th March 2020, due to the COVID-19 pandemic, the School and Mass Education Department, GoO announced that students from classes one to eight of government-run institutes in Odisha will be taught via radio from Monday 28th September 2020. The Department had provided textbooks to school children earlier.
- Lessons conducted for two classes each day are aired through all radio stations in the state. The audio programme is also uploaded in the central government's DIKSHA online platform. Students from Class I to VIII learn their lessons through a class of 15 minutes duration everyday from 10 a.m. to 10.15 a.m. conducted by experienced teachers. Like 'Radio Pathsala', differently abled students are being taught through a community radio programme Radio Surbhi during the pandemic.
- (d) Odisha ShikshaSanjog': A digital learning programme through WhatsApp groups has been initiated since 19th April 2020 to engage students in teaching learning activities during lock down situation due to COVID-19. Community based teaching-learning programmes are adopted in different districts like Shiksha Setu (Bargarh), Shiksha Sanklapa (Jajpur) Shiksha Sanjibani (Bhadrak), Mo Shiksha Sathi and Ashara Pathe (Sundargarh).
- (e) Madhu App: A syllabi-based e-learning App in Odia language dedicated to provide mother tongue based virtual classroom experience focusing on Self-learning and self-assessment of learning achievement in online mode. Telecast of Video Lessons in Doordarshan (Odia Channel) going on for Grade-10 since April 2020. Recording of video lessons for Grade 9 and 12 are going on for telecast in Swayamp Prabha Channel.
- (f) Teacher training on-line: 1,37,705 teachers trained on making educational videos through Smart phone to facilitate Odisha ShikshaSanjog, 163 Principals of OAVs trained on understanding School Leadership. 3122 Teachers trained on Ganita Kalika Andolan. 3258 English teachers trained through MOOC provided by British Council on Learner and Classrooms organised by Mo School, Odisha. 517 DEO, BEO and Headmasters trained online on Knowledge series which was organised by Mo School, Odisha.

Hence, the School and Mass Education Department turned to All India Radio to reach out to children in remote parts of the State. The AIR service reaches the remote parts of the State. Also, radio is cheap compared to smart phones and the recurring cost is also low. The School and Mass Education Department has covered more students with the radio school programme.

III. SUMMARY AND CONCLUSIONS

Certain Observations were made with regard to implications of pandemic on elementary education.

First, emerging facts shows that the pandemic has negatively affected academic expansion widening existing disparities.

Second, for many learners, the sudden shift to learning from home amid the challenges of the pandemic has become harder for the students to cope with.

Third, almost all students have experienced some challenges to their mental health and well-being during the pandemic and many have lost access to school-based services and supports for education. It is true that technology paves the way for education, thus helping the students and teachers to connect virtually through online class, digital exams, and so on. But the sad truth is that it is not available to many students all over the nation.

In this study, our findings indicated that the Covid-19 outbreak has made a significant impact on the elementary education sector in Odisha. The Covid-19 related interruptions highlight key challenges and provide an opportunity to further evaluate alternate measures in the education sector. To develop multimodal approaches to achieve course content objectives for better learning outcome can be a better idea to deal with the complexity of online education. Undauntedly, the governments must ensure the availability of reliable communication tools, high quality digital academic experience, and promote technology-enabled learning for students to bridge the disparities originated in the education system before and after COVID-19 catastrophe which is also inevitably necessitated for uninterrupted learning. Few steps should be accounted in the wake of this pandemic; to develop such a curriculum that reflects the perceptible change in the content knowledge and learning experience of students as well as enable them to think critically.

Various steps are also being taken by the Govt. Odisha to curtail dropout rate and to enhance enrollment rate that has been affected by the pandemic by extending all help to students of elementary education to continue school. Everyone must learn to live and survive

with the present crisis as it will continue for some more years; in the long run, no can afford the negligence towards digital transformation in elementary education sectors. The new policies and guidelines in this direction would help mitigate some of the negative effects and prepare educators and students for the future health crisis. The infrastructure should be updated and providing education to every child amid the pandemic is the need of the hour.

REFERENCES

- [1] UNICEF (2020), "Education and Covid -19 Response", Adressing the Impact Of COVID-19 on Education, <https://www.unicef.org/eap/education-and-covid-19...>
- [2] Economic Survey(February 2021), "Planning and Convergence Department Directorate of Economics and Statistics ,Government of Odisha".
- [3] Global Campaign for Education (GCE) (2020), "CoronaVirus: Don't Let Our Children Down!", philani@campaignforeducator.org .
- [4] Hindustantimes(Jan 06,2022), "Odisha withholds decision to reopen schools for Classes 1 to 5".
- [5] Jena, P. (2020), "Online learning during lockdown period for covid19 in India". International Journal of Multidisciplinary Educational Research, 9(8). P 82-87.
- [6] Mishra, et al.(2020). "Online teaching-learning in higher education during lockdown period of Covid-19 pandemic." International Journal of Educational Research
- [7] Ramakrishna, K. (2021), "Impact of Covid-19 on Higher Education in India", International Journal Of Multidisciplinary Educational Research, Vol.10, Issue:3(7).
- [8] Swain & Das, (2021) ., "Combit response to COVID-19 pandemic in Odisha: future public health challenges and measures", International journal of community Medicine and Public Health 8(2):979 DOI:10.18203/2394-6040.ijcmph20210253.
- [9] The Times Of India (JUNE,2021), "Odisha Govt.e-learning methods for student".
- [10] The Indian Express (Friday, January 07, 2022), "Absent Students: How dropout rate went up in Odisha post pandemic".
- [11] UNICEF (2020), "Education and Covid 19".

AUTHORS

First Author – Swetapadma Nayak, PhD Scholar, Ravenshaw University, Cuttack, Email:nayaksweta2010@gmail.com .Contact no:9178992302

Second Author – Dr. Lipishree Das,

Associate Professor. Ravenshaw University, Cuttack. Contact No. 861460154, Email Id: drlipi_dsa@yahoo.co.in

Gaucher's Disease : A Rare Genetic Disorder

Dr. Avinash Narayan More

Junior Resident Doctor at Dept. of Pediatrics, Maharashtra PGIMER & Civil Hospital, Nashik

DOI: 10.29322/IJSRP.12.10.2022.p13044
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13044>

Paper Received Date: 4th September 2022
Paper Acceptance Date: 5th October 2022
Paper Publication Date: 13th October 2022

Abstract- Gauchers disease caused by beta glucocerebrosidase deficiency, being the commonest lysosomal storage disorder, is a rare genetic disorder. Presenting features vary depending on the types classified by neuronal involvement.

Treatment mainly is symptomatic. Specific therapy includes enzyme replacement, substrate reduction and bone marrow transplant.

I. INTRODUCTION

Gaucher's disease is the most common lysosomal storage disorder. Mode of inheritance being autosomal recessive, It is caused by deficiency of beta- glucocerebrosidase enzyme (present on chromosome 1) which leads to deposition of glucocerebroside in cells of macrophage-monocyte system in various organs.

It is extremely rare in India and commonly found in Ashkenazi jews.

There are three types of Gaucher's disease depending on CNS (central nervous system) involvement as follows -

Type 1 : Non-neuronopathic form, most common type, seen in childhood or early adulthood

Type 2 : Acute neuronopathic form , presents in childhood, Rapidly progressive and fatal

Type 3 : Chronic non-neuronopathic form, slowly progressive

Other types

-Perinatal lethal form

-Cardiovascular form

Individuals with gauchers have clinical features viz bruising, lethargy, anemia, skeletal involvement, hepatosplenomegaly, Interstitial lung disease, pulmonary arterial hypertension. CNS involvement is in the form of cognitive decline, ataxia, gaze abnormalities and seizures.

II. CASE PRESENTATION

9 year old female child , hindu by religion, born to parents of non-consanguineous marriage was admitted to tertiary care hospital with predominant clinical presentation of abdominal distension, loss of muscle strength, short stature & conjunctival hemorrhage in Right eye. Milestones were normal. The parents also gave history of repeated blood transfusions in the past since the child was 6 month old. On examination the child was pale, cachexic, abdomen was distended (liver was 5cm palpable below right costo-chondral margin and spleen was 20cm palpable below left costo-chondral margin). CNS examination was normal.

Peripheral blood smear was s/o pancytopenia and bone marrow biopsy was showing histiocytes with abundant granular and fibrillar cytoplasm (charecterstic crumpled tissue paper appearance).

Screening was done by enzyme levels which surprisingly turned out to be normal and the diagnosis was confirmed by genetic testing.

Considering the scenario and findings patient was diagnosed type 1 Gaucher's .

Treatment given: multiple blood transfusions f/b splenectomy.

III. IMAGES



Image 1: Muscle wasting with short stature with distended abdomen.



Image 2: Massive splenomegaly crossing the umbilicus.



Image 3: Massive Hepatosplenomegaly.



Image 4: Large subconjunctival hemorrhage in Right eye.

Test Performed: Sequence and deletion/duplication analysis of the *GBA* gene
Reason for Referral: Clinical features of disease

1

 Pathogenic sequence variant and sequencing variant of uncertain significance detected.
 No reportable copy number variants (CNV) detected.
 Clinical and biochemical correlation is required.

Relevant Findings and Interpretation

Sequence variants:

Classification	Gene	Exon/ Intron	DNA Change	Protein Change	Zygoty	Inheritance	OMIM	Associated Disease
Pathogenic	<i>GBA</i>	11	c.1448T>C	p.Leu483Pro	Heterozygous	Autosomal Recessive	606463	Gaucher disease
Uncertain Significance	<i>GBA</i>	12	c.1603C>A	p.Arg535Ser	Heterozygous	Autosomal Recessive	606463	Gaucher disease

***GBA* c.1448T>C (p.Leu483Pro) - Pathogenic.** The c.1448T>C (p.Leu483Pro) missense variant results in the substitution of the leucine codon at amino acid position 483 with a proline codon. This variant, also known as p.Leu444Pro, is a common *GBA* pathogenic variant and is frequently identified in individuals with type 2 or 3 Gaucher disease (PMID: 10649495, 10796875, 20301438). The highest population frequency of this allele in gnomAD is 0.25% in the Ashkenazi Jewish population, with a frequency of 0.12% in the total population (9/1/22 PMID: 32461654). *In silico* meta-analysis (REVEL) predicts a deleterious effect on protein function (PMID: 27666373). The c.1448T>C (p.Leu483Pro) *GBA* variant is classified as pathogenic. Clinical and biochemical correlation is required.

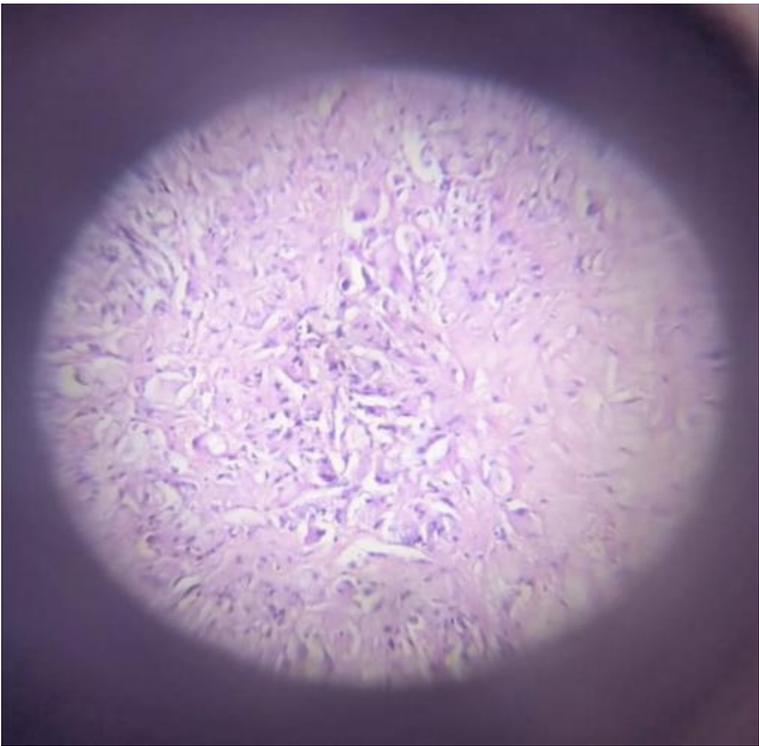
***GBA* c.1603C>A (p.Arg535Ser) - Uncertain Significance.** The c.1603C>A (p.Arg535Ser) missense variant results in the substitution of the arginine codon at amino acid position 535 with a serine codon. To our knowledge, this variant has not been reported in the literature as causative of disease or as a variant in the general population (9/1/22 PMID: 32461654). *In silico* meta-analysis (REVEL) is inconclusive regarding the predicted effect on protein function (PMID: 27666373). Substitutions at the same codon, p.Arg535His and p.Arg535Cys, have been reported in individuals affected with Gaucher disease (PMID: 8432537, 27735925, 32042592, 1487244, 24522292). However, there is currently insufficient evidence to determine the pathogenicity of the c.1603C>A (p.Arg535Ser) *GBA* variant, therefore this variant is classified as a variant of uncertain significance. Clinical and biochemical correlation is required.

Image 5: Gene sequencing & deletion/duplication analysis of the *GBA* gene s/o Gauchers disease.



Image 6: Gross specimen of massively enlarged spleen of around 1.5 to 2 kg.

Image 7: Histology of Spleen showing multiple cells with eccentric nucleus with abundance of eosinophilic cytoplasm s/o crumpled tissue paper appearance of cytoplasm.



IV. DISCUSSION

Gauchers disease is a rare genetic disorder due to deficiency of beta- glucocerebrosidase enzyme levels which leads to deposition of beta-glucocerebroside in various organs eventually causing interference with normal functioning of cells. It has varied and multi-organ presentation.

Gold standard for diagnosis is genetic testing and enzyme levels can be used for screening. Treatment is mainly supportive. Specific treatment includes enzyme replacement therapy. Bone-marrow transplant may be beneficial only in type 3. Substrate reduction therapy might be done in few cases only.

REFERENCES

- [1] Cassinerio E., Graziadei G., Poggiali E. Gaucher disease: a diagnostic challenge for internists. Eur J Intern Med.
- [2] Relichman G.D., Linares A., Villalobos J., Cabello J.F., Kerstenetzky M., Kohnan R., et al. Enfermedad de Gaucher en Latinoamérica. Uninforme del registro internacional y del grupolatinoamericano para la enfermedad de Gaucher. Medicina.
- [3] Acanda de la Rocha A.M. Aspectos bioquímicos, genéticos y comorbilidades de la enfermedad de Gaucher, diagnóstico molecular en Cuba. Rev Cubana Genet Comunit
- [4] Herráez-Albendea M.M., Fernández-Cofrades E.G., Castillo Jarilla-Fernández M., Jiménez-Burgos F. Enfermedad de Gaucher: a propósito de un caso.
- [5] Cristo-Pérez V., Arias-Galán L., Quesada-Laferté Y., Yllodo-Hernández O., Casa de Valle-Castro M., Pérez-Porras B. Enfermedad de Gaucher tipo I y enfermedad de Parkinson

AUTHORS

First Author – Dr. Avinash Narayan More (Junior Resident Doctor at Dept. of Pediatrics, Maharashtra PGIMER & Civil Hospital, Nashik)

Second Author – Dr. Anarya H. Karle (Senior Resident Doctor at Dept. of Medicine)

Autopsy of an Abortion Case with Birth Concealment

Reza Priatna¹, Adriansyah Lubis¹, Zulfia Retnanti Marissa¹

¹ Department of Forensic and Medicolegal, Medicine Faculty University of North Sumatra
RS. H. Adam Malik 20136, Medan, Indonesia.

DOI: 10.29322/IJSRP.12.10.2022.p13045
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13045>

Paper Received Date: 6th September 2022
Paper Acceptance Date: 6th October 2022
Paper Publication Date: 13th October 2022

Abstract- Abortion is the expulsion of a fetus from the uterus before it has reached the stage of viability. In the case of finding an unknown baby's body in an improper place, it is very important to know whether the baby has breathed after birth or not. This will affect the type of charge against the suspect, whether it is abortion case or infanticide. The ability to breathe the fetus after birth is influenced by viability where one of the criteria is the age of the fetus in the uterus. In Indonesia, the fetus is considered viable if the fetus is over 28 weeks old, but in the UK it is now using the limit of 24 week above. Illegal abortion is always followed by concealing the birth by burying, hiding or removing the baby's body. The baby's body was found floating on the beach with the umbilical cord still intact. At the examination, the decomposition process was found and no clear signs of violence were found. Anthropometric measurements of the baby were body weight 850 g, body length 34 cm and head circumference 30 cm. The examination of lung indicated that the lung was never expanded. lung float test was negative. From the results of the examination, it was concluded that the victim was not breathing since birth because the fetus was not yet viable at birth.

Index Terms- Abortion; Still Birth, Birth Concealment.

I. INTRODUCTION

In Indonesia, a lot of women experienced a pregnancy that is not planned each year, and most of them want to ending their pregnancy because for various reasons. According to Gilda Sedgh et al, the incidence of abortion in the world is 35 out of 1000 women aged 15-44 in 2010-2014, where more occur in developing countries (37 out of 1000 women) than in developed countries (27 out of 1000 women). About 80 percent of pregnancy that is not planned ending with the abortion.¹ Estimated cases of abortion in Indonesia is around two million in 2000. Incidence rate of abortion based on a study is 37 out of 1,000 women's reproductive age.² This estimation is higher when compared with other countries in Asia, about 29 abortions occur for every 1,000 woman of reproductive age.¹

Existing law in Indonesia has arranged action abortion criminals as law criminal material, then every deed abortion will be charged penalty criminal to the culprit. In the Criminal Code (KUHP), there are related articles with abortion criminal that is in Pasal 299, 346, 347, 348, and 349. Abortion can also be legal

action if indicated for medical reason with the conditions that have been determined in the Undang-Undang Republik Indonesia Number 36 of 2009 concerning Health.

The role of the doctor in the autopsy of the fetus corpse is to check fetus corpse for several things, one of them that is birth signs of life. This thing is important for police in determining the provision of the law violated by the suspect. Besides that, estimating the ability fetus to live outside the womb (viability) is also important.³

Birth concealment is a crime. The most frequent thing that makes a mother hide the birth of the baby is fear or embarrassment known by people because of unwanted pregnancy.⁴ Concealment birth is breaking the regulated crime in Pasal 308 of KUHP for birth concealment and Pasal 181 of KUHP for still birth.

II. CASE DESCRIPTION

The examination of a fetus corpse has been done accompanied by a letter request for Visum et Repertum. The corpse found on the beach in position face down. Umbilical cord still attached to the body with placenta. The corpse found without wearing clothes.

External Examination

- a. The body is unlabeled.
- b. Corpse was in plastic bag shrouded with towel and jacket.
- c. There was no post mortem rigidity and lividity were found. Signs of decay was found like change of skin color and exfoliation skin all over the body.
- d. Fetus corpse was a female with body length 34 cm, weight 850 grams.
- e. Head:
Asymmetrical, her hair was straight and black, hair length was ± 1 cm, head circumference was 30 cm.
Eyes: cloudy cornea eye.
Nose: symmetrical, no abnormalities.
Mouth: normal shape, teeth have not grown. No abnormalities.
Ears: normal shape, no abnormalities.
There were no signs of violence on the head.
- f. Chest: No signs of violence were found.
- g. Abdomen: looks bulging, umbilical cord is still attached to the body, bluish red color, length 31 cm. The placenta and umbilical cord are still attached to the abdomen.

- h. Upper and lower limbs: nails do not pass the fingertips.
- i. External genitalia: no abnormalities.
- j. Anus: no abnormalities and no signs of violence were found.



Image 1. Fetus corpse complete with placenta and umbilical cord.

Internal Examination

- a. Chest cavity
 - (1) No signs of violence.
 - (2) Lungs not fulfill the chest cavity .
 - (3) Diaphragm was at level 3rd ribs.
 - (4) Heart consistency was soft, the color was red, size heart was 2 x 1.5 x 1.5 cm. Not found of abnormality.



Figure 2. Macroscopic view of the heart and lungs

- (5) Lungs: crepitus (-), consistency was chewy, red color, edge lungs was sharp. The right lung measures was 2.5 x 2 x 1 cm. The left lung measures was 2 x 1.5 x 1 cm.



Figure 3. The lungs do not fulfill the chest cavity at the opening of the chest cavity

- b. Stomach Cavity
 - (1) Liver colored red black, smooth surface, sharp edge, chewy consistency, the weight was 50 grams.
 - (2) There was no food in gaster. The gaster was submerged in water.

- (3) The small intestine and large intestine were submerged in water.

c. Cavity Head

- (1) Not found abnormality or signs of violence.
- (2) The brain was melted (sign of decay)



Figure 4. Macroscopic view of the brain that has melted a result of the decay process

- d. Neck: No abnormalities or signs of violence.

Inspection Addition

- a. Lung floating test: negative.
- b. The ossification center was found in the calcaneus.
- c. Blood type: O



Figure 5. Lung floating test

Conclusion on Visum et Repertum

1. The corpse was female.
2. On external examination: signs of the decay process were found. Weight 850 grams, body length 34 cm, head circumference 30 cm. There is a change in skin color and peeling of the skin. There were no signs of abuse or violence.
3. On examination, it was found that the lungs did not fulfill the chest cavity, negative lung rattles, sharp lung edges. The lung floating test was negative. No abnormalities or violence were found.
4. The fetus was not viable (26-28 weeks), the fetus never breath. No signs of treatment were found.
5. The victim did not breathe after birth (abortion) according to the age of the fetus in the womb.

III. DISCUSSION

There was a case of the corpse of an unknown fetus in an inappropriate place, which was found on the beach. Several possible cases happened to the victim, including the abortion baby, the victim of the murder of her own child, the murder victim, stillbirth and discarded and the neglect of the newborn child. All of the cases mentioned above are certainly related to different legal provisions.

Born alive or stillborn?

The first thing we find out from examining a fetus's corpse is whether it was born alive or stillborn.

To determine whether the fetus was born alive or dead, it can be seen from the examination of the respiratory system. In babies who have breathed, the level of diaphragm as high as 5th or 6th ribs while those who haven't breathed is as high as 3rd or 4th rib. Fetus lungs who has breathe colored red, no homogeneous and mottled, consistency like sponge and cracks at the touch. Meanwhile, in the fetus lungs who hasn't breathe colored red purple. Fetus lungs who has breathe will floating if in water, while fetus lungs who hasn't breathe will sink.⁶

In this case, the lungs were dark red in color, the lungs did not crack, the consistency was chewy, the lung edges were sharp and the floating test of both lungs was negative. The lungs do not appear to fill the chest cavity. The diaphragm is palpated at the level of the 3rd intercostal space. From the results of the examination, it can be concluded that the body of the baby never breathed or was stillborn.

Treatment signs

The next thing to look for from the examination of the baby's corpse is signs of treatment. Newborn that didn't get treatment care is known from several signs, body still covered by blood, placenta still attached with umbilical cord. When placenta no exists, then the end of the umbilical cord cuts look irregularly. Presence of vernix caseosa, on the forehead and in the area containing folds skin, like area fold armpit, fold thighs and parts behind buttocks. Signs of treatment are not as important for stillbirth cases as in live birth cases, where in live birth cases it will determine whether the case leads to homicide or the murder of the child himself. But it is also useful as additional information for investigators in solving their cases.⁶

In this case, the umbilical cord was found completely with the placenta still attached to the baby's body, which indicated that there were no signs of postnatal care on the baby's body. This indicates that the mother of the baby's corpse may not want the baby. Even though the baby she gave birth to was dead, as a mother, at least cut the umbilical cord and buried it properly, not throwing it on the beach.

Viability

Estimated child capable live outside the womb if the weight has reach 1000 grams or age 28 weeks gestation. Determine viability baby means to do evaluation to ability for maintain his life outside womb without special equipment. Viable if the baby the could live outside womb without additional care or life support from special equipment. The criteria for a viable baby are gestational age of more than 28 weeks, body length of more than 35 cm, weight of more than 1000 grams, head circumference of more than 32 cm and no severe congenital abnormalities.^{7,8}

In this case, the body weight was found to be 850 grams. According to her weight, the baby's gestational age is around 26-27 weeks old. Body length measured on examination is 34 cm, when converted to gestational age it becomes 27-28 weeks. In the head circumference measurement, a value of 30 cm was obtained, where the baby's viability limit was above 32 cm. On external examination and internal examination of the body, no major

congenital abnormalities were found. So from the findings and measurements of the corpse, it can be concluded that the baby is not viable, which means the baby is unable to maintain life outside the womb. Estimated fetal age is 26-28 weeks.

Mother-daughter identification

In the case of abortion, an examination by a doctor is also carried out on the suspect (the baby's biological mother) and the baby. Signs of new childbirth can be seen from new torn wounds along the birth canal, the uterine ostium can be passed by the fingertips, bleeding from the uterus, uterus size, breast milking, and hyperpigmentation of the areola mammae.³

In this abortion case, the police did not catch the mother of the fetus. Investigators only sent the baby's body. Therefore, the examination is only carried out on the corpse of the baby.

Aspect medicolegal

When investigators ask autopsy corpse to a doctor, then doctor must know what to do so as not to there is missed things after autopsy. Because visum et repertum used for judiciary, doctor should also know about the law, especially criminal law so that examination of the corpse can more focus on related things with that law.

In this case, the baby's corpse is declared as a stillborn in a non-viable baby. However, because in KUHP there is no question about gestational age, the punishment for stillbirth in a viable baby is the same as in the case for a stillbirth for a non-viable baby. The articles related to this case are Pasal 299, 346, 347, 348, 394.⁹

In this case, information was also obtained that the baby's body was found on the beach. Therefore, this case can also be subject to a crime of concealment of birth (stillbirth and then discarded) as stated in Pasal 181 of KUHP which reads: Whoever bury, hide, carry away or remove a corpse with the intention of hiding his death or birth, is threatened with imprisonment. a maximum of nine months or a maximum fine of four thousand five hundred rupiah.⁹

All of the above are criminal articles that may be related to this case. But it would be even better if investigators could find suspects and other new evidence so that this case could be revealed.

IV. CONCLUSION

This report contains cases of alleged abortions accompanied by concealment of births that began with the discovery of the corpse of an unknown fetus on the beach. On autopsy examination it was found that the baby was stillborn, there were no signs of treatment, the baby was not yet full term in the womb (not viable) without any signs of violence. However, the suspect (the victim's biological mother) has not yet been found, so the act of abortion is still uncertain. The articles that can be imposed due to the act of abortion are psdsl 299, 346, 347, 348 and 394 of KUHP as well as acts of concealment of births of Pasal 181 of KUHP.

REFERENCES

- [1] Lancet. Abortion rates at all-time low in developed countries but remain unchanged in developing countries. *ScienceDaily*; 2016. Diakses pada 28

Oktober 2020 dari
www.sciencedaily.com/releases/2016/05/160511210615.htm.

- [2] [2] Utomo B dkk. Insiden dan Aspek Sosial-Psikologis dari Aborsi di Indonesia: Survei Komunitas di 10 Kota dan 6 Kabupaten, Tahun 2000. Jakarta: Pusat Penelitian Kesehatan, Universitas Indonesia; 2001.
- [3] [3] Hoediyanto. Buku Ajar Ilmu Kedokteran Forensik dan Medikolegal. Surabaya: Departemen Ilmu Kedokteran Forensik dan Medikolegal Fakultas Kedokteran Universitas Airlangga; 2010.
- [4] [4] Rifki Firman. Analisis Kriminologis Kejahatan Penelantaran Bayi. Jurnal Poenale Vol 3 No 4; 2015.
- [5] [5] Idries, A.M. Pedoman Ilmu Kedokteran Forensik. Jakarta: Binarupa Aksara; 1997.
- [6] [6] Budiyanto, dkk. Ilmu Kedokteran Forensik. Jakarta: Bagian Kedokteran Forensik Fakultas Kedokteran Universitas Indonesia; 1997.
- [7] [7] Asmarawati. Hukum & Abortus. Yogyakarta: Deepublish; 2013.
- [8] [8] Hamdani, N. Ilmu Kedokteran Kehakiman. Jakarta: Gramedia Pustaka Utama; 1992.
- [9] [9] Hamzah, A. KUHP & KUHAP. Jakarta: Rineka Cipta; 2004.

AUTHORS

First Author – Reza Priatna, Department of Forensic and Medicolegal, Medicine Faculty University of North Sumatra RS. H. Adam Malik 20136, Medan, Indonesia., Email: rjpr11111@gmail.com

Second Author – Adriansyah Lubis, Department of Forensic and Medicolegal, Medicine Faculty University of North Sumatra RS. H. Adam Malik 20136, Medan, Indonesia.

Third Author – Zulfia Retnanti Marissa, Department of Forensic and Medicolegal, Medicine Faculty University of North Sumatra, RS. H. Adam Malik 20136, Medan, Indonesia.

Zambia's Response To The Coronavirus (Covid-19) Driven- School-Closures: The Effectiveness Of TV Teaching To The Learners And The Teachers In Secondary Schools: The Case Of ZNBC TV4 channel introduced in the wake of COVID-19 on the Topstar Decoder.

Gladys Matandiko

PHD student in Education Administration and Management @ University of Zambia. Holds a Masters in Philosophy in Conflict Resolution and Peace Studies (2015) and A Bachelor Science in Education (B.Sc. Ed), Works as Assistant National Education Secretary in the Education Department @ the Catholic Secretariat of the Zambia Conference of Catholic Bishops (ZCCB).

DOI: 10.29322/IJSRP.12.10.2022.p13046
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13046>

Paper Received Date: 5th September 2022
Paper Acceptance Date: 5th October 2022
Paper Publication Date: 13th October 2022

Abstract- According to Ngware (2020), Countries around the world have responded to coronavirus (COVID-19) driven school closures by adopting remote learning approaches, with many deploying online learning programs. However, online learning has exposed deep digital divides between and within countries, including high-income countries. The situation is far worse for lower resource environments in middle- and- low-income countries with Internet penetration rates typically less than 50% and a large share of students without devices to enable online learning at home. Countries are therefore turning to television to significantly increase access to remote learning.... (Ngware, April 19, 2020), but is this effective for middle and low income countries? How many learners could be benefiting from this initiative?

This paper aimed to bring to the fore how effective television teaching was in countries like Zambia where it was the most widely used and disseminated means as an intervention to continued learning for pupils in the countries. The researcher used a descriptive research design because of the descriptive and analytical nature of the study. As can be seen from the literature reviewed, the researcher has shown how the MoGE not created an even learning environment while being involved in the provision of education in the country. Although some learners have used television lessons to remain 'learning something' during the COVID-19 era, the researcher is interested in knowing whether the TV lessons were effectively covering the syllabus and the time lost.

Index Terms- Television(TV) teaching and learning, ZNBC TV 4, Topstar Decoder, educational technology, COVID 19.

I. BACKGROUND

The normal teaching and learning in the Zambian education setup is highly an interactive classroom teaching. Interactive teaching is a means of instructing whereby the teacher actively involves learners in their learning process by way of regular teacher-learner interaction or learner-learner interaction, use of audio-visual aids and hands-on demonstrations. The learners are constantly encouraged to be active participants. (www.interactivetutors.hk>interactive Sept 5, 2011, accessed on 03/05/2020).

This national summary provides an overview of the structure of Zambia's general education system: out of 9,852 schools, 90% (8,843) are primary while 10% (1009) are secondary schools. A total of 4,139,390 learners were enrolled in 2017, representing a gross enrollment rate of 104.3% at primary and 46.4% at secondary levels. The efficiency and equity indicators suggest the need for further strengthening of the general education system.

(https://www.moge.gov.zm/download/statistics/annual_statistics/Educational-Statistical-Bulletin/EDUCATIONAL-STATISTICAL-BULLETIN-2017.PDF)

At the moment the effectiveness of educational technology depends on the strength of national networks and connectivity to technology. It's dependent on service providers and the devices at the disposal of schools, parents and learners, such as smartphones. To add to these are country-specific market realities, such as taxes and incentives.

Such efforts will be more effective if complemented with smartphone penetration. This currently stands at [far below 50%](#) of the total population in most countries. A 2017 survey showed that

smartphone penetration was at 51% in South Africa, 30% in Kenya and 13% in Tanzania.

In Africa, [internet penetration](#) in March 2020 stood at 39.3% of the total population compared to the rest of the world at 62.9%. In a few countries such as Ghana and South Africa, smartphone and internet penetration seem to go hand in hand, but for other countries such as Kenya, Nigeria and Senegal, internet penetration is way ahead of smartphone penetration. (Ngware, April 19, 2020)

Zambia shares in these limitations, hence, the Ministry of General Education (MoGE) had embarked on the use of television teaching to reach out to the learners who had to prematurely close schools and stay home for safety.

II. STATEMENT OF THE PROBLEM

In the wake of COVID 19, schools and all learning institutions had to close up and pupils were subjected to stay home for long periods of time with literally very little learning taking place. This worried many governments and in Zambia particularly, the first intervention that government initiated was the introduction of television learning. This was introduced with the opening of a television station solely for educational programs.

ZAMBIA NATIONAL BROADCASTING CORPORATION (ZNBC) OPENS AN EDUCATION CHANNEL ON TOPSTAR

Government has challenged parents to encourage their children to watch the newly launched ZNBC Education Channel 9. Ministry of General Education Permanent Secretary Jobbicks Kalumba says parents should not relent but take a role of teachers in homes. Dr. Kalumba told ZNBC news that the Ministry will ensure all necessary lessons are provided on ZNBC TV 4 for children, he said, government will also print education materials on CDs to be distributed country wide for the pupils. Dr. Kalumba said the printed education materials will supplement those that will be televised on TV and radio in rural areas (Jere, 2020). This paper aimed to establish the effectiveness of this television learning for the secondary school learners in Zambia.

III. INTRODUCTION

The use of television as a tool for formal education is an established fact. The extent of its use in this field, the size of television classes, the most effective subject matter adaptation, and the relationship of television teachers to classroom teachers are still matters of speculation and experimentation. Television being a dynamic instrument and Education being a dynamic process, it is probable that such speculation and experimentation will continue for a long time to come. And will produce a great many ideas and techniques in the field of learning. It can be reasonably stated that television teaching holds no threat to the professional teacher; it is not a substitute for teaching but an instrument for teachers to use in proportion to their ability to master its technique (Vernon, 1958).

Low and middle-income countries have been using education television [since the 1950s](#) including interactive television lessons more recently.

The World Bank's EdTech team has catalogued [examples of education television being used by countries during COVID-19](#) and has developed a [rapid response guidance note on using educational television programming](#) during school closures. This blog summarizes five key insights on starting, using and sustaining education television for remote learning, corroborated by more than 40 current examples from countries.

Five key things to get started

1. Use a mix of live broadcasts, pre-recorded (on demand) content and edutainment programs.

Broadcasting live lessons in mock classroom settings is the fastest way to get started for countries with limited or no education television experience (e.g. [Morocco](#), [Spain](#), [South Africa](#)). Some countries have existing national education television networks with a wide reach. For those Broadcasting existing pre-recorded material (possibly available as on-demand content) from private and non-profit organisations (e.g. [Khan Academy](#)) is a useful option for countries with existing educational television programs (e.g. [Croatia](#), [Spain](#)). Edutainment programs that provide education in the form of entertainment is another useful source for programming. Developing these as a short-term response to COVID-19 is not advised. Instead, consider sourcing, curating and obtaining intellectual property rights for existing content from local or international sources (e.g. Ubongo used in [33 African countries](#), Sesame Workshop used in [40 countries](#)).

2. Identify channels for broadcasting programs.

without this, partnering with state television networks is a quick-start solution. [Morocco](#)'s national channel dedicated to sports is now being used to broadcast educational television as well. Partnering with private broadcasters can further amplify the reach of this programming across communities and allow simultaneous broadcasts for students across grade levels (e.g. [Mexico](#)). Rebroadcasted content is another way to amplify its reach using livestreaming or as on-demand content (e.g. Kenya uses YouTube, [Pakistan](#) uses an app).

3. Develop schedules for educational television programming.

Broadcast schedules must clarify where and when such broadcasting can be accessed. Some countries are providing student-friendly daily and weekly schedules on their education ministry's website (e.g. [Mongolia](#)), some on their education television network websites (e.g. [China](#), [India](#)) and some on institutional websites (e.g. [Kenya](#)).

4. Develop a communication strategy and communicate regularly.

Continuously communicating during this period is pivotal to the success of such programming. Communicate before launching the programming (e.g. [Brazil](#), [West Bank and Gaza](#)). To amplify awareness, communicate schedules continuously and widely using every available media including television, radio, mobile phone via text messages or WhatsApp (e.g. [Peru](#)), social media like Facebook (e.g. [Rwanda](#)) and websites of education ministries and education television networks (e.g. [Korea](#)). Organizing all programming related resources in one place makes it easier to access them and increases uptake. This can be done on

the education ministry website, national television network website, etc. (e.g. [India](#), [Nigeria](#), [Uganda](#)).

5. Provide support for students, parents and educators.

Throughout this programming, students, parents/caregivers and educators will require technical support (e.g. toll-free helplines or low cost [chatbots](#) can be employed), pedagogical support and socio-emotional support (e.g. [Spain](#)). Teachers can be mobilized to provide this (e.g. [China](#)). Education television can be made more interactive by answering questions during lessons. Questions can be collected by phone calls, text messages, email or social media, and answered during live lesson recordings. Keep multiple communication channels open (e.g. [Jamaica](#) has 36 helplines) and encourage feedback to improve the programming (e.g. [China](#), [Russia](#)).

(**Sharon Zacharia and Alex Twinomugisha**, Educational television during COVID-19: How to start and what to consider, |**APRIL 24, 2020**, **Education for Global Development in worldbank blogs**, <https://blogs.worldbank.org/education/educational-television-during-covid-19-how-start-and-what-consider>, viewed on 25/05/2020.)

EDUCATIONAL BROADCASTING SERVICES (EBS) OF LEARNING AT TAONGA MARKET: A ZAMBIAN STRATEGY

Learning at Taonga Market is one of the most successful education initiatives in Zambia's history. Since the radio lessons were first broadcasted 2001, hundreds of thousands of vulnerable children have received a high-quality education listening to our solar and wind-up radios. Taonga Market uses effective interactive radio instructions (IRI) methodology and follows the national curriculum. Lessons are broadcast over community radio stations across Zambia. (Education, 2014).

MATERIALS AND METHODS

IV. RESEARCH METHODS

The researcher used a descriptive research design because of the descriptive and analytical nature of the study. As can be seen from the literature reviewed, the researcher has shown how the MoGE not created an even learning environment while being involved in the provision of education in the country. Although some learners have used television lessons to remain learning something during the COVID-19 era, the researcher is interested in knowing whether the TV lessons were effectively covering the syllabus and the time lost.

In researching on this topic, the researcher used Qualitative research methods. The researcher used qualitative research methods because the techniques used in data collection was literature review, interviews and observation of how the Ministry of General Education in conjunction with ZNBC channel 4 on the TopStar decoder was effective in delivering TV lessons in Zambia.

7.1. Data Collection Methods

In the data collection, the researchers collected the data in two ways, namely; primary data collection and secondary data collection methods.

7.2. Primary Data Collection

In the primary data collection, the researchers used qualitative methods. In the qualitative methods, the researchers used the Literature Review, Interviews and Observation methods because these were the best methods to achieve the required results. The researcher needed to review the literature in order to learn of what the impact television lessons in terms of the television broadcasting media landscape, conduct interviews in the various home set-ups so as to get the views of the learners, parents/guardians and the teachers on how they were being impacted after the introduction of television lessons and also do their own observations to see whether these television lessons have assisted them amid COVID-19 school closure or not.

7.3. Secondary Data Collection

The researchers used some books, magazines, newspapers and the internet to beef up on the primary data that was collected. This is reflected in the section dealing with literature review across the breadth and length of Sub Saharan Africa. Document data collection is crucial for the purposes of reinforcing the primary data as well as the entire research so that there is more substance and evidence. This added up to the credibility of the research findings.

7.4. Sampling Technique

This research applied the purposeful/judgemental sampling technique because the researcher knew the target groups which were the school going pupils. Another sampling technique that was used was the expert sampling technique which meant surveying experts in the teaching field and get their views on this subject matter.

7.5. Data Analysis

In analysing the Literature Reviewed, the researchers focused on the actual content to determine whether in the implementation of the television lessons by Topstar Company on ZNBC channel 4 was doing anything to the benefit of Zambian learners and how many learners has accessed this national service initiated by the Ministry of General Education (MoGE) for all grades from Early childhood to grade 12.

However, in the case of Zambia, many other factors needed to be considered even before television learning/teaching can be considered as an option. These factors include Access to electricity, Access and Usage of Television and number of secondary school learners who are in privileged households that own a working and connected TV set and TopStar decoder. Their ability to subscribe monthly to the service providers TopStar and maintain this cost continually..

a) Access to Electricity by Households

A key feature on households investigated was the access to electricity which has possible causal influence on uptake of ICTs. Only 32.9 percent of the households indicated that they source power through a utility company. The problem is particularly pronounced in rural areas where only 6 percent of the households receive electricity from utility companies while 65.5 percent of households based in urban areas have access to electricity through power utility companies.

b) Access and Usage of Television and Radio Broadcasting Services

The proportion of households across the whole country with a working television set increased from 33 percent to 37 percent between 2015 and 2018. The proportion of households across the country that own a working radio reduced from 45 percent in 2015 to 40 percent in 2018. ZNBC television stations remain the most widely accessed local television stations by households that own working television sets in Zambia. On the other hand, the majority of households in the country that own working radios indicated that they access community radio stations. GoTV and TopStar recorded the highest frequency of households that indicated that they owned a working television set which was used to access broadcasting services and had access to pay television channels constituting 56.5 percent and 28.4 percent respectively (ZICTA, 2018). With only an access rate of 28.4 percent it is clear that TV learning failed to meet its intended objective.

V. FINDINGS

Comparing the milestones achieved during the Taonga Market radio programs, it is evident that the Television teaching/learning initiative needed a number of prerequisite strategy before being implemented for use by the learners. Most learners seemed to have failed to benefit from these initiatives due to many reasons ranging from lack of electricity, television sets to connectivity issues in the rural areas. While the TopStar decoder was unaffordable for some households, the TopStar decoder lacked popularity among the learners who were privileged to be in affluent households.

Learners did not appreciate the content of the lessons on television as it seemed lacking in content to their normal school lessons. Learners also missed out on the interactive side of the lessons making follow up very difficult. In addition not all grades and subjects were taught during this period leaving out a number of levels.

VI. RECOMMENDATIONS AND CONCLUSION

1. Connect and learn from other countries.

While the use of radio learning seems to have been a success story in the taonga Market programme, we have very little to show on any achievements in Television teaching/learning. It is therefore prudent that we fall back on other countries that have used TV as a starting point. These are countries with a history of using educational television (eg. [Brazil](#), [China](#), [Ethiopia](#), [Ghana](#), [India](#), [Mexico](#)) or have longer experiences using television to respond to school closures (e.g. [Korea](#)).

2. Content used during COVID-19 closures can be reused when schools reopen and to reach out-of-school children.

Video has one great advantage in that students can review the content multiple times, thereby possibly increasing its effectiveness. It is important to archive all the education television programming on online platforms (e.g. education television website, YouTube) and reuse them for regular school lessons and to reach out-of-school children (eg. [Mexico](#)).

3. **Compliment television with expanded access to the Internet and devices.** This can amplify the reach, impact and effectiveness of this television programming as well as related communication including, program schedules and support. This is possible even with limited Internet connectivity (e.g. text messages, WhatsApp) and simple devices. Access to digital platforms that host this education programming can be [zero-rated](#) (eg. Ghana, Korea, Qatar). Partner with Internet service providers to provide free internet access to online learning platforms, this has been achieved in [Kenya](#), [Rwanda](#), [Nigeria](#). Ministries and schools can loan out devices to students this the way [Saudi Arabia](#) has managed.

4. Consider supplementary actions like text messages and print material.

Supplementing television programming using print material like workbooks, written homework or newspaper-based activities can improve its effectiveness like in [Bangladesh](#). Text-messages can be used to 'nudge' parents/caregivers, students and educators with reminders to use this programming, share feedback or adopt 'good practices' that supplement the effectiveness of this programming.

5. Consider diversity, equity and inclusion.

Varied expertise can add diversity to this programming, say, by bringing in musicians, chefs or photographers to support teachers in providing real-life lessons to students of all ages and learning capabilities.

6. Zero-rate education websites to provide cost free access to learners.

The MoGE should work in partnership with internet service providers to zero-rate education websites for all levels of our education system. With this provision of free access to learners, it will be easier for the learners that have access to the internet to concentrate on the use of their devices for educational purposes. This has been done in South Africa through A [telecom operator](#), Telkom ZA, and it is achievable here too. (operator, 2020).

7. Cover all grade levels

It would be very important to cover all grades in an initiative like this as all learners were affected by the pandemic. Covering just a few grades left out most would-be beneficiaries from the initiative.

REFERENCES

- [1] Education, M. o. (2014). *Education broadcasting services*. Retrieved May 05, 2020, from <http://lifelendenergy.org>
- [2] Jere, J. (2020, April 13). *znb.co.zm*. Retrieved May 07, 2020
- [3] Mei Lick Cheok [1], S. L. (2017). Teachers' Perceptions of E-Learning in Malaysian Secondary Schools. *Malaysian Online Journal of Educational Technology*, vol. 5- issue 2.
- [4] Ngware, M. (April 19, 2020). Delivering education online: coronavirus underscores what is missing in Africa. *African Population and Health Research*, 1.
- [5] operator, t. (2020, April July 2020). *telecomoperator. Telkom ZA*. Retrieved from <http://techcentral.co.za/telkom-zero-rates-education-websties-amid-coronavirus-outbreak>.

- [6] Vernon, B. (1958). What is Television teaching? *High School Journal*, university of Carolina Press.
- [7] ZICTA. (2018). 2018 NATIONAL SURVEY ON ACCESS AND USAGE OF INFORMATION COMMUNICATION TECHNOLOGIES; A demand Side Assessment of Access and Usage of ICTs in Zambia. LUSAKA: Zambia Central Statistical Office.

AUTHORS

First Author – Gladys Matandiko, PHD student in Education Administration and Management @ University of Zambia. Holds a Masters in Philosophy in Conflict Resolution and Peace Studies (2015) and A Bachelor Science in Education (B.Sc. Ed), Works as Assistant National Education Secretary in the Education Department @ the Catholic Secretariat of the Zambia Conference of Catholic Bishops (ZCCB).

Skill Development in Electronics Sector: A Tool for Employability

Dr Mary Jacintha M, Vivek Arya, Manish Kumar

Centre for Development of Advanced Computing(C-DAC)
B-30, Academic Block, Sector-62, Noida

DOI: 10.29322/IJSRP.12.10.2022.p13047

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13047>

Paper Received Date: 4th September 2022

Paper Acceptance Date: 5th October 2022

Paper Publication Date: 13th October 2022

Abstract- The demand for electronic products in India has been tremendously increased and it is projected to increase in the next decade also. The education/skill development system in India at both formal as well as non-formal level needs the improvement to meet the emerging requirement of the electronics sector. The Government of India has initiated several initiatives for the development of electronics sector in the country for both domestic as well as to serve the International market by creating an enabling environment for increasing the numbers of skill providers (both in public and private domain) to address the emerging human resource requirements for electronics sector. Also, India has large young talent and low wage costs, needs improvement to meet the emerging requirement of the electronics sector, to give a unique opportunity to consider India as a destination in this sector and be part of the next largest Electronic Manufacturing Hub of the world and also provide value added manufacturing, involving medium and high technologies. This paper discusses on the effectiveness of aiding students/unemployed youth through skill development training in electronics sector to increase their employability to work in 'Manufacturing' and 'Service support' functions. This paper also discusses the best practices for a training provider in terms of the growth of electronics Sector, whether it makes a difference to people, groups, organizations or communities.

Index Terms- Electronics System Design and Manufacturing, Skill Development, Employability, growth of ESDM sector, Electronics Manufacturing hub.

I. INTRODUCTION

Education, skill development and continuous learning are the three drivers of employability (ILO, 2011). They not only reduce unemployment but also improve the living standard of the workers and in turn improve the economy. In education, the large drop outs are at an age of 15 years, largely females. Besides, the low literacy and obsolete training results in the failure to meet industry requirements and offer jobs to the people. India is one of the largest and fastest growing electronics markets in the world with a Compound Annual Growth Rate of around 66.1% and is expected to grow to 30%. In India, the electronics market is divided into 6 segments viz. Consumer electronics, Industrial Electronics, Computers, Communication and broadcasting equipment, Strategic electronics and Electronic components. The Indian Electronics System Design and Manufacturing (ESDM) industry is at a huge inflection point. From being predominantly consumption driven, the Indian Electronics industry has a major potential to become a design led manufacturing industry. The employment in the Electronics industry is estimated to grow phenomenally.

India is at its middle of skill development initiative in the electronics sector, to improve the unemployment ratio and improve standard of living, the industry has already partnered through government with National Skill Development Corporation (NSDC) and Sector Skill Councils (SSCs) in designing course curriculum, creating standards and course content (Tara, S.N. et al, 2016). The industry has been already using National Skill Qualification Framework (NSQF) for designing course curriculum and deciding the levels of learning outcomes. To transform India into a premier ESDM hub, Government of India had taken an initiative, to create an eco-system for a globally competitive Electronic System Design and Manufacturing sector in the country and to achieve a turnover of USD 400 billion by 2020 and employ 27.8 million (approx.) at various levels by 2022. ESDM is of strategic importance, not only in internal security and defense but also in the pervasive deployment of electronics in civilian domains such as telecom, power, railways, civil aviation, etc. The government had also set up an Electronics Development Fund to support innovative start-ups in the industry and established partnerships with state governments, industry bodies, and foreign partners to develop a strong ESDM industrial base. Various departments in Government of India took the initiative for skill development, e.g. Pradhan Mantri Kaushal Vikas Yojana(PMKVY), Deen Dayal Upadhyaya Grameen Kaushalya Yojana(DDU-GKY), Pradhan Mantri YUVA Yojana(PMY), Pradhan Mantri Kaushal Kendra(PMKK).

II. RESEARCH METHODOLOGY

This study was conducted by collecting data through surveys and interviews. The structured questionnaires were designed for the survey
This publication is licensed under Creative Commons Attribution CC BY.

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13047>

www.ijsrp.org

and aligned to specific stakeholder(s) of Skill Development. Two separate questionnaires had been designed to focus two different categories of stakeholder of Skill Development: (1) Students/unemployed youth who availed Skill Development training: 1,95,440 trained and certified through assistance by Government, (2) Training Providers: 1900 who have trained students/unemployed youths, and demand of the industry in electronic sector was also reviewed to compare the course trained and need of Electronics industry.

The questions captured the relevant aspects of social-economic impacts. Structured and semi-structured interviews were conducted. Parameters considered to analyze are: trainings process followed by the Training Providers, ICT infrastructure at the centres, involvement/development of number of students, methodology used for training by faculties, Course selected for training, requirement of industry, employment created. The data collected through the survey was studied, analyzed using statistical technique and conclusions were drawn. For analyzing the socio-economic impact(as shown in Figure-1), the entire data were converted and transformed into ordinal and nominal scales. The independent variables include: Training Partner (Infrastructure) Support and Student (Trainee) Satisfaction were measured using five-point Likert Scale (where, 1: Highly Satisfied and 5: Highly dissatisfied). The dependent variables considered for the study were Employment Status and Socio-Economic Status. Employment Status was measured as a nominal scale with categories as Suitable, Suitable but not best and Unsuitable. Socio-Economic Status was measured using five-point Likert Scale (where, “1” indicates Highly Agree and “5” indicates Highly Disagree). Keeping in view the objective of the study, the statistical test used for analyzing the data were Chi-Square test and Multi-Regression.

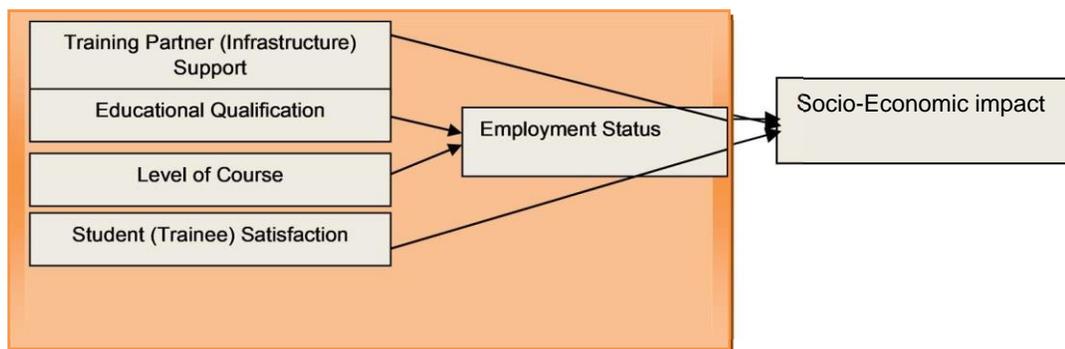


Figure 1: Conceptual Framework: Socio-Economic Impact

III. DATA ANALYSIS AND FINDINGS

In order to understand and integrate various perspectives, to bring Best Practices has to be followed by a Training Provider. The training courses being imparted at the Training Center are chosen based on the baseline data and skills gap assessment done by them. All the courses offered by the training providers are to be at appropriate NSQF levels. The courses conducted at the Training Centres had an adequate mix of technical skills, soft skills and field exposure needed for the job. Also, the open-ended questions through semi-structured interviews provided rich information for this study, and was analysed on multiple dimensions using both quantitative and qualitative methods.

A Quantitative Approach: Training Providers for the skill development in the electronics sector should follow the methodology as best practices to fill the gap of trained manpower requirement. They have to facilitate the students with Computers lab, Qualified faculties/trainers, fully equipped classrooms and associated course labs as per requirement of course.

- Training Partner has to maintain tie-ups and networks with Industry for respective Courses. They have to actively search and initiate for placement drives. Training Partner can align with Industry for apprenticeship programmes to provide hands-on experience to aspirants. They should provide necessary support to promote Entrepreneurship / Self Employment.
- Placement Policy: One of the major requirements is employability. The training partners in coordination with industry are responsible for arranging the placement drives. This may include: participating in job fairs, tie-ups with industries for regular placements.
- Infrastructure Facility: All the training centers reviewed across the nation were equipped with necessary infrastructure such as required classroom, comfortable seating arrangements to students, computer & projector for teaching, internet facility, white boards & accessories to conduct the class, medical facility, cafeteria and other basic facilities required as a Training Centre. It was observed that some of the training providers arranged boarding and lodging facility for the students who are from far-flung places.
- Laboratory and tools: The objective of the Skill Development in the Electronics Sector will lead to employability. Accordingly, all the courses in this scheme are practical and industry-oriented courses. All the training centers reviewed during the conduct of training period were equipped with necessary laboratory equipment such as computers hardware and tools as per requirement of the courses. It was specifically noted during the interaction with the students that more than employment or new skills learned, students are motivated due to improvement in handling the tools and experiments with them. Even though the tools, equipment and knowledge required for the courses in L4 & L5 such as Solar Panel Installation Technician, Embedded System Design using EIGHT-bit Microcontrollers, etc. are sophisticated, Training Partners made those available for the students for better understanding and learning.
- Courses Offered: The list of the courses offered by the training partner is found to be varied and intended for enhancement of skills and competencies. The linkage between industry and training partners, the commitment of industry to provide employability in terms of market demand increased motivation among the students. Majority of the courses are from Computer Applications, promotion of electronics skills and service-oriented courses. The quality of the courses reflected in terms of

coverage of syllabus, duration of the course, assessment, feedback, employment opportunities, job opportunities in employment market etc., are found to be adequate. During the operation of curriculum, adequate practical training, home assignments, need based curriculum and practical aspects have been taught.

- Students satisfaction: Students felt that the courses enhanced their skills and competencies leading to their employability and securing the jobs and also in performing jobs that they have acquired. Students are confident enough to get gainful employment after completion of the course and one fourth each felt that it paves a way to enter into the self-employment. The quality of the courses in terms of coverage of syllabus, generation of employment skills, hands-on training, assessment, arranging resource persons, feedback, extent of employment opportunities, scope of the job in the local market etc., is satisfactory. It is also observed that most of the students want to pursue the job in their hometown, mainly students from West Bengal and North East are more inclined towards job opportunity at their native place.
- Trainers Quality: Trainers were having minimum of three years' experience in the relevant field, Computer Science/Information Technology, Mechanical Engineering, Electronics Engineering, required for the course. They were diploma holders, graduates/engineering graduates or MCA graduates. Trainers were also exposed to the industry for understanding current practices followed by them. Largely the feedback from the students about the trainer is the satisfaction in terms of content delivery, providing practical exposure, clearing the doubts, providing enough time in laboratory work, quality of assignments. It is observed that the prime motivator for the enrollment is trainers followed by parents and friends. The motive for their enrollment is to enhance their employment opportunities followed by to secure employment and enhance managerial skills to support their families. Apart from regular trainers, industry experts are used frequently to provide practical knowledge in the courses taught. Also, in some Training Centres, ex-students were motivated to become trainer in their centres.

B. Quantitative Approach: The findings of the Quantitative Approach are discussed in respect of Socio-economic aspects. A total of 2,83,634 students were registered for the skill development in electronics sector and 66% of students, i.e.1,95,440 students, could be certified after successful completion of training and assessment.

Table 1: Status as per Level of Courses out of total

Percentage of Students in Scheme 1 & 2	Level 1 and Level 2 (%)	Level 3 (%)	Level 4 (%)	Level 5 (%)
Registered Students	20.89	27.49	39.01	12.59
Certified Students	19.28	30.14	37.97	12.60

Registration and Certification for Level 3& 4 courses are more in comparison to Level 1,2 and 5 courses. There were 59 courses offered by the Training Providers for the Skill Development and 70% of the total enrolled students, i.e.1,98,848 students are enrolled in 20 courses only.

Table 2: List of top 20 courses in terms of students' Registration

Course Name	Course Level	Students Registered	% of Registration out of total registered students
Installation Technician - Computing and Peripherals	L3	42317	14.92
Field Technician Computer & Peripherals	L4	29459	10.39
Handset repair Engineer (Level II)	L4	24599	8.67
Assembly & Maintenance of PCs	L1-L2	23898	8.43
Field Technician Networking and Storage	L5	15029	5.3
DTH Set-top-box Installer and Service Technician	L1-L2	9566	3.37
Installation & Maintenance of Photocopiers and Printers	L1-L2	9415	3.32
Telecom Technician- PC Hardware and Networking	L4	5874	2.07
Optical Fiber Splicer	L3	5013	1.77
Repair & Maintenance of Power Supply, Inverter & UPS	L3	4667	1.65
CHM - A Level	L5	4351	1.53
Optical Fiber Technician	L4	4231	1.49
Broadband Technician	L4	3740	1.32
CHM- O Level	L4	3358	1.18
Field Technician AC	L3	3065	1.08
Repair & Maintenance of Power Supply, Inverter & UPS	L4	2605	0.92
Field Engineer RACW	L5	2511	0.89
Installation Engineer SDH & DWDM	L5	2243	0.79
Field Engineer RACW	L4	1503	0.53
DTH Set-top-box Installer and Service Technician	L3	1404	0.5
Total		198848	70.11

Multi-Regression Analysis were conducted out to analyze the effect of independent variables (Training Partner (Infrastructure) Support, Student (Trainee) Satisfaction and Employment Status) on the dependent variable (Socio-Economic Status). The results are indicated in table 1(k) with model equation as show in (a). The table indicates p-value less than 0.05 with t- value = 48.088 and level of significance = 0.05) for Employment Status, t (17.613, 0.05) for Training Partner (Infrastructure) Support and t (71.647, 0.05) for Student (Trainee) Satisfaction. Hence, rejects the Null hypothesis. The beta values indicate the Standardized Coefficients with Y-intercept = 0, the slope of regression line is 0.280, 0.098 and 0.415. The regression model indicates total of 0.027 random error.

Table 3: Regression Analysis

Coefficients								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
			Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	0.150	0.021		6.973	.000	0.108	0.192
	Employment Status	0.271	0.006	0.280	48.088	.000	0.260	0.282
	Training Partner (Infrastructure) Support	0.278	0.016	0.098	17.613	.000	0.247	0.309
	Student (Trainee) Satisfaction	0.371	0.005	0.415	71.647	.000	0.360	0.381

a. Dependent Variable: Socio-Economic Status

Model Equation: Socio-Economic Status=0.280ES+0.098TPS+0.415SS----- (a)

Where, ES: Employment Status; TPS: Training Partner (Infrastructure) Support; SS: Student (Trainee) Satisfaction

Dependent Variable: Socio Economic Impact

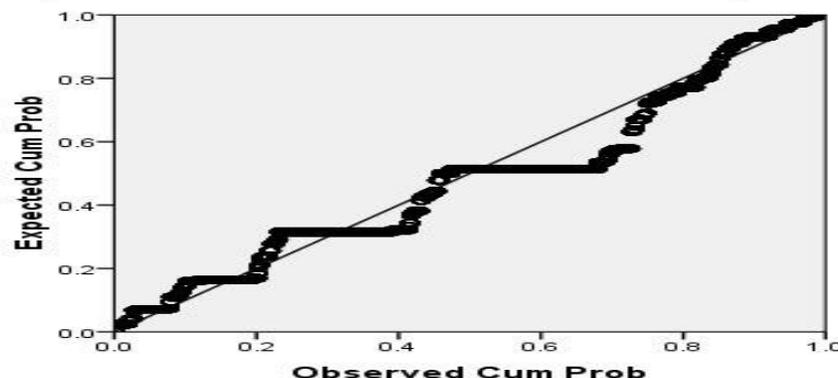


Figure 4.32: Normal P-P Plot of Regression Standardized Residual

The result implies a positive linear relationship between Employment Status, Training Partner (Infrastructure) Support, Student (Trainee) Satisfaction and Socio-Economic Impact. The line equation indicates that with a percentage increase in Student (Trainee) Satisfaction will lead to about 41.5% increase in the Socio-Economic Status. Similarly, with a percentage increase in Employment, it will lead to 28% increase in the Socio-Economic Status.

IV. CONCLUSION

As students' mobilization is one of the key activities to encourage candidates to avail the opportunity to develop skill in the electronics sector, it is concluded that building ecosystem for skill development in electronics sector through Training Providers by supporting them for student mobilization and job opportunity. The prime motivator for the enrollment is trainers followed by parents and friends. The major issues with Training providers in respect to placements is that even though they possess Letter of Indents (LoIs) for industry linked batch allotments but these LOIs are not approved by authority which leads to failure in their efforts and discontent among them. It is also concluded that Semiconductor industry is right now trending in electronics industry, but when while compared with skilled manpower in semiconductor domain, it is nearly negligible.

REFERENCES

- [1] Anbuthambi, B., Chandrasekaran, N. (2017). Impact Of Skill India On Rural Youth – A Perspective. Ictact Journal On Management Studies, February 2017, Volume: 03, Issue: 01, Issn: 2395-1664 (Online)
- [2] Automotive Mission Plan: 2016-26 (AMP 2026). Retrieved from <http://www.siamindia.com/uploads/filemanager/47AUTOMOTIVEMISSIONPLAN.pdf>
- [3] Billorou, N., Pacheco, M., Vargas, F. (2011). Skills development impact evaluation. A practical guide. International Labour Organization (ILO/Cinterfor)
- [4] BRICS Skill Development Working Group. (2016). Skill development for industry 4.0. Retrieved from
- [5] Department of Information Technology (2010–11 Annual Report); Corporate Catalyst India; Aranca Research Notes: SCADA – Supervisory Control and Data Acquisition; PLC – Programmable Logic Controller
- [6] FICCI, NASSCOM & EY. (2017). Future of jobs in India—A 2022 perspective. Retrieved from http://ficci.in/spdocument/22951/FICCI-NASSCOM-EY-Report_Future-of-Jobs.pdf INTERNATIONAL JOURNAL OF TRAINING RESEARCH 129
- [7] FICCI-PWC. (2019). India manufacturing barometer. Retrieved from <https://www.pwc.in/assets/pdfs/research-insights/2019/india-manufacturing-barometer-2019.pdf>
- [8] Indian Brand Equity Foundation (IBEF, 2015) March. www.ibef.org
- [9] Indian Brand Equity Foundation (IBEF, 2016) January. www.ibef.org
- [10] Skill Development and Employability through Intensive Vocational Training. Hindustan times, May 23, 2018, hteducation, Pg. 04
- [11] Skill Development Sector, Achievement Report (2016). MAKE IN INDIA, Department of Industrial Policy and Promotion, Ministry of Skill Development and Entrepreneurship.
- [12] Tara, S.N., Kumar, N.S (2016). Skill development in India: In conversation with S. Ramadorai, Chairman, National Skill Development Agency & National Skill Development Corporation; former CEO, MD and Vice Chairman, Tata Consultancy Services. IIMB Management Review (2016) 28, 235–243
- [13] Twelfth Five Year Plan (2012-2017) Economic Sector, (2013). Planning Commission (Government of India) http://planningcommission.gov.in/plans/planrel/12thplan/pdf/12fyp_vol2.pdf
- [14] <http://ddugky.gov.in/>
- [15] http://dipp.nic.in/English/Investor/Make_in_India/sector_achievement/Electronics_&_IT_Sector_AchievementReport.pdf

AUTHORS

First Author – Dr.Mary Jacintha M, M.Tech(CSE), MBA, Ph.D, Centre for Development of Advanced Computing(C-DAC),email address:maryjacintha@cdac.in

Second Author – Mr.Vivek Arya, B.Tech, MBA, Ph.D Perusing, Centre for Development of Advanced Computing(C-DAC); email address:vivekarya@cdac.in

Third Author – Mr.Manish Kumar, B.Tech, MBA, Centre for Development of Advanced Computing(C-DAC); email Address:manishkumar@cdac.in.

Correspondence Author – Dr.Mary Jacintha M, email address: maryjacintha@cdac.in; Contact Number:9910339478.

Physical Activity levels associated with Overweight and Obesity amongst female traders in Municipal Markets in Eldoret, Kenya.

Mugotitsa Lynnah *, Prof. Jennifer Wanjiku Khamasi **, Florence Waku Wamunga ***

* Bsc. Agriculture bio-systems Management, Moi University, School of Agriculture Biotechnology, Department of Family and consumer Science, University of Eldoret

** Wanjiku Khamasi, Associate Professor, Dedan Kimathi University of Technology

***PhD.University of Eldoret

DOI: 10.29322/IJSRP.12.10.2022.p13048

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13048>

Paper Received Date: 4th September 2022

Paper Acceptance Date: 5th October 2022

Paper Publication Date: 13th October 2022

Index Terms- Women traders, Body Mass Index, Overweight, Obese, Physical activity

Abstract- Background: Overweight (BMI 25-29) and obesity (BMI ≥ 30) is currently a global epidemic. Increase in non-communicable diseases is a major cause of death globally that is linked to nutritional imbalances like overweight and obesity. This study was to determine the prevalence of overweight and obesity among women traders aged 20-50 years at Eldoret municipal markets, Kenya and identify the levels of physical activity amongst these women.

Methods: This study was a cross sectional descriptive survey. Data was collected using researcher administered questionnaires for demographic information, their physical activity patterns and anthropometric measurements (height, weight, and waist and hip circumference) for Body mass index calculations was collected from 238 registered female traders aged 20-50 years from the Eldoret Municipal markets. Proportionate sampling was used to identify the number of subjects per market because all the four markets differ in population. Body Mass Index (BMI) was used to determine the prevalence of overweight and obesity. Data was analyzed using the Statistical Package for Social Sciences (SPSS) software (Version 26). Descriptive and inferential statistics was used to describe the data. Chi-square tests was performed at 0.05 level of significance to establish the association between physical activity and nutritional status.

Results: The prevalence of overweight 24 % and obesity 37% among the women traders was 61% with a statistically significant ($p < 0.05$) relationship between overweight and obesity and

Conclusion: This study concludes that the prevalence of obesity and overweight among women traders is a cause to worry being it is a predisposing factor to non-communicable diseases, which is currently a major cause of deaths.

Recommendation: The ministry of health in collaboration with the trade department and related policy makers should introduce obesity and overweight and the risks that come with it through sensitization programs for the market women and outreach programs and implement essential strategies that can play an important role in the sensitization of anti-obesity habits and practices.

I. INTRODUCTION

The increasing prevalence of overweight and obesity remains a major contributing factor to the global burden of non-communicable diseases which are chronic, disability and a reduced life expectancy (Chu et al., 2018; Roth et al., 2020). OWO is as a result of abnormal or excess fat accumulation in the adipose tissues resulting to an impairment in the health of an individual (Ahmed, Sultan, & Greene, 2021). OWO classification is done using the index of weight for height whereby, in adults, obesity is having a body mass index (BMI) of greater than 30.0 Kg/ M², while overweight is having a BMI that is greater than 25.0 Kg/ M² but less than 30 Kg/ M² respectively (WHO,2016).

The entire process involved in an individual becoming OWO may not be very clear, but one major reason is when an individual has an imbalance between energy consumption and energy expenditure resulting to a high energy intake and a low energy output. There are increasing levels of OWO among women of reproductive age in urban Africa whereby obesity has doubled or tripled in 12 of the 24 countries in Africa (Amugusi, Dimbuene, Mburu, Muthuri & Ezech, 2017).

Despite the serious implications of obesity and overweight, most attention is concentrated on famine and under nutrition or malnutrition (Ekholuenetale, Tudeme, Onikan, & Ekholuenetale, 2020) yet on the other hand, women form a better part of our community hence equally exposed to health risks associated with OWO.

Physical activity is very significant in health for the well-being of the heart, body and mind. It remains to be a major contributing factor in prevention and management of non-communicable diseases, reduction of depression and anxiety, thinking, learning and judgment enhancement and improvement of the general well-being in healthy growth and development. However, according to WHO (WHO, 2020). Globally, one in every four adults fail to meet the global physical activity recommendations yet up to five million deaths a year could have been avoided if only the population was more physically active (Migueles et al., 2017). Physical

activity is the body movement during leisure time, transport from one place to another and as part of an individual's work (Ross et al., 2020). Physical activity is classified in four dimensions as indicated in the table below

Table 1: Dimensions of physical activity

Dimension	Definition and context
Mode	Specific activity performed (eg, walking, gardening, cycling).
Frequency	Number of sessions per day or per week (Session is ≥ 10 min in duration/length)
Duration	Time (minutes or hours) of the activity during a specified time frame (eg, day, week, month or year)
Intensity	Rate energy expenditure which indicates metabolic demand

The infrastructure that is prevalent in a given population influences the means of transport that is found in the neighborhood and this influences the chances of walking by the people in the region. High neighborhood walkability has been found to be associated with a decreased prevalence of overweight and obesity (Creatore et al., 2016). The world has witnessed a reduction in transport-related physical activity and this is closely associated with the increase in car ownership as well as the presence of infrastructure that supports automotive transport (King & Jacobson, 2017). The choice of transportation can influence obesity and especially the decision by an individual regarding whether to travel by motorized travel (e.g., driving an automobile) or active travel (e.g., walking, cycling). While auto-mobiles provide a fast and convenient travel mode, replacing active travel with motorized travel also replaces the physical activity involved in walking or cycling with the sedentary activity of driving, thereby reducing personal energy expended (King & Jacobson, 2017).

There has been a shift in the working environments for different people across the globe. The majority of the people in white-collar jobs have minimal moderate to vigorous physical activity and hence they are mostly sedentary (Migueles et al., 2017). The development of communication technology further aggravates the situation as basic things such as moving from one office to another have been replaced by technological systems. The development of various enterprise resource planning programs and systems have facilitated communication between people within an organization without having them meet or move from their desks. This reduces the walkability of the populations and the chances of involving themselves in any form of physical activity (Ross et al., 2020).

II. MATERIALS AND METHODS

Study design, setting, population

In this study descriptive survey was most suitable because of its unique characteristic of describing characteristics and frequencies through a survey. The research was conducted in the day to day environment of the female traders and was quick to perform because there is no

follow-up on the subjects hence inexpensive (Asenahabi, 2019).

This study was conducted in the four Municipal markets in Eldoret. Eldoret serves as the main administrative center of Uasin Gishu County. Eldoret stands out as the principal town in the Rift valley region of Kenya serving as the capital of Uasin Gishu County. According to the Kenya Population and Housing Census 2019, Eldoret is the second most important city in Western Kenya after Kisumu and the fifth most populated urban area in Kenya. Eldoret Municipality has four Municipal markets. Two of these markets are in the town center, whereby one is the main market and the other is the retail market. The other two are Kahoya, which is out of town and the Eldoret West market, which is an assorted goods market. All the four markets were used for the study.

Sampling technique, ethical consideration

The study applied non-probability sampling procedure in the determination of the sample size. A clustered sampling technique which denotes the technique dividing the population into smaller groups and randomly selecting among them to form a sample (Mahmud, Huang, Salloum, Emara, & Sadatdiynov, 2020). According to the Eldoret municipal Market records, the total traders are 840 (inclusive of the male traders) in all the four markets, with female traders being 80%(672) of all the traders, (Uasin Gishu County, 2017). All the four markets were eligible for this study. Proportionate sampling was used to determine the number of subjects per market as they differ in population, having a retail market with an estimated population of 700 registered traders, main market has 100 registered traders, West market has 30 registered traders and Kahoya market has only 10 registered traders, registration was determined by having a trader allocated a stall space within the four walls of the specific municipal market.

Table 2: Population data for Eldoret County council markets (Uasin Gishu County, 2017)

Stratum	Retail Market	Main market	West market	Kahoya Market
Total population	700	100	30	10
Fraction of female (4/5); Sample population	560	80	24	8
Sample ratio	70	10	3	1
Sample size	198	28	9	3

Ethical consideration

Before conducting the research, a clearance form from the Graduate School of the University of Eldoret was obtained. A research permit was also obtained from the Ethical Committee of National Commission for Science, Technology and Innovation (NACOSTI). The Eldoret county council office was also informed of research intentions. Participants were recruited upon their informed consent and they were assured of confidentiality and anonymity is maintained throughout the study. Confidentiality was applied by providing the participants' identification numbers and no names and/ or other means of identification was used. All the

references used to obtain the information in this study were duly acknowledged.

Data collection procedure

The study adopted use of primary data collected from respondents using structured questionnaires. While structuring the questionnaire the study adopted questions from Global Physical Activity Questionnaire (GPAQ) (Armstrong and Bull 2006) for physical activity data. The relevant market authorities were consulted and an official approval to proceed with the research within the market was given. The market was visited a month before data collection to establish the market patterns and identify an appropriate or most convenient time for data collection. The researcher and the assistants visited the market and carried out the study after allowing the participant to sign the consent form. The researcher and research assistants administered the questionnaire, and took the anthropometric measurements; to avoid inter-observer errors; one research assistant would take the anthropometric measurements twice while the other assistant took the records before moving to another participant. For calibration accuracy of the weighing scale, a known weight of a kilo of flour was used to continuously confirm accuracy. Upon completion, the two research assistants checked the questionnaire for completion, the accuracy of information and consistency before moving to the next participant.

Data analysis

Data was then analyzed using SPSS version 26. Nutritional status was determined using WHO gender specific BMI –for – Height. Descriptive statistics was used in the analysis of the quantitative variables like, weight, height, BMI at <0.5 level of significance. Chi-square test was used to determine the level of statistical significance in nutritional status and physical activity as the independent variables. Data analysis involved testing for variability and associations with Pearson’s Correlation Coefficient test being applied to measure variability and associations respectively. This study also applied a +5% or -5% precision level and a 95% confidence level (Wagner et al., 2019).

III. RESULTS

Demographic and socioeconomic characteristics of the respondents

A total of 238 female traders participated in the study. The age groups 30-39 and 40-49 had the highest number of participants at 38% and 37% respectively. Age group 20-29 years had 16% women, and 50-59 years had the least participants at 8%. The mean age in this study was 37 years. Majority, 50% of the respondents were married, the singles were 24%, separated 13% (30), and divorced 7%. The response shows that the majority of the respondents (47%), have between 3-5 children. The respondents with 0-2 children were 41% and 12% had a parity of 6 and above children as indicated in table 5 below which shows the demographic characteristics of the respondents.

The respondents with no formal education were 9%. Those with primary education were 48%. The respondents with secondary education were 32% and 12% had tertiary education.

Table 3: Demographic characteristics of the respondents

Factor	n (%) (n=238)
Age	
20 -29 Years	39 (16.4)
30-39 Years	91 (38.2)
40- 49 Years	88 (37.0)
50- 59 Years	20 (8.4)
Marital Status	
Single	58 (24.4)
Married	120 (50.4)
Divorced	30(12.6)
Separated	14(5.9)
Parity	
0-2 Children	97 (40.8)
3-5 Children	112 (47.1)
6 and above children	29 (12.2)
Education	
None	21 (8.8)
Primary	113 (47.5)
Secondary	17 (31.5)
Tertiary	29 (12.2)

The sample was categorized into six income group levels as follows: Those with income range <10,000 per month, 11,000-20,000; 21,000-30,000; 31,000-40,000; 41,000-50,000 and 50,000 plus

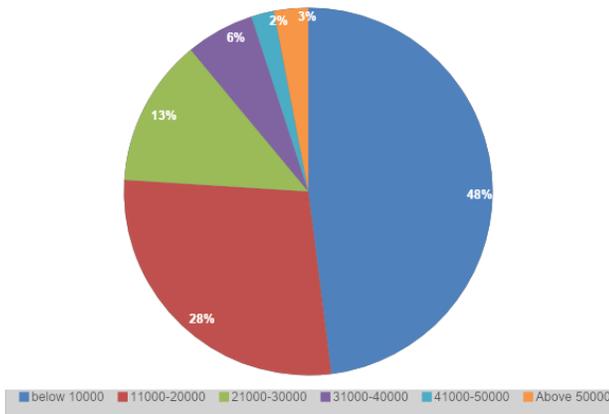


Figure 1: Monthly income of the respondents

Out of the 238 women, 48% earned less than Kshs. 10,000; 28% earned in the range of 11,000 – 20,000; 13% earned between 21,000 and 30,000; 6% earned in the range of 31,000 – 40,000; 2% earned in the range of 41,000 – 50,000 and 3% earned above 50,000.

Physical activity levels

The 238 respondents reported to spend different hours at the market. According to this study 11% women traders spent between one to three hours at the market. Those who spent above seven hours at the market were the majority at 75 %. The remaining 14% reported to spent between four hours to six hours on the vending job

The mode of travel to and from the market was considered. The means of transport that was common among the respondents was the use of matatu which is a form of public transport 77%. The respondents who walked and those who used motorcycles were 11% and 10% respectively.

Another measure of physical activity at work was established by asking the women if their work involved activities that require hard physical effort (vigorous physical activity) like moving around while carrying a heavy load or moderate physical effort (moderate physical activity) like walking around the market. The results indicated that 66% of the women had a very light (sitting) level of physical activity: not active, while 13% had light weight (standing for less than two hours) level of physical activity:

slightly active. Moderately active (walking) level of physical activity was among 20% of the women traders while only 1% (2) of the respondents had a vigorously active level (walk carrying a heavy load) of physical activity.

Total time spent on sedentary activities per day was established by asking the women to report on the total time spent sitting, standing, walking or reclining at work, and getting goods from one place to another place. The results indicated that 79% engaged in sedentary behavior of sitting for more than five hours in a day, with 15% of them being slightly active by spending two to five hours standing at their specific workstations without being mobile. The activity levels of these respondents during the day is sedentary whereby 5% of the respondents engage in moderate active activities like walking for less than two hours as reflected in the figure 4.3 below.

The results indicated that most of the respondents are exposed to being sedentary at their work stations since most of their tasks were conducted while sitting. Movement was often within the cubicle work station which does not offer a lot of space for vigorous movement

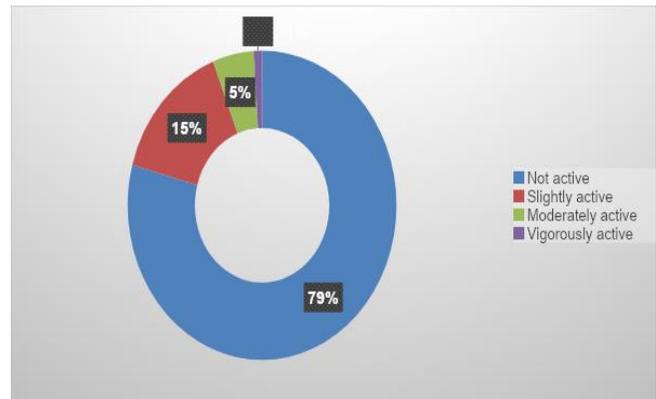


Figure 2: Physical activity levels

Relationship between socio demographic and economic characteristics of the normal weight, overweight and obese women traders

With the $\alpha \leq 0.05$, there was a statistically significant relationship between overweight and obesity and the marital status ($p=0.024$), income ($p = 0.012$), age ($p <0.05$) and parity ($p= 0.012$). However, there was an insignificant relationship between in being overweight or obese and level of education ($p= 0.178$).

Table 4: Relationship between socio demographic to economic characteristics of the nutritional status of women traders

Socio demographic Characteristics		Normal weight (n%)	Overweight (n%)	Obese (n%)	Chi-Square test (P-Value)
Marital status	Married	18 (56.3)	49 (58.3)	53(43.4)	0.024
	Single	8 (25.0)	18 (21.4)	32(26.3)	
	Separated	4 (12.5)	12 (14.3)	14(11.5)	
	Divorced	2 (6.3)	2 (2.4)	12 (9.8)	
	Widowed	0 (0.0)	3 (3.6)	11 (9.0)	

Level of Education	None	1 (3.1)	8 (9.5)	12 (9.8)		
	Primary	12 (37.5)	34 (40.5)	67(54.9)	0.178	
	Secondary	11 (34.4)	32 (38.1)	32(26.2)		
	Tertiary	8 (25.0)	10 (11.9)	11 (9.1)		
Monthly income	Below 10,000	14 (43.8)	42 (50.0)	59(48.5)		
	11,000-20,000	4 (12.5)	22 (26.2)	41(33.6)		
	21,000-30,000	7 (21.9)	13 (15.5)	12 (9.8)	0.012	
	31,000-40,000	5 (15.6)	4 (4.8)	5 (4.1)		
	41,000-50,000	2 (6.3)	0 (0.0)	2 (1.5)		
	Above 50,000	0 (0.0)	3 (3.6)	3 (2.5)		
	Age	21 - 25	11 (34.4)	5 (6.0)	7 (5.7)	
		26 -30	5 (15.6)	18 (21.4)	16(13.1)	
31 - 35		8 (25.0)	15 (17.9)	19(15.6)	0.000	
36 -40		3 (9.4)	21 (25.0)	30(24.6)		
41 -45		4 (12.5)	14 (16.7)	25 (20.5)		
46 - 60		1 (3.1)	11 (13.1)	25(20.5)		
Parity	0 - 2 Children	17 (53.1)	43 (51.2)	37(30.3)		
	3 -5 Children	15 (46.9)	31 (36.9)	66(54.1)	0.012	
	< 6 Children	0 (0.0)	10 (11.9)	19(15.6)		

Nutritional status in relation to physical activity levels among women traders aged 20-50 years in Eldoret Municipal markets

Among the 11% who spent between one to three hours at the market, 52% of these respondents were overweight while 24% were obese and 24% were normal in weight. Those who spent above seven hours at the market were the majority at 75 %, with 58% of them being obese, 34% were overweight and 8% had normal weight. The rest 14% reported to spent between four hours to six hours on the vending job and 42% of them were obese while 18% were of normal weight but 40% were overweight. Therefore, the longer the hours spent at the market the more the chances of being overweight or obese because the level of physical activity while at the market was low.

The women who use matatu 77%, 50% were obese while 11% were normal weight and 39% were overweight. Fifty-nine percent of those who walked were obese, 29% were normal weight and 12% were overweight. On the other hand, 56% of those who used motorcycles were obese, 41% were overweight and 3% was of normal weight. The respondents using matatu made up 40% of those who were obese in relationship to the

mode of transport used to travel to the market. Majority of these market women do not walk to their centers of business meaning a low level of physical activity which does not balance with the levels of energy consumption and energy use hence predisposing them to being overweight or obese.

The physical activity levels were low having 79% engaging in sedentary behavior, hence 80% of those who were sedentary were obese and only 3% were of normal nutritional status. Among the 15% who were slightly active, 69% of them were obese, 22% were overweight and only 9% were in the normal nutritional status category. The results indicated that most of the respondents had a sedentary lifestyle whereby tasks were conducted while sitting. Movement was often within the cubicle workstation which does not offer a lot of space for vigorous movement.

ANOVA statistics indicate that there is a statistically significant relationship between levels of physical activity and nutritional status, p- value= 0.000, which is greater than critical value of 0.05, and indicates that, overall, the regression model is statistically significant in predicting the outcome variable

Table 5: Relationship between levels levels of physical activity and nutritional status

ANOVA^a

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	1.497	1	1.497	3.574	.000 ^b
Residual	13.824	33	.419		
Total	15.321	34			

a. Dependent Variable: Nutritional status

b. Predictors: (Constant), physical activity levels

IV. DISCUSSION

Prevalence of overweight and obesity among women traders aged 20-50 years at Eldoret Municipal market by demographic and socioeconomic status

The prevalence of obesity and overweight was determined using BMI and Waist Circumference ratio. These methods were considered adequate to determine the overall fat and abdominal fat deposition in the sampled population. The study population was aged 20-50 years; the mean age of 37.4 and a median of 38, and a mean BMI of 30.3kg/M².

This study found that the overweight prevalence among women traders age 20-50 to be 26%, whereas that for obese women to be 37%. Therefore, 53% of the respondents were in the overweight or obese category. In essence, approximately one in every two respondents was obese or overweight, concurring with a study by (Mkuu et al., 2018) The mean age of the respondents being 37.4 matches a study by (Mkuu et al., 2018). WHO (WHO, 2019) indicates that the prevalence of obesity and overweight is generally greater in older women; hence the risk of obesity and overweight increases across the lifespan, explaining the increased risks of non-communicable diseases as one grows older Bruce et al., 2008.

Women aged 40 to 44 have four times the risk of being obese or overweight than women aged 15 to 24 (Hales, Carroll, Fryar, & Ogden, 2017; Mkuu et al., 2018) established that the prevalence for young adults between ages 20-39 is at 35.7%. According to Lee et al. (2017) proves that the older people get, the higher their chances of becoming overweight and obese. Data in this study indicates the age bracket 30 to 39 years as the highest population. However, the age bracket of 40 to 49 years is the highest 32% (76) in obesity and overweight prevalence. The minor percentage 10% (28) of obese and overweight respondents is in the age bracket of 20 to 29 shows the risk of obesity and overweight is lower among younger women.

Forty-eight percent of the respondents receive an income below 10,000 per month, making them low income earners. According to (Ondicho et al., 2016) confirmation in his study among health workers in Kisumu that overweight and obesity is rapidly increasing among the low and middle-income earners.

Although the relationship between marital status and overweight and obesity is not clearly established, a study by (Tzotzas et al., 2010) indicates that married individuals tend to be heavier than the unmarried. In this study marital status indicates a significant relationship to prevalence of obesity and overweight being $P=0.024$. On the other hand, the divorced and separated had higher percentages of those who are overweight and obese as compared to the never married or single which relates to a study (Bell & Thorpe Jr, 2019).

Higher parity has previously been implicated as one of the predisposing risk factors of obesity and overweight among women (Taghdir et al., 2020) which is revealed in this study at $p=0.012$. The greater the number of live births the higher the prevalence of obesity and overweight which makes parity positively associated with the risk of obesity and overweight especially the abdominal obesity. In this study, a parity of six and more children has all the subjects being either obese or overweight. Women who have three or more children were 1.75 times at risk of being obese or

overweight according to a study by Taghdir et al. (2020), whereby in this study those with a parity of 3 and above had 87% of them being overweight or obese. On the other hand, the married participants showed a higher prevalence of obesity than other marriage categories except for the widowed women.

A study by Bell and Thorpe Jr (2019) indicates that married individuals will more often have a confidant with whom they can eat together; therefore, this makes them eat more often. Another study by (Ondicho et al., 2016) explains how the married are less conscious about their weight because they are not actively seeking a mate. On the other hand, a couple of studies (Bell & Thorpe Jr, 2019; Ondicho et al., 2016) explain that there is a lot of psychological, and social disruption when there is a disruption in someone's marital status, and it mainly affects women.

Physical activity levels of women traders aged 20-50 years in Eldoret Municipal markets

Physical activity (PA) is known to be a major factor in reducing the likelihood of being obese or overweight and physical inability which is associated with aging, P. Mawaw et al. (2017) which improves the quality of life measures. Previous research, Tremblay et al. (2011) indicates that the levels of physical activity as per the health regulations tends to decrease as people age, which is risky for women approaching menopause because they are highly predisposed to non-communicable diseases like chronic heart disease.

The study results indicated that >65% of the women did work that did not involve vigorous physical activity. The differences between the BMI regarding vigorous physical activity was significant (p -value = 0.01), with the proportion of obese females who engaged in less physical activity, i.e. 0-10 minutes is high at 74% and this proportion reduced among females who spent 10-20 and 20-30-minutes on physical activity. This same trend was witnessed among women who did not work for more than 20 minutes a day. The proportion of obese women who spend 0-10 minutes on the continuous walk was 66%, and this percentage sharply dropped to 13% among women who spent 20-30 minutes walking. (Table 5.0). The levels of physical activity among the respondents were at minimum levels, which is one reason for having high levels of obesity and overweight (Peters et al., 2019). The increase in sedentary lifestyle coupled with the consumption of energy-dense foods accounts for the increasing burden of obesity and overweight.

The results indicated that 80% of the women engaged in sedentary behavior of sitting as explained by (Lavie et al., 2019) with 15% of the women being lightly active by standing and only 5% being moderately active by moving around their stalls. The use of mobile phones more so helps to link with the improved technology which offers affordable delivery services as indicated by (i Figuls et al., 2018). A sedentary practice increases the risks of being obese or overweight, as acknowledged in a study by (Migueles et al., 2017). In this case, the problem of overweight and obesity among the group of women traders is not a paradox as most of these women engage in sedentary activities (Creatore et al., 2016; Lavie et al., 2019) coupling with the long hours of physical inactivity and high energy intake, there has to be a high prevalence of obesity and overweight. A study by Mkuu et al. (2018) that reveals women aged 40 to 44 years have four times higher chances of being overweight and obese as compared to women aged between 15 to 24 years, explaining why the study

sample of mean age 37.4 years is at a high risk of being overweight or obese.

The analysis further proceeded to logistic regression which indicated only the means of transport to the market has no significance relationship with the prevalence of obesity and overweight. Whereas factors like hours spent at the market were significant, in relation to a study by (Amugsi et al., 2017) who says the longer the hours one stays away from home the higher the chances of unhealthy eating habits hence increasing the prevalence of obesity and overweight. The activity level remains significant as the study indicates that most women, P. Mawaw et al. (2017) while at their vending job have a sedentary work environment which predisposes them to the high prevalence of obesity and overweight.

ACKNOWLEDGMENT

I would like to acknowledge my supervisors for their patience in working with me and offering the step by step guidance and supervision. I acknowledge my family for their unwavering support, in both socially and economically during my period of taking this professional step of growth, may God richly bless you.

COMPETING INTERESTS

All authors declare that they have no competing interests

REFERENCES

- [1] Ahmed, B., Sultana, R., & Greene, M. W. (2021). Adipose tissue and insulin resistance in obese. *Biomedicine & Pharmacotherapy*, 137, 111315.
- [2] Amugsi, D. A., Dimbuene, Z. T., Mberu, B., Muthuri, S., & Ezech, A. C. (2017). Prevalence and time trends in overweight and obesity among urban women: an analysis of demographic and health surveys data from 24 African countries, 1991–2014. *BMJ open*, 7(10), e017344.
- [3] Asenahabi, B. M. (2019). Basics of research design: A guide to selecting appropriate research design. *International Journal of Contemporary Applied Researches*, 6(5), 76-89.
- [4] Bell, C. N., & Thorpe Jr, R. J. (2019). Income and marital status interact on obesity among Black and White men. *American journal of men's health*, 13(1), 1557988319829952.
- [5] Chu, D.-T., Nguyet, N. T. M., Dinh, T. C., Lien, N. V. T., Nguyen, K.-H., Ngoc, V. T. N., . . . Jurgowski, A. (2018). An update on physical health and economic consequences of overweight and obesity. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 12(6), 1095-1100.
- [6] Creatore, M. I., Glazier, R. H., Moineddin, R., Fazli, G. S., Johns, A., Gozdyra, P., . . . Manuel, D. G. (2016). Association of neighborhood walkability with change in overweight, obesity, and diabetes. *Jama*, 315(20), 2211-2220.
- [7] Ekholuenetale, M., Tudeme, G., Onikan, A., & Ekholuenetale, C. E. (2020). Socioeconomic inequalities in hidden hunger, undernutrition, and overweight among under-five children in 35 sub-Saharan Africa countries. *Journal of the Egyptian Public Health Association*, 95(1), 1-15.
- [8] i Figuls, M. R., Garcia, L. M., Martinez-Zapata, M. J., Pacheco, R., Mauricio, D., & Cosp, X. B. (2018). Interventions for treating overweight or obesity in adults: an overview of systematic reviews. *The Cochrane Database of Systematic Reviews*, 2018(12).
- [9] King, D. M., & Jacobson, S. H. (2017). What is driving obesity? A review on the connections between obesity and motorized transportation. *Current obesity reports*, 6(1), 3-9.

- [10] Lavie, C. J., Ozemek, C., Carbone, S., Katzmarzyk, P. T., & Blair, S. N. (2019). Sedentary behavior, exercise, and cardiovascular health. *Circulation research*, 124(5), 799-815.
- [11] Mahmud, M. S., Huang, J. Z., Salloum, S., Emara, T. Z., & Sadatdiynov, K. (2020). A survey of data partitioning and sampling methods to support big data analysis. *Big Data Mining and Analytics*, 3(2), 85-101.
- [12] Mawaw, P. M., Yav, T., Mukuku, O., Lukanka, O., Kazadi, P. M., Tambwe, D., . . . Luboya, O. N. (2017). Prevalence of obesity, diabetes mellitus, hypertension and associated risk factors in a mining workforce, Democratic Republic of Congo. *Pan African Medical Journal*, 28(1).
- [13] Migueles, J. H., Cadenas-Sanchez, C., Ekelund, U., Nyström, C. D., Mora-Gonzalez, J., Löf, M., . . . Ortega, F. B. (2017). Accelerometer data collection and processing criteria to assess physical activity and other outcomes: a systematic review and practical considerations. *Sports medicine*, 47(9), 1821-1845.
- [14] Ondicho, Z., Omondi, D., & Onyango, A. (2016). Prevalence and socio-demographic factors associated with overweight and obesity among healthcare workers in Kisumu East Sub-County, Kenya.
- [15] Ross, R., Chaput, J.-P., Giangregorio, L. M., Janssen, I., Saunders, T. J., Kho, M. E., . . . McLaughlin, E. C. (2020). Canadian 24-Hour Movement Guidelines for Adults aged 18–64 years and Adults aged 65 years or older: an integration of physical activity, sedentary behaviour, and sleep. *Applied Physiology, Nutrition, and Metabolism*, 45(10), S57-S102.
- [16] Roth, G. A., Mensah, G. A., Johnson, C. O., Addolorato, G., Ammirati, E., Baddour, L. M., . . . Benziger, C. P. (2020). Global burden of cardiovascular diseases and risk factors, 1990–2019: update from the GBD 2019 study. *Journal of the American College of Cardiology*, 76(25), 2982-3021.
- [17] Taghdir, M., Alimohamadi, Y., Sepandi, M., Rezaianzadeh, A., Abbaszadeh, S., & Mahmud, F. M. (2020). Association between parity and obesity: a cross sectional study on 6,447 Iranian females. *Journal of preventive medicine and hygiene*, 61(3), E476.
- [18] Tremblay, M. S., LeBlanc, A. G., Kho, M. E., Saunders, T. J., Larouche, R., Colley, R. C., . . . Gorber, S. C. (2011). Systematic review of sedentary behaviour and health indicators in school-aged children and youth. *International journal of behavioral nutrition and physical activity*, 8(1), 1-22.
- [19] Kenya National Bureau of Statistics (KNBS) & ICF Macro. (2019). Kenya Demographic and Health Survey 2014-2015 Calverton, Maryland: KNBS and ICF Macro.
- [20] Tzotzas, T., Vlahavas, G., Papadopoulou, S. K., Kapantais, E., Kaklamanou, D., & Hassapidou, M. (2010). Marital status and educational level associated to obesity in Greek adults: data from the National Epidemiological Survey. *BMC public health*, 10(1), 1-8.
- [21] Wagner, C., Kawulich, B., & Garner, M. (2019). A mixed research synthesis of literature on teaching qualitative research methods. *SAGE Open*, 9(3), 2158244019861488.
- [22] World Health Organization Fact Sheet (2016). Obesity and Overweight.
- [23] World Health Organization Fact Sheet (2020). Obesity and Overweight

AUTHORS

First Author – Mugotitsa Lynnah, Bsc. Agriculture bio-systems Management, Moi University, School of Agriculture Biotechnology, Department of Family and consumer Science, University of Eldoret. Lynnahm28@gmail.com

Second Author- Prof. Jennifer Wanjiku Khamasi, Associate Professor, Dedan Kimathi University of Technology wanjiku.khamasi@gmail.com

Third Author – Florence Wakhu Wamunga. PhD. University of Eldoret. florencewakhu@yahoo.com

Correspondence Author – Mugotitsa M Lynnah . Lynnahm28@gmail.com. Cell: +254721831667

Authors contributions

ML, JW, and FW were all involved in all aspects of the development of this manuscript.

Amount Of Damage Due To Landfill In The Area Near The Construction (The example of Ar Zaisan area of Bogd Khan mountain)

B. Lhamsuren¹, B. Bolorchuluun²

* Department, Institute Name

** Department, Institute Name, if any

¹ Mongolian University of Life Sciences (MULS)-School of Agroecology

² Mongolian University of Life Sciences (MULS)--School of Agroecology

DOI: 10.29322/IJSRP.12.10.2022.p13049

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13049>

Paper Received Date: 3rd September 2022

Paper Acceptance Date: 5th October 2022

Paper Publication Date: 13th October 2022

Abstract- Cuts were made in the soil of the area to determine the negative impact on the soil cover caused by the construction on 10 hectares of the Ar Zaisan area of Bogdhan Mountain and to estimate the amount of damage to the soil. Soil physics and chemistry feature quality specific year focus by indicator Areas of the same typology that have been fenced for more than 10 years [7] soil feature quality in comparison study wax. According to the research results, the content of humus in the soil of the area decreased by 2.3%, the content of mobile phosphorus and potassium as nutrient elements decreased by 61.1-83.3%, the content of physical clay decreased by 78.8%, the salt content decreased by 1.55%, the volume weight or density increased by 18.1% and sand content increased by 65.5%. Based on this, it is reasonable to believe that the properties of the soil in the built-up area have deteriorated significantly.

Index Terms- Soil degradation, soil physics, chemical properties, juniper stock, soil quality assessment

I. INTRODUCTION

Environment when human act operation with adverse effects a person mouth dense settled in central areas natural Native appearance the situation is great a lot lost are [4, 7]. Especially in recent years, soil degradation caused by intensive construction activities and recreation, tourism and land use planning has been strongly observed in specially protected areas [7]. Therefore, it is necessary to realistically plan measures for the restoration and protection of these areas, and to implement optimal land use management.

The removal work river purpose is to determine the amount of damage caused to the soil cover by construction activities. Above the purpose implementation for the following objectives proposed

It includes :

1. Determining changes in soil properties in the study area

2. Determining the degree of soil damage in the study area, calculating the ecological and economic evaluation of damaged soil, and determining the amount of damage

II. RESEARCH ELABORATIONS

Research object . Ulaanbaatar City, Khan-Uul District, District 11 territory, or 10 ha area where the construction of the Ar Zaisan are of Bogd Khan Mountain took place.

Determination of morphological characteristics of soil:

The morphology of the soil was determined by cutting the soil. When making a cut in the soil, 70-80 cm wide and 1.0-1.5 meters long, with an average depth of 60-150 cm, samples were taken from the 0-8 and 10-16 cm layers of the soil in 3 repetitions.

Soil chemical Indicators : Soil reaction environment Potentiometric method, Soil humus of Turing method, Mobile phosphorus and exchange potassium Machigin method help help defined.

Soil physics feature chan rear indicator : Soil mechanics composition-Kaczynski method, Soil ezl e son weight Cylinder, Soil hard of the section density Pycnometric method, Soil infiltration calculation method help help defined [1,2].

Soil ecology tissue government When assessing and calculating damages :

Soil ecology, tissue government assessment in 2010 Nature environment-travel tourism No. 156 of Minister by command approved below method science according to performed [3].

$$E_s = OR_s * K_p * K_g * K_s * S * H_e$$

(1.17)

E_s – ecological and economic assessment of soil,

OR_s – soil humus stock, kg/ha

K_p – coefficient of soil properties

K_g – coefficient of environmental parameters

K_s – coefficient of soil typology

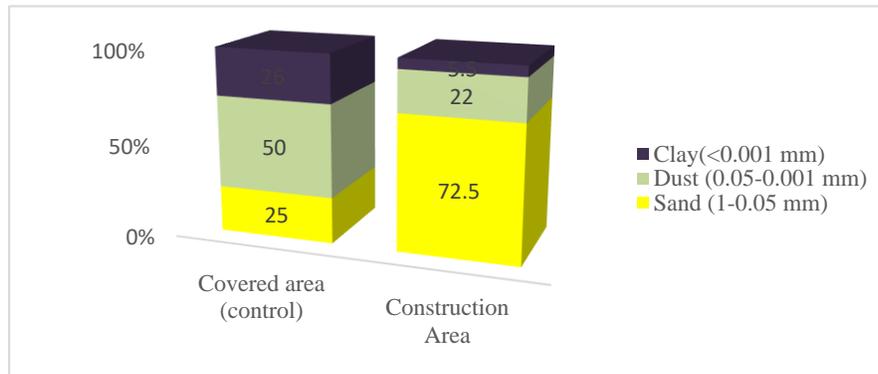
S – soil area, ha

He – 1.0 kg of humus material rating, tons/kg

III. RESULTS OF THE RESEARCH

We have compared the physical properties of the stabilized mountain brown soil in the study area with the characteristics of the control or fenced area and summarized them in the graph below by sand, dust and clay fractions (Graph 1).

Graphic 1. Soil of the study area mechanics composition comparison (0-8 cm)



Above from the chart to watch The sand content of the constructed area increased by 65.5 % compared to the fenced or control area, and the dust and clay content decreased by 56-78.8 %, respectively . From here to watch There is a reason to believe

that the soil of the built-up area is being absorbed and its nutrient quality is being lost.

Table 1. Soil chemical properties

Soil pattern feature	Sampled depth (cm)	pH , Salinity (%) _ Humus (%)			Phytonutrients (mg/100 g)	
					P ₂ O ₅	K ₂ O
Fenced area (Control)						
Mountain Brown	0-6	6.65 ±0.10	0.002 ±0.02	3.5±1.30	1.8±0.30	60±5.02
	6-21	6.60 ±0.03	0.002±0.02	2.5±0.45	1.5±0.22	15±6.23
Built-up area						
Mountain Brown	0-6	8.00±0.3	0.033±0.03	1.2±0.50	0.7±0.35	10±5.16
	6-28	7.48±0.16	0.034±0.03	0.4±0.30	0.8±0.30	8±9.03

According to the above results, the reaction environment in the 0-6 cm layer of the soil of the built-up area is weakly alkaline, the salt content is 0.031% higher than that of the fenced area, and humus It is lower by 2.3% in terms of content and 61.1-83.3 % in terms of nutrient elements, respectively. From here to watch There is a reason to believe that the soil in the construction area has been damaged by salinization and loss of nutrients.

Changes in soil properties in the study area

Based on the results of the above research, we have compared and summarized the changes in the soil properties of the studied area with the following key indicators (Table 2).

Table 2. Changes in physical and chemical properties of soil (0-8 cm)

Turf layer thickness, cm	pH	Salinity, %	Humus, %	Nutrients (mg/100 g)		Volumetric weight (g/cm ³)	Sand (1-0.05 mm)	Clay (<0.001 mm)	
				P ₂ O ₅	K ₂ O				
Fenced area (Control)									
13	6.6	0.002	3.5	1.8	60	1.1	25	26	
Built-up area									
3	8.0	0.033	1.2	0.7	10	1.33	72.5	5.5	
Difference (%)									
	- 76.9	+ 21.2	+1.55	-2.3	-61.1	- 83.3	+ 18.1	+ 65.5	-78.8

the results of the above comparison (with the control area). The soil reaction environment in the built-up area increased by 21.2% and became weakly alkaline, the thickness of the turf layer increased by 76.9%, the content of humus increased by 2.3%, the content of mobile phosphorus and potassium, which are nutrient elements, increased by 61.1-83.3%, and the physical clay content

decreased by 78.8%, salt content by 1.55%, volume weight or density by 18.1%, and sand content by 65.5%. It can be seen from this that the soil characteristics of the built-up area have deteriorated significantly.

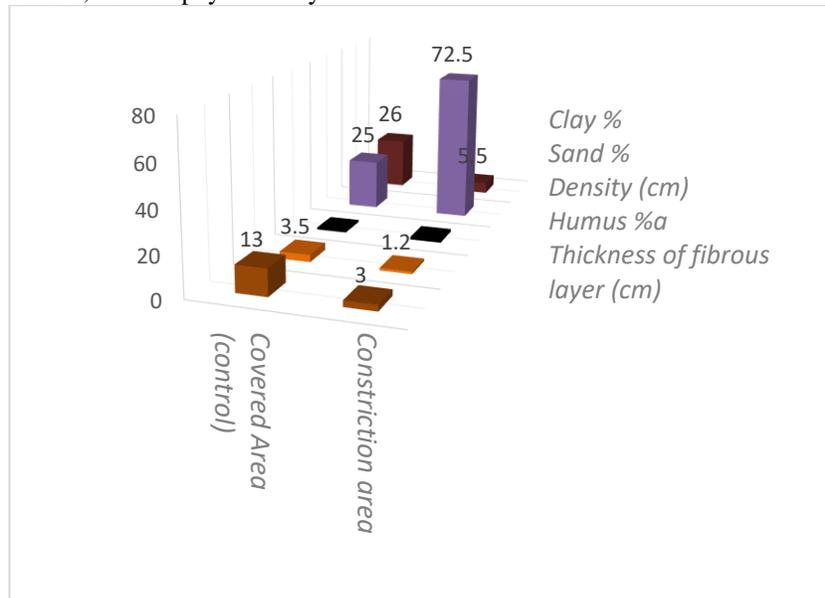


Chart 3. Soil of the study area feature quality change percent

According to the above results, the thickness of the peat layer, humus content, and physical clay content of the built-up area have decreased significantly, the sand content has increased by more than 50 percent, and the soil is more compacted.

Ecological-economic assessment of the soil cover of the research area and the estimated amount of damage

Table 3 . Soil humus stock of the study area

Soil typology	Soil layers	Thick, cm	humus, %	Volumetric weight, g/cm ³	Compost stock, tons/ha
Fenced area (Control)					
Mountain brown soil	A	18	3.5	1.1	69.3
	AB	30	2.5	1.1	82.5
	BC	30	1.5	1.1	49.5
	Total humus stock of 1 ha of soil				
Built-up area					
Mountain brown soil	A	10	1.2	1.3	15.6
	A B	17	0.4	1.3	8.84
	BC	30	0.1	1.3	3.9
	Total humus stock of 1 ha of soil				

According to the above results, the humus reserve of 1 ha of soil in the control area is 201.3 tons/ha, while that of the soil

near the construction area is 28.34 tons/ha. From this, the humus stock of the study area decreased by 85.9%.

Table 4. Degree of soil degradation in the study area

Specifications	Degree of soil disturbance (in points)					
	No damage	Less	Medium	Great	Strong	Very special
Reduction of compost stock, in %	<5	5-25	25-50	50-75	75-95	95<
	According to our calculations:				(85.9)	

According to the above results, which determine the degree of soil degradation, the humus stock of the area near the construction site has decreased by 85.9%, which is classified as severely degraded by the degree of soil degradation.

Table 5. Loss of humus resources of damaged soil (without correction factor)

Soil typology	Degree of damage	Damaged area, ha	Humus reserves of undisturbed soil, tn/ha	Humus reserves of degraded soil, tn/ha	Loss of soil humus resources, tn/ha	Loss of total humus stock, tn/ha
Mountain dark brown	Strong	10	201.3	28.34	172.96	1,729.6

Table 6 . Loss of humus resources of disturbed soil (with correction factor)

Soil typology	Degree of damage	Loss of total humus resources, tn	K. of correction of parameters of soil characteristics	K. of correction of geographical indications	K. of revision of soil classification	Loss of total humus resources, tn (edited)
Mountain dark brown	Strong	1,729.6	1	0.7	0.7	847.504

Table 7. Amount of soil damage caused by construction

Soil typology	Degree of damage	Damaged area, ha	Loss of soil humus resources, tn/ha	Assessment, thousand	Soil assessment of 1.0 ha area, thousand
Mountain dark brown	Strong	10	847.504	233,911.104	23,391.1

According to the above results, if the loss of humus resources in the heavily eroded and damaged areas due to construction is calculated including the correction coefficients for soil properties and geographical parameters, the total loss of humus resources is 847,504 tons. If the amount of this resource is calculated at the exchange rate (2010) of 1.0 kg of humus substance (276 toke), the damage to the soil of the area is 233,911.104 thousand MNT.

IV. DISCUSSION

D. Dorzhgot (1986, 2003) and Mongolia country extent soil detailed research do soil mold feature help The characteristics of each are studied and according to the above researchers, humus in the 0-10 cm layer of mountain brown soil content 2.0 %, reaction environment weakly acidic or pH 6.5, powder dirt content or of pieces composition for loose sand and silt (<0.01 mm to occupy percentage 5 %, <0.001 mm to occupy percent 1 %) mechanics consists of is that defined be it Ours by research mountain brown soil of humus in the strata above content 1.2-3.0 %, reaction environment weakly alkaline to medium degree alkaline pH 7.3-8.8, powder dirt content or of pieces composition for sand and light loam mechanics consists of is _

D. Avaadorj (1990-2000) . researchers Mountains and steppes of Mongolia soil humus , humus generation thick , hummus resources established is _

Table 8. Soil of compost resources established seeds amount comparison

Soil mold feature	Soil period layer	Thick , cm	Humus , %	Volume weight , g/cm ³	Compost reserve , tons / ha
D. Avaadorj et al. (1990-2000)					
Mountain brown soil	A	18.5	2.2	1.3	52.9
	AB	14.2	1.5	1.3	27.6
	B	13.4	1.1	1.3	19.1
	1 ha soil of compost total resources				99.6
Ours by research					
Mountain brown soil	A	10	1.2	1.3	15.6
	AB	17	0.4	1.3	8.84
	B	30	0.1	1.3	3.9
	1 ha soil of compost total resources				28.34

V. CONCLUSIONS

According to the results of the changes in the soil characteristics of the research area, the thickness of the turf layer of the soil increased by 76.9%, the content of humus increased by 2.3%, the content of mobile phosphorus and potassium as nutrient elements increased by 61.1-83.3%, and the physical clay content increased by 78.8 % . decreased by 21.2%, the reaction environment of the soil increased by 21.2% and became slightly alkaline, the salt content increased by 1.55%, the volume weight or density increased by 18.1%, and the sand content increased by

65.5%. Based on this, it is reasonable to believe that the properties of the soil in the built-up area have deteriorated significantly.

The humus reserve of the research area has decreased by 85.9%, which is included in the level of severe soil damage, and the total loss of humus reserve is 847,504 tons (with the correction factor of soil characteristics and geographical parameters) . If the amount of this resource is calculated at the price of 1.0 kg of humus material (276 toke) (2010) , it is determined that the damage to the soil cover of the area is 233,911.104 thousand MNT .

REFERENCES

- [1] Avaadorj D. (2011) . Methodology for assessment of soil degradation, erosion and disturbance. Ulaanbaatar. pp. 2-18
- [2] Avaadorj D., Ganga A. (2019) . Soil science. Ulaanbaatar. p 49, 348-354, 462-471
- [3] Guide to the use of methods for environmental damage assessment and compensation calculation. (2018) . Ulaanbaatar. p. 41
- [4] Bathishigh O., Nyamsambuu N., Dorzhgot D., Nyamdavaa B. (2015) . Terelj river basin and geosystem. Ulaanbaatar. pp. 98-110
- [5] BONHAJYA. (2014) Bogdhan Mountain Nature Reserve Management Plan 2014-2018. Ulaanbaatar. pp. 10-14
- [6] Dorzhgot D. (2003) . Soil of Mongolia. Ulaanbaatar. pp. 89-113, 191-247
- [7] Lhamsuren B., Purevsuren Sh., Odgerel B (2017) . Results of the study of soil degradation in the natural complex. Dissertation for Ph.D. Ulaanbaatar. pp. 38-43

AUTHORS

First Author – B. Lhamsuren, Mongolian University of Life Sciences (MULS)-School of Agroecology, Lkhamsuren@mul.s.edu.mn
Second Author – B. Bolorchuluun, Mongolian University of Life Sciences (MULS)--School of Agroecology

Awareness and Attitudes of Men towards Prostate Cancer Screening in Makurdi Metropolis

¹Raymound Tartenger Tachin & Simon Agbo Itodo²

¹Department of Psychology, Benue State University, P.M.B 102119 Makurdi, Benue State, Nigeria.

²Department of Clinical Psychology, Federal Medical Centre, Makurdi, Benue State, Nigeria.

Email: itodo.simon@yahoo.com, Mobile number +2347061110861.

Abstract

Prostate Cancer is a health issue that is generating growing concerns globally and it is the number one cancer in males in Africa, both in terms of incidence and mortality. The purpose of this study was to establish the relationship between awareness, attitude and prostate cancer screening among men in Makurdi metropolis. A correlation design was used for the study and a total of 400 respondents participated in the study. Data was collected using an adopted Thomas Jefferson prostate cancer screening survey and a self-developed questionnaire. The data was analysed using Pearson product moment correlation and the results of hypothesis one revealed a no significant relationship between awareness and prostate cancer screening ($r(398) = -.020$; $P > 0.05$). Hypothesis one was therefore rejected. The second hypothesis revealed a significant negative relationship between men's attitude and prostate cancer screening ($r(398) = -.109$; $P < 0.05$), this hypothesis was therefore confirmed. Based on these findings, it was recommended that future studies should focus on how cultural and religious beliefs may be related to prostate cancer screening practice. Furthermore, socioeconomic factors should also be investigated as possible determinants of prostate cancer screening practice in future studies.

Key words: Awareness, Attitudes, prostate cancer, and screening.

Introduction

Many men have died of prostate cancer (PC) over the years and some could be as a result lack of awareness of existence of this disease while others are borne out of deliberate negligence to screening and late detection of prostate cancer (Saudi Cancer Registry, 2007). Prostate cancer is the number one cancer in males both in incidence and mortality in Africa including Nigeria, constituting 40,000 (13%) of all male cancer incidences and 28,000 (11.3%) of all male cancer-associated mortalities (Ferlay, Shin, Bray, Forman, Mathers, & Parkin, 2010; Akinremi, Ogo & Olutunde, 2011). Prostate cancer is age related and it is common in men older than 80 years of age. As a matter of fact, some studies have suggested that among men over 80 years of age, 50%-80% of them may have prostate cancer. More than 80% of prostate cancers are diagnosed in men older than 65 years of age (Abdel-Gawad, 2010; Adibe, Aluh, Isah, & Anosike, 2017).

Generally, prostate cancer tumour at the early stage usually grows slowly and remains confined to the gland for many years. During this time, the tumour produces little or no symptoms or outward signs (Al- Hamdan, Rayichandran, & Al-Sayyad, 2009). The only way to detect it at this stage is through regular early screening. Prostate cancer screening is an attempt to find unsuspected cancers, and may lead to more invasive follow-up tests such as a biopsy, with cell samples taken for closer study (American Cancer Society (2009). Other screening options include the digital rectal exam (DRE), the prostate-specific antigen (PSA) blood test or a combination of these methods. The primary goal of prostate cancer screening is the early detection of men with clinically significant cancers resulting in a reduction of overall morbidity and mortality associated with this disease. Screening may allow for early detection or diagnosis of more localized cancers, resulting in improved cancer specific mortality

with appropriate treatment. Men's prostate cancer screening behaviour may be related to their awareness and attitude of the disease condition and its implications.

Awareness is the understanding of knowledge-based information derived by the individual perception of a particular thing or phenomenon. It is the ability to perceive, to feel, or even to be conscious of events or objects. In this level of consciousness, sensory data can be confirmed by the observer without necessarily implying understanding (Ries, Eisner, & Kosary, 2004). When people are properly informed for example of prostate cancer, a need for screening becomes necessary and important. However, available literature showed that, deaths recorded from prostate cancer cases have been complicated by under-reporting and by cases that have not been diagnosed due to poor awareness on the part of individuals with the condition and, probably, lack of structured guidelines to deal adequately with this health condition that is now emerging in our health care system and community. Attitude about cancer screening is an enduring organization of beliefs, feelings, and behavioural tendencies towards socially significant objects, groups, events or symbols (cancer screening) (Hoag & Vaughan, 2005). It is a psychological tendency that is expressed by evaluating a particular entity with some elements of favour or disfavour. When people become aware of the essence of regular check-up for screening and the early detection of growth of cancer in the prostate, it enhanced their positive attitude to screening. In the same vein, when people are unaware of the essence of screening for prostate cancer, it makes them have negative attitude towards screening.

Statement of the Problem

Cancer, regardless of the type is considered a fatal disease to people in both developed and developing countries of the world (Kennerson, 2010). The World Health Organization (WHO) 2004 report for countries of the world with significant prostate cancer disease burden revealed that out of the top ten countries of the world with the disease, Nigeria ranked as the third highest with the total deaths in that year from the disease being 13,700, after the United States and India with 35,300 and 18,200 deaths, respectively. The reported burden of the disease for 2004 also showed that the total deaths from all cancers/neoplasm in Nigeria was 78,700 and prostate cancer recorded 13, 700 (17.41%), while breast cancer recorded 10,600 deaths (13.47% in the eleventh position globally). Within Africa, Nigeria ranked first out of the nine countries with the highest prevalence of prostate cancer. Despite documented fatality from prostate cancer and its devastating impacts, it can be managed to improve the life expectancy and quality of life of men with the disease if detected early through screening. However, there appear to be low screening behaviours among men in Makurdi Metropolis which is not unconnected with their poor awareness and attitudes towards early screening for the disease. There is also dearth of literature regarding awareness, attitude and prostate cancer screening among men in Makurdi Metropolis as the researchers are not aware of any of such research at the time of conducting this study. It is against this background that this study is conceived to investigate the relationship between awareness, attitude and prostate cancer screening among men in Makurdi Metropolis.

Aim and Objectives of the Study

The aim of the current study is to investigate the relationship between awareness, attitude and prostate cancer screening among men in Makurdi Metroplis. This aim is translated in to the following objectives:

1. To determine the relationship between awareness of prostate cancer and screening practice among men in Makurdi Metropolis.
2. To ascertain if attitude of men towards prostate cancer relate to screening practice in Makurdi Metropolis.

Research Questions

1. What is the relationship between men's awareness of prostate cancer and screening practice in Makurdi Metropolis?
2. How does men's attitude towards prostate cancer relate to their screening for the disease in Makurdi Metropolis?

Hypotheses

The following hypotheses were tested.

1. There will be a significant relationship between men's awareness and prostate cancer screening practice in Makurdi Metropolis
2. There will be a significant relationship between men's attitude and prostate cancer screening practice in Makurdi Metropoli.

Methods

Design

A survey research with a correlational research design was employed for the study. The choice of correlational research design was because the researcher was primarily interested on establishing the relationship between awareness, attitude towards prostate cancer and prostate cancer screening practice among the selected sample of the men population in Makurdi metropolis.

Participants

A purposive sampling technique was adopted to select a total of 400 participants for the study. Purposive sampling technique was preferred because it gives the researchers the opportunity to select participants based on their availability and willingness to provide answer to the research questions. Inclusion criteria was that participant must be a man and aged 35 years and above. Exclusion criteria include women, children, adolescents and anyone below the age of 35 years. Previous study has potentially put the age of onset of prostate cancer at 35 years.

Instruments

Three instruments were used for data collection. Knowledge of prostate cancer and prostate cancer screening attitude both adopted for this study from the Thomas Jefferson University Prostate Cancer Screening Survey developed by Myers (2005) and a prostate cancer screening questionnaire developed by the researcher.

Awareness of Prostate Cancer

The awareness of prostate cancer was measured using the knowledge of prostate cancer screening questionnaire (Weinrich, 2004). It measures the level of prostate cancer and prostate cancer screening knowledge. It is a 12 item questionnaire that measures prostate cancer screening limitation, prostate cancer screening symptoms, prostate cancer risk factors, and prostate cancer guidelines. It is a Likert type of scale ranging from strongly disagree, Disagree, Agree, and Strongly Agree. Content validity was established with five cancer health professionals who provided suggestions for the questionnaire. The questionnaire was revised and administered 12 additional times to 56 men. The reliability using factor analysis was 0.61. Construct validity was based on factor loading of 0.35 or greater. The 12 item clustered on one factor indicating a one-dimensional scale. The internal consistency of the knowledge scores using a Cronbach's alpha is ($\alpha=0.77$ (weinrich 2004)).

b. Prostate Cancer Screening Attitude.

The Thomas Jefferson University Prostate cancer survey (Myers 2005) was used to assess factors associated with screening frequency among men. The scale has a number of items on a personal attitude about prostate cancer screening, and each item was measured on a four-point Likert –type scale. Prostate cancer awareness and attitudes scales have indicates the following properties: 1) salience and coherence of prostate cancer screening (four items, Cronbach's $\alpha=0.85$); 2) personal susceptibility to prostate cancer (two items, Cronbach's $\alpha=0.74$); and 3) concern about exam related pain and anxiety (two items, Cronbach's $\alpha=0.75$)

c. Prostate Cancer Screening Questionnaire

The screening test was self-developed questionnaires of four items with responses from strongly agree to strongly disagree. The instrument was validated using a pilot sample of 52 participants. The test has reliability co-efficient of .872 and four items Cronbach's α also of .872, thus making the scale highly reliable.

Procedure

During the administration of the questionnaires, the researchers with other two assistants went out in peers to meet respondents in the selected locations within the Makurdi Metropolis. Upon arrival, the researchers briefly explained the purpose of the study to them including necessary information needed to complete the questionnaire and seek their consents to participate in the study. All those who indicated interest to participate were given consent form to sign followed by the research questionnaire. Participation was optional and participants were at liberty to withdraw their participation any time. After completing the questionnaires, the researchers appreciated participants for their participation, assured them of confidentiality of the information provided and left their contact details behind should any of the participants wants to make clarifications or further enquiry about the study.

Data Analysis

The data collected was analyzed using Descriptive Statistics and Pearson Moment correlation to test the two hypotheses formulated. A statistical package for social sciences (SPSS) was used for all the analysis.

Results

Demographic Characteristics of Respondents

The mean age and standard deviation of respondent were 42.7 and 8.7 respectively indicating that majority of respondents were within the age of onset of prostate cancer. Further demographic characteristic is summarised in table 1 below:

Table 1: Marital status, religion, tribe, and education as well as occupation distribution of respondents

VARIABLES	FREQUENCY	PERCENTAGE
MARITAL STATUS		
Single	93	23.9
Married	276	71.0
Separated/divorced	12	3.1
Widower	8	2.1
RELIGION		
Christianity	356	87.9
Islam	21	5.3
Traditional	16	4.0
Others	3	.8
TRIBE		
Tiv	281	70.5
Idoma	32	8.1
Igede	56	14.2
Others	24	6.1
EDUCATION		
Tertiary	317	82.3
Secondary	35	9.1
Primary	30	7.8
No formal education	3	.8
OCCUPATION		
Civil servant	263	68.0
Farming	16	4.1
Business	52	13.4
Student	56	14.5

Sources: Field work, 2021

Table 1 above revealed the demographic characteristics of the respondents. Married persons were the highest respondents (71.0%). In terms of education and occupation, majority of the respondents had tertiary education (82.3%) and were civil servants (68.0%). They were predominantly Tiv (70.5%) by tribe and Christian (87.9%) by religion.

Table 2: Pearson Correlation showing the relationship between Awareness of Prostate Cancer and Prostate Cancer Screening Practice

Variable	N	Df	R	P-value	Remark
Awareness	400	398	-.020	0.05	Not significant

The result of Pearson correlation presented in table 1 shows that there is no statistical significant relationship between awareness of prostate cancer and its screening practice, ($r_{(398)} = -.020$; $P > 0.05$) among men studied. Therefore, the research hypothesis is rejected

Table 3: Pearson Correlation showing the Relationship between Men’s Attitude towards Prostate Cancer and Prostate Cancer Screening Practice

Variable	N	Df	R	P-value	Remark
Awareness	400	398	-.109	0.05	significant

The result of the Pearson correlation presented in table 2 above shows that there is a negative significant relationship between men’s attitude and prostate cancer screening practice.

($r_{(398)} = -.109$; $P < 0.05$). Therefore, the research hypothesis is accepted.

Discussion

Hypothesis one was tested using the Pearson product moment correlation statistics and the result showed no significant relationship between men’s awareness and prostate cancer screening practice ($r_{(398)} = -.020$; $P > 0.05$). This finding is consistent with the finding of Olusegun, Ayoola & Oluwakemi, (2020) who found that there was a high level of awareness of Prostate cancer among male journalists in Lagos but this did not lead to a positive attitude towards Prostate cancer screening among them. Similarly, Necku, Anaba & Abuosi, (2019) studied Prostate cancer awareness and attitude toward early detection among male soldiers

in Ghana in a cross-sectional study. They found that 58.3% of the soldiers were less aware of PC and 76.0% had low or neutral knowledge regarding risk factors and symptoms of Prostate Cancer. The soldiers had positive attitudes toward early detection but had low intentions of getting tested. Awareness was significantly associated with education, rank, haven received PC information from a health worker and being knowledgeable of signs of Prostate Cancer. One of the reasons this hypothesis was not significant could be due to cultural and religious believe of the people. There is a common belief among the studied population that “what you don’t know cannot kill or harm you”. So going for prostate cancer screening when one has not been diagnosed or having symptoms is like looking for a problem where there is none.

The second hypothesis was also tested using Pearson product moment correlation and the result shows a negative significant relationship between attitude towards prostate cancer and screening practice ($r_{(398)} = -.109$; $P < 0.05$). This implied that the more positive attitude of respondents towards prostate cancer, the less they are willing to go for screening. The finding of this hypothesis is contrary to the works of Hoffman (2011) who in his study found men who chose not to get screened had less knowledge about prostate cancer and a less positive attitude towards screening than men who choose to get screened. Similarly, Other studies conducted on screening, knowledge, perceptions, attitude and behaviours among African men also found knowledge about disease, lack of access to screening services, embarrassment and fear of positive diagnosis and related sexual dysfunction as determinants of negative attitude towards screening (Forrester-Anderson, 2005; McFall, Hamm & Volk, 2006). Unlike previous studies, one of the reasons positive attitude did not positively correlates screening practice among the studied population could be the socioeconomic disadvantage of the people which is believed to heighten the knowledge and attitudinal barriers to early screening and detection of prostate cancer.

The study focused on understanding the relationship between awareness, attitude and prostate cancer screening practice among men in Makurdi Metropolis. It can be concluded based on the study that awareness did not relate to screening practice and attitude negatively correlate with prostate cancer screening practice among the studied population.

Recommendations

No doubt, more research is needed on the current phenomenon. Attention of future researchers should focus on how cultural and religious beliefs may be related to prostate cancer screening practice. Furthermore, socioeconomic factors should also be investigated as possible determinants of prostate cancer screening practice in future studies.

References

- Adibe, M. O., Aluh, D. O., Isah, A. & Anosike, C. (2017). Knowledge, Attitudes and Perceptions of Prostate Cancer among Male Staff of the University of Nigeria. 1 (2) DOI:10.22034/APJCP.2017.18.7.1961
- Akinremi, T. O., Ogo, C. N. & Olutunde, A. O (2011). Review of prostate cancer research in Nigeria. *Infectious Agents and Cancer*, 6, (8), 1–9. Doi: 1186/1750-9378-6-S2-S8.
- Al- Hamdan, N. Rayichandran, K., & Al-Sayyad, J., (2009). Incidence of Cancer in Gulf Cooperation Council Countries, *Saudi Arabia Medical Journal*, 3,179-84.
- American Cancer Society. (2009). *Cancer facts and figures*. Atlanta, Georgia: American Cancer Society.
- Ferlay, J., Shin, H. R., Bray, F., Bray, F., Forman, D., Mathers, C., & Parkin, D. M. (2010). Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. *International Journal of Cancer*, 127,(12) 2893–2917. Doi.org/10.1002/ijc.25516.
- Forrester-Anderson, I. T. (2005). Prostate screening perceptions, knowledge, and behaviors among African American men: Focus group findings. *Journal of Health Care for the Poor and Underserved*, 16, 22-30.
- Hoag, N.A., Davidson R.A, Pommer, V. & Ville P. J. (2008). Prostate Cancer Screening Practice among Primary Care Physicians in Victoria, British Colombia. *BC Medical Journal*, 50 No (8):56-60.
- Kenerson, D. (2010). Use of the theory of planned behavior to assess prostate Cancer screening intent among African American men. *Dissertation* submitted to the faculty of the graduate school of Vanderbilt University.
- McFall, S. L., Hamm, R. M. & Volk, R. J. (2006). Exploring beliefs about prostate cancer and early detection in men and women of three ethnic groups. *Patient Education and Counseling*, 61, 109-116.
- Necku, J. G., Anaba, E. A., & Abuosi, A. A. (2019). Prostate cancer awareness and attitude toward early detection among male soldiers in Ghana: a cross-sectional study. *African Journal of Urology* (2019) 25:5 doi.org/10.1186/s12301-019-0004-3
- Olusegun, O., Ayoola, A. & Oluwakemi, O. (2020). Awareness and Attitude of Male Journalists in Lagos State towards Prostate Cancer Screening. *Global media journal*. 18 (34). Retrieved from www.globalmediajournal.com on 23rd January, 2021, 1550-7521
- Ries, L. A., Eisner, M. P. & Kosary, C. L. (2004). *Seer Cancer Statistics Review, 1975–2001*.
- Saudi Cancer Registry. (2007). *Cancer incidence and survival report*. Al-proffers; Saudi Arabia.

Weinrich, S. P. & African American Hereditary Prostate Cancer Study Network, (2006). Prostate cancer screening in high-risk men. *American Cancer Society Journal*, 106 (4), 796-803. Doi.org/10.1002/cncr.21674

World Health Organization. (2004). *World Health Report: changing history* Retrieved from <http://www.who.int/whr> on 20th January, 2021.

Quality Of Life And Temporal Adaptation Of Refugees Relocating To New Environments

Kavitha Padmanabhan

DOI: 10.29322/IJSRP.12.10.2022.p13051
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13051>

Paper Received Date: 15th September 2022

Paper Acceptance Date: 16th October 2022

Paper Publication Date: 21st October 2022

I. INTRODUCTION

The United States resettles a significant number of refugees that flee from their countries (Larsen, 2004). Refugees are displaced from home due to war, political turmoil, persecution, and conflict (Driver & Beltran, 1998). Their resettlement process is strenuous despite existing environmental supports. Refugees often adapt to their new environments however their adaptation trajectories are not well researched.

II. LITERATURE REVIEW

The UNHCR (1951) defines a refugee as-

A person owing to well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality and is unable or, owing to such fear, is unwilling to avail himself of the protection of that country; or who, not having a nationality and being outside the country of his former habitual residence as a result of such events, is unable or, owing to such fear, is unwilling to return to it. (p.16)

Refugees are uprooted from their stable homes, experience disruptions in everyday lives, and have to rebuild their existence from the ground up. Limitations to their participation and inability to perform occupations that are central to adaptation often leave refugees unable to integrate successfully in their new communities (Gupta, 2012).

The term adaptation is derived from the Latin work 'adaptare' which means to fit. Adaptation has been extensively studied in biology as an explanation for evolution, in physiology as change in an organ or organism in response to sensory stimulation, and in psychology as change in quality of the experience with changes in the environmental contexts. The concept of occupational adaptation was introduced within occupational therapy when Meyer adopted the notion from psychiatry in 1922. He stated that most psychiatric conditions were 'problems of adaptation' and their remedy was participation in work. He is also credited with introduction of the concepts of 'systematic use of time' and 'engagement of interest' within occupational therapy (Meyer, 1922). Since then, the concept of adaptation has been used liberally in the OT literature described as adaptive responses, adaptive equipment, adaptive skills, and adaptive environments (Reed & Sanderson, 1999). According to

the most recent Occupational Therapy Practice Framework (2008), occupational adaptation is the response that the client makes when encountered by an occupational challenge. Thus, occupational adaptation is related to personal factors, environmental factors, and time.

Some research within occupational therapy has addressed adaptation and refugee issues. Suleman and Whiteford (2013) explored the use of occupations in understanding refugee resettlement and improving occupational adaptation with the use of life skills training. They highlighted the supports and barriers the environment presents to the resettlement process; for example, as a positive, resettlement camps may even inculcate attributes like resilience, persistence, and determination. Successful adaptation is influenced by various factors including physical and psychological health, in addition to the environmental challenges. Many refugees may have experienced physical ailments like amputations, war related injuries, chronic health conditions such as multiple sclerosis, preventable vaccine related health crisis such as tuberculosis, malaria, and various forms of malnutrition (Burnett & Peel, 2001; Hollifield et al., 2002). Psychological health issues are also prevalent in refugees. Post-traumatic stress disorder, a stress reaction to traumatic events, is very well documented in this population (Papadopoulos, 2002; Friedman, 2002; Van de Put & Eisenbruch 2004). These stress related disorders along with depression, hopelessness, and a lack of security are all related closely to quality of life.

Quality of life can be defined as 'a person's perception of his or her position in life in the context of the culture and value systems in which he or she lives and in relation to his or her goals, expectations, standards, and concerns (Szabo, 1996, p.355). The Center for Disease Control (CDC) states that on an individual level, quality of life includes perceptions of physical and mental health. It is not limited to an individual's functional status or social support, and includes resources and policies on a community level. Occupational therapy strives to assist individuals to maximize their capabilities, adapt to their physical environments, interact with society, and take charge of their lives thus improving quality of life (Hammell, 2004). There is a scarcity of measures that assess adaptation to new environments, especially that of refugees. In her dissertation, Grist (2010) studied the relationship between adaptation to disability as measured by an adaptation to disability index and examined quality of life as measured by a sense of well-being inventory and found a strong positive correlation. Thus, it is

believed that successful adaptation can be depicted by positive changes on a quality of life measures.

Purpose

Refugees enter their host countries with a long term goal of becoming successful members of the society. However, they are often faced with ailments related to physical and mental health such as communicable diseases, chronic conditions like HIV/AIDS, depression, post-traumatic stress disorder (PTSD) etc. Limited access to healthcare services and an inability to comprehend and navigate the system places them at a further disadvantage (Burnett & Peel, 2001). Moreover, individual perceptions of their health, social supports, and environment are crucial to the quality of life experience. This research served to explore adaptation as measured by a health related quality of life measure in the refugee population by examining the temporal aspects of the experience in the host country. The research question was: Is there a relationship between quality of life, as measured by a health related quality of life scale, and temporal adaptation?

III. METHODOLOGY

Design

In this study the research question was addressed using a mixed method design with a primarily quantitative focus to explore whether or not temporal adaptation improves health related quality of life in the participant refugee population. Kielhofner (2008) states, 'Occupation is the purposeful use of time by humans to fulfill their own internal urges toward exploring and mastering their environment' (p. 659) and explained temporal adaptation as adaptation over time. The World Health Organization Quality of Life Measure-Brief (WHOQOL- BREF) was used as the quantitative measure.

Participants

Five refugees, who had been in the USA for different lengths of time, participated in the quantitative survey. The participants were obtained using a snowball sampling approach: two participants were recommended by a personal friend who teaches English as a second language, the other three were references from personal contacts/ community members known for their work with the refugee population. All five individuals were English speaking and agreed to participate in the study. The refugees were contacted via phone, informed consents were obtained, and the WHOQOL-BREF was administered at a location of their preference. Participants 1, 2 and 3 completed the survey in their homes; participants 4 and 5 completed the survey in their place of work. The participants completed the questionnaire by answering the questions individually with the researcher present and available for any clarification; two of the refugees needed clarification for some of the questions. The measure was administered at one time and the refugees were then asked to explain their choices on the questionnaire. The tool required 10-15 minutes to administer and the discussion was audiotaped for all participants except participant 3 (pseudonym: Sheila).

Data Collection Tool

The WHOQOL-BREF is an abbreviated version of the WHO quality of life measure that has 100 questions. Twenty six questions addressing four (physical, psychological, social relationships, and environmental) domains are present within the brief measure. The scoring uses an ordinal scale ranging from 1-5, 1 being poor and 5 being very good for most questions. The WHOQOL- BREF was developed by the WHO to understand perceptions about culture and value systems and how these factors affect everyday life.

The tool has been used with a variety of populations, translated in various languages and provides a cross-cultural comparison of quality of life indices internationally. The WHOQOL- BREF has good to excellent reliability and validity and has been tested with adolescents in Bangladesh, urban community residents in China, individuals with pulmonary tuberculosis in Taiwan, older adults in Brazil, and the general population in Norway and Iran (Trompenaars, Masthoff, Van Heck, Hodiament, & De Vries, 2005; Izutsu et al., 2005; Xia, Li, Hau, Liu, & Lu, 2012; Chung, Lan, & Yang, 2012; Chachamovich, Trentini, & Fleck, 2007; Hanestad, Rustøen, Knudsen, Lerdal, & Wahl, 2004; Nedjat, Montazeri, Holakouie, Mohammad, & Majdzadeh, 2008). In clinical practice, the WHOQOL assessment assists clinicians in making judgments about the areas in which a patient is most affected by disease and in making treatment decisions. In some developing countries, where resources for health care may be limited, treatments aimed at improving quality of life through palliation, for example, can be both effective and inexpensive. Together with other measures, the WHOQOL-BREF enables health professionals to assess changes in quality of life over the course of treatment. The tool is attached as Appendix A.

Data Analysis and Management

The data were stripped of any identifying information and entered into a Microsoft Excel sheet. The data form included demographic information such as age, gender, marital status, education and current health status. The raw QoL scores were converted into transformed scores so they can be analyzed on a 0-100 range using instructions from the WHO. Domain scores are scaled in a positive direction where higher scores indicate higher quality of life. Basic descriptive statistics such as mean and ranges were obtained. The domain scores were correlated to the answers the participants provided for their choices to obtain an understanding of the general changes in scores and their relationship to time spent in the host country.

IV. RESULTS

The WHOQOL-BREF measures physical, psychological, social relationships, and environments as four domains of well-being/ quality of life. Demographic information is provided in Table 1 with researcher chosen pseudonyms for the five participants. Raw domain scores are shown in Table 2 and the transformed domain scores of the participants are shown in Table 3.

Physical health questions addressed activities of daily living, energy, mobility, sleep and rest, and work capacity. Norma (a researcher chosen pseudonym) addressed this stating: "I am working, my husband is working. I have one daughter and we

registered her in a school and she is healthy and this is very important to me.” The psychological domain addressed positive and negative feelings, spirituality, bodily image, and appearance. Sheila, a young Nepali refugee, who had limited opportunities for leisure and education, explained her feelings about satisfaction with her life stating: “I am happy that I have work but I want to study more”. Social relationships included social support and sexual activity. Evan explained social relationships in his neighborhood: “Everybody here is immigrant; everybody here cares for each other.” The environment included physical safety, home, opportunities for participation, acquiring new information, transport and financial resources. Evan highlighted the importance of safety: “We are safe. We are in this country and we are not persecuted or intimidated. We have security in the condominium, everything is near, and so for that reason I feel safe.” He did report difficulty with transport,

I don’t drive right now. That is a big problem. Right now we don’t know the city. We need more information about how to move in the bus. We don’t know where some parts are. We know where we live, we know our address but we don’t know how to get to other places.

Norma explains her feelings of anxiety secondary to being away from her parents, “Actually I have family back home and the situation in Iraq is not good. So I am always worried about them, the explosions and all the things you know, it’s not settled. It’s not peaceful.” George explained the lack of time for leisure activities that included travel and seeing different countries, “I feel sometimes though that time available for leisure activities is not enough.”

The refugees who were new to the host country and in the process of becoming familiar with the new environment showed fairly good quality of life depicted by higher scores (Evan and Rebecca). In contrast, once the refugees have lived here for a while and understood the system; their scores took a dip (participants Sheila and George). The QoL scores were higher again for participants who had lived in the USA for a longer period of time (Norma). This pattern was most evident for domain three, the social relationships area. The graphical representation of the different domain scores for each of the five participants is provided as graphs 1 through 5. Evan scored high on social relationships and environment domains. For Rebecca and Norma, social relationships were scored the highest. George scored highest on domain four (environment). Although the overall QoL score for Sheila was low, she scored high in the psychological domain. Her lowest scores were social relationships and environment.

V. DISCUSSION

The WHOQOL-BREF measure completed by the five participants provided an understanding of their health related quality of lives. The refugees who were fairly new had only good experiences from the agencies, reported their environments were satisfactory, and had fewer complaints. They were satisfied with their lives as they had ‘house, food, electricity- the minimal conditions’ that were necessary for living. A refugee who had been here more than two years appeared to understand that she was surviving on basic amenities and could have access to opportunities that would better her life. She highlighted the lack

of adequate services that would allow her to study and work at the same time and lack of transportation facilities as she was unable to drive. She did not address this as a sole responsibility of the resettling agency but perceived that it was a system level change that needed to happen to accommodate more people like her. Another refugee female who had lived nine years in the host country expected more out of life and wanted to study. She reported having difficulty with finding appropriate employment and education opportunities.

The domain scores did not necessarily show a linear positive or negative disposition with respect to time spent in the United States. Conversely, the refugees appeared to have a variable trajectory of adaptation or quality of life when compared with each other. Every participant answered the questions based on their current status. For example, one female participant was pregnant and attributed lower scores to having less energy and time to complete leisure activities and decreased satisfaction with physical appearance. She described her situation relative to being very close to her due date and hence she was unable to partake in those tasks to the best of her abilities and to the level of her satisfaction. All five refugees reported having a good quality of life and primarily attributed it to safety. One refugee commented that he felt he was not persecuted or intimidated and felt he was in a safe place being here in the United States. Two of the refugees addressed lack of appropriate information as limiting successful participation in tasks of their choice. The domain scores showed areas of strengths as well as weaknesses for each participant for e.g. Sheila and George had limited socialization but Evan reported a strong nurturing environment.

The WHOQOL-BREF measure evaluates health related quality of life. Although none of the refugees had any physical ailments at the time of administration of the tool, the psychological factors involved in adaptation were revealed. Psychometric studies on the WHOQOL-BREF showed that QoL scores decreased with an increase in psychiatric symptoms such as depression, somatic symptoms as well as perception of social support (Trompenaars et al., 2005). It is evident that adaptation is related to the psychosocial make up, personal experiences, and environmental press of each individual, and how the individual then deals with the challenges.

Berry, Phinney, Sam and Vedder (2006) researched the relationship between acculturation and adaptation of immigrant youth to new societies and discussed the results of their factor analysis, which revealed two important themes of adaptation: psychological and sociocultural adaptation. This is assumed to be true with the refugee population as well. Stevens and colleagues researched problems in adaptation as a result of migration and resettlement, and the factors that influence this process from a psychological perspective. They undertook qualitative interviews with six Russian speaking immigrants to a novel culture in New Zealand and found that immigrants experience struggles during the process of their psychological and sociocultural adaptation to the host culture and these interactions with the host environment have far-reaching effects on their mental health, employment and participation in society. All the participants in their study experienced high levels of psychological distress in the initial stage of their resettlement, but those who later chose the integration strategy of acculturation were more successful and satisfied with their adaptation. In this study, when compared with

each other, the five participants showed various degrees and methods of temporal adaptation to their environments. They also had variable individual trajectories that highlight the dynamic nature of adaptation. Adaptation was thus observed to be a non-linear phenomenon, multi-factorial, and influenced by time.

VI. LIMITATIONS

The WHOQOL measure is a personal evaluation of functioning, hence comparative analysis between participants was only based on the subjective understanding of their adaptation trajectories. Additionally, secondary to the low number of participants (five), no statistical analysis could be conducted; only descriptive analysis could be completed. The study was not longitudinal in nature and hence was unable to capture changes in the domain scores, if any, which happen over time, spent in this country. A qualitative assessment tool with in depth questions about choices and how they relate to adaptation would have strengthened the study.

VII. CONCLUSIONS

Occupational therapists need to appreciate that there are multiple factors affecting quality of life in the refugee population. These individuals have been deprived of basic amenities in camps and may have fled from their countries for safety. Hence, they are often very appreciative of the services provided by agencies like basic self-care needs and safety. We, as therapists, have to be open-minded and have a genuine interest in knowing their needs and priorities in order to assist them in adapting successfully. In fact, this is not very different from the process outlined by AOTA of obtaining an extensive occupational profile in our clients with conventional physical or mental health care needs.

During the assessment and intervention process, therapists also need to understand the different trajectories of adaptation that individuals pass through in their lives. Adaptation implies change and change is dynamic. It is influenced by multiple factors, both internal such as personal resilience and external such as social supports. In addition, the adaptation process is not always linear and one-directional. There are peaks and valleys along the path of adaptation. Penrod, Hupcey, Baney and Loeb (2011) describe the caregiving trajectories of caregivers who provide end-of-life care. They interviewed 46 informal family caregivers to individuals with terminal conditions such as cancer and found that trajectories of death influenced the caregiver experience. They also report how an in-depth understanding of the trajectories can assist clinicians in planning service delivery with respect to the nature and timing for individuals with terminal diseases and their caregivers. Similarly, therapists' understanding of temporal adaptation and adaptation trajectories can inform their clinical reasoning while working with forced migrants. Future research studies could address individual adaptation trajectories further by conducting longitudinal studies with a larger sample of participants.

REFERENCES

- [1] American Occupational Therapy Association. Occupational therapy practice framework: Domain and process. *American Journal of Occupational Therapy*, 62(6):625-683.
- [2] Berry, J. W., Phinney, J. S., Sam, D. L. and Vedder, P. (2006), Immigrant Youth: Acculturation, Identity, and Adaptation. *Applied Psychology: An International Review*, 55(3), 303–332. doi: 10.1111/j.1464-0597.2006.00256.x
- [3] Burnett, A. and Peel, M. (2001). Asylum seekers and refugees in Britain: Health needs of asylum seekers and refugees. *BMJ: British Medical Journal*, 322 (7285), 544.
- [4] Chachamovich, E., Trentini, C., and Fleck, M. (2007). Assessment of the psychometric performance of the WHOQOL-BREF instrument in a sample of Brazilian older adults. *International Psychogeriatrics*, 19(4), 635-646.
- [5] Chung, W., Lan, Y., and Yang, M. (2012). Psychometric testing of the short version of the world health organization quality of life (WHOQOL-BREF) questionnaire among pulmonary tuberculosis patients in Taiwan. *BMC Public Health*, 12:630. doi:10.1186/1471-2458-12-630
- [6] Szabo, S. (1996). The World Health Organization quality of life (WHO-QoL) assessment instrument. In B. Spilker (Ed.), *Quality of life and pharmacoeconomics in clinical trials* (pp. 355-362). Philadelphia: Lippincott, Raven.
- [7] Driver, C., and Beltran, R. (1998) Impact of refugee trauma on children's occupational role as school students. *Australian Occupational Therapy Journal*, 45, 23-38.
- [8] Friedman, J. (2002). From roots to routes Tropes for trippers. *Anthropological Theory*, 2(1), 21-36.
- [9] Grist, V. L. (2010). The relationship between age of disability onset, adaptation to disability, and quality of life among older adults with physical disabilities. (Doctoral dissertation). Retrieved from Electronic theses, treaties and dissertations, Florida State University, URN etd-04122010-171802.
- [10] Gupta, J. (2012). Human displacement, occupational disruptions, and reintegration: a case study. *WFOT Bulletin*, 6627-29.
- [11] Hammell, K. W. (2004). Dimensions of meaning in the occupations of daily life. *Canadian Journal of Occupational Therapy*, 71 (5), 296-305.
- [12] Hanestad, B., Rustøen, T., Knudsen Ø, J. r., Lerdal, A., and Wahl, A. (2004). Psychometric properties of the WHOQOL-BREF Questionnaire for the Norwegian general population. *Journal of Nursing Measurement*, 12(2), 147-159.
- [13] Hollifield, M., Warner, T. D., Lian, N., Krakow, B., Jenkins, J. H., Kesler, J., Stevenson, J., and Westermeyer, J. (2002). Measuring trauma and health status in refugees. *JAMA: the journal of the American Medical Association*, 288(5), 611-621.
- [14] Izutsu, T., Tsutsumi, A., Islam, A., Matsuo, Y., Yamada, H.S., Kurita, H., and Wakai, S. (2005). Validity and reliability of the Bangla version of WHOQOL-BREF on an adolescent population in Bangladesh. *Quality of Life Research*, 14(7), 1783-1789.
- [15] Kielhofner, G. (2008). *Model of Human Occupation: Theory and Application*. (4th Ed.). Baltimore, MA: Lippincott, Williams & Wilkins.
- [16] Larsen, L. J. (2004). *The Foreign-Born Population in the United States: 2003*. Current Population Reports, U.S. Census Bureau, Washington, D.C. P20-551.
- [17] Meyer A (1922, 1977). The philosophy of occupational therapy. *Archives of Occupational Therapy* 1: 1–10; Reprinted in *American Journal of Occupational Therapy*, 31(10): 639–42.
- [18] Nedjat, S., Montazeri, A., Holakouie, K., Mohammad, K., and Majdzadeh, R. (2008). Psychometric properties of the Iranian interview-administered version of the World Health Organization's Quality of Life Questionnaire (WHOQOL-BREF): a population-based study. *BMC Health Services Research*, 8:61.
- [19] Papadopoulos, R. K. (2002). Refugees, home and trauma. In Papadopoulos, R. K. (Eds), *Therapeutic care for refugees: No place like home*, (pp. 9-39). Great Britain: Studio Publishing Services.
- [20] Penrod, J., Hupcey, J. E., Baney, B. L., and Loeb, S. J. (2011). End-of-life caregiving trajectories. *Clinical nursing research*, 20(1), 7-24.
- [21] Reed, K. L. and Sanderson, S. N. (1999). *Concepts of Occupational Therapy* (4th Ed). Philadelphia: PA, Lippincott, Williams & Wilkins.

- [22] Suleman, A., and Whiteford, G. (2013). Understanding Occupational Transitions in Forced Migration: The Importance of Life Skills in Early Refugee Resettlement. *Journal of Occupational Science*, 20 (2), 201-210.
- [23] Trompenaars, F.J., Masthoff, E.D., Van Heck, G.L., Hodiamont, P.P., and Devries, J. (2005). Content validity, construct validity, and reliability of the WHOQOL-BREF in a population of Dutch adult psychiatric outpatients. *Quality of Life Research*, 14(1), 151-160.
- [24] United Nations High Commission for Refugees (2005). Basic facts, UNHCR, Geneva. Retrieved November 12, 2008 from <http://www.unhcr.org/pages/49c3646c2.html>
- [25] United Nations High Commissioner for Refugees. (2011). 60 years and still counting: UNHCR global trends 2010. Geneva: Author.
- [26] Van de Put, W. A. C. M., and Eisenbruch, M. (2004). Internally displaced Cambodians: Healing trauma in communities. In K. E. Miller & L. M. Rasco (Eds.), *The mental health of refugees: Ecological approaches to healing and adaptation* (p.133–160). Mahwah, NJ: Lawrence Erlbaum Associates.
- [27] Xia, P., Li, N., Hau, K., Liu, C., and Lu, Y. (2012). Quality of life of Chinese urban community residents: a psychometric study of the mainland Chinese version of the WHOQOL-BREF. *BMC Medical Research Methodology*, 1237.

AUTHORS

First Author – Kavitha Padmanabhan

Digital Transformations in Central Asia: Internet Stimulus on Trade

Fazal Ahmad Afzali

Social Development and Research Organization
Department of Economics, Merwais Neka Institute of Higher Education

DOI: 10.29322/IJSRP.12.10.2022.p13052
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13052>

Paper Received Date: 13th September 2022
Paper Acceptance Date: 14th October 2022
Paper Publication Date: 21st October 2022

Abstract- The main objective of this paper is to realize that how Internet affects the overall trade in Central Asia. It further discuss the effects of internet on production, unemployment, and industry. This research work perceives a quantitative panel data analysis method via secondary data for Central Asian countries because the assigned topic is studied in multiple countries for the period of 19 years (2000-2019). There is a special focus on discovering the relationship of internet with trade in Central Asia. We discovered that Internet has strong positive relationship with overall trade, industry, and production but a negative relationship with unemployment. To make it more clear, the results of this research work show that internet can increase trade, improve industry, and production but reduce the unemployment by great margin.

Index Terms- Trade, Unemployment, Industry, and Production

I. INTRODUCTION

Central Asia Profile:

Central Asia is known as a single region, comprises of five culturally and ethnically miscellaneous countries and have a conjoint geography, historical legacy and common security concerns and interests that tracked both political and economic transformation alleyways in the past twenty five years since their independence from Soviet Union. Kazakhstan and Kyrgyzstan have made steps in market reforms in relative terms, while Turkmenistan and Uzbekistan still have not accomplished their conversions to a market economy and Tajikistan symbolizes an in-between circumstance so far. In many regards, the historic legacy of the 20th century and their sole topographical and geopolitical position have not assisted Central Asian countries in their exertions on the way to economic development and integration. The central Asian countries experienced more than decade of growth while still facing with collective challenges resulted from decreasing trade and lower remittances (Marek 2017).

The deficiency of economic compatibility and complementarity among the states created a push and full consequences that not only can accommodated labor migrants but also poverty, unemployment, security, health, and political softness. This nurtured competition instead, while each state observing at its capitals as independent and at its neighbors as opponents rather than partners in international marketplaces. Thus, economic relations and economic associations with countries outdoor the region are prioritized, leading to high trade dependency outside and small force intra-regional trade among the Central Asian countries that slowed down by policies of border controls, tariffs and regulations (Shahrbanou 2012).

The first internet service was launched in 1990 in Central Asia such that it became known to the people and only a few small companies had provided the internet services but now some famous communication monopolies provide the internet. Web resources are still in both Russian and English languages but now it is changing into local languages such as Kazakh, Kyrgyz, Tajik, and Uzbek. The people understood that internet could bring changes and play important role in their social lives. It has supported students, teachers, state authorities, administrations and employees in many ways especially in getting actual information. At first, internet was used in day-to-

day life as a source of information, and a means for communications. The internet was just used to create relationships and gain new experiences (Aitymov 2012).

Problem Statement:

Internet is a potent facilitator for innovation, economic development and social well-being and is the mainstay of the digital economy. Internet enabled people to look after more things online such as opening a business, generating new services or revolutionizing the provision of existing ones, voicing views, raising wealth, distributing knowledge and thoughts, doing research, interacting and improving skills. Limiting the use of internet will affect the benefits and innovation that pushes social, economic and cultural development. People can benefit from internet capacity to assist inventions, entrepreneurship, and international trade. Internet as a global interconnected nature which conveys effective and flexible strategies and observes for digital economy (OECD 2016). The internet provides numerous benefits globally for the people who have access to it. For example, sharing and collecting information, checking news, searching jobs, make advertisements, communicating, entertaining, getting online educations, buying or selling products, or other online services provided by the internet globally (Essect 2015).

The Central Asian countries experienced internet usage in the past 20 years and a lot of people understand that internet played an important role in their social lives, particularly for organizations, NGOs, teachers, students, and employees. It is worth mentioned that government authorities, and state administrations also benefited from internet especially for collecting information and sharing with others. Young generation use internet for making relationships and gaining new experiences. The impacts of internet on economy are not very obvious in Central Asia because it is just mentioned that economies are growing vastly due internet access (Nazarkulova 2019). There is limited research on the overall impacts of internet on many aspects and perspective of Central Asia.

Internet brought improvements in education of Central Asia but not as much as needed. There are arguments that internet improved learning via great amount of information and resources available in internet, smooth classroom environment, and created good relationships between students and teachers. There are also claims that internet poses problem rather than improving education in Central Asia. Sabine Henning discovered that internet supported learning in providing numerous resources of information, flexible classrooms, and good contact between teachers and students but claimed that lack of English language skills and lack of teachers' skills in web apps are the key problems in education (Sabine 2019). More than half of the population of Central Asia has access to internet but still very limited impacts on education and on other aspects are not well enough. According to Statista online website for statistics, shows that 43.85 million users have access to internet and the overall population is only 75.4 million of Central Asia. One can argue that there is a need for quality research to be conducted on the overall impacts of internet on general aspects of Central Asia (Statista 2021).

There is extensive research on the effects of internet on FDI conducted in many countries and discovered a positive relations between internet and FDI. For example, Amany Fakher discovered in his research that internet has positive relationship with FDI inflow in Egypt and claimed that the more the users in the country, the more FDI inflow to that country (Amany Fakher 2016). However, there is no such research on the effects of internet of FDI inflow conducted in Central Asia.

The impacts of internet are very obvious in many countries and especially in developing countries. There are plenty of research conducted on the internet effects on many aspects in these countries. For instance, Behzad Salmani discovered in his research in Iran that Internet has significant impacts on trade and got a positive relationship in between (Behzad 2013). One can argue that the effects of internet on trade could be different from country to country or different between rich and poor countries. In this regard, Caroline Freund found a different inferences in her study which found that the effects of internet are stronger in poor countries comparing to rich countries (Freund 2000). However, the question is what are the impacts of internet on trade in Central Asian countries? There is no good answer for this question because this issue is not researched or studied in Central Asia and that is why there is a need for such study to find out the relationship of internet with trade and also what kind of relationship exists, strong, weak, or even no relationship. Internet access in Central Asia has been a big change but why researchers are so silent about its impacts.

Many researchers believe that internet provide more new opportunities for unemployed people and is a good tool for job searching and job matching. There are arguments that internet created more jobs for people who want to work from home. However, this might not be true in each country. Many people also argue that internet replace traditional jobs and many people become unemployed because internet replaced people with machines. For instance, before the internet, a company could hire 100 employees but accessing to internet, they would reduce the number of employee. There are different arguments in this regard. Lorenzo Pupillo discovered that internet produced

many new jobs but also claimed that a large number of job have been destroyed in the transition process. Moreover, lessons suggested that routinization, job market divergence and new labor market disparities have appeared in recent years (Pupillo 2018). But still, we do not know how internet affected the employment in Central Asian countries either positive or negative. There is a big gap due to very less number of studies on the assigned issue.

In addition to those, industry is also the hot topic for many researchers to discover that how internet affects the overall industry in the world. There are similar agreements and arguments that industry is positively affected by the internet meaning that increasing internet will increase industry in same geography. Enough reasons and claims are presented in this regards. For instance, innovation, easiness, communication, reduces transaction cost, and information are conducted due to the existence of internet. Sendil Ethiraj found out in his research study conducted in New Zealand that the new technology, especially internet generated new entrepreneurship opportunities by converting the “value chain, disintermediation, reintermediation, and reconfiguration”. Thus, one can argue that internet provides more information, give hints in creating new ideas, and brings innovation which as a result increase industry in the world (Ethiraj 2013). The researchers and writers are silent on this issue to cover it in Central Asia and yet it is not clear that how internet affected or affects the industry in central Asia. Maybe the inferences of internet on industry will be different in Central Asia comparing to other countries and one reason could be traditional way of doing business and traditional interest in product design.

The problem is that many researchers, state policy applicators, and business companies do not feel that internet could affect the trade, education, employment, industry and production at great percentage which maybe they are right or not. However, people do understand that internet is their first choice for communication. Many new businesses still do not invest money in digital technology because they do not feel their impacts on many aspects, especially on trade. If one can argue that digital technology especially internet can have good impact in other Asian countries, why not in Central Asia. But we should say that if something has impacts in one country, does not mean to have the same impact in Central Asia.

The internet offered new models for buyers and sellers, and provided customer service in new ways. Significant changes took place, for instance new methods of production, distribution, and search, advertising and new markets for the trade. Countries who adopted to such changes received greater impacts on international trade comparing to those who did not adopted to those changes. Reliable evidence showed that internet has affected investment and education in Central Asia but a research has not been conducted on the internet effects on international trade yet.

Internet has been a huge change in Central Asia in the past 20 years and its impacts should be wide and wise. Some people may understand that internet provided many benefits for them in many aspects but this might be true only in practice, not in theory. In order to know that internet could have great benefits for business, trade, education, industry, and production, an extensive and quality research is needed which will make a roadmap for policy applicators to know the benefits of internet an invest more in digital technology.

Purpose of the Study:

The main objective of this research study is to explore the effects of internet on trade through empirically and non- empirically analysis. To acknowledge that how internet mainly affects the trade, education, industry, employment, and production in Central Asia. Besides, how existed internet and technology dealt and managed with trade in Central Asia. Furthermore, where it provides specific benefits and find out the specific inferences to trade in Central Asian countries.

Hypothesis and Research Objectives:

H₀: Internet does not affect trade, industry, employment, and production in Central Asian countries

H₁: Internet does affect trade, education, industry, employment, and production in Central Asian countries

Research Questions:

1. How internet relates with trade in Central Asia?
2. What are the significances of internet for trade in Central Asia?
3. How internet comeback to trade in Central Asia
4. What are the specific benefits of internet for many other aspects?

State of Art:

Before touching the main topic and it is very important to know that what has been studied, who studied it and where it has been studied. There are many researches and studies about the effects of internet on many aspects in different countries of the world. However, their effects in different countries are very different and some countries even did not feel such effects. In this regards, a number of research papers on this are summarized here for the purpose of knowing the different, strong and weak impacts of internet on trade, unemployment, industry, and production which will lead us to focus on key variable that they would also covered in this research in Central Asia.

In 2011, Seyed Reza Miraskari researched on the effects of internet on trade inflows in developing countries via panel data analysis for period of 2001-2008 and discovered very meaningful inferences regarding this issue. He argued that internet has positive relationship with trade inflow and the relation significant at 5% level. He added that internet provided great support to trade in these developing countries. If the number of internet users is increasing, the trade is also increasing. Consequences of this research, hypothetically and empirically, show that Internet is effective, and is inspiration to policy makers for formulating basis and setups of Internet, because, it could upsurge export and society wellbeing (Miraskari 2004). One can argue that internet can speed transaction process, make ease border management, and helps in finding more buyers and sellers.

In 2002, James J. Choi conducted an empirical study on the title of: How Does the Internet Affect Trading? Evidence from Investor Behavior in 401(k) Plans. The data was 401 k plans from a number of online firms which is a retirement saving in the United States. The researcher came up w a different understanding. The results of his research says that internet had less impacts on trading and claim that there is no connection in between. The results of this research is different comparing to other research inferences because many researches showed that trade has a significant relationship with trade in many countries (J Choi 2002). Now we can argue the effects on internet on trading are not the same in every country and there is a need that each country should research this issue regarding their country.

Next, it is important to find out that how internet affect the business environment in other countries. In 2014, Elena-Iulia conducted research study on the effects of internet on business environment in developing countries and came up with acceptable inferences. She discovered that internet provided great opportunities and challenges for new and old businesses and had direct relationships with them. It is added that a few intermediaries emerged and achieved competitive advantage and good income but some replaced due to the existence of internet. Internet also developed good consumer behavior, relationships, and created loyalty. Besides, new markets, products, and new competitors emerged. Via the Internet, the associations can shape or develop competitive advantage, an advantage that should be based on real realities, that is different from entrants offer and also is important to impending customers. The Internet is efficient that offers status to a business, increase brand visibility and upsurge the confidence of possible customers in the company's offer. Recent research studies showed that the lack of online existence persuade clients the feeling that they are dealing with a small and poor company. An up-to-date business, regardless of size, is without an online presence either a limited business only, with no applied application at distance, either a simple implemented business, without much outlook in time and space (Lulia 2014).

Besides those, it is very vital to know about the relationship of internet with international trade. This might be true that impacts are different in different countries but one has to make it clear that there is a relationship or not between the internet and international trade. In this regard, Caroline Freund conducted a research study on the effects of internet on international trade in 2000, using panel data analysis for the period of 1995 -1999 in 56 countries. The results discovered in this research are very different from other research studies. It is found out that the effects of internet on international trade are different in each year. For example, in 1997, there is no evidence that internet would have effect on trade but there are effects in 1998 and 1999 (Freund 2000). One can draw conclusion that the effects of internet in each country and in different years are various. Thus we need a research about this topic in Central Asia as well.

In fact internet has got impacts on trade in many countries and in different years but there are countries who do not have evidence to proof that internet has impacts on trading. In order to fully understand that internet has also impacts on other aspects such as FDI and investment. In this regards, Tim Hockey summed a conclusions from a conference held on the impacts of internet on investing and investors which the results are very acceptable. Technology basically changes the investors' relationship with money and had great impact on how to spend and manage money and technology is merged into financial lives of many investors. It is added that technology provides controlling, certainty, and reliability which simplifies financial management for nearly half of the investors. They discovered that investors appreciated and wished technology in their lives forever because it made possible some of their favorite activities and made their lives easier as well. Investors are excited to try more new technology and wished that internet could manage their finances on the smartphone the same as online shopping (Hockey 2011).

More to the point, internet has got impacts on manufacturing as well and has a positive relationship in between. Stefan Boinec conducted research on the impacts of internet on manufacturing trade in OECD countries in 2009 and discovered same positive results. The empirical inferences suggested that internet encourages manufacturing exports such that the number of internet users is found to be significant in the importing countries. The sum of Internet users' increases information on the accessibility of manufacturing trade, decreases trade costs, improves competition, and inspires industrial exports. The upsurge in the number of Internet users has also alleviated the effect of space on manufacturing exports. The number of Internet users as an influence of industrial export development provides provision for a more thorough role of computer information systems in global manufacturing trade activities (Stefan 2009).

Dusko Tomic also researched the benefits and challenges with implementation of internet of things in manufacturing industry following all IBM employees in his survey and came up with same results. He discovered that internet of things increased the output and productivity of the companies while making the equipment smarter and interconnected by internet. A more responsive manufacture process will be shaped and a much deeper vision into plant data will be conceivable. Equipment effectiveness will increase which will directly decline the preservation costs. However, firms are still in the process of assessing these benefits and are examining the execution challenges their organizations might face which include, cyber-attacks, cultural conflict to technological changes and infrastructural issues (Tomic 2017). Now it is clear that internet has also impacts on production and productivity as well.

R Anita also conducted research study on effect of internet of things on manufacturing process and discovered same results. She found that internet of things supports in motivating operational productivity and success and also supports to enhance performance and productivities across your industrial devices, manufacture lines, and plant as a whole. She also added that using technologies will monitor and enhance equipment performance, without disrupting plant operation and function at peak effectiveness by drawing visions from data generated by connected equipment. It is also addressed that internet of things enhance effectiveness, improves processes, reduce waste in firms. Internet of things could help to serve better your customers, decrease fuel consumption, reduce maintenance costs, and improve customer experience (Anita 2017). So far we found that internet could impact on production in many countries the same but it is also important to find out these impacts in Central Asia.

Akinade Akindele on the other hand researched on the effects of internet technology on employment towards jobless society. He discovered that internet technology is a special cure for unemployment via reordering job landscape, upsurges productivity, enhance quality of life, promotes prosperity and investment in a country such that training and capacity buildings are vital by individuals. It is also addressed that internet technology cannot eradicate the demand for human skills in firms or organizations and no technology can completely replace humans. The rationale behind this is that with internet access, productivity, prosperity, and more investments are encouraged into countries and thus more new jobs are created (Akindele 2020). One can argue that internet technology can have a positive relationship with employment because increasing in internet access will increase employment but this might not be true in each country because there are plenty of research which showed that employment is decreased due to replacements in firms they have got access to internet or use internet in their plants. So each can country may feel different on the impacts of internet on employment, thus a research is much needed in Central Asia.

Research Gap:

Regarding this short literature review and the author best understanding of the Central Asia situation, there are notable research gaps in the study of impacts on internet on trade. The very first gap of this research is that this type of study work is less done and at the very best effort of author, he was not able to find such studies in Central Asian countries and hence it is a need to research and find a solution to this problem. Besides, many researchers conducted only time series analysis for very short periods of time which did not meet the requirement of time series analysis that is why this paper will use panel data analysis. Thus the inferences of panel data analysis will be different and accurate compared to time series analysis. Furthermore, many researchers found different relationships and results that some of them claimed that internet has positive relationship with trade, education, employment, production, industry, and investment but only few mentioned that internet has no effects on some of them . So this paper will find the correct relationship between internet and trade which will be positive. Finally, it is complicated problem that it must be researched, find a solution, and assign the appropriate polices implications.

Research Methodology:

In this research paper, a quantitative analysis method is applied which perceives the secondary data via panel data analysis for Central Asian countries because the assigned the topic is studied in multiple countries for the period of 19 years (2000-2019). To make it clear,

in quantitative method, a numerical data is collected for algebraic analysis that includes descriptive and analytical analysis. In qualitative method, non-numerical data is collected that would include idea, concepts and arguments to support the numerical analysis. There is a special focus on discovering the relationship of internet with trade in Central Asia. Besides, the relationships between internet with foreign direct investment, industry, production, and employment are added as control variables. In order to explore this relationship, a time series analysis for the period of 19 years is focused.

It is worth mentioned that panel data analysis contains “i” that stands for identity such as country and individuals and “t” for time period such that these make panel data analysis different from time series analysis. On the other hand, time series includes only “t” for time periods in the featured model and not “i” because there exists only one country or individual.

Quantitative Method: the data for the assigned variables such as internet, trade, FDI, production, industry, and employment are taken from World Bank Data bank. The dependent variable is internet and the independent variables are trade, FDI, production, industry, and employment.

Multiple Regression Model (Panel Data Analysis):

This study work follows a multiple regression model for studying the relationship of a single dependent variable with multiple independent variables. First, this model expresses the relationship of internet with final trade through multiple regression model. Second, additional control variables are added such as FDI, production, industry, and employment for discovering the best inferences.

$$\text{Plain Form: } Y_j = \beta_0 + \beta_1 X_{1j} + \beta_2 X_{2j} + \dots + \beta_n X_{nj} + e \dots\dots\dots 2$$

$$\text{Featured Form: } \text{Internet}_{it} = \beta_0 + \beta_1(\text{Trade})_{it} + \beta_3(\text{Prod})_{it} + \beta_4(\text{Indus})_{it} + \beta_5(\text{Emp})_{it} + \mu_i + U_{it} \dots\dots 3$$

i : 1, 2,, N (5)
 t : 1, 2,, T (19)

Where

β_0 : The intercept or constant amount

β_1 - β_4 : The coefficients of the assigned regressors

Internet: Internet users are individuals who have used the Internet (from any location) in the last 3 months. The Internet can be used via a computer, mobile phone, personal digital (World Bank)

Trade: Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product (World Bank).

Prod: Manufacturing refers to industries belonging to ISIC divisions 15-37. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Note: For VAB countries, gross value added at factor cost is used as the denominator (World Bank).

Indus: Industry corresponds to ISIC divisions 10-45 and includes manufacturing (ISIC divisions 15-37). It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Note: For VAB countries, gross value added at factor cost is used as the denominator (World Bank).

Emp: Unemployment refers to the share of the labor force that is without work but available for and seeking employment (World Bank).

U_t is the country specific error in the model.
 μ_i : The unobserved effect error

Assigned Hypothesis

$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$
 H_1 : at least one $\beta_i \neq 0$

Diagnostics and Estimation Analysis

The main objective of diagnostics tests is to find out the miss-specification in the regression model which creates severe adversative effects on the properties of both estimators and tests that have implications on the predictions. The complications that come from miss-specification are Multicollinearity, specification error, autocorrelation, heteroskedasticity, unit root, and Cointegration. The rationale behind using these tests is to make ensure that the model is valid for this linear regression model with acceptable inferences for the estimates of the coefficients (Linda 1996).

Summary Statistics:

It is an over-all summarization of the data such as mean, median, and variability which is the first impression for a researcher to figure out the data used in a research paper. It is a descriptive statistics that show all the data for each variable is clearly summarized. It gives the writer and the readers a good understanding of the data used in a research paper such as the mean of a specific variable and its variability.

Multicollinearity:

Correlation matrix test is always used to find out the connection among variables such that there is always a relationship between variables but depends how much. Correlation produces the problem of Multicollinearity which in this case the results of a regression are not biased but of course ineffective. If a variable has a correlation close to 1; there is a high correlation and needs to be removed. On the other hand, sometimes the coefficients of independent variable go opposite as they are not expected which this is also a sign of collinearity. In this paper, VIF test is used for this purpose (German 2010).

Heteroskedasticity:

Heteroskedasticity can be well-defined that the variances of error terms are not continuous and it is actually the violation of homoscedasticity which is the key assumption of the Classical linear regression model (CLRM). Heteroskedasticity will not result in biased parameter estimates, however, OLS estimates will no longer be best linear unbiased estimator (BLUE). There are several ways to notice heteroscedasticity such as graphical method, Park Test, Breusch-Pagan and Cook-Weisberg but for curative it is important to use the robust standard error method (Williams 2018).

Unit Root Test:

Mostly, researchers face the problem of stationary and non-stationary which create a series of problems in the analysis. A stationary process is one which statistical properties do not alter over time and mean and the variance of a "stochastic" practice is not determined by t and hence they are constant. The first condition merely declares that the estimated value of the time series should be constant and fixed. If the data is non-stationary, then there is a serious problem in the regression system. One of the possible problems is that R-squares and t-ratios incline to be overestimated and OLS regressions are likely to create incorrect inferences and justifications (Lyocsa 2009). Although, there are several ways to test the stationary and non-stationary data but IM Perasa Shin (IPS) is commonly used (Aminu 2013). In case, there exists non-stationary variables, they can be stationarized by using first difference method.

Ordinary Least square Estimation (OLS):

The initial method used for estimation in this paper is ordinary least squared estimation (OLS). The least squared is a classical estimation method broadly used in “geophysical” data study, developed by Gauss (1795), Legendre (1805) and Adrain (1808) which was issued in the initial era of 19th century. Simple ordinary least square estimation is the first method to find out about unknown parameters. In this method, it is important to see how your applied model looks like, are independent variables significant, is there any biases and inconsistency and are all variables exogenous. Besides, what are the signs of the coefficients of independent variables, are the signs match which were expected, is there endogeneity problem, is there a serial correlation and is there Multicollinearity problem (Agnew 2008).

Fixed effect estimation model:

This paper tends to use panel data econometric analysis method which will probably have an individual effect error problem. Individual effect error problem exists when the individual error term is correlated with one of the explanatory variables and hence creates endogeneity problem in the regression model which the results of regression model will be biased and the coefficients will be inconsistent. In order to remove individual effect error problem, the fixed effect estimation model is used. In other words, in fixed effect model, Allison states that when we use a panel data which means the similar topics measured at two or more points in time, some “characteristics that do not change across time whether they are measured or not such as sex, race, and ethnicity” and we get a problem that we can control by panel data. The fixed effect model controls the time changing variables but does not control for time in-varying variables and hence we should be no longer worried about the effects of those omitted time unchanging variables that go to the error term and affect one of the explanatory variables.

Summary:

Overall, this chapter highlighted the basic description of the model, methodology, diagnostic, and estimation tests. The assigned variables and data are explained deeply for the purpose of understanding its importance and inclusion in the model.

Findings

Introduction:

This chapter proceeds with a short summary of the sample and provides statistical explanation for understanding the data regularities. Furthermore, various diagnostic tests apply such as model specification, autocorrelation, heteroskedasticity, and unit root,. In order to find the regression results, simple ordinary least square estimation (OLS), fixed effects and random effect estimation tests are applied. Hausman test is used to choose between fixed effect and random effect estimation models.

Table 1: Summary

Variable	Obs	Mean	Std.Dev	Min	Max
Internet Access	90	16.33379	18.59135	.0485996	76.42675
Trade of GDP	90	85.47221	31.50643	29.74841	175.3512
Industry	90	31.65108	11.2	16.6823	66.57986
Manufacture	90	14.03732	3.828968	7.617665	20.45652
Unemployment	90	7.6236	2.833801	3.74	14.96

Source: Stata Worked out

The mean is the best measure of central tendency but still, there is no good or bad mean because it just shows the central point in the data set. However, very large and small numbers exaggerate the mean in the data set. The means of all variables are clearly placed in

table 1. The most important point in summary statistic is the standard deviation which the lowest is the best and the highest is the worst because the lowest states the data points are close to the means and the highest states that the data points are spread out from the means but still a researcher should not decide based on standard deviation only. In this summary, unemployment has the lowest standard deviation which is good but trade has the highest which not good but also not bad. Also, trade of GDP has the highest mean but manufacture has the lowest mean. Besides that, minimum and maximum also show the spread out of the data through their ranges. In this summary, internet access has the lowest minimum and trade has the highest minimum and similarly, Trade has the highest maximum but unemployment has the lowest maximum. The main objective of this summary is the see how spread the data is from the mean and also how the data misleads the overall findings. From this summary, we understand that the data set has some very big and small numbers but still we cannot imagine that it would definitely give us misleading inferences. We have more options to find out that how the data would give us either good or unacceptable results.

VIF Test:

The VIF points out that how much the projected variance of a variable coefficient is overstated in case R-Squared equals zero which is defined as $1/(1-R_2)$. Besides, it indicates the influence of Multicollinearity on the variance of a variable coefficient in linearity of other predictors. The range of numbers that indicates the degree of Multicollinearity is (1-10) which greater than “10” indicates high Multicollinearity problem in the model. Furthermore, the tolerance is defined as $1/VIF$ which detects the level of Multicollinearity such that 0.1 is similar to 10 of VIF (Robert 2007).

Table 2: VIF Test

VIF Test		
Variable	VIF	1/VIF
Trade	1.31	.744066
Unemployment	1.79	.557766
Industry	2.18	.459041
Manufacture	1.79	.557766

Source: Stata Worked Out

Following table 2, there are correlations between the variables either small or acceptable big but there are no such correlations that a variable should be removed such that it would take collinearity in the model. We should always be worried about the biggest number because they create collinearity in the model. For instance, the biggest 1/vif results is 0.74 for trade of GDP which is less than one and there is no fear of high Multicollinearity in the model. So this does not mean to remove any variable from the model.

Heteroskedasticity Test:

Heteroskedasticity as defined that the variances of error terms are not constant and it is actually the violation of homoscedasticity which is the key assumption of the Classical linear regression model (CLRM). Heteroskedasticity will not result in biased parameter estimates, however, OLS estimates will be no longer best linear unbiased estimator (BLUE). There are several ways to detect heteroskedasticity such as graphical method, Park Test, Breusch-Pagan and Cook-Weisberg but for remedial it is important to use the Method of Weighted Least Squares.¹ In this research paper, Cook-Weisberg test is used. The hypothesis is H_0 : there is not

heteroskedasticiy in the model and H_1 : there is heteroskedasticiy in the model. Decision rule is when the p-value is less than significance level (5%), reject but if it is greater than significance level, do not reject it.

Table 3: Heteroskedasticiy

Breusch-Pagan / Cook-Weisberg test for Heteroskedasticiy	
Ho:	Constant variance
chi2(1)	= 45.410
Prob>chi2	0.10

According the table 3, result showed that there is no heteroskedasticiy in the model because the p-value is greater than significance level (5%). So there is no the problem of heteroskedasticiy.

Unit root Test:

Furthermore, it is very vital to find out the stationary of time series which means that the means and variances of variables are constant and non-stationary when the means and variances are not constant. If a variable or variables are non-stationary, then there is a serious problem in the regression systems because it will lead to a spurious regression in case they are not cointegrated. One of the possible problems is that R-squares and t-ratios incline to be overestimated and standard OLS regressions are likely to create incorrect inferences, and justifications. In order to find out stationary and non-stationary, we need to use IM Perasa Shin (IPS) test. Regarding this test, the null and alternative hypotheses are H_0 : non-stationary (unit root), H_1 : Stationary (no unit root). The basic decision rule is when the value of t-statistics is greater than critical value or when the p-value is less than the significance level (5%), we reject the null hypothesis and can draw the conclusion that data is stationary and do not have unit roots.

Table 4: Im-Pesaran-Shin unit-root test in levels and first difference

Variables	T- Statistic	P-value
Internet Access	-2.9587	0.0002
Trade	-2.9587	0.000
Industry	-2.012	0.0004
Unemployment	-1.8405	0.0045
Manufacture	0.7100	0.014

Regarding table 4 and the p-value approach, we do reject the null hypotheses for Internet Access, Trade, Industry, Unemployment, and Manufacture because p-values are less than alpha. Finally, it is concluded that all the variables are stationary and there is no unit root mostly in levels.

Fixed Effect and Random Effect Estimations Results:

The purpose of using fixed effect estimation in this paper is to remove the individual fixed effects (error) from the model which created endogeneity problem because individual effect error correlates with one of the explanatory variables and hence endogeneity takes place. Using fixed effect estimation ensures a researcher to be no longer worried about unknown omitted variable bias. Fixed effect model controls and even removes the effects of time-invariant variables such as gender, sex, and color but it could be a disadvantage if the model includes time-invariant variables. Fortunately, this data set does not have time-invariant variables.

This paper also used random effect estimation test for the purpose of having unbiased, consistent and efficient estimation results. It is clear that under the random effects assumptions, explanatory variables are exogenous so that simple OLS provides consistent estimates but errors are correlated over time for given t and there might be serial correlation which will be removed by using random effect estimation.

Table 5: Fixed and Random Effect Estimation Results						
R-Squared:						
Within: 0.3320						
Between: 0.2022						
Overall: 0.0197						
Variables	Fixed Effect			Random effect		
Internet Access	Coef.	Std. Err	P>/Z/	Coef.	Std. Err	P>/Z/
Trade	.0346993	.0165805	0.040	.0211326	.0152318	0.165
Manufacture	.1754649	.1200304	0.014	-.0284547	.1318588	0.829
Unemployment	-.775949	.1695493	0.000	-1.040105	.2270717	0.000
Industry	.0108301	.0551938	0.08	-.062813	.0454658	0.167

Applying fixed effect and random effect models results completely changed compared to OLS results because individual fixed effects are removed and hence no endogeneity exists. At the same time, results from fixed effect and random effect also differ in economic and statistical significance levels. Following the comparison results in table, the fixed effect provided logical and rationale results compared to random effects but one should not decide without using Hausman test for assurance to take correct decisions. The results after the correct choice of estimation such as fixed effect or random models are deeply discussed in discussion section after Hausman test.

Hausman Test:

Hausman test is used to find out the correct estimation model between fixed and random. In Hausman test, the null hypothesis is that random effect is appropriate and the alternative hypothesis is that fixed effect estimator is appropriate. So if we reject the null hypothesis by Hausman test, we should use fixed effect estimation but if we do not reject the null hypothesis, we will use random effect estimation.

Table 6: Hausman Test

Coefficients			
Variables	(b)	(B)	(b-B)
	Fixed	Random	Difference
Internet Access	.1925359	.1447721	.0477638
Trade	.0346993	.0211326	.0135667
Unemployment	-.775949	-1.040105	.2641558
Industry	.0108301	-.062813	.073643
Manufacture	.1754649	-.0284547	.2039195
b = consistent under Ho and Ha; obtained from xtreg			
B = inconsistent under Ha, efficient under Ho; obtained from xtreg			
Test: Ho: difference in coefficients not systematic			
Prob>chi2 = 0.001			

According to table, the Hausman test results showed that the fixed estimation is preferred because the p-value for Chi² is 0.001 which is less than 5% and the null hypothesis says that there is difference in coefficients which are not systematic. So the null hypothesis is rejected in favor of alternative hypothesis and that is why fixed effect estimation model is preferred as the best in this research paper.

Interpretation and Discussion:

1. Trade of GDP

According to the Fixed Effect Estimation, the Trade of GDP as the main dependent variable is significant at 4% significance level and hence it means that a 1% increase in Internet Access, will increase the Trade of GDP by 0.034% which is statistically feasible. They have both positive and direct relationship among each other. This make a good sense because one can argue that internet can improve productivity, export, and border management, reduce costs and speeds the transportation process. In this regard, Sayed Reza discovered similar understanding, added that internet has positive and significant impacts on trade volume both in exporter and importer countries. He claimed that the results from both theoretically and empirically, show that internet is so efficient, and a stimulator to trade because it can increase export and social welfare (Sayed Reza 2011). Besides that, Alberto and Shawn also found out that internet reduced the cost of export among 56 countries in its very short history and hence claimed that internet can boast the trade by a huge margin. It is also added that countries who have both enough internet access, have more trade compared to those countries who have no equal internet access (Alberto 2016). On the other hand, George R discovered a little different inferences. He claims that internet access can only increase trade from rich countries to poor countries and wrote that internet made it easier for fro firms to enter the new markets by reducing communication and research costs. His research findings are different because he addressed that effects of internet on trade are only applicable in developing countries. Regulating internet and communication policies will increase trade more in developing countries by increasing their exports (George R 2004). So the inferences of this research study is similar with Karim, Alberto and George research works and hence one can claim that internet access can increase the trade with a positive and significant correlation in Central Asia.

2. Manufacture

The inference by Fixed Effect also shows that Manufacture is also significant at .014% significance level and there is exists a positive relationship between them because the sign of the coefficient is +. It reads that a 1% increase in Internet Access will result in 0.17% increase Manufacture. A general thought would also suggest that Internet Access could improve the quality of products, reduce cost of products, helps in better designing, using of advanced tech, and improve labor experience. This finding is similar with Chen Yang

research study conducted regarding the effects of internet on manufacturing in 2016. The author discovered that internet improved and increase the degree of manufacturing because the all the manufacturing devices, equipment, processing, communication, data, and many more are powered by the internet. Today, it transformed the manufacturing industry by a lot after the internet application to manufacturing. She added that it is true because internet improved many portions in manufacturing such as architecture, cloud computing, business model, services composition, pervasive environment, energy management, maintenance, critical issues, risk, automation and efficiency, and supply chain management (Chen Yang 2016). More to the point, Hamid Morssi studied the effects of internet on supply chain performance, conducted in 9 companies based in Egypt via doing Simi structured interviews. He discovered that internet increased and improve the flow of supply chain performance in these companies and claimed that this also increases and improves the manufacture overall (Hamid Morssi 2020). Dusko Tomic studied the benefits and challenges of internet in manufacturing conducting a survey and came up with similar findings. It is showed that internet increased output and productivity of the companies because all the equipment are made smarter and interconnected by the internet and made it easy to manufacture. However, some firms are still in the process of measuring these benefits and are examining challenges that their organizations might face which include, cyber-attacks, cultural conflict to technological changes and infrastructural issues (Tomic 2017). Now it is clear that internet has also impacts on production and productivity as well.

3. Unemployment

The unemployment is mostly effected by the internet access but it may depend in different countries. In this research study, Internet Access negatively affects the unemployment which means if one increases, the other decreases. The unemployment is statistically significant at 0.000 significance level and it is feasible too. It states that 1% increase in Internet Access can result in 0.77% decrease in the number. Meaning that if Internet increases, unemployment decreases. A decrease in unemployment also takes place when people who can do online job get more jobs by the increase of internet. So it is different in each labor section. Betsey conducted a quality research on how the internet brought changes in labor markets since the usage of internet raised by a great amount. He found out that internet dramatically changed the labor market to positive outcomes because it made more efficient the job search, awareness and matching the positions, however this change is only for those who use internet not only for job search but also for working by internet. The internet also speeds the hiring process and the employer can easily the right matching candidate for their positions (Betsey 2006). But one can also argue that internet brought more positive changes in manufacturing and economy as a whole that itself creates more jobs and this internet could be the greater determinant of the job flow. Anne Green and her research team conducted a research study on correlation between internet and Job in in 2012 and came up with strong positive arguments. They simply claimed that internet increased jobs and hence reduced the unemployment by a greater level. They found out that technology change is now accounted as an important for changing the occupation structure along with global economy structure which its results are felt in most sectors and professions because it provides the labor market information and played a vital role in job education, training, and job options based on their skills. It is better in speed than traditional of job search. The internet reduced the unemployment because it provided the opportunity for international jobs which was not easily possible in tradition way of search. It also provided the environment for both online and in person jobs which let people get more various job cultures (Anne Green 2012).

4. Industry

The Fixed Effect Estimation shows that Internet Access stimulates the overall industry in a country, meaning that the increase in Internet Access, can increase the overall industry in its quantity. This is significant at 0.08% significance level and statistically feasible. 1% increase in Internet Access can increase the overall industry by 0.010% which is applicable. If one guess that industry is very in its nature and there plenty of industry that would be affected by the internet in many aspects but pricing, costumer behavior, costs, data transfer and many more aspects of industry are impacted the by the internet. In this regard, Sandra Sieber conducted relevant research and discovered that internet affects market structure overall and created comparative advantages for dot com companies. Computer willingness to pay and reducing costs of products, services, transaction, and coordination costs. It also creates new entry possibilities, increase market transparency, and new products and services. The value creation is another good illustration of internet effect on industry. She concluded that internet can effect both the supply and demand sides of the industry (Sandra 2002).

Conclusion and Policy Implications:

This paper studies that the digital transformations in Central Asia, mainly that Internet encourages trade to a better position as well as a few other influencers. This research work perceives a quantitative panel data analysis method via secondary data for Central Asian

countries because the assigned the topic is studied in multiple countries for the period of 19 years (2000-2019). There is a special focus on discovering the relationship of internet with trade in Central Asia. Besides, the relationships between internet with production, industry, and employment are added as control variables. Running Fixed Effect and Random Effects estimation tests in multiple regression, we discovered that Internet has strong positive relationship with overall trade, industry, and production but a negative relationship with unemployment which are true based on original expert theories regarding internet effects. We found that they are statistically significant and are feasible if there takes place an increase in internet access in Central Asia. To make it more clear, the results of this research work show that internet can increase trade, improve industry, and production but reduce the unemployment by great margin. This paper suggest the following policy implication for a better change in trade, industry, unemployment, and production.

Increase internet in trade, production, and industry and train well their users in various sectors will be a must job for Central Asian states to enhance further these sectors. We believe that internet is still an issue in rural areas in these countries. The first important effects of internet in Central Asia are that it increase trade, employment, improve industry and increase production as they were highlighted in this research study inferences. Besides those, internet can bring marketing benefits because it builds trust between the business and the costumers. Internet improves and speeds productivity in many aspects, for example, machines and equipment are run by internet and do not make more mistakes and errors in production and it also speeds the production process compared to traditional one. Internet can be the 24/7 doors of business because nowadays, businesses are run 24/7. Social media any other platforms will be the used for customer support and it is only internet that can provide this facility for the businesses. Remote staffing, outsourcing, online employee training and development, online banking, business growth, costumers relationship, online accounting services, online meeting and assigning tasks are other important benefits of internet. So finally, one can argue that internet can applied in each business sectors and well trained internet users will make a good use of Internet. So finally this research paper suggests that an increase in Internet by Central Asian businesses and administrations will grant them a better trade, reduced unemployment, improved industry, and quality production.

REFERENCES

- [1]: AKINADE AKINDELE, "THE EFFECT OF INTERNET TECHNOLOGY ON EMPLOYMENT TOWARDS A JOBLESS SOCIETY", INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH · JULY 2020: 1-6
- [2]: ALBERTO, SHAWN, "DISAGGREGATING THE IMPACT OF THE INTERNET ON INTERNATIONAL TRADE," WORLD BANK, 2016: 1-19
- [3]: Amany Fakher, "The Impact of Investment in ICT Sector on Foreign Direct Investment: Applied Study on Egypt", Review of Integrative Business and Economics Research, Vol. 5, no. 2, April 2016: 1-15
- [4]: Aminu, Aminu Bashir, "The Determinants of Bank's Profitability in Nigeria" Eastern Mediterranean University January, 2013: 36
- [5]: Anne Green, Maria de Hoyos, and Yuxin Li, "Employment and The Internet," Institute for Employment Research, University of Warwick, 2012:1-15
- [6]: Behzad Salman, "The effect of the Internet on international trade in services: Developing countries' case study", Conference Paper, 2013: 1-9
- [7]: Betsey Stevenson, "The Impact of the Internet on Worker Flows," *The Wharton School, University of Pennsylvania*, 2006: 1-24
- [8]: Caroline Freund and Diana Weinhold, "On the Effect of the Internet on International Trade". International Finance Discussion Papers, 2000: 1-13
- [9]: Chen Yang, Xianbin Wang and Weiming Shen, "Applications of Internet of Things in Manufacturing," The University of Western Ontario and National Research Council of Canada, 2016: 1-8
- [10]: D.C. Agnew, "Chapter 7: Least Squares Estimation" (2008): 1
- [11]: Dr. R.Anita and Bodla. Abhinav, "Internet of Things (IoT)– Its Impact on Manufacturing Process", International Journal of Engineering Technology Science and Research 2017: 1-7

- [12]: Dusko Tomic, "The Benefits and Challenges with Implementation of Internet of Things (IoT) in Manufacturing Industry", STOCKHOLM, SWEDEN 2017: 1-40
- [13]: Elena-Iuli, "The Impact of Internet on Business Environment," *Procedia Economics and Finance*, University of Tîrgu Mures, 2014: 1-8
- [14]: Elena-Iulia Apvloaie, "The impact of the Internet on the business environment", *Procedia Economics and Finance* 15 2014: 1-8
- [15]: Essect, "Advantage and Disadvantages of Internet", *Essect* 2015: 1-12
- [16]: Ezequiel Uriel, "The simple regression model: estimation and properties", University of Valencia, 2013: 21-23,
- [17]: George R. G. Clarke and Scott J. Wallsten, "Has the Internet Increased Trade? Evidence from Industrial and Developing Countries", *World Bank Policy Research Working Paper* 3215, February 2004: 1-20
- [18]: German, "Correlation matrix" *Stata Premir*, 2010: 1-2
- [19]: Hennig, S. and Nazarkulova, A., "Benefits and Challenges of eLearning in Central Asia", *International Journal of Geoinformatics*, 2019: 1-10
- [20]: Hennig, Sabine, "The Benefits and Challenges of ELearning in Central Asia," University of Salzburg, 2021: 1-10
- [21]: James J Choi, David Laibson, Andrew Metrick, "How does the Internet affect trading? Evidence from investor behavior in 401(k) plans," *Journal of Financial Economics*, 2002: 1-15
- [22]: James J. Choi, David Laibson and Andrew Metrick, "How Does the Internet Affect Trading? Evidence from Investor Behavior in 401(k) Plans", *Wharton School* 2002: 1-20
- [23]: Linda F. De Benedictis and David E. A. Giles, "Diagnostic Testing in Econometrics: Variable Addition, RESET, and Fourier Approximations" *Department of Economics, University of Victoria, Victoria, B.C., CANADA*, October 1996: 2-4
- [24]: Lorenzo Pupillo, Eli Noam and Leonard Waverman, "The Internet and Jobs Opportunities and ambiguous trends", *CEPS • Place du Congrès*, 2018: 1-16
- [25]: Ly'ocsa, Eduard Baum'ohl and S'tefan, "stationary of time series and the problem of spurious regression" *Munich Personal RePEc Archive, Faculty of Business Economics in Ko'sice, University of Economics in Bratislava*. 2009: 1-6
- [26]Maha Abdel Hamid Morssi, Hussein Magdy Elhousseiny and Dina Adel Hammad, "The Impact of Internet of Things on Supply Chain Performance," *College of International Transport and Logistics*, 2020: 1-9
- [27]: OECD, "Internet Openness and Innovation", *OECD Ministerial Meeting, Cancun Mexico* 2016: 1-4
- [28]: Robert M. O'Brien, "A Caution Regarding Rules of Thumb for Variance Inflation Factors", *Quality & Quantity* (2007) 41, *Department of Sociology, University of Oregon, Eugene* (2007): 673-690
- [29]: Sandra Sieber, "Impact of the Internet on market structure," *Universidad de Navarra*, 2002: 1-22
- [30]: SENDIL ETHIRAJ and ISIN GULER, "The impact of Internet and electronic technologies on firms and its implications for competitive advantage", *Huntsman Center for Global Competition and Innovation*, 2013: 1-35

- [31]: Seyed Reza Miraskari, Noorollah Salehi Asfiji, Seyed Abdolkarim Siadat and Seyed Ali Mirasgari, “The Effect Of The Internet On Trade Flows”, Economics and Finance Review Vol. 1(6) pp. 100 – 106, August, 2011: 1-7
- [32]: Shahrbanou Tadjbakhsh, “Central Asia and Afghanistan: Insulation on the Silk Road, Between Eurasia and the Heart of Asia”, Peace Research Institute Oslo PRIO, 2017: 1-15
- [33]: Stefan Bojnec, “Impact of the internet on manufacturing trade”, Journal of Computer Information Systems · September 2009: 1-10
- [34]: Statista, Internet access User in Central Asia,” 2020: 1
- [35]: Tim Hockey, “The Tech Effect: How the Digital Age Is Changing Investing”, TD Ameritrade 2015: 1-30
- [36]: Uuriintuya Batsaikhan and Marek Dabrowski, “Central Asia at 25”, Policy Contribution, Issue n°13, 2017: 1-5
- [37]: Williams, Richard, “Heteroskedasticiy” University of Notre Dame, And January 30, 2015: 1-8
- [38]: Zhandos Aitymov, “Internet history and it’s perspectives in central Asia – internet for social and political development: community building”, Karaganda State University, Kazakhstan, 2012: 1-2

ABOUT AUTHOR



Fazal Ahmad Afzali obtained Bachelor Degree in Finance from Afghan American University in 2010 and 2014 respectively and Master of Arts in Economic Governance and Development from OSCE Academy in Bishkek 2017 and 2018 in Kyrgyzstan. He remained as an Assistant Professor in Mirwais Neka Institute of Higher Education in Kandahar Afghanistan since 2014 to 2019. He also added knowledge to research while working for National and International Research Organization (Samuel Hall & IWPS). His preferred expertise are Macro and Microeconomics and Fiscal Policies development.

Email ID: Afzali.fazil@gmail.com, f.afzali@osce-academy.net

The Influence of Interest Rate Fluctuation on Final Consumer Consumption in Central Asia: Empirical Study

Fazal Ahmad Afzali

* Department, Merwais Neka Institute of Higher Education

DOI: 10.29322/IJSRP.12.10.2022.p13053

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13053>

Paper Received Date: 15th September 2022

Paper Acceptance Date: 16th October 2022

Paper Publication Date: 21st October 2022

Abstract: This research study aims to expose an inference of Interest Rate Fluctuation with Final Consumer Consumption in Central Asia and discover how other explanatory factors either stimulate or reduce the Final Consumer Consumption as a whole. This research work absorbed a quantitative analysis through Panel Data Analysis by using a Multiple Regression Model for the period of 22 years (1995-2017). In this study, Final Consumer Consumption is the dependent variable but Interest Rate, Inflation, Gross National Income, and Interest Payment are independent variables. Based on the data type and quality, the appropriate Estimations tests, such as ARDL, Fixed Effect, and Random Effect, were applied for the purpose of exposing the long run relationship between Interest Rate and Final Consumer Consumption. Random Effect test provided suitable inferences that meet the objective of the research work. The results provided that Interest Rate fluctuation as the focused independent variable is significant both economically and statistically that acquired a negative affiliation with Final Consumer Consumption, meaning that if one increases, the other decreases, which we call it a vice versa relationship. The other explanatory variables such as Inflation and GNI are also significant with positive relationships. The inferences suggested that the government of Central Asia is supposed to adopt such policies that would balance the Interest Rate Fluctuation and control Inflation in this region such that it would better of both parties, the state and the people.

Index Terms- Final Private Consumption, Real Interest Rate Fluctuation, Interest Payment, Inflation, and Gross National Income.

1. Introduction

Research Area Profile:

Central Asia is known as a single region that consists five countries such as Kazakhstan, Tajikistan, Turkmenistan, Uzbekistan, and the Kyrgyz Republic. This landlocked region comprises 65 million diverse population both ethnically and linguistically that 5% of overall population in Tajikistan, Kazakhstan, and the Kyrgyz Republic live under poverty line which is 1.90 \$ per day. However, poverty rates in Turkmenistan and Uzbekistan are very high which equal almost 40 percent. The general economy is based on agriculture that largely relies on cereals, cotton, fruits, and vegetables. (USAID 2018). Central Asia is accounted as a stable region but corruption, human rights violations, and ethnic disputes ruined the big images of these countries. This region is the tactical interest of foremost supremacies such as China, and US largely based on the importance of a bridge between Europe and Asia (Natalia 2018). Central Asia experienced different political and economic adaptation footpaths in the last 25 years after receiving independence from the Soviet Union. Namely, Kazakhstan and Kyrgyzstan have made superior steps in market reforms, while Turkmenistan and Uzbekistan have not yet completed their moves to a market economy but Tajikistan characterizes a transitional case. The unique and geographical locations and 20th historical century did not help them toward economic development and integration (Uuriintuya 2017). The Central Asia is faced with current challenges such as insecurity, political and social, and economic reform barriers (Anna 2016).

Problem Statement:

The outcome of interest rates on consumer consumption is the principal concern in macroeconomics that drew the attention of many researchers recently due to its dramatic fluctuations. It is because that the quest of sustainable and fair growths that improve the living standard of people has been one of the developing policies intentions of many nations worldwide, including Central Asia. It is a fact that numerous macroeconomic policies are adopted to the improvement in the prosperity of nations, however still some nations are ousted from such policies due to their weak economic development efforts that Central Asia is a remarkable example.

Consumption is well-defined as the over-all demand for all consumer goods and services in a specific economy stated in monetary terms. Besides, it is known as the spending by families on goods and services and acquisitions of assets among others that financing them requires income or money. The law of John Maynard Keynes states that men are disposed and added that consumption increases when income increases but not as much as income (Hammed 2017). The size of consumption is explained as the result of a decision making process of families over the time construction of the distribution of their income. The total consumption of Kazakhstan in 2016 was 102 billion US dollars, Kyrgyzstan had 8.8 billion, and Tajikistan had 7.2 billion in 2016 (WB 2021).

Regarding the popular opinion, if interest rates increase, consumption decreases that means a significant demand element drops. However, Keynes disbelieved that the interest rate is actually a factor of consumption under normal circumstance, instead he concentrated on current income as the most important factor. Besides, the budget restraint of households is a fair initial point for answering the question of whether interest rates have an influence on consumption such that the budget is financed from current income, assets or credits (Hermann 1996). Economic theory suggested that the influence of real interest rates on consumption rest on the relative extents of the substitution weight and the income weight which the former is the sum that a consumer wins profit from a cut in real interest rate by consuming today rather than saving that results in increase in consumption. The latter is the effect that a cut in real interest rate causes a diminution in consumption because the sum of life time income declines by the drop of returns on saving (Shinobu 2000).

The rapid changes in interest rates of Central Asian countries provides a ground to discover its effects on consumption. The Central Asian countries experienced ups and downs in interest rate and hence it for sure affected the consumption in one or in another way. For example, Kyrgyzstan had 17.8%, 12.6%, and 17.7% interest rates changes in 2016, 2017, and 2018 respectively. Besides, Tajikistan had 17.9%, 23.5%, and 24.6% in 2016, 2017, and 2018 respectively. These changes are positive and negative which these huge changes definitely affect the consumption and other economic components in various ways (WB 2021). Bela Balassa discovered a negative relationship that if interest rises, consumption will decrease which is true for the case of Central Asian countries (Bela 1989). This negative relationship reduces the savings of households which is the first negative effect of rise interest rates.

It has been a past that interest rates fluctuation distorted the economies of the world badly in difference times. The history of interest rate fluctuations in Central Asian countries experienced a number of both positive and negative effects on the economic growth determinants. For instance, it is believed that higher interest rate will encourage consumption and investment. Joshua Aizenman discovered that higher interest rate policy will inspire consumption, saving and investment in 135 countries including Kyrgyzstan, Tajikistan, and Kazakhstan (Aizenman 2017). World Bank Group indicated that higher interest rates in Tajikistan experienced a return on riskier project during 2016 which is another positive effect of interest rate. (World Bank Group 2017). Besides, Olga Croitorov found out that any interest policy affects, inflation, consumption, and investments in one or in another way (Olga 2009). It is also argued that interest affects the prices of goods and services either positive or negative related its moves. For example, Saltanat Kanapiyaevna exposed that the increase of interest rate motivates of real prices of goods and services in Kazakhstan. This means that if interest rate is increased, real prices will decrease which is a negative impact of high interest rate in Kazakhstan (Saltanat 2013).

In addition, IMF released a report which stated that during inflationary period, Kazakhstan Central Bank cut interest rate for the purpose of reducing inflation, liquidity and shocks (IMF 2018). This indicates that the measure of inflation is linked to high or low interest rates. There exists another argument on the effect of interest rate on capital which states that the decrease in interest rate reduces capital adequacy. In this regards, National Bank of Kyrgyzstan published a report which stated that decreasing interest rate tends to reduce the level of capital adequacy ratio in Kyrgyzstan (N. Jenish 2016). Not only those, it is worth mentioned low interest rate may increase the amount of loan and decrease the prices that lead to investment. For example, Hans Holzhacker argued in his research output that reducing interest rate will tend to increase loan that will lead to distort the market prices, and misallocation of financial sources in non-profitable projects in Kyrgyzstan. Besides, this low interest rate will also increase overinvestment which is not that much required in Kyrgyzstan (Hans 2019).

Since, the interest rate either high or low has both positive and negative impacts on many economic factors such as prices, inflation, investment, saving, capital, and financial projects but still the research are silent on its effect on consumption, that is why, it is a motivation to research and work on it. Besides, it important to find out what is the real level interest rate in Central Asia since it is called a big challenge to the whole economic performance. Furthermore, there are remarkable experiences of interest effects on Central Asia economy recently that affect both adversely and positively. As interest rate is a great challenge, it has to be explored to better policy implications.

Objective of the Study:

The main objective of this research work is to find the exact relationship between consumer consumption and interest rate. Besides, there are additions of a few control variables such as inflation, interest payments, tax payment, and gross national incomes. This study uses only panel data analysis for the period of 22 years (1995-2017) because the assigned title cannot be studied by other data analysis in Central Asian countries.

2. Literature Review

In 2015, Syed Mumtaz Ali Kazmi conducted an empirical study on the real private consumption modeling which used a time series analysis for the period of 1971-2012 via ARDL econometric model in Pakistan. The study focused quite enough factors that stimulate private consumption such as unemployment rate, wealth but interest rate as the main determinant. The inference shows that the relationship between private consumption and interest rate is significant and got a negative relationship. But there is always two sides of the coin, one can argue that interest rate may affect the private consumption positively which means if interest rate increases, consumption may increase too. It is true only for investor who invest investing institutions (Syed Mumtaz 2013). Besides, IMF provided a working paper on the determinants of private consumption in China in 2010. This is a qualitative report which provided a theoretical base collections as a result. Among other factors, interest rate fluctuations have greater impacts on private consumption and has an adverse relationship between each other. The interpretation of the result states that if interest rate increases, private consumption decreases which is true in many emerging economies worldwide (Kai Guo 2010).

In addition, Mudit Kapoor and Shamika Ravi researched on the effect of interest rate on consumption in India in 1998. The author used a cross section data namely Indian National Survey and applied a simple ordinary least squared regression estimate. The result is quite impressive in digits which states that an increase of 50 basis points in interest rate leads to an immediate decline of 10 basis points in consumption. The result is clear and accurate because the former theories regarding the relationship of interest rate and consumption claims that interest rate has negative relationship with consumption (Kapoor 2015). On the other hand, Hammed discovered a very unique understanding on the relationship of interest rate and private consumption through a time series analysis for the period of 1981-2013 by using ARDL regression estimate model in Nigeria. Among other control determinants of private consumption, interest rate had no relationship with private consumption which very unique compared to other previous studies (Hammed 2017). One to argue, might claim that there is always a relationship between two economic components in any economic situation. This inference is not true regarding the former conceptual theories of private consumption.

Bryan M. Vengelen also exposed similar inference which agrees the former consumption theories. He researched on the general relationship of long term interest rate and private consumption in 2015 by using consumer expenditure survey with a qualitative analysis. The finding of this research showed that private consumption and long term interest rate have negative relationship which means that if interest decreases, consumption increases (Bryan 2015). Besides, in 2007, the ministry of environment in New Zealand provided a qualitative report on the pressure on consumption in New Zealand which stated that the principal indicators of private consumptions are income, population, and size of family, technology, economic growth, and emerging technology. But this research work is silent about the interest rate which is the main factor of private consumption (ENZ 2007).

Furthermore, Anthony Kofi Osei-Fosu conducted a research on the relationship of interest on house hold deposits with households' consumptions in Ghana in 2014 by using time series analysis for the period of 1970-2009 through ARDL estimation method. The results provided that interest rate is significant in short period rather than long period. This relationship is negative as similar to previous studies conducted on the same issue (Anthony 2014). Bimal Singh also researched on the effects of interest rate on consumption by using a time series analysis for the period of 1979 – 2001 through error correction model (ECM) in Fiji in 2004. Interest rate among other determinants such income and wealth had negative impacts on consumption through adverse relationship. The author argued that if

interest rate is increased, consumption will decrease which this is a *vis versa* relation between interest rate and consumption (Bimal 2004).

On the other hand, Panagiota Tzamouran discovered a very unique inference in a research conducted on the interest impact on household consumption Europe in 2019. The author used a cross sectional analysis which the data is taken from household finance and consumption survey and applied a multiple regression model estimation method. The finding suggests that increasing interest rate has positive impact and positive relationship in some European countries namely in Belgium, Germany, Italia, and Austria. This means that if interest rate increases, consumption will also increase which is straight positive relationship. The author also claimed that in some countries, the relationship is negative such as Spain, Portugal, Cyprus, and Ireland. This inference is much debatable and quite different compared to other studies. The first part of the result is also different compared to former theoretical work on the relevant issue but it is true for those who are investors in investing banks (Panagiota 2019). In contrast, Christiana Osei Bonsu (2017) is silent on interest rate factor of consumption, instead he argued that real exchange rate and economic growth are the main factor of stimulating consumption. The findings suggests that economic growth has positive impacts on consumption which an increase in it will increase the level of consumption (Christiana 2017).

In addition, Charles O. Manasseh conducted a research work on the effects of interest rate and inflation on private consumption in Nigeria in 2018 using time series analysis for the period of 1981-2011 through modified consumer spending model. The finding displayed that inflation and interest rate have significant implications on consumer spending. Both showed that if interest rate and inflation are increased, consumer spending will be decreased as these are *vis versa* relationships with consumer consumption (Charles 2018). On the other hand, Nahanga Verter discovered that a different inference in a research conducted on the determinants of consumer spending in Czech Republic in 2014. The implication showed that only inflation, saving rate, and income have significant impacts on consumer spending by using a time series analysis through Ganger Causality Analysis model (Nahanga 2014). The author most importantly missed the interest rate effects on spending as it is called a vital factor of consumer spending in former theories and conceptual framework.

Besides those, Hermann-Josef Hansen (1996) exposed in an empirical analysis used a time series analysis with quite enough regression estimate methods that central bank interest rates are not the appropriate instruments for stimulating or restraining the private consumption in Germany. However, it is showed that interest rate fluctuations in short term does not have significant impacts on private consumption but there will be effects in long term (Hermann 1996). This inference is quite different and unique when it is claimed that interest rate is not a strong indicator of private consumption because the theories regarding interest rate and consumption indicate that increase in interest rate influences private consumption negatively in all economies. In contrast, Abiodun A. ADEGBOYE discovered completely different understanding in his research conducted on the determinants of private consumption in Nigeria in 2013 by using time series analysis for the period of 1981-2010 through ECM regression model. The finding showed that all factors such as income, FDI, and GDP growth are significant except interest rate (Adedayo 2013). This finding is different compared to other studies because interest rate is found insignificant which might be true in different economies.

Further, Ekaterina also researched on the determinants of Final Consumer Consumption in Asian countries using panel data analysis via multiple regression model in 2018. Among other determinants, interest rate was found significant in relationship with Final Consumer Consumption. The relationship is negative as it is true and similar with existing theories regarding consumption. The inference showed that if interest rate is increased, consumption will be reduced by unknown parameters (Ekaterina 2018). On the other hand, Neelesh Gounder also researched the determinants of consumption and poverty in Fiji in 2012 by using household consumption survey via ordinary least squared estimation model. The inference showed that the allocation of labor and agriculture policies directly influence the consumption and poverty but the author is silent about interest rate effects on consumption and poverty (Neelesh 2012).

Ricardo Barradas conducted research on drivers of financialisation on private consumption in 28 European countries via Panel data analysis for the period of 1995-2015. The author created private consumption equation by including interest rate and other control variables. Besides, a multiple regression and estimation method is used in this research work. The result indicated that labor income comes as the first impression that affect the private consumption with a direct and positive relationship with consumption. Besides, interest rate is also significant and have an adverse relationship with private consumption (Ricardo 2017). The result is similar and in line with previous studies but only labor income is taken as the strong determinant of private consumption which is true based on old theories regarding consumption. Besides, J.Varlamova provided in his research conducted on the macroeconomic and demographic determinants of private consumption in OECD countries through a qualitative analysis in 2015. The results similar with Ricardo which states that among other factors, interest rate has significant impact on private consumption (J.Varlamova 2015).

Dr Adama Combey conducted a research on the impact of interest rate on private consumption in West African Monetary Union using panel data analysis for period of 2006-2014 via mean group, pooled mean group, and dynamic fixed effects in 2016. The result is very debatable because it showed that interest rate is significant and there is no statistical evidence to claim that interest rate either increase or decrease the private consumption in Western African countries. This inference is unique and is not in line with previous studies conducted on the same issue. Besides, this finding is in line with existing theories which say that interest rates do affect the private consumption either positively or negatively (Adama 2016). Thus, one cannot draw a better conclusion from this result.

Research Gap:

The very first gap of this research is that this type of study work is less done and at the very best effort of author, he was not able to find such studies in Central Asian countries and hence it is a need to research and find a solution to this problem. Besides, many researchers conducted only time series analysis for very short periods of time which did not meet the requirement of time series analysis that is why this paper will use panel data analysis. Thus the inferences of panel data analysis will be different and accurate compared to time series analysis. Furthermore, many researchers found different relationships and result that some of them claimed that interest rates have positive relationship with consumption but only few mentioned that they have negative relationship. So this paper will find the correct relationship with a new roadmap. Finally, it is a complicated problem that it must be researched, find a solution, and assign the appropriate policies implications.

3. Methodology

Generally, this research work uses a quantitative method by a assigning a panel data analysis and multiple regression model in Central Asian countries namely, Kazakhstan, Tajikistan, and Kyrgyzstan. This study observes secondary data which the data for dependent variable such as consumption, and independent variables such as interest rate, national income, interest payment, inflation, and tax pay is taken from World Bank for the period of 22 years (1995-2017).

Econometric Model:

This study work follows a multiple regression model for studying the relationship of a single dependent variables with multiple independent variables. First, this model expresses the relationship of interest rate with Final Consumer Consumption through multiple regression model. Second, additional control variables are added such as inflation, national income, interest payment, and tax payment for the discovering the best inferences.

Multiple Regression Model (Panel Data Analysis):

Plain Form: $Y_j = \beta_0 + \beta_1 X_{1j} + \beta_2 X_{2j} + \dots + \beta_n X_{nj} + e$ 2

Featured Form: $\beta_0 + \beta_1(Cons)_{it} + \beta_2(Int\ Rte)_{it} + \beta_3(GNI)_{it} + \beta_4(Inf)_{it} + \beta_5(Int\ Pay)_{it} + \beta_6(TaxPay)_{it} + \mu_i + U_{it}$ 3

i: 1, 2,....., N (8)

t: 1, 2,....., T (22)

Where

β_0 : The intercept or constant amount

β_1 - β_4 : The coefficients of the assigned regressors

Con: it is the sum of household Final Consumer Consumption(Private) and general government consumption.

Int Rte: interest rate is the spread charged by banks on loans minus the interest paid

Inf: inflation is measured via the consumer price index which is the annual percentage change in the cost to the average consumer.

GNI: is the general national income and is the sum of value added by resident producers, plus product tax, and plus net receipts of primary income.

Int Pay: the payments of interest on government loans to both foreign and domestic residents.

Tax Pay: The total payments of taxes by businesses

Assigned Hypothesis:

H0: There exists no significant relationship between

Consumption and interest rate

H1: There exists a significant relationship between Consumption and Interest rate

Or:

H0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$

H1: at least one $\beta_i \neq 0$

Variable Justification and Expected Sign:

Final Consumer Consumption: it is the sum of overall growth of both private and government consumption on a constant local currency (World Bank 2021). It is the dependent variable in this study which other independent variables are tested to show the relationships and effects on it.

Interest rate: It is the spread of the charged interest by banks on loans to private sector consumer minus the interest paid by commercial banks which is different in each country. This is the principal indicator that affect consumption negatively in this study. The expected sign is negative as also discovered in some previous studies. It is believed that interest rate will cause Final Consumer Consumption either to increase or decrease by its changes. The author believes that when interest rate increases, consumption will decrease. The rationale behind this is that consumer will pay more on loans and will hence decrease their income such that they will not be able to buy as much as before.

Inflation: It is a rise in price in general terms but define it, it is measured by consumer price index which is the annual change in cost to average consumer of buying goods and services. The sign is expected to be negative because the increase in inflation will tend to decrease the consumption. It is because that consumer will pay more on high prices of goods and services which will also effect on income and saving. Inflation will also decrease consumer buying power of consumer too.

Interest payments: It is the actual payment on government bonds including both short term and long term loan provided to foreign and domestic residents (World Bank 2021). Consumer who pay more in interest payment will decrease their buying power and affect their income such that they will be unable to buy the same as before the increased interest payment. The expected sign in negative in this research work.

GNI: It is the gross national income which is the sum of overall value added, plus product taxes, and plus primary income (World Bank 2021). The expected sign positive in this research work. It is argued that GNI will tend affect the Final Consumer Consumption positively which means that an increase in GNI will increase the Final Consumer Consumption. It is because GNI will directly affect the income of consumer and will increase Final Consumer Consumption and saving.

Tax payments: It is the payment by businesses on taxes which is the total number of taxes paid by businesses. It is worth mentioned that tax is paid once in a year (World Bank 2021). It should claimed that the more tax paid, the less the consumer be able to buy goods and products because it directly affect the income negatively. If tax pay increases, consumption will decrease and hence the expected sign is negative.

Diagnostics and Estimation

Multicollinearity (VIF):

The very best approach for assessing Multicollinearity problem in a research study is to use the Variance Inflation Factor which the purpose is to show that how much the variance of the coefficient of explanatory variables are bigger in the data. The significant limitation of VIF is that when VIF equals 1, there is not a Multicollinearity problem but if the VIF is bigger than 1, there is a slight Multicollinearity problem. In such situations, a variable should not be removed from the model because the Multicollinearity is that much big that deteriorate the inferences. However, if the VIF of a variable is greater than 5, then the same variable should be removed because the model contains high Multicollinearity problem which misleads the result. (Akinwande 2015).

Stationarity:

As for the condition of Classical Linear Regression Model, it is vital find and check the Stationarity and non-Stationarity of the variables. It is important to note that if a variable's statistical properties such as mean and variance do not alter over time is called Stationarity, if they are changed, is called non-Stationarity. It worth mentioned that a variable should be stationary because non-stationary variable provides spurious regression inferences and besides, R-Squared and T-statistics will be overestimated and misleading (Ly'ocsa 2009).

Autocorrelation:

Autocorrelation is a condition when the observation of one variable is interconnected with another variable in the disturbances such that the inference of OLS is still linear, unbiased, and reliable but inefficient. For this purpose, it is important that a model should have no autocorrelation or in other words, serial correlation. In this regard, this paper practices the Wooldridge test which the decision rule is that the Null hypothesis: H_0 : there is not serial correlation, and H_1 : there is serial correlation. (Damodar 2004).

Heteroskedasticity:

It is best defined that the variances of error terms are not constant that is actually the violation homoscedasticity which is a key assumption of CLRM. The existence of heteroscedasticity will not result in biased parameters, however, OLS estimates will no longer be best linear unbiased estimator (BLUE). Besides that, the standard errors are biased in the existence of heteroskedasticity because they lead to biased T-statistics, Confidence intervals, and the entire hypothesis will not be reliable and valid. So it is important to detect heteroskedasticity. (Williams 2015).

Cointegration:

It is an econometric concept that determines the short run and long run relationship among variables over time series by making rock-solid algebraic and economic base for error correction model. Discovering the Cointegration for the long run relationship is the best part of this test. There are several tests for Cointegration but ARDL or in other words, Autoregressive Distributed Lag is the best and more common among them. (Nkoro2016).

OLS (Ordinary Least Squared):

It is a generalized regression technique which is used to make a single independent variable in one interval measure applied both for single and multi-explanatory variables. It is basically used to indicate the relationship of Y (Dependent) with X (Independent) variables via using a line of best fit in a way to predict Y via X in some degrees. (Hutcheson 2011). Besides that, OLS is the first regression

method to test the unknown parameters of classical linear models (CLRM) through minimizing sum of squared of errors. It is important to mention that result of OLS is consistent when the independent variables are exogenous and there is no Multicollinearity problem but it is optimal when there is not serial correlation and errors are homoscedastic. (Anchoar2002).

Fixed effect estimation model:

This research study practices a panel data analysis that will probably have individual fixed effect error problem. Individual effect problem takes place when the individual error is correlated with one of the explanatory variables such that creates endogeneity problem in the regression model. In such case, the inferences of regression model are biased and the coefficients are inconsistent which such problems must be detected, controlled, and removed from the regression model. Allison stated that using panel data analysis means similar topics measured at two or more points in time which some “characteristics that do not change across time whether they are measured or not such as sex, race and ethnicity” and we get a problem that we can control by panel data. By using Fixed Effect model, we should be no longer worried about the effects of omitted time unchanging variables which go to error and affect one of the independent variables. (Williams 2015).

Random effect Estimation

This paper also uses Random effect model for the purpose of having unbiased, consistent and efficient estimation results. It is clear that under the random effects assumptions explanatory variables are exogenous so that pooled OLS provides consistent estimates but if simple ordinary least square estimation is used, standard errors have to be adjusted for the fact that errors are correlated over time for given i . Since there might be serial correlation, OLS is not efficient. On the other hand, using random effect estimation will benefit the results by estimating time in-variant variables which do not work in fixed effect estimation model. Generalized least square estimation is used in random effect model. According to the econometric guide, random effect model undertakes that the individual-specific effect is a random variable which is not correlated with the independent variables of all previous, present and future time periods of the similar individual. Random effect model also accepts continuous variance of the individual specific effect and adopts that the explanatory variables with a continuous variable are not completely collinear (Schmidheiny 2016).

4. Regression Findings

VIF Test:

The VIF test is used to detect the problem of Multicollinearity in the model that shows how much the variance of the coefficient of explanatory variables are bigger in the data. In the existence of Multicollinearity, a variable should be removed from the model because the Multicollinearity deteriorates and misleads the inferences.

Variables	VIF	1/VIF
Int Rate	4.30	0.2325581
GNI	3.20	0.3125
Tax Pay	2.80	0.357142
Int Pay	2.50	0.4
Inf	1.06	0.943396

Following table #1, it is shown that there is not the problem of Multicollinearity in the model because the applied provided that all VIF values are lesser than the limits which is 5. This means that this model does not suffer from the problem of Multicollinearity

because the highest collinearity is shown by interest rate which is 4.30. Hence, there is not such variable that it should be removed from the model because all the assigned variables showed less correlation among each other.

Autocorrelation Test:

Usually, models in research study face the problem of autocorrelation which is the relationship among residuals that is caused by missing variables or incorrect functional form. The existence of autocorrelation provides inefficient inferences of the regression model although there still unbiased and linear. For this purpose, this research study practices the Wooldridge test in order to detect the problem of autocorrelation.

Table #2: Wooldridge test for autocorrelation in panel data	
H0: no first-order autocorrelation	
Prob> F=	0.1652

Following table #2, the result provided that the p-value is 0.1652 that greater than significance level (0.05). This means that H₀ is not rejected and validates that there is not enough evidence to prove that the model has a serial correlation and hence this model is free of autocorrelation.

Heteroskedasticity:

The basic understanding of heteroskedasticity is that the variances of error are not constant such that it is the violation of classical linear regression model (CLRM). The existence of heteroskedasticity provides unbiased inferences but they will not be best linear unbiased estimator (BLUE). In order to detect the problem heteroskedasticity, this paper used Breusch Pagan test.

Table #3: Breusch-Pagan / Cook-Weisberg test for Heteroskedasticity	
Ho:	Constant variance
Variables:	fitted values of Consumption
chi2(1)	= 45.410
Prob>chi2	0.361

Regarding table #3, the result of the Breusch Pagan test provides that there is not the problem heteroskedasticity in this model and one cannot reject the H₀ hypothesis. It is because that p-value is greater than the significance level (0.05) and hence there is not enough evidence to prove that this model has the problem of heteroskedasticity which is the violation of homoskedasticity.

Stationarity:

It is a condition of Classical Linear Regression Model to find and check the Stationarity and non-Stationarity of the variables. It worth mentioned that a variable should be stationary because non-stationary variable provides spurious regression inferences and besides, R-Squared and T-statistics will be overestimated and misleading

Table #4: Stationarity

Variables	T-Statistic	P-value
Final Con	-12.3818	0.000
Int r Rate	-2.9587	0.020
GNI	-2.012	0.004
Tax Pay	-1.8405	0.035
Int Pay	0.7100	0.044
Inf	0.5501	0.055

Regarding table #4, there are not any variables that they are non-stationary because all the p-values of the assigned variables are less than the significant level (0.05) which showed this model is an exception of non-Stationarity because all the variables are stationary in this model. It is important to mention that if there is a non-stationary variable, it should be changed to stationary by the first difference. But this model does not have any non-stationary variable that it should be changed to stationary.

ARDL Cointegration			
Final Consumer Consumption	Coef.	Std. Err.	P> z
Int Rate	-.6881799	.2171501	0.002
Inf	-.3398683	.190984	0.075
GNI	.5295508	.2496844	0.034
Int Pay	-.559071	.5660504	0.323

In table #5, one can see the result of ARDL test applied for the purpose of discovering both the short term and long term relationships between dependent and independent variables as it comes the first sign of understanding that how each independent variable relates with the dependent variable. Fortunately, we came up with satisfied result and put here only the long term relationship because we estimate the decisions and policy implications based on the long term relationships. In this table, it is revealed that Interest rate is significant at 0.2% significance level which means that there is a relationship between Final Consumer Consumption and interest rate. Following Inflation and Gross National Income are also significant at 1% and 3% significance levels respectively. But Interest Pay is not significant because the alpha value is greater than 10% significance level. This might be only true in Central Asia but if we use data for other countries, this may get its significance level. It is worth mentioned that those variable that we call them significant, or in other words, when the values of Alpha are less than 10% of the assigned variables, this means they have long term relationships among each other. So if one of the independent variable increases or decreases, this affect the dependent variable in value.

Table #6: Fixed and Random Effect Estimation Results						
Variables	Fixed Effect			Random effect		
Final Con	Coef.	Std. Err	P>/Z/	Coef.	Std. Err	P>/Z/
Int Rate	-.1566262	-.0687587	0.027	-.1421625	.0666905	0.033
Inf	.0989741	.0602134	0.106	-.1008271	.0596999	0.091
GNI	.9834903	.24407	0.000	.9093184	.2282324	0.000
Int Pay	-.4750002	.616218	0.444	-.7274016	.5342381	0.173
_cons	3.277721	3.908688	0.405	4.788131	3.426484	0.089

We have already addressed the importance and the obligation of using either Fixed Effect or Random Effect estimation in this analysis. We insist that Panel Data analysis usually has individual error problem, saying that individual error is correlated with one of the explanatory variable which creates endogeneity and resulting biased and inconsistent inferences. So using Fixed Effect estimation will help us to remove individual error problem. On the other hand, Random Effect Estimation will give us unbiased, consistent and efficient results by removing serial correlation: A condition when standard errors are correlated over time.

Both Fixed and Random Effects tests are applied via STATA but provided different and close inferences which is hard for a researcher to decide without applying the Hausman Test. A Hausman test can tell the difference and at the same time, states that which test result is correct for the objective of the paper. So we also applied the Hausman test to decide on the true inferences.

Table #7: Hausman Test	
Prob> Chi2	0.9078

Note; if alpha greater than 10%, do not reject the null and argue that RE is correct.

The inference provided by applying the Hausman Test tells that we do not reject the null hypothesis in favor alternative. If the value of alpha is less than 10%, reject the null hypothesis which means that the Fixed Effect provide accurate results, otherwise, Random Effect. So the result in table # 7 says that the value of alpha is greater than 10%, it means that the Random Effect is correct and provides correct inferences. So based on the Hausman Test Results, we follow the results of Random Effect Test for analysis of this paper.

In table # 6, the Interest Rate Fluctuation disclosed an impartial relationship with Final Consumer Consumption via running RE. The Interest Rate Fluctuation as the core independent variable is significant at 2.7% Alpha significance level. It tells that 1% increase in Interest Rate would reduce the Final Consumer Consumption by 0.15% which means that the relationship between these two variable is negative; if one increases, the other should decrease. Siphosethu Lucia Fikizolo discovered similar results in his research study conducted in South Africa; “The Asymmetric Effects of Interest Rate Changes on Household Consumption: South Africa”. He claimed that there exists a negative relationship between Final Consumer Consumption Expenditure and Interest Rate. This hints that an increase in Interest Rate would decrease the value of Final Expenditure (Siphosethu 2020). Besides that, the inferences that were discovered in Mudit Kapoor research work is matching with the conclusions of this paper. He studied “the Effect of Interest Rate on Household Consumption: Evidence from a Natural Experiment in India”, and found out that Final Consumer Consumption and Interest Rate have a negative relationship between them. He claimed that changes in Interest Rate bring negative changes in Final Consumer Consumption, adding that if Interest Rate changes, Final Consumer Consumption will be decreased by different percentage (Mudit Kapoor 2009). On the other hand, Douglas W. Elmendorf discovered contradictory inferences in a research work: “The Effect of Interest-Rate Changes on Household Saving and Consumption: A Survey”. He came up with three different effects. First, he claimed that if Interest Rate increase, people tend to consume less today and save for the future. This the condition when people put money for interest in a bank. The Second effect is that an increase in Interest Rate leads people to consume more today and save less for the future (Douglas 1996). Furthermore, Warren Tease exposed a very unique assumption and claimed that it is very difficult to find a relationship between Interest Rate and Final Consumer Consumption and also added that if there is, it will be very weak relationship. He addressed these explanation after conducting research on “Real Interest Rate Trends: The Influence of Saving, Investment and Other Factors” (Warren 1991).

The next important variable is Inflation such that a change in its value will bring greater impacts on the Final Consumer Consumption. According the RE test result, this variable is significant at almost 10% significance level. A 1% increase in Inflation will increase the Final Consumer Consumption by 0.011%. The sign of the coefficient of the variable is positive which means the relationship is also positive among them. Obinna Osuji discovered that Inflation and Consumption have positive relationship to each other which the results of this research study is consistent with Obinna Osuji research study (Osuji 2020). The inferences of this research study is also consistent with the Christiana Osei Bonsu research work conducted in Ghana under the title: Macroeconomics Determinants of Household Consumption Expenditure in Ghana: A Multivariate Cointegration Approach. He claimed that lower interest rate reduces savings but higher Inflation stimulate Consumption which definitely displays a positive relationship (Christiana 2017). Besides those, Suman Yadav and Ravi Shankar provided consistent conclusions about how inflation affects household consumption in India. He insisted that Inflation plays a significant role in changing consumption levels and added that higher Inflation leads to higher Consumption which is a positive relationship (Suman 2015). On the other hand, the results discovered in this research work is inconsistent with the research study conducted by Casadio, Paolo and Paradiso, Antonio. They found that Inflation can have several effects on Final Consumer Consumption but notified that Inflation is negatively linked with Consumption such that it affects income distribution and consumer behavior (Casadio 2010).

On the other hand, Gross National Income (GNI) is strongly significant at 0.0% significance level but with a positive relationship among them. This means that a 1% increase in GNI, will rise the Final Consumer Consumption by 0.10%. If a country has an increase in Gross

National Income, it will directly affect the Final Consumer Consumption of the same country people. Ekaterina conducted researched the title of “Determinants of Household Final Consumer Consumption Expenditures in Asian Countries: A Panel Model, 1991-2015” and established consistent consequences. He added that increasing to some extent the Gross National Income, will affect the value of Final Consumer Consumption (Ekaterina 2015).

On the contrary, the final independent variable; Interest Payment, is not significant even at 10% significance level. The result we discovered via STATA by running RE, shows that an increase or decrease in Interest Payment will not effect on the Final Consumer Consumption. But the theory suggests that Interest Payment should have impacts on Final Consumer Consumption because there is a strong negative relationship between them.

5. Conclusion

The main objective of this research work is to study the impacts of Interest Rate Fluctuations on Final Consumer Consumptions via panel data analysis for the period of 23 years (1995-2017) in Central Asia. In this study, a multiple regression model is used for the purpose of discovering the relationship of one dependent variables with a few other independent variables. Besides using a few diagnostic tests for data and model correction, an ARDL, Fixed Effect, and Random Effect estimations are used for investigating the long run relationship of the above mentioned variables because they were the best fit tests based on the data formation and type. In this study, a few explanatory variables were added who were also effecting the same problem in Central Asia that includes, Inflation, Gross National Income, and Interest Payments.

In contrast to literature review, this research work came up with a different and unique result which is consistent with theories provided on the relationship of interest rate and consumption. The conclusion say that interest rate adversely affect the consumption in Central Asia, meaning that if interest rate are increase, consumption will be decreased and it is called a vice versa relationship. This inference is also consistent with other research understanding conducted in other Asian and European countries but in different times. Furthermore, Inflation and gross national income were also significant and showed their impacts on Final Consumer Consumption via STATA tests and estimations. The connections for inflation and GNI are negative and positive respectively. Finally, we discovered that interest payments was not significant however, it should have impacts on Final Consumer Consumption but this research work result did not discover any relationship. Yet, the author could not find any research study that would show the relationship between interest payment and consumption. It is believed these inferences are interesting to apply a few policies that would solve both the economic and social impacts of the problem existed by the higher interest rates and inflation.

Policy Implications

1. **Balancing the Interest Rate:** The inferences of this research work suggest that balancing or lowering interest rates on loan would stimulate the Final Consumer Consumption. Meaning that borrower will not pay more on their debts and will have enough money either to save or consume for the purpose of making a living. There are numerous examples that people who took loan from banks for the purpose of buying land, homes, cars, or funding their businesses, are paying the interest payments or the charges but when the interest rate gets higher, then they pay more and hence, they will not have enough money to consume or save. So it is very vital for Banks in Central Asia to adopt a monetary policy for lowering the interest rates especially for borrower. So if borrowers pay more for their loans and remain less to save, then this will push the whole community low level of living and we may call the condition poverty when this happens for a long time. This will also affect the ability to buy or purchasing power and many products will leave their value in the markets which will also affect the personal income. Besides, this will also effect on the health of the borrowers because they will get depression and anxiety which will need more money to spend. So lowering interest rate on loan given to borrowers will improve both the social and economic problem of the community.
2. **Controlling Inflation:** The results also provided that higher inflation will decrease consumption which is not good both for economic and social life of Central Asian Countries people. To elaborate, when the prices are high, people will pay more than before but they will buy less which means people will not have purchasing power or to pay for making a living. Still people will face both economical and healthy problems in Central Asian Countries. So it is important for the governments of Central Asia to adopt monetary policies, reduce the supply of the money, wage growth, fiscal policies, and exchange rate policies.

References

- [1]: Adama Combey, "Private Consumption in the WAEMU Zone: Does Interest Rate Matter?" Munich Personal RePEc Archive, MPRA Paper No. {2016}: 1-9
- [2]: Adedayo O. ADEDEJI, "The Determinants of Private Consumption Spending in Nigeria", International Center of Science Education and Academic Research for Scholars, Volume 1, Issue 2, ISSN 2306-9074, (2013): 1-15
- [3]: Aizenman, Joshua, "The interest rate effect on private saving: Alternative perspectives", Asian Development Bank Institute (ADBI), Tokyo Working Paper, No. 715, Econstor, {2017}: 1-4
- [4]:]: Akinwande, Michael Olusegun, Hussaini Garba Dikko, and Agboola Samson, "Variance Inflation Factor: As a Condition for the Inclusion of Suppressor Variable(s) in Regression Analysis," Open Journal of Statistics, Vol 5, (2015): 3
- [5]: Anchoar, Ande, "Ordinary least squares," Creative Commons Attribution, (2002): 1-4
- [6]: Anna Gussarova, "Current Challenges to Central Asia and Afghanistan: Towards a Better World", Central Asia Institute for Strategic Studies, {2016}: 1-45
- [7]: Anthony Kofi Osei-Fosu, "The Effect of Interest Rate on Deposit on Household Consumption in Ghana: ARDL Cointegration Analysis", Research Journal of Economics Vol. 2 | No. 8 | ISSN 2347-8233, {2014}: 1-18
- [8]: Bela Balassa, "The Effects of Interest Rates on Savings in Developing Countries", Development Economics, the World Bank, {1989}: 1-5
- [9]: Bimal Singh, "Modelling Real Private Consumption Expenditure - An Empirical Study on Fiji", Working Paper 2004/05, Economics Department, Reserve Bank of Fiji, {2004}: 1-32
- [10]: Bryan M. Vengelen, "Household Consumption and Long-Term Interest Rates", School of Arts and Sciences of Georgetown University, Washington, DC, {2015}: 1-27
- [11]: Casadio, Paolo and Paradiso, Antonio, "Inflation and consumption in a long term perspective with level shift", University of Rome La Sapienza, Munich Personal RePEc Archive, (2010): 2-27
- [12]: Charles O. Manasseh, "The Effects of Interest and Inflation Rates on Consumption Expenditure: Application of Consumer Spending Model", International Journal of Economics and Financial, ISSN: 2146-4138, {2018}: 1-7
- [13]: Christiana Osei Bonsu and Paul-Francois Muzindutsi, "Macroeconomic Determinants of Household Consumption Expenditure in Ghana: A Multivariate Cointegration Approach", International Journal of Economics and Financial, ISSN: 2146-4138, {2017}: 1-9
- [14]: Christiana Osei Bonsu and Paul-Francois Muzindutsi, "Macroeconomic Determinants of Household Consumption Expenditure in Ghana: A Multivariate Cointegration Approach", International Journal of Economics and Financial Issues, ISSN: 2146-4138 (2017): 1-9
- [15]: Damodar N. Gujarati, "Basic Econometrics. Fourth Edition," The McGraw-Hill, New York, (2004): 435-449
- [16]: Douglas W. Elmendorf, "The Effect of Interest-Rate Changes on Household Saving and Consumption: A Survey", Federal Reserve Board (1996): 1-8
- [17]: Ekaterina Arapova, "Determinants of Household Final Consumer Consumption Expenditures in Asian Countries: A Panel Model, 1991-2015", Applied Econometrics and International Development, Vol. 18-1 (2018): 1-20
- [18]: ENZ, "Pressures on the Environment: Houseful Consumption", Environment New Zealand, {2007}: 1-16
- [19]: Hammed, Agboola Yusuf, "Interest Rate and Private Consumption Behavior in Nigeria: Some Empirical Evidences", Asia Pacific Institute of Advanced Research (APIAR), Vol 3, Issue 3, {2017}: 1-4
- [20]: Hans Holzhaecker and Dana Skakova, "Kyrgyz Republic Diagnostic", European Bank for Reconstruction and Development, {2019}: 1-16
- [21]: Hermann-Josef Hansen, "The impact of interest rates on private consumption in Germany", Discussion paper 3/96, Economic Research Group of the Deutsche Bundesbank, {1996}: 1-8
- [22]: Hutcheson, G. D, "Ordinary Least-Squares Regression," The SAGE Dictionary of Quantitative Management Research, (2011) 1- 2

- [23]: International Monetary Fund, “Republic Of Kazakhstan: 2018 Article IV Consultation—Press Release and Staff Report, IMF Country Report No. 18/277, {2018}: 1-14
- [24]: J.Varlamova and N.Larionova, “Macroeconomic and demographic determinants of household expenditures in OECD countries”, International Conference on Applied Economics, Kazan, Russia, {2015}: 1-5
- [25]: Kai Guo and Papa N’Diay, “Determinants of China’s Private Consumption: An International Perspective”, International Monetary Fund Working Paper, 10/93, {2010}: 1-17
- [26]: Ly’ocsa, Eduard Baum’ohl and S’tefan, “stationary of time series and the problem of spurious Regression” Munich Personal RePEc Archive, Business Economics in Ko’sice, University of Economics in Bratislava, (2009): 1-6
- [27]: Mirimanova, Natalia, “Central Asia: Climate-related security risk assessment”, Stockholm International Peace Research Institute, {2018}: 1-20
- [28]: Mudit Kapoor and Shamika Ravi, “Effect of Interest Rate on Consumption”, Indian School of Business Hyderabad, India, {2015}: 1-19
- [29]: N. Jenish, “The Financial Sector Stability Report of The Kyrgyz Republic”, National Bank of The Kyrgyz Republic, {2016}: 1-44
- [30]: Nahanga Verter and Christian Nedu Osakwe, “A time series analysis of macroeconomic determinants of household spending in the era of cross-cultural dynamics: Czech Republic as a case study”, ELSEVIER, Procedia Economics and Finance 12 (2014): 1-10
- [31]: Neelesh Gounder, “The Determinants of Household Consumption and Poverty in Fiji”, Griffith University, ISSN 1837-7750, {2012}: 1-20
- [32]: Nkoro, Emeka and Aham, Kelvin Uko, “Autoregressive Distributed Lag (ARDL) Cointegration technique: application and interpretation,” Journal of Statistical and Econometric Methods Vol 5, No 4, (2016):13-14
- [33]: Olga Croitorov, “Effects of Credibility of Monetary Policy: Case of Kazakhstan And Moldova”, Kyiv School of Economics, {2009}: 1-30
- [34]: Osuji Obinna, “Effect of Inflation on Household Final Consumer Consumption Expenditure in Nigeria”, Journal of Economics and Development Studies, Vol. 8, No. 1, (2020): 1-9
- [35]: Panagiota Tzamourani, “The interest rate exposure of euro area households”, Discussion Paper, Deutsche Bundesbank, No 01 {2019}: 1-35
- [36]: Ricardo Barradas, “Drivers of Private Consumption in the Era of Financialisation: New Evidence for the European Union Countries”, Working Paper, Instituto Universitário de Lisboa (ISCTE-IUL), {2017}: 1-30
- [37]: Richard, Williams. “Heteroskedasticity.” University of Notre Dame, January 30, 2015:1-8.
- [38]: Saltanat Kanapiyaevna Kondybayeva and Zhanna Shamilevna Ishuova, “The Effect of Monetary Policy on Real House Price Growth in the Republic of Kazakhstan: A Vector Auto regression Analysis”, World Applied Sciences Journal 22 (10): 1384-1394, ISSN 1818-4952, IDOSI Publications, {2013}: 1-7
- [39]: Schmidheiny “Short Guides to Micro econometrics: Panel Data: Fixed and Random Effects.” Kurt University Version: 14-11, (2016): P 3&4
- [40]: Shinobu Nakagawa and Kazuo Oshima, “Does a Decrease in the Real Interest Rate Actually Stimulate Personal Consumption: An Empirical Study”, Working Paper 00-2, Research and Statistics Department Bank of Japan, {2000}: 1-
- [41]: Siphosethu Lucia Fikizolo, “The Asymmetric Effects of Interest Rate Changes on Household Consumption: A Case for South Africa: How Household Consumption Reacts to Changes in the Interest Rate”, NOVA Information Management School, Instituto Superior de Estatística e Gestão de Informação, (2020): 1-5
- [42]: Suman Yadav and Ravi Shankar, “Inflation Expectations and Consumer Spending in India: Evidence from the Consumer Confidence Survey”, Reserve Bank of India Occasional Papers Vol. 35 & 36, No. 1 & 2, (2015): 1-40
- [43]: Syed Mumtaz Ali Kazmi, “Real Private Consumption Expenditure Modeling: An Empirical Study on Pakistan”, Journal of Economics and Sustainable Development, Vol.6, No.17, {2015}: 1-13

- [44]: USAID, “Climate Risk Profile: Central Asia” United State Agency for International Development Order, Number AIDOAA-BC-17-00042, {2018}: 1-9
- [45]: Uriintuya Batsaikhan and Marek Dabrowski, “Central Asia at 25”, Policy Contribution Issue N 13, Buegel, {2017}: 1-22
- [46]: Warren Tease, Andrew Dean, Jorgen Elmeskov and Peter Hoeller, “Real Interest Rate Trends: The Influence of Saving Investment and Other Factors”, OECD Economic Studies No. 17. (1991): 1-17
- [47]: World Bank Group, “Tajikistan: Heightened Vulnerabilities Despite Sustained Growth”, Macroeconomics and Fiscal Management, Country Profile Update, {2017}: 1-16

ABOUT AUTHOR



Fazal Ahmad Afzali obtained Bachelor Degree in Finance from Afghan American University in 2010 and 2014 respectively and Master of Arts in Economic Governance and Development from OSCE Academy in Bishkek 2017 and 2018 in Kyrgyzstan. He remained as an Assistant Professor in Mirwais Neka Institute of Higher Education in Kandahar Afghanistan since 2014 to 2019. He also added knowledge to research while working for National and International Research Organization (Samuel Hall & IWPS). His preferred expertise are Macro and Microeconomics and Fiscal Policies development.

Email ID: Afzali.fazil@gmail.com, f.afzali@osce-academy.net

Cash Waqf in Indonesia: Legal Aspects and Its Impact on Economic Resilience

Adi Nur Rohman¹, Sugeng²

Faculty of Law, Universitas Bhayangkara Jakarta Raya, Jakarta, Indonesia

DOI: 10.29322/IJSRP.12.10.2022.p13054

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13054>

Paper Received Date: 14th September 2022

Paper Acceptance Date: 15th October 2022

Paper Publication Date: 21st October 2022

Abstract: The scope of waqf so far is generally understood to be limited to waqf of immovable objects such as land and buildings. Meanwhile, cash waqf began to show potential and a significant role in building the country's economy. This study is directed at two research objectives: to identify aspects of strengthening cash waqf regulations in Indonesia, and also to analyze its potential and influence on national economic resilience. The research is categorized as a normative juridical research that uses a statutory approach and a conceptual approach. This study finds that the regulation of cash waqf in Indonesia already has sufficient space to be implemented in conjunction with other types of conventional waqf, however, it is necessary to strengthen several aspects so as to mitigate disputes that may occur. In addition, important findings from this study show that the potential for cash waqf has a large enough impact in maintaining the country's economic resilience. In the end, it can be concluded that cash waqf has a significant role in building the economy and economic resilience so that adequate regulations are needed to be able to minimize the occurrence of disputes in the future that follow the times and technology.

Keywords: *cash waqf; economic resilience; regulation.*

Introduction

Waqf is the holding of assets that are taken advantage of which are not immediately destroyed and their use is for things that are permitted by religious law with the aim of getting the pleasure of Allah swt (1). By releasing the waqf property, legally the wakif has lost his ownership rights so that he no longer has the authority or right to use it for his personal interests and the right to transfer or transfer his ownership to other parties, such as selling, giving, including bequeathing to heirs (2). Waqf as a worship that has a social and horizontal dimension is certainly very important for the people, because in addition to zakat, waqf worship can also improve people's welfare and can alleviate poverty (3).

Indonesia as a country with a Muslim majority population has great potential in developing waqf. However, public understanding regarding waqf is still limited to traditional waqf in the form of land or other worship facilities. Whereas waqf can also be in the form of movable objects such as cash waqf (4). Law Number 41 of 2004 concerning Waqf states that people who make waqf (wakif) can donate part of their wealth in the form of movable waqf property, either tangible or intangible, one of which is in the form of money. The application of cash waqf as a form of productive waqf today will have greater advantages than traditional waqf. Cash waqf can be collected in a container, so that it becomes a large business capital and can be managed productively through competent and professional management institutions (5).

However, the implementation of cash waqf is not without problems. In the practice of traditional waqf, several problems that often arise such as waqf exchange, protection of waqf property, settlement of disputes over ownership of waqf property, problems with registration and recording of waqf. (6), is still a big job that must be completed by the stakeholders. Likewise, in cash waqf, it is also considered that there are still many problems that need to be resolved, such as guarantees for the protection of cash waqf assets, the types of investments allowed in cash waqf, and so on.

Cash waqf is a new source of fiscal finance with great potential in maintaining national economic resilience. Besides that, the use of cash waqf can encourage the level of community welfare, on the other hand, the existence of cash waqf also has the potential to be able to maintain the stability of the country's economy. The pattern of cash waqf management from the beginning of its collection to its utilization must be followed by strong regulations so that it can avoid practices that violate the rule of law both in terms of religious law and positive law.

The aspect of regulating cash waqf is one of the government's concerns to be able to realize the essence and purpose of waqf which is expected to continue to be in the form of waqf property. Therefore, in addition to good, systematic and measurable management and management, the legal aspects that underlie it must also be considered. Considering that the existence of cash waqf like other traditional waqf also has the potential for irregularities and various legal cases so that the direction and purpose of cash waqf which is expected to participate in supporting the country's economic stability can be well maintained.

The problem in this study is the lack of cash waqf arrangements in Indonesia which have not fully guaranteed the protection of waqf assets and settlement of disputes over ownership of waqf assets. Another problem is that the existence of cash waqf has not shown its contribution to its participation in the development and resilience of the national economy. Based on these problems, this research focuses on at least two objectives, namely to analyze the form of legal regulation of cash waqf in Indonesia. In addition, this study also intends to analyze the impact of cash waqf on national economic resilience in the territory of the Unitary State of the Republic of Indonesia.

Research Method

This research is included in the normative juridical research (doctrinal research) which instrumented several research approaches, including the statutory approach and the conceptual approach. Both approaches are used to be used as a researcher's point of view in viewing a legal study. The data used in this study is secondary data consisting of primary, secondary and tertiary legal materials. The process of collecting data was carried out through a literature study which was then analyzed descriptively analytically.

Literature Review

Waqf is etymologically a masdar form of the word waqafa-yaqifu which means al-habs (hold) or al-muks (settled) (7). While waqf according to the term, holding property that can be used by maintaining the principal property and distributing its benefits to those who are allowed to receive it (2). The definition of waqf according to the schools of fiqh is quite varied. The Hanafiyah group defines waqf as holding back the material belongings of the waqif (the person who is waqf) and giving charity or waqf its benefits to whoever it wants for the purpose of virtue. While Malikiyah argues, waqf is to make the benefits of a property owned to be given to people who are entitled to one contract (sigat) within a certain period of time in accordance with the wishes of the waqif. As for the Shafi'iyah school community, waqf is defined as holding assets that can provide benefits and eternal material objects (al-'ain) by deciding the management rights owned by waqif to be handed over to Nazirites which are permitted by Shari'ah. Meanwhile, Hanabilah defines waqf in simple language, namely holding back the origin of property (land) and giving alms to the resulting benefits (8).

Waqf according to Government Regulation Number 28 of 1977 is a legal act of a person or legal entity that separates part of his assets in the form of property and institutionalizes it forever for the benefit of worship or other public interests. In the Compilation of Islamic Law (KHI) article 215 paragraph (1) it is stated that waqf is a legal act of a person or group of people or legal entities that separates part of his property and institutionalizes it forever for other public interests in accordance with Islamic teachings. Meanwhile, according to Law Number 41 of 2004 concerning Waqf, what is meant by waqf is a legal act of wakif to separate and/or surrender part of his property to be used forever or for a certain period of time in accordance with his interests for the purposes of worship and/or public welfare according to Law No. sharia.

While the basis for waqf practice in Indonesia is the following laws and regulations:(9)

- 1) Law Number 41 of 2004 concerning Waqf
- 2) Government Regulation Number 42 of 2006 concerning the Implementation of Law Number 41 of 2004 concerning Waqf
- 3) Indonesian Islamic law compilation
- 4) Government Regulation Number 28 of 1977 concerning Land Waqf

In order to achieve the purpose and function of waqf, waqf property can only be designated for:(10)

- 1) worship facilities and activities
- 2) educational and health facilities and activities
- 3) assistance to the poor, abandoned children, orphans
- 4) progress and improvement of the people's economy
- 5) other public welfare advancements that do not conflict with sharia and the laws and regulations.
- 6) the period of waqf (this period is adjusted to the condition of the property in the waqf).

According to Law Number 41 of 2004 concerning Waqf, waqf assets consist of:

- 1) immovable objects, including:
 - a. land rights in accordance with the provisions of applicable laws and regulations, both those that have been and have not been registered
 - b. plant land and other objects related to land ownership rights to the apartment unit in accordance with the provisions of the applicable laws and regulations
- 2) other immovable objects in accordance with sharia provisions and applicable laws and regulations.
- 3) movable objects, are property that cannot be used up due to consumption, including:
 - a. money
 - b. precious metal
 - c. securities
 - d. vehicle
 - e. intellectual property rights
 - f. lease rights
 - g. other movable objects in accordance with sharia provisions and applicable laws and regulations.

The fatwa of the Indonesian Ulema Council (MUI) explains about cash waqf (waqf al-Nuqud), namely waqf carried out by a person, group of people, institutions or legal entities in the form of cash. Included in the definition of money are securities. Waqf of movable property in the form of money, hereinafter referred to as cash waqf, is waqf in the form of money that can be managed productively, the results are used for mauqaf alaih. While the basis of cash waqf in Indonesia, among others:(5)

- 1) MUI Fatwa in 2002 concerning Cash Waqf
- 2) Law Number 41 of 2004 concerning Waqf
- 3) Government Regulation Number 42 of 2006 concerning the Implementation of Law Number 41 of 2004 concerning Waqf
- 4) Regulation of the Minister of Religion number 4 of 2009 concerning the Administration of Cash Waqf
- 5) Decree of the Minister of Religion Number 92-96 regarding the determination of LKS to become LKS PWU
- 6) BWI Regulation number 1 of 2009 Guidelines for the Management and Development of Movable Waqf Assets in the Form of Money

With regard to cash waqf in Indonesia, the research conducted is still relatively small. Among them are research by Junaidi Abdullah (1) who discovered the procedures and effective management of cash waqf. However, there has been no specific study on the legal aspects of cash waqf. Furthermore, Hisam Ahyani and Muharir (3) concluded that cash waqf plays an important role in the welfare of the people in the era of the industrial revolution 4.0. However, the application of cash waqf has not shown its effect on national economic resilience which is directly proportional to the welfare of the community. Other studies such as those conducted by Diah Sulistyani (5), Alfin Syauqi (4) and Inne Risnaningsih (11) which generally raises the issue of cash waqf management in Indonesia by raising various problematic issues related to the implementation of cash waqf.

In contrast to previous studies, this study focuses on the regulation of cash waqf in Indonesia as an important sector that has direct contact with the community. In addition, this study will also examine the impact of money law instrumentation on national economic resilience while also looking at the positive impact of cash waqf on the progress of the country's economy.

Cash Waqf and its Regulations in Indonesia

Waqf is a legal act that has very high spiritual value and is widely known by the people of Indonesia. The knowledge of the Indonesian people about waqf is quite high, although it is still limited to the aspect of waqf of land and immovable objects. Therefore, it can be found several regulations governing land waqf in Indonesia such as PP no. 28 of 1977 concerning the Endowment of Owned Land and Regulation of the Minister of Religion No. 1 of 1978 as the implementing regulation.

In the historical record of Islam, waqf first occurred after the event of the Prophet's migration to Medina. The construction of the Quba mosque which was built out of taqwa and faith for the sake of religion became the first waqf in Islamic history. It did not stop there, followed by the construction of the Prophet's mosque which was built on the land of orphans from Bani Najjar, the purchase of the Raumah well by Uthman bin Affan's friend whose water was donated for the benefit of the Muslims at that time, and also land waqf carried out by Umar bin Khattab's friend who gave up his best land in Khaibar for waqf (12).

Cash waqf is a new thing in Indonesia. However, the existence of cash waqf has long been developed in several countries. The existence of cash waqf has long been felt by the wider community and has enormous potential for development. In Law no. 41 of

2004 concerning Waqf, the discussion of cash waqf can be found in at least several articles, namely Articles 28, 29, 30 and 31. The regulation of cash waqf in the Act emphasizes the importance of developing cash waqf as an instrument for developing social welfare (13). The presence of the Waqf Law changed the waqf paradigm that developed in the community before the existence of the Law. At that time, the community focused on waqf only on immovable objects with the nuances of social worship, such as mosques, burial grounds, schools, hospitals, prayer rooms and so on. In addition, the policies that were born after the existence of the Waqf Law were able to accommodate cash waqf instruments as one of the productive waqf that deserves to be developed in Indonesia in addition to other types of productive waqf.

The Problems of Management and Development of Cash Waqf in Indonesia

The management and development of cash waqf in Indonesia has been specifically regulated through the Indonesian Waqf Agency (BWI) Regulation No. 1 of 2009 concerning Guidelines for the Management and Development of Cash Waqf. In the regulation, cash waqf which is categorized as waqf of movable property in the form of money is defined as waqf in the form of money that can be managed productively and the results can be utilized by the mauquf 'alaih. The money that is donated must be in the form of rupiah currency so that the money to be donated in foreign currency must first be converted into rupiah. Furthermore, in the regulation, it is stated that cash waqf certificates will be given to waqif who donate at least one million rupiah (13).

The above provisions indicate that with a minimum amount of cash waqf of one million rupiah, it at least shows the potential for the development of cash waqf in Indonesia, which is followed by a very large number of Indonesian Muslim population. Cholil Nafis assumes that if 20 million Indonesians want to endow cash waqf of one hundred thousand rupiahs every month, the funds collected by waqf funds will be 24 trillion rupiahs. Likewise, if the number of waqf residents increases to 50 million people, then 60 trillion rupiah of waqf funds will be collected (14). And so on, which shows that the more people who donate money, the greater the value of the waqf funds that will be collected.

The current management and collection of waqf funds is also quite modern where the government determines Islamic financial institutions as recipients of cash waqf. In Law no. 41 of 2004 it is stated that the handover of cash waqf is not carried out directly to the nazir of waqf but through a sharia financial institution that is designated as the recipient of cash waqf, hereinafter referred to as the Islamic financial institution that receives cash waqf (LKS-PWU). (15). In practice, nazir of cash waqf also acts as a manager of waqf funds by investing them in accordance with sharia investment provisions. With a note that the invested waqf funds should not be reduced. And as a form of benefit that the nazir may receive, the profit from the investment returns of 10% can be allocated to honorarium for the nazir and the remaining 90% for the welfare of the community (4)(16).

Until January 2022, there were at least 29 Islamic financial institutions designated as Islamic Financial Institutions Recipient of Cash Waqf. The stipulation refers to the Regulation of the Minister of Religion No. 4 of 2019 which is then stipulated through a Decree of the Minister of Religion. It is known that to be designated as LKS PWU, a bank must submit a written application to the Minister of Religion by attaching the Articles of Association and ratification as a legal entity and having an operational office in the territory of the Unitary State of the Republic of Indonesia.

Cash waqf is a slice of traditional waqf which is generally in the form of assets and property. Given that cash waqf is relatively new in the scope of the Indonesian economy, as a new instrument, it is necessary to have adequate infrastructure and regulations. Cash waqf is different from traditional waqf, so there needs to be renewal and strengthening in various lines to avoid cash waqf from the forms of deviations that damage the values of cash waqf which incidentally is ta'abbudiy.

In the process of its implementation, cash waqf also cannot be separated from obstacles that often approach. Some of these obstacles, such as the patterned community paradigm of traditional waqf, so that some people interpret cash waqf as waqf with money. Apart from the lack of public understanding, the pattern of monitoring and risk mitigation also seems to still need to be improved. This is considering that money is a medium of exchange that may experience inflation, so of course it really needs a legal instrument that regulates this.

Other obstacles that are also important to observe are the lack of government support, the low level of human resources capable of integrating financial managerial capabilities and waqf fiqh simultaneously, the lack of institutional and regulatory support in the form of adequate implementation instructions and the need for the development of financial technology as a supporting instrument to face industrial revolution 4.0.

Aspects of Strengthening Money Waqf Law

As a modern state of law (Rechstaat), the function of regulation in Indonesia not only provides a formal form of values and norms prevailing in society, but also becomes an instrument to direct people's lives towards the expected ideals. In practice, the formation of regulations is primarily intended to provide direction for the realization of national development goals (17). Realizing a strong and stable economy requires adjustments to various policies and regulations in the economic and monetary sector.

Strengthening regulations is expected to accelerate Islamic finance nationally so that Indonesia can become one of the financial centers in the ASEAN region and the world by maximizing the potential of cash waqf. Waqf which is directed to improve the welfare of the people should be placed in a position that is in accordance with the direction and purpose of the waqf itself. In addition, the government as a regulator must also be able to provide regulations that are more adequate and in accordance with needs.

The development of the digital industry today also deserves the government's attention in responding to changes and dynamics of technological advances that have an impact on digital financial transactions. The era of digitalization must also include cash waqf instruments as a form of adaptation to technological developments (18). This is not without reason, various marketplace platforms that provide various applications to facilitate various transactions should also inspire the digitization of money waqf.

However, just as digital financial transactions require special regulations, the cash waqf industry also requires regulations that can accommodate technological developments. The current public's preference for technology-based financial transactions, including cash waqf, is the basic capital for the development of technology-based cash waqf instruments. In line with the program, regulations concerning the digital world in the field of cash waqf must also be formulated as a form of legal protection for waqf, wakif and mauqf alaih assets.

Cash Waqf and Economic Resilience

Cash waqf in the economic field has occupied a strategic position in building the national economy. As one of the Islamic fiscal instruments in the economic field, cash waqf has made a significant contribution in the context of empowering the national economy through the social security system. The superiority of cash waqf is based on a paradigm shift that sees the form of productive waqf in contemporary times not fixated on immovable objects, but instead the form of movable objects can outperform immovable powder from a more professional management side. So that the purpose of waqf will be more achievable and even targeting the wider community.

As it is known that the cash waqf mechanism is collected in a container called Islamic Financial Institutions Recipient of Cash Waqf (LKS PWU) as stated in the decision of the Minister of Religion of the Republic of Indonesia which states that there are at least 27 financial institutions that receive cash waqf. The main tasks of LKS PWU include: first, to announce to the public its existence as one of the LKS recipients of cash waqf, secondly, to provide a form of cash waqf certificate, and thirdly to receive cash waqf from waqif on behalf of nazir. The money waqf funds that have been collected can later be used as large capital to be managed productively so that they can generate substantial income. This of course must be carried out by professional and competent personnel so that they can manage them properly and reliably. Efforts to optimize cash waqf as one of the Islamic financial instruments can certainly support government policies in order to improve people's welfare which has a direct impact on economic resilience.

Economic resilience is defined as a dynamic condition that occurs in the economic life of the nation which consists of tenacity and resilience and has the ability to develop national strength in anticipating all forms of threats, obstacles, and obstacles including all threats originating from within and outside the country, either directly or indirectly. directly in ensuring the continuity of the economic life of the nation and state (19). In the macro context, economic resilience is the ability of a country to maintain stable economic growth and maintain a sustainable standard of living for its entire population through quality economic development while maintaining economic independence. It is known that the stability of economic growth is largely determined by the stability of the achievement of Gross Domestic Product (GDP) from year to year (20).

As an effort to maintain economic resilience, economic independence is needed to realize this desire. Economic independence itself is the economic ability of a country/region to continue to grow stably and to a minimum depend on the global economy outside the country/region. In an effort to realize economic independence, various programs and strategic steps are also promoted, such as by increasing people's purchasing power with equitable development and by increasing the absorption of labor so as to minimize poverty (13).

The state's obligation to maintain economic resilience is a mandate from the 1945 Constitution in which the state, at the central and regional levels, is equally responsible for maintaining economic stability in order to create prosperity for the Indonesian people as a whole. In the amendment to Article 34 of the 1945 Constitution, it is stated, "That the State develops a social security system for all people and empowers the weak and incapable in accordance with human dignity". The government's commitment is carried out through various programs and efforts that can maximize community empowerment.

In the context of community empowerment, cash waqf is projected as one of the effective community empowerment instruments and plays a very important role in participating in building an independent society, especially independence in the economy. Waqf essentially requires waqf property to be maintained so that it can be eternal and eternal. The waqf assets must be managed with good management and the results can be given to community empowerment programs in accordance with the mandate of the 1945 Constitution.

Conclusion

Cash waqf is a new source of fiscal finance with great potential in maintaining national economic resilience. For this reason, comprehensive regulations are needed that are able to accommodate the public interest. The regulation of cash waqf in Indonesia already has sufficient space to be implemented in conjunction with other types of conventional waqf, however, it is necessary to strengthen several aspects so as to mitigate disputes that may occur. In addition, important findings from this study show that the potential for cash waqf has a large enough impact in maintaining the country's economic resilience. In the end, it can be concluded that cash waqf has a significant role in building the economy and economic resilience so that adequate regulations are needed to be able to minimize the occurrence of disputes in the future that follow the times and technology.

References

1. Abdullah J. Tata Cara Dan Pengelolaan Wakaf Uang Di Indonesia. *ZISWAF J Zakat dan Wakaf*. 2017;4(1):87.
2. Ali MD. *Sistem Ekonomi Islam: Zakat dan Wakaf*. Jakarta: UI Press; 1998.
3. Ahyani H, Muharir. Perspektif Hukum Ekonomi Syariah Tentang Wakaf Uang Di Era Revolusi Industri 4.0. *J Ekon Syari'ah*. 2021;2(2):85–100.
4. Syauqi MA. Optimalisasi Pengelolaan Wakaf Uang untuk Kesejahteraan Umum. *Kanun J Ilmu Huk*. 2014;63(2):369–83.
5. Sulistyani D, Asikin N, Soegianto S, Sadono B. Pelaksanaan Dan Pengembangan Wakaf Uang Di Indonesia. *J Usm Law Rev*. 2020;3(2):328.
6. Mukhalad W. Problematika Pengelolaan dan Pengembangan Tanah Wakaf (Studi Kasus di Kecamatan Meureubo Kabupaten Aceh Barat). *Tadabbur J Perad Islam*. 2020;2(2):229–30.
7. Basyir AA. *Hukum Islam Tentang Wakaf Ijarah dan Syirkah*. Bandung: Alma Arif; 1987.
8. Al-Jaziri A. *al-Fiqh 'ala al-Madzahib al-Arba'ah*. Vol. IV. Beirut: Daar al-Fikr;
9. Mubarok J. *Wakaf Produktif*. Bandung: Simbiosis Rekatama Media; 2008.
10. Rohim AN. Optimalisasi Wakaf sebagai Instrumen Pembiayaan UMKM untuk Pengembangan Industri. *J Bimas Islam*. 2021;14(2).
11. Risnaningsih I, Nurhayati S. Problematika Pengembangan Wakaf Uang Melalui Koperasi Syariah Di Era 4.0. *Co-Management*. 2020;3(1):402–13.
12. Baqutayan SMS, Ariffin AS, Mohsin MIA, Mahdzir AM. Waqf Between the Past and Present. *Mediterr J Soc Sci*. 2018;9(4):149–55.
13. Arif MNR Al. Wakaf Uang dan Pengaruhnya Terhadap Program Pengentasan Kemiskinan di Indonesia. *Indo-Islamika [Internet]*. 2012;2(1):17–29. Available from: <http://asy-syirah.uin-suka.com/index.php/AS/article/view/41>
14. Zahro' K, Jamal M, Arroisi J, Agustin NP. Implementasi Pendistribusian Wakaf Tunai Sebagai Penunjang Usaha Kecil Menengah di Badan Wakaf Uang & Badan Wakaf Tunai MUI Yogyakarta. *Ulul Albab J Stud dan Penelit Huk Islam*. 2020;3(1):49.
15. Rusydiana AS, Devi A. Analisis Pengelolaan Dana Wakaf Uang di Indonesia: Pendekatan Metode Analytic Network Process (Anp). 2017;10(2):115–33.

16. Md. Shahedur Rahaman Chowdhury. Economics of Cash WAQF management in Malaysia: A proposed Cash WAQF model for practitioners and future researchers. *African J Bus Manag.* 2011;5(30):12155–63.
17. Chotimah HC, Sandec JP, Dwi C E, Yusvarini DR, Hong S. Perkembangan Aspek Keamanan Ekonomi dalam Konsep Human Security. *J Transform Glob.* 2019;4(1):65–76.
18. Habibunnajar R, Rahmatullah I. Problematika Regulasi Pinjam Meminjam Secara Online Berbasis Syariah di Indonesia. *J Leg Reason* [Internet]. 2020;2(2):120–34. Available from: <https://republika.co.id/berita/pwmq1n370/afsi-peraturan-ojk-belum-mewadahi-ltemgtfintechltemgt>
19. Maharani A, Mahalika F. New Normal Tourism Sebagai Pendukung Ketahanan Ekonomi Nasional Pada Masa Pandemi (New Normal Tourism As a Support of National Economic Resistance in the Pandemic Period). *J Kaji LEMHANNAS RI* [Internet]. 2020;8:14. Available from: <http://jurnal.lemhannas.go.id/index.php/jkl/article/view/87>
20. Rohman AN, Sugeng, Fitriana D, Aidy WR. *Ekosistem Bisnis dan Regulasi Fintech Syariah Dalam Perspektif Keamanan Ekonomi.* Banyumas: CV. Pena Persada; 2021.

Impact of Covid-19 on the spending patterns, saving and investment behavior of lower middle classes in an urban city

Parth Tiwari *, Sanjay Tomer **

* Welham Boys School, Dehradun, India

** Professor , Finance & Investment, FOSTIIMA , New Delhi , India

DOI: 10.29322/IJSRP.12.10.2022.p13055

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13055>

Paper Received Date: 14th September 2022

Paper Acceptance Date: 15th October 2022

Paper Publication Date: 21st October 2022

Abstract- The COVID-19 health crisis has had a significant impact on all walks of life and caused severe damage by pushing poverty and increasing inequalities. This unpredictable and unprecedented black swan event had pushed economies to struggle and strive and had a long-lasting impact on the spending, savings and investing behavior of individuals. This study focuses to understand how the Covid-19 pandemic has influenced the behavior of low to medium income earning habitants (up to INR 1,50,000 per household) and earning population of aged up to 55 years in urban city of Gurugram Haryana (India) towards saving, investments and spending patterns. To achieve this a survey was conducted during June/July 2022 via a structured questionnaire and a random sampling technique had been adopted for data collection. The study's findings show that people's lifestyles and spending habits, saving, and investing behavior have changed significantly and indicates a permanent shift in the preferences of people towards usage of money they earn.

Kristine M. Smith et al. (2019) have studied the sectorial impact of infectious diseases on an economy and advised for more collaborations and partnership amongst the countries as most of the time because of global trade pathogen crosses boundaries. Imlak Sheikh (2020) have studied the effects of Covid-19 on global equity market, and Gurbaxani and Gupte (2021) done a study on impact of Covid-19 on Investors behavior of individuals in a small town in the state of Madhya Pradesh, India and couple of more similar studies have been done using data from different cities. Michel Smith (2021) has analyzed relationship between Maslow's hierarchy of Needs and Consumer Spending Patterns. Maslow (1908-1947) considered the lowest order-order needs to be physiological in nature towards humankind to survive and for sustenance the life. These have been denominated as hygiene factors and once met, one motivated towards achieving higher end sociological and safety needs. Covid-19 has influenced the stability aspects of physiological needs itself and therefore motivation to move to higher order of needs have also influenced and is part to this research.

I. REVIEW OF LITERATURE

According to World Bank's study, Covid-19 has induced poverty and inequalities amongst the social groups specially in developing countries. In countries like India, rural population could get support from free distribution of food grains through Public Distribution System (PDS), the urban population belonging to low to medium income groups have been affected the most in middle of job-cuts and reducing household income levels. Because of psychological pain the affected population underwent, Covid-19 has brought behavioral changes specially to financial aspects of decision making.

In his research Kristine M. Smith et al. (2019) found that The conventional scope of estimating economic impact of disease events in humans has often been limited to basic direct costs (health care) and limited indirect losses (e.g., wages not earned and informal health costs such as patient transport). In fact such events have significant multi -sectorial impact as per table-1 below. All such impact taken together cumulatively have bearing on financial decision making by affected population.

Chart-1

Examples of financial impacts due to zoonotic infectious disease events beyond the public health sector.

Sectors impacted	Time period	Geographic scope	Disease	Metrics	Economic estimate
Tourism	2009	Mexico	H1N1	tourism	2.8 billion
Agriculture	1998–2002	Somalia	RVF	livestock export losses	435 million
Government	1998–1999	Malaysia	Nipah	lost tax revenue	105 million
Financial	2013–2015	Ghana, Liberia, Sierra Leone	Ebola	loss of investor confidence	600 million
Travel	2003	Global	SARS	airline losses	7 billion+

Source Research Paper : Kristine M. Smith et al. (2019)

Imlak Sheikh (2020) examined the market volatility leading to uncertainty impacting investor sentiments. The plausible reason for such market disruption is the deterioration of public health, temporal and diffusional long-lived effects, global economy and interconnectedness, social distancing, travel ban and lack of put protection. The fear and anxiety amongst the participants demanded portfolio protection and hence increased in risk premium. This fear and anxiety had lasting impact which later had influenced the investment preferences in future.

Farheen Siddiqui et al. (2022) in study on Impact of Covid-19 on spending pattern and investment behavior of Retail Investor, found that post Covid-19 event, the investor became more risk-averse because of negative effect on job and income source, and this further had influenced preferences towards using the money whether as spend, or investment. People looked for safer avenues. For example, people shifted their spending towards to essential items than non-essential or discretionary items. Arguably it can be maintained that meaning that meaning of essential and non-essential items keep varying depending upon income levels and impacted by propensity to save more. Increased level of fear and anxiety during Covid-19 explains the later and that's why keeping other things constant, people have increased preferences towards saving for future.

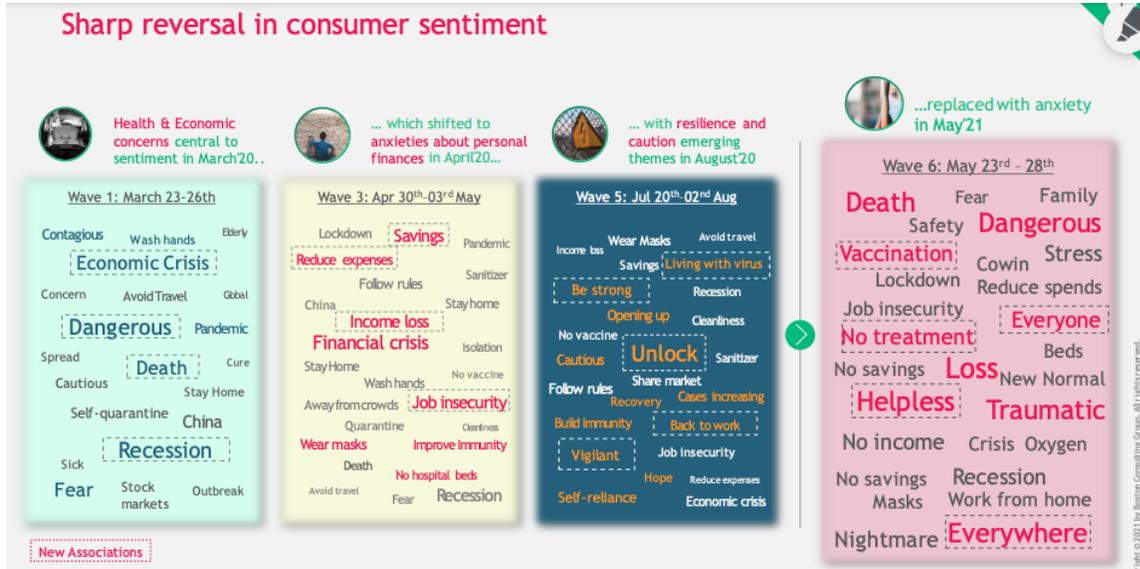
Shehbazbano Khan et al. (2020) researched the impact of Covid-19 on the investment pattern of investors regarding traditional investment and market based financial products in Mumbai with an objective to analyze degree of investor preference towards certain assets class such as gold, equity, real estate etc. the findings suggested that Covid-19 has a considerable impact on investors' preference for real estate but has had no meaningful impact on investors' preference for gold or stock. The study concluded that investor preference is dynamic and therefore change in preference may not be sustainable for long run.

Gurbaxani and Gupte (2021) research on impact of Covid-19 on Investors' behavior of Individuals in a small town in the state of Madhya Pradesh, India showed that the Covid-19 epidemic has influenced people's investment and financial decisions in rural part of the country. India is country with second largest population with significant portion in rural part, lockdowns have been proven to be unsettling for long time. Due to measures taken by the government to control the spread of COVID-19 such as lockdown and the stock market crash, individual investor's willingness to invest in mutual funds and the stock market has been impacted negatively. In present times, investors seem to have become more risk averse, and prefer relatively secure investment options offering moderate return with low risk. Researcher pointed out that investors also need to be educated about various investment opportunities for example Gold ETFs, mutual funds etc and timing their investments It also throws some light on the fact that mutual fund associations and policymakers should conduct campaigns in smaller towns to enhance financial literacy of people.

Boston consulting group (BCG) Center for Customer Insight in India (CCI) has conducted six surveys on variety of population in tier 1/2/3/4 cities in India during march-2020 to June-2021 and shared insights related impact of COVID-19

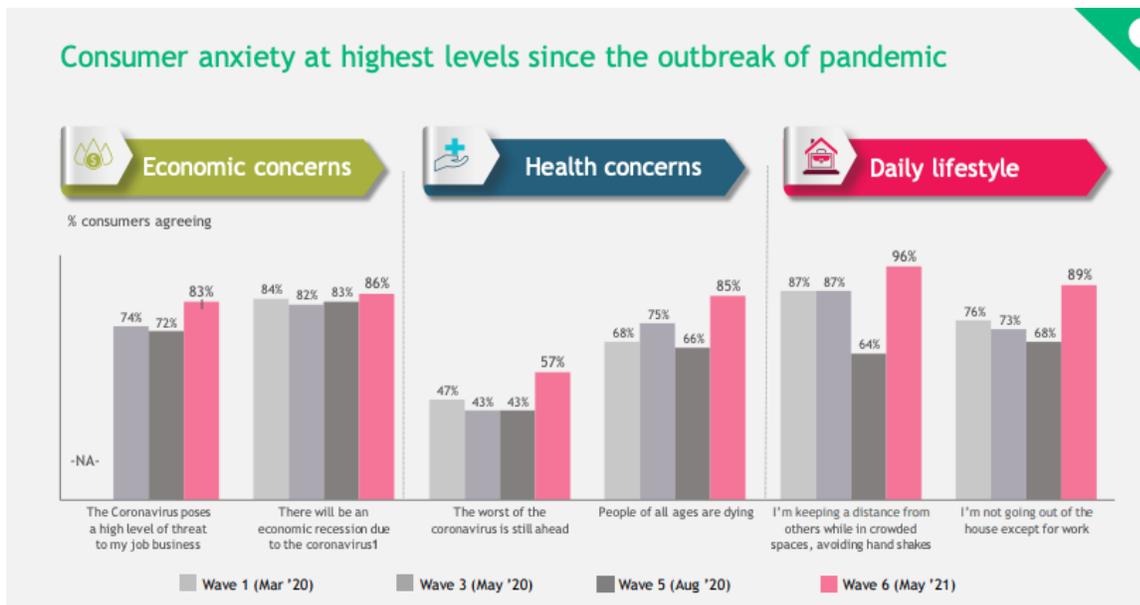
consumer sentiment, consumer anxiety levels and perception about economic outlook and change in income levels. It is significantly evident that the consumer perceptions have changed over a period of time and therefore indicating a dynamic behaviour. Taking analogy, there are possibilities that all findings from studies/researches on Covid-19 impact in past 2 years may not be true over period of time.

Chart-2 Response to question: What comes to your mind when you think about the Covid-19 virus



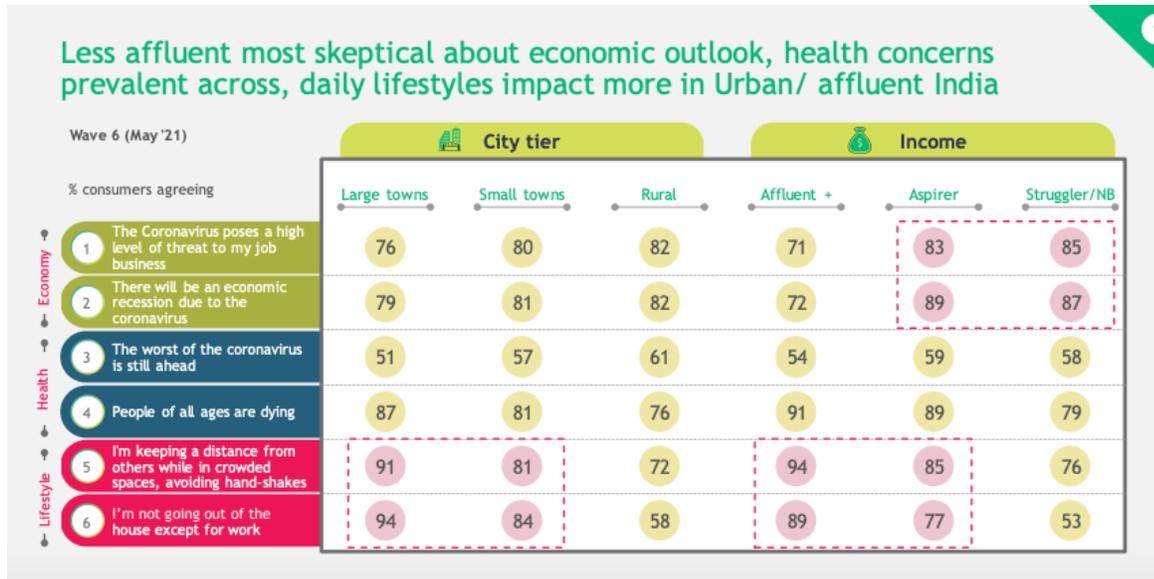
Source-BCG survey

Chart-3 Response to Question: "How much do you agree with each of the following statements about the coronavirus?"



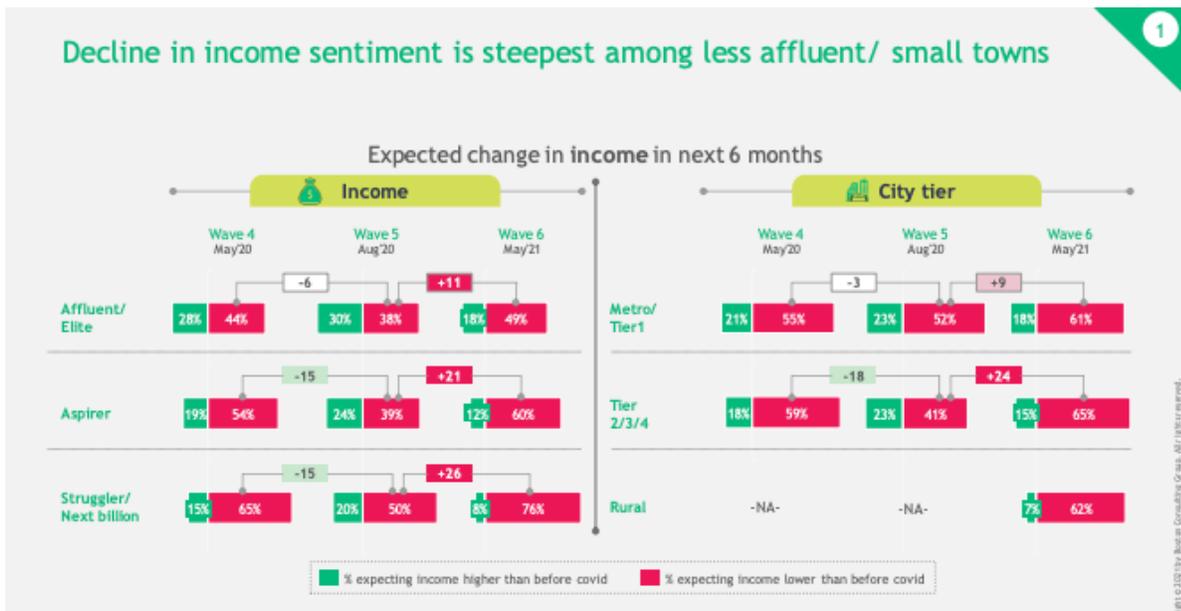
Source-BCG survey

Chart-4 Response to Question: "How much do you agree with each of the following statements about the coronavirus?"



Source-BCG survey

Chart-5 Response to Question: "How do you expect your overall available household income to change in the Next 6 months as compared to before covid?"



Source-BCG survey

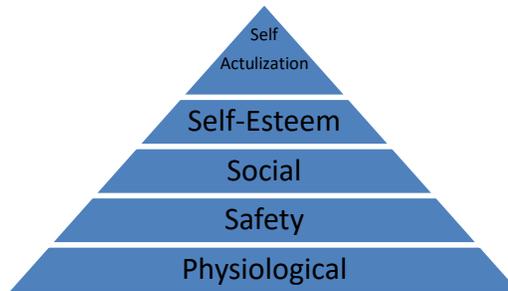
Analytical analysis of Investment pattern and Investment Preferences of Retail Investors Post Covid-19 according to a paper by Kumbhakar and Nerlekar (2020), this study aims to examine the influence of Covid-19 on retail investors' investing patterns and changes in their investment preferences following the epidemic. According to the study's findings, most people adjusted their portfolios after the outbreak of Covid-19. Changes in incomes are mostly to blame for this shift in the portfolio. However, following the pandemic of Covid-19, respondents have become more risk conservative and are transferring their investments to Fixed Income Securities.

Maslow's five categories of needs can be further analysed from a strictly financial perspective. Research has been conducted that relates an individual's spending and savings patterns to a hierarchical pattern, similar to Maslow's hierarchy. In

fact, just as Maslow's needs are hierarchical, a hierarchical order has been established in personal financial decision making and saving motives. In addition to this further studies relating to money attitude finds that gender and family size impact saving motives

Xiao and Noring (1999) also suggest that a hierarchical association exists among financial needs. Their research indicate that financial needs differ based on household characteristics such as home ownership, marital status, number of children, income, education, and several other variables. The implication from this study is that financial needs vary due to the perception of the consumer. There is no one concrete fixed process to savings goals and motives. Multiple characteristics influence these goals. Factors such as age, family size, and length of planning are important predictors for advancing from lower levels to higher levels.

Along with household characteristics, gender has also been investigated as a factor in savings goals. Oleson finds that gender is a component to savings along Maslow's hierarchy of needs, with males being more strongly correlated with the desire to meet safety needs (27.5 percent) and female motivations being more strongly correlated with esteem needs (26.7 percent). Money Attitude and level of need satisfaction are individualized which confirms that individuals have different thresholds of need satisfaction.



II. RESEARCH OBJECTIVES

- To study the impact of Covid-19 the change in spending patterns
- To study the impact of Covid-19 on savings and investment pattern

III. RESEARCH METHODOLOGY

Research Design: Exploratory research design has been used for the study.

Research Approach: Survey approach has been adopted for the study.

Research Instrument: Open-end and close-end questionnaires have been used as study instruments.

Sampling: About 400 respondents have contacted the survey questionnaire and only 203 respondents able to submit full questionnaires who meets criteria of maximum household income of INR 1,50,000 per month or less. Only One earning member taken from a single household.

Data Collection: The primary data for the present study were collected through a questionnaire.

Nature of the Data: The following tables show the nature of the data:

Need based parameters included in the survey: Table-1

Table-1

Physiological	Safety	Social	Self Esteem
Food at home	Insurance	Restaurant	Branded wardrobe
Shelter	Healthcare	Alcohol	Car
Utilities	Savings	Smoking	Vacations outside country
Basic apparel	Investments	Mobile	Own House
Public transport		Pets	
		Vacations In country	
		Child education	

Lower end needs: Physiological and Safety
 Higher end needs: Social and Self-esteem

Table-2A Occupation and gender

Gender	#Daily wager	Full time Job	^Street vendor	Total	%
Female	6	54	44	104	51%
Male	32	37	30	99	49%
Total	38	91	74	203	

Daily wager includes Mechanic of all kind , IT professional, freelancers
 ^Street Vendors includes shop keepers

Table-2B: Household Income

Gender	up to 50000	50001-75000	75001-100000	>100000	Total
Female	3	4	44	53	104
Male	57	26	7	9	99
Total	60	30	51	62	203
%	30%	15%	25%	30%	

Table-2C : Marital Status

Gender	Married	Unmarried	Window	Total
Female	32	59	13	104
Male	39	40	20	99
Grand Total	71	99	33	203

Table-2D : Household Members

Household members	1	3	4	2	>4	Total

Respondents	50	61	20	65	7	203
-------------	----	----	----	----	---	-----

Table-2E: Earning Members including the respondent

Earning members	1	>2	2
Respondents	162	14	27

Table 3. Categorical Data Analysis of Spending behavior towards Lower and Higher End Needs

Age-Range (Years)	25 or less	26-35	36-45	46-55	All
Pre-Covid Spend towards Lower end needs	61.5%	61.8%	61.2%	62.0%	61.5%
Pre-Covid Spend towards Higher end needs	38.5%	38.2%	38.8%	38.0%	38.5%
Post-Covid Spend towards Lower end needs	60.9%	62.1%	61.4%	60.5%	61.5%
Post-Covid Spend towards Higher end needs	39.1%	37.9%	38.6%	39.5%	38.5%
No of Respondents	11	77	93	22	203
Spend towards lower end needs					
Increased	6	43	44	2	95
Reduced	3	14	21	14	52
Remains Same	2	20	28	6	56
No of Respondents	11	77	93	22	203

Source: Author’s own compilation

Out of 203 respondents, 95 have increased spend towards lower end needs, 52 have reduced while 56 have no change to explain. Respondents in age group of up-to 25 years, reduction in lower ends needs was more on an average, while increase is quantum was at low. Respondents underage range of 26-35 years and 36-45 years have shown increase in spend towards lower end needs. Respondents underage range of 45-55 years have reduced spend towards lower end needs. 73 Respondents who increased their lower end needs spend or remained at same level and having one or more child, 33 of them increased their spend preference towards child education.

IV. ANALYSIS AND INTERPRETATION

Statistical Tools: The data in the study were analyzed using chi-square test.

Spending pattern Post Covid-19

Covid-19 has also affected the spending pattern of people. Most of the people have drastically changed their spending habits. Survey used specific leaning towards items mentioned in table-1 and responses were grouped according to Maslow Needy Theory as per table-3.

Statements of Hypotheses (Objective 1)

Ha1: There is a change in spending pattern post Covid 19 towards Lower end needs

Ha2: Age factor has an impact on change in spending patterns

Ha3: Size of Family has an impact on change in spending patterns

Ha4: No of Children have an impact on change in spending patterns

Hypotheses	P-value	Significance level	p-value < Significance level
Ha1	0.00072	0.05	Yes
Ha2	0.82923	0.05	No
Ha3	0.26139	0.05	No
Ha4	0.37461	0.05	No

Source: Author's own compilation

From the above table, we can conclude that:

- There has been a change in Spending Patterns post Covid 19 and those were towards lower end needs as the p-value are less than significance value.
- Size of family, number of children and age factor did not have any impact as the p-value are greater than significance value.

Impact of Covid -19 Pandemic on Saving and investment Behavior

Covid-19 has affected the investment pattern of investors. Due to this, the investors have also made changes in their preferences. They have shifted their investment into less risky avenues. The study covers the differences in investment preferences pre and posts Covid-19.

Statements of Hypotheses (Objective 2):

Ha1: Gender has influenced saving behavior in pre and post Covid-19 scenarios.

Ha2: Household income has impact on saving behaviour in pre and post Covid-19 scenarios.

Ha3: Age factor has contributed to change in investment behavior towards safe heaven like fixed deposits and gold

Hypotheses	P-value	Significance level	p-value < Significance level
Ha1	0.00000	0.05	Yes
Ha2	0.07334	0.05	No
Ha3	0.00263	0.05	Yes

Source: Author's own compilation

From the above tables, we can conclude that:

- The accompanying table shows a high degree of correlation between gender and saving preferences before Covid – 19 and after Covid – 19. The p-value is 0.0000, indicating that the correlation is significant.
- The accompanying table shows a moderate degree of correlation between investor preferences for safe heaven investments before Covid – 19 and after Covid – 19. The p-value is less than 0.05 at a 5% significance level.

V. DISCUSSION

As per the study of data points there has been major change in spending patterns and there is leaning towards spending more on lower end needs, including healthcare and savings for future even with same level of income source. During Covid-19, individuals underwent unexplained uncertainty surrounded them for almost one and half year and lead to change in their lifestyle and belief system. People have definite leaning towards safe heaven investments which are easy to monetize during crises.

In his original research, Maslow suggested that human beings only progress from a lower-order need to a higher-order need once the lower-order need has been met. While logical, this original assertion has suffered much criticism due to numerous findings that suggest that people do not simply ladder up the hierarchy of Needs and preferences are influenced by other aspirations. Mahmoud A. Wahba (1976). Many respondents have shown increased preferences for children education at good schools /universities by committing high spend even they have reduced spend towards level of higher end needs. Similarly, 83% respondent have shown higher preference towards savings in form of fixed deposits and gold to secure future security, even they may have to compromise current returns on investments.

VI. CONCLUSION

Covid-19 has impacted investors' preferences toward safe heaven investments like Gold and Fixed deposit so that they can monetize them at the time of crises. During pandemic , people face job losses , migration , income cut and sort of other uncertainties , which seems to have permanent impact on their preferences and leading to change in life style. People are now spending more towards health care both towards well-being and insurance. People have new and personalised definition of essential and non-essential things and directed their spends. However such behaviour would continue to be dynamic and may shape over in due course of time.

VII. LIMITATIONS

- 1- Random sampling method was used
- 2- Respondent belongs to lower middle-class households in urban city of Gurgaon with income levels up to INR 1,55,000 and age group of up to 55 years.

REFERENCES

- [1] <https://blogs.worldbank.org/opendata/impact-covid-19-poverty-and-inequality-evidence-phone-surveys>
- [2] <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6330263/>
- [3] <https://www.tandfonline.com/doi/pdf/10.1080/1331677X.2020.1863245>
- [4] https://ejmcm.com/article_7689_446a3efce1f6994e17ebc62195223808.pdf
- [5] <https://www.bcg.com/india-covid-19-consumer-sentiment-snapshot-series>
- [6] Xiao and Noring (1999), endnote 6.
- [7] Devaney, Anong, and Whirl (2007), endnote 6; Mark Oleson, "Exploring the Relationship between Money Attitudes and Maslow's Hierarchy of Needs," *International Journal of Consumer Studies* 28, no. 1 (2004): 83- 92.
- [8] Abraham Maslow, "A Theory of Human Motivation," *Psychological Review* 50, no. 4 (1943): 370-396.
- [9] Raef Lee, John D. Anderson, and Michael Kitces, "The Next Wave of Financial Planning," SEI (2019); accessed at: <http://www.smallake.kr/wp-content/uploads/2016/10/SEI-Next-Wave-Financial-Planning-White-Paper.pdf>
- [10] Mahmoud A. Wahba and Lawrence G. Bridwell, "Maslow Reconsidered: A Review of Research on the Need Hierarchy Theory," *Organizational Behaviour and Human Performance* 15, no. 2 (1976): 212-240.
- [11] Gurbaxani, A., & Gupte, R. (2021). A study on the impact of COVID-19 on investor behaviour of individuals in a small town in the state of Madhya Pradesh, India. *Australasian Accounting, Business and Finance Journal*

- [12] Farheen Siddiqui ,Anvita Raghuvanshi ,Srijan Anant , Surendra Kumar (2022) “ Impact of the Covid-19 on the spending pattern and investment behaviour of the retail investors pandemic in rural-urban India. Asian Journal of Economics and Banking

AUTHORS

First Author – Parth Tiwari, Welham Boys School, Dehradun, India, Parthtiwari852@welhamboys.org

Second Author – Sanjay Tomer, Professor , Finance & Investment , FOSTIIMA , New Delhi , India, sanjaytomarfin011@gmail.com

Graphic organizers and the level of students' performance and self-efficacy in an online learning environment

¹ Estacio, Randel D., ² Reyes, Erlee Angel S., ³ Torre Franca, Edward R.

^{1,3} College of Education, Mathematics and Science Department, Quezon City University

² College of Business Administration and Accountancy, Quezon City University

DOI: 10.29322/IJSRP.12.10.2022.p13056

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13056>

Paper Received Date: 15th September 2022

Paper Acceptance Date: 15th October 2022

Paper Publication Date: 21st October 2022

Abstract- Graphic organizers are research-based learning materials and approaches that help students understand a challenging subject. This study aims to see how graphic organizers influence students' performance and self-efficacy in the subject Science, Technology, and Society (STS) in an online setting. It was conducted at Quezon City University (QCU) in the first semester of Academic Year 2021–2022. It used a quasi-experimental study design technique known as the Pretest-Posttest Design. The results demonstrate that participants in the treatment group performed better than those in the control group. After obtaining lessons and learning using various graphic organizers, the subjects in the control group improved their degree of self-efficacy. The study concludes that graphic organizers seemed to influence students' performance and level of self-efficacy in STS. Teachers should use visual organizers to help students enhance their academic accomplishment and self-efficacy, particularly in an online learning setting..

Index Terms- Graphic organizers, Online learning environment, Students' performance, Self-efficacy, Science, Technology, and Society (STS)

I. INTRODUCTION

The COVID-19 pandemic caused a sudden shift in learning mode from face-to-face learning to online and distant learning. There are studies that have been conducted in the past about the usefulness of online courses (Boykin, et al. 2019; Kwon, Shin, & Park, 2018; Ponce, et al. 2018). However, most of these concentrate on comparing traditional classrooms to online classrooms (Boykin, et al. 2019; Kwon, Shin, & Park, 2018; Ponce, et al. 2018), but little research on what effective instructional learning materials and activities are suitable for this kind of learning environment to ensure the promotion of student satisfaction and academic achievement.

According to Kurniaman et al. (2018), when appropriate instructional learning materials are chosen and incorporated into

each lesson, students' performance improves. Furthermore, studies support the claim that relevant and appropriate instructional learning materials do improve students' performances because they directly support the presenting and gathering of facts, principles, and concepts in class (Kaku & Arthur, 2020; Nja et al. 2020; Taculod & Arcilla, Jr., 2020). In addition, the use of appropriate instructional learning materials, whether in a regular face-to-face class (Kaku & Arthur, 2020) or in an online learning space (Yilmaz & Korur, 2021), helps the learners to establish schemas that extend their working memory so that they can understand and learn more difficult information (Chairilysha & Kurnia, 2018). And lastly, with the use of suitable instructional learning materials, students become more engaged and motivated to learn, according to Nasir, Prastowo, and Riwayani (2018). As a result, in order to have the greatest impact, such materials must be carefully planned, selected, organized, refined, and used in a course (Garzon-Diaz, 2021).

Research-based learning materials and strategies that help students learn complex content (Kurniaman & Zufriady, 2019). It is a non-linguistic, visual tool that enables the learner to connect new information to their existing knowledge and see how concepts relate to each other and fit in, which in turn makes them recall information easily (Kurniaman & Zufriady, 2019).

The spatial arrangements of graphic organizers allow the students to identify the missing information or absent connections in one's strategic thinking (Ellis, 2015). According to Conditorio (2010), graphic organizers facilitate student comprehension of science content by showing the interrelatedness of ideas; providing visual cues to help students process the information; and allowing students to direct their own learning by keeping graphic organizers open to interpretation and independent thinking. In fact, dozens of empirical studies were conducted to verify the efficacy of such organizers, and some of these studies asserted their viability for teaching science subjects (Atomatofa, 2013; Chuang, & Liu, 2014; Dexter, Park, & Hughes, 2011; Omondi, Keraro, & Anditi, 2018; Wachanga, Arimba, & Mbugua, 2013). It is found that these organizers help the students visualize the abstract ideas, divide the writing tasks into smaller palatable parts, and monitor

their writing progress (Prihandoko, Slamet, & Winarno, 2018; Suarman & Hikmah, 2018).

In a study conducted by Wang et al. (2020) on the benefits of interactive graphic organizers in online learning, it was revealed that graphic organizers helped students perform better on their test performance and improved students' satisfaction with learning. In addition, the interactive graphic organizers helped increase the students' generative cognitive processes and helped them create graphic organizers in new situations. The study points to the potential of interactive graphic organizers as a tool for priming generative learning strategies in learners. In addition, Ponce et al. (2018) claimed that when graphic organizers are incorporated into a computer-based learning methodology, students' short-term and long-term memories improve.

While graphic organizers improve students' performances, they also improve the level of students' self-efficacy (Eissa, 2012). According to Bandura, as cited by Zimmerman (2015), self-efficacy is a person's perception of his or her ability to complete a task successfully. Additionally, Bandura stated that perceived self-efficacy is concerned with what you believe you can do with the skills you possess in a variety of situations (Olave, 2019; Zimmerman, 2015). Self-efficacy is task-specific, in contrast to other, more general constructs such as self-concept or self-esteem (Olave, 2019; Zimmerman, 2015). Self-efficacy is frequently attributed to four sources of influence: personal experiences, observation of others, physical status, and feedback from others (Panc, Mihalcea, & Panc, 2012; Schunk, 2012).

Self-efficacy has been examined in a range of circumstances, and the findings of self-efficacy research have been consistent across contexts in terms of the relationship between self-efficacy and behaviors (Zimmerman, 2015). When confronted with a difficulty, people with higher levels of confidence were more likely to engage in related actions (Alexander, 2013). Educational psychologists are fascinated with self-efficacy because of its links to motivation, perseverance, performance, and self-regulation (Olave, 2019; Zimmerman, 2015).

Despite the success of using graphic organizers in class (Balasundram & Karpudewan, 2020; Bucayong, 2019; Bucayong & Ong, 2018), there are still areas that need to be clarified, like the influence of graphic organizers in improving the level of self-efficacy of students in an online learning environment, especially in science classes like Science, Technology, and Society (STS) subject at the tertiary level. STS is a new subject in many countries' curricula (Primastuti & Atun, 2018), and because it is new, there are no studies that have particularly looked at students' academic achievement in the subject, especially when it is conducted in an online learning environment.

In general, however, literature indicates that students' performance in science subjects continues to wane, owing to students' negative views toward traditional science, science classes, and science teachers (Li, 2019; Li, 2018; Lin, et al. 2019; Margot & Kettler, 2019; Thibaut, et al. 2018). As a result, researchers investigate how graphic organizers improve students' performance in STS subjects in an online learning environment and how it influences students' level of self-efficacy. Specifically, this study attempts to: describe the performance of

the students before and after receiving traditional learning instructions and learning instructions with different types of graphic organizers; find out the difference between the performance of the students in STS after receiving traditional learning instructions and learning instructions with different types of graphic organizers; describe the level of self-efficacy of the students before and after receiving instructions that utilize different types of graphic organizers; and find out the difference in the level of their self-efficacy before and after receiving instructions and learning with different types of graphic organizers.

Considering the research objectives, the researchers hypothesize that there is no significant difference in the performance of the students who received traditional learning instructions and students who received learning instructions with different types of graphic organizers in STS subject in an online learning environment before and after the conduct of the study; there is no significant difference in the level of self-efficacy of the students who received learning instructions with different types of graphic organizers in STS subject in an online learning environment before and after the conduct of the study; and there is no significant difference in the level of self-efficacy of the students who received learning instructions with different types of graphic organizers in STS subject in an online learning environment before and after the conduct of the study.

II. METHODOLOGY

The theoretical premises of the study include the dual-coding theory (Paivio, 1971) and the self-efficacy theory (Bandura, 1977).

According to the dual-coding theory, verbal associations and visual imagery are the two ways a person can expand on learned material (Paivio, 1971). According to Paivio (1971), both visual and verbal information are used to represent information. Visual and verbal information are processed differently and along distinct channels in the human mind, creating separate representations for information processed in each channel. The mental codes corresponding to these representations are used to organize incoming information that can be acted upon, stored, and retrieved for subsequent use. Both visual and verbal codes can be used when recalling information (Paivio, 1971).

On the other hand, self-efficacy is a person's belief in their ability to succeed in a particular situation (Bandura, 1977). According to Bandura (1977), one's sense of self-efficacy can provide the foundation for motivation, well-being, and personal accomplishment.

The researchers' use of dual-cognitive theory and self-efficacy theory helped them visualize and conceptualize the study. Since the study primarily aims to establish the influence of graphic organizers on students' performances, the dual-coding theory of Paivio (1971) allows the researchers to understand how an individual could expand on learned materials. The self-efficacy theory of Bandura (1977) guided the researchers in presenting graphic organizers in a way that encouraged students to participate and complete the tasks during the conduct of the study.

The study was conducted at Quezon City University (QCU) during the First Semester of the Academic Year 2021–2022. The study utilized first-year Bachelor of Science in Accountancy (BSA) students from QCU to determine the influence of graphic organizers on students' performances and self-efficacy. They were officially enrolled in the subject STS during the First Semester of the Academic Year 2021–2022 at the University. The study used a convenient sampling technique to obtain the sample size due to the restrictions imposed by the Inter-Agency Task Force (IATF) for the Management of Emerging Infectious Diseases in the Philippines on movement and activities during the COVID-19 pandemic.

A total of seventy (70) participants were involved in the study, and they were divided into two groups (Control and Treatment) with thirty-five (35) students each.

The study adopted the quasi-experimental research design technique (Fraenkel, Wallen, & Hyun 2019), specifically, the Pretest-Posttest Design. First, the primary researcher asked the approval of the Quezon City University Office of the Vice President for Research, Extension, Planning, and Linkages (QCU-REPL) to conduct the study, and after the approval, the researcher emailed the Informed Consent Letter and Informed Consent Form to the subjects via Google Forms. When the subject completed and signed the Informed Consent Form and returned it to the primary researcher, the formal experiment began immediately.

The experiment lasted for six (6) weeks. It started on October 9, 2021 and concluded on November 13, 2021. The pre-test was given to the subjects in both groups during the first week of the experiment. It includes sixty (60) multiple-choice items, where each of which is worth one (1) point and requires a working knowledge of fundamental definitions and concepts ranging from simple to complex and distributed into three cognitive levels based on a modified version of Bloom's taxonomy: Knowledge, Understanding and Application, and Higher Mental Process. The General Self-Efficacy Scale (GSES) was given only to the subjects in the treatment group. The GSES was adopted from the Generalized Self-Efficacy Scale by Schwarzer and Jerusalem (1995). The items were modified to suit the objectives of the present study, which includes ten (10) items of structured statements in a Likert format. The self-efficacy of the subjects in the treatment group was interpreted using the mean score computed from their responses on the Likert Scale.

Science and Technology and Nation Building; The Human Flourishing; The Good Life; The Information Age (Gutenberg to social media); Biodiversity and Health Society; and Genetically Modified Organisms: Science, Health, and Politics were taught for six weeks in an online learning environment using the lecture-discussion method. However, the subjects in the treatment group received lecture and discussion of the topics with the addition of several graphic organizers in various parts of the session, such as motivation, activity, summary, assessment, and assignment.

On the sixth week of the experimental procedure, a post-test was administered to both groups to determine their performances. On the other hand, the GSES instrument was given to the subjects in the treatment group after the experiment since they were the group who were exposed to the use of

graphic organizers. In this way, the researchers were able to clearly establish the influence of graphic organizers on the subjects' self-efficacy.

After the retrieval of the research instruments, the responses of the subjects were processed using IBM SPSS Statistics version 22 statistical software. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to interpret the subjects' performances and self-efficacy. Likert scales were used to describe the results and supplement the interpretation derived from the collected data. The difference in individuals' performance in the post-test between the control and treatment groups after the experiment was determined using an independent sample t-test at the 0.05 level of significance.

III. RESULTS AND DISCUSSION

Performance of the subjects before and after receiving traditional learning instructions and learning instructions with different types of graphic organizers

Table 1 shows the over-all mean of the control ($M = 20.20$, $SD = 7.52$) and treatment ($M = 20.23$, $SD = 7.56$) groups in the pretest given to them. As shown in the table, before receiving the traditional method (lecture and discussion), most of the subjects in the control group failed the test given to them. A total of twenty-five subjects out of thirty-five subjects, or 71.42 percent, in the control group got a score that was less than 25 points. There are only five, or 14.29 percent, of the subjects who got a score between 25 and 30 points and are described as "Improve," while the same number of subjects got a score between 31 to 36 points, which is classified as "Pass."

On the other hand, before receiving instructions and learning using various types of graphic organizers, most of the subjects in the treatment group got "Failing" scores on the pre-test given to them. Most of the subjects, or a total of twenty-six subjects out of thirty-five, or 74.29 percent, got a score that is less than 25 points, which is interpreted as "Fail". There are only five, or 14.29 percent, of the subjects who got a score between 25 and 30 points and were described as "improved," while four subjects in the treatment group got a score between 31 to 36, which is classified as "Pass."

Table 1

Pre-test and post-test results of the subjects before and after receiving traditional learning instructions and learning instructions with different types of graphic organizers

Range of Scores	Description	Control Group				Treatment Group			
		Pretest		Posttest		Pretest		Posttest	
		Mean = 20.20, SD = 7.52	Mean = 23.00, SD = 7.25	Mean = 20.23, SD = 7.56	Mean = 31.06, SD = 6.60	f	%	f	%
55-60	Excellent	0	0	0	0	0	0	0	0
49-54	Very Good	0	0	0	0	0	0	0	0
43-48	Good	0	0	0	0	0	0	0	0
37-42	Moderate	0	0	3	8.57	0	0	7	20.00
31-36	Pass	5	14.29	4	11.43	4	11.42	9	25.71
25-30	Improve	5	14.29	7	20.00	5	14.29	16	45.71
Less than 25	Fail	25	71.42	21	60.00	26	74.29	3	8.58

After receiving the traditional method of teaching, subjects in the control group somehow improved their over-all performances, as revealed by their over-all mean ($M = 23.00$, $SD = 7.25$) as shown in Table 1. However, the majority (21 or 60%) of the subjects got a failing score, which is less than 25. Meanwhile, there are a few (7 or 20%) who got a score which is in between 25 to 30 points and described as "Improve". Four or 11.43 percent of the subjects got a passing score of 31 to 36 points, and only three (8.5 percent) got a "Moderate" score between 37 to 42 points. While the subjects in the treatment group show an improvement in their overall performances, as revealed by the overall mean of the post-test given to them ($M = 31.06$, $SD = 6.60$) as shown in the table. Fewer than half of the subjects in the treatment group, or 45.71 percent, got a score ranging from 25 to 30 points, which is described as "Improve", while 25.71 percent got a passing score between 31 to 36 points, which is interpreted as "Pass", and 20 percent got a score between 37 to 42 points, which is construed as "Moderate". While there are only three, or 8.58 percent, in the treatment group, got a failing score, which is less than 25 points.

Data revealed that subjects in the control group who are subjected to the traditional lecture discussion method show a slight improvement in their performance in the class. It was observed that during the lecture discussion, students get direct feedback from the teacher. And thus, it is expected that they performed better after the duration of the experiment, as manifested in the results of their post-test exam. However, it was also observed that some students during the lecture-discussion manipulate the entire discussion while others remain passive during the discussion. Thus, it can be related to the result of the post-test, where there is a smaller number of subjects who got "pass" or "moderate" scores. Also, it was observed that subjects with limited communication abilities in the control group could not participate in the discussion.

The traditional lecture-discussion method used in the control group was found to be slightly effective at improving the subjects' overall performance, as revealed by the results of their post-test. The result is congruent with studies comparing the lecture-discussion method with other teaching and learning strategies (Avila, 2020; Mutrofin, et al. 2017; Smale-Jacobse, et al. 2019), where the traditional method of teaching slightly improves the performance of the students. By comparing the means before and after the traditional lecture discussion, students' engagement still increased using this kind of method. The results can also be interpreted that the traditional lecture-discussion method improves students' ability to think creatively and at the same time strengthens their existing cognitive structures.

On the other hand, data revealed that the combination of the lecture discussion method and the use of graphic organizers as learning instructional material directly improves the subjects' performances. During the experiment, the teacher maximized the use of graphic organizers by asking questions that require reasoning, analyzing, and evaluating, such as "why and how" instead of "what". It was observed that when graphic organizers are used as part of the lecture-discussion to present concepts, it allows students to actively participate and permits them to carefully analyze the relationships among concepts and relate them to their previous knowledge or constructs.

The result of the post-test is not surprising to the researchers because it was observed that during the experiment, when the teacher uses graphic organizers as part of the lecture-discussion and even as part of the motivational strategy, graphic organizers help the subjects focus on a particular concept and avoid irrelevant answers or ideas. Graphic organizers also permit a tactful way of accepting doubtful answers that encourages students to participate in the discussion. Similarly, the results agree with the study conducted by Balasundram and Karpudewan (2020), Bishop et al. (2015), Bucayong (2019), Bucayong and Ong (2018), Ilter (2016), and Lingaiah and Dhanapal (2020) that when graphic organizers are given or incorporated in class, students perform better as compared with their initial performances in class after using the material.

Furthermore, it was discovered that graphic organizers help students perform better because they carefully guide the discussion by allowing the teacher to ask questions at various points and provide clues to keep it on a clear and smooth flow of discussion. Also, with the use of graphic organizers, it avoids the "continuous talk" of the teacher during the lecture-discussion, which may sound boring to some students.

The results indicate that whenever an instructional intervention, like the use of graphic organizers, is given to students, they perform better after receiving such an intervention. According to Myers and Savage (2005), instructional materials like graphic organizers promote comprehension and aid in students' learning with complex content, and so it does as reveal in the results of the subjects' post-test results. And lastly, after utilizing various types of graphic organizers in class, subjects in the treatment group improve their performance. It allows students to reason out, analyze, and evaluate concepts presented to them. Graphic organizers help them to organize their thoughts and ideas and relate them to previous concepts in a way that helps them perform better on the post-test given to them.

Performance of the subjects in STS after receiving traditional learning instructions and learning instructions with different types of graphic organizers

Result shows that the scores in the treatment group ($M = 31.06$, $SD = 6.60$) is significantly different from scores in control group ($M = 23.00$, $SD = 7.56$) as revealed by the result of the independent sample t-test, $t(68) = -4.749$, $p < 0.001$ presented in Table 2.

Table 2.

Difference between the performance of the subjects in STS after receiving traditional learning instructions and learning instructions with different types of graphic organizers

Groups	Mean	SD	df	t	p-value
Control	23.00	7.56	68	-4.749*	.000
Treatment	31.06	6.60			

The data indicates that instruction and learning with various types of graphic organizers has a direct effect on students' performance. When the post-test results from the two groups were compared, subjects in the treatment group outperformed their counterparts in the control group. This is because, when using the lecture-discussion method, those with superior communication skills tend to monopolize the discussion. Additionally, when the lecture method is used indefinitely without any form of learning activity or the incorporation of a variety of instructional learning materials or strategies, the session tends to become boring, especially for learners with a short attention span.

The significant difference in mean scores of the post-test between the control and treatment groups demonstrates that graphic organizers help subjects develop their capacity to draw on prior knowledge to become independent readers, active citizens, and problem solvers of complex problems. Graphic organizers enable subjects to construct the processes associated with teaching and learning, which ultimately improves their performance. Additionally, one could argue from the findings that subjects develop autonomy and the capacity for complex thinking because of the deliberate design and implementation of graphic organizers. Additionally, observations made during the experiment indicate that various types of graphic organizers, such as tree maps, concept maps, Venn diagrams, semantic organizers, and the Frayer model, can be used effectively in a variety of contexts and different parts of the lesson. Notably, the results indicate that graphic organizers can aid subjects in deconstructing information into smaller categories in order to make inferences. Also, the findings indicate that subjects can benefit from the use of graphic organizers in an online learning environment, in small groups, or independently.

As previously mentioned, graphic organizers are pictorial ways of constructing knowledge based on existing knowledge and organizing complex information in a simple-to-understand manner in the mind (Degrano, 2017). The above results reaffirm the views of Marzano et al. (2001) that, as students complete graphic organizers and socially interact with their peers, they develop creative and critical thinking skills. The net result is the occurrence of meaningful learning, which enhances their ability to transfer classroom knowledge to real-life situations (Marzano et al., 2001). The significant difference in the performance of the subjects after the experiment supports the claims of Ajverdi, Nakiboglu, and Aydin (2014) and Vallori (2014) that graphic organizers show how concepts are linked to prior knowledge to aid in understanding, improve memory, retain information, and increase students' understanding and insight into the topic. Furthermore, the study conducted by Khamkhong (2018) revealed that after receiving training, developing, and implementing graphic organizers, an increase in the students' test scores was funded, which is like the results of this study. Thus,

the findings assert that when utilized properly, graphic organizers are useful and effective in improving students' performances in class.

With the results, the null hypothesis that there is no significant difference in the performance between the two groups of subjects after receiving traditional instruction and after receiving instruction and learning using various types of graphic organizers is rejected.

Level of self-efficacy of the subjects before and after receiving instructions that utilize different types of graphic organizers

The over-all self-efficacy level of the subjects before receiving instructions that utilize different types of graphic organizers is described as "somewhat confident," with a computed over-all mean value of 2.95 and a standard deviation of 0.18 (see Table 3). As we gleaned from the table, respondents described their self-efficacy level as "somewhat confident" when it comes to their ability to apply STS concepts in addressing issues of climate change (M = 3.20, SD = 0.53), awareness of the positive and negative implications of nanotechnology to society (M = 3.11, SD = 0.83), and in determining the relationship between society, environment, and health (M = 3.09, SD = 0.74). In addition, the subjects said that they are "somewhat confident" when it comes to their ability to discuss and share with others the ethics and implication of GMO's (M = 2.97, SD = 0.71), being aware of the importance of biodiversity to the human race and to the development of society (M = 2.94, SD = 0.76) and of the potential future impacts of Genetically Modified Organisms (GMOs) on agriculture and crop production (M = 2.91, SD = 0.66), and being aware of the current situation of the world's climate and its changing state (M = 2.91, SD = 0.78) before using graphic organizers in class.

Subjects also said that they are "somewhat confident" when it comes to their ability to discuss the major impacts of nanotechnology on society confidently (M = 2.89, SD = 0.68), straightforwardly link the information or concepts that they have learned to the development of the information age and its impact on society (M = 2.83, SD = 0.82), and ability to illustrate how the social media and the information age have impacted our lives (M = 2.63, SD = 0.65) as revealed by the General Self-Efficacy survey before the experiment.

The results indicate that the self-efficacy of the subjects in the treatment group is not affected by any intervention or instructional learning materials like the graphic organizers before the experiment. Thus, any change in the subjects' level of self-efficacy after the treatment is somehow attributed to the intervention or instructional learning material used.

Table 3

Self-efficacy of the subjects in the treatment group before and after receiving instructions that utilize different types of graphic organizers

General Self-Efficacy Scale Item	Before Instruction			After Instruction		
	Mean	SD	Description	Mean	SD	Description
1. I can	2.83	0.82	Somewhat	3.60	0.69	Fairly

Statement	Confident		Confident		of climate change.		
	Pooled Mean	2.95	0.18	Somewhat Confident	3.89	0.21	Fairly Confident
straightforwardly link the information or concepts that I have learned to the development of the information age and its impact to society.							
2. I am completely able to illustrate how the social media and the information age have impacted our lives.	2.63	0.65	Somewhat Confident	3.80	0.72	Fairly Confident	
3. I can easily determine the relationship between society, environment, and health.	3.09	0.74	Somewhat Confident	3.91	0.78	Fairly Confident	
4. I am fully aware of the importance of biodiversity to human race and to the development of the society.	2.94	0.76	Somewhat Confident	4.14	0.77	Fairly Confident	
5. I am able to discuss and share to others the ethics and implication of Genetically Modified Organisms (GMO's).	2.97	0.71	Somewhat Confident	4.09	0.78	Fairly Confident	
6. I am completely aware of the potential future impacts of Genetically Modified Organisms (GMOs) to agriculture and crop production.	2.91	0.66	Somewhat Confident	3.86	0.77	Fairly Confident	
7. I am confidently able to discuss the major impacts of nanotechnology on society.	2.89	0.68	Somewhat Confident	3.80	0.80	Fairly Confident	
8. I am fully aware of the positive and negative implications of nanotechnology to society.	3.11	0.83	Somewhat Confident	4.00	0.77	Fairly Confident	
9. I am fully aware of the current situation of the world's climate and its changing state.	2.91	0.78	Somewhat Confident	3.83	0.66	Fairly Confident	
10. I can apply STS concepts in addressing issues	3.20	0.53	Somewhat Confident	3.91	0.74	Fairly Confident	

After receiving instructions using different types of graphic organizers, the subjects in the treatment group said that the level of their self-efficacy is "fairly confident," with a computed over-all mean value of 3.89 and a standard deviation of 0.21 as shown in Table 3. Specifically, respondents said that after exposure to various types of graphic organizers they become "fairly confident" after being exposed to various types of graphic organizers when it comes to being aware of the importance of biodiversity to the human race and to the development of society (M = 4.14, SD = 0.77), the ability to discuss and share with others the ethics and implications of genetically modified organisms (GMO's) (M = 4.09, SD = 0.78), and being fully aware of the positive and negative implications of nanotechnology to society (M = 4.00, SD = 0.77).

Moreover, Table 3 revealed that the subjects under the treatment group said that they have become "fairly confident" when it comes to their ability to apply STS concepts in addressing issues of climate change, and they can easily determine the relationship between society, environment, and health (M = 3.91, SD = 0.78) after utilizing the different types of graphic organizers in class. Lastly, the results of the GSES rating scale given to the subject under the treatment group after being exposed to various graphic organizers revealed that the level of self-efficacy of the subject when it comes to being completely aware of the potential future impacts of Genetically Modified Organisms (GMOs) to agriculture and crop production (M = 3.86, SD = 0.77), being fully aware of the current situation of the world's climate and its changing state (Mean = 3.83, SD = 0.66), being able to discuss the major impacts of nanotechnology on society confidently (M = 3.80, SD = 0.80), being able to illustrate how the social media and the information age have impacted our lives completely (M = 3.80, SD = 0.80), being able to illustrate how the social media and the information age have impacted our lives completely (M = 3.80, SD = 0.72), and being able to link the information or concepts that they have learned to the development of the information age and its impact on society straightforwardly (M = 3.60, SD = 0.69) is "fairly confident".

It can be gleaned from the data that graphic organizers directly affect the level of self-efficacy of the respondents. This is true because during the treatment, subjects in the treatment group showed an interest in using graphic organizers as part of individual and group activities as well as during formative assessment. As observed, they were highly engaged in developing their own organizers, especially when they presented their individual work in class. The creativity of the students during the presentation was expressed. They were also able to articulately express their own ideas when they were asked to present their work in class.

Furthermore, it was observed that the subjects in the treatment group were confident enough to answer the teachers' questions with the help of their personally made graphic organizers. Online classroom discussions become lively and interactive as the subjects participate during the presentation of their work. They were able to answer the "why" and "how"

questions during the discussion. And it is evident that their confidence improves as the lesson progresses using graphic organizers.

The results reflect how graphic organizers develop confidence among the subjects in the treatment group during the experiment. Data showed that after using graphic organizers, subjects became "fairly confident" about the topics presented to them, compared to their reported level of self-efficacy prior to the experiment. This is because, primarily, graphic organizers tend to help the subjects with visualizing and constructing ideas, organizing complex ideas, and sequencing available information. It was also observed that when the students use the graphic organizers as part of their presentation and formative assessment, they learn how to plan what to write, increase their reading comprehension, initiate brainstorming among group members, organize problems and solutions, compare ideas, show cause and effect, and many more.

Additionally, since graphic organizers help the subjects organize their thoughts and ideas and present them as a single concrete idea, they gain the confidence to share what they know. As observed during the experiment, students also learn how to accept their mistakes and show their willingness to eliminate information or concepts that are not relevant to the discussion.

Based on the results, the level of self-efficacy of the subjects in the treatment group improved after they were exposed to various types of graphic organizers in class. This is consistent with the idea of Alexander (2013), where she asserted that when confronted with a difficulty, people with higher levels of self-efficacy were more likely to engage in related actions (Alexander, 2013). Thus, as the subjects in the treatment group are continuously exposed to the different types of graphic organizers which they need to answer, they become more engaged in the task and their performance in the class increases (Olave, 2019; Zimmerman, 2015). The results also confirm the findings of Eissa (2012) on his study about the effect of using advanced graphic organizers on academic achievement, self-efficacy, and motivation to learn social studies in learning disabled second-year prep students.

As revealed in the results of the GSES rating scale given to the subjects in the treatment group after the experiment, graphic organizers improve students' self-efficacy towards learning. The results suggest that utilizing various types of graphic organizers and maximizing their potential use in class helps to improve students' self-efficacy, motivation, and performance.

Difference in the level of self-efficacy of the subjects before and after receiving instructions and learning with different types of graphic organizers

Table 4 shows the difference in the level of self-efficacy of the subjects before and after receiving instructions and learning with different types of graphic organizers. Data indicate that the level of self-efficacy of subjects in the treatment group (M = 2.95, SD = .181) prior to treatment is significantly different than the level of self-efficacy following treatment (M = 3.89, SD = .210), $t(68) = -4.749$, $p < 0.001$.

Table 4

Difference in the level of self-efficacy of the subjects in the treatment group before and after receiving instructions and learning with different types of graphic organizers

Self-efficacy	Mean	SD	Df	t	p-value
Before	2.95	.181	68	-20.208*	.000
After	3.89	.210			

The results argue that when the treatment group was exposed to various types of graphic organizers in class, their self-efficacy increased. In other words, instruction and learning that incorporates various types of graphic organizers have been shown to increase students' self-efficacy.

As evidenced by the significant difference in mean scores between the treatment and control groups following the experiment, graphic organizers increase students' self-efficacy for learning. The findings indicate that incorporating a variety of graphic organizers and maximizing their potential for use in class can help students' self-efficacy, motivation, and performance.

Data indicates that graphic organizers have a direct effect on respondents' self-efficacy. This is because subjects in the treatment group demonstrated an interest in using graphic organizers as part of individual and group activities, as well as during formative assessment throughout the treatment. They were extremely engaged in developing their own organizers, which is especially important when they present their individual work in class. Throughout the presentation, the students' creativity was demonstrated. Additionally, they were able to articulate their own ideas when asked to present their work in class. In addition, it was observed that the subjects in the treatment group were confident in their ability to respond to the teachers' questions using their self-created graphic organizers. As subjects participate in the presentation of their work, classroom discussions become lively and interactive. Throughout the discussion, they were able to respond to the "why" and "how" questions. And it's clear that their confidence grows as the lesson progresses using graphic organizers.

The results demonstrate how graphic organizers foster confidence in subjects in the treatment group over the course of the experiment. The data revealed that after using graphic organizers, subjects developed a "fairly confident" attitude toward the topics presented to them, compared to their pre-experiment level of self-efficacy. This is because graphic organizers assist subjects in visualizing and constructing ideas, organizing complicated ideas; and sequencing available information. Additionally, it was observed that when students use graphic organizers as part of their presentation and formative assessment, they learn how to plan what to write, improve their reading comprehension, initiate group brainstorming, organize problems and solutions, compare, and contrast ideas, and demonstrate cause and effect, among other skills.

Additionally, because graphic organizers assist subjects in organizing their thoughts and ideas and distilling them into a single concrete concept, they gain confidence in sharing what they have learned. As demonstrated during the experiment, students also learn how to accept their mistakes and demonstrate their willingness to omit irrelevant information or concepts from the discussion.

The findings of this study confirm the relationship of self-efficacy with behavior (Zimmerman, 2015), as the subjects' self-efficacy improved when they were exposed to activities that required higher-order thinking using graphic organizers. The findings support Alexander's (2013) hypothesis that people with higher levels of self-efficacy are more likely to engage in related actions when confronted with a challenge (Alexander, 2013). As the treatment group's subjects are continually exposed to the various types of graphic organizers that they must complete, they become more engaged in the task and their class performance improves (Olave, 2019; Zimmerman, 2015).

Furthermore, the findings back up Eissa's (2012) findings on the impact of advanced graphic organizers on academic achievement, self-efficacy, and motivation to learn social studies in learning disabled second-year prep students. As a result, the findings suggest that graphic organizers should be used to improve students' achievement, self-efficacy, and motivation to learn science topics.

Based on the given findings, the null hypothesis that there is no significant difference in the level of self-efficacy between subjects in the treatment group before and after receiving instructions and learning using various types of graphic organizers is rejected.

IV. CONCLUSION

Based on the results of the study, the researchers found that most of the subjects in the control group failed the test in STS given to them before receiving the traditional method of teaching, and a slight improvement in their performances was observed after the procedure. Similarly, most of the subjects in the treatment group failed the test in STS given to them before receiving instructions and learning with different types of graphic organizers. However, after the procedure, subjects in the treatment group improved their overall performance on the test given to them. While comparing the results of the post-test given to the two groups, subjects in the treatment group performed better as compared to the performances of the subjects in the control group. It can be argued that graphic organizers seemed to influence the performance of subjects more in STS than in the traditional way of instruction.

Furthermore, most of the subjects in the treatment group had a low level of self-efficacy before receiving instructions and learning using various types of graphic organizers. However, an improvement in the level of their self-efficacy is seen after receiving instructions and learning using various types of graphic organizers. Subjects in the treatment group demonstrated a significant difference in self-efficacy before and after receiving instructions and learning using various types of graphic organizers in ST. The level of the subjects' self-efficacy significantly improved after receiving instructions and learning utilizing different types of graphic organizers. Graphic organizers seemed to influence the level of the subjects' self-efficacy in STS.

From the significant findings and conclusions of the study, it was recommended that students make a greater effort to improve their grades. On the other hand, teachers should innovate traditional instructional strategies by incorporating research-based instructional materials that support student

learning and achievement, as well as the overall teaching and learning process. They should make a more concerted effort to improve their academic performance. Conversely, teachers should utilize a variety of instructional learning materials, such as graphic organizers, to help students improve their academic achievement and learning performance.

In addition, graphic organizers should be used and maximized inside and outside the classroom, especially in teaching science concepts in an online learning environment. Teachers should take advantage of using graphic organizers as an instructional learning material to improve student learning. Additionally, teachers should be trained in how to use various types of instructional learning materials like graphic organizers to effectively deliver science concepts.

Students' level of self-efficacy should be considered when selecting appropriate instructional learning materials for an online learning environment that will be used in teaching science subjects. In addition, teachers should design effective instructional learning materials and resources considering the level of the students' self-efficacy to facilitate learning, enhance motivation, and improve academic performance.

And lastly, the self-efficacy of the learners should be considered in designing, developing, and selecting instructional learning materials in teaching science subjects. Educational leaders and school administrators should support the use of available instructional learning materials by providing seminars and workshops to teachers and instructional developers about instructional learning material development, selection, and modification. Teachers also improve their skills in selecting and evaluating instructional learning materials by submitting themselves to training and graduate school.

ACKNOWLEDGMENT

The researchers would like to thank all the respondents who participated in this study despite the pandemic. The primary author would also like to acknowledge the support and patience of his family during the conduct of this study. Special thanks to Dr. Theresita V. Atienza, the QCU University President, for her encouragement to complete the manuscript.

REFERENCES

- [1] Ajverdi, L., Nakiboglu, C. & Aydin, O. Z. (2014). Use of graphic organizers in science and technology. *Procedia: Social and Behavioral Sciences*, 116, 4264-4269
- [2] Alexander, P. (2013). Calibration: What is it and why it matters? An introduction to the special issue on calibrating calibration. *Learning and Instruction*, 24, 1-3.
- [3] Atomatofa, R. (2013). Effects of Advance Organizers on Attainment and Retention of Students' Concept of Gravity in Nigeria. *International Journal of Research Studies in Educational Technology*, 2(1), 81-90. <https://doi.org/10.5861/ijrset.2013.363>
- [4] Avila, M. (2020). Teaching Purposive Communication in Higher Education Using Contextualized and Localized Techniques. *International Journal of Scientific and Research Publications (IJSRP)*, 10(09); p105103
- [5] Balasundram N. & Karpudewan M. (2020). Embedding multiple modes of representations in open-ended tests on learning transition elements, in Teo T. W., Tan A. L. and Ong Y. S. (ed.), *Science Education in the 21st Century: Re-searching Issues that Matters from Different Lenses*, Singapore: Springer, pp. 113-136.

- [6] Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191–215. <https://doi.org/10.1037/0033-295X.84.2.191>
- [7] Bishop, A., Sawyer, M., Alber-Morgan, S., & Boggs, M. (2015). Effects of a Graphic Organizer Training Package on the Persuasive Writing of Middle School Students with Autism. *Education and Training in Autism and Developmental Disabilities* 50(3):290-302
- [8] Boykin, A., Evmenova, A., Regan, K., & Mastropieri, M. (2019). The impact of a computer-based graphic organizer with embedded self-regulated learning strategies on the argumentative writing of students in inclusive cross-curricula settings, *Computers & Education*, Volume 137, Pages 78-90, ISSN 0360-1315, <https://doi.org/10.1016/j.compedu.2019.03.008>.
- [9] Bucayong, C. (2019). Mixed method analysis in assessing the effectiveness of intentional learning instruments in teaching circuits. *PEOPLE: International Journal of Social Sciences*, 4(3), 1426-1442
- [10] Bucayong, C & Ong, B. (2018). Predicting conceptual understanding of DC Circuits using intentional learning questionnaire. *Advanced Science Letters*, 24(11); pp.7866-7870(5). DOI: <https://doi.org/10.1166/asl.2018.12445>
- [11] Chairilisyah, D., & Kurnia, R. (2018). Teacher assessment to school readiness on the 5–6-year-old children in state kindergarten in Pekanbaru (Motoric Physical, Social Emotional, Moral, Language, and Cognitive Aspect). *Journal of Educational Sciences*, 2(2), 74-82.
- [12] Chuang, H., & Liu, H. (2014). Investigating the Effect of Different Verbal Formats of Advance Organizers on Third Graders Understanding of Heat Transfer Concept. *International Journal of Education In Mathematics, Science and Technology*, 2(1), 78-84. <https://doi.org/10.18404/ijemst.59887>
- [13] Condidorio, K. (2010). The Usefulness of Graphic Organizers in Enhancing Science Learning. Master's Thesis, St. John Fisher College, Rochester, New York.
- [14] Degrano, P. (2017). Teaching Earth and Space through computer-aided instructional materials. Unpublished Thesis. Surigao State College of Technology, Surigao City
- [15] Dexter, D., Park, Y., & Hughes, C. (2011). A Meta-Analytic Review of Graphic Organizers and Science Instruction for Adolescents with Learning Disabilities: Implications for the Intermediate and Secondary Science Classroom. *Learning Disabilities Research and Practice*, 26, 204-213. <https://doi.org/10.1111/j.1540-5826.2011.00341.x>
- [16] Eissa, M. (2012). The Effects of Advance Graphic Organizers Strategy Intervention on Academic Achievement, Self-efficacy, and Motivation to learn Social Studies in Learning Disabled second year Prep Students, *International Journal of Psycho-Educational Sciences*, 1(1); pp. 18-26
- [17] Ellis, E. (2015). Differentiated visual tools for vocabulary: Real-world connections. Northport, AL: MakesSenseStrategies.com
- [18] Fraenkel, J., Wallen, N., & Hyun, H. (2019). *How to Design and Evaluate Research in Education* (10th Ed.) New York: McGraw-Hill Book Company.
- [19] Garzón-Díaz, E. (2021). Translanguaging in Science Lessons: Exploring the Language of Science in L2 Low Achievers in a Public-School Setting in Colombia. *International Perspectives on CLIL*, pages 85-106.
- [20] İtler, İ. (2016). The Power of Graphic Organizers: Effects on Students' Word-Learning and Achievement Emotions in Social Studies. *Australian Journal of Teacher Education*, 41(1). Retrieved from <http://ro.ecu.edu.au/ajte/vol41/iss1/3>
- [21] Kaku, D. & Arthur, F. (2020). Perceived effect of instructional materials on the effective teaching and learning of Economics. *European Journal of Education Studies*, 7(9); pp. 26-36
- [22] Khamkhong, S. (2018). Developing English L2 critical reading and thinking skills through the PISA reading literacy assessment framework: A Case Study of Thai EFL Learners. 3L: The Southeast Asian Journal of English Language Studies, 24(3), 83–94. <http://doi.org/10.17576/3L-2018-2403-07>.
- [23] Kurniaman, O. & Zufriady (2019). The Effectiveness of Teaching Materials for Graphic Organizers in Reading in Elementary School Students. *JES*, Vol. 3, No. 1, 48-62 *Journal of Educational Sciences*. Retrieved at <https://ejournal.unri.ac.id/index.php/JES>. Doi: <https://doi.org/10.31258/jes.3.1.p.48-62>
- [24] Kurniaman, O., Zufriady, Mulyani, E., & Simulyasih, N. (2018). Reading comprehension skill using graphic organizer for elementary school student. *Journal of Teaching and Learning in Elementary Education (JTLEE)*, 1(2), 75-80.
- [25] Kwon, K., Shin, S. & Park, S. (2018). Effects of graphic organizers in online discussions: comparison between instructor-provided and student-generated. *Education Tech Research Dev* 66, 1479–1503. <https://doi.org/10.1007/s11423-018-9617-7>
- [26] Li, Y. (2018). Journal for STEM education research – promoting the development of interdisciplinary research in STEM education. *Journal for STEM Education Research*, 1(1–2), 1–6. <https://doi.org/10.1007/s41979-018-0009-z>.
- [27] Li, Y. (2019). Five years of development in pursuing excellence in quality and global impact to become the first journal in STEM education covered in SSCI. *International Journal of STEM Education*, 6, 42. <https://doi.org/10.1186/s40594-019-0198-8>.
- [28] Lin, T., Lin, T., Potvin, P., & Tsai, C. (2019). Research trends in science education from 2013 to 2017: A systematic content analysis of publications in selected journals. *International Journal of Science Education*, 41(3), 367–387.
- [29] Lingaiah, J. & Dhanapal, S. (2020). Use of Graphic Organiser and Instructional Scaffolding as a Teaching Strategy for TESL Undergraduates: An Overview of Students' Experiences. *Journal of Humanities and Social Sciences Research* 2(1):87-102
- [30] Margot, K., & Kettler, T. (2019). Teachers' perception of STEM integration and education: A systematic literature review. *International Journal of STEM Education*, 6, 2. <https://doi.org/10.1186/s40594-018-0151-2>.
- [31] Marzano, R. J., Pickering, D., & Pollock, J. E. (2001). Classroom instruction that works: Research-based strategies for increasing student achievement. Ascd.
- [32] Mutrofin, Degeng, I., Ardhana, W., & Setyosari, P. (2017). The Effect of Instructional Methods (Lecture-Discussion versus Group Discussion) and Teaching Talent on Teacher Trainees Student Learning Outcomes. *Journal of Education and Practice*, 8(9).
- [33] Myers, M. & Savage, T. (2005). Enhancing student comprehension of social studies material. *Social Studies*, 96, 18-24.
- [34] Nasir, M., Prastowo, R., & Riwayani (2018). Design and development of Physics learning media of three-dimensional animation using blender applications on Atomic Core material. *Journal of Educational Sciences*, 2(2), 23-32.
- [35] Nja, C., Cornelius-Ukpepi, B., Edoho, E., & Neji, H. (2020). Enhancing students' academic performance in Chemistry by using kitchen resources in Ikom, Calabar. *Educational Research and Reviews*, 15(1); pp. 19-26
- [36] Olave, B. (2019). Self-efficacy and academic performance among college students: Analyzing the effects of team-based learning. (Master's Thesis) California State University, Sacramento
- [37] Omondi, K., Keraro, F. & Anditi, Z. (2018). Effects of Advance Organizers on Students' Achievement in Biology in Secondary Schools in Kilifi County, Kenya. *Frontiers in Education Technology*, 1(2); pp. 191-205
- [38] Paivio, A. (1971). *Imagery and Verbal Processes*. New York: Holt, Rinehart & Winston.
- [39] Panc, T., Mihalcea, A. & Panc, I. (2012). Self-Efficacy Survey: a new assessment tool. *Procedia - Social and Behavioral Sciences* 33, 880 – 884. doi:10.1016/j.sbspro.2012.01.248
- [40] Ponce, H., Mayer, R., López, M. (2018). Adding interactive graphic organizers to a whole-class slideshow lesson. *Instr Sci* 46, 973–988. <https://doi.org/10.1007/s11251-018-9465-1>
- [41] Prihandoko, Y., Slamet, S., & Winarno. (2018). Cognitive Moral Based on Civics Education Material in Elementary School. *Journal of Education and Learning (EduLearn)*, 12(3), 472-477. DOI: 10.11591/edulearn.v12i3.8587.
- [42] Primastuti, M. & Atun, S. (2018). Science Technology Society (STS) learning approach: an effort to improve students' learning outcomes. *IOP Conf. Series: Journal of Physics: Conf. Series* 1097
- [43] Schunk, D. H. (2012). *Learning theories an educational perspective sixth edition*. Pearson.
- [44] Smale-Jacobse, A. E., Meijer, A., Helms-Lorenz, M., & Maulana, R. (2019). Differentiated instruction in secondary education: A systematic review of research evidence. *Frontiers in psychology*, 10, 2366.
- [45] Suarman, H. & Hikmah, N. (2018). Development of innovative teaching materials through scientific approach. *Journal of Educational Sciences*, 2(2), 14-22.
- [46] Taculod, N. & Arcilla, Jr. F. (2020). Enhancing the Academic Performance and Learning Interest in Biology of Grade 10 Students Using Expanded PowerPoint Instruction. *SMCC Teacher Education Journal*, 2; pp. 57-81

- [47] Thibaut, L., Ceuppens, S., De Loof, H., De Meester, J., Goovaerts, L., Struyf, A., Pauw, J. B., Dehaene, W., Deprez, J., De Cock, M., Hellinckx, L., Knipprath, H., Langie, G., Struyven, K., Van de Velde, D., Van Petegem, P., & Depaeppe, F. (2018). Integrated STEM education: A systematic review of instructional practices in secondary education. *European Journal of STEM Education*, 3(1), 2.
- [48] Vallori, A. (2014). Meaningful learning in practice. *Journal of Education and Human Development* 3 (4), 199-209
- [49] Wachanga, S. W., Arimba, A. M., & Mbugua, Z. K. (2013). Effects of Advance Organizers Teaching Approach on Secondary School Students' Achievement in Chemistry in Maara District, Kenya. *International Journal of Social Science and Interdisciplinary Research*, 2(6), June 2013.
- [50] Wang, X., Mayer, R., Zhou, P. & Lin, L. (2020). Benefits of interactive graphic organizers in online learning: Evidence for generative learning theory. *Journal of Educational Psychology*, American Psychological Association (APA). DOI: 10.1037/edu0000606
- [51] Yilmaz, E., & Korur, F. (2021). The effects of an online teaching material integrated methods on students' science achievement, attitude and retention. *International Journal of Technology in Education (IJTE)*, 4(1), 22-45. <https://doi.org/10.46328/ijte.79>
- [52] Zimmerman, W. A. (2015). *Impact of Instructional Materials Eliciting Low and High Cognitive Load on Self-Efficacy and Demonstrated Knowledge*. (Doctoral Dissertation)

AUTHOR

Correspondence Author – Randel D. Estacio, Associate Professor, College of Education, Quezon City University. Email: randel.estacio@qcu.edu.ph. Mobile Number: +639479685282

Flipped classroom and students' academic achievement in mathematics

Josephine S. Uy

* College of Education, Mathematics and Science Department, Quezon City University

DOI: 10.29322/IJSRP.12.10.2022.p13057
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13057>

Paper Received Date: 14th September 2022
Paper Acceptance Date: 15th October 2022
Paper Publication Date: 21st October 2022

Abstract- Flipped classroom is one of the models that utilizes technology to provide instructional materials to students prior to the classroom sessions and uses class time to participate in meaningful learning activities. The present study primarily focuses on assessing and identifying the effectiveness of the flipped classroom approach in the academic performance of students in the subject of Mathematics in the Modern World. The experimental research design using the true control group pretest-posttest true-control group is adopted in this study. This study's participants are selected BSIT students from Quezon City University during the first semester of the 2019-2020 academic year, who are divided into two groups: the control group (50 students) and the experimental group (50 students). In determining the actual operation of the flipped classroom approach, selected faculty members of Quezon City University were asked to assess the effectiveness of the approach using the survey questionnaire. Results revealed that the flipped classroom approach in actual operations is highly effective, and there is a significant difference in the performance of the control and experimental groups after the conduct of the study. Based on the findings and conclusions of this study, it is recommended to adopt the flipped classroom approach as an alternative modality of teaching and learning.

Index Terms- Flipped classroom, Mathematics Education, Mathematics in the Modern World, Student Achievement

I. INTRODUCTION

Numerous scholars have suggested integrating technology into the curriculum due to the quick progress of educational technology and the good effects it has on students' ability to learn and comprehend concepts. To engage and inspire children to study mathematics in a more meaningful way, researchers and educators have been looking into new methodologies and teaching techniques. One of these options is the flipped classroom (Strelan, Osborn, & Palmer, 2020).

Many researchers define the flipped classroom model as one in which teachers use the time in the classroom to engage students in meaningful learning discussion activities and instructor-guided problem-solving instructions rather than having

students watch lectures on video, read handouts, or watch online video lectures (Humrickhouse, 2021; Latorre-Coscolluela, et al. 2021; Wei, et al. 2020). Additionally, flipped classrooms provide students the freedom to learn at their own speed (Sosa Díaz, Guerra Antequera, & Cerezo Pizarro, 2021). As a result, the paradigm shifts from a teacher-centered to a student-centered approach occurs.

The amount of time allotted to each topic in traditional schools is the same for every student, however in flipped classrooms, a mastery learning approach is used, which requires that each student grasp a topic before moving on to the next (Strelan, Osborn, & Palmer, 2020).

Numerous scientific publications provide extensive research data on the utility of flipped classrooms in teaching and learning across a variety of disciplines, including statistics (Price & Walker, 2021), chemistry (Pienta, 2019), English (Seema & Írfana, 2019), nursing (Li, et al. 2020), and engineering (Bhat, et al. 2020). Studies, however, appear to be few when it comes to using the flipped classroom technique for Mathematics teaching and learning. As an example, as of right now, no such study has been carried out at the local university level.

Since the implementation of the New General Education Curriculum for tertiary level is now in place as instructed by the Commission on Higher Education in the Philippines, local studies that focus on the effects of flipped classrooms, specifically in learning mathematics, are found to be limited. To fill this gap, the present study examined the effects of flipped classroom models on the academic achievement of students taking mathematics courses, particularly at a local university in the Philippines.

This study may not seem so new, but it was able to provide concrete data and ideas on the effective teaching strategies in teaching mathematics to higher education, particularly in a local university like Quezon City University. It also paved the way for the researcher to explore the effects of a flipped classroom on students' achievement in mathematics, which is also a good topic for future research.

Generally, the study focuses on assessing and determining the effectiveness of the flipped classroom approach in the academic performance of students in the subject of Mathematics in the Modern World. In particular, it sought answers to the following research questions: (1) how effective is

the flipped classroom as used in the actual operation of the study in terms of objectives, learning content, presentation, usefulness, and student performance; and (2) how do students in the experimental and control groups perform in the post-test after the conduct of the study?

Considering the objectives of this study, the researcher hypothesizes that there is no significant difference between the post-test scores of the students between the experimental and control groups after the conduct of the study.

II. METHODOLOGY

2.1 Research Design

The study utilized an experimental research design utilizing the true control group pre-test-post-test true-control group design to determine the effects of the flipped classroom approach on students' learning in the subject Mathematics in the Modern World. The Pretest-Posttest Design was used to determine the performance of students after exposing students to the flipped classroom approach and it was used to measure or observe two groups before and after being exposed to a treatment (Fraenkel, Wallen, & Hyun, 2012). This design is far better than a one-shot case study because the researcher at least knows whether any change occurred.

The study was conducted at Quezon City University, a local university in Metro Manila, Philippines, during the Academic Year 2019–2020.

The content of the flipped classroom method for mathematics in the modern world was validated by mathematics professors and education experts at Quezon City University (QCU). In developing the content of the flipped classroom method, the instructional problem was clarified by analyzing prior knowledge of the students, followed by establishing instructional goals and objectives and the learning environment. After careful analysis, the researcher, together with the I.T specialist, creates and assembles the content assets that will be used in the experiment.

Prior to the experimental procedure, the researcher secured a letter of approval from the Department Head of the QCU Mathematics Department to conduct the study, and after the approval, the experimental procedure was conducted.

The researcher administered a pre-test to the students in the control and experimental groups to determine students' prior knowledge of the subject Mathematics in the Modern World before the start of the first semester and prior to the use of the method. After the pre-test, topics in Mathematics in the Modern World were taught based on the OBE Syllabus for the subject. The control group was exposed to a normal classroom lecture-discussion method, while students in the experimental group were exposed to a flipped classroom method.

In the flipped classroom method, the researcher provides learning materials (ex. lecture hand-outs, activity sheets, problem sets, reading materials, video lectures, and related online games) to the students prior to the discussion using the agreed online learning group (ex. Facebook Learning Group and Google Classroom). In the actual classroom meeting, the researcher conducts a short discussion that focuses on the difficulties and challenges faced by the students in doing the prior assigned task.

The class hours were spent checking students' output, clarifying issues, and correcting misconceptions.

The method was utilized by the teacher throughout her lessons in Mathematics in the Modern World within the semester and was done regularly throughout the experimental period. After the experimental period, a post-test was given to the control and experimental groups to determine their performances in the class.

Respondents of the Study

The general population of this study refers to all students who are officially enrolled in Quezon City University taking up Bachelor of Science in Information Technology (BSIT) during the 1st Semester of the Academic Year 2019-2020 and under the direct supervision of the researcher.

The control group consists of fifty (50) students under SBIT01, while the experimental group will also consist of fifty (50) students under SBIT02. Moreover, student respondents should satisfy the following criteria: he or she should be a bona fide student at Quezon City University (QCU) and officially enrolled in the subject Mathematics in the Modern World during the first semester of the school year 2019-2020.

To determine the actual operation of the flipped classroom approach, a total of fifteen (15) faculty members from the Mathematics and Science Department of Quezon City University were asked to assess the effectiveness of the approach using the survey questionnaire.

Research Instrument

The study utilized pre-test and post-test instruments and a researcher-made survey questionnaire to answer the research questions posed in this study.

The pre-test and post-test used in the study adopted the 50-item achievement test used by the Mathematics and Science Department of Quezon City University (QCU) for the General Mathematics course and is composed of fifty (50) multiple-choice questions, each worth one (1) point. Most of the questions in the pre-test consist of problems requiring an understanding of basic definitions, concepts, and the use of single equations, while others may be more complex. The test covered the topics in General Mathematics based on the Curriculum Guide set by the Commission on Higher Education (CHED). A similar set of questions will be given to students after the exposure to the flipped classroom method, which will serve as the post-test.

To ensure the validity of the test questionnaire, the researcher asked for the help of her adviser to evaluate the content of the survey questionnaire in terms of its format, language used, and questions measuring the desired objectives. Suggestions and comments from the thesis adviser were properly documented and reflected in the second version of the survey questionnaire. In terms of reliability, a total of twenty-five (25) randomly selected students who will not be part of this study will be asked to answer the second version of the survey questionnaire. Using SPSS version 22, Cronbach's alpha test will be administered to determine the test's acceptability and reliability.

On the other hand, the researcher-made survey questionnaire was used to describe the actual operation of the flipped classroom approach. The survey questionnaire was based on the survey questionnaire by Tabunda (2018), which was validated through the Content Validity Index (CVI) involving five content experts and modified by the researcher to suit the sub-problems presented in this study. It consists of twenty-five (25) items which aim to determine the effectiveness of the flipped classroom method in terms of objectives, learning content, presentation, usefulness, and effects on students' performances as seen by the mathematics teachers at Quezon City University. Options for the response are presented in a Likert format where there are five choices provided for every question or statement, which represents the degree of agreement that each respondent had on the given question (5 – Very Highly Effective, 4 – Highly Effective, 3 – Effective, 2 – Moderately Effective, and 1 – Least Effective).

Data Processing and Statistical Treatment

After the retrieval of the survey questionnaires, the responses of the respondents will be tallied, tabulated, and analyzed. To further interpret the study's findings, collected data were processed using statistical software known as IBM SPSS Statistics version 22. The researcher utilized descriptive statistical tools such as frequency and central tendency to describe the distribution of the responses of the respondents to each question found in the survey questionnaire and the most common response of the respondents towards the effectiveness of the flipped classroom method in terms of objectives, learning content, presentation, usefulness, and effects on students' performances. And to determine if a significant difference exists between the scores of the students, the independent-sample t-test was used.

III. RESULTS AND DISCUSSION

Views on the actual operation of the flipped classroom approach to the subject Mathematics in the Modern World

The following tables show how mathematics and science faculty members of Quezon City University viewed the effectiveness of the flipped classroom method in the actual operation.

Table 1

Effectiveness of the Flipped Classroom Method in the Actual Operation in terms of Objectives

Criteria	Mean	V.I
1. Learning objectives are clearly stated in each lesson and is aligned to the New General Education Curriculum Guide.	4.00	Highly Effective
2. Learning objectives can change students' behavior and develop students to become 21 st century life-long learners.	4.07	Highly Effective
3. Learning objectives provides learning opportunities and experiences.	4.13	Highly Effective
4. Learning objectives are appropriate within the	4.20	Highly

student's level and can be achieved within a given timeframe.		Effective
5. Learning objectives are complete and sufficient to improve students' performances and achievements in the Mathematics in the Modern World.	3.87	Highly Effective
Over-all Weighted Mean	4.05	Highly Effective

In terms of objectives, Table 1 shows that Mathematics and Science faculty members of Quezon City University view that the flipped classroom method is highly effective with a computed over-all weighted mean value of 4.05

In addition, Table 1 revealed that the teacher respondents viewed that the learning objectives of the lesson in the flipped classroom approach are appropriate within the student's level and can be achieved within a given timeframe are highly effective with a computed mean value of 4.20, the highest mean as far as the effectiveness of the flipped classroom method in the actual operation in terms of objectives is concerned. As Wei, et al (2020) states, the main feature of the flipped classroom involves moving the "transmission of knowledge" to outside the classroom and moving the "application of knowledge" into the classroom. An effective "flip" requires careful preparation by the educator; selecting appropriate learning goals and objectives (Humrickhouse, 2021); and an understanding of existing and emerging tools that are available to help support the out-of-class portion of courses (Sosa Díaz, et al. 2021).

Table 2

Effectiveness of the Flipped Classroom Method in the Actual Operation in terms of Learning Content

Criteria	Mean	V.I
1. Learning contents are sufficient and complete covering the topics based on the New General Education Curriculum Guide for the subject Mathematics in the Modern World.	4.13	Highly Effective
2. Learning contents provide opportunities and experiences to improve students' cognitive, psychomotor, and affective skills.	4.00	Highly Effective
3. Material consists of appropriate and relevant diagrams to enhance students' understanding and problem-solving skills.	4.40	Highly Effective
4. Material provides variety of activities that are suited to students' individual needs.	4.33	Highly Effective
5. Online material/s utilized are sufficient, properly presented and/or labelled, and relevant to the lesson or topic.	4.73	Very Highly Effective
Over-all Weighted Mean	4.32	Highly Effective

Table 2 shows the overall weighted mean of the responses of the respondents towards the effectiveness of the flipped classroom in the actual operation in terms of learning content, and as we glean from the table, it shows that respondents agreed that it was highly effective with a computed over-all mean value of 4.32. In terms of learning content on the effectiveness of the flipped classroom method in the actual operation, online material/s utilized in the flipped classroom approach were sufficient, properly presented and/or labeled, and relevant to the lesson or topic according to the respondents, with the highest

computed mean value of 4.73 and interpreted as very highly effective. Similarly, the study of Stöhr, et al (2020) into the use of flipped classrooms found that it is important for educators to take care in developing learning content and materials that allow students to come to class prepared and be ready with some questions they wish to discuss.

Table 3

Effectiveness of the Flipped Classroom Method in the Actual Operation in terms of Presentation

Criteria	Mean	V.I
1. Topics are presented in sequential manner based on the General Education Curriculum Guide for the subject Mathematics in the Modern World.	4.47	Highly Effective
2. Topics are well-organized so that teachers and students can use it properly and independently.	4.07	Highly Effective
3. Parts consists of lesson title, learning objectives, introduction, content, evaluation, and application.	4.00	Highly Effective
4. Diagrams, animation, videos, and links utilized can motivate students' interests, curiosity, and awareness.	4.47	Highly Effective
5. Presentation of mathematical concepts is simple and clear.	4.40	Highly Effective
Over-all Weighted Mean	4.28	Highly Effective

Table 3 shows the computed over-all weighted mean of the responses made by the respondents towards the effectiveness of the flipped classroom approach in the actual operation in terms of presentation, which is 4.28 and considered to be highly effective. Topics are presented in a sequential manner based on the General Education Curriculum Guide for the subject Mathematics in the Modern World and the diagrams, animation, videos, and links utilized can motivate students' interests, curiosity, and awareness. They both have the highest computed mean of 4.47 in terms of presentation on the effectiveness of the flipped classroom method in the actual operations, which are highly effective.

The above results support the claims that to facilitate successful flipped classrooms, educators need to accommodate students using a familiar and safe learning environment in the presentation of the lessons (Tang, et al. 2020), with appropriate supporting technology (Wannapiroon & Petsangsri, 2020). Lecturers get to create their lectures then post them online, in the form of podcasts, PowerPoint with voice, videos, and so forth. Pre-class work by students also frees up more time for educators to focus on discussions, further reinforcing students' understanding and allowing them to provide more hands-on activities for students to be engaged in active, problem-solving-based learning (Strelan, Osborn, & Palmer, 2020).

In terms of usefulness, respondents viewed that the flipped classroom approach in the actual operation is highly effective, as shown in Table 4 with a computed over-all weighted mean value of 4.29.

Table 4

Effectiveness of the Flipped Classroom Method in the Actual Operation in terms of Usefulness

Criteria	Mean	V.I
1. The instructional material is very useful in developing	4.20	Highly

students' cognitive, exploratory, and affective skills, and understanding of mathematics concepts and principles.		Effective
2. The instructional material is very useful to improve students' achievement.	4.53	Very Highly Effective
3. The instructional material widens and deepens students' mathematical and logical ability.	4.13	Highly Effective
4. The material is activity-oriented so that the students can work and apply what they have learned in everyday life.	4.33	Highly Effective
5. The material is useful in applying various teaching strategies to meet students' needs and level of capabilities.	4.27	Highly Effective
Over-all Weighted Mean	4.29	Highly Effective

Similarly, the usefulness of the flipped classroom approach to students is that they can access class materials outside of class time at a time and location convenient to them (Pienta, 2019; Price & Walker, 2021). Thus, flipped classrooms allow students to take greater responsibility for their own learning in a space where they have greater independence and experimentation (Seema & Írfana, 2019). Flipped lectures enable students to review lessons in whole or in part, as many times as they want to grasp concepts (Li, et al 2020).

Strelan, Osborn, and Palmer (2020) in their meta-analysis study note that students learn best when they are given the opportunity to expand on knowledge acquired through flipped lectures in in-class activities that promote greater creative and higher-level thinking. Students who have difficulties with activities in-class can also benefit from peer support and allow lecturers to gain a better insight into which students require assistance.

Table 5

Effectiveness of the Flipped Classroom Method in the Actual Operation in terms of Effects to Students' Performance

Criteria	Mean	V.I
1. Content and evaluation are sufficient to determine if transfer of learning occurs.	4.53	Very Highly Effective
2. Develop enthusiasm among learners.	4.60	Very Highly Effective
3. Improved students' academic performance in the subject.	4.60	Very Highly Effective
4. Motivates the learner to explore more and develop self-confidence and inquiry.	4.67	Very Highly Effective
5. Allow students to become creative and critical thinker.	4.33	Highly Effective
Over-all Weighted Mean	4.55	Very Highly Effective

In terms of the effects on students, respondents agreed that the flipped classroom approach is very highly effective, as revealed by the over-all weighted mean of their responses shown in Table 5, and the computed over-all mean is 4.55. Specifically, respondents agreed that the flipped classroom approach is very effective in motivating learners to explore more and develop self-confidence and inquiry (Mean, 4.67). In addition, respondents agreed that the flipped classroom approach is very highly effective in developing enthusiasm among learners and in improving students' academic performance in the subject (Mean, 4.60).

Table 5 also revealed that respondents agreed that the flipped classroom approach is very highly effective when it comes to completeness and appropriateness of the content and evaluation in determining the occurrence of transfer of learning among learners, with a computed mean value of 4.53. Lastly, respondents agreed that the flipped classroom approach is highly effective (Mean, 4.33) in allowing students to become creative and critical thinkers.

The above results contribute to the many benefits (yet potential challenges) of flipped classrooms for lecturers and students in that, if implemented effectively, flipped classrooms can bring a degree of authenticity to students' learning through real-life examples used and worked through by the lecturer and students in in-class activities. Authentic learning allows students' learning to be defined in terms of real-world relevance as well as provide a greater purpose and motivation to learn (Strelan, Osborn, & Palmer, 2020). Authentic learning that is facilitated using authentic contexts enables knowledge to be applied to real-life problems.

Humrickhouse (2021) argues that flipped classrooms should provide students with in-class activities that involve the use of specific techniques applied to new problems. Doing hands-on activities provided opportunities for students to reflect on the relevance of the course content to their professional goals, while group activities enable students to work in teams to develop teamwork and oral communication skills, which also become additional assets for employability and career success (Seema & İrfana, 2019).

As a result, students in the flipped classroom approach were able to devote much of the class time to problem-solving, allowing them to present their solutions to solve problems; as a result, students in the flipped classroom group performed as well as or better on all problems, and performed better on problems involving designs than their traditional lecture group peers.

Table 6

Summary of the Effectiveness of the Flipped Classroom Method in the Actual Operation in teaching the subject Mathematics in the Modern World

Criteria	Mean	V.I
Objectives	4.05	Highly Effective
Learning Content	4.32	Highly Effective
Presentation	4.28	Highly Effective
Usefulness	4.29	Highly Effective
Effects to Students' Performance	4.55	Very Highly Effective
Over-all Weighted Mean	4.30	Highly Effective

Table 6 revealed that the views of the respondents towards the effectiveness of the flipped classroom approach in teaching Mathematics in the Modern World and in actual operations is highly effective in terms of objectives, learning content, presentation, usefulness, and effects to students' performance with computed over-all weighted mean of 4.30.

The table reveals that in terms of the effects of the flipped classroom approach on the performances of the students in the actual operations and teaching the subject Mathematics in the Modern World, the respondents agreed that it was very

highly effective with a computed mean value of 4.55. On the other hand, in terms of learning content (Mean, 4.32), usefulness (Mean, 4.29), presentation (Mean, 4.28), and objectives (Mean, 4.05), the flipped classroom approach is highly effective, according to the faculty members of the Mathematics and Science Department at Quezon City University.

While flipped classrooms can have many benefits for addressing the ways educators teach and the ways in which students learn, certain challenges are associated with the implementation of flipped classrooms.

The time-consuming nature of the set-up required for a flipped classroom and student frustration at being responsible for their own learning can all contribute toward less-than-successful cases of flipped learning (Strelan, Osborn, & Palmer, 2020). Nevertheless, with careful design and implementation, flipped classrooms can play a key role in modernizing education in the higher education sector by freeing up more time for lecturers to design learner-centered activities and, in turn, encourage students to become independent self-learners who are able to apply knowledge and skills to solve real-world problems in their future careers and lives.

Comparison between the post-test performances of the experimental and control groups

Table 7 shows the t-test results between the post-test scores of the control and experimental groups after the conduct of this study.

Table 7

t-test result of the Post-test scores of the Control and Experimental Groups

Group	N	\bar{X}	p-val.	t-val.	Interpretation	Decision
Control	50	24.26	0.00	3.27	Statistically Significant	Reject the H_0
Experimental	50	27.16				

*Significant Level 0.05

*Degrees of Freedom 98

The mean score of each test signifies that the students' performances in the experimental group show a significant increase after the conduct of this study as compared with the performance of students in the control group.

It is important to note that after the conduct of this study and the implementation of the flipped classroom approach, the performance of the students in the experimental group shows a significant improvement in the subject Mathematics in the Modern World. The table shows that the control group obtained a mean score of 24.26, which is considered below the passing mark of the total number of correct items, while the mean score obtained by the experimental group, which is 27.16, indicates a score above the passing mark.

Table 7 shows that the group's computed t-value at the 0.05 level of significance is $t(98) = 3.27, p < .05$. By conventional criteria, the computed t-value is statistically significant. This means that the performance of the two groups in their post-test is not the same after the conduct of this study. Therefore, the results

of the independent sample t-test reject the null hypothesis of this study, stating that there is no significant difference in the performance of the students in their post-test scores prior to the conduct of the study.

The significant change, either positive or negative, in the performance of students before and after the experimental study denotes that the application of the treatment to the experimental group has a greater effect on the variables being measured (Fraenkel, Wallen, & Hyun, 2013).

IV. CONCLUSION

The study revealed that the views of the respondents towards the effectiveness of the flipped classroom approach in teaching Mathematics in the Modern World and in actual operations are highly effective in terms of objectives, learning content, presentation, usefulness, and effects on students' performance, with a computed over-all weighted mean of 4.30.

The mean score of the post-test signifies that the students' performances in the experimental group show a significant increase after the conduct of this study as compared with the performance of students in the control group. It is important to note that after the conduct of this study and the implementation of the flipped classroom approach, the performance of the students in the experimental group shows a significant improvement in the subject Mathematics in the Modern World. The group's computed t-value at the 0.05 level of significance is $t(98) = 3.27, p < .05$. By conventional criteria, the computed t-value is statistically significant. This means that the performance of the two groups in their post-test is not the same after the conduct of this study.

Based on the analysis of the performance of the students after the conduct of this study, the flipped classroom approach served as an effective alternative method in enhancing and developing students' cognitive skills and improving the teaching-learning process.

Specific implications drawn from the findings of this study are: (1) Objectives are achieved within the given time frame; (2) Simple technology; (3) Efficient and effective utilization of instructional material; (4) Motivate students to learn; (5) Management of the sequence and flow of the lecture; (6) Improve students' achievement; and (7) Motivate the learner to explore more and develop self-confidence and inquiry. Aside from the positive implications of the flipped classroom found in this study, there are several challenges that can be noted for the use of the flipped classroom approach, such as creating a digital divide among learners, dependence on preparation and trust, and an increase in the time in front of the computer screens instead of people and places.

ACKNOWLEDGMENT

The researcher would like to thank all the respondents who

participated in this study despite the pandemic. The researcher would also like to acknowledge the support and patience of her family during the conduct of this study. Special thanks to Dr. Randel D. Estacio, the Dean of College of Education, for his guidance and support to complete the manuscript.

REFERENCES

- [1] Bhat, S., Raju, R., Bhat, S., & D'Souza, R. (2020). Redefining quality in engineering education through the flipped classroom model. *Procedia Computer Science*, 172, 906-914.
- [2] Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education* (Vol. 7, p. 429). New York: McGraw-hill.
- [3] Humrickhouse, E. (2021). Flipped classroom pedagogy in an online learning environment: A self-regulated introduction to information literacy threshold concepts. *The Journal of Academic Librarianship*, 47(2), 102327.
- [4] Latorre-Coscolluela, C., Suárez, C., Quiroga, S., Sobradiel-Sierra, N., Lozano-Blasco, R., & Rodríguez-Martínez, A. (2021). Flipped Classroom model before and during COVID-19: using technology to develop 21st century skills. *Interactive Technology and Smart Education*, 18(2), 189-204.
- [5] Li, B. Z., Cao, N. W., Ren, C. X., Chu, X. J., Zhou, H. Y., & Guo, B. (2020). Flipped classroom improves nursing students' theoretical learning in China: a meta-analysis. *PloS one*, 15(8), e0237926.
- [6] Pienta, N. J. (2019). Introductory Chemistry Using the "Flipped" Environment: An Update. *Journal of Chemical Education*, 96(6), 1053-1054.
- [7] Price, C., & Walker, M. (2021). Improving the accessibility of foundation statistics for undergraduate business and management students using a flipped classroom. *Studies in Higher Education*, 46(2), 245-257.
- [8] Seema, A. R. Í. F., & Írfana, O. M. A. R. (2019). Effectiveness of flipped classroom in teaching basic English courses. *Yükseköğretim Dergisi*, 9(3), 279-289.
- [9] Sosa Díaz, M. J., Guerra Antequera, J., & Cerezo Pizarro, M. (2021). Flipped classroom in the context of higher education: Learning, satisfaction and interaction. *Education Sciences*, 11(8), 416.
- [10] Stöhr, C., Demazière, C., & Adawi, T. (2020). The polarizing effect of the online flipped classroom. *Computers & Education*, 147, 103789.
- [11] Strelan, P., Osborn, A., & Palmer, E. (2020). The flipped classroom: A meta-analysis of effects on student performance across disciplines and education levels. *Educational Research Review*, 30, 100314.
- [12] Tabunda, R. (2018). Technology based instructional material in Grade 11 STEM Program (General Mathematics): Its Acceptability. Master's Thesis. Eulogio "Amang" Rodriguez Institute of Science and Technology. Philippines: Manila
- [13] Wannapiroon, N., & Petsangsri, S. (2020). Effects of STEAMification Model in flipped classroom learning environment on creative thinking and creative innovation. *TEM Journal*, 9(4), 1647.
- [14] Wei, X., Cheng, I., Chen, N. S., Yang, X., Liu, Y., Dong, Y., & Zhai, X. (2020). Effect of the flipped classroom on the mathematics performance of middle school students. *Educational Technology Research and Development*, 68(3), 1461-1484.
- [15] Tang, T., Abuhmaid, A. M., Olaimat, M., Oudat, D. M., Aldhaeabi, M., & Bamanger, E. (2020). Efficiency of flipped classroom with online-based teaching under COVID-19. *Interactive Learning Environments*, 1-12.

AUTHOR

Correspondence Author – Josephine S. Uy, Mathematics Instructor, College of Education, Quezon City University. Email: josephine.uy@qcu.edu.ph. Mobile Number: +639275532209

The Impact of electronic word of mouth on customer purchase intention: A study on mobile banking with special reference to Western Province in Sri Lanka

Kalinga Senanayake¹, Thilini Mudiyanse²

¹Postgraduate Candidate of Imperial Institute of Higher Education, Colombo, Sri Lanka, Validated Center of University of Wales

²Lecturer of Imperial Institute of Higher Education, Colombo Sri Lanka, Validated Center of University of Wales

Corresponding Author: Kalinga Senanayake

DOI: 10.29322/IJSRP.12.10.2022.p13058

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13058>

Paper Received Date: 13th September 2022

Paper Acceptance Date: 14th October 2022

Paper Publication Date: 21st October 2022

Abstract: *Due to its significance in understanding how customers think, feel, and choose from many possibilities, marketers constantly make efforts to ascertain consumers' purchase intentions. Cultural, social, personal, and psychological aspects are important ones that affect consumers' purchasing intentions. As a result, consumers may be influenced along with what they hear (WOM) from people in their immediate social circle, such as friends, peers, family, etc. The rapid development of the Internet and its enhanced communication capabilities have greatly increased the breadth and scale of word-of-mouth (WOM) communication, creating a favorable environment for electronic word-of-mouth ("e-WOM").*

The study used four theoretical models and the results of empirical research to perform a critical assessment of the literature. The independent variable, e-WOM and its dimensions of information quality, information credibility, website quality, social support and attitudes towards e-WOM are along with the dependent variable of customer purchase intention to develop the conceptual framework and construct the hypotheses. The positivism philosophy, which relies on theory, as well as the deductive method, were both included in the research design. Data were gathered by a survey using a standardized questionnaire.

The result of the data analysis emphasises that information quality, information credibility, website quality, social support and attitudes towards e-WOM have a positive relationship with customer purchase intention and there is an impact of all the independent variables on the dependent variable. Additionally, the results of the data assessment are consistent with the conceptual frameworks and empirical study results described in the literature review. Based on the findings of the current study, feasible recommendations were suggested by the researcher to improve the e-WOM in enhancing customer purchase intention in Sri Lankan mobile banking industry.

Key words: *e-WOM, customer purchase intention, Sri Lankan mobile banking industry*

I. Introduction

Word-of-mouth (WOM) communication is generally recognized to play a considerable role in influencing and forming consumer attitudes and behavioural intentions (Xia & Bechwati, 2008). It is initially considered as a person-to-person conversation between

This publication is licensed under Creative Commons Attribution CC BY.

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13058>

www.ijsrp.org

consumers about a product/service. Research has shown that WOM communication is more powerful and influential than other modes of communication such as editorial recommendations or advertisements (Bickart & Schindler, 2001; Trusov, et al., 2009). The customer believes and recognizes word of mouth as the most reliable source of information (Bickart & Schindler, 2001; Trusov, et al., 2009). WOM communication has changed rapidly over the years with the development of more sophisticated technologies and new techniques and formed a new way of communication called e-WOM. The widespread use of the Internet has become the fundamental reason for to spread e-WOM (Jalilvand & Samiei, 2012). e-WOM reshapes the traditional WOM to a more virtual way of communication while providing an opportunity for consumers to share information about their consumption experience and to provide advice to peer consumers using social platforms, blogs and consumer review sites. The widespread technology makes e-WOM as the most popular source of information. E-WOM is assumed to be even more effective than WOM communication in the offline world due to its greater accessibility and higher reach (Chatterjee, 2001).

The potential effect of other people's view has expanded considerably as a result of the advent of the Internet (Chevalier & Mayzlin, 2006; Heath & Motta, 2006), and (Stephen & Lehmann, 2009). Consumer communication is evolving as a result of the Internet, which is offering a common platform for people to exchange their ideas and evaluations (Hennig-Thurau & Walsh, 2003). In addition, customer views may be read and acted upon by other consumers all across the globe, giving them a significant potential reach. Studies have proven that online word-of-mouth affects customer behaviour (Chen, et al., 2011) as well as corporate sales (Duan, et al., 2008) in recent years. User-generated content, e-WOM, and other factors are important in generating purchase intention on electronic media platforms. Social networking is becoming more popular (Sulthana & Vasantha, 2019). To get the most up-to-date information about products and services, people are actively participating in a variety of social networking sites and platforms all around the world (Duan, et al., 2008). As well as in the Sri Lankan context this become a very critical point. Using peer-to-peer connections, they may generate and distribute information on products and services (Leong, et al., 2021). User reviews and referrals guide customers to find the most appropriate product/services from among the numerous alternative items that are generally accessible.

II. Research Problem

The positive e-WOM can be considered as a successful communication technique which can be used for promotions (Chu & Kim, 2011; Kwon, et al., 2013). Customers tend to keep trust in the information shared by other customers over the information provided by the marketers (Kim, et al., 2015). Customers seriously evaluate internet evaluations supplied by other customers before adopting any technology (Shankar, et al., 2019). As a result, e-WOM has a significant impact on consumer acceptance of technology-related goods and services (Kim et al., 2015). Following this line of reasoning, academics have claimed that while deciding whether or not to embrace or not adopt technology-related goods and services, customers examine several elements of positive e-WOM (Cheung & Thadani, 2012; Kim, et al., 2015). When deciding whether or not to implement new technology, they examine the legitimacy and value of positive e-WOM, for example (Kim et al., 2015). The Internet has changed consumer buying behaviour (Kamalasena & Sirisena, 2021). According to estimates, the number of active internet users in Sri Lanka has increased in tandem with the global rise in internet users and now stands at around 11.34 million in January 2022 (Digital Sri Lanka, 2022). In addition, a considerable proportion of internet users are social media users. Sri Lanka has 8.20 million social media users in January 2022 (Digital Sri Lanka, 2022).

Negative electronic word of mouth (e-WOM) has a significant influence on consumers' buying choices. It is undeniably true that internet complaint messages about a business may quickly become viral and serve as a deterrent to existing customers, resulting in harm to the enterprise's brand name (Chang & Wu, 2018). As a result, e-WOM seems to act as either an incentive or a barrier for people with

purchase intentions (Xiaorong, et al., 2011). As a service in the banking sector, customer recommendation to use the relevant product, service or brand is very important to others. Even if firms cannot directly control the spread of e-WOM it will highly affect the brand image that leads to a purchase intention. However, there is no considerable attention on this by part of the organization although how much it is critical. However, the main problem of this study is assessing the impact of e-WOM on customer purchase intention. However, there is no considerable attention on this by part of the organization although how much it is critical.

III. Research objectives

To identify the dimensions of e-WOM towards customer purchase intention in the Sri Lankan mobile banking sector.

To analyze the impact of e-WOM on customer purchase intention in the Sri Lankan mobile banking industry.

To provide recommendations through the findings to successfully manage e-WOM to increase customer purchase intention in the Sri Lankan mobile banking industry.

IV. Significance of the Research

The area assessed by the present study is not addressed by any other research earlier. Customer purchase intention is a highly essential component which relies on e-WOM. As a consequence, this will bring major advantages to future researchers to cover the remaining gap today. This study will support other researchers and academics who are investigating or conducting research on a similar subject and scope. In addition, the author will obtain expertise and deeper knowledge in the field of customer purchase intention particular in the banking sector, which will be useful in order to pursue future goals in the appropriate area of scope. The researchers who are searching for literature regarding e-WOM and customer purchase intention will be benefitted through this study. In addition, the current study will be supported to bridge the identified research gap by providing empirical evidence for future researchers.

It is expected that the present research will give a better understanding of how e-WOM impacts customer purchase intention as a consequence of the findings. This will provide a better opinion of how should manage the customers as to no negative effect on the company image. This study will support with information that will benefit financial service providers, the banking industry, the government of Sri Lanka, and other local and international stakeholders in the banking industry in understanding the factors that affect e-WOM in their sectors. As well as this will contribute to marketing strategists, and professionals developing their strategies in this area. The result of the current study will be provided with a better exposure to understanding how to develop and maintain positive e-WOM & what is its impact on customer purchase intention in the banking sector. As a competitive industry, the players will be benefitted from the awareness of the importance with e-WOM and how should deal with it. The current study provides a better insight into developing & maintaining excellent customer perception in the banking sector & how to increase customer purchase intention.

V. Literature review

5.1 Information Quality

The persuasive power of a communication is referred to as information quality (IQ), which is a widely used and recognized predecessor of the main channel. (Cheung & Thadani, 2012). Users usually try to digest every given piece of information in order to determine whether or not a message is true. When these customers feel a point is valid, they think that information is beneficial (Sussman & Siegal, 2003). Previous research indicates that information quality is a significant factor (Aghakhani & Karimi, 2013; Cheung & Thadani, 2012). Information quality was defined in this study as the persuasive power of an e-WOM communication. Prior research has found

that the quality of information has a beneficial impact on purchasing intent (Lee, et al., 2003; Park & Han, 2007). Usually, the precursor of the core route has been information quality, as it is referred to as the persuasive power of a message (Cheung & Thadani, 2012). When these consumers judge an argument to be valid, they think the information to be beneficial (Sussman & Siegal, 2003). Prior research considers information quality to be an essential component (Aghakhani & Karimi, 2013; Cheung & Thadani, 2012). Specifically, past research indicates that the quality of information influences purchase intent favorably (Park & Han, 2007).

Usually, the precursor of the core route has been information quality, as it is referred to as the persuasive power of a message (Cheung & Thadani, 2012). When these consumers judge an argument to be valid, they think the information to be beneficial (Sussman & Siegal, 2003). Prior research considers information quality to be an essential component (Aghakhani & Karimi, 2013; Cheung & Thadani, 2012). Specifically, past research indicates that the quality of information influences purchase intent favorably (Park & Han, 2007). Information quality is essential to user views which has been used in a series of studies to evaluate the performance of information systems (Hamilton & Chervany, 1981). Due to the absence of face-to-face interaction, service quality is particularly crucial in the context of online buying (Ahn, et al., 2020). Zhou et al. (2010) shown that the quality of the information has a substantial impact on the flow experience of users, which in turn impacts their loyalty.

5.2 Information Credibility

Since it is the message recipients' sense of a communication's credibility that drives the peripheral routes, information credibility is considered a vital factor (Cheung & Thadani, 2012). Cheung and Thadani's definition is used in this investigation (2012). Customers are more ready to interact in any type of communication if they believe the content is trustworthy. Consumers in digital spaces have complete opportunity to express their thoughts without having to meet in person, therefore traditional indicators of information reliability do not applicable (Reichelt, et al., 2014). People may potentially be harmed as a result of the incentives offered by businesses. The value of information credibility has been proven by the several studies. According to one research, information credibility is the most important factor in customers' decision-making (Naveen & Arik, 2014). Furthermore, research has proven the impact of information trustworthiness on customers' purchasing intent (Prendergast & Ko, 2010). The findings are in line with earlier research, which suggests that information trustworthiness is critical to information utility (Erkan, 2016).

Due to the fact that it is the message recipients' assessment of a message's credibility, information credibility is regarded as a significant driver of peripheral routes (Cheung and Thadani, 2012). It accepts the definition of Cheung and Thadani in this research (2012). When customers determine that information is reliable, they are more receptive to all forms of communication. In online environments, people have unrestricted ability to express their emotions without face-to-face interactions; hence, conventional indicators of information credibility do not apply (Reichelt, et al., 2014). According to a research, information trustworthiness is the primary factor in customer decision-making (Awad & Ragowsky, 2008). In addition, research have shown the impact of information credibility on customers' purchasing intent (Prendergast et al., 2010).

5.3 Website Quality

Customers' perceptions of a website's performance in retrieving and delivering information are referred to as website quality (Yang, et al., 2012). System and service quality are used to assess the quality of a website. A social networking website's high quality will eventually persuade people to remain using it, particularly as a platform for exchanging information (Ahn, et al., 2020). After reviewing the e-commerce literature, it was discovered that website quality can affect client contact with businesses (McKnight, et al., 2002). Because transactions were conducted through the portal, website quality may have an impact on consumers' perceptions of the sites

(Ahn, et al., 2020). As a result, the current study claims that the quality of websites influences customers' e-WOM participation. There are two aspects to website quality: system and service. They were evaluated using three questions modified from a Liang et al. research (2011).

Prior studies have hypothesized that website quality may have a direct impact on customer satisfaction and purchase intent (Cheung & Thadani, 2012; Erkan, 2016). Only the customer, not the online merchant, can judge if the quality of a website contributes to fun (Ahn, et al., 2020). When the consumer believes that the website quality surpasses their expectations, a sense of fun is produced. Website quality is a crucial term in e-commerce, since client views of website quality directly influence their buy intent (Aladwani & Palvia, 2002).

5.4 Social Support

Previously, many people saw the internet as a unique way to avoid meeting new people. According to several research, the more time a person spends on the internet, the worse his interpersonal ties become (Sanders, et al., 2000). The growth of social networking sites has transformed the internet into a major avenue for consumer contact. Social support is an important social asset that customers may obtain from a variety of online communities. Gottlieb and Bergen (2010) describe social support as "social resources offered by a social group that fosters a sense of warmth, caring, and belonging" (Ali, 2011). Social assistance is a multifaceted concept that varies depending on the situation (Huang, et al., 2010). Given that the internet is a virtual world where interactions are based on information transmission, online social support is intangible, leaving informational and emotional support as the only options (Huang, et al., 2010). In this context, emotional support is being able to confide in and rely on another person, as well as contributing to the sensation of being loved or cared about, or even feeling like a part of a community rather than a stranger (Pfeil and Zaphiris, 2009). Informational assistance, on the other hand, entails sending signals to other customers in the form of recommendations or advice (Liang & Turban, 2011).

In terms of online communities, social media sites provide a platform for users to obtain knowledge through interacting with peers, which may lead to good emotional responses (Lee, et al., 2003). Social support is defined as knowledge that allows people to feel cared for and understood inside a social group. Cobb's (1976) definition is used in this investigation. Various s-commerce research has looked into this type of support (Hajli, 2013; Hajli & Sims, 2015). It's thought to be a multi-faceted construct that combines both educational and emotional assistance in an online situation. Individuals are more likely to acquire educational and emotional assistance in an online setting (Welbourne, et al., 2009) Informational support refers to the giving of counsel, assistance, or relevant information to help consumers overcome obstacles (Liang & Turban, 2011), whereas emotional support refers to the provision of empathy, concern, care, love, understanding, and encouragement to the recipient. These characteristics, in particular, include online social support. When customers feel cared for in an online community, they feel compelled to share their buying experiences with other members of the group. Emotional and informational assistance are two types of social support. The emotional and informational support elements were similarly adopted from Liang et al. (2011).

As social networking has grown in popularity, it has become a vital medium for fostering social connections. Social support has been identified as an important social asset that Internet users might obtain from a variety of online organizations. As a result, social support is described as social resources easily available from members of a social group. Social support is a multidimensional Electronic Word of Mouth Engagement Model 987 construct whose components might vary depending on the circumstance (Lee, et al., 2003). Given that virtual interactions are frequently centered on message exchange, online assistance in s-commerce is typically intangible, leaving only informational and emotional support (Ali, 2011). Surprisingly, the primary motive for customers to join virtual groups is for social support and useful information.

5.5 Attitudes towards e-WOM

The shareable information is known as electronic word of mouth (e-WOM) and may be described as any good or negative comment made by prospective, existing, or past consumers about a product or business that is given access to a large number of individuals and entities over the world wide web (Hennig-Thurau, et al., 2004). All consumers and retailers are capable of generating e-WOM. Among s-commerce users, e-WOM interactions often center on brands (Chu, 2011; Wolny & Mueller, 2013). Yang and Yoo (2004) found that attitude consists of two components: cognitive and emotional attitudes. There was no correlation between the emotional attitude and the intention to utilize the information systems. Ramayah and Suki (2006) concurred that there is a favorable correlation between attitude and behavioral intent. According to Megha Sharma and R. C. Dangwal, e-WOM is the most significant tool in the digital business sector.

Amblee and Bui (2011) discovered that positive e-WOM may aid to enhance online product sales. Customers often question the originality and credibility of e-word of mouth (online reviews and social buzz). Cheung, Lee, and Rabjohn (2008) discovered that even while e-word of mouth increases online purchase intentions, such information must be thorough and relevant. In 2011, Ye, Law, Gu, and Chen discovered that users' intents were positively impacted by electronic word of mouth, as seen by a 10 percent increase in online hotel reservations.

VI. Methodology

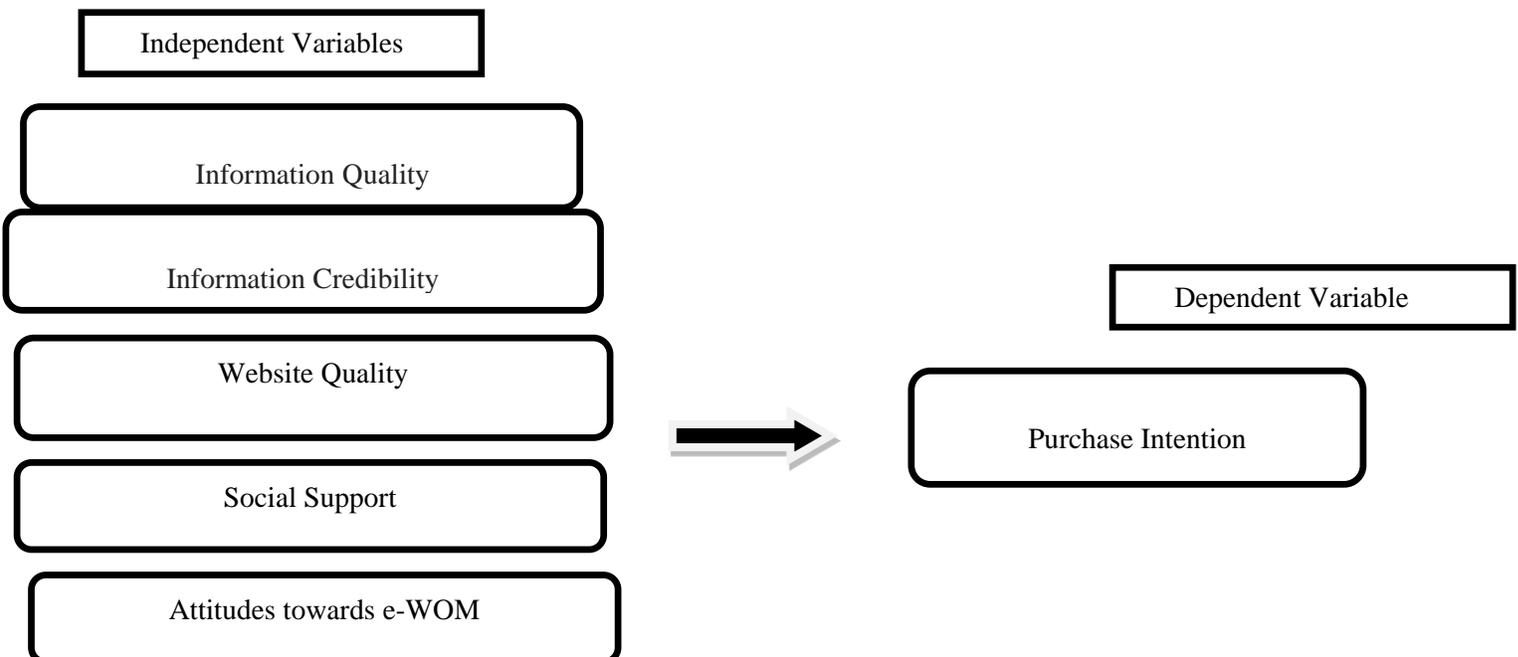
6.1 The conceptual framework and operationalization of concepts

The researcher intends to analyze the following research question:

Identify what is the impact of e-WOM on customer purchase intention in the Sri Lankan banking sector Western province, of Sri Lanka.

The conceptual model is generated with the support of literature review and the hypotheses are developed accordingly.

Figure 1 – Conceptual Framework



H1₁: Information quality has a significant impact on purchase intention of mobile banking sector in Western province

H2₁: Information credibility has a significant impact on purchase intention of mobile banking sector in Western province.

H3₁: Website quality has a significant impact on purchase intention of mobile banking sector in Western province.

H4₁: Social support has a significant impact on purchase intention of mobile banking sector in Western province.

H5₁: Attitudes towards e-WOM has a significant impact on purchase intention of mobile banking sector in Western province.

Operationalization helps removing the ambiguity of written work by defining all relevant variables in a way to be objectively measured as depicted in table 2

Table 01 – Operationalization of variables

	Variables	Indicators
Independent Variables	Information Quality	Understandability of information Clearance of information Perceived quality of information
	Information Credibility	Convenience nature Strength of information Perceived credibility Accuracy of information
	Website Quality	Easiness of access User-friendliness
	Social Support	Belief on friends Relationship with social groups Belonginess to social groups
	Attitudes towards e-WOM	Read of information before buy a product Get support in decision making Confidence in purchasing
Dependent Variable	Customer Purchase Intention	Repurchase Recommend to others Purchase

VII. Research Design & Data Collection

The researcher has followed the sequence and made choices in methodology as elaborated by the “research onion” model of Saunders et al. (2006). Experiment, survey, case study, archival research, ethnography, action research, mixed methods research, grounded theory and narrative inquiry are the research strategies indicated by the research onion. Survey strategy was selected as the research strategy for the current study. It enables the collection of a significant quantity of data from a wide population in a cost-effective manner. These data are often gathered by administering a questionnaire to a sample, and they are standardized, enabling for simple comparison. Because the research is primarily concerned with quantitative data, a survey provides a practical way to gather it (Saunders et al., 2009).

This study will be based on the "Positivism" philosophy. It is based on the ontological theory that previously acquired knowledge can be generalized. As a result, parameters are examined through a highly structured approach to determine gaps and given fresh information and statistics on e-WOM and customer purchase intention in Sri Lankan mobile banking sector, concept on existing theories. Researcher used deductive approach for this study based on the previous studies done by various researchers to identify whether there is an impact of e-WOM on customer purchase intention in the Sri Lankan mobile banking sector. This study used a quantitative method, primarily a survey with a well-structured questionnaire, to determine the impact of e-WOM on customer purchase intention in Sri Lankan mobile banking sector.

Due to the study being based on a certain timespan on a specific occurrence, the researcher collects data and performs a cross-sectional time horizon (Levin, 2006). Furthermore, since the data is collected at a single moment in time, this research is a low-cost strategy. The survey method was used to collect data in this research, and it was also utilized in the current study. For the sample selection, 4 major commercial banks in Sri Lanka will be selected and will gather data from their customers who use digital banking users. Due to the study limits to Western province, two branches in the Western province from each bank will be selected to derive the sample. The selected banks are NDB, Commercial bank, Sampath bank, and HNB. Based on the internal data from each bank the total population is 17,647.

The sample size was determined by taking into account the population's heterogeneity and time restrictions. Krejcie and Morgan (1970) developed a sampling formula to ensure adequate representation of the population. Accordingly, the sample size is determined as 377 for a 95% confidence level based on Krejcie & Morgan sampling table. A structured questionnaire was used to obtain data from the selected branches of the banks in the Western province. The convenience sampling approach, a non-probability sampling method that takes into account respondents who have picked from the same demographic, was used in the research. The structured questionnaire was developed and made available online through the "Google Form" technology.

Secondary data such as empirical research, theories and models, reports, websites and case studies will be used to corroborate the primary data collected. To analyze and interpret the acquired data, quantitative analysis with SPSS (Statistical Package for the Social Sciences) software will be utilized. The Likert Scale was utilized with the Five Likert Scale, 1-5 scale, with 1 indicating "strongly disagree" and 5 representing "strongly agree."

1– Strongly disagree

2 – Disagree

3 – Neutral (Agree or disagree)

4 - Agree

5 – Strongly agree

Correlation and regression analysis will also be used to examine the hypothesis. Measures of dispersion, skewness, and central tendency approaches will be used to examine the specified variables. As identified by Sekaran and Bougie (2016) a survey or questionnaire is a collection of pre-written questions to which respondents record their responses. The questionnaire of the current study was developed based on the conceptual framework and the operationalization of the research. Sekaran and Bougie (2016) classify the strengths of approaches developed only on the basis of data for reliability as well as validity. Moreover, this test eliminates irrelevant data elements and ensures the presence of the most important characteristics and dimensions.

VIII. Findings

After evaluating the validity and reliability of the measures, as well as demographics, descriptive statistics, and hypothesis testing, the responses received through the structured questionnaire are thoroughly studied in different segments.

Based on the results of the research questionnaire that was sent using Google forms, the data analysis for the primary study was completed. 377 respondents shared the questionnaire to collect the main data, which was then critically analyzed and only 295 of responses were received. This section investigated the obtained sample's demographic variables.

Table 2 - Analysis of demographic factors

Variable	Characteristics	N	%
Gender	Male	153	52.00%
	Female	142	48.00%
Age	18-25	74	25.00%
	26-35	115	39.00%
	36-45	65	22.00%
	45 Above	41	14.00%
Marital Status	Single	121	41.00%
	Married	174	59.00%
Level of Employment	Non-Executive	15	5.00%
	Executive	83	28.00%
	Managerial	53	18.00%
	Senior Managerial	56	19.00%
	Own Business	59	20.00%
	None of the above	29	10.00%
Level of Income	Below 25,000 LKR	18	6.10%
	25,000 – 50,000 LKR	86	29.15%
	50,001 – 100,000 LKR	59	20.00%
	100,001 – 200,000 LKR	66	22.37%
	Above 200,001	66	22.37%
Level of Education	Ordinary Level	15	5.00%
	Advanced Level	83	28.00%
	Diploma	59	20.00%
	Undergraduate	53	18.00%
	Graduate	56	19.00%
	Post Graduate	29	10.00%
Experience with Mobile Banking	Below 1 Year	65	22.00%
	1 to 3 Years	124	42.00%
	3 to 5 Years	65	22.00%
	Above 5 Years	41	14.00%
Frequency of Using Mobile Banking	Rarely	77	26.00%
	Sometimes	130	44.00%
	Frequently	88	30.00%

According to the above table, it indicates the gender composition of the sample and according to that, 52% are male while 48% are female. This implies the majority of females have participated in the research study. Further, 4.2 indicates 39% of the sample represent the age category of 26-35 and 25% represent the age category of 18-25 while 22% and 14% of the sample represent the age categories of 36-45 and 45 above respectively. The majority of the sample is married and it is 59% of the sample while 41% are single. Consumers, regardless of their marital status, consistently rely on the advice and support of their friends, family, and other close relatives to make decisions about purchases (Cam, et al., 2019). Therefore, marital status cannot be considered as an influential factor in e-WOM towards

customer purchase intention. The findings indicate the majority of the sample represents executives and it is 28% of the sample. Meanwhile, 19% of the sample represents senior managers, 18% managers, 20% business owners, 5% non-executives and 10% others. The level of employment can be considered as an important factor in adopting e-WOM and making purchasing decisions based on that. According to figure 4.5, 29% of respondents fall into the group of those with monthly incomes between 25,000 – 50,000. According to Hruska and Maresova's explanation in 2020, socioeconomic factors such as individual income levels affect how much time people spend on social media and how much they plan to spend online. As a result, income level must be taken into account as a key demographic feature when assessing the adoption of e-WOM. Furthermore, the majority of the sample is in the category of advanced level and it is 20% of the sample. Meanwhile, the lowest number of the sample is in the category of ordinary level. The phrase "digital divides" describes structural disparities in society that are mirrored in the unequal distribution of incentives, utilization of potential and essential online technology navigation abilities, and internet use. Comparatively more highly educated and affluent people are able to take advantage of platform-related benefits and increase virtual consumption (Koiranen, et al., 2020). Thus, a key element of the adoption to e-WOM and its influence on customer purchase intention is the population's degree of education. Apart from that, most of the respondents are with mobile banking for 1 – 3 years and it is 40% of the sample. Meanwhile, 22% of the respondents are with mobile banking for 3 – 5 years and another 22% are for below 1 year while 14% are with above 5 years. The experience with mobile banking can be identified as a critical factor in adopting e-WOM towards purchase intention (Zarnadze & Pereira, 2021). The majority of the sample use mobile banking sometimes and it is 44% of the entire sample. Meanwhile, 30% of the sample use mobile banking frequently. The frequency of using mobile banking as well as mobile banking acceptance can be influenced by e-WOM (Zarnadze & Pereira, 2021).

8.2 Analysis of quantitative data collected through 5-point Likert scale

8.2.1 Testing the reliability and validity of data

Statistical testing has been used as part of the validation of dimension attributes with the goal of analyzing the validity and reliability of the primary research.

Test for validity

Test of Uni-dimensionality

Exploratory Factor Analysis (EFA) was used to determine the Uni-dimensionality of measures. The test outcomes are given below.

Table 03 - Factor Analysis

Rotated Component Matrix^a

	Component				
	1	2	3	4	5
Attitude toward e-WOM 1	.965				
Attitude toward e-WOM 2	.973				
Attitude toward e-WOM 3	.969				

Attitude toward e-WOM 4	.959			
Attitude toward e-WOM 5	.963			
Information Quality 1		.923		
Information Quality 2		.943		
Information Quality 3		.922		
Information Quality 4		.902		
Information Quality 5		.942		
Information Credibility 1			.914	
Information Credibility 2			.912	
Information Credibility 3			.798	
Information Credibility 4			.918	
Information Credibility 5			.799	
Website Quality 1				.802
Website Quality 2				.907
Website Quality 3				.907
Website Quality 4				.925
Website Quality 5				.811
Social Support 1				.692
Social Support 2				.678
Social Support 3				.657
Social Support 4				.863
Social Support 5				.874

Table 4.1: Test for Uni-dimensionality of the Main study (Source: Based on final survey data, 2022)

Table 4.1 shows that all of the aforementioned indicators have a value larger than 0.5. A number larger than 0.5 is acceptable, according to Field (2013). As a result, all of the above-mentioned indications were deemed reliable and acceptable.

Test of convergent validity

KMO, Bartlett’s tests of Sphericity, Composite reliability and Average variance extractor are used to measure Convergent Validity. The values for the independent variables and the dependent variable are shown in table 4.2 below,

The KMO values for all variables are more than 0.5, as indicated in table 4.2. At less than 0.01 the Chi-squared value is important. For all variables, the AVE and CR are larger than 0.5 and 0.7, respectively.

Table 04: Results of the convergent analysis and reliability analysis

Variable	Dimensions	KMO	P value of Bartlett’s test	AVE
Independent variable	Information quality	0.774	0.000	0.894
	Information credibility	0.783	0.000	0.839
	Website quality	0.810	0.000	0.851
	Social support	0.726	0.000	0.659
	Attitudes towards e-WOM	0.883	0.000	0.951
Dependent variable	Customer purchase intention	0.763	0.000	0.681

Table 5.1: Test of convergent validity (Source: Developed by author based on final survey data, 2022)

Test of discriminant validity

The degree to which a measure does not correlate with other variables from which it is meant to differ is known as discriminant validity. The value of the squared paired correlation of the respective dimension should be smaller than the corresponding AVE value to assess the feasibility of the discriminant validity successfully (Pituch & Stevens, 2016).

Table 05: Results of the convergent analysis

		Information quality	Information credibility	Website quality	Social support	Attitudes towards e-WOM	Customer purchase intention
Information quality		0.894					
Information credibility	Pearson correlation	0.220	0.839				
	Squared correlation	0.048					
Website quality	Pearson correlation	0.276	0.454	0.851			

	Squared correlation	0.076	0.206				
Social support	Pearson correlation	0.325	0.464	0.430	0.659		
	Squared correlation	0.106	0.215	0.185			
Attitudes towards e-WOM	Pearson correlation	0.119	0.206	0.068	0.228	0.951	
	Squared correlation	0.014	0.042	0.005	0.052		
Customer purchase intention	Pearson correlation	0.301	0.616	0.545	0.535	0.330	0.681
	Squared correlation	0.091	0.379	0.297	0.286	0.109	

Table 05: Test of discriminant validity (Source: Based on final survey data, 2022)

The findings of the discriminant validity are summarized in Table 4.3. If the value of each variable's AVE is larger than 0.5 and the value of the Squared Pearson Correlation is less than the value of the corresponding AVE, the variable is considered to have discriminant validity.

As can be seen in Table 4.3, all of the AVE value dimensions are more than 0.5, and all of the Squared Pearson Correlation values are lower than the relevant AVE values. As a result, the independent variables – information quality, information credibility, website quality, social support, and attitudes towards e-WOM and the dependent variable, customer purchase intention evaluated and identified discriminant validity as reached.

Test of reliability

The degree to which a particular measure may be free of error, as well as ensuring that the measurement is constant throughout time, is referred to measure of reliability. The reliability of the current study was examined using Inter-item consistency reliability to see whether the respondents' responses to all of the questions in a measure were consistent.

Cronbach's Alpha was employed to assess the internal consistency, and Cronbach's Alpha coefficient should be larger than 0.7 as a yardstick value (Field, 2013).

Table 06: Results of reliability analysis

Variable	Dimensions	Cronbach's Alpha
Independent variable	Information quality	0.970
	Information credibility	0.952

	Website quality	0.956
	Social support	0.867
	Attitudes towards e-WOM	0.987
Dependent variable	Customer purchase intention	0.880

Table 06: Test of reliability (Source: Developed by author based on final survey data, 2022)

The Cronbach's Alpha values for all of the dimensions are more than 0.7, (shown in Table 4.4). This demonstrates that the variables' internal consistency was verified.

8.4 Hypotheses Testing

Through the conceptual framework, which was created as a consequence of a literature review, the independent and dependent variables were produced. The 5 established hypotheses have been used in the deductive technique to investigate the link between the independent and dependent variables. Table 4.10 shows the allowed level of correlation.

Table 07: Interpretation of correlation values

Correlation value	Interpretation
< 0.4	Low
0.4 – 0.7	Moderate
> 0.7	High

Table 07: Interpretation of correlation values (Source: Taylor, 1990)

Table 08: Results of hypothesis testing for independent variables

Hypothesis	Correlation coefficient	Sig. of the coefficient	Conclusion
H1 ₁ : Information quality has a significant impact on purchase intention of mobile banking sector in Western province.	0.301	0.000	H1 ₁ - Accepted H1 ₀ - Rejected
H1 ₀ : Information quality has not a significant impact on purchase intention of mobile banking sector in Western province.			
H2 ₁ : Information credibility has a significant impact on purchase intention of mobile banking sector in Western province.	0.616	0.000	H2 ₁ – Accepted H2 ₀ - Rejected
H2 ₀ : Information credibility has not a significant impact on purchase intention of mobile banking sector in Western province.			
H3 ₁ : Website quality has a significant impact on purchase intention of mobile banking sector in Western province.	0.545	0.000	H3 ₁ – Accepted H3 ₀ - Rejected

H3 ₀ : Website quality has not a significant impact on purchase intention of mobile banking sector in Western province.			
H4 ₁ : Social support has a significant impact on purchase intention of mobile banking sector in Western province.	0.535	0.000	H4 ₁ – Accepted H4 ₀ - Rejected
H4 ₀ : Social support has not a significant impact 0.330on purchase intention of mobile banking sector in Western province.			
H5 ₁ : Attitudes towards e-WOM has a significant impact on purchase intention of mobile banking sector in Western province.	0.330	0.000	H5 ₁ – Accepted H5 ₀ - Rejected
H5 ₀ : Attitudes towards e-WOM has not a significant impact on purchase intention of mobile banking sector in Western province.			

Table 4.13: Results of hypothesis testing for independent variables (Source: Developed by author based on SPSS Output, 2022)

The correlation coefficient for each independent variable is shown in Table 4.13. All independent variables, information quality, information credibility, website quality, social support and attitudes towards e-WOM, show moderate correlation values, which is within the permissible range for correlations. The table also shows that each correlation value is below the threshold limits' significance level of 0.00, which is shown in the table. The data in the above table shows that the independent variables information quality, information credibility, website quality, social support and attitudes towards e-WOM and the dependent variable customer purchase intention have a positive correlation. As a result, the null hypothesis can be rejected since there is enough circumstantial evidence to support it.

IX. Conclusion

The widespread use of the Internet has become the fundamental reason for to spread e-WOM. e-WOM reshapes the traditional WOM to a more virtual way of communication while providing an opportunity for consumers to share information about their consumption experience and to provide advice to peer consumers using social platforms, blogs and consumer review sites. The widespread technology makes e-WOM as the most popular source of information. E-WOM is assumed to be even more effective than WOM communication in the offline world due to its greater accessibility and higher reach. User-generated content, e-WOM, and other factors are important in generating purchase intention on electronic media platforms. Social networking is becoming more popular. To get the most up-to-date information about products and services, people are actively participating in a variety of social networking sites and platforms all around the world. As well as in the Sri Lankan context this becomes a very critical point. Using peer-to-peer connections, they may generate and distribute information on products and services.

The current study was conducted with the major aim of to assess the impact of e-WOM on customer purchase intention in the Sri Lankan mobile banking sector Western province, of Sri Lanka. The research was conducted in the deductive approach by implementing four theoretical models in the literature review namely A Dual-Process Model of Electronic Word-of-Mouth Participation, Conceptual framework of determinants of e-WOM influence, Information acceptance model, e-WOM engagement model.

The information quality, information credibility, website quality, social support and attitudes towards e-WOM have been recognized as important aspects or characteristics connected to the customer purchase intention for mobile banking. A conceptual framework and hypotheses were constructed taking into account the data. Analysis of the data gathered via the questionnaire revealed that there are

strong correlations between all of the independent and dependent variables. The quantitative research revealed that information credibility is the independent variable that has the greatest impact on customer purchase intention. Secondly, website quality and social support indicate a moderate relationship with customer purchase intention. Moreover, the independent variables of information quality and attitudes towards e-WOM have been proved that contribute to stimulating customer purchase intention. The research's results would thus enable the discovery of other elements that might affect customer purchase intention in the Sri Lankan mobile banking sector.

X. Implications and Recommendations

Based on the findings of the current study, information quality was identified as an important factor in e-WOM towards influencing customer purchase intention. As per the customer response understandability of the information plays a vital role in delivering quality information. The banks should deliver their information in a way which the customers can understand them clearly and simply. As well as the customers feel the information shared in social media is high in quality because some others are verified. The banks should be attention in whether they have negative meaning about their services. If there is something in negative about the bank's service, they should make sure the customers are not perceived them as quality information. As well as the banks can encourage people to share quality information about the products and services of the bank.

According to the findings of the current study, the credibility of the information shared in social media has a great impact on customers' decisions on purchasing. People trust others' opinions on social media heavily. Therefore, banks can get the advantage of this through third parties. They can use community pages on social media to promote their products and services. It will be more influential than direct promotions by the bank. As well as the shared information should be stronger. As well as the banks can use different influencers to make news about the products and services of the bank on social media because it is stronger. In addition, the information shared by them should be more accurate. Otherwise, customers will share their negative feedback as they perceived against what they expect.

Based on the final outcome of the research, it can be identified that website quality has a significant impact on customer purchase intention in Sri Lankan mobile banking industry. The bank can influence customers via their own social media pages through e-WOM. For that, they should develop the website to a high-quality level. The website should be user-friendly, easy to access, effectively functioning, interactive and should have a higher loading speed. As well as the third-party social media platform used by the bank should also include these qualities.

The findings of the current study reveal that there is a significant impact of social support on customer purchase intention in the Sri Lankan mobile banking industry. With that, the banks should operate with the concern of social support obtained by the customers via social media. Then they can get the advantage towards increasing the customer purchase intention towards their products and services. Here, the companies can influence customers through different community groups on different social media platforms such as Facebook, and WhatsApp. Because the customers highly rely on friends' groups on social media in their decision-making towards purchasing. Therefore, the banks can use this kind of social groups in influencing customers to purchase a product or service.

According to the findings of the research, a significant impact of attitudes towards e-WOM can be identified on customer purchase intention in Sri Lankan mobile banking industry. The bank should be followed the attitudes of customers when they try to use e-WOM via social media for the promotion purposes. In general, most of customers have an attitude of trusting others' opinions in digital platforms in their day today life. Because they make customers confident in their purchase decisions. The banks should make available

information when customers are searching more details regarding their services. Because according to the findings of the current study, most of the customers have an attitude of searching information more over when they expose to e-WOM.

The research can be expanded to a wider sample to test whether the findings of the study are the same or are there any differences or is there any additional factors to be considered as influential.

A qualitative study can be conducted to get a deeper response from the customers or can be used as a mixed method to get more insights into the research area. Although the current study is based on the B2C market, future researchers can be conducted the same research relevant to the B2B market. Other factors can be identified as the dimensions of e-WOM and can measure the impact on customer purchase intention. As well as the impact of e-WOM can be measured on another dependent variable. The same study can be conducted in another industry. Especially in the product sector, it can be obtained a totally different response.

Acknowledgements

The author of this paper would like to express their sincere gratitude to those who participated in the survey.

References

- Adam, D. A., Nelson, R. R. & Todd, P. A., 1992. Perceived usefulness, ease of use, and usage of information technology: a replication. *MIS quarterly*, pp. 227-247.
- Aghakhani, N. & Karimi, J., 2013. Acceptance of implicit and explicit eWOM: a factor based study of social networking sites.
- Ahn, J. (., Choi, E.-K. (. & Joung, H.-W., 2020. Does Gender Moderate the Relationship among Festival Attendees' Motivation, Perceived Value, Visitor Satisfaction, and Electronic Word-of-Mouth?. *Information*, 11(9), p. 412.
- Ahn, T., Ryu, S. & Han, I., 2007. The impact of Web quality and playfulness on user acceptance of online retailing. *Information & Management*, 44(3), pp. 263-275.
- Aladwani, A. & Palvia, P., 2002. Developing and validating an instrument for measuring user-perceived web quality. *Information & management*, 39(6), pp. 467-476.
- Ali, A. H., 2011. The Power of Social Media in Developing Nations: New Tools for Closing the Global Digital Divide and Beyond. *Toward an International Law of the Internet*, Volume 24, p. 185.
- Auxier, B. & Anderson, M., 2021. *Social Media Use in 2021*. [Online] Available at: <https://www.pewresearch.org/internet/2021/04/07/social-media-use-in-2021/> [Accessed 21 July 2022].
- Awad, N. & Ragowsky, A., 2008. Establishing Trust in Electronic Commerce Through Online Word of Mouth: An Examination Across Genders. *Journal of Management Information Systems*, 24(4), pp. 101-121.
- Bai, Y., Yao, Z. & Dou, Y.-F., 2015. Effect of social commerce factors on user purchase behavior: An empirical investigation from renren.com. *International Journal of Information Management*, Volume 35, pp. 538-550.
- Berger, J. & Milkman, K. L., 2012. What Makes Online Content Viral?. *Journal of Marketing Research*, 49(2), pp. 192-205.
- Bickart, B. & Schindler, R. M., 2001. Internet forums as influential sources of consumer information. *Journal of Interactive Marketing*, 15(3), pp. 31-40.
- Cam, L. N. T., Anh, T. T., Moslehpour, M. & Thanh, X. D. T., 2019. Exploring the Impact of Traditional and Electronic Word of Mouth on Travel intention. *The 2019 5th International Conference*.
- Chaiken, S., 1980. Heuristic versus systematic information processing and the use of source versus message cues in persuasion. *Journal of personality and social psychology*, 39(5), p. 752.
- Chaiken, S. & Trope, Y., 1999. *Dual-process Theories in Social Psychology*. London: Guilford Press.

- Chang, H. H. & Wu, L. H., 2018. An examination of negative e-WOM adoption: Brand commitment as a moderator. *Decision Support Systems*, Volume 59, pp. 206-218.
- Chatterjee, P., 2001. Online Reviews: Do Consumers Use Them?. *Advances in Consumer Research*, Volume 28, pp. 129-133.
- Chen, Y., Wang, Q. & Xie, J., 2011. Online social interactions: A natural experiment on word of mouth versus observational learning. *Journal of marketing research*, 48(2), pp. 238-254.
- Cheung, C. M. & Thadani, D. R., 2012. The impact of electronic word-of-mouth communication: A literature analysis and integrative model. *Decision support systems*, 54(1), pp. 461-470.
- Cheung, C. M. & Thadani, D. R., 2012. The impact of electronic word-of-mouth communication: A literature analysis and integrative model. *Decision Support Systems*, 54(1), pp. 461-470.
- Cheung, C. M. & Thadani, D. R., 2012. The impact of electronic word-of-mouth communication: A literature analysis and integrative model. *Decision support systems*, 54(1), pp. 461-470.
- Chevalier, J. A. & Mayzlin, D. M., 2006. THE EFFECT OF WORD OF MOUTH ON SALES:. *NATIONAL BUREAU OF ECONOMIC RESEARCH*, 43(3), pp. 345-354.
- Chu, S.-C., 2011. Determinants of Consumer Engagement in Electronic Word-of-Mouth in Social Networking Sites. *International journal of Advertising*, 30(1), pp. 47-75.
- Davis, F. D., 1989. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13(3), pp. 309-340.
- Deutsch, M. & Gerard, H. B., 1955. A study of normative and informational social influences upon individual judgment. *The journal of abnormal and social psychology*, 51(3), p. 629.
- Duan, W., Gu, B. & Whinston, A. B., 2008. The dynamics of online word-of-mouth and product sales—An empirical investigation of the movie industry. *Journal of Retailing*, 84(2), pp. 233-242.
- Erkan, I., 2016. The Influence of Electronic Word of Mouth in Social Media on Consumers' Purchase Intentions. *An extended approach to information adoption. Computers in human behavior*, Volume 61, pp. 47-55.
- Field, A., 2013. *Discovering statistics using IBM SPSS statistics*. s.l.:sage.
- Filho, D., Silva, J. D., Paranhos, R. & Rocha, E. D., 2011. What is R2 all about?. p. 6068.
- Fu, J.-R., Ju, P.-H. & Hsu, C.-W., 2015. Understanding why consumers engage in electronic word-of-mouth communication: Perspectives from theory of planned behavior and justice theory. *Electronic Commerce Research and Applications*, 14(6), pp. 616-630.
- Hajli, M. N., 2013. A study of the impact of social media on consumers. *International Journal of Market Research*, 56(3), pp. 387-404.
- Hajli, M. N., 2014. The role of social support on relationship quality and social commerce. *Technological Forecasting & Social Change*, Volume 87, pp. 17-27.
- Hajli, N. & Sims, J., 2015. How Social Commerce: Transfer of the Power from Sellers to Buyers?. *Technological Forecasting and Social Change*, Volume 94, pp. 350-358.
- Hajli, N. & Sims, J., 2015. Social commerce: the transfer of power. *Technological Forecasting & Social Change*, pp. 350-358.
- Hamilton, S. & Chervany, N. L., 1981. Evaluating Information System Effectiveness - Part I: Comparing Evaluation Approaches. *MIS Quarterly*, 5(3), pp. 55-69.
- Heath, T. & Motta, E., 2006. Person to Person Trust Factors in Word of Mouth Recommendation. *Conference on Human Factors in Computing Systems*.

- Hendrickson, A. R., Masse, P. D. & Cronan, T. P., 1993. On the Test-Retest Reliability of Perceived Ease of Use Scales. *MIS quarterly*, pp. 227-230.
- Hennig-Thurau, T., Gwinner, K. P., Walsh, G. & Gremler, D. D., 2004. Electronic word-of-mouth via consumer-opinion platforms: what motivates consumers to articulate themselves on the internet?. *Journal of interactive marketing*, 18(1), pp. 38-52.
- Hennig-Thurau, T. & Walsh, G., 2003. Electronic Word of Mouth: Motives for and Consequences of Reading Customer Articulations on the Internet. *International journal of electronic commerce*, 8(2), pp. 51-74.
- Huang, Y., Basu, C. & Hsu, M. K., 2010. Exploring Motivations of Travel Knowledge Sharing on Social Network Sites: An Empirical Investigation of U.S. College Students. *Journal of Hospitality Marketing & Management*, Volume 19, pp. 717-734.
- Jalilvand, M. R. & Samiei, N., 2012. The effect of electronic word of mouth on brand image and purchase intention: An empirical study in the automobile industry in Iran. *Marketing Intelligence & Planning*.
- Kamalasena, B. D. T. M. & Sirisena, A. B., 2021. The Impact of Online Communities and E Word of mouth on Purchase Intention of Generation Y: The Mediating Role of Brand Trust. *Sri Lania journal of marketing*.
- Keil, M., Beranek, P. M. & Konsynski, B. R., 1995. Usefulness and ease of use: field study evidence regarding task considerations. *Decision Support Systems*, Volume 13, pp. 75-91.
- Koiranen, I., Teo, K., Koivula, A. & Rasanen, P., 2020. Changing patterns of social media use? A population-level study of Finland. *Universal Access in the Information Society*, Volume 19, pp. 603-617.
- Kozinets, R. V., Valck, K. d., Wojnicki, A. C. & Wilner, S. J., 2010. Networked narratives: Understanding word-of-mouth marketing in online communities. *Journal of marketing*, 74(2), pp. 71-89.
- Kozinets, R. V., Valck, K. d., Wojnicki, A. C. & Wilner, S. J., 2010. Networked Narratives: Understanding Word-of-Mouth Marketing in Online Communities. *Journal of Marketing - J MARKETING*, Volume 74, pp. 71-89.
- Lee, J.-N., Pi, S.-M., Kwok, R. C.-w. & Huynh, M. Q., 2003. The Contribution of Commitment Value in Internet Commerce: An Empirical Investigation. *Journal of the Association for Information Systems*, 4(1), pp. 39-64.
- Lee, W.-I., Cheng, S.-Y. & Shih, Y.-T., 2017. Effects among product attributes, involvement, word-of-mouth, and purchase intention in online shopping. *Asia Pacific Management Review*, 22(4), pp. 223-229.
- Leong, C.-M., Loi, A. M.-W. & Woon, S., 2021. The influence of social media eWOM information on purchase intention. *Nature public health emergency collection*, pp. 1-13.
- Liang, T.-P. & Turban, E., 2011. Introduction to the Special Issue Social Commerce: A Research Framework for Social Commerce. *International Journal of electronic commerce*, 16(2), pp. 5-14.
- Lin, L. & Lu, C., 2010. The influence of corporate image, relationship marketing, and trust on purchase intention: the moderating effects of word-of-mouth. *Tourism Review*.
- Maheswaran, S., 1992. Empirical Implications of Arbitrage-Free Asset Markets. *Cowles Foundation Discussion Papers*.
- Massaro, T. M., 1988. Empathy, legal storytelling, and the rule of law: New words, old wounds. 87(8).
- McKnight, D., Choudhury, V. & Kacmar, C., 2002. The impact of initial consumer trust on intentions to transact with a web site: a trust building model. *The journal of strategic information systems*, 11(3-4), pp. 297-323.
- McKnight, D. H., Choudhury, V. & Kacmar, C., 2002. Developing and Validating Trust Measures for e-Commerce: An Integrative Typology. *Information systems research*, 13(3), pp. 334-359.
- Moore, A., Anderson, B., Das, K. & Anderson, W., 2011. *Handbook of Biosurveillance*. Burlington: Elsevier Academic press.
- Naveen, A. & Arik, R., 2014. Establishing Trust in Electronic Commerce Through Online Word of Mouth: An Examination Across Genders. *Journal of management information systems*, 24(4), pp. 101-121.

- Park, D.-H. & Han, I., 2007. The Effect of On-Line Consumer Reviews on Consumer Purchasing Intention: The Moderating Role of Involvement. *International Journal of Electronic Commerce* , Volume 11, pp. 125-148.
- Park, H. M., 2006. Univariate Analysis and Normality Test Using SAS, and SPSS. *Univariate Analysis and Normality Test*.
- Payne, C. M., 2007. The Organizing Tradition and the Mississippi Freedom Struggle, With a New Preface. *University of California Press*.
- Perloff, R. M., 1999. The third person effect: A critical review and synthesis. *Media psychology*, 1(4), pp. 353-378.
- Petty , R. E. & Cacioppo , J. T., 1986. The elaboration likelihood model of persuasion. *In Communication and persuasion*, pp. 1-24.
- Pituch, K. A. & Stevens, J. P., 2016. *Applied Multivariate Statistics for the Social Sciences*. 6th ed. Newyork & London: Pearson.
- Prendergast, G. & Ko, D., 2010. Online word of mouth and consumer purchase intentions. *International Journal of Advertising* , Volume 29, pp. 687-708.
- Prendergast, G., Yin, V. Y. S. & Ko, D., 2010. Online word of mouth and consumer purchase intentions. *International Journal of Advertising* , Issue 5, pp. 687-708.
- Reichelt, J., Sievert, J. & Jacob, F., 2014. How credibility affects eWOM reading: The influences of expertise, trustworthiness, and similarity on utilitarian and social functions. *Journal of Marketing Communications*, 1(2), pp. 65-81.
- Reichelt, J., Sievert, J. & Jacob, F., 2014. How credibility affects eWOM reading: The influences of expertise, trustworthiness, and similarity on utilitarian and social functions. *Journal of Marketing Communications* , Volume 20, pp. 65-81.
- Ryu, Y. & Kim, S., 2015. Testing the heuristic/systematic information-processing model (HSM) on the perception of risk after the Fukushima nuclear accidents. *Journal of Risk Research* , pp. 840-859.
- Saleem, A. & Ellahi, A., 2017. Influence of Electronic Word of Mouth on Purchase Intention of Fashion Products on Social Networking Websites. *Pakistan Journal of Commerce and Social Sciences*, 11(2), pp. 597-622.
- Sanders, et al., 2000. The relationship of Internet use to depression and social isolation among adolescents. *Adolescence*, 35(138), p. 237.
- Segars, A. H. & Grover, V., 1993. Re-Examining Perceived Ease of Use and Usefulness: A Confirmatory Factor Analysis. *MIS Quarterly*, pp. 517-525.
- Shah, S. S. H. et al., 2012. The Impact of Brands on Consumer Purchase Intentions. *Asian Journal of Business Management*, 4(2), pp. 105-110.
- Shashikala, E. D. T. & Thilina , D., 2020. Impact of Electronic Word of Mouth on Consumer Purchase Intention in Fast Food Industry: A Conceptual Review with Special Reference to Facebook Users. *International Conference on Business & Information*.
- Stephen, A. T. & Lehmann, D. R., 2009. IS ANYONE LISTENING? MODELING THE IMPACT OF WORD-OF-MOUTH AT THE INDIVIDUAL LEVEL.
- Steyn, S. & Roos, V., 2018. Cell phone usage relational regulation strategies of older South Africans. *Journal of Psychology in Africa* , 28(3), pp. 201-205.
- Subramanian, G. H., 1994. A replication of perceived usefulness and perceived ease of use measurement. *Decision sciences*, 25(5-6), pp. 863-874.
- Sulthana, A. & Vasantha, S., 2019. Influence Of Electronic Word Of Mouth eWOM On Purchase Intention. *INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH*, 8(10).
- Sulthana, A. & Vasantha, S., 2019. Influence Of Electronic Word Of Mouth eWOM On Purchase Intention. *INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH*, 8(10).
- Sussman, S. & Siegal, W., 2003. Informational influence in organizations: An integrated approach to knowledge adoption. *Information systems research*, 14(1), pp. 47-65.

- Sussman, S. W. & Siegal, W. S., 2003. Informational influence in organizations: An integrated approach to knowledge adoption. *Information systems research*, 14(1), pp. 47-65.
- Szajna, B., 1994. Software Evaluation and Choice: Predictive Validation of the Technology Acceptance Instrument. *MIS quarterly*, pp. 319-324.
- Torres, J. A. S., Arroyo, X., Irurita, A. A. & Moro, M. L. S., 2018. Impact of Gender on the Acceptance of Electronic Word-of-Mouth (eWOM) Information in Spain. *Contaduría y Administración*, 63(4), pp. 1-19.
- Torres, J. A. S., Solé-Moro, Maria-Luisa & Argila-Irurita, 2018. Impact of gender on the acceptance of electronic word-of-mouth (eWOM) information in Spain. *Contaduria y administracion*, 63(4).
- Trusov, M., Bucklin, R. E. & Pauwels, K., 2009. Estimating the dynamic effects of online word-of-mouth on member growth of a social network site. *Journal of Marketing*, 73(5), pp. 90-102.
- Venkatesh, V. & Davis, F. D., 2015. A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. *Management Science*, 46(2), pp. 186-204.
- Wang, X., Teo, H.-H. & Wei, K.-K., 2009. What Mobilizes Information Contribution to Electronic Word-of-Mouth System? Explanations from a Dual-Process Goal Pursuit Model. *Workshop Association for Informational Systems, Oklahoma*.
- Welbourne, J. L., Blanchard, A. L. & Boughton, M. D., 2009. Supportive Communication, Sense of Virtual Community and Health Outcomes in Online Infertility Groups. *In Proceedings of the fourth international conference on Communities and technologies*, pp. 31-40.
- White, C. J., 2010. The impact of emotions on service quality, satisfaction, and positive word-of-mouth intentions over time. *Journal of Marketing Management*, 5(6), pp. 381-394.
- Wolny, J. & Mueller, C., 2013. Analysis of fashion consumers' motives to engage in electronic word-of-mouth communication through social media platforms. *Journal of Marketing Management*, Volume 29, pp. 562-583.

- Xiaorong, F. et al., 2011. Impact of Quantity and Timeliness of EWOM Information on Consumer's Online Purchase Intention under C2C Environment. *Asian Journal of Business Research* , 1(2), pp. 37-52.
- Yang, S. et al., 2012. An Empirical Study of Word-of-Mouth Generation and Consumption. *Marketing Science*, 31(9), pp. 952-963.
- Yang, S. et al., 2012. An Empirical Study of Word-of-Mouth Generation and Consumption. *Marketing Science*, 31(6), pp. 952-963.
- Yusuf, A. S., Hussin, A. R. C. & Busalim, A. H., 2018. Influence of e-WOM engagement on consumer purchase intention in social commerce. *Journal of Services Marketing*.
- Zarnadze, G. & Pereira, I. V., 2021. The impact of WOM on the acceptance of mobile banking. *the International Conference on Business Excellence*, pp. 377-391

The Influence of Accounting Systems, Internal Control, And Transparency of Regional Financial Management on The Performance of Local Governments

(Study on the Office, Agency and Regional Secretariat of Financial Administration Officials at the Surakarta City Government)

¹Raisita Mutiara Sani, ²Andy Dwi Bayu Bawono

* Accounting, Muhammadiyah of Surakarta University

b200180108@student.ums.ac.id

andy.bawono@ums.ac.id

DOI: 10.29322/IJSRP.12.10.2022.p13059

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13059>

Paper Received Date: 14th September 2022

Paper Acceptance Date: 15th October 2022

Paper Publication Date: 21st October 2022

Abstract – This study aims to determine the effect of the Accounting System, Internal Control, and Transparency of Regional Financial Management on Local Government Performance.

The population in this case is the Financial Administration Staff and Officials who work in the Surakarta City Government Office, Agency, and Regional Secretariat. The sample used in this study was 101 samples. Sampling method used purposive sampling technique. The statistical method uses multiple linear regression analysis model using SPSS version 21.

The results show that the accounting system has a significant effect on the performance of local governments with a significant value of $0.000 < 0.05$, while internal control has no effect on the performance of local governments with a significant value of $0.369 > 0.005$ and transparency of regional financial management does not affect the performance of local governments with a significant value of $0.925 > 0.05$.

Index Terms - Accounting System, Surakarta City Government, Transparency Of Regional Financial Management.

I. INTRODUCTION

Recently, local governments have had many internal and external pressures, which include increasing optimal performance and the demands of the community who want local governments to be able to create prosperous community goals as an implication of the implementation of regional autonomy that prioritizes performance accountability and public service improvement (Hidayat, 2015).

Performance has become one of the keywords that are widely discussed in various organizations ranging from corporate organizations, government, and also universities. Likewise, performance is included in every socio-economic aspect of society. This condition can be seen from many organizations that include the word performance in their vision and mission. Performance achievement is not only expected for employees, but in the long term it is expected to be able to improve institutional performance Rosmawati: 2011 in (Hidayat, 2015).

Local government performance is said to be good if it is seen from the actual and maximal achievement of results. The performance that has been carried out must be in accordance with the vision and mission of the organization that has been set as the basis for carrying out the tasks that must be accounted for. Mohamad Mahsun, 2006:4 in (Putra & Indraswarawati, 2021). Performance measurement is a process of assessing the results that have been achieved. The success of local government performance can be assessed from development in the economic, political, social and cultural fields. The wider community assesses the success of development in the economic sector which is manifested in infrastructure development. Development does not only mean an emphasis on acceleration and success in the economic field, but includes the reorganization and renewal of the entire system and economic and social activities in the welfare of people's lives.

Measurement of local government performance is measured by indicators of input, process, output, results, benefits, and impacts Mahsun, 2006:77 in (Annisa & A, 2017) The first factor that affects the performance of local governments is the Regional Financial Accounting System. To support and strengthen performance, it is necessary to implement a Regional Financial Accounting System (SAKD). The application of the Regional Financial Accounting System (SAKD) is confirmed in Permendagri Number 13 of 2006 chapter XI article 232 paragraph 1 concerning Regional Financial Management Guidelines which states that the Regional Financial Accounting System (SAKD) is a series of procedures starting from the process of collecting data, recording, summarizing, up to financial reporting in the context of accountability for the implementation of the APBD which can be done manually or using a computer application.

Understanding the accounting system plays a role in the activities that will be carried out by local governments as well as measuring the performance of local governments. Governments in managing regional finances enable the achievement of an efficient and effective government administration mechanism by showing good managerial performance as well. To achieve this, the role of regional financial managers and regional financial accounting systems is needed. Usman and Lukman Pakaya 2014 in (Annisa & A, 2017), Regional Financial Accounting Systems affect the performance of local governments.

The passage of reform has increasingly revived the meaning of democracy in the life of the state. Democracy is synonymous with accountability. Implementing accountability means applying transparency as well so that between accountability and transparency there is a link between Mohamad et al., 2004:33 in (Adiwirya & Sudana, 2015). Accountability is the willingness to provide explanations and justifications for the wishes and actions of those concerned. Another thing with transparency is being accountable for what has been done by providing relevant information or reports that are open to outside parties or independent organizations (legislators, auditors, the public) and published. In the end, elements of accountability and transparency become a necessity in government management, including in the financial sector, especially in terms of performance-based budgeting.

However, the phenomenon that has occurred lately, there are many deviations related to the budget in a government agency. Sadjarto, 2000 in (Adiwirya & Sudana, 2015) states that abuse of authority in managing regional budgets often occurs and comes to the surface so that people often question the performance of regional leaders.

Research on the effect of the accounting system, internal control, and transparency of regional financial management on the performance of local governments has been carried out by many researchers. But there is a research gap that comes from differences in the results of previous studies.

Research (Yusuf, 2021) states that the Local Government Accounting System has a positive and significant effect on Government Performance Accountability. But research from (Sumaryati, Novitasari, & Machmuddah, 2020) states that the Accounting Information System and internal control system have no effect on the quality of the final statement in the Grobogan Regency Government. Research from (Muda, et al., 2017) states that the Regional Financial Accounting System (SAKD) mediates the effect of human resource competence not having a positive effect and a significant influence on the Quality of Financial Reports of the Regional Government of Labuhanbatu Regency. The Regional Financial Accounting System (SAKD) mediates the effect of the use of Information Technology which has no positive and significant effect on the Quality of the Local Government Financial Reports in Labuhanbatu Regency.

In research (Salamah, Sudarmanto, & Herlisnawati, 2021) stated that Internal Control has a positive and significant effect, so that to improve performance is to increase supervision because optimal supervision will have a good impact on the performance of government agencies. Simultaneous test results with the F test, namely the application of public sector accounting and internal control together have a positive effect on the performance of government agencies. And research from (Mifti, Lestariyo, & Kowanda, 2009) states that there is a positive and significant effect of internal control on the performance of the Inspectorate General of the Ministry of Home Affairs.

Research (Putra & Indraswarawati, 2021) states that transparency in regional financial management has a positive effect on local government performance at the Klungkung Regency Government Service. And research from (Audyta & Lismawati, 2013) states that financial management transparency has a positive and significant effect on the performance of the Bengkulu Provincial government. But research from (Benawan, Saerang, & Pontoh, 2018) states that Financial Transparency has a negative and insignificant effect on Employee Performance at the Transportation Service Office of Tidore Islands City.

II. IDENTIFY, RESEARCH AND COLLECT IDEA

In this section, the researcher identifies similar studies that have been carried out previously. Then found several previous research studies that can be used for comparison and reference in research. And able to avoid similarities with previous research. The previous research on this topic was found as below:

The first research conducted by Adiwira and Sudana (2015) by title "Accountability, Transparency, and Performance-Based Budgeting at the Denpasar City Regional Apparatus Performance Unit". The results show that simultaneously accountability and transparency have a positive effect on performance-based budgeting. Partially examined, it was found that accountability had no effect on performance-based budgeting while transparency had a positive effect on performance-based budgeting. This finding shows that accountability and transparency are indeed perceived to have a very important role in the preparation of performance-based budgeting. This study also found that respondents place openness or transparency as a more important factor than accountability.

The second research conducted by Benawan, Saerang, and Pontoh (2018) by title "The Effect of Supervision, Accountability and Financial Transparency on Employee Performance (Case Study at the Transportation Office of Tidore Islands City)". Based on

the results of hypothesis testing, it was found that Financial Supervision has a positive and significant influence on employee performance at the Transportation Service Office of Tidore Islands City. Based on the results of the hypothesis, it was found that Financial Accountability has a positive and significant influence on Employee Performance at the Transportation Service Office of Tidore Islands City. Based on the results of the hypothesis, it was found that financial transparency has a negative and insignificant effect on employee performance at the Transportation Service Office of Tidore Islands City. Based on the results of hypothesis testing, it was found that supervision, financial accountability had a positive or significant effect on employee performance, while financial transparency had a negative or insignificant effect on employee performance at the Department of Transportation of the City of Tidore Islands. So the hypothesis which states that Financial Transparency allegedly has a positive effect on Employee Performance is rejected.

The third research conducted by Umar, Syawalina, and Khairunnisa (2018) by title “The Effect of Accountability and Transparency of Regional Financial Management on the Performance of Aceh Inspectorate Agencies”. The results of the study prove that accountability and transparency together affect the performance of the Aceh Inspectorate Office. Accountability partially affects the performance of the Aceh Inspectorate Office with a regression coefficient of 0.155. The results of this study will have an impact that accountability will have a real impact on improving the performance of the Aceh Inspectorate Office.

The fourth research conducted by Putra and Indraswarawati (2021) by title “The Effect of Regional Financial Supervision, Transparency of Regional Financial Management and Accountability on the Performance of the Klungkung Regency Government (Survey on the Klungkung Regency Opd)”. The results of the study revealed that regional financial supervision had no effect on the performance of local governments at the Klungkung Regency Government Office. This shows that the higher the regional financial control, the more employees can feel depressed because of lack of opportunity for self-development thus making the performance of the local government at the Klungkung Regency Government Office will also decline. Transparency of regional financial management has a positive effect on the performance of local governments at the Klungkung Regency Government Office. This shows that the better the transparency of regional financial management, the performance of the local government at the Klungkung Regency Government Office will also increase. Accountability has a positive effect on the performance of local governments at the Klungkung Regency Government Office. This shows that the better the accountability, the performance at the Klungkung Regency Government Service will also increase.

III. WRITE DOWN YOUR STUDIES AND FINDINGS

A. Discussion of Research Results

1. Effect of Accounting System on Local Government Performance.

The results showed that the accounting system variable had a value of $t_{count} > t_{table}$ ($4.349 > 1.988$) with a significance level of $0.000 < 0.05$. Therefore, H_1 is accepted. So that the accounting system has a significant effect on the performance of local governments. This means that if the accounting system increases, the performance of the local government will also increase.

The results of this study are consistent with research (Yusuf, 2021), which shows the results of research that the Accounting System has a significant effect on Local Government Performance. However, this study does not support the results of research conducted by (Muda, et al., 2017), and (Sumaryati, et al., 2020) which states that the Accounting System has no significant effect on Local Government Performance.

2. The Effect of Internal Control on Local Government Performance.

The results showed that the internal control variable had a value of $t_{count} < t_{table}$ ($0.902 < 1.988$) with a significance level of $0.369 > 0.05$. Therefore, H_2 is rejected. So that internal control does not have a significant effect on the performance of local governments. This means that if the Internal Supervision is increasing, the performance of the Regional Government will also increase.

The results of this study do not support the results of research conducted by (Salamah, et al., 2021) and (Mifti, et al., 2009) which show the results of research that Internal Control has a significant effect on Local Government Performance.

3. The Effect of Transparency of Regional Financial Management on Local Government Performance.

The results showed that the regional financial management transparency variable had a value of $t_{count} < t_{table}$ ($-0.094 < -1.988$) with a significance level of $0.925 > 0.05$. Therefore, H_3 is rejected. So that the transparency of regional financial management does not significantly affect the performance of local governments. This means that increasing or decreasing transparency will not impact local government performance.

The results of this study are consistent with research (Benawan, et al., 2018), which shows the results of research that the transparency of regional financial management has no significant effect on Local Government Performance. However, this study does not support the results of research conducted by (Putra, et al., 2021) and (Audyta, et al., 2013) which state that the transparency of regional financial management has a significant effect on the performance of local governments.

IV. CONCLUSION

Based on the results of the research discussed in the previous chapter, the following conclusions can be drawn: LAMPIRAN

Lampiran, jika perlu, muncul sebelum pengakuan.

1. The accounting system has a significant effect on the performance of local governments. These results are evidenced by the value of $t_{\text{count}} > t_{\text{table}}$ ($4.349 > 1.988$) with a significance level of $0.000 < 0.05$. Therefore, H_1 is accepted. So that the accounting system has a significant effect on the performance of local governments.
2. Internal supervision has no significant effect on the performance of local governments. These results are evidenced by the value of $t_{\text{count}} < t_{\text{table}}$ ($0.902 < 1.988$) with a significance level of $0.369 > 0.05$. Therefore, H_2 is rejected. So that internal control does not have a significant effect on the performance of local governments.
3. Transparency of Regional Financial Management has no significant effect on Local Government Performance. These results are evidenced by the value of $t_{\text{count}} < t_{\text{table}}$ ($-0.094 < -1.988$) with a significance level of $0.925 > 0.05$. Therefore, H_3 is rejected. So that the transparency of regional financial management does not significantly affect the performance of local governments.

ACKNOWLEDGMENT

Based on the results of data analysis and discussion in the previous chapter, several limitations were found which are not expected to reduce the purpose of the study. The limitations in conducting this research are as follows:

1. The data collection method used in this study only used a questionnaire survey method, so the results obtained only refer to the results of the questionnaire.
2. The sample used in this study was only the revenue treasurer, the expenditure treasurer, the assistant revenue treasurer and the assistant expenditure treasurer at the Surakarta City Government Office, Agency, and Regional Secretariat, so the results cannot be generalized to the profession or field as a whole.
3. The variables in this study are only the Accounting System, Internal Control, and Transparency of Regional Financial Management, even though there are other factors that affect the performance of local governments.

REFERENCES

- Adiwirya, M. F., & Sudana, I. P. (2015). Akuntabilitas, Transparansi, dan Anggaran Berbasis Kinerja pada Satuan Kerja Perangkat Daerah Kota Denpasar. *E-Journal Akuntansi Universitas Udayana*, 612-613.
- Annisa, V., & A, E. D. (2017). Pengaruh Sistem Akuntansi Keuangan Daerah, Pengelolaan Keuangan Daerah, dan Good Governace Terhadap Kinerja Pemerintah Daerah. *JOM Fekon, Vol. 4 No. 1 (Februari) 2017*, 1874.
- Benawan, E. T., Saerang, D. P., & Pontoh, W. (2018). Pengaruh Pengawasan, Akuntabilitas dan Transparansi Keuangan Terhadap Kinerja Pegawai (Studi Kasus pada Dinas Perhubungan Kota Tidore Kepulauan).
- Hidayat, R. (2015). Pengaruh Pengelolaan Keuangan Daerah dan Sistem Akuntansi Keuangan Daerah Terhadap Kinerja Pemerintah Daerah. *ejournal.unp.ac.id*.
- Mifti, S., Lestariyo, N. B., & Kowanda, A. (2009). Pengawasan Internal dan Kinerja (Suatu Kajian di Kantor Inspektorat Jenderal Departemen Dalam Negeri).
- Muda, I., Wardani, D. Y., Erlina, Maksum, A., Lubis, A. F., & Abubakar, R. B. (2017). The Influence of Human Resource Competency and the use of Information Technology on the Quality of Local Government Financial Report With Regional Accounting System As An Intervening. 95.

- Putra, I. P., & Indraswarawati, S. A. (2021). Pengaruh Pengawasan Keuangan Daerah, Tranparansi Pengelolaan Keuangan Daerah dan Akuntabilitas Terhadap Kinerja Pemerintah Daerah Kabupaten Klungkung. *ejournal.unhi.ac.id*, 79-80.
- Sumaryati, A., Novitasari, E. P., & Machmuddah, Z. (2020). Accounting Information System, Internal Control System, Human Resource Competency and Quality of Local Government Financial Statements in Indonesia. 7.
- Salamah, N., Sudarmanto, E., & Herlisnawati, D. (2021). Pengaruh Penerapan Akuntansi Sektor Publik dan Pengawasan Internal Terhadap Kinerja Instansi Pemerintah. *Jurnal Online Mahasiswa (JOM) Bidang Akuntansi*.
- Yusuf, M. (2021). The Impact of Local Government Accounting Systems and Performance Based Budgeting on Local Government Performance Accountability.

AUTHORS

First Author – Raisita Mutiara Sani, Muhammadiyah of Surakarta University, b200180108@student.ums.ac.id

Second Author – Andy Dwi Bayu Bawono, Muhammadiyah of Surakarta University, andy.bawono@ums.ac.id

Correspondence Author – Andy Dwi Bayu Bawono, Muhammadiyah of Surakarta University, andy.bawono@ums.ac.id

Forecasting The Price Of Broiler Chicken In Ambon City-Maluku Province And The Risks That Increase On The Purchase Power Of The Community (Application of Linear Trend Forecasting Method)

Adolf B. Heatubun¹, Michel J. Matatula²

¹Department of Magister Management, Indonesian Christian University, Indonesia
²Department of Animal Husbandry, Faculty of Agriculture, Pattimura University, Indonesia

DOI: 10.29322/IJSRP.12.10.2022.p13060

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13060>

Paper Received Date: 14th September 2022

Paper Acceptance Date: 15th October 2022

Paper Publication Date: 21st October 2022

Abstract- The price of broiler meat in Ambon City, Maluku Province, Indonesia has recently continued to increase due to limited supply and strong demand pull. The increase in prices causes people's purchasing power to decrease and results in various risks that the consumer community must face. It is necessary to forecast future prices and find out how big the risk of a decline in consumer purchasing power is. This study aims to predict the upward trend in chicken meat prices in Ambon City, Maluku Province in the next year and analyze the risk of such price increases on the decline in people's purchasing power. Forecasting uses the linear trend method, starting with regression model analysis and following by forecasting the price of broiler meat for the next year's period (October 2022 to September 2023). Data for analysis is sourced from the National Strategic Food Price Information Center (PIHPS NASIONAL). The results showed that the average price of broiler meat in Ambon City, Maluku Province for 21 periods before forecasting was Rp. 37,476.19 per kg or grew 0.94%. The average price per kg in the forecasting period from October 2022 to September 2023 is Rp. 41,976.18 or a growth of 0.65%. The increase in the average price before the forecast and after the forecast is 12.01% or the price increases by Rp. 4,500,- per kg. This price increase indicates a decrease in consumer purchasing power by an average of 12.01% or equivalent to a decrease in the amount of consumption from 1 kg or 1000 g to the remaining 0.88 kg or 880 g. The decrease in purchasing power and the amount of consumption of broiler meat is categorized as a significant risk figure. Mitigation is carried out by encouraging the development of broiler meat production at the local producer level, although the effect of reducing risk is quite slow.

Index Terms- Broiler meat price, forecasting, decreasing purchasing power, risk and mitigation, Ambon City-Maluku Province-Indonesia.

I. INTRODUCTION

The development of prices for various foodstuffs has recently tended to increase. Many factors have contributed to the price increase, including internal factors such as limited supplies, rising prices for production factors and raw materials, and production failures at the producer level. The causes of external factors include over-consumer demand, major holiday events, hampered food imports, rising regional inflation, distribution and trade disruptions, and even effects such as rising prices for fuel oil (BBM). All of these factors can lead to a rapid increase in the price of basic food needs of the community.

The market price is defined as the value expressed in monetary units or money that must be paid by buyers to traders or sellers for goods or services (Chang & Su, 2022; Gaca, 2019). The market price includes the tax charged on the product. From time to time the price of a product can move up and down depending on the conditions that affect it. The first condition that can affect changes in the price of

a product is the inventory or stock available in the market. Panda, et al., (2013) stated that reduced inventory in the market will directly push up the price per unit of product. On the other hand, excess market inventory will push product prices down. If the product is perishable or perishable, then the excess inventory pushes the price down to speed up the product being bought by consumers and consumed.

On the producer side, a product that is produced requires a certain number of inputs or raw materials to produce the product. If the required number of inputs is not available, it will hamper the smooth production process for the desired number of products. The role of input is the main thing in the production process of output. The unavailability of the main input needed causes production to not be produced and causes the availability of products that are distributed to the market to decrease in number. As a result, it pushes up the price of the product in question in the market. The efforts of product-producing producers in providing the necessary inputs, also applying more

advanced production processes, and even large production expansions can be called innovations that ensure product availability (Diéguez-Soto, et al., 2018).

The development of input prices, which are always moving fast and rising, is another determining factor for rising product prices in the market. The increase in input prices is the main factor causing changes in product prices in the market. The rising prices of inputs and factors of production stemmed from various factors, ranging from the availability of the inputs themselves, and the increase in input prices, to the effects of trade and market transactions. The increase in input prices has the consequence of increasing production costs so to cover the increase in costs, producers are encouraged to increase the selling price of their products in the market. The results of the analysis of Srivastava, et al., (2017) show that the increase in production costs is mostly contributed by the increase in input prices and causes an increase in inflation.

External factors that have contributed to the increase in food prices include the pull of demand. The large and continuous demand-pull causes the need for food commodities to continue to increase and cause product prices in the market to move up. This pull in demand can be caused by various events that encourage people to ask for more. Often the demand-pull is caused by changes in weather or seasons, as well as increases in people's incomes, and even changes in people's tastes (Abbott, et al., 2011).

In particular, growth in people's incomes and improvements in dietary habit has encouraged rapid growth in food imports. This also affects changes in food prices in the market. Another thing that cannot be denied is that the price of products in the market will also increase when the price of fuel oil (BBM) increases. The increase in fuel prices due to the reduction in subsidies will have an effect on the increase in transportation costs which will push up prices for various products, including food prices. In general, the increase in fuel prices causes inflation to creep up (Harun, et al., 2018).

Inflation has consequences for the decline in people's purchasing power. The general increase in prices or inflation reduces the purchasing power of the people from a certain number of previously owned monetary units. This means that with a fixed and unchanged income level, people have lower purchasing power. With the same amount of money when prices have increased, consumers can only buy the same good in less quantity. This will be in line with the amount of consumption. Consumption of lesser amounts indicates declining consumer spending and is an indication of declining consumer preferences. Thus, rising prices or inflation risk reducing purchasing power, reducing public consumption, and increasing consumer spending just to maintain a certain amount of consumption. All of these things are indications that people's welfare is moving downwards (Agha, 2019; Aklin, et al., 2022).

In connection with the development of food prices that continue to increase and cause various consequences as mentioned above, it is necessary to predict future price developments in question. Food price volatility can occur due to an imbalance between supply and demand. Therefore, to identify the movement of food prices, a forecasting method is needed. Forecasting food prices play

an important role in knowing the trend of future price movements. Price forecasting can help provide consumers with information to regulate their consumption. Also is important information for producers in making sales decisions (Menculini, et al., 2021; Rosyid, et al., 2019; and Zulfiqar and Hussain, 2014).

In the last few years, broiler meat is a favourite food ingredient in Ambon City, Maluku Province, Indonesia. The price per kilogram is relatively lower and affordable than beef, and even quite competitive with the price of fresh fish which is relatively more expensive. Because it is relatively affordable, the demand for broiler meat continues to increase from time to time. This demand-pull encourages broiler producers to increase production. Local production is insufficient and does not keep pace with demand, causing importers to bring in frozen broiler meat from outside the region. Until now, the import of broiler meat continues to increase and the price continues to increase (<https://rri.co.id/ambon/Ekonomi>).

As a food commodity that is in demand by the public and its demand continues to increase, the price per kilogram of broiler meat continues to move up. This price increase has the opportunity to become uncontrollable in the future and can suppress public consumption. Also, the increase in the price of chicken meat can encourage other food prices to increase and cause inflation in the Ambon City area. Given the movement in the price of broiler meat, it is important if the current development of chicken meat prices can be predicted to increase in the future. This study aims to predict the trend of increasing chicken meat prices in Ambon City, Maluku Province in the next year. It is also followed by an analysis of the risk of increasing the price of broiler meat on people's purchasing power.

II. MATERIALS AND METHODS

Location and Data

This research took place in Ambon City, the Capital of Maluku Province, Indonesia. The data used is secondary data per month about the development of broiler meat prices. The data selected for analysis needs is the data period from January 2021 to September 2022 and produces a total of 21 data items (months). The consideration of using 21 periods of data for future forecasting needs is that this amount of data is sufficient to analyze the trend of subsequent price developments. Published data on the development of broiler meat prices were recorded in two locations, namely Gotong Royong Market and Mardika Market Ambon. Therefore, the said data is transformed into market averages for analysis purposes. The data was obtained from the NATIONAL STRATEGIC FOOD PRICE INFORMATION CENTER (PIHPS NASIONAL) through the website <https://hargapangan.id/table-harga/pasar-tradisional/regional>.

Analysis Stage

1. Data Tabulation and Regression Analysis

The data collected were tabulated and used for the needs of regression analysis with Linear Trend forecasting techniques. The linear trend formula is written as follows:

$$HDA_t = HDA_0 + bT \dots\dots\dots (1)$$

Information:

- HDA_t = Price of broiler meat that will be forecasted in month t.
- HDA_0 = Estimated time-series value (regression constant) in the base period (month t= 0)
- b = The absolute amount of growth each month.
- T = Time period (months) to be forecasted.

2. Forecasting the price of broiler meat in Ambon City

After obtaining the results of the regression analysis using a linear trend estimation technique, forecasting is then carried out to determine the trend of increasing broiler meat prices in Ambon City over the next year's period (12 months).

3. Analysis of Consumer Purchasing Power per Kilogram of Broilers and the Risks It Incurs

Based on the results of forecasting the price of chicken meat obtained, then an analysis of purchasing power is carried out based on the comparison of the consumer's purchasing ability per kilogram of chicken meat before the forecasting period and after the forecasting period.

III. RESULTS AND DISCUSSION

1. Data Tabulation and Results of Linear Trend Regression Analysis

The results of the tabulation of data on the development of broiler meat prices in Ambon City are shown in Table 1 below.

The data in Table 1 shows that the price per kilogram of broiler meat in Ambon City has continued to increase from January 2021 to September 2022. The average growth of chicken meat prices over the past 21 periods was 0.94%. According to information from the data provider source, the price of chicken meat is the price at the producer level which is applied in the Gotong Royong Market and Mardika Market. The reported price per kilogram of broiler meat may be much lower than the price per kilogram that occurs at the retail level in various locations in Ambon City and its surroundings.

The price development data for the initial period above is used to estimate the Linear Trend model and gives the following results:

$$HDA_t = 34,476.190 + 272,727 T \dots\dots\dots (2)$$

R² = 0.627; Prob. F test = 0.0001; r = 0.792; Prob.t-Test = 0.0001

Table 1. Data on the Development of Broiler Meat Prices in Ambon City in the Early Period

Data Period (T)	Month - Year	Chicken Meat Price (IDR/kg)	Chicken Meat Price Growth (%)
1	January 2021	33,250.0	-
2	February 2021	35,250.0	6.01
3	March 2021	36,000.0	2.13
4	April 2021	36,500.0	1.39
5	May 2021	37,000.0	1.37
6	June 2021	37,000.0	0.00
7	July 2021	38,000.0	2.70
8	August 2021	36,750.0	-3.29
9	September 2021	36,000.0	-2.04
10	October 2021	34,500.0	-4.17
11	November 2021	35,000.0	1.45
12	December 2021	35,500.0	1.43
13	January 2022	38,000.0	7.04
14	February 2022	40,250.0	5.92
15	March 2022	39,500.0	-1.86
16	April 2022	39,750.0	0.63
17	May 2022	39,750.0	0.00
18	June 2022	39,750.0	0.00
19	July 2022	39,750.0	0.00
20	August 2022	39,750.0	0.00
21	September 2022	39,750.0	0.00
Average		37,476.19	0.94

Source: PIHPS data, processed

The estimation results in equation (2) along with the statistical criteria values displayed show the price of broiler meat in Ambon City in December 2020, namely HDA₀

before the month data for forecasting is estimated at Rp. 34,476.19 per kg. The price will increase at an average rate of Rp. 272,727 per kg every month.

Statistically, the coefficient of determination (R²) is 0.627, which means that the development of broiler prices in Ambon City can be explained by changes in time (monthly) of 62.70%. The remaining percentage can be explained by other factors. Statistical proof (F test) on the value of the coefficient of determination shows a probability value of 0.0001, which means that the use of the T variable (month) significantly affects the price of broiler meat in Ambon City. The results of the test of the relationship between the price of broiler meat and the monthly time period indicated by the value of the correlation coefficient (r) are 0.792. The value of this correlation coefficient shows that the relationship between the price of broiler meat and the time period (months) is strong. The results of the significance test (t-test) of the monthly variable (T) on the price of broiler meat is 0.0001 which indicates that the monthly time period significantly influences the development of broiler meat prices in Ambon City. The results of the analysis of various statistical indicators above show that the regression estimation results of the linear trend model are valid enough to be used in forecasting analysis. The results of the regression estimation above explain that the price of broiler meat in Ambon City will continue to increase every month.

2. Forecasting Broiler Meat Prices in Ambon City, Maluku Province

Based on the results of the linear trend estimation above, forecasting is carried out to determine the value of the increase in the price of broiler meat in Ambon City over the next year's period (12 months). The results of forecasting the price of broiler meat in Ambon City for the next 12 months are shown in Table 2 below.

The forecasting period T (22) in the table above follows the data period used in the analysis, starting from January 2021 as period (1) to September 2022 (period 21). Therefore, the forecasting of chicken meat prices begins in the 22nd period from October 2022 to September 2023 (for the next 12 months). From the results of the linear trend forecasting, the price per kilogram of broiler meat continues to increase from October 2022 to September 2023. The achievement of average forecast price per kilogram of broiler meat for the next year is Rp. 41,976.18 with growth in the forecast period of 0.65%. Although the average price growth per kilogram of broiler meat in the forecasting period is smaller than the average growth in the initial period, physically the price per kilogram of broiler meat in Ambon City continues to increase. This is in line with the research results of Nurhabibah, et al., (2022) that the price of broiler meat continues to move up due to increasing consumer demand.

Table 2. Forecasting Results of Broiler Meat Prices in Ambon City One Year Ahead

Data Period (T)	Month - Year	Chicken Meat Price (IDR/kg)	Chicken Meat Price Growth (%)
22	October 2022	40,476.18	-
23	November 2022	40,748.91	0.67
24	December 2022	41,021.64	0.67
25	January 2023	41,294.36	0.66
26	February 2023	41,567.09	0.66
27	March 2023	41,839.83	0.66
28	April 2023	42,112.55	0.65
29	May 2023	42,385.27	0.65
30	June 2023	42,658.00	0.64
31	July 2023	42,930.73	0.64
32	August 2023	43,203.45	0.63
33	September 2023	43,476.18	0.63
Average		41,976.18	0.65

3. Analysis of Consumer Purchasing Power per Kilogram of Broiler in Ambon City and the Risks posed

Purchasing power is defined as the inherent wealth (basic) in the units of money used in exchange. Money has value or wealth because it can be exchanged for goods and services for human needs. The level of wealth in money depends on the quantity and quality of goods and services that it can buy (Polman, et al., 2018). According to this understanding, if one unit or unit of goods can be exchanged for a smaller amount of money, it is said that money has increased value or wealth. On the other hand, if the same number of units of goods must now be exchanged for more money, the money is said to have decreased value or wealth.

Based on the understanding of purchasing power of money above, can be calculated the value of money's purchasing power per kilogram of broiler meat purchased by people in Ambon City. The results of these calculations are presented in Table 3 below.

Based on the results of the analysis of purchasing power per kg of broiler meat in Table 3, it is known that in the next 12 months, consumers who consume broiler meat will experience a decrease in purchasing power by an average of 12.01% or Rp. 4.500,- per kg (rounded up). This decrease in purchasing power shows that the people's ability to maintain their purchasing power against the consumption of one kilogram of chicken meat has decreased by 12.01%. In other words, with the original broiler price of Rp. 37,476.18 per kg, people can consume

as much as 1 kg (= 1000 g), but after the price increase, in the same consumption value, people can only consume as much as 0.88 kg (= 880 g). These results indicate that reducing purchasing power has the risk of reducing the amount of physical consumption of chicken meat. As stated by Ayaviri-Nina, et al., (2022) that the decrease in purchasing power reduces/reduces the number of units of food that can be consumed by the community. This has the potential to lead the community toward micronutrient deficiencies. Also in terms of consumption, the decline in purchasing power gives an indication of a measure of the inability of individual households and communities to access food as a source of nutrition.

Furthermore, the decline in purchasing power associated with a reduction in the amount of consumption indicates that there is a reduction in the amount of

individual consumption expenditure of the community if there is no support in terms of the amount of people's income. On the other hand, if the individual community wants to maintain the amount of basic consumption as in the initial conditions and does not want a decrease in the amount of consumption, then the consequence is that consumption expenditure must be increased. If public consumption expenditure will also increase as a result of wanting to maintain the amount of initial consumption, then this will increase the burden of spending on overall consumption. The burden of higher consumption expenditures on the one hand followed by the amount of people's income not moving up on the other hand will indicate the level of individual welfare of the community is decreasing (Witt, 2016; Ayaviri-Nina, et al., 2022).

Table 3. Results of Analysis of Average Purchasing Power per Kilogram of Chicken Meat in Ambon City

Period (T)	Value of Money or Wealth per kg of Chicken Meat (IDR/kg)	Growth (Decrease) Purchasing Power (%)
Before Forecasting (Initial)	37,476.18	-
Forecasting (12 months Period)	41,976.18	12,01
Average price increase/kg	4,499.99	-

Source: analysis results, processed

In accordance with the decline in purchasing power which has consequences on various related matters, will be discussed related to the concept of risk. Risk is defined as an event or consequence of an event in which the event and its consequences are subject to uncertainty. In this state of uncertainty, something of human value is at stake (Aven, et al., 2011). According to this risk definition, it can be defined as the risk related to the increase in the price of broiler meat and the decrease in purchasing power as a consequence of the upward trend in the price of chicken meat which causes a decrease in purchasing power, a decrease in consumption, an increase in expenditure, and a decrease in people's welfare. All of these conditions constitute uncertainty considering that actual changes in the price of chicken meat may increase or even decrease.

According to the results of forecasting data on the price of broiler meat in Ambon City, the risk of an increase in the price of chicken meat causes the purchasing power of the people to decrease by 12.01%. This decrease in purchasing power resulted in the amount of special consumption expenditure for broiler meat which also increased by 12.01% if individuals in the community tried to maintain their total consumption. In terms of the number of units/units of consumption of broiler meat, the price increase which was followed by a decrease in purchasing power resulted in a decrease in the amount of chicken meat consumption by 0.88 kg from the original 1 kg unit. The risk faced by the consumer community in Ambon City is that the decrease in purchasing power is 12.01% or proportional to the burden of increasing the price per kg of chicken meat by Rp. 4.500, - and also physically the amount of consumption decreased to 0.88 kg indicating a number that is categorized as a big risk. This is quite reasonable considering the intensity of the decline in purchasing power that occurs in a relatively short time, namely 1 year (12 months) ahead, purchasing power and total consumption has the potential to decline to reach 2 digits. If this continues and is not controlled, it is conceivable that the potential decline in the welfare of the people who consume broiler meat in Ambon City may increase, even more, something that is not desired by both the consumer community and the local government.

Checking the above risk conditions for the purpose of overcoming various existing consequences and or reducing unwanted conditions, mitigation is carried out as follows. To maintain and maintain the purchasing ability of the consumer community, it is expected that the measure of consumer income needs to be increased. Mitigating this is admittedly quite difficult considering the number of consumers of broiler meat is not detected and may vary at various levels of consumer society. For example, in the case of the government providing direct cash assistance (BLT) for fuel subsidies, it might be used to increase people's purchasing power. However, the real practice of the community in using BLT is not specifically allocated to the consumption of broiler meat, but to all needs that are free and uncontrolled.

If the local government takes part in controlling the price of broiler meat in the market in order to suppress the rate of increase, this too will be difficult to control. This is due to the growing public preference on the one hand and on the other hand insufficient local production, followed by an increasing trend in imports of frozen chicken meat from outside the region. The way that can be done, may be enough to help overcome the risks that

exist but is quite slow in effect and can be built for the long-term goal is to encourage the development of broiler meat production at the local producer level.

IV. CONCLUSION

From the results and discussion above, the following conclusions are drawn:

1. The average price of broiler meat in Ambon City for 21 periods before forecasting is Rp. 37,476.19 per kg or grew by 0.94%. While the average price per kg in the forecasting period from October 2022 to September 2023 is Rp. 41,976.18 or grew by 0.65%. The results of the analysis using the linear trend regression model are statistically valid and can be used for forecasting the price of broiler meat in the future.
2. Comparison of the increase in the average price of broiler meat before forecasting with after forecasting by 12.01% or the price increasing by Rp. 4.500,- per. In the next 12 months, consumers who consume broiler meat will experience a decrease in purchasing power by an average of 12.01%.
3. The decrease in people's purchasing power of 12.01% is equivalent to the number of units of consumption of chicken meat which decreased from 1 kg or 1000 g to only 0.88 kg or 880 g remaining. The magnitude of the decline in purchasing power and the amount of consumption of broiler meat is categorized as a fairly large risk figure.
4. Mitigation can be done to maintain and maintain the purchasing ability of the consumer community through increasing consumer income, although this method is admittedly quite difficult considering the number of consumers of broiler meat is not detected and with varying levels.
5. Direct Cash Assistance (BLT) for fuel subsidies to the public may be used to increase people's purchasing power. However, this cannot be guaranteed in overcoming the decline in purchasing power of broiler meat consumption.
6. If the local government takes part in controlling the price of broiler meat in the market, this too will be difficult to achieve, given the people's growing preferences. The way that can be done although the effect is slow but can be built for long-term goals is to encourage the development of broiler meat production at the local producer level.

REFERENCES

- [1] [1] Abbott, P. C., Hurt, C., & Tyner, W. E. (2011). *What's driving food prices in 2011?* (No. 741-2016-51225).
- [2] [2] Agha, S. R. (2019). How the Economic Inflation Affects the Financial Statement. *International Journal of Multicultural and Multireligious Understanding*, 6(6), 526-539.
- [3] [3] Aklin, M., Arias, E., & Gray, J. (2022). Inflation concerns and mass preferences over exchange-rate policy. *Economics & Politics*, 34(1), 5-40.
- [4] [4] Aven, T., Renn, O., & Rosa, E. A. (2011). On the ontological status of the concept of risk. *Safety Science*, 49(8-9), 1074-1079.

- [5] [5] Ayaviri-Nina, V. D., Quispe-Fernández, G. M., Vanegas, J. L., Ortega-Mejía, V., & Cordero-Ahiman, O. V. (2022). Importance of Purchasing Power and Education in the Food Security of Families in Rural Areas—Case Study: Chambo, Ecuador. *Sustainability*, 14(10), 6068.
- [6] [6] Chang, H. H., & Su, J. W. (2022). Sustainable consumption in Taiwan retailing: The impact of product features and price promotion on purchase behaviors toward expiring products. *Food Quality and Preference*, 96, 104452.
- [7] [7] Diéguez-Soto, J., Garrido-Moreno, A., & Manzaneque, M. (2018). Unravelling the link between process innovation inputs and outputs: The moderating role of family management. *Journal of Family Business Strategy*, 9(2), 114-127.
- [8] [8] Gaca, R. (2019). Price as a measure of market value on the real estate market. *Real Estate Management and Valuation*, 26(4), 68-77.
- [9] [9] Harun, M., Mat, S. H. C., Fadzim, W. R., Khan, S. J. M., & Noor, M. S. Z. (2018). The effects of fuel subsidy removal on input costs of productions: Leontief input-output price model. *International Journal of Supply Chain Management*, 7(5), 529-534.
- [10] [10] <https://rri.co.id/ambon/ekonomi/1048335/peminat-daging-dan-ayam-cukup-tinggi-di-ambon>
- [11] [11] Menculini, L., Marini, A., Proietti, M., Garinei, A., Bozza, A., Moretti, C., & Marconi, M. (2021). Comparing prophet and deep learning to ARIMA in forecasting wholesale food prices. *Forecasting*, 3(3), 644-662.
- [12] [12] Nurhabibah, N., Firmansyah, F., Pramushinto, B., & Hoesni, F. (2022). Analysis of Broiler Chicken Price Forecasting in Traditional Markets in Jambi Province. *J-MAS (Journal of Management and Science)*, 7(1), 35-43.
- [13] [13] Panda, S., Saha, S., & Basu, M. (2013). Optimal pricing and lot-sizing for perishable inventory with price and time dependent ramp-type demand. *International Journal of Systems Science*, 44(1), 127-138.
- [14] [14] Polman, E., Effron, D. A., & Thomas, M. R. (2018). Other people's money: Money's perceived purchasing power is smaller for others than for the self. *Journal of Consumer Research*, 45(1), 109-125.
- [15] [15] Rosyid, H. A., Widiyaningtyas, T., & Hadinata, N. F. (2019, October). Implementation of the exponential smoothing method for forecasting food prices at provincial levels on java Island. In *2019 Fourth International Conference on Informatics and Computing (ICIC)* (pp. 1-5). IEEE.
- [16] [16] Srivastava, S. K., Chand, R., & Singh, J. (2017). Changing crop production cost in India: Input prices, substitution and technological effects. *Agricultural Economics Research Review*, 30(347-2017-2758).
- [17] [17] Witt, U. (2016). The evolution of consumption and its welfare effects. In *Demand, Complexity, and Long-Run Economic Evolution* (pp. 117-139). Springer, Cham.
- [18] [18] Zulfiqar, F., & Hussain, A. (2014). Forecasting wheat production gaps to assess the state of future food security in Pakistan. *Journal of Food and Nutritional Disorders*, 3(3), 2.
- [19] [19] <https://hargapangan.id/tabel-harga/pasar-tradisional/daerah>.

AUTHORS

First Author – Adolf B. Heatubun, Department of Magister Management, Indonesian Christian University, Indonesia
Email: adolpheatubun5@gmail.com
Second Author – Michel J. Matatula, Department of Animal Husbandry, Faculty of Agriculture, Pattimura University, Indonesia, Email: michelmatatula1962@gmail.com

A Study To Assess The Effectiveness Of Information Booklet On Knowledge Regarding Premenopausal Symptoms Among Women, In Selected Rural Area, Lucknow, UP

Laxmi Pandey, Komal Gautam ,Nidhi, Anushka Sharma,Lakshmi,Neeshu Rawat , Roshni Rani , Somi Singh

DOI: 10.29322/IJSRP.12.10.2022.p13061
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13061>

Paper Received Date: 15th September 2022
Paper Acceptance Date: 15th October 2022
Paper Publication Date: 21st October 2022

Abstract- Background: Pre-menopause is natural occurring in every woman's reproductive age, this typically occurs between the age of 40-50 years and its symptoms includes menstrual irregularities, hot flashes, fatigue, vaginal dryness, which occurs 2-10 years before attaining the menopause. Objectives: To evaluate pre-test knowledge score related to pre-menopausal symptoms. To assess the post-test knowledge score related to pre-menopausal symptoms. To compare the pre-test and post-test knowledge score regarding pre-menopausal symptoms. To find out association between pre-test level of knowledge with their socio demographic variable. Methodology: This study was conducted using quantitative research approach A quasi- experimental research design (one group pre-test post-test) was used. 30 women of age group from 40-51 years were selected through convenient sampling technique, in selected rural area of Lucknow. A Self Structured Knowledge questionnaire was used to assess the knowledge regarding premenopausal symptoms among women. Result-The study revealed that mean and SD of pretest level of knowledge score was 9.33 ± 2.1 and post-test level of knowledge score was 11.43 ± 1.9 . The paired (t) test value shows that there is a significant difference between pre-test and posttest knowledge score ($t=8.4$) at the level of significance ($p<0.05$). There is no significance found with the demographic variables except source of previous knowledge. Conclusion: The overall findings of the study shows that information booklet was effective, appropriate and feasible to impart the knowledge regarding premenopausal symptoms among women.

Index Terms- assess, effectiveness, information booklet, knowledge, premenopausal symptoms

I. INTRODUCTION

Pre-menopause is an unspoken, unattendant , reality of life. It is one such midlife stage which might be overcome easily or make a woman miserable and menopause is the cessation of menstruation. Pre-menopause by definition is the time in a women's life when she is adapting to physical, emotional, mental and hormonal changes. Some of the common associated changes include interrupted sleep pattern, hot flashes, stress and menstrual irregularities. Pre-menopause is completely natural occurring in every woman's reproductive age. This typically occurs between the age of 40-50 years and it is a period of menopause transition refers to 2-10 years before attaining the menopause. The average age of menopause is around 55 years of age.

According to World Health Report (2015), population of female in the world is estimated 3.905 billion out of which 476 million women attain menopause every year.

A normal woman's life cycle consists of stages-

1. Pre-pubertal stage
2. Pubertal stage(menarche)
3. Menstruation stage
4. Pre-menopausal stage
5. Menopausal stage
6. Post -menopausal stage

According to Pan Asian Menopause Society (2008). The Asian pre-menopausal women were more likely to have body ache (76-93%) and western pre- menopausal women were more prone to get vasomotor symptoms (14-34%) According to Stacy B. German, (2010) in the United States about 1.3 million women attain menopause per year out of which 20% of women diagnosed with depression.

According to Govil (2010) women in pre-menopause period are negligent about their health and end up with chronic disease.

According to M. Deepan. Babu in (2020) at Tamil Nādu India shows that 0% of the women had adequate knowledge ,15% of the women had moderate knowledge and 94% of women had inadequate knowledge regarding premenopausal symptoms. With all these observations the investigator felt that it is essential to identify the premenopausal symptoms and home remedies among women (45-55 years).

II. STATEMENT OF THE PROBLEM

“A study to assess the effectiveness of information booklet on knowledge regarding Premenopausal symptoms among Women, in selected rural area, Lucknow, U.P.”

III. OBJECTIVE OF THE STUDY

- To evaluate pre-test knowledge score related to pre-menopausal symptoms.
- To assess the post-test knowledge score related to pre-menopausal symptoms.
- To compare the pre-test and post-test knowledge score regarding pre- menopausal symptoms.
- To find out association between pre-test level of knowledge with their socio demographic variable.

HYPOTHESIS

- **H1-** There would be a significant difference between pre-test and post- test knowledge score of women on premenopausal symptoms
- **H2-** There would be a significant association between pre-test knowledge score with their selected demographic variable.

OPERATIONAL DEFINITION

A) ASSESS: In present study, assess refers to the process used to identify the level of

B) EFFECTIVENESS: Effectiveness refers to the knowledge score after providing information booklet regarding premenopausal symptoms among women.

C) INFORMATION BOOKLET: In present study, information booklet is an instructional aid, designed to provide information regarding premenopausal symptoms among women. knowledge regarding the pre-menopausal symptoms.

D) KNOWLEDGE: In this study the knowledge refers to right response given by women to the questionnaires related to pre-menopausal symptoms.

E) PRE-MENOPAUSAL SYMPTOMS: Pre menopause symptoms includes menstrual irregularities, hot flashes, fatigue, vaginal dryness, which occurs 2-10 years before attaining the menopause

DELIMITATIONS

The study is delimited to premenopausal women (40-51 years) of selected rural area of Lucknow.

IV. RESEARCH METHODOLOGY

Research Approach : The research approach indicates the basic procedures for conducting research, based on the nature of the problem and objective of the study. The research chosen for the study was Quantitative research approach.

Research Design : It refers to overall strategies that one chooses to integrate different components of the study. The research design chosen for the study was Quasi – experimental research design (one group pre-post-test).

Variables: The variable in the present study includes:

- **Independent variable** -In present study independent variables is “Information booklet”.
- **Dependent variable** -In present study dependent variable is “pre-menopausal women” (40-50years)

Setting: The study was conducted at the selected rural area of Lucknow. The present study was conducted in juggaur , Chinhat Block , Lucknow District , Uttar Pradesh.

Population:

- **Target population** – In present study target population was women of premenopausal age.

- **Accessible population-** Women (40-51 years) of selected rural area in Lucknow.

Sample: In the present study sample was women (40-51 years) in selected rural area Lucknow.

Sample size: The study consists of 30 samples at selected rural area of Lucknow.

Sampling technique: Convenient sampling technique.

Sampling criteria

- **Inclusion criteria-**
 - women was willing to participate.
 - Women was able to speak hindi.
 - Women were of age group (40-51 years)
- **Exclusion criteria-**
 - women unwilling to participate
 - women who were not present at the time of data collection.

Tools of data collection

- Section A- Demographic variable
- Section B- Structured knowledge questionnaire

SCORING KEY

Level of knowledge	Knowledge score
Adequate	14-26
Inadequate	0-13

Content validity: Content validity of the tool was obtained by expert suggestion for development of tool.

Ethical Consideration: The proposed study was conducted after taking administrative permission from Principal of Sahara College of Nursing and Paramedical Science and Ethical permission from Sarpanch and Pradhan of village.

Data Collection process: Informed consent from the participants was taken. Pretest was conducted through structured knowledge questionnaires. Intervention was given by information booklet to pre-menopausal women. Post test was conducted after 7 days.

Plan for data analysis-

Organization of data in master sheet. Frequency and percentage used for analysis of demographic data.

Descriptive statistics- Calculation of mean, standard deviation, chi square for the analysis of knowledge score.

Inferential statistics- Paired t-test to determine the association between pre-test knowledge score with their demographic variables.

V. ANALYSIS AND INTERPRETATION

SECTION-A

Socio Demographic Variables of Participants

Table No.1- Frequency, Percentage Distribution of socio demographic variables of pre-menopausal women:

[1] S.No.	[2] Characteristics	[3] Frequency	[4] Percentage (%)
[5] 1	[6] Age [7] 42-46 years [8] 46-49 years [9] 49-51 years	[10] [11] 9 [12] 14 [13] 7	[14] [15] 36% [16] 46.66% [17] 23.33%
[18] 2	[19] Religion [20] Hindu [21] Muslim	[22] [23] 25 [24] 5	[25] [26] 83.33% [27] 16.66%
[28] 3	[29] Marital status [30] Married [31] Divorced [32] Widow	[33] [34] 20 [35] 2 [36] 8	[37] [38] 66.66% [39] 6.66% [40] 26.67% [41]
[42] 4	[43] Level of Education [44] Illiterate [45] Primary Education [46] Graduate	[47] [48] 10 [49] 19	[51] [52] 33.33% [53] 63.33%

		[50] 01	[54] 3.34%
[55] 5	[56] Socio-Economic status [57] <10,000/month [58] 10,000-20,000/month	[59] [60] 23 [61] 7	[62] [63] 76.66% [64] 23.33%
[65] 6	[66] Dietary Pattern [67] Vegetarian [68] Non vegetarian [69] Eggetarian	[70] [71] 7 [72] 13 [73] 10	[74] [75] 23.33 [76] 43.33% [77] 33.33
[78] 7	[79] Habits [80] Tobacco chewing [81] Alcoholism [82] Smoking [83] No bad habits	[84] [85] 8 [86] 2 [87] 7 [88] 13	[89] [90] 26.66% [91] 6.66% [92] 23.33% [93] 43.33%
[94] 8	[95] Source of information [96] Family [97] Peer group [98] Mass media [99] Other	[100] [101] 25 [102] 2 [103] 2 [104] 1	[105] [106] 83.33% [107] 6.66% [108] 6.66% [109] 3.33%

Table No.1 Reveals that maximum no. of participants 46.66% were between 46-49 years of age , 30% were between 42-46 years of age, 23.33% were between 49-51 years of age. Most of the women 83.33% were hindu and only 16.66% were muslim women. 66.66% of women were married, 6.66% were divorced and 26.67% of women were widow. Most of the 63.33% of women were having primary education, 33.33% of women are illiterate and only 3.34% of women were graduate. Most of the 76.66% of women were having very low socio- economic status and 23.33% have low socio-economic status. 43.33% of women were non-vegetarian, 33.33% of women were eggitarian , and only 23.33% of women were vegetarian. Most of the women 43.33% were having no bad habits, 26.66% of women were having the habit of tobacco chewing, 23.33% of them were having smoking habits, and 6.66% of women were having the habit of drinking alcohol. Most of the women 83.33% were having family as a source of information, 6.66% of women were having information from peer groups and mass media, 3.33% of were were having other source of information .

SECTION-B

Comparison of PRE-TEST and POST-TEST knowledge score

Table No.2: Frequency and Percentage distribution of knowledge score of pre-menopausal women.

[110]Knowledge	[111] Pre-Test		[112] Post- Test	
	[113]Frequency	[114]Percentage(%)	[115]Frequency	[116]Percentage(%)
[117]Inadequate(0-13)	[118]29	[119]96.66%	[120]21	[121]70%
[122]Adequate(14-26)	[123]1	[124]3.33%	[125]9	[126]30%

Table No.2 exhibits the comparison,96.66% of women had inadequate and 3.33% of women had adequate knowledge in pre-test; whereas in post-test 70% of women had inadequate knowledge and 30% have adequate knowledge.

SECTION-C

Effectiveness of Information Booklet on knowledge regarding Pre-menopausal Symptoms

Table No.3 Depicting the mean, standard deviation , and t-value of pre-test and post-test.

[127]Test	[128]Mean+_SD	[129]'t' value	[130]Inference [131](df)
[132]Pre-Test	[133]9.33+_2.1	[134]8.4	[135]2.05(29)
[136]Post-Test	[137]11.43+_1.9		

Table No.3: Exhibit the overall pre-test mean and standard deviation was 9.33+_ 2.13 whereas overall post-test means and standard deviation was 11.43+_ 1.94. The obtained paired 't' value was 52.20 significant at 5% level 'p' <0.05. The statistical 't' test implies that the difference in pre-test and posttest value was found 52.20 which is statistically significant at 5% level (p<0.05). There exists a statistical significance in the enhancement of level of knowledge score indicating the positive impact of information booklet. Hence the stated hypothesis H1 is accepted.

SECTION-D

Association between the Pre-Test Knowledge score with demographic variables.

Table No.4: Depicting association between pre-test knowledge score with demographic variables.

S.No.	Variable	Pre-Test Knowledge Score		Chi-Square Value	DF	P-Value	Inference
		Inadequate	Adequate				
1	Age in Years			3.399	2	5.99	NS
	42-46	9	0				
	46-49	14	0				
	49-51	6	1				
2	Religion			0.2068	1	3.84	NS
	Hindu	24	1				
	Muslim	5	0				
3	Marital Status			0.5172	2	5.99	NS
	Married	19	1				
	Divorced	2	0				
	Widow	8	0				
4	Education Level			0.5989	2	5.99	NS
	Illiterate	10	0				
	Primary Education	18	1				
	Graduate	1	0				
5	Socio-Economic Status			0.3148	1	3.84	NS
	<10000 /Month	22	1				
	10000-20000 /month	7	0				

6	Dietary Pattern			3.3990	2	5.99	NS
	Vegetarian	6	1				
	Non-Vegetarian	13	0				
	Eggetarian	10	0				
7	Habits			1.352	3	7.82	NS
	Tobacco Chewing	8	0				
	Alcoholism	2	0				
	Smoking	17	0				
	No Bad Habits	12	1				
8	Source of previous information			14.4828	3	5.99	S
	Family	25	0				
	Peer Group	1	1				
	Information Media	2	0				
	Other	1	0				

Table No.4: shows that there was no significant association between age, religion, marital status, education level, socio-economic status, dietary pattern, and habits of pre- menopausal women with socio- demographic variables except source of previous information at the level of significance $p < 0.05$.

VI. SUMMARY:

Data were analysed according to the objectives of the study. Analysed data were presented in the form of tables. The presentation was described in empirical and justified manner.

VII. DISCUSSION

Objectives

1. To assess the pre-test knowledge score regarding premenopausal symptoms.

The mean pre- test score was 9.33 and SD was 2.1 and post-test results states that 9 (30%) had adequate knowledge whereas majority of women 21(70%) had inadequate knowledge. The mean post test score was 11.43 and SD was 1.9. Therefore, the overall mean of post-test knowledge score was 11.43 when compared to pre-test of 9.33. The obtained t value was 8.4 highly significance at $p < 0.05$ (2.05) level.

2. To find the association between pre-test level of knowledge with their socio demographic variables.

There is significant association found between pre-test knowledge score with selected demographic variable (source of previous information).

ACKNOWLEDGMENT

Firstly, we thank almighty God giving us strength to conduct this study.

It is our pleasure and privilege to express our deep sense of gratitude and appreciation to Prof. Mrs. Rossily Nirmal, Principal, Sahara College of Nursing, Lucknow for giving an opportunity to work in a place that investigates inevitable and scientifically inspiring involvement with gratefulness, we express great sense of thanks to her for providing administrative permission, support, and encouragement throughout the research study.

Our most sincere gratitude of thanks to Mrs. Aparna Pandey, Vice Principal, HOD Medical Surgical Nursing, Sahara College of Nursing, Lucknow for her encouragement and motivation during Research Project.

We are extremely thankful to Mrs. Laxmi Pandey, Assistant Professor, obstetrics and gynecology, Lucknow, we express great sense of thanks to her for being our research guide. she mentored us with excellence and kept believing in our potential till the end. Her tireless motivation, constructive guidance and immense patience enabled us to prepare this dissertation.

We extend our sincere thanks to all participants in this study for their whole hearted cooperation without whom this study would have been impossible. Our unresolved gratitude to our classmates, our friends for their endless support till last. Last but not the least we would like to express our heartfelt gratitude towards our parents for their patience, sacrifice, emotional and economical support throughout the Research Project.

REFERENCES

BOOKS

- [1] Lynette Denny ,Stergios poumouchsis .oxford Textbook Of Obstetrics And Gynaecology.1st edition .New Delhi: Oxford Publishers ;2019. 559,560,561
- [2] Konar Hiralal. Textbook of Obstetrics.9th edition .New Delhi: Jaypee Publishers;2017.60,61,62
- [3] Kaur Sandeep.Textbook Of Midwifery And Obstetrical Nursing .2nd edition. New Delhi:CBS publishers;2021.66,67,68
- [4] Balkrishnan Sheila.Textbook Of Obstetrics .3rd edition.New Delhi:New Paras Medical Publishers ;2020.235,236,237,238,239,240
- [5] Jacob Anamma.A Comprehensive Textbook Of Midwifery And Gynaecological Nursing .5th edition .Haryana: Jaypee Publishers;2018.323,324,325 Suddharth's And Brunner.Textbook Of Medical Surgical Nursing .1st South Asian edition
- [6] Joyce M.Black.Black's Medical Surgical Nursing.1st South Asian edition. New Delhi: JOURNALS
- [7] Ashok Asha .A study to assess the knowledge regarding premenopausal symptoms among women in selected areas of Emaculam Kerala. International journals of nursing Education and Research 2021;7
- [8] Borker Sagar .A,Venugopalan PP etall.Astudy to find out the prevalence of premenopausal symptoms and perceptions regarding menopause among women of Kreaala.International journals of Nursing Education And Research.2011
- [9] Sharma s,TandonVR,Mahajan.Astudy to assess the the impact of menopausal symptoms on daily life among urban women of Chennai.Journals of JK Sciences.2007
- [10] C.Goonaratna,P.Foneska and k.wijewardene.A study to assess the effect of premenopausal symptoms on their health among the rural women of Sri Lanka. Ceylon medical journal.1999
- [11] W.Y.Lin,W.S.Yang,L.T.Lee ,etall.A study to assess the knowledge on insulin resistance, obesity and metabolic syndrome among non –diabetic pre and postmenopausal women in North Taiwan .International Journal of Obesity.2006 S.Ozkan,E.S.Alatas,And M.Zencir.A Comparitive study to asses the womens quality of life in the premenopausal and postmenopausal periods. Chinese journals of Nursing.2005
- [12] Kalhan Meenakshi,Singhania Komal etall.A study to assess the prevalence of menopausal symptoms and its effect on quality of life among rural middle aged women of Haryana. International journal of basic and applied research.2020
- [13] WEBSITES
- [14] www.Jk science.org
- [15] www.ncbi.nih.gov/PMC/.gov
- [16] <http://ijanm.com/abstract>

- [17] <http://www.mayoclinic.org>
[18] www.webmed.com
[19] <https://www.researchgate.net>

AUTHORS

First Author – Laxmi Pandey
Second Author – Komal Gautam
Third Author – Nidhi
Fourth Author – Anushka sharma
Fifth Author – Lakshmi
Sxith Author – Neeshu Rawat
Seventh Author – Roshni Rani
Eighth Author- Somi Singh

Contraception Following Abortion

Dr. Sheetal Sachdeva (DGO, DNB)

Apollo Cradle, Moti Nagar, Delhi

DOI: 10.29322/IJSRP.12.10.2022.p13062
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13062>

Paper Received Date: 15th September 2022
Paper Acceptance Date: 15th October 2022
Paper Publication Date: 21st October 2022

I. INTRODUCTION

Every contraceptive method is efficient and safe when followed by abortion procedures immediately and medically suitable for the patient. Offering a contraceptive option directly following a spontaneous or induced abortion may help patients achieve the desired outcomes for their reproductive health and lessen the stress of numerous appointments. Counseling and methods for contraception should be offered to all patients experiencing an abortion that is spontaneous or induced. The right of the patient to choose to delay or decline the procedure is to be protected. Being aware of the specific limitations that every patient could encounter is essential in providing patient-centered care. We look at the different methods of contraception available following an abortion that is surgical or medical.

The use of effective contraception that is reversible following an abortion is acknowledged as such by the World Health Organization¹ as an essential element of integrated care. Ovulation can happen within eight days after the abortion² three, and over fifty percent of women are reported to return to sexual activity in the two weeks after having an abortion; prompt initiation of a successful contraceptive method is crucial.

II. METHODOLOGY

It is the world health organization's (WHO) medical requirements for the use of contraceptives specify that the use of hormonal methods that are combined (pills patches, vaginal rings, injectable contraceptives) and progestin-only pills could be started immediately following an abortion [55]. The process involved during a surgical or medical first-trimester abortion, which includes bleeding after abortion, is not affected by the prompt initiation of any contraceptive methods. Additionally, using these methods did not result in any more negative or unfavorable vaginal bleeding outcomes, nor in any significant clinical change in the coagulation parameters, compared to women who were using an IUD that was placebo-based, copper-based, which is a non-hormonal contraceptive, or who waited for the initiation the use of contraceptives combined with oral (COCs) [6], [7] [8], [9] [10][11][12], and [13]. So, these techniques can be used and should be initiated on the same day that misoprostol can be used to induce medical abortion, or at the time of surgery in the case of surgical abortion, or on the day of discharge from the hospital following treatment of incomplete abortion or

spontaneous abortion. A possible exception is a vaginal ring. There is limited evidence on initiating the use of the vaginal contraceptive ring immediately following a first-trimester medical or surgical abortion; however, no serious adverse events and no infection related to the use of the ring were found during three follow-up cycles after an abortion [14]. However, if bleeding is heavy, insertion of the ring may be delayed, but for no longer than five days. If the delay exceeds five days, a backup with barrier methods of contraception is recommended.

Implants are typically inserted right following the first-trimester surgical abortion, though most studies of implants focus on the levonorgestrel (LNG)-releasing implants [15][16] and [17].

The WHO's medical eligibility guidelines state that IUDs are inserted after the first trimester, spontaneous abortion, or even induced [55]. It is crucial to remember that all studies of the post-abortion insertions cited by WHO are restricted only to surgery evacuation and surgical abortion without any data regarding medical abortions [18] [19] [20] [21]and [22].

There was no difference in the chance of complications between an immediate and delayed insertion of an IUD following surgery. In addition, no differences were discovered in terms of safety or the rate of expulsion after the post-abortion insertion of the LNG- IUS as compared to IUDs made of copper [23] [24]. If there is abortifacient septicemia, IUDs should not be placed till the patient has had the condition treated successfully. In such cases, alternative methods of contraception should be considered in the interim.

In certain studies, a greater expulsion rate was found when the insertion was immediately following the abortion of an IUD compared to delayed placement [25] and [26] [27]. However, the rapid insertion can increase the percentage of women receiving the IUD.

The possibility of IUD removal when the device is placed after a surgical abortion or uterine expulsion increases by gestational duration and the size of the uterus. The chance of being expelled is higher for women when their IUD is implanted after a second- trimester abortion compared to an abortion that occurred in the first trimester [27] or [28].

It has also been shown that an IUD can be inserted as soon as expulsion has been confirmed in cases of medical abortion [29], [30], [31]. Expulsion rates were no higher if the IUD was inserted one week after medical abortion or during a 3–4-week post-abortion follow-up visit [31]. In addition, no connection was observed between the thickness of the endometrium or ultrasound results and the expulsion [31]. Furthermore, the earlier installation

of the LNG-IUS lowered the duration of bleeding that was heavy following an abortion medically prescribed [31].

Injectable contraceptives with only progestin (DMPA or norethisterone) can be administered immediately after a medical, surgical, and spontaneous abortion [32] [33] [34].

Although DMPA is often used with abortion or post-abortion treatment, no studies have been published regarding the beginning of the contraceptive procedure before the day of misoprostol's administration in the case of medical abortion.

Concerning sterilization, The WHO's medical eligibility requirements stipulate that the procedure can be performed following an uncomplicated abortion. However, it must be avoided in the event of any complications [55]. However, regret following sterilization is more prevalent for younger women and men (less than 30 years old age) [34], [35], (36) and when sterilization is done after delivery in the initial year following the birth [36]. According to these research findings, sterilization should not be routinely done when an abortion is performed among young women. Still, other options for appropriate, safe contraception must be provided, and, in actuality, it is essential to have them available when abortion services are offered.

Barrier methods can be started at any time, but per WHO medical eligibility guidelines, diaphragm, diaphragm, and cap are not suitable for use until six weeks following an abortion in the second trimester [5].

When there is a possibility of transmitting an infection transmitted by sexual contact (STI) as well as HIV, the use of dual protection should be considered, including the use of condoms and a more effective contraception method. The emergency contraceptive pill should be given to women relying on less efficient ways.

Natural family planning methods cannot be used until the menstrual cycle is back.

III. CONCLUSION

The treatment of pregnant women seeking termination of their pregnancy and abortion that is incomplete is not comprehensive or effective if family planning counseling and the supply of a reliable contraceptive method are not integral components of the treatment. We must never forget that most women have decided to have a child shortly. If they conceive again, there is a likely chance that their pregnancy could result in another abortion that is either safe or unsafe, based on their legal rights and available abortion facilities within the country where they reside.

REFERENCES

- [1] 1. World Health Organization. Safe abortions: technical and policy guidance for health systems: World Health Organization; 2012.
- [2] 2. Gemzell-Danielsson K, Kallner HK. Post-abortion contraception. *Women's Health* 2015;11(6):779-84. doi: 10.2217/wh.15.72.
- [3] 3. Schreiber CA, Sober S, Ratcliffe S, Creinin MD. Ovulation resumption after medical abortion with mifepristone and misoprostol. *Contraception* 2011;84(3):230-3. doi: 10.1016/j.contraception.2011.01.013.
- [4] 4. Boesen HC, Rørbye C, Nørgaard M, Nilas L. Sexual behavior during the first eight weeks after legal termination of pregnancy. *Acta Obstetrica et Gynecologica Scandinavica* 2004;83(12):1189-92. doi: 10.1111/j.0001-6349.2004.00494.x. World Health Organization

- [5] 5. Medical eligibility criteria for contraceptive use (4th ed.), WHO, Geneva (2010)Google Scholar
- [6] 6. Influence of oral contraceptives on immediate postabortal pituitary-ovarian functionLähteenmäki *Acta Obstet Gynecol Scand Suppl*, 76 (1978), pp. 1-43Google ScholarP. Lähteenmäki, V. Rasi, T. Luukkainen, G. Myllyä
- [7] 7. Coagulation factors in women using oral contraceptives or intrauterine contraceptive devices immediately after abortion *Am J Obstet Gynecol*, 141 (2) (1981), pp. 175-179 P. Lähteenmäki, V. Rasi, T. Luukkainen, G. Myllyä ArticleDownload PDFView Record in ScopusGoogle Scholar C.W. Martin, A.H. Brown, D.T. Baird
- [8] 8.A pilot study of the effect of methotrexate or combined oral contraceptive on bleeding patterns after induction of abortion with mifepristone and a prostaglandin pessary *Contraception*, 58 (2) (1998), pp. 99-103 C.W. Martin, A.H. Brown, D.T. Baird ArticleDownload PDFView Record in ScopusGoogle Scholar
- [9] [9] J.W. Niswonger, G.D. London, G.V. Anderson, L. Wolfe 9. Oral contraceptives during immediate postabortal period *Obstet Gynecol*, 32 (3) (1968), pp. 325-327 View Record in ScopusGoogle Scholar [10]W.F. Peterson
- [10] 10. Contraceptive therapy following therapeutic abortion: an analysis *Obstet Gynecol*, 44 (6) (1974), pp. 853-857 View Record in ScopusGoogle Scholar
- [11] [11]O.S. Tang, P.P. Gao, L. Cheng, S.W. Lee, P.C. Ho 11. A randomized double-blind placebo-controlled study to assess the effect of oral contraceptive pills on the outcome of medical abortion with mifepristone and misoprostol *Hum Reprod*, 14 (3) (1999), pp. 722-725 View Record in ScopusGoogle Scholar [12]O.S. Tang, J. Xu, L. Cheng, S.W. Lee, P.C. Ho
- [12] 12. The effect of contraceptive pills on the measured blood loss in medical termination of pregnancy by mifepristone and misoprostol: a randomized placebo controlled trial *Hum Reprod*, 17 (1) (2002), pp. 99-102 View Record in ScopusGoogle Scholar [13]M.E. Gaffield, N. Kapp, A. Ravi
- [13] 13. Use of combined oral contraceptives post abortion *Contraception*, 80 (4) (2009), pp. 355-362 ArticleDownload PDFView Record in ScopusGoogle Scholar [14]P.M. Fine, J. Tryggstad, N.J. Meyers, H. Sangi-Hagheykar
- [14] 14. Safety and acceptability with the use of a contraceptive vaginal ring after surgical or medical abortion *Contraception*, 75 (5) (2007), pp. 367-371 ArticleDownload PDFView Record in ScopusGoogle Scholar
- [15] [15]H. Kurunmäki 15. Contraception with levonorgestrel-releasing subdermal capsules, Norplant, after pregnancy termination *Contraception*, 27 (5) (1983), pp. 473-482 ArticleDownload PDFView Record in ScopusGoogle Scholar [16]H. Kurunmäki, J. Toivonen, P.L. Lähteenmäki, T. Luukkainen
- [16] 16. Immediate postabortal contraception with Norplant: levonorgestrel, gonadotropin, estradiol, and progesterone levels over two postabortal months and return of fertility after removal of Norplant capsules *Contraception*, 30 (5) (1984), pp. 431-442 ArticleDownload PDFView Record in ScopusGoogle Scholar
- [17] [17]N. Ortayli, A. Bulut, T. Sahin, I. Sivin 17. Immediate postabortal contraception with the levonorgestrel intrauterine device, Norplant, and traditional methods *Contraception*, 63 (6) (2001), pp. 309-314 ArticleDownload PDFView Record in ScopusGoogle Scholar
- [18] [18]H. Timonen, T. Luukkainen 18. Immediate postabortal insertion of the copper-T (TCu- 200) with eighteen months follow-up *Contraception*, 9 (2) (1974), pp. 153-160 ArticleDownload PDFView Record in ScopusGoogle Scholar [19]A. Moussa
- [19] 19. Evaluation of postabortal IUD insertion in Egyptian women *Contraception*, 63 (6) (2001), pp. 315-317 ArticleDownload PDFView Record in ScopusGoogle Scholar
- [20] [20] 20. N.L. Stanwood, D.A. Grimes, K.F. Schulz 20. Insertion of an intrauterine contraceptive device after induced or spontaneous abortion: a review of the evidence *BJOG*, 108 (11) (2001), pp. 1168-1173 ArticleDownload PDFView Record in ScopusGoogle Scholar
- [21] 21. D. Grimes, K. Schulz, N. Stanwood Immediate postabortal insertion of intrauterine devices *Cochrane Database Syst Rev*, 3 (2002), p. CD001777 View Record in ScopusGoogle Scholar
- [22] 22.A. El Tagy, E. Sakr, D.C. Sokal, A.H. Issa 22. Safety and acceptability of post-abortal IUD insertion and the importance of counseling *Contraception*, 67 (3) (2003), pp. 229-234 ArticleDownload PDFView Record in ScopusGoogle Scholar

- [23] 23. P. Pakarinen, J. Toivonen, T. Luukkainen 23. Randomized comparison of levonorgestrel- and copper- releasing intrauterine systems immediately after abortion, with 5 years' follow-up *Contraception*, 68 (1) (2003), pp. 31-34 ArticleDownload PDFView Record in ScopusGoogle Scholar
- [24] 24.J. Suvisaari, P. Lähteenmäk 24. Detailed analysis of menstrual bleeding patterns after postmenstrual and postabortal insertion of a copper IUD or a levonorgestrel-releasing intrauterine system *Contraception*, 54 (4) (1996), pp. 201-208 ArticleDownload PDFView Record in ScopusGoogle Scholar
- [25] 25.P.G. Gillett, N.H. Lee, A.A. Yuzpe, I. Cerskus 25. A comparison of the efficacy and acceptability of the Copper-7 intrauterine device following immediate or delayed insertion after first-trimester therapeutic abortion *Fertil Steril*, 34 (2) (1980), pp. 121-124 ArticleDownload PDFView Record in ScopusGoogle Scholar
- [26] 26.P.H. Bednarek, M.D. Creinin, M.F. Reeves, C. Cwiak, E. Espey, J.T. Jensen 26. Post-Aspiration IUD Randomization (PAIR) Study Trial Group. Immediate versus delayed IUD insertion after uterine aspiration *N Engl J Med*, 364 (23) (2011), pp. 2208-2217 View PDF CrossRefView Record in ScopusGoogle Scholar
- [27] 27. D.A. Grimes, L.M. Lopez, K.F. Schulz, N.L. Stanwood 27. Immediate postabortal insertion of intrauterine devices *Cochrane Database Syst Rev*, 6 (2010), p. CD001777 View Record in ScopusGoogle Scholar
- [28] 28.M.W. Steenland, N.K. Tepper, K.M. Curtis, N. Kapp 28. Intrauterine contraceptive insertion postabortion: a systematic review *Contraception*, 84 (5) (2011), pp. 447-464 ArticleDownload PDFView Record in ScopusGoogle Scholar
- [29] 29. S.J. Betstadt, D.K. Turok, N. Kapp, K.T. Feng, L. Borgatta 29. Intrauterine device insertion after medical abortion *Contraception*, 83 (6) (2011), pp. 517-521 ArticleDownload PDFView Record in ScopusGoogle Scholar
- [30] 30. N. Shimoni, A. Davis, M.E. Ramos, L. Rosario, C. Westhoff 30. Timing of copper intrauterine device insertion after medical abortion: a randomized controlled trial *Obstet Gynecol*, 118 (3) (2011), pp. 623-628 View Record in ScopusGoogle Scholar
- [31] 31. I. Sääv, O. Stephansson, K. Gemzell-Danielsson 31. Early versus delayed insertion of intrauterine contraception after medical abortion - a randomized controlled trial *PLoS One*, 7 (11) (2012), p. e48948 View PDF CrossRefView Record in Scopus 32.P. Lähteenmäki, J. Toivonen, P.L. Lähteenmäki
- [32] 32. Postabortal contraception with norethisterone enanthate injections *Contraception*, 27 (6) (1983), pp. 55-62 Google Scholar
- [33] 33. S.T. Cameron, A. Glasier, Z.E. Chen, A. Johnstone, C. Dunlop, R. Heller 33. Effect of contraception provided at termination of pregnancy and incidence of subsequent termination of pregnancy *BJOG*, 119 (9) (2012), pp. 1074-1080 View PDF CrossRefView Record in ScopusGoogle Scholar
- [34] 34. E. Hardy, L. Bahamondes, M.J. Osis, R.G. Costa, A. Faúndes 34. Risk factors for tubal sterilization regret, detectable before surgery *Contraception*, 54 (3) (1996), pp. 159-162 ArticleDownload PDFView Record in ScopusGoogle Scholar
- [35] 35. C.D. Holman, Z.S. Wisniewski, J.B. Semmens, I.L. Rouse, A.J. Bass 35. Population-based outcomes after 28,246 in-hospital vasectomies and 1,902 vasovasostomies in Western Australia *BJU Int*, 86 (9) (2000), pp. 1043-1049 View Record in ScopusGoogle Scholar
- [36] 36. S.D. Hillis, P.A. Marchbanks, L.R. Tylor, H.B. Peterson 36. Poststerilization regret: findings from the United States Collaborative Review of Sterilization *Obstet Gynecol*, 93 (6) (1999), pp. 889-895 ArticleDownload PDFView Record in ScopusGoogle Scholar

AUTHORS

First Author – Dr. Sheetal Sachdeva (DGO, DNB)
Apollo Cradle, Moti Nagar, Delhi

Adolescent PCOS – Diagnosis and Management

Dr. Sheetal Sachdeva

Sr. consultant Obs & Gynae Apollo Cradle, Moti Nagar, Delhi

DOI: 10.29322/IJSRP.12.10.2022.p13063
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13063>

Paper Received Date: 14th September 2022
Paper Acceptance Date: 15th October 2022
Paper Publication Date: 21st October 2022

I. INTRODUCTION

PCOS is increasing across the globe. The prevalence of PCOS in India varies between 3.7 percent to 22.5 percent (1,2). The prevalence of PCOS among adolescents is between 10.7 percent to 22.5 percent (3).

The debate continues over the causes, diagnostic criteria, and best practices for teenagers' polycystic ovary syndrome (PCOS). Recent studies have recognized these weaknesses, and evidence-based expert advice has become more readily available.

While the presence of polycystic or ovary shape (PCOM) is considered an important diagnostic criterion for PCOS among adults, it is not recommended for diagnosis in adolescents; the determination of PCOS in adolescents is based on the presence of ovulatory dysfunction and orogen excessive (5). The most reliable evidence for the presence of ovulatory problems is menstrual intervals of >90 days within the first year following menstrual onset, menstrual intervals that are consistently 21 days or greater than 45 days two or more years after menarche, and the absence of menstrual flow after 15 years or a couple of years after the budding of breasts. The most reliable indicators of an excess of androgens are: moderate to extreme hirsutism, persistent acne that is not responsive to topical treatment, and persistent elevation of the free testosterone and total testosterone levels. A conclusive diagnosis of PCOS is not necessary for treatment.

Treatment can reduce the chance of developing future comorbidities, even without an accurate diagnosis. The delay in

diagnosis, treatment for symptoms, and regular/ frequent symptomology check-ups is a good option. The treatments for PCOS must be tailored according to the symptoms, needs, and preferences of every patient. The goals of treatment are to enhance the quality of life and health-related outcomes over the long term. Lifestyle modifications are the primary treatment for obese and overweight teens with PCOS. COCs, also known as combined oral contraceptives (COC), are the first-choice treatment for acne and menstrual irregularity, and metformin is better than COCs in weight reduction and improvement in dysglycemia. COCs and metformin share the same effects when it comes to hirsutism, but they often have to be combined with other treatments for further improvement of skin-related symptoms.

Diagnostic criteria

There are three types of diagnostic criteria for adults with PCOS. According to the National Institutes of Health (NIH), criteria call for menstrual irregularity and evidence of an excess of androgen (9). The Rotterdam guideline allows any of the three criteria: menstrual irregularity or irregularity, androgen excess, and polycystic ovary morphology (PCOM) via ultrasound (10). It is recommended that the Androgen Excess and PCOS Society (AE-PCOS) is a good source of diagnosis when there is hyperandrogenism associated with menstrual irregularities as well as PCOM (11). In December 2012, the NIH's Evidence-based Methodology Symposium regarding Polycystic Ovary Syndrome recommended upholding the broad, inclusive Rotterdam criteria while focusing on the distinctive PCOS type. ([Table 1](#)) ([12](#)).

Table 1
PCOS phenotypes included in specific diagnostic criteria

Diagnostic criteria	PCOS phenotype			
	AE	PCOM	OD	AE + PCOM + OD
NIH 1990	+			
Rotterdam 2003/2006	+	+	+	+
AE-PCOS 2006 society	+	+		+
NIH 2012	+	+	+	+

The majority of criteria suggest excluding other causes. Androgen excess, or AE; OD, ovulatory dysfunction; PCOM, polycystic ovary anatomy; PCOS, polycystic ovary syndrome.

In everyday use, the same guidelines have been extended to adolescents. However, these adult-specific diagnostic guidelines are the problem of practical application in adolescents. Many adolescents experience symptoms of excess androgen (e.g., acne) in the peripubertal phase (13). Additionally, normal testosterone levels are not well defined for this age group (14), and the normal ovarian morphology of adolescents coincides with those of women suffering from PCOS (15,16).

Specialists working in the field for years have been aware of the difficulties in diagnosing PCOS for adolescents. A recent consensus document of international pediatric and adolescent specialization societies assessed what the PCOS criteria are supported by sufficient evidence to support their use to make PCOS diagnostics among adolescents (4). The most important findings from this study are concise below.

The authors emphasized the difficulty in distinguishing normal 'physiological anovulation' from real Ovulatory dysfunction. However, they also pointed out that most adolescent menstrual cycles are still between certain parameters. Accordingly, these were suggested as a sign of ovulatory disorder in adolescents:

1. Regular menstrual intervals of >90 days, even during the first year following the menstrual cycle
2. Menstrual intervals consistently 21 days or more than 45 days two or more years following menarche
3. Absence of menstrual cycles within 15 or 2 years following the budding of breasts

A persistent increase in serum-free and total testosterone levels determined by an accredited reference laboratory was considered the best evidence of excess biochemical androgen in an adolescent girl suffering from signs of PCOS. Although mild hirsutism that was isolated was considered normal at the beginning of post-menopausal periods, the presence of severe to moderate hirsutism was recognized as a clinical sign of androgen excess, as was the case with persistent acne not responding to topical treatment. It was suggested to test the condition for the presence of hyperandrogenemia before beginning any medical treatments.

Concerning PCOM, the consensus was that ovarian imaging might be delayed during the diagnosis of PCOS in adolescents until reliable data regarding PCOM exist. This means that diagnosing PCOS in adolescents currently rests on the presence of ovulatory dysfunction and androgen excess.

Important diagnostic considerations that were also that were highlighted in the consensus document included:

- I. The definitive identification of PCOS is not required to begin treatment. Treatment could reduce the chance of developing complications without an accurate diagnosis.
- II. The delay in diagnosing PCOS and allowing the treatment of symptoms and regular monitoring of symptoms is an option that is recommended;
- I. Obesity, hyperinsulinemia as well as insulin resistance, are acknowledged as common among adolescents with PCOS; however, these signs are not to be utilized to diagnose the condition; Other reasons for hyperandrogenemia and irregular menstrual cycle need to be identified before diagnosing PCOS.

Clinical features

Adolescent girls suffering from PCOS can experience abnormal menstrual cycles, hirsutism, or acne. A stepwise approach to diagnosis is recommended for the case of these patients. History details should include an examination of any exogenous medication's intake. Androgenic steroids and anti-seizure drugs can trigger the same clinical symptoms observed in PCOS, and some medications prescribed to treat acne can be able to mask or eliminate certain PCOS characteristics (17).

Menstrual irregularities in a variety of patterns can be observed in teenagers who suffer from PCOS, such as the primary form of amenorrhea (absence of menarche before 15 years old or 2 to 3 years after the budding of breasts), secondary amenorrhea (more than 90 days without menstrual flow, accompanied by previous menstrual cycles) or oligomenorrhea. Even excessive bleeding from the uterus (4). A recent study found that PCOS is the second most frequent cause of hospitalization for adolescents with abnormal bleeding from the uterus (AUB) or menorrhagia, representing 33% of the admissions (18).

The appearance of acne and hirsutism may be a sign of hyperandrogenemia. The extent and the progression of both conditions must be closely monitored. The Ferriman-Gallwey score is used to determine the severity of the hirsutism (19, 20). Acne severity may be classified as moderate, mild, or severe depending on the type of lesion and the number of lesions (21).

The clinician must be aware of the possibility of other underlying diseases like thyroid dysfunction, elevated prolactin levels, hypercortisolemia, and different causes of virilization that could cause the same clinical manifestation. Biochemical and clinical tests will be required to determine the presence of these conditions.

Laboratory evaluation

The measurement of free and total testosterone is the most commonly used hormone test to detect the presence of hyperandrogenemia (11, 19, 22). Testing using an extraction procedure with a total testosterone level greater than ng/dL usually indicates an increase in hyperandrogenism (23). Dehydroepiandrosterone sulfate (DHEAS) level is also useful to screen for the primary adrenal source of hyperandrogenemia.

The levels of these hormones should be measured early in the morning. An average afternoon androgen level does not necessarily mean that you have hyperandrogenemia. If a patient has met the requirements for clinical diagnosis of PCOS, but the test does not show hyperandrogenemia, the morning hormone levels may be taken (24, 25). The doctor should be aware that the treatment was started in the interim, hormone levels have been altered, and the patient's health could change.

Further laboratory testing can be customized as required to rule out any other causes of menstrual irregularity or hyperandrogenemia according to the clinical signs. Generally, this workup includes 17-hydroxyprogesterone (17-OHP), androstenedione, free thyroxine (FT4), thyroid-stimulating hormone (TSH), LH, FSH, and prolactin. It is recommended to rule out pregnancy for every patient.

Ultrasonography of the pelvic region is not generally advised for diagnosing PCOS in adolescents. Ultrasonographic criteria for diagnosing PCOS in adolescents are not clear (4). However, pelvic ultrasound may be recommended based on the characteristics of the pelvis to rule out other causes of disease (28). Some experts in this area believe it is important to rule out the possibility of uncommon causes of androgen-producing tumors that affect all girls who present with symptoms of anovulatory and hyperandrogenemia (29).

Evaluation for comorbidity

PCOS is connected to serious psychological and metabolic mortality (30- 32). The high prevalence of hyperinsulinemia and insulin resistance has been extensively documented within PCOS (4). In addition, obesity and obesity are typical in PCOS patients and can increase their risk (33). Metabolic syndrome and impaired glucose tolerance, as well as type 2 diabetes, are more prevalent in teens who suffer from PCOS (30, 34 - 37), and those suffering from PCOS must be evaluated for the presence of these conditions. The 2-hour blood glucose level following an oral glucose test is believed to be the most reliable test for screening to detect abnormalities in the tolerance of glucose, and some researchers have suggested regular screening for abnormal glucose tolerance by using the oral glucose tolerance test for adolescents suffering from PCOS (38).

The psychological effects of PCOS must not be overlooked (39). An increase in the frequency of anxiety and depression has been proven, and validated tools must be used to recognize these conditions among adolescents with PCOS (31, 32). Additionally, healthcare providers must be aware that subclinical and clinical eating disorders can be common among adolescents suffering from PCOS and should be aware of this when they offer lifestyle counseling (40).

Management considerations

Since the evidence currently available is not of the highest quality, the treatment options for PCOS should be tailored to the specific needs, presentation, and preferences of every patient, while considering potential adverse consequences (41). The treatment goals are to enhance the overall quality of life and health outcomes.

Lifestyle modifications are the primary treatment for overweight and obese teenagers who suffer from PCOS. Menstrual irregularity is improved, lowered risk of cardiometabolic illness, and a reduction in androgen excess can be achieved through losing weight (42- 46).

Contraceptives with a combination of oral and spermicides (COC) are a top treatment option for PCOS since they can treat some of the symptoms associated with PCOS (6). Furthermore, COC provides contraceptive coverage for patients that are active sexually. The estrogen-progesterone combination overwhelms the endogenous hypothalamic-pituitary-ovarian (HPO) axis and thereby intrudes the pathophysiologic mechanism of PCOS, consequential in reduced ovarian androgen production.

Furthermore, COC increases sex hormone binding globulin and further decrease the excess of androgen (47). The progesterone portion of the COC can also block estrogen's unopposed action and prevent the development of endometrial hyperplasia.

COC is a top option to regulate any menstrual irregularity like amenorrhea or oligomenorrhea. Menorrhagia, and the AUB (6, 19). The improvement in the menstrual cycle is typically noticed in the first two to three months. Hyperandrogenemia can also be observed to improve, and testosterone levels can be tested again at the end of the third-month treatment to determine a reduction. The duration of treatment with COC is not yet determined. There has been a suggestion that a test of the COC could be considered after at least one year of treatment to allow healing of the HPO axis and to see whether menstrual irregularity is restored spontaneously. However, the advantages of this approach have not been determined and must be evaluated against the potential risks of pregnancy.

COC is also an option for hyperandrogenemia-related skin manifestations. Improvements have been observed in acne and the progression of hirsutism using COC. While contraceptives that contain only progestin can be used to treat menstrual irregularity, their effect on hyperandrogenism has been less, which is why fewer improvements in the appearance of the skin are apparent with these strategies.

Metformin is a recommended treatment for women suffering from PCOS who have type 2 diabetes or have impaired tolerance to glucose that is not improved by lifestyle modifications (6). Recent meta-analyses of random controlled trials that evaluated the efficacy of metformin compared to COC in treating PCOS in adolescents showed metformin to be just as efficient as COC in treating sexual hirsutism. Metformin was shown superior to COC for weight loss and improved dysglycemia. COC was preferred in menstrual control. However, the authors cautioned that the overall quality of research is low, and further studies of high quality are required to address the key issues concerning treatment for PCOS in teenagers (41).

In order to achieve further improvement in the appearance of skin problems, further treatment is usually required in conjunction with COC or metformin. Spironolactone is an effective anti-androgen that can be used alongside COC and metformin. Spironolactone is a potent remedy for menstrual irregularities and the cutaneous manifestations of hyperandrogenism. However, it does not ameliorate metabolic issues (48, 49). Ganie and coworkers discovered that the combination of metformin with spironolactone was superior to any drug in improving menstrual irregularity and hirsutism, as well as the levels of serum androgens insulin resistance (50). Because spironolactone is Teratogens, it is important to combine it in conjunction with a secure contraception method for teens who are sexually active. In a pilot study the occasional use of oral finasteride in moderate doses was shown to be effective in treating hirsutism of teens suffering from PCOS or chronic or idiopathic persistent hirsutism. (51).

Procedures for removing hair that are cosmetic may provide better results as compared to pharmacotherapy. It is also accessible to patients with no requirement for prescription. Electrolysis and laser hair removal procedures are gaining popularity as they

become more efficient and cost-effective. Treatments for hair loss include eflornithine, an oil that is beneficial to people suffering from hirsutism however it should continue to be utilized for prolonged duration to ensure its efficacy.

REFERENCES

- [1] 1. Gill H, Tiwari P, Dabadghao P. Prevalence of polycystic ovary syndrome in young women from North India: A Communitybased study. *Indian. J. Endocrinol. Metab.* 2012;16(Suppl 2):S389-392.
- [2] 2. Joshi B, Mukherjee S, Patil A, Purandare A, Chauhan S, Vaidya R. A cross-sectional study of polycystic ovarian syndrome among adolescent and young girls in Mumbai, India. *Indian. J. Endocrinol. Metab.* 2014;18(3):317-324.
- [3] 3. Nidhi R, Padmalatha V, Nagarathna R, Amritanshu R. Prevalence of polycystic ovarian syndrome in Indian adolescents. *J. Pediatr. Adolesc. Gynecol.* 2011;24:223- 227.
- [4] 4. Witchel SF, Oberfield S, Rosenfield RL, et al. The Diagnosis of Polycystic Ovary Syndrome during Adolescence. *Horm Res Paediatr* 2015. [Epub ahead of print]. 10.1159/000375530 [PubMed] [CrossRef] [Google Scholar]
- [5] 5. Manmohan K, Kamboj I and Andrea E. Bonny1,2 Polycystic ovary syndrome in adolescence: diagnostic and therapeutic strategies. 2017 Oct; 6(4): 248–255. 10.21037/tp.2017.09.11 PMID: PMC5682369PMID: 29184806
- [6] 6. Legro RS, Arslanian SA, Ehrmann DA, et al. Diagnosis and treatment of polycystic ovary syndrome: an endocrine society clinical practice guideline. *J Clin Endocrinol Metab* 2013;98:4565-92. 10.1210/jc.2013-2350 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
- [7] 7. Dumesic DA, Oberfield SE, Stener-Victorin E, et al. Scientific Statement on the Diagnostic Criteria, Epidemiology, Pathophysiology, and Molecular Genetics of Polycystic Ovary Syndrome. *Endocr Rev* 2015;36:487-525. 10.1210/er.2015-1018 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
- [8] 8. Rosenfield RL, Ehrmann DA. The Pathogenesis of Polycystic Ovary Syndrome (PCOS): The Hypothesis of PCOS as Functional Ovarian Hyperandrogenism Revisited. *Endocr Rev* 2016;37:467-520. 10.1210/er.2015-1104 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
- [9] 9. Zawadzki JK, Dunaif A. Diagnostic criteria for polycystic ovary syndrome: towards a rational approach. In: Dunaif A, Givens JR, Haseltine F et al. editors. *Polycystic ovary syndrome*. Boston, MA: Blackwell Scientific Publications, 1992:377-84. [Google Scholar]
- [10] 10. Rotterdam ESHRE/ASRM-Sponsored PCOS Consensus Workshop Group. Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovary syndrome. *Fertil Steril* 2004;81:19-25. 10.1016/j.fertnstert.2003.10.004 [PubMed] [CrossRef] [Google Scholar]
- [11] 11. Azziz R, Carmina E, Dewailly D, et al. Positions statement: criteria for defining polycystic ovary syndrome as a predominantly hyperandrogenic syndrome: an Androgen Excess Society guideline. *J Clin Endocrinol Metab* 2006;91:4237-45. 10.1210/jc.2006- 0178 [PubMed] [CrossRef] [Google Scholar]
- [12] 12. National Institutes of Health. Evidence-based Methodology Workshop on Polycystic Ovary Syndrome. 2012. Available online: https://www.nichd.nih.gov/news/resources/spotlight/Page_s/112112-pcos.aspx
- [13] 13. Blank SK, Helm KD, McCartney CR, et al. Polycystic ovary syndrome in adolescence. *Ann N Y Acad Sci* 2008;1135:76-84. 10.1196/annals.1429.005 [PubMed] [CrossRef] [Google Scholar]
- [14] 14. Fanelli F, Gambineri A, Mezzullo M, et al. Revisiting hyper- and hypo-androgenism by tandem mass spectrometry. *Rev Endocr Metab Disord* 2013;14:185-205. 10.1007/s11154-013-9243-y [PubMed] [CrossRef] [Google Scholar]
- [15] 15. Villarroel C, Merino PM, Lopez P, et al. Polycystic ovarian morphology in adolescents with regular menstrual cycles is associated with elevated anti-Mullerian hormone. *Hum Reprod* 2011;26:2861-8. 10.1093/humrep/der223 [PubMed] [CrossRef] [Google Scholar]

- [16] 16. Codner E, Villarroel C, Eyzaguirre FC, et al. Polycystic ovarian morphology in postmenarchal adolescents. *Fertil Steril* 2011;95:702-6. e1-2. [PubMed]
- [17] 17. Eichenfield LF, Krakowski AC, Piggott C, et al. Evidence-based recommendations for the diagnosis and treatment of pediatric acne. *Pediatrics* 2013;131 Suppl 3:S163-86. 10.1542/peds.2013-0490B [PubMed] [CrossRef] [Google Scholar]
- [18] 18. Maslyanskaya S, Talib HJ, Northridge JL, et al. Polycystic Ovary Syndrome: An Under-recognized Cause of Abnormal Uterine Bleeding in Adolescents Admitted to a Children's Hospital. *J Pediatr Adolesc Gynecol* 2017;30:349-55. 10.1016/j.jpog.2016.11.009 [PubMed] [CrossRef] [Google Scholar]
- [19] 19. Martin KA, Chang RJ, Ehrmann DA, et al. Evaluation and treatment of hirsutism in premenopausal women: an endocrine society clinical practice guideline. *J Clin Endocrinol Metab* 2008;93:1105-20. 10.1210/jc.2007-2437 [PubMed] [CrossRef] [Google Scholar]
- [20] 20. Hatch R, Rosenfield RL, Kim MH, et al. Hirsutism: implications, etiology, and management. *Am J Obstet Gynecol* 1981;140:815-30. 10.1016/0002-9378(81)90746-8 [PubMed] [CrossRef] [Google Scholar]
- [21] 21. Rosenfield RL. The Diagnosis of Polycystic Ovary Syndrome in Adolescents. *Pediatrics* 2015;136:1154-65. 10.1542/peds.2015-1430 [PubMed] [CrossRef] [Google Scholar]
- [22] 22. Escobar-Morreale HF, Carmina E, Dewailly D, et al. Epidemiology, diagnosis and management of hirsutism: a consensus statement by the Androgen Excess and Polycystic Ovary Syndrome Society. *Hum Reprod Update* 2012;18:146-70. 10.1093/humupd/dmr042 [PubMed] [CrossRef] [Google Scholar]
- [23] 23. Carmina E, Oberfield SE, Lobo RA. The diagnosis of polycystic ovary syndrome in adolescents. *Am J Obstet Gynecol* 2010;203:201. e1-5. [PubMed]
- [24] 24. Rosenfield RL, Helke JC. Small diurnal and episodic fluctuations of the plasma free testosterone level in normal women. *Am J Obstet Gynecol* 1974;120:461-5. 10.1016/0002-9378(74)90621-8 [PubMed] [CrossRef] [Google Scholar]
- [25] 25. Abraham GE. Ovarian and adrenal contribution to peripheral androgens during the menstrual cycle. *J Clin Endocrinol Metab* 1974;39:340-6. 10.1210/jcem-39-2-340 [PubMed] [CrossRef] [Google Scholar]
- [26] 26. Speiser PW, Azziz R, Baskin LS, et al. Congenital adrenal hyperplasia due to steroid 21-hydroxylase deficiency: an Endocrine Society clinical practice guideline. *J Clin Endocrinol Metab* 2010;95:4133-60. 10.1210/jc.2009-2631 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
- [27] 27. New MI, Lorenzen F, Lerner AJ, et al. Genotyping steroid 21-hydroxylase deficiency: hormonal reference data. *J Clin Endocrinol Metab* 1983;57:320-6. 10.1210/jcem-57-2-320 [PubMed] [CrossRef] [Google Scholar]
- [28] 28. Bremer AA. Polycystic ovary syndrome in the pediatric population. *Metab Syndr Relat Disord* 2010;8:375-94. 10.1089/met.2010.0039 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
- [29] 29. Buggs C, Rosenfield RL. Polycystic ovary syndrome in adolescence. *Endocrinol Metab Clin North Am* 2005;34:677-705, x. 10.1016/j.ecl.2005.04.005 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
- [30] 30. Coviello AD, Legro RS, Dunaif A. Adolescent girls with polycystic ovary syndrome have an increased risk of the metabolic syndrome associated with increasing androgen levels independent of obesity and insulin resistance. *J Clin Endocrinol Metab* 2006;91:492-7. 10.1210/jc.2005-1666 [PubMed] [CrossRef] [Google Scholar]
- [31] 31. Dokras A, Clifton S, Futterweit W, et al. Increased risk for abnormal depression scores in women with polycystic ovary syndrome: a systematic review and meta-analysis. *Obstet Gynecol* 2011;117:145-52. 10.1097/AOG.0b013e318202b0a4 [PubMed] [CrossRef] [Google Scholar]
- [32] 32. Dokras A, Clifton S, Futterweit W, et al. Increased prevalence of anxiety symptoms in women with polycystic ovary syndrome: systematic review and meta-analysis. *Fertil Steril* 2012;97:225-30.e2. 10.1016/j.fertnstert.2011.10.022 [PubMed] [CrossRef] [Google Scholar]
- [33] 33. Glueck CJ, Morrison JA, Friedman LA, et al. Obesity, free testosterone, and cardiovascular risk factors in adolescents with polycystic ovary syndrome and regularly cycling adolescents. *Metabolism* 2006;55:508-14. 10.1016/j.metabol.2005.11.003 [PubMed] [CrossRef] [Google Scholar]
- [34] 34. Rossi B, Sukalich S, Droz J, et al. Prevalence of metabolic syndrome and related characteristics in obese adolescents with and without polycystic ovary syndrome. *J Clin Endocrinol Metab* 2008;93:4780-6. 10.1210/jc.2008-1198 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
- [35] 35. Roe AH, Prochaska E, Smith M, et al. Using the androgen excess-PCOS society criteria to diagnose polycystic ovary syndrome and the risk of metabolic syndrome in adolescents. *J Pediatr* 2013;162:937-41. 10.1016/j.jpeds.2012.11.019 [PubMed] [CrossRef] [Google Scholar]
- [36] 36. Hart R, Doherty DA, Mori T, et al. Extent of metabolic risk in adolescent girls with features of polycystic ovary syndrome. *Fertil Steril* 2011;95:2347-53, 2353.e1. [PubMed]
- [37] 37. Fruzzetti F, Perini D, Lazzarini V, et al. Hyperandrogenemia influences the prevalence of the metabolic syndrome abnormalities in adolescents with the polycystic ovary syndrome. *Gynecol Endocrinol* 2009;25:335-43. 10.1080/09513590802630146 [PubMed] [CrossRef] [Google Scholar]
- [38] 38. Palmert MR, Gordon CM, Kartashov AI, et al. Screening for abnormal glucose tolerance in adolescents with polycystic ovary syndrome. *J Clin Endocrinol Metab* 2002;87:1017-23. 10.1210/jcem.87.3.8305 [PubMed] [CrossRef] [Google Scholar]
- [39] 39. Genovese A, Smith T, Kramer H, et al. "Is It Her Hormones?": Psychiatric Diagnoses and Polycystic Ovarian Syndrome. *J Dev Behav Pediatr* 2016;37:103-4. 10.1097/DBP.0000000000000243 [PubMed] [CrossRef] [Google Scholar]
- [40] 40. Bernadett M, Szeman NA. Prevalence of eating disorders among women with polycystic ovary syndrome. *Psychiatr Hung* 2016;31:136-45. [PubMed] [Google Scholar]
- [41] 41. Al Khalifah RA, Florez ID, Dennis B, et al. Metformin or Oral Contraceptives for Adolescents With Polycystic Ovarian Syndrome: A Meta-analysis. *Pediatrics* 2016;137. [PubMed] [Google Scholar]
- [42] 42. Toscani MK, Mario FM, Radavelli-Bagatini S, et al. Effect of high-protein or normal-protein diet on weight loss, body composition, hormone, and metabolic profile in southern Brazilian women with polycystic ovary syndrome: a randomized study. *Gynecol Endocrinol* 2011;27:925-30. 10.3109/09513590.2011.564686 [PubMed] [CrossRef] [Google Scholar]
- [43] 43. Ornstein RM, Copperman NM, Jacobson MS. Effect of weight loss on menstrual function in adolescents with polycystic ovary syndrome. *J Pediatr Adolesc Gynecol* 2011;24:161-5. 10.1016/j.jpog.2011.01.002 [PubMed] [CrossRef] [Google Scholar]
- [44] 44. Marzouk TM, Sayed Ahmed WA. Effect of Dietary Weight Loss on Menstrual Regularity in Obese Young Adult Women with Polycystic Ovary Syndrome. *J Pediatr Adolesc Gynecol* 2015;28:457-61. 10.1016/j.jpog.2015.01.002 [PubMed] [CrossRef] [Google Scholar]
- [45] 45. Fields EL, Trent ME. Treatment Considerations for the Cardiometabolic Signs of Polycystic Ovary Syndrome: A Review of the Literature Since the 2013 Endocrine Society Clinical Practice Guidelines. *JAMA Pediatr* 2016;170:502-7. 10.1001/jamapediatrics.2015.4866 [PubMed] [CrossRef] [Google Scholar]
- [46] 46. Lass N, Kleber M, Winkel K, et al. Effect of lifestyle intervention on features of polycystic ovarian syndrome, metabolic syndrome, and intima-media thickness in obese adolescent girls. *J Clin Endocrinol Metab* 2011;96:3533-40. 10.1210/jc.2011-1609 [PubMed] [CrossRef] [Google Scholar]
- [47] 47. Mastorakos G, Koliopoulos C, Creatsas G. Androgen and lipid profiles in adolescents with polycystic ovary syndrome who were treated with two forms of combined oral contraceptives. *Fertil Steril* 2002;77:919-27. 10.1016/S0015-0282(02)02993-X [PubMed] [CrossRef] [Google Scholar]
- [48] 48. Ganie MA, Khurana ML, Eunice M, et al. Comparison of efficacy of spironolactone with metformin in the management of polycystic ovary syndrome: an open-labeled study. *J Clin Endocrinol Metab* 2004;89:2756-62. 10.1210/jc.2003-031780 [PubMed] [CrossRef] [Google Scholar]
- [49] 49. Zulian E, Sartorato P, Benedini S, et al. Spironolactone in the treatment of polycystic ovary syndrome: effects on clinical features, insulin sensitivity and lipid profile. *J Endocrinol Invest* 2005;28:49-53. 10.1007/BF03345529 [PubMed] [CrossRef] [Google Scholar]

- [50] 50. Ganie MA, Khurana ML, Nisar S, et al. Improved efficacy of low-dose spironolactone and metformin combination than either drug alone in the management of women with polycystic ovary syndrome (PCOS): a six-month, open-label randomized study. *J Clin Endocrinol Metab* 2013;98:3599-607. 10.1210/jc.2013-1040 [PubMed] [CrossRef] [Google Scholar]
- [51] 51. Tartagni MV, Alrasheed H, Damiani GR, et al. Intermittent low-dose finasteride administration is effective for treatment of hirsutism in adolescent girls: a pilot study. *J Pediatr Adolesc Gynecol* 2014;27:161-5. 10.1016/j.jpag.2013.09.010 [PubMed] [CrossRef] [Google Scholar]
- [52] 52. Smith SR, Piacquadio DJ, Beger B, et al. Eflornithine cream combined with laser therapy in the management of unwanted facial hair growth in women: a randomized trial. *Dermatol Surg* 2006;32:1237-43. [PubMed] [Google Scholar]
- [53] 53. Hamzavi I, Tan E, Shapiro J, et al. A randomized bilateral vehicle-controlled study of eflornithine cream combined with laser treatment versus laser treatment alone for facial hirsutism in women. *J Am Acad Dermatol* 2007;57:54-9. 10.1016/j.jaad.2006.09.025 [PubMed] [CrossRef] [Google Scholar]

AUTHORS

First Author – Dr. Sheetal Sachdeva
Sr. consultant Obs & Gynae Apollo Cradle, Moti Nagar, Delhi

Investigating the Impact of SERVQUAL Dimensions on Customer Satisfaction: Evidence from Outbound Travelers in Sri Lanka

R.A.D.D.N. Ranatunga^{1*}, W.M.A.H. Bandara ², P.G.S.S. Pattiyagedara ², A.M.N.M. Gangananda²

¹Department of Tourism Studies, Uva Wellassa University, Badullla, Sri Lanka

*dinunawanji@gmail.com, TP: +9471 5380998

DOI: 10.29322/IJSRP.12.10.2022.p13064

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13064>

Paper Received Date: 12th September 2022

Paper Acceptance Date: 13th October 2022

Paper Publication Date: 21st October 2022

Abstract

As a result of the intricacy and globalization of today's competitive business climate, service quality has emerged as one of the most critical sources of value in the tourism industry. One method of determining service quality is to assess client satisfaction. The purpose of this paper is to investigate the impact of the service quality dimensions of Travel Agencies on customer satisfaction of outbound travelers in Sri Lanka. It will assist in steering contemporary online travel agencies and potential newcomers to have a thorough understanding of customer satisfaction in their domain. The researchers suggest a model to identify the factors influencing customer satisfaction based on a thorough literature review. The data was collected from a sample of 384 outbound travelers using a convenient sampling method through online questionnaires in order to achieve the identified objectives. The reliability of the data was evaluated using the Cronbach Alpha method. Both descriptive and inferential statistics were analyzed using SPSS (version 21) software to accomplish the objectives of this quantitative study. The five SERVQUAL Model dimensions—tangibility, responsibility, reliability, assurance, and empathy—were introspectively examined during the research. The correlation analysis demonstrated a significant correlation between customer satisfaction and the service quality dimensions. Nevertheless, the outcome of the regression analysis showed that tangibility, reliability, responsiveness, and empathy have a significant impact on customer satisfaction. It is recommended that travel agencies make sure that the services provided to customers are completed with accuracy and the assurance of meeting tour schedules on time. Reliability was the most important service quality dimension with the strongest predicting power on customer satisfaction. The study's findings also indicated that improving customer satisfaction requires ensuring that the tangibles, physical environment, and virtual environment of the travel agency are visually appealing and that quick responses are guaranteed through a reliable information system and practical communication channels.

I. Introduction

The corporate climate has altered dramatically as a result of globalization. As a result, there is fierce competition among organizations. To successfully combat and overcome these challenges, firms must provide better services that leave customers completely satisfied. Companies may earn or lose market share based on customer reactions (Panditharatne & Gamage, 2019). Customers who are satisfied help the company win the market, whereas dissatisfied customers cause the company to lose the market. As a result, it is critical that they pay careful attention to their customers' satisfaction (Hirbo, 2018).

The tourism business is a service industry, which the customer is the main character who plays an important part in the industry (Al-Dmour et al., 2016). Industry can function best and achieve their vision by maximizing service quality and customer satisfaction. When examining the service sector, it is rather difficult to optimize a client's happiness in the tourism business due to their various nationalities, faiths, thoughts, languages, interests, beliefs, rules and regulations, and so on (Shahin & Janatyan, 2011). As a result, in high-involvement industries such as tourism, perceived service quality plays a large impact. To thrive in the competitive travel agency business, travel agencies should provide their customers with more than they expect from the company (Marinković, et al., 2013). The

This publication is licensed under Creative Commons Attribution CC BY.

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13064>

www.ijsrp.org

needs of clients in the tourism industry change frequently, thus businesses must be strategically focused to capture the dynamic wants by providing services accordingly (Shahin and Janatyan 2011).

Quality has received a lot of attention in the tourism sector during the last decade. Many studies have shown that offering good service to consumers retains them, attracts new customers, increases business image, positive word-of-mouth recommendation, and, most importantly, ensures survival and profitability (Guo, et al., 2020). It is more difficult to determine the customer's expectations. However, in today's corporate environment, it is critical to have a good sense of the customer's mindset and to provide a flexible service (Manani et al., 2013). Travel agents may detect these many types of wants and objectives, and if they can provide a better service for each customer as expected, that firm can maintain a high level of customer loyalty (Shahin & Janatyan, 2011).

Better service leads to happier customers, and happier customers lead to customer loyalty. However, the European and American customer satisfaction index models indicate that service quality is a component of satisfaction. "SERVQUAL," a standardized questionnaire developed by Parasuraman, Berry, and Zeithaml, measures respondents' "expectations" and "performance" scores and calculates service quality as the difference between them (Vryoni, Bakirtzoglou, & Ioannou, 2017). As the travel agency industry is more service oriented than other industries, it can offer a source of competitive advantage (Panditharatne & Gamage, 2019). The purpose of the study is to identify the impact of service quality on customer satisfaction in Travel Agencies in Sri Lanka. The specific objectives of the current study are as follows:

- To investigate the most significant dimension(s) of service quality that impact on customer satisfaction.
- To investigate mean difference of Customer Satisfaction based on demographic factors.

Literature Review

Customer Satisfaction

Customer satisfaction is a mental state that contrasts the performance perceptions made after a purchase with the results of the customer's expectations prior to making the purchase. Customers are happy when they are pleased with the results of their purchases, accomplish their objectives, and have a hassle-free experience. It is thought that happy customers keep in contact with the business and make more frequent purchases of goods or services than unhappy ones (Paul et al., 2016). Customers who have experienced a hotel's performance and had their expectations met are said to be satisfied. The positive relationship between customer satisfaction and service quality has been demonstrated by many academics (Ali & Anwar, 2021). Customers are the most significant stakeholders in organizations and their satisfaction is a majority to management. In recent years, organizations are appreciative to concentrate more services in addition to their offers. The quality of service has become a major feature of customer satisfaction (Agbor, 2011).

Service Quality

Quality is a theory that is evasive and muddled (Abdullah & Afshar, 2019). Since they have different qualities, it is crucial to distinguish between goods and services. The former is a more tangible thing, whereas the latter is an intangible, legit performance (Abdullah & Rahman, 2015).

The degree of inconsistency between consumers' desires and expectations for service and their insights of service performance also can be defined as Service Quality (Vryoni et al., 2017). Service quality and customer satisfaction are vital concepts that each and every companies must recognize if they want to endure competitive and grow. In now a day, competitive business environment the key for a sustainable competitive advantage is providing high quality service to the consumers (Angelova & Zekiri 2011). Over the last few decades, many researches have been giving their consideration on quality in the tourism industry. Quality is become as a global concept that is applied to tourist destinations, regions or nations and also same as individual private enterprises. In the contemporary era consumers are demanding higher quality in products and services which they use than ever before (Kant & Jaiswal, 2017). Therefore, in now a day without any hesitation service Quality has become as the most significant consumer trend. The aggressive and growing competition and speedy deregulation have made number of businesses in the service sector to pursue profitable ways and becoming competitive. To succeed in their business it's a good strategy for a business providing high quality services to their customers (Angelova & Zekiri 2011).

The SERVQUAL Model

One of the most widely used indicators of service quality, SERVQUAL has been used in a number of different industries, including the travel and tourism sector. Studies which had examined the determinants of travel agencies' service quality were reviewed as part of a

process to determine whether SERVQUAL would be a suitable indicator of the level of service provided by travel agencies (Ryan & Cliff, 2008). As long as service quality is acknowledged as the foundation for customer satisfaction, a high level of service quality must be provided by the service provider in order to achieve a high level of customer satisfaction (Hussain et al., 2015). Perceived service quality is the customer's assessment of the overall excellence or superiority of the service based on a comparison of their desires or expectations and the actual received service (Liu & Lee, 2016).

Dimensions of service quality

Tangibility

Many researchers defined Tangibility in number of ways. Tangibility is defined as the appearance of physical facilities, equipment, personnel and written materials (Ananth et al., 2011). Based on the definitions established researchers define tangibility as the physical appearance, modern looking equipment and the appearance of the personnel of an organization.

Reliability

According to Shahin and Janatyan (2011) reliability is capability to accomplish the assured service consistently and accurately. Reliability depends on managing consumer's services difficulties, services delivered right the first time, offer services at the assured time and continuing error-free record. Moreover, they indicated reliability as the most vital aspect in conventional service. Reliability also comprises of exact order contentment, perfect record, perfect quote, accurate in billing, exact calculation of commission, keep services assurance (Bharwana et al., 2013). Reliability as existing of the organization, firm and the workers to carry out services promised and correct manner. Studying the above stated definitions, the researchers define the reliability as the capability to provide the service to the potentials or the customers to in assured and accurate manner.

Responsiveness

Responsiveness can be defined as the willingness of workforces to offer service (Shahin & Janatyan, 2011). It contains appropriateness of services. It is also comprising identifying desires and expectations of the consumer, appropriate effective hours, individual consideration given by the staff, courtesy to problems and customers protection in their transaction. defined responsiveness as giving prompt response to the customer requests and willingness to provide better service (Shahin & Janatyan, 2011). By considering above definitions the researchers define responsiveness as providing prompt service by giving immediate response to the customers' requests and the willingness to help for their problems.

Assurance

Knowledge and politeness of employees and their capability to encourage trust and confidence defined as Assurance. In some circumstances, Assurance define as the well-mannered and friendly staff, provision of financial advice, inside comfort, eases of access to account information and knowledgeable and experienced management team (Sadek et al., (2010). Assurance also defined as awareness and courtesy of workers and their capability to motivate trust and confidence. Also mentioned that assurance consist competence, courtesy, credibility and security (Shahin and Janatyan 2011). Based on the above stated definitions the researchers defines assurance as the knowledge and politeness of employees in the firm as well as their capability to deliver trust and confidence.

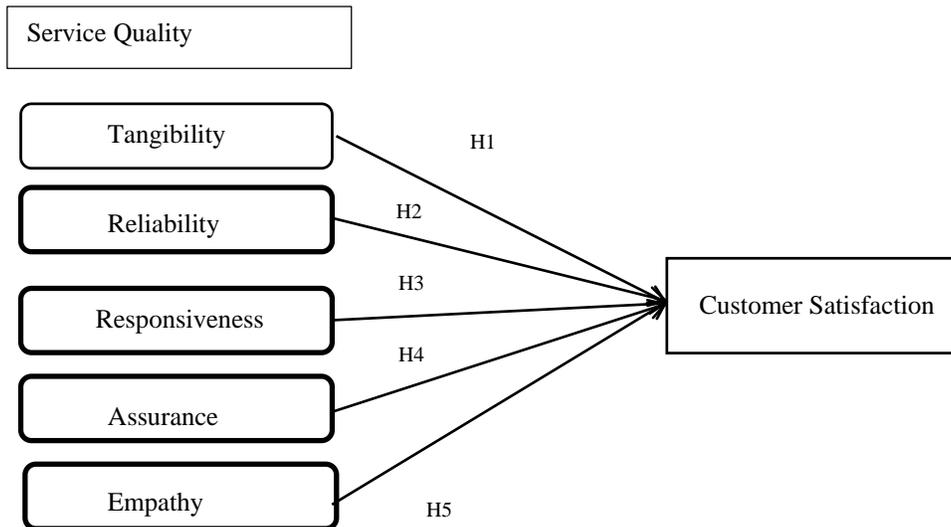
Empathy

Empathy can be defined as the providing of considerate, individualized attention to customers. Empathy contains the ensuing features: friendliness, sensitivity and effort to know the customer's needs. It comprises paying customers' individual attention and workers who recognize the desires and expectations of their customers and convenience business hours. This has argued with elements such as ease of access, good communications, identifying the customer desires and expectations, and friendliness (Saghier and Nathan 2013). As same as Empathy defined as Considerate, individualized attention that the firm provides to its customer including access, communication and understanding the customer's desires and expectations (Shahin & Janatyan, 2011). By considering above statements researchers define empathy as giving individualized attention to the customers by understanding their desires and expectations to create best interest on their mind.

II. Methodology

Conceptual framework

Based on the literature survey this study is conducted to investigate the impact of service quality on customer satisfaction. Independent variable is service quality and the five-dimensions are: tangibility, reliability, responsiveness, assurance and empathy. These five dimensions are used to measure the service quality and the dependent variable is customer satisfaction



Source: Developed by researchers based on the Previous Literature

Accordingly, following hypotheses were constructed.

- H1: There is a significant impact of Tangibility on customer satisfaction in Travel Agencies in Sri Lanka.
- H2: There is a significant impact of Reliability on Customer Satisfaction in Travel Agencies in Sri Lanka.
- H3: There is a significant impact of Responsiveness on Customer Satisfaction in Travel Agencies in Sri Lanka.
- H4: There is a significant impact of Assurance on Customer Satisfaction in Travel Agencies in Sri Lanka.
- H5: There is a significant impact of Empathy on Customer satisfaction in Travel Agencies in Sri Lanka.

Sekaran (2013) stated that there are two types of business researches namely applied researches and basic researches. Applied research is commonly used to solve a current problem faced by the manager in the work setting. Basic research is creating a body of knowledge by trying to realize how certain problems that arise in organizations can be solved. Therefore, this study falls into the category of applied research due to this study investigate the impact of service quality on customer satisfaction in travel agencies in Sri Lanka. Moreover, the current research is explanatory research which defines as an attempt to connect ideas to understand cause and effect meaning researchers want to explain what is going on. This study employed a co relational research design in order to explore the relationship between service quality (independent variable) and customer satisfaction (dependent variable) in Travel Agencies. The unit of analysis in this study is individual outbound traveller. In addition to that, the population of this study is all the outbound travelers from Sri Lanka . In this study researchers used, the convenient sampling method. Sekaran (2013) mentioned if population was exceeding 1000000. Therefore, researchers selected 384 outbound travelers.

III. Analysis and Results

Sample Profile

The data was collected from 384 outbound travelers who had obtained service from travel agencies in Sri Lanka. The personal information gender, age, province of the travel agency that the service obtained from, country visited, time period, duration, purpose of the travel and with whom travel are presented.

Table 4.1 Sample profile of demographic factors

Demographic Factors		Frequency	Percent
Gender	Male	194	50.5
	Female	190	49.5
Age	18 – 29 Years	255	66.4
	30 – 39 Years	78	20.3
	40 – 49 Years	40	10.4
	50 – 59 Years	08	2.1
	Above 60 Years	03	0.8
Province of the Travel Agency that the service obtained from	Central Province	131	34.1
	Southern Province	38	9.9
	Western Province	84	21.9
	North Province	19	4.9
	Eastern Province	04	1.0
	North Central Province	18	4.7
	Uva Province	32	8.3
	North Western Province	34	8.9
	Sabaragamuwa Province	24	6.3
Country Visited	India	76	19.8
	Singapore	70	18.2
	Malaysia	54	14.1
	Thailand	70	18.2
	Japan	23	6.0
	China	15	3.9
	Maldives	07	1.8
	Australia	22	5.7
	New Zealand	03	0.8
	European countries	11	2.9
	American countries	01	0.3
	Middle East Countries	15	3.9
	Other	17	4.4
Travelling Period	January	38	9.9
	February	31	8.1
	March	51	13.3

	April	51	13.3
	May	19	4.9
	June	31	8.1
	July	33	8.6
	August	26	6.8
	September	19	4.9
	October	09	2.3
	November	27	7.0
	December	49	12.8
Duration of the tour	01 – 03 Days	66	17.2
	04 – 06 Days	160	41.7
	01 – 03 Weeks	101	26.3
	01- 03 Months	17	4.4
	More than 03 Months	40	10.4
Purpose of the tour	Family leisure tour	235	61.2
	Business	42	10.9
	Medicine	4	1.0
	Honeymoon	12	3.1
	Other	91	23.7
With whom travelled	Individually	70	18.2
	Spouse	45	11.7
	Family	161	41.9
	Friends	98	25.5
	Other	10	2.6
Services that obtained from travel agency	Tour Packages	180	46.9
	Visa	151	39.3
	Air Tickets	219	57.0

Source: Survey Data 2021

The research sample consist both parties which are males and females. According to the “Table 4.1” shows that almost 50.5% are male respondents and out of total 49.5% are female respondents who responded to the questionnaire. Majority of the respondents in the sample belongs to age between 18 – 29 years (66.4%) with 225 respondents out of total and the minor respondents belong to age above 60 years (8%) with 3 respondents. Other age groups 30 – 39 years, 40 – 49 years and 50 – 59 years represented the sample 20.3%, 10.4% and 2.1% respectively. In addition to that most of the respondents obtained services from the travel agencies which are located in Central Province (34.1%) and the least represented the Eastern Province (1.05) out of total. When considering the above table most of the respondents who visit India show 19.8% (N= 76) out of total and least of the respondents in the sample visited American countries show 0.3%. Other than India 18% of respondents was visited Singapore and Thailand. Further 14.1% respondents were visited Malaysia. All the countries represent one-digit percentages of respondents.

According to the survey, researchers found that most of the respondents were travelled in March (13.3%) and April (13.3%). The minor respondents were travelled in October 2.3%. Further 12.8% respondents were travelled in December. Also, the majority of the respondents were travelled for family leisure purposes (61.2%). A minority of respondents of the sample were traveled for medicinal purposes. Based on survey data 2021, “Table 4.1” shows with whom travellers were travelled. Its majority of the respondents represent 41.9% travelled with their families. Minority travelled with others such as team members, office mates etc. Other than those respondents of sample were travelled with their friends, individually and with their spouses which show 25.5%, 18.2% and 11.7% respectively.

Reliability Test

Cronbach’s Alpha Test of Reliability was used to measure the internal consistency among the indicators and the variables. According to the Cronbach’s Alpha model, the coefficient alpha value 0.80-0.95 is considered as very good reliability. And the coefficient alpha value of 0.70-0.80 is considered as good reliability while the coefficient value of 0.60-0.70 is considered as fair reliability. And when the value is below 0.60, it is considered as week reliability (Sekaran, 2013).

“Table 4.2” shows the reliability of the independent variable, service quality dimensions namely tangibility, reliability, responsiveness, assurance and empathy and the dependent variable customer satisfaction.

Table 4.2 Reliability test

Variable	Cronbach's Alpha	No. of Items
Tangibility	0.832	4
Reliability	0.872	4
Responsiveness	0.778	3
Assurance	0.794	3
Empathy	0.813	3
Customer Satisfaction	0.928	6

Source: Survey Data 2021

According to the “Table 4.2” Cronbach’s Alpha value for five dimensions of the independent variables were tangibility alpha value is 0.832, reliability alpha value is 0.872, responsiveness alpha value is 0.778, assurance alpha value is 0.794 and empathy alpha value is 0.813. Dependent variable or customer satisfaction alpha value is 0.928. The entire items alpha values were more than 0.7 Therefore, above all dimensions (tangibility, reliability, responsiveness, assurance, and empathy) can be identified as providing good support to the customer satisfaction.

Descriptive Analysis

Descriptive statistics for Independent Variables

To identify the basic nature of the independent variables, descriptive statistics were calculated. “Table 4.3” shows the descriptive analysis with mean, standard deviation and skewness.

Table 4.3 Descriptive Analysis - Independent Variables

Variable	Mean	Std. Deviation	Skewness	
	Statics	Statistics	Statistics	Std. Error
Tangibility	3.5677	.75702	-.881	.125
Reliability	3.6478	.81103	-1.046	.125
Responsiveness	3.6502	.74517	-.943	.125

Assurance	3.6693	.72962	-.931	.125
Empathy	3.4826	.84461	-.558	.125

Source: Survey Data 2021

According to the above survey data 2021, mean value for tangibility showed that customer satisfaction is relatively high (M=3.56, SD=0.75). As same as the respondents mean value for reliability (M=3.64, SD=0.81), responsiveness (M=3.65, SD=0.74), assurance (M=3.66, SD=0.84), empathy (M=3.65, SD=0.83) exceeded the 3. It means that the respondents of the sample have normally responded to dimensions in between “Moderate” and “Agree” where the Likert Scale value for “Moderate” equals 3 and “Agree” equals 4. The Skewness of tangibility, reliability, responsiveness, assurance, empathy is -0.881, -1.046, -.943, -.931, -and .558 respectively.

Correlation analysis

The Pearson Correlation can display strength of the relationship between variables. Pearson correlation value is spread between the value (+01) and (-01). Significant value describes the significance of the relationship between dependent and independent variables. In 99% confidence level it value must be a below 0.01 and also in 95% confidence level it value must be a below 0.05.

99% confidence level = <0.01

95% confidence level = <0.05

Table 4.21 Correlation Analysis

Variable	TAN	REL	RES	ASS	EMP	CS
Tangibility	1	.706**	.591**	.632**	.642**	.693**
Sig. (2 – tailed)		.000	.000	.000	.000	.000
Reliability		1	.719**	.720**	.722**	.817*
Sig. (2 – tailed)			.000	.000	.000	.000
Responsiveness			1	.697**	.670*	.715**
Sig. (2 – tailed)				.000	.000	.000

Continued table 4.21s

Variable	TAN	REL	RES	ASS	EMP	CS
Assurance				1	.677**	.696**
Sig. (2 – tailed)					.000	.000
Empathy					1	.772**
Sig. (2 – tailed)						.000
Customer Satisfaction						1

** Correlation is significant at the 0.01 level (2-tailed).

Source: Survey Data 2021

The Pearson’s Correlation Coefficient was calculated for the purpose of defining the relationship between Service quality and customer satisfaction in Travel Agencies Sri Lanka. As shown in Table 4.21, all five independent variables are significant with the Customer Satisfaction variable at the 0.05 level. Correlation coefficient for the relationship between customer satisfaction and tangibility is 0.693 that is significant at 0.01(P<0.05). This result found that there is a strong positive and significant relationship between tangibility and customer satisfaction.

Correlation coefficient for the relationship between customer satisfaction and reliability is 0.817 that is significant at 0.01(P<0.05). Therefore it can be concluded that there is a strong positive relationship between reliability and customer satisfaction. As shown in

Table 4.21, correlation coefficient for the relationship between customer satisfaction and responsiveness is 0.715 that is significant at 0.01($P < 0.05$). Therefore it can be concluded that there is a strong positive and significant relationship between customer satisfaction and assurance. Correlation coefficient for the relationship between customer satisfaction and assurance is 0.696 that is significant at 0.01($p < 0.05$). Therefore it can be concluded that there is a strong positive relationship between customer satisfaction and assurance.

Correlation coefficient for the relationship between customer satisfaction and empathy is 0.772 that is significant at 0.01($P < 0.05$). Therefore it can be concluded that there is a strong positive and significant relationship between customer satisfaction and empathy. According to the above table it can be concluded that all the individual variables have a significant positive relationship ($P < 0.05$) towards customer satisfaction.

Hypothesis Testing

By conducting normality test researchers found that data was normally distributed. Resulting study proceed parametric tests to explore research objectives.

Regression analysis

Regression analysis was used to identify the impact of independent variables on the dependent variable of the study. Customer satisfaction is the dependent variable and dimensions of Tangibility, Reliability, Responsiveness, Assurance and Empathy are the independent variables. Table 4.13 presents the summary of the model

Table 4.22 Summery of model

Model	R	R Square	Adjusted R Square	Std. Error
1	.870 ^a	.756	.753	.41393

Source: Survey Data 2021

The R Square value is 0.753. It means 75.3% of customer satisfaction can be explained by the Tangibility, Reliability, Responsiveness, Assurance and Empathy.

Table 4.23 Regression Analyses – ANOVA Table

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	200.905	5	40.181	234.509	.000 ^b

Source: Survey Data 2021

According to the “Table 4.23” The P value from the ANOVA table is less than 0.001 and F Value is 234.509 the model can use to explain the customer satisfaction.

Table 4.24 Regression Analyses – Coefficient Table a

Model	Unstandardized Coefficients		Standardized Coefficient	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.033	.120		.273	.785

Tangibility	.135	.042	.123	3.238	.001
Reliability	.401	.047	.391	8.473	.000
Responsiveness	.152	.045	.136	3.357	.001
Assurance	.054	.047	.047	1.153	.250
Empathy	.284	.040	.288	7.097	.000
a= Dependent Variable: Customer Satisfaction					

Source: Survey Data2021

H1: There is a significant impact of Tangibility on customer satisfaction in Travel Agencies in Sri Lanka

According to the survey data 2021, the regression coefficient of tangibility indicates that it has a significant impact on customer satisfaction ($\beta = 0.135$, $P < 0.001$). Therefore, the first hypothesis (H1) of the study is accepted. This result further supports the first hypothesis (H1) of the study. Increase of tangibility by 1%, lead to increase of customer satisfaction by 13.5% when other independent variables remain constant. This is further supported by Shahin and Janatyan (2011), Jamal and Anastasiadou (2009) and Manani et al. (2013)

H2: There is a significant impact of Reliability on Customer Satisfaction in Travel Agencies in Sri Lanka

The coefficient of $\beta = 0.401$ of reliability shows that it has a significant influence on customer satisfaction, ($\beta = 0.401$, $P < 0.000$). According to the above analysis the second hypothesis (H2) of the study is accepted. Increase of reliability by 1%, lead to increase of customer satisfaction by 40.1% when holding other variables constant. Further this is supported by Manani et al. (2013) and (Jamal & Anastasiadou, 2009).

H3: There is a significant impact of Responsiveness on Customer Satisfaction in Travel Agencies in Sri Lanka

The regression coefficient of responsiveness shows that it has a significant impact on customer satisfaction ($\beta = 0.152$, $P < 0.001$). According to the above analysis the third hypothesis (H3) of the study is accepted. This result further supports the third hypothesis (H3) of the study. Increase of responsiveness by 1%, lead to increase of customer satisfaction by 15.2% when other variables remain constant. This is further supported by previous studies. (Johns et al., 2004; Manani et al., 2013; Yuen & Thai, 2015)

H4: There is a significant impact of Assurance on Customer Satisfaction in Travel Agencies in Sri Lanka

The coefficient of assurance also indicates that there is no significant impact on customer satisfaction ($\beta = 0.054$, $p < 0.250$). Therefore, the fourth (H4) hypothesis is rejected. This result further supports the fourth hypothesis (H4) of the study. Increase of assurance by 1%, lead to increase of customer satisfaction by 5.4% when other variables remain constant. But there is an insignificant impact with 0.250 values.

H5: There is a significant impact of Empathy on Customer satisfaction in Travel Agencies in Sri Lanka

And also regression coefficient of empathy indicates that it has a significant impact on customer satisfaction ($\beta = 0.284$, $p < 0.000$). By through the above analysis the fifth (H5) hypothesis is accepted. This result also supports the fifth hypothesis (H5) of this study. Increase of empathy by 1%, lead to increase of customer satisfaction by 28.4% when other variables remain constant. Further this is supported by Shahin and Janatyan (2011) and Johns et al. (2004)

By considering all, the researchers found that tangibility, reliability, responsiveness and empathy significantly impact on customer satisfaction and assurance insignificantly impact on customer satisfaction in travel agencies in Sri Lanka.

Further researchers found that reliability as the most significant dimension ($\beta = 0.401$, $p < 0.000$). Increase of reliability by 1%, lead to increase of customer satisfaction by 40.1% when holding other variables constant.

IV. Conclusion

The research was conducted to investigate the impact of service quality of travel agencies on customer satisfaction in Sri Lanka. By using convenient sampling method researchers collected data from 384 outbound travelers who were obtained services from travel

agencies in Sri Lanka. Both female and male included in the sample profile. Most of the respondents were under 18 – 29 age group and most of respondents obtained services from the travel agencies which located in Central Province. Also, researchers conclude that based on the analysis most of respondents visited India mostly in March and April. Further they travel for 04 – 06 days for the purpose of family and leisure travel along with families.

Based on the research objectives researchers investigate mainly the impact of service quality of travel agencies on customer satisfaction in Sri Lanka using service quality dimensions. According to the normality test the data were normally distributed and researchers used parametric tests such as regression, correlation assesses the objectives.

The researchers carried out the regression analysis with the aim of achieving the main objective of the current study. As well as there was a strong positive relationship could be found between tangibility, reliability, responsiveness, assurance and empathy and customer satisfaction. According to the correlation analysis all the relationships were significant at the 0.01 significant levels. Therefore, it can be concluded that the service quality dimensions have direct and positive relationship with customer satisfaction in travel agencies in Sri Lanka.

According to the regression analysis, service quality dimensions such as tangibility, reliability, responsiveness and empathy significantly impact on customer satisfaction in travel agencies in Sri Lanka with the p values were lower than 0.05. Further assurance was not significantly impact on customer satisfaction in travel agencies in Sri Lanka. In this research, researchers found that assurance insignificantly impact on customer satisfaction in travel agencies in Sri Lanka with 0.250 value. The researchers conclude that it happens due to the technological development. Customers have good awareness of the services that they obtained from the travel agencies through new technology. Further in contemporary era most of the customers looking for low budgeted products than considering other factors such as reputation.

According to this research, commonly researchers can express reliability and empathy as the most significant dimensions, and Secondly tangibility and responsiveness also important for the improvement of the customer satisfaction in the travel agencies in Sri Lanka. Further researchers concludes that 75.3% customer satisfaction can be defined by service quality dimensions namely tangibility, reliability, responsiveness, assurance and empathy.

Further researchers conclude that Reliability as the most significant dimension of the service quality which is significantly impact on customer satisfaction in travel agencies in Sri Lanka.

To investigate the mean difference researchers conducted ANOVA and t- test. According to the analysis researchers concluded that there is no significant mean difference of customer satisfaction based on demographic factors such as gender, age group, province of the travel agency, country visited, time period, duration of the tour, purpose of the tour and with whom travel. But there is an insignificant mean difference based on in between travel individually and travel with families and travel individually and travel with friends.

V. Recommendations

Tangibility

According to the findings of the study, tangibility has positive and significantly impact on customer satisfaction in travel agencies in Sri Lanka. If travel agencies want to improve their performance, researchers can recommend following actions for them.

- Maintain customer attract environment in the travel agency premises both inside and outside with clean, neat and attractive manner.

Means maintain the premises cleanly and neatly without dusts and unnecessary documents on the tables. Nice tourism related paintings, boards also can display.

- Further, researchers can recommend travel agencies should locate in places, which are convenient to the customers and also their parking.

Most of customers are looking convenience for them. If there is no car parking either good location customers were unsatisfied. Therefore, it's a good advantage locate the travel agency in remote areas where the customers captured easily.

- And also researchers can recommend to the travel agency they should recruit the young, active and smart employees to the staff.

By hiring smart, active young employees to the staff will increase the performance of the agency by providing services in actively.

- Visually appealing are very essential. If customers come to the travel agency if materials such as promotional brochures, markets they handled are visible to them, it is very useful to the customer. So researchers can recommend travel agencies should have materials in visible compactable places.

Researchers also recommend to use visual appealing such as barouches, itineraries, tour packages, market display boards that travel agency handle.

Reliability

According to the findings of the study, reliability has positive and significantly impact on customer satisfaction in travel agencies in Sri Lanka. If travel agencies want to improve their performance, researchers can recommend following actions for them.

- It's important to complete the tasks which travel agency had promised to their customers. If failure to complete the promised task it's negatively affected the travel agency. Therefore researchers recommend to the travel agencies complete the tasks to maximize the satisfaction of the customer based on their requirements.
- Mostly travel agency services highly depend on the specific time duration with specific date. Therefore it's important to provide the service on time. If travel agency wants to improve their performances researchers recommend, travel agencies should provide the services on time to the customers.
- Travel agencies provide travel and tourism services and its necessary to meeting the tour schedules. If not it may be negatively affect to the performance of the travel agency. Therefore if travel agencies want to improve their performance researchers recommend, travel agencies should give their attention to meeting the tour schedule that they will provide from beginning to the end of the tour with accuracy.

Responsiveness

According to the findings of the study, responsiveness has positive and significantly impact on customer satisfaction in travel agencies in Sri Lanka. If travel agencies want to improve their performance, researchers can recommend following actions for them.

- Most of the customers expect the quick responses from the travel agencies. Therefore, researchers recommend to the travel agencies should establish proper departments, information systems and allocate employees to respond to the customers.
- Also travel agencies handled international markets. Sometimes customers have to face many problems before of within their tours, visa problems, air ticket problems. On that kind of situations travel agencies should have to involve solving the problems. Therefore researchers recommend travel agencies should pay attention to the customer problems to resolve them.
- As well as travel agencies'' staffs should maximize their customer's needs even they are busy.

Assurance

According to the findings of the study, assurance has positive insignificant impact on customer satisfaction in travel agencies in Sri Lanka. Researches assume that in Sri Lankan context most of the outbound travelers were depend on budget than reputation and others. Further researchers assumed that due to the technological development most of the travellers aware about the destinations and travelling procedures.

Empathy

According to the findings of the study, empathy has positive and significantly impact on customer satisfaction in travel agencies in Sri Lanka. If travel agencies want to improve their performance, researchers can recommend following actions for them.

- It's important to pay individual attention to the customers to identify their specific requirements to maximize their satisfaction. Researchers recommend employees should give their highest attention to the customers and their preferences.
- Researchers also recommend to travel agencies allocating required time for customers to provide better service.

Suggestions for Future Research

- This research study is limited to the travel agencies in Sri Lanka. It can wide as tour operators, destination management companies to assess the tourism industry.

- Researchers followed SERVQUAL Model for this research. Further researchers can apply another different models or different dimensions for the study. Such as conventions, security and understanding the customers etc.
- Researchers can find impact of view point about service quality and customer satisfaction based on demographic factors. Also, future study could carry out to test these same variables in an airline or hotel sector.

References

- Abdullah, N. N. & Afshar, P. A. (2019). Investigating research and development costs on the profitability of Iranian industries. *Journal of Organizational Behavior Research*. Volume 4 (S2). 1-14
- Al-Dmour, F., Fouzia, M., & Sarayreh, W. R. (2016). The Effect of Dynamic Packaging System Quality on Jordanian Tourist Satisfaction. *International Journal of Humanities and Social Science*, 6(2), 150-164.
- Ali, B. J., & Anwar, G. (2021). An Empirical Study of Employees' Motivation and its Influence Job Satisfaction. Ali, BJ, & Anwar, G.(2021). An Empirical Study of Employees' Motivation and its Influence Job Satisfaction. *International Journal of Engineering, Business and Management*, 5(2), 21-30.
- Guo, Q., K. Anderson, C., Dong, J., Zhao, P., & Ji, Q. (2020). Coordination Contracts for Hotels and Online Travel Agents. *Sustainability*, 12(8), 3355.
- Hirbo, N. M. (2018). The Extent of Use of Quality Practices By Commercial Banks in Kenya. *Journal of Business Management and Economic Research*, 2(3), 20.
- Manani, T. O., Nyaoga, R. B., Bosire, R. M., Ombati, T. O., & Kongere, T. O. (2013). Service quality and customer satisfaction at Kenya Airways Ltd. *European Journal of Business and Management*, 5(22), 170-179.
- Marinković, V., Senić, V., Kocić, M., & Šapić, S. (2013). Investigating the impact of SERVQUAL dimensions on customer satisfaction: The lessons learnt from Serbian travel agencies. *International Journal of Tourism Research*, 15(2), 184-196.
- Panditharatne, V., & Gamage, P. N. (2019). Impact of service quality on customer satisfaction: evidence from boiler water and cooling tower water treatment chemical industry in Sri Lanka. In *Proceedings of 10th International Conference on Digital Strategies for Organizational Success*.
- Paul, J., Mittal, A., & Srivastav, G. (2016). Impact of service quality on customer satisfaction in private and public sector banks. *International Journal of Bank Marketing*.
- Shahin, A., & Janatyan, N. (2011). Estimation of customer dissatisfaction based on service quality gaps by correlation and regression analysis in a travel agency. *International Journal of Business and Management*, 6(3), 99.

A Comparative Analysis of Financial Performance Before and During The Pandemic of Covid-19: Empirical Study of Textile and Garment Companies Listed On The Indonesian Stock Exchange in 2018-2021

Aditya Reyhan Yafi Wiryawan¹, Noer Sasongko²

Accounting, Muhammadiyah of Surakarta University

¹b200180089@student.ums.ac.id

²Corresponding author: ns243@ums.ac.id

DOI: 10.29322/IJSRP.12.10.2022.p13065

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13065>

Paper Received Date: 15th September 2022

Paper Acceptance Date: 15th October 2022

Paper Publication Date: 21st October 2022

Abstract- *This research purpose to determine the comparison of financial performance before and during the Covid-19 pandemic in the 2018-2021 period in textile and garment sub-sector companies listed on the Indonesia Stock Exchange. The comparison result are used as an evaluation of the company's financial performance.*

The financial performance proxies used in this research are debt to equity ratio, quick ratio, return on assets, inventory turnover, and working capital turnover. This research uses a quantitative approach using secondary data derived from the annual report and financial statements of the company. This research samples were taken using purposive sampling method, the number of samples according to the criteria was 14 companies with a period of 2018-2021.

The analysis technique used in descriptive statistical analysis with paired sample t-test and Wilcoxon signed rank test to determine the hypothesis. The result of this research show that there is no difference between debt to equity ratio, quick ratio, return on assets, working capital turnover, and there is a significant difference in inventory turnover before and during the Covid-19 pandemic.

Index Terms- *financial performance, debt to equity ratio, quick ratio, return on assets, inventory turnover*

1. INTRODUCTION

At the end of the year 2019, the world experienced the pandemic of Covid-19, including Indonesia. The case was first detected in Wuhan, China, at the beginning of Desember 2019. Covid-19 is a part of the Coronavirus (CoV) which causes many diseases, both mild symptoms, and even death. Various types of policy done by the Indonesian government in facing this pandemic, one of them being at the beginning of March 2020, with Social Distancing and Physical Distancing implemented in Indonesian citizens (Hadiwardoyo, 2020). The government also applied a large-scale social restriction to prohibit offices and industries from operating for an extended period; this has an impact on the disruption of the production of good and services, resulting in a sluggish economy and losses (Misno, 2020).

Activities at the market are quiet and closed because people are careful in buying something outside the home to avoid the spread of this pandemic virus (Hanoatubun, 2020). In the current pandemic period, many companies from various sectors experienced a loss effect, in which the management must be able to determine the decisions to be taken to reduce future risks. One of them is by analyzing financial performance in the financial report to find out the financial condition of a company.

Financial performance assesses the condition of the company carried out by management in running its functions in a certain period, and financial reports as a medium for assessing financial performance, as well as communication liaison between financial data to interested parties (Suhendro, 2018). Financial performance is a form of the company's accomplishment that is achieved in a certain period by describing a healthy financial condition, as well as the company can see the potential for future development of the company. Financial performance is a benchmark for achieving the company's success from various activities that have been carried out (Fahmi, 2006, p.64).

However, the occurrence of Covid-19 in Indonesia affected the financial performance of various sectors, starting from a decrease in company income due to a decrease in the community's purchasing power, increased debt due to ongoing production and operational

financing of the company, a decrease in sales resulting in slow inventory turnover activities, causing a buildup of production goods in warehouses. It can be viewed from the financial report before and during the pandemic to determine whether there is a significant difference in the company's financial performance. In order to measure the financial performance, it is necessary to do a financial report analysis.

Therefore, this research focuses on comparing financial performance by choosing the title "A Comparative Analysis of Financial Performance Before and During the Pandemic of Covid-19: A Empirical Study of Textile and Garment Companies Listed on the Indonesia Stock Exchange". Financial performance can be calculated based on analyses and ratios. The ratios are solvency ratio, measured using Debt to Equity Ratio (DER), liquidity ratio, measured using Quick Ratio (QR), profitability ratio, measured using Return On Assets (ROA), and activity ratio, measured using Inventory Turnover (IT) and Working Capital Turnover (WCT).

2. LITERATURE REVIEW & RESEARCH METHODOLOGY

2.1. Literature Review

a. Signalling Theory

Signalling theory is a theory that transparently provides information signals to stakeholders carried out by company management who have detailed company information in published financial reports. The signal from this theory is in the form of information about the result of management performance, the information is about the success or failure of a company, as well as signaling from the management aims to reduce asymmetric information between the company and external parties with internal information more known to management than outside parties, such as investors and creditors (Sari and Zuhrotun, 2006).

b. Financial Statement

Financial statement are the main source of finance which is useful for users of financial statements to be used as decision makers, knowing the company's performance, and as a form of management accountability to shareholders who have trusted in managing the company well. Basically, financial reports are a form of accounting process used in communicating financial data (Munawir, 1991, p.2).

c. Financial Performance

Financial performance, namely the achievements that have been achieved by a company in business activities, both in terms of finance, marketing, financing and distribution, technology, and human resources (Jumingan, 2006).

d. Financial Ratios

Financial ratios are one of the methods of financial performance analysis to analyze financial statements by calculating financial ratios. Financial ratios are used to measure the company's financial condition by comparing one account to another, the aims is to find out and measure the company's ability to manage its business.

2.2. Hypothesis Development

a. Difference in financial performance based on DER

conditions during the Covid-19 pandemic, can affect the company's finances, including the DER. A high DER means that the company's capital originating from creditors funds is greater than its own capital. A high DER ratio shows the company's ability to obtain additional funds from creditors avoid the risks that are borne if the company suffers losses (Nidya Afrinda, 2013). The result of the research by Esomar & Christianty (2021) show that there are significant differences in the DER before and after the Covid-19 pandemic.

Based on the description above, this study formulates the first hypothesis as follows:

H₁: There are differences in financial performance based on the company's Debt to Equity Ratio before and during the Covid-19 pandemic.

b. Difference in financial performance based on QR

During the Covid-19 pandemic, people's purchasing power decreased, affecting the company's income which also decreased. Continuous decline in revenue, making the company take steps with debt, to maintain production activities and cover other costs. QR value reaches 100% or equal to 1, indicating a strong and healthy company with current assets that can over its current liabilities. The components of liquid current assets include cash, accounts receivable, and marketable securities. Research conducted by Saputro and Hapsari (2022) states that there is a difference in QR before and after the pandemic which decreased by -3.01%. It means that the company's ability to pay it's obligations with more liquid current assets is decreasing.

Based on the description above, this study formulates the second hypothesis as follows:

H₂: There are differences in financial performance based on the company's Quick Ratio before and during the Covid-19 pandemic.

c. Difference in financial performance based on ROA

Net profits from several corporate sectors decreased due to the impact of the Covid-19 pandemic. Because people's purchasing power is declining, people tend to be careful in spending. Research conducted by Umam et al., (2021) states that there are significant

differences in the value of ROA in consumer goods manufacturing companies before and during the Covid-19 pandemic. The average ROA before the pandemic tends to increase, while the average ROA in 2020 has decreased significantly from 10.69% to 6.50%. The decrease was due to a decrease in total revenue while the company also had to continue to bear operating costs.

Based on the description above, this study formulates the third hypothesis as follows:

H₃: There are differences in financial performance based on the company's Return On Assets before and during the Covid-19 Pandemic.

d. Difference in financial performance based on IT

The Covid-19 pandemic affects people's buying and selling activities, it also has an impact on a company's inventory turnover, how fast a company can sell inventory within a certain period, including during the Covid-19 pandemic. Low Inventory Turnover indicates a low level of sales and allows excess inventory to be stored, making it unproductive. Meanwhile, a high Inventory Turnover indicates a high level of sales and is able to reduce the cost of storing goods in inventory. Research conducted by Fernando & Edi (2021) states that there is a significant difference in the inventory turnover ratio after a merger or acquisition.

Based on the description above, this study formulates the fourth hypothesis as follows:

H₄: There are differences in financial performance based on the company's Inventory Turnover before and during the Covid-19 pandemic.

e. Difference in financial performance based on WCT

Working Capital Turnover shows how efficiently a company uses working capital to generate sales. Companies that have a high Working Capital Turnover illustrate the company's ability to run operations to generate more efficient sales. Research conducted by Afriyani et al., (2020) showed that there was a decrease in working capital turnover before and after the IPO.

Based on the description above, this study formulates the fifth hypothesis as follows:

H₅: There are differences in financial performance based on the company's Working Capital Turnover before and during the Covid-19 pandemic.

2.3. Research Designs

This research is designed in the form of comparative research as well as a descriptive statistic by using the approach method of quantitative. Descriptive statistic explains the data based on the mean, minimum, maximum, standard deviation, and variance (Ghozali, 2016, p.19). A comparative study is a form of research that compares and makes an assumption about what causes the difference in the situation that occurs (Ferdinand, 2006, p.5). the presentation of data uses a comparative, which compares before and during the Covid-19 pandemic period 2018-2021.

This research uses on of the classic assumption tests, the data normality test using the One-Sample Kolmogorov-Smirnov Test with a significant value of 0.05 on Asymp. Sig. (2-tailed).

- a. Probability > 0.05 means data is normally distributed.
- b. Probability < 0.05 means data is not normally distributed.

Comparative research uses Paired Sample t-Test if the data is normally distributed and Wilcoxon Signed Rank Test if the data is not normally distributed.

- a. Asymp. Sig. (2-tailed) < 0.05 means there is a significant difference. H₀ is rejected, and H_a is accepted.
- b. Asymp. Sig. (2-tailed) > 0.05 means there is no difference. H₀ is accepted, and H_a rejected.

2.4. Population, Sample, and Sampling Techniques

The population in this study is the sub-sector of textile and garment companies listed on the Indonesia Stock Exchange. The sample collection uses the Purposive Sampling method. The sample criteria are determined as follows:

1. Textile and garment companies listed on the Indonesia Stock Exchange (IDX) for the period 2018-2021.
2. The company provides a complete annual report for the period 2018-2021 consecutively.
3. The company's financial report have complete data needed according to the variables studied.

The number of appropriate data based on predetermined criteria 14 company data for the 2018-2021 periods in a row.

2.5. The Research Variable and Measurement

The variables used in this study are financial ratios. In this study, in measuring the comparison of financial performance using five variables including:

a. Debt to Equity Ratio (DER)

This indicator is to see the extent to which the company's equity capability can meet all of the company's liabilities, namely short-term liabilities and long-term liabilities.

Counting formula (DER):

$$\text{Debt to Equity Ratio} = \frac{\text{Total Liability}}{\text{Total Equity}}$$

b. Quick Ratio (QR)

This indicator is to measure the entity’s ability to pay current liabilities/short-term liabilities
 Counting formula (QR):

$$\text{Quick Ratio} = \frac{\text{Current Assets} - \text{Inventory}}{\text{Current Liabilities}}$$

c. Return On Assets (ROA)

This indicator is to measure the company’s ability to generate profits from the total assets owned by the company.
 Counting formula (ROA):

$$\text{Return On Assets} = \frac{\text{Net Profit}}{\text{Total Assets}}$$

d. Inventory Turnover (IT)

This indicator is to measure how effectively inventory can be managed by comparing the cost of goods sold and measuring inventory turnover in a year.
 Counting formula (IT):

$$\text{Inventory Turnover} = \frac{\text{Cost Of Goods Sold}}{\text{Average Inventory}}$$

e. Working Capital Turnover (WCT)

This indicator is to measure the company’s ability to make a working capital turnover in a period and to use working capital to generate sales.
 Counting formula (WCT):

$$\text{Working Capital Turnover} = \frac{\text{Net Sales}}{(\text{Current Assets} - \text{Current Liabilities})}$$

3. RESULT AND DISCUSSION

3.1. The Result of Descriptive Statistics Analysis

The Result of Descriptive Statistics Analysis					
	N	Minimum	Maximum	Mean	Std. Dev
DER_BEFORE	28	-2.10	14.69	1.8250	3.42738
DER_DURING	28	-30.15	114.29	3.8304	22.50106
QR_BEFORE	28	0.03	4.62	1.1211	1.37990
QR_DURING	28	0.01	4.12	0.8118	1.07305
ROA_BEFORE	28	-1.12	0.10	0.0300	0.21992
ROA_DURING	28	-0.88	0.12	-0.0382	0.17499
IT_BEFORE	28	1.11	8.21	3.6050	1.83389
IT_DURING	28	0.64	6.56	2.7789	1.72160
WCT_BEFORE	28	-12.86	312.38	19.3257	60.70442
WCT_DURING	28	-1.47	111.80	8.2239	21.54043

Source: Data processing result, 2022

The descriptive statistical test result in the table above show that the DER before the pandemic had a minimum value of -2.10, a maximum value of 14.69, a standard deviation of 3.42738, and an average value of 1.8250. DER during the pandemic has a minimum value of -30.15, a maximum value of 114.29, a standard deviation value of 22.50106, and an average value of 3.8304. QR before the pandemic had a minimum value of 0.03, a maximum value of 4.62, a standard deviation value of 1.37990, and an average value of 1.1211. QR during a pandemic has a minimum value of 0.01, a maximum value of 4.12, a standard deviation value of 1.07305, and an average value of 0.8118. ROA before the pandemic had a minimum value of -1.12, a maximum value of 0.10, a standard deviation value of 0.21992, and an average value of 0.0300. ROA during a pandemic has a minimum value of -0.88, a maximum value of 0.12, a standard deviation value of 0.17499, and an average value of -0.0382. IT before the pandemic had a minimum value of 1.11, a maximum value of 8.21, a standard deviation value of 1.83389, and an average value of 3.6050. IT during a pandemic has a minimum value of 0.64, a maximum value of 6.56, a standard deviation value of 1.72160, and an average value of 2.7789. WCT before the pandemic had a minimum value of -12.86, a maximum value of 312.38, a standard deviation of 60.70442, and an average value of 19.3257. WCT during a pandemic has a minimum value of -1.47, a maximum value of 111.80, a standard deviation value of 21.54043, and an average value of 8.2239.

3.2. The Result of Normality Test

The Result of Normality Test		
	Kolmogorov-Smirnov Z	Asymp.Sig. (2-tailed)
DER_BEFORE	1.474	0.026
DER_DURING	2.386	0.000
QR_BEFORE	1.576	0.014
QR_DURING	1.236	0.094
ROA_BEFORE	1.888	0.002
ROA_DURING	1.697	0.006
IT_BEFORE	0.760	0.611
IT_DURING	0.744	0.637
WCT_BEFORE	2.223	0.000
WCT_DURING	1.972	0.001

Source: Data Processing Result, 2022

The result of the normality test based on the table above show that there is an Asymp.Sig. (2-tailed) value greater than 0.05, meaning the data is normally distributed, and less than 0.05, meaning the data is not normally distributed. As for values greater than 0.05, including QR during the pandemic and IT before and during the pandemic, it is concluded that the data is normally distributed. The values smaller than 0.05 include DER before and during the pandemic, QR before the pandemic, ROA before and during the pandemic, and WCT before and during the pandemic. It is concluded that the data is not normally distributed.

3.3. The Result of Hypothesis Test

In this research, data with normal distribution will use the *Paired Sample t-Test*, while data with abnormal distribution will use the *Wilcoxon-Signed Rank Test*.

a. Paired Sample t-Test

The Result of Paired Sample t-Test				
	Std. Deviation	T	Df	Sig. (2-tailed)
IT_BEFORE – IT_DURING	1,01511	4,306	27	0,000

Source: Data Processing Result, 2022

The result of the different Paired Sample t-Test based on the table above show that there are significant differences in financial performance as measured by Inventory Turnover, the significance value of 0.000 is less than 0.05. Then, H_0 is rejected, and H_a is accepted. The existence of these differences indicates that the ability of textile and garment companies in the average inventory turnover is not stable.

b. Wilcoxon Signed Rank Test

The Result of Wilcoxon Signed Rank Test		
	Z	Asymp. Sig. (2-tailed)
DER_BEFORE – DER_DURING	-0,973	0,330
QR_BEFORE – QR_DURING	-0,986	0,324
ROA_BEFORE – ROA_DURING	-0,764	0,445
WCT_BEFORE – WCT_DURING	-1,605	0,108

Source: Data Processing Result, 2022

The result of the different Wilcoxon Signed Rank Test based on the table above show the significance value on DER is 0.330 > from 0.05. It means that there is no difference between DER before and during the pandemic, so H_0 is accepted, and H_a is rejected. The Significance value on QR is 0.324 > from 0.05. It means that there is no difference between QR before and during the pandemic, so H_0 is accepted, and H_a is rejected. The significance value on ROA is 0.445 > from 0.05. It means that there is no difference between ROA before and during the pandemic, so H_0 is accepted, and H_a is rejected. The significance value on WCT is 0.108 > 0.05. It means that there is no difference between WCT before and during the pandemic, so H_0 is accepted, and H_a is rejected.

3.4. Discussion

a. DER Comparison of Textile and Garment Companies

The test result state that there is no difference in DER before and during the Covid-19 pandemic. It means that the source of funds from the lender to the company during the pandemic has not changed. The lower the DER, the better for the fundamental condition of the company because the debt is smaller than the size of the company's assets.

b. QR Comparison of Textile and Garmen Companies

The test result state that there is no difference in QR before and during the Covid-19 pandemic. It means the ability of the company to meet current obligations using the most liquid assets without taking into account the value of inventories in stable conditions. The company provides good guarantees for short-term creditors because the company is able to pay off its short-term debt.

c. ROA Comparison of Textile and Garmen Companies

The test result state that there is no difference in ROA between before and during the Covid-19 pandemic. It means to generate profits in a stable condition.

d. IT Comparison of Textile and Garment Companies

The test result state that there was a significant IT difference before and during the Covid-19 pandemic. The pandemic has had a major impact on companies in their inventory turnover. Companies need to re-measure in order to be able to provide a good financial position, make careful decisions in handling the movement of goods, save expenses in producing goods, and buy inventory.

e. WCT Comparison of Textile and Garment Companies

The test result state that there is no difference in WCT between before and during the Covid-19 pandemic. it means that there is no change in how efficiently the company uses working capital to generate sales. A high WCT indicates the company is more efficient in carrying out operations to generate sales, while a low WCT indicates operations are not running effectively.

4. CONCLUSSION

Based on the data collected and test result conducted, this research aims to determine whether there are significant differences or no differences in the financial performance of textile and garment companies before and during the pandemic. judging from the proxied financial ratios, there are no differences in the ratios, including Debt to Equity Ratio, Quick Ratio, Return On Assets, and Working Capital Turnover before and during the pandemic. Means the pandemic does not have a major impact on these financial ratios and is in a stable condition. Meanwhile, in the Inventory Turnover ratio, there is a significant difference before and during the pandemic. It means that the pandemic has had a major impact on the company's decision to regulate the turnover of its inventory. Companies need to make the right dicisions in the movement of goods, save expenses in producing goods, or buying in order to provide a good financial position.

The Research Limitations

Below are some of the limitations of this research as follows:

1. This research only uses data from textile and garment companies, it still cannot be said to represent all companies listed on the Indonesia Stock Exchange.
2. This research only uses financial ratios including DER, QR, ROA, IT, and WCT.

Suggestions

Below are some suggestions for use in further research as follows:

1. The subsequent research examines other companies to find out differences in financial performance before and during the pandemic in the sector.
2. The subsequent research examines financial ratio by add or replacing other variables. For example: *Fixed Assets Turnover*, *Net Profit Margin*, *Cash Ratio*.

REFERENCE

- Afriyani, A., Syukri, A. U., & Masyita, M. (2020). Analisis Perbandingan Kinerja Keuangan Sebelum dan Sesudah *Initial Public Offering* (IPO) pada PT. Jasa Armada Indonesia, Tbk. *Jurnal Mirai Management*, 5(3), pp. 8-17.
- Anggraini, N., & Ruzikna, R. (2017). *Pengaruh Struktur Modal Terhadap Kinerja Keuangan Pada Perusahaan Farmasi Yang Terdaftar Di Bursa Efek Indonesia Periode 2010-2014* (Doctoral dissertation, Riau University).
- Arumingtyas, F. (2017). Pengaruh Rasio Keuangan terhadap Kinerja Bank Umum Syariah di Indonesia Tahun 2012-2014. *Competitive Jurnal Akuntansi dan Keuangan*, 1(2).
- Astutik, D. (2017). Pengaruh Aktivitas Rasio Keuangan Terhadap Nilai Perusahaan (Studi Pada Industri Manufaktur). *Jurnal Stie Semarang (Edisi Elektronik)*, 9(1), pp. 35-53.

- Derek, Z. E., Tommy, P., & Baramuli, D. N. (2017). Analisis Perbandingan Kinerja Keuangan Pada Perusahaan Manufaktur Sub Sektor Industri Semen Yang Terdaftar di Bursa Efek Indonesia Periode 2011-2016. *Jurnal EMBA: Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi*, 5(2).
- Durrah, O., Rahman, A. A. A., Jamil, S. A., & Ghafeer, N. A. (2016). *Exploring the relationship between liquidity ratios and indicators of financial performance: An analytical study on food industrial companies listed in Amman Bursa*. *International Journal of Economics and Financial Issues*, 6(2).
- Esomar, M. (2021). Analisa Dampak Covid-19 terhadap Kinerja Keuangan Perusahaan Pembiayaan di Indonesia. *Jurnal Bisnis, Manajemen, dan Ekonomi*, 2(2), pp. 22-29.
- Esomar, M. J., & Christianty, R. (2021). Dampak Pandemi Covid-19 terhadap Kinerja Keuangan Perusahaan Sektor Jasa di BEI. *JKBM (Jurnal Konsep Bisnis Dan Manajemen)*, 7(2), pp. 227-233.
- Fernando, F., & Edi, E. (2021). Analisis Perbandingan Kinerja Perusahaan Sebelum Dan Sesudah Merger Dan Akuisisi Pada Perusahaan Yang Terdaftar Di BEI. In *Combines -Conference on Management, Business, Innovation, Education and Social Sciences* (Vol. 1, No. 1, pp. 1755-1768).
- Fernando, Y. E., & Iskandar, D. (2019). Analisis Rasio Keuangan Untuk Penilaian Kinerja Keuangan Pada PT. Telekomunikasi Indonesia Tbk. *Aktual*, 4(2).
- Hanoatubun, S. (2020). Dampak Covid-19 terhadap Prekonomian Indonesia. *EduPsyCouns: Journal of Education, Psychology and Counseling*, 2(1), pp. 146-153.
- Krisnandi, H. (2019). Pengaruh *Current Ratio, Inventory Turnover, Debt To Equity Ratio* dan Ukuran Perusahaan Terhadap Kinerja Keuangan Perusahaan. *Jurnal Rekrayasa Informasi*, 8(2), pp. 111-123.
- Lestari, D. A., & Hidayanti, A. N. (2017). Pengaruh Rasio Keuangan, Ukuran Perusahaan dan *Corporate Social Responsibility* Terhadap Agresivitas Pajak Pada Perusahaan Manufaktur Yang Terdaftar di Bursa Efek Indonesia. *Accounting Global Journal*, 1(1).
- Markonah, M., Salim, A., & Franciska, J. (2020). Effect of profitability, leverage, and liquidity to the firm value. *Dinasti International Journal of Economics, Finance & Accounting*, 1(1), pp. 83-94.
- Oktavina, K. (2014). Analisis Perbedaan Kinerja Keuangan Antara Industri Perbankan Dengan Asuransi Yang Terdaftar Di Bursa Efek Indonesia Periode 2010-2012. (Doctoral dissertation, Universitas Negeri Sultan Syarif Kasim Riau).
- Permana, A. A. N. B. A., & Rahyuda, H. (2019). Pengaruh Profitabilitas, Solvabilitas, Likuiditas, Dan Inflasi Terhadap Nilai Perusahaan. *E-Jurnal Manajemen Unud*, 8(3), pp. 1577-1607.
- Prasetya, V. (2021). Analisis Kinerja Keuangan Perusahaan Sebelum Dan Saat Pandemi Covid 19 Pada Perusahaan Farmasi Yang Tercatat Di Bursa Efek Indonesia. *Cerdika: Jurnal Ilmiah Indonesia*, 1(5), pp. 579-587.
- Putri, N. K. D. (2019). Perbandingan Kinerja Keuangan Sebelum dan Sesudah Akuisisi (Studi pada Perusahaan Manufaktur yang Terdaftar di Bursa Efek Indonesia). *Jurnal Ilmiah Mahasiswa FEB*, 8(1).
- Romadoni, M. (2020). Analisis Perbandingan Kinerja Keuangan Sebelum dan Sesudah Penerapan PSAK 69 pada Perusahaan Agroindustri di Indonesia. *Jurnal Ekonomi Akuntansi dan Manajemen*, 19(2), pp. 152-167.
- Sampul, G. T. P. (2013). Perbandingan Kinerja Keuangan Perusahaan Farmasi Milik Negara dan Milik Swasta Yang Terdaftar di Bursa Efek Indonesia. *Jurnal EMBA: Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi*, 1(4).
- Saputro, D. F. H., & Hapsari, D. I. (2022). Dampak Pandemi Corona Terhadap Kinerja Keuangan Perusahaan Pertambangan dan Perkebunan. In *Proceeding of National Conference on Accounting & Finance* (Vol. 4, pp. 66-72).
- Septiana, A. (2019). Analisis Laporan Keuangan Konsep Dasar dan Deskripsi Laporan Keuangan (Vol. 96). Duta Media Publishing.
- Simorangkir, R. T. M. C. (2019). Pengaruh Kinerja Keuangan Terhadap Return Saham Perusahaan Pertambangan. *Jurnal Bisnis Dan Akuntansi*, 21(2), pp. 155-164.
- Sisbintari, I. (2012). Analisis Komparatif CAR, LDR, ROA dan ROE Sebelum dan Sesudah Merger pada PT. Bank CIMB Niaga Tbk. *PROFIT: Jurnal Administrasi Bisnis*, 6(2).
- Suhendro, D. (2018). Analisis penilaian kinerja keuangan perusahaan menggunakan rasio keuangan pada pt unilever indonesia tbk Yang Terdaftar di Bursa Efek Indonesia (BEI). *AT-TAWASSUTH: Jurnal Ekonomi Islam*, 3(1), pp. 23-47.
- Tahu, G. P. (2019). Pengaruh Kinerja Lingkungan Dan Pengungkapan Lingkungan Terhadap Kinerja Keuangan (Studi Pada Perusahaan Manufaktur yang Terdaftar di BEI). *Jurnal Ekonomi dan Pariwisata*, 14(1).
- Utami, A. A., Umam, K., Zahrudin, Z., & Maya, M. (2021). Analisis Profitabilitas Industri Manufaktur *Consumer Goods* Sebelum dan di Saat Pandemi Covid-19 di Indonesia. *JABE (Journal of Applied Business and Economic)*, 8(2), pp. 146-158.
- Yamali, F. R., & Putri, R. N. (2020). Dampak Covid-19 Terhadap Ekonomi Indonesia. *Ekonomis: Journal of Economics and Business*, 4(2), pp. 384-388.

AUTHORS

First Author – Aditya Reyhan Yafi Wiryawan, Muhammadiyah of Surakarta University, b200180089@student.ums.ac.id

Second Author – Noer Sasongko, Muhammadiyah of Surakarta University, ns243@ums.ac.id

Correspondence Author – Noer Sasongko, Muhammadiyah of Surakarta University, ns243@ums.ac.id

Pulp survival of permanent teeth following crown fractures - A prospective cohort study

Lokuappu Kuttige Nadeesha Premathilaka*, Sivaguru Vasantha**, Lekamalage Hansamali Prasangika***

* (BDS, MD in Restorative Dentistry)- Senior Registrar in Restorative Dentistry, National Dental Hospital – Colombo, Sri Lanka

** (BDS, MS in Restorative Dentistry) – Consultant in Restorative Dentistry, National Dental Hospital – Colombo, Sri Lanka

*** (BSc (Honors in Statistics))- Temporary Lecturer, Faculty of Dental Sciences, University of Peradeniya, Sri Lanka

DOI: 10.29322/IJSRP.12.10.2022.p13066

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13066>

Paper Received Date: 12th September 2022

Paper Acceptance Date: 15th October 2022

Paper Publication Date: 21st October 2022

Abstract- Background/ Aim: Preservation of pulp vitality in fractured teeth is important especially in young permanent teeth. The aim of this study was to analyze the pulp survival of permanent teeth following crown fractures. **Materials and Methods:** All the patients presented to the Restorative Unit 'A', National Dental Hospital, Colombo, Sri Lanka from June 2016 to December 2017, fulfilling the inclusion criteria were included for the study. Treated teeth were monitored for a period of 12 months from the trauma. Kaplan-Meier method was used to assess the incidence: rate ratio. Log-rank test was applied to assess the differences in the survival rate. Cox proportional hazard regression analysis was performed to investigate the association between pulp survival and the predictor variables. **Results:** 83.4% teeth (378/453) showed no loss of pulp vitality. after one year of the injury. The highest pulp survival was observed in uncomplicated crown fractures without a periodontal injury (98.1%). Presence of a concurrent periodontal injury was identified as a highly significant risk factor for pulp necrosis (p value= <2e-16). Level of root maturity and time elapsed since the injury did not show a significant association with pulp survival. **Conclusions:** The treatment of crown fractures in the permanent dentition resulted mostly in successful outcomes. Presence of a concurrent periodontal injury was identified as a highly significant risk factor for pulp necrosis.

Index Terms- Crown fracture, permanent teeth, pulp survival, dental trauma

I. INTRODUCTION

Dental trauma is one of the most common oral health problems in the general population¹. Trauma to the permanent dentition can occur in all stages of life, with increased numbers documented in the first and second decades of life^{2, 3}. The commonest form of traumatic dental injury to the permanent dentition is crown fracture and constitutes 26% to 76% of all traumatic injuries⁴.

According to the International Classification of Diseases (ICD-11) endorsed by the World Health Organization, crown

fractures include enamel infraction, enamel fracture, enamel - dentine fracture and complicated crown fracture⁵.

Any form of crown fracture should be treated to preserve the pulp vitality, to achieve optimum aesthetic and functional outcome. Preservation of pulp vitality is of major importance especially in young permanent teeth, as maintenance of a healthy pulp throughout the root canal system is important to ensure apexogenesis⁶.

The highest pulp survival rate was documented in teeth with uncomplicated fractures without a concurrent periodontal injury^{7, 8, 9}.

Literature suggests that the stage of root development^{6,7,8,10}; presence of a concurrent periodontal injury^{6,9}; time interval between trauma and the emergency treatment¹¹; type of crown fracture and positive response to pulp sensibility tests at the time of injury¹² are significantly influential on the pulp survival of crown fractured teeth. Nevertheless, some studies have reported that the time interval between trauma and emergency treatment^{6,8} and the type of emergency treatment provided^{4,10} have no significant effect on pulp survival of the affected tooth.

The aims of this study were to analyze the pulp survival and the factors affecting pulp survival of permanent teeth with crown fractures, presented to Restorative Unit A, National Dental Hospital - Colombo during June 2016 to December 2017.

II. MATERIALS AND METHODS

This prospective cohort study was conducted at the Restorative Unit A, National Dental Hospital, Colombo, Sri Lanka in the period from June 2016 to December 2018. Ethical clearance was obtained from the Ethical review committee of the Faculty of Medicine, University of Colombo.

All the patients who presented or referred to the unit from June 2016 to December 2017 with a crown fracture in the permanent teeth, within a month of the injury were included in this study after obtaining their informed consent. Patients who had root fractures, intrusion / extrusion / avulsion of the same tooth; a previous history of dental trauma; severe tooth substance loss due to dental caries or tooth wear; root canal treatment in the affected tooth; incomplete data on initial examination /emergency

treatment received; where the emergency care was not in line with the guidelines given by the International Association of Dental Traumatology¹³; dislodged emergency restorations were excluded from the study.

A pre-tested, interviewer-administered, structured compilation sheet was used for data collection. It consisted of questions to elicit demographic data, time elapsed since trauma to the initial treatment, type of emergency treatment received. Clinical examination findings (type of fracture, tooth colour, type of the concurrent periodontal injury if present, restorations placed to treat the fracture), pulp sensibility test results, radiographic findings of the first visit and the follow-up visits were also included in the data collection sheet.

Fractured teeth were treated according to the guidelines given by the International Association of Dental Traumatology¹³ by well-trained Dental Surgeons worked at the Restorative Unit A, National Dental Hospital, Colombo. All diagnostic and therapeutic information was consistently recorded during patient management on a separate case record sheet.

Treated teeth were monitored for a period of minimum 12 months after the trauma. Initial follow-up was done 6-8 weeks after the trauma, followed by 3 months, 6 months, 9 months, and 12 months from the trauma. Where there was a concomitant periodontal injury (concussion/ subluxation/ luxation), follow-up was done after 2 weeks, 4 weeks, 6-8 weeks, 3 months, 6 months, 9 months, and 12 months from the trauma.

The whole data set was initially transferred into a Microsoft Excel sheet. The descriptive analysis was done using Microsoft Excel and the statistical software SPSS version 21. Exploratory statistical analysis was performed using R software. Kaplan-Meier method was used to assess the incidence: rate ratio. A tooth with two or more of the classical signs of pulp necrosis (i.e., grey/blue/red discoloration of crown, persistent tenderness to percussion, negative sensibility testing after 3 months of shock period, apical radiolucency) was considered as non-vital. Differences in the survival rate were assessed by applying the Log-rank test. Cox proportional hazard regression analysis was performed to investigate the association between pulp survival of traumatized teeth and the predictor variables.

Results

A total of 263 patients were included in this study, of which 224 (85.17%) were males and 39 (14.83%) were females. The mean age of the sample was 16.1 years, with a range of 7 - 62 years.

Of this study sample, 166 patients (63.1%) were referred from the Outpatient Department or Emergency Unit of National

Figure 01: The Kaplan-Meier curve which illustrates the pulp survival probability in relation to the type of crown fracture. P-value for the log rank test is <0.0001.

Dental Hospital Colombo; 10 (3.8%) were referred from the Oral and Maxillofacial Units of the same hospital and 87 (33.1%) were referred from peripheral hospitals or private dental practices or school dental clinics. On presentation, only 31.1% of teeth had received the emergency treatment for the fractured teeth.

A total number of 453 fractured permanent teeth were evaluated in this study. 74.4% (n= 337) of them had uncomplicated crown fractures and 25.6% (n= 116) had complicated crown fractures. Out of those 337 teeth with uncomplicated crown fractures, 3% had enamel infraction, 10.81% had enamel fracture and the great majority, 60% had enamel-dentine fracture.

131 (28.9%) teeth showed incomplete root formation, while 322 (71.1%) teeth had closed roots.

Out of 453 teeth, 175 (38.6%) were associated with a concomitant periodontal injury. The most common type of periodontal injury was concussion (68%), followed by subluxation (30.9%) and lateral luxation (1.1%) (Table 01).

Of all 263 patients, 121 patients (209 teeth) had received emergency treatment within 2-3 hours of injury, 60 patients (113 teeth) had received it within 3-24 hours of injury and 82 patients (131 teeth) had received it after 24 hours of trauma.

Out of the 337 teeth with uncomplicated crown fractures, 29.4% had received a light cured composite restoration/ reattachment of the fractured fragment; 66.2% had received a GIC restoration initially and a composite restoration on a subsequent visit and 4.4% had received no restoration. Whereas of 116 teeth with complicated crown fractures, the majority (59.5%) were treated with direct pulp capping with Dycal® (Dentsply Caulk); 37.1% were treated with partial/total pulpotomy using non-setting Calcium hydroxide and 3.4% had received root canal treatment (Table 02).

No loss of pulp vitality was observed in 378 teeth (83.4%), after one year of the injury. Uncomplicated crown fractures without a periodontal injury showed the highest pulp survival (98.1%) followed by the uncomplicated crown fractures with a concurrent periodontal injury (84.3%), complicated crown fractures without a periodontal injury (62.9%) and complicated crown fractures with a concurrent periodontal injury (46.3%) respectively (Table 02).

The Kaplan-Meier curves which illustrate the pulp survival probability over a period of 12 months in relation to the type of crown fracture, concurrent periodontal injury, root maturity, duration between trauma and the emergency treatment; and the type of treatment provided are generated (Figures 1-5).

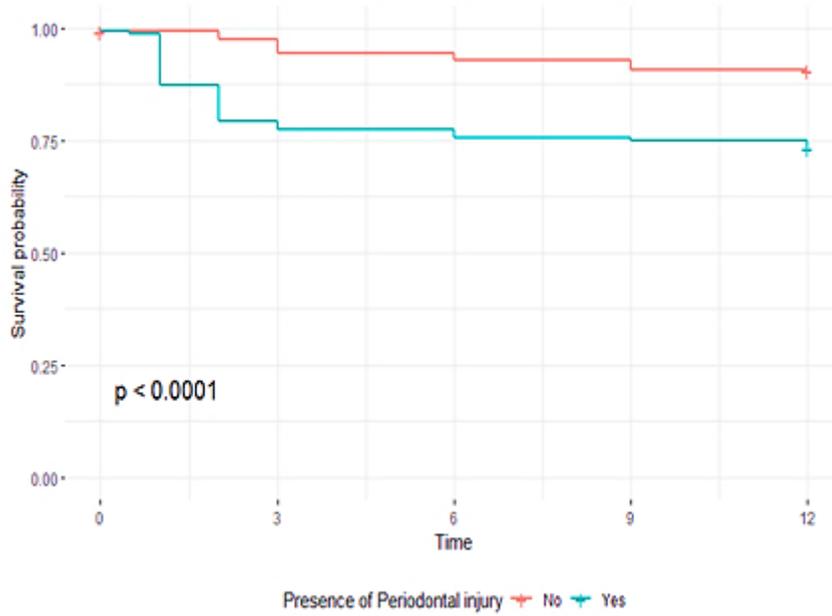


Figure 02: The Kaplan-Meier curve which illustrates the pulp survival probability in relation to the presence/absence of a concurrent periodontal injury. P-value for the log rank test is <0.0001 .

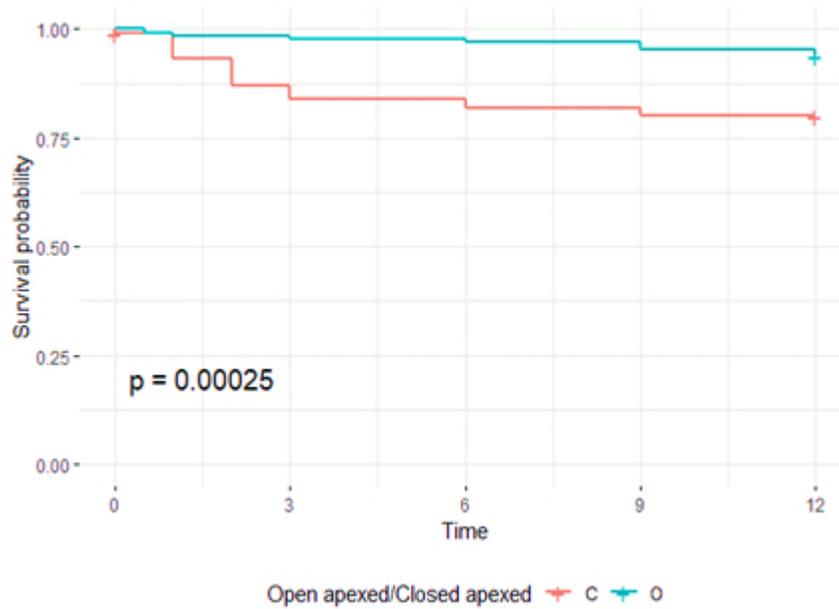


Figure 03: The Kaplan-Meier curve which illustrates the pulp survival probability in relation to the level of root maturity. P-value for the log rank test is <0.00025.

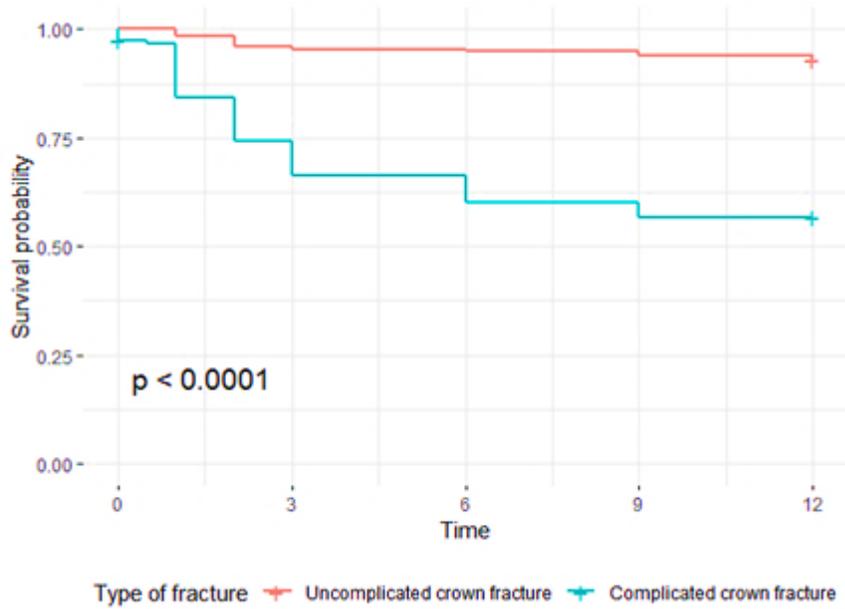
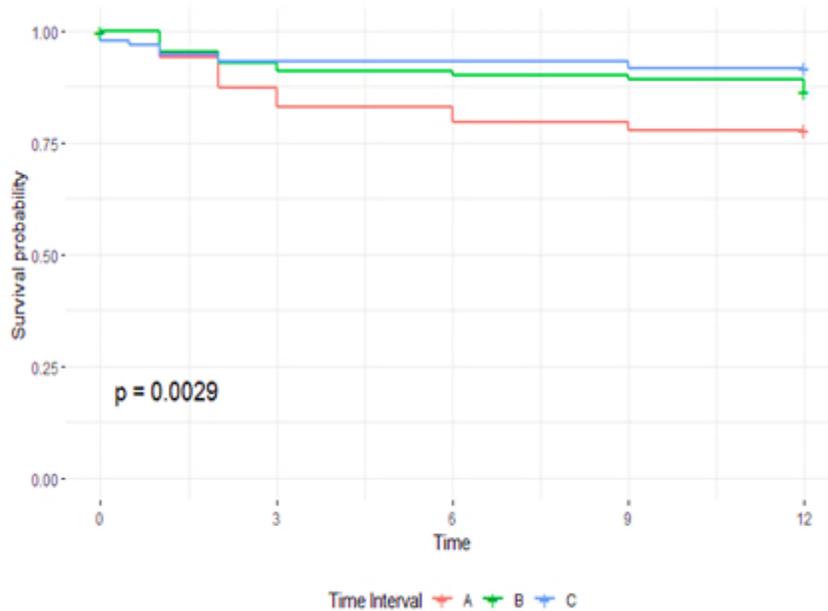
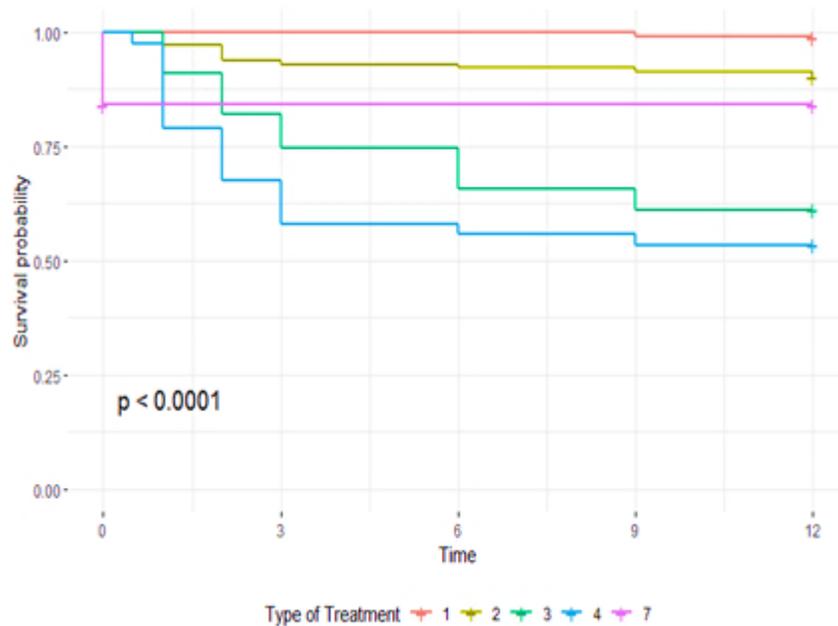


Figure 04: The Kaplan-Meier curve which illustrates the pulp survival probability in relation to the duration between trauma and the emergency treatment. P-value for the log rank test is <0.0029.



A- Emergency treatment is received within 2-3 hours of injury, B- Emergency treatment is received within 3-24 hours of injury, C- Emergency treatment is received after 24 hours of injury

Figure 05: The Kaplan-Meier curve which illustrates the pulp survival probability in relation to the type of restorative treatment. P-value for the log rank test is <0.0001.



1- Reattachment of the fractured fragment or composite restoration, 2- Initial GIC restoration followed by a composite restoration, 3- Direct pulp capping, 4- Partial/ total pulpotomy, 7- Any other treatment

Cox proportional hazard regression analysis was applied to investigate the association between the pulp survival and the prognostic factors. However, as proportional hazard assumptions were not met, the extended Cox model was used. Formation of the Extended Cox model was done by adding the time function to the variable 'presence of a periodontal injury' (as presence of a periodontal injury is the variable which did not meet the PH assumption). Finally, the best model was selected by stepwise variable selection method and the results are given in Table 03. Accordingly, presence of a concurrent periodontal injury was identified as a highly significant risk factor for pulp necrosis in crown fractured teeth (p value= <2e-16).

Discussion

This prospective cohort study aimed to assess the pulp survival of permanent teeth following crown fractures and to determine the impact of different prognostic factors on pulp survival.

In the present study, most of the teeth showed uncomplicated crown fractures (74.4%) as reported in many other studies^{9,10,14}.

According to the study findings, 83.4% of crown fractured teeth were vital after one year of the injury as reported in another study⁹. In accordance with similar other studies^{9,10}, the highest pulp survival was observed in the group of uncomplicated crown fractures without a periodontal injury (98.1%). Pulp survival in the group of uncomplicated crown fractures with a concurrent periodontal injury was 84.3% and this finding is almost similar or above the findings of other studies^{9,10}.

In this study, pulp survival of complicated crown fractures without a periodontal injury was 62.9%. Whereas a higher survival rate of 86.1% was observed in another study⁹. The pulp survival of complicated crown fractures with a concurrent periodontal injury was as low as 46.3%. The same finding has been reported in another study¹⁰.

In the literature it has been reported that the stage of root development^{6,7,8,10}; presence of a concurrent periodontal injury^{6,9}; time elapsed since the trauma¹¹; type of the crown fracture and response to pulp sensibility tests at the time of injury¹² are significantly influential on the pulp survival of crown fractured teeth.

Kaplan-Meier curves were generated (Figures 01, 02, 03, 04 and 05) and the differences in the survival rates were assessed by the Log-rank test. According to that, pulp survival probability of the complicated crown fractures was significantly lower than that of the uncomplicated crown fractures (p= <0.0001). In accordance with the other studies^{6,9}, a significantly low probability of pulp survival was observed in the teeth associated with a concurrent periodontal injury (p= <0.0001). Further, a significantly low probability of pulp survival was observed in the teeth with closed apices than the teeth with open apices (p= <0.00025) as found in another study⁸. Interestingly, a low pulp survival probability was observed in teeth which had received the emergency treatment within 2-3 hours of the injury compared to the groups of teeth which had received the emergency care after 3- 24 hours and after 24 hours (p= 0.0029). This might be explained by the fact that most of the teeth which received treatment within 2-3 hours had complicated crown fractures, in which pulp survival probability was low.

Moreover, the teeth treated with reattachment/ composite restoration showed the highest pulp survival probability, while the teeth treated by initial GIC+ composite restoration, any other

treatment, direct pulp capping and pulpotomy showed low of pulp survival probabilities respectively ($p= 0.0001$).

Cox proportional hazard regression analysis was applied to investigate the association between the pulp survival and the prognostic factors. However, as proportional hazard assumptions were not met the extended Cox model was used, and the stepwise variable selection method was used to select the best model (Table 03). Accordingly, presence of a concurrent periodontal injury was identified as a statistically highly significant risk factor ($p= <2e-16$) for pulp necrosis in crown fractured teeth. This finding is in line with other studies^{6,9}. This increased risk of pulp necrosis may be due to the temporary or permanent interruption of the blood supply at the apical foramen, which is typically linked to luxation injuries. In contrast to other studies^{8,10}, level of root maturity did not show a significant association with pulp survival ($p= 0.93$). Further, direct pulp capping ($p= 0.008$) and pulpotomy ($p= 0.004$) treatments were found to have significant associations with pulp necrosis. In the present study, no significant association between the time elapsed since the injury to emergency care and pulp necrosis was identified.

The key factor which determines the prognosis of a tooth after any form of pulp exposure is the elimination of the bacteria invading the pulp^{15, 16}. Therefore, removal of the infected pulp tissue as early as possible following the injury and provision of a hermetic seal to the exposed pulp is critical in management^{11, 16}. Several procedures have been recommended for the treatment of exposed pulps and these include direct pulp capping, partial pulpotomy, total cervical pulpotomy and pulpectomy procedures¹⁰. Pulpotomy procedures appear to be superior to pulp capping^{10, 16}.

In the present study, the majority (59.5%) of pulp exposed teeth were treated with direct pulp capping and 37.1% were treated with partial/total pulpotomy (Table 02). The frequency of pulp necrosis among the teeth treated with direct pulp capping was 40.6%. Hecova et al.⁷ has observed a similar rate of pulp necrosis and infection (45.5%) in teeth treated with direct pulp capping. The frequency of pulp necrosis in pulpotomy treatment was slightly higher (46.5%) than that of the direct pulp capping. Whereas many other studies have reported a lower rate of pulp necrosis following the pulpotomy treatment compared to the direct pulp capping^{7,8,9}.

The indication for a partial pulpotomy is judged by the clinical assessment of bleeding from the pulp, which should be controlled within 3 to 5 minutes under the slight pressure of a cotton pellet soaked in physiologic saline¹⁷. If bleeding is excessive, a more invasive procedure such as total coronal pulpotomy may be needed¹⁸. In the present study, patients who were referred to the clinic after the pulpotomy treatment fulfilling the inclusion criteria were included. Therefore, the variability in clinical judgement of bleeding from the pulp, which is a limitation of this study would have contributed to the observed higher frequency of pulp necrosis after the pulpotomy.

Further to that, in other studies, either MTA or Calcium hydroxide was used as the medicament in pulpotomy. Whereas in this study, the only medicament used was Calcium hydroxide as it was the material available in the clinic free of cost. In the literature, it has been reported that the clinical outcome of MTA is better than Calcium hydroxide in the case of indicated pulpotomies⁹. This may also have contributed to the relatively

higher rate of pulp necrosis observed in pulpotomies in the present study.

In conclusion, the highest pulp survival was observed in teeth with uncomplicated crown fractures which did not have a concurrent periodontal injury and the lowest pulp survival was observed in complicated crown fractures which had a concurrent periodontal injury. The presence of a concurrent periodontal injury was identified as a statistically highly significant risk factor for pulp necrosis in crown fractured teeth. Level of root maturity and time elapsed since trauma to the emergency care did not show significant association to the pulp survival.

ACKNOWLEDGEMENT

We would like to thank all the staff members of Restorative Unit 'A', National Dental Hospital – Colombo, Sri Lanka for giving their support to conduct this study.

REFERENCES

- [1] Andersson L. Epidemiology of traumatic dental injuries. *Pediatr Dent* 2013; 35:102–5.
- [2] Bücher K, Neumann C, Hickel R, Kühnisch J. Traumatic dental injuries at a German university clinic 2004-2008. *Dent Traumatology* 2013; 29(2):127–133.
- [3] Andreasen JO. Etiology and pathogenesis of traumatic dental injuries. A clinical study of 1,298 cases. *Scand J Dent Res* 1970; 78:329–342.
- [4] Castro JMC, Poi WR, Manfrin TM, Zina LG. analysis of the crown fractures and crown-root fractures due to dental trauma assisted by the Integrated Clinic from 1992 to 2002. *Dent Traumatol* 2005; 21:121-126.
- [5] Petti S, Andreasen JO, Glendor U, Andersen L. NAOD – The new Traumatic Dental Injury classification of the World Health Organization. *Dental Traumatology* 2022; 38: 170-174.
- [6] Robertson A, Andreasen FM, Andreasen JO, Nore'n JG. Long term prognosis of crown-fractured permanent incisors. The effect of stage of root development and associated luxation injury. *Int J Paediatr Dent* 2000; 10:191–199.
- [7] Hecova H, Tzigkounakis V, Merglova V, Netolicky J. A retrospective study of 889 injured permanent teeth. *Dent Traumatol*. 2010; 26:466-475.
- [8] Wang G, Wang C, Qin M. Pulp prognosis following conservative pulp treatment in teeth with complicated crown fractures—a retrospective study. *Dent Traumatol* 2017; 33(4):255–260.
- [9] Bissinger R, Muller DD, Reymus M, Khazaei Y, Hickel R, Bucher K, Kühnisch J. Treatment outcomes after uncomplicated and complicated crownfractures in permanent teeth. *Clinical Oral Investigations* 2021; 25:133–143.
- [10] Viduskalne I, Care R. Analysis of the crown fractures and factors affecting pulp survival due to dental trauma. *Stomatologija, Baltic Dental and Maxillofacial Journal* 2010;12:109-115.
- [11] Maguire A, Murray II, Al-Majed I. Retrospective study of treatment provided in the primary and secondary care services for children attending a dental hospital following complicated crown fractures in the permanent dentition. *Int J Paediatr Dent* 2000; 10:182-190.
- [12] Day PF, Duggal MS. The role for 'reminders' in dental traumatology: 3. The minimum data set that should be recorded for each type of dento-alveolar trauma – a review of existing evidence. *Dent Traumatol* 2006; 22:258–264.
- [13] DiAngelis AJ, Andreasen JO, Ebeleseder KA et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1. Fractures and luxations of permanent teeth. *Am Acad Pediatr Dent* 2012; (1): 2–12.
- [14] Güngör H C, Uysal S, and Altay Nil. A Retrospective Evaluation of Crown-fractured Permanent Teeth Treated in a Pediatric Dentistry Clinic. *Dental Traumatology* 2007; 23(4):211-217.
- [15] Moule AJ, Moule CA. The endodontic management of traumatized permanent anterior teeth: a review. *Aust Dent J* 2007; 52:122-37.

- [16] Trope M, Blanco L, Chivian N, Sigurdsson A. The role of endodontics after dental traumatic injuries. In: Cohen S, Hargreaves KM. Pathways of the pulps. 9th ed. St. Louis: Elsevier Mosby; 2006. p. 610-49.
- [17] Bogen G, Chandler NP. Pulp preservation in immature permanent teeth. Endod Topics. 2010; 23:131-152.
- [18] Gungor HC. Management of crown-related fractures in children: An update review. Dent Traumatol. 2014; 30:88-99.

(Currently, attached to the Faculty of Dental Sciences, University of Peradeniya)

Second Author – Sivaguru Vasantha (BDS, MS in Restorative Dentistry) – Consultant in Restorative Dentistry, National Dental Hospital – Colombo, Sri Lanka

Third Author – Lekamalage Hansamali Prasangika (BSc (Honors in Statistics))- Temporary Lecturer, Faculty of Dental Sciences, University of Peradeniya, Sri Lanka

AUTHORS

First Author – Lokuappu Kuttige Nadeesha Premathilaka (BDS, MD in Restorative Dentistry)- Senior Registrar in Restorative Dentistry, National Dental Hospital – Colombo, Sri Lanka

Correspondence Author – L.K.N. Premathilaka, Address- Division of Pediatric Dentistry, Dept of Community Dental Health, Faculty of Dental Sciences, University of Peradeniya, Sri Lanka, E-mail- nadeeshap@dental.pdn.ac.lk, Telephone: +94704298103

Qualitative Study of Barriers in Adopting a Healthy Diet and Lifestyle Among Kadazandusun Community with Nasopharyngeal Carcinoma in Sabah

Raja Muhammad Raja Omar*, Che wan Ilmiyah**, Fredie Robinson**, Haryati Abdul Karim***

* Otorhinolaryngology Department of Hospital Queen Elizabeth Kota Kinabalu Sabah, Malaysia

** Community & Family Medicine Department, Faculty of Medicine and Health Sciences, UMS, Jalan UMS, 88400, Kota Kinabalu, Sabah, Malaysia

*** Faculty of Social Science and Humanities University Malaysia Sabah Jalan UMS, 88400, Kota Kinabalu, Sabah, Malaysia

DOI: 10.29322/IJSRP.12.10.2022.p13067

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13067>

Paper Received Date: 14th September 2022

Paper Acceptance Date: 15th October 2022

Paper Publication Date: 21st October 2022

Abstract- Nasopharyngeal carcinoma is uncommon cancer. However, it is the most prevalent cancer among Sabah indigenous, particularly those from Kadazan and Dusun ethnic groups. This ethnicity contributes to more than half of all nasopharyngeal cancer diagnoses between 2012 and 2016. Despite a health program and screenings, this malignancy remained steadily high among the ethnicity throughout the year. This study explores the barriers to adopting a healthy lifestyle in terms of diet practices and risky behavior with nasopharyngeal carcinoma among the Kadazandusun ethnicity in Sabah. Four focus groups discussion were conducted with in-depth interviews from three separate district locations to get the information. Results: Three barriers were identified that prevent Kadazandusun from adopting a healthy diet and lifestyle, level of understanding, individual acceptance, and cultural pressure. In conclusion, understanding the barriers to adopt a healthy lifestyle would aid in appropriately creating health programs or relevant linked policies to help lower this malignancy among the target groups involved.

Index Terms- Barriers, Diet, Lifestyle, Nasopharyngeal Carcinoma, Qualitative Study

I. INTRODUCTION

Nasopharyngeal carcinoma (NPC) causes a significant health burden in Malaysia; it ranked number fifth (4%) among all cancer most commonly diagnosed in the population [1]. From 2012 to 2016, 4,597 cases of NPC were reported, compared to 5,090 patients in the previous study from 2007 to 2011[2]. Kadazan and Dusun ethnicity are most affected by this malignancy[3] with the average age-standardized (ASR) rate of nasopharyngeal carcinoma in Sabah being 7.9 per 100,000. Dusun ethnic was found to have the highest ASR individuals, 3.19 per 100,000 in males and 1.69 per 100,000 in females, with a 2.4 ratio between male-to-females followed by Chinese and Kadazan [4]. The rise in NPC cases puts pressure on Malaysia's medical costs [5]. This burden occurs because Malaysia has subsidized medical expenses, including cancer treatment [5]. Many scholars claim that nasopharyngeal carcinoma is associated with diet and lifestyle. According to [6]–[9], salted and grilled fish, and pickled food are associated with NPC as well as smoking and alcohol drinking[10]. Besides that, genetics and Epstein Barr Virus are non-modifiable risk factors related to NPC.

Kadazandusun is the largest ethnic group in Sabah, with 698,300 people accounting for 18% of the Sabah population in 2021 [11]. They live on the western shore and in the countryside surrounding the coast of Sabah. As the dominant race, Kadazandusun is well-known for its diverse social culture and tradition, including diet. Apart from symbolizing spirituality and emotions, this culture and tradition also give social groups characteristics [12]. Kadazandusun is also known for its heavy reliance on alcohol. These diverse cultures and practices have been passed down from one generation to another [13].

Food preparation by utilizing salty techniques to keep food from fast and permanently deteriorating is a storage method practiced by this ethnic [14]. This technique results in a more significant number of health issues, as salt reduction is important to prevent hypertension and cardiovascular disease [15]. This assertion is comparable to the finding, pickles had become Kadazandusun's preferred food [16]. This diet is an appetizer and a most popular diet than other traditional food.

Consumption of this food increases the risk of developing NPC [9] and esophageal cancer [17]. One example of salty food is salted fish. According to [6], this food has associated with NPC. This salted fish contained nitrosamines that are formed during the manufacturing process [18]. The International Agency for Research on Cancer, this nitrosamine is a human mutagenic carcinogen.

Kadazandusun also likes to eat smoked food, known locally as “bakas.” This diet increases the risk to NPC through the carbon created during its preparation combustion process, known as polycyclic aromatic hydrocarbons (PAH). These chemicals are related to NPC [19]

and breast cancer [20]. Drinking alcohol is part of Kadazandusun culture. One of the reasons because alcohol is quickly gained due to self-made [21]. According to [21], [22] this activity is quite worrying, especially among young children. The sadder effect is seen more during festival Kaamatan when many people drunken or fights due to excessive drinking. This alcohol has associated with NPC, and liver disease and slows down the rate of nutrient absorption [10], [23], [24].

Kadazandusun community, who lives in the interior used rolled cigarettes because it is cheap and easy to obtain. This hand-rolled cigarette smoking causes DNA damage and oxidation of plasma protein significantly higher than in filter-cigarette smokers [25]. Anyhow, both types of cigarettes can cause lung cancer and NPC [10].

II. RESEARCH METHODOLOGY

This qualitative study uses focus group discussion (FGD) and in-depth interviews with a semi-structured questionnaire. Purposive and snowball sampling methods were applied for sample selection. Four focus groups were recruited from three districts in Sabah. Inclusion criteria were age between 17-70 years old, not being a cancer patient, or having a family with cancer. Meanwhile, the exclusion criteria were respondents with pregnancy. Interviews were conducted between November 2021 and December 2021. The time spent on each interview varied from half an hour to 45 minutes. Each interview takes an average of 36 minutes to collect all relevant information, and data saturation was achieved after four group discussions with 17 respondents.

Written consent is taken before each interview, and respondents were told about the study contents and assured of ethical norms such as anonymity and confidentiality. Open questions were used to gather information on barriers to adopting a healthy diet and lifestyle. Each respondent was allowed to provide all the relevant information. All session was recorded, the video recording was de-identified, and personally-identifying information was not mentioned.

Semi-structured interviews consist of 4 to 6 persons in each focus group session. An in-depth interview is done to get a better and more detailed description of the information. Below is the question used.

- a) What is the favorite food among the Kadazandusun, and state how often the food is taken?
- b) In your opinion, can this diet increase the risk of nasopharyngeal cancer among Kadazandusun?
- c) Have you ever heard that consuming fermented food and alcohol may increase the risk of nasopharyngeal cancer?
- d) Can you tell me what barriers keep you from quitting this risky activity?

From the information given, open coding and thematics were identified and analyzed, as suggested by Braun and Clarke [26]. All the data was gathered and analyzed using a conventional content analysis method with qualitative data experts to understand differences in perspectives within the ethnic group about their diet and lifestyle.

This study was carried out according to the ethical precepts of the Declaration of Helsinki and the Good Clinical Practice Guidelines, with permission Ministry of Health Medical Research and Ethics Committee.

III. RESULT

This study involved 17 respondents from three locations. The mean age of participants was 41.47 years. Nine female and eight male participants with seven of them having higher education. Three have primary and seven with secondary education. The majority of them were married. The demographic shows two participants have incomes below RM 1200, seven of them have incomes that fall between RM 1200 and RM 2400, and the remaining eight participants have more than RM 2400 per month, as shown in Table 1.

Table 1: Demographic Characteristics of Participants

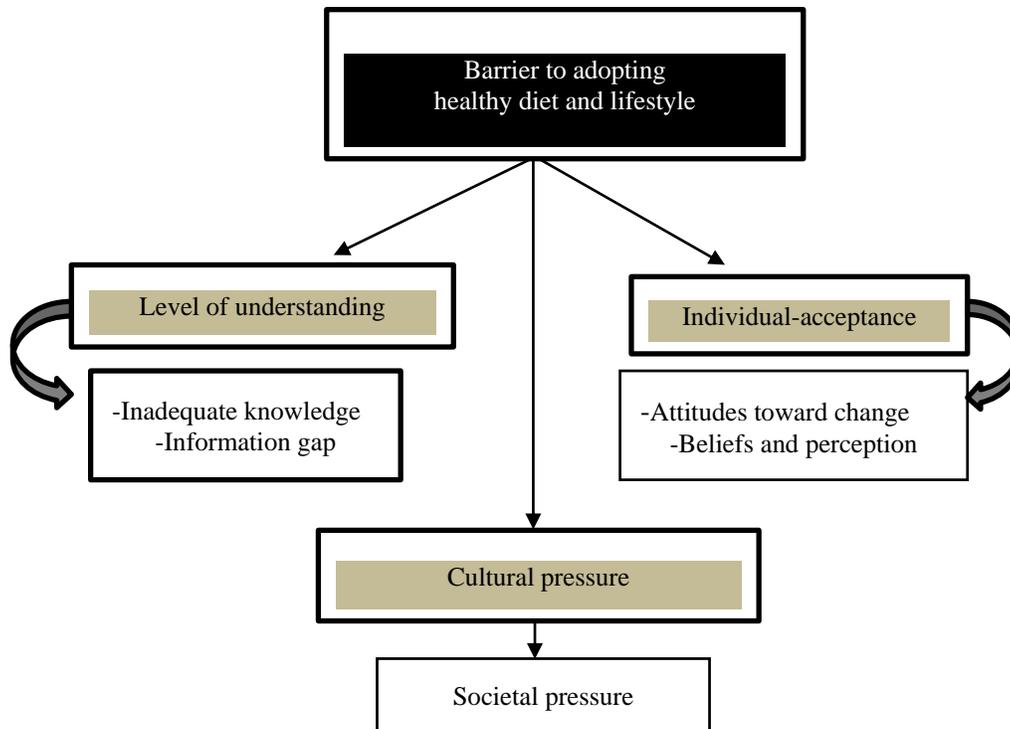
	Ethnic	Location	Gender	Age	Education	Income	Marital status
A.	Dusun	Keningau	Female	54	Primary school	<RM 1200	Married
B.	Dusun	Keningau	Male	44	Secondary School	RM 1200-2400	Married
C.	Kadazan	Penampang	Female	36	Higher education	RM 1200-2400	Married
D.	Dusun	Penampang	Male	35	Secondary School	RM 1200-2400	Married
E.	Dusun	Keningau	Female	28	Primary school	<RM 1200	Single
F.	Kadazan	Kota Kinabalu	Female	48	Higher education	>RM 2400	Married
G.	Dusun	Keningau	Male	30	Higher education	>RM 2400	Married
H.	Dusun	Keningau	Male	34	Higher education	RM 1200-2400	Married
I.	Kadazan	Penampang	Male	44	Secondary School	RM 1200-2400	Married
J.	Dusun	Keningau	Female	56	Primary school	RM 1200-2400	Married
K.	Kadazan	Penampang	Female	50	Secondary School	>RM 2400	Married
L.	Dusun	Keningau	Female	48	Higher education	>RM 2400	Married
M.	Kadazan	Keningau	Female	36	Secondary School	>RM 2400	Married
N.	Dusun	Keningau	Male	44	Higher education	>RM 2400	Married
O.	Kadazan	Penampang	Female	40	Higher education	>RM 2400	Married
P.	Kadazan	Kota Kinabalu	Male	44	Secondary School	RM 1200-2400	Married

Q.	Kadazan	Kota Kinabalu	Male	34	Secondary School	>RM 2400	Married
----	---------	---------------	------	----	------------------	----------	---------

3. Barriers To Adopting Healthy Diet and Lifestyle

Level of understanding, individual acceptance, and cultural pressure are the three main themes barrier prevents this ethnicity from adopting a healthy diet and lifestyle. Under the main themes, there were two subthemes related as illustrated in figure 1.

Figure 1: The Relationship between Themes (Grey Boxes) and Subthemes (White Boxes) the Barrier of Kadazandusun to Adopting a Healthy Diet and Lifestyle.



3.1 Level of understanding theme

Inadequate knowledge and information gap have been assigned to these subthemes. These subthemes inferred the meaning level of understanding and importance of a healthy lifestyle and behavior in their daily activities, which contributed to the emergence of this problem. The possible reason for this is that a health program that warns of the health risk of an unhealthy diet and lifestyle, which can lead to NPC, does not reach the target group because they live in the interior and rural areas. The information presented above can be summed up in the sentence below.

“They have been consuming a particular dish for quite some time. every person in the village consumes this meal, but I have never heard of anyone in the area contracting this illness, and I am unsure whether it can cause health problems.” (Person: D).

“I’ve heard of this disease, but I’m not sure what causes it...” (Person: E)

There are also statements from them referring to inadequate knowledge because thinking tapai is safer than factory-made alcoholic beverages.

"For me, drinking this tapai is better than drinking alcoholic beverages purchased at a store. It is safer because we made it ourselves and we know it's clean and the mixture as opposed to being made in a factory, mixed with chemicals and not natural" (Person: I)

Information gap statement:

"I've never heard of it, and I rarely hear of this illness." (Person: J)

"I heard something, but is it true that pickled or salted food causes it?" (Person: L)

"I’m not familiar with this disease." (Person: M)

According to the statement above, they have insufficient knowledge and information about the food consumed and the consequences of drinking tapai. The NPC incidence can be reduced if the factors mentioned above are effectively addressed.

3.2 Individual acceptance's theme

Individual acceptance is the second theme identified. The attitude toward change, belief, and perception of the importance of healthy food intake and lifestyle were two subthemes extracted from FGD. Kadazandusun believed their diet was healthy because they

had been exposed since childhood, and everyone in their surroundings was practicing it.

The findings obtained are as follows:

Belief and perception

"For me, the food is good for health as there are no chemicals and no fertilizer. People in the past, they live longer than the current generation... even hundreds of years." (Person: A)

"Drinking is not to get drunk, maybe just to warm the body, like in Tambunan. It's a cold place, so if you drink, you will feel more comfortable." (Person: K)

Attitude towards change:

"I am aware that it is not a healthy beverage... but if you drink just a little bit, it encourages you to work hard" (Person: A)

"Drinking already become our tradition, many people practice it, even though they know that drinking is not good" (Person: C)

3.3 Cultural pressure theme

Kadazandusun ethnicity has its own unique culture. It's a delight and a source of pride for them to have food such as bosou, hinava, and many others including homemade alcohol called tapai. Their community accepts this food as their culture and tradition such as serving this food and alcohol to guests or giving alcohol to those in attendance. As a result, those who desire to improve to healthy diet and lifestyle will face social pressure. It requires them to eat or drink what is given to caring for the feelings of the house owners and friends.

Societal pressure statement:

"At our place, everyone will drink, regardless of religion. If they don't drink, they will be said to be arrogant". (Person: B)

"It is difficult to stop this activity because it is already a tradition and accepted by the community. For me, it is better to take care of my parent's and the villagers' feelings. If I don't drink, it will make them feel bad for us, so I have to drink even a little" (Person: H)

"This tapai is frequently offered to respect the guests... it has become a tradition among people in kadazandusun." (Person: I)

"Every function, we served tapai; it has been a practice and tradition for me since I was a child. Especially at weddings ceremonies and funerals." (Person: H)

IV. DISCUSSION

The increased incidence of nasopharyngeal cancer over the last five years, with the trend of this disease being identified at a younger age among this ethnicity, is quite concerning. As stated by [9], [27], [28], moving to a better diet and avoiding a dangerous lifestyle can assist this community in living healthier and minimizing the risk of NPC.

4.1 Level of Understanding

Understanding of disease risk factors involved is crucial to maintaining individual health status. By avoiding specific foods or engaging in a risky lifestyle, this community can reduce its chances of having nasopharyngeal cancer. According to [29], this is one of the reasons why Singapore's problem with the liver disease continues to exist despite efforts to regulate and treat it. The study noticed that the population of Singaporeans had a poor understanding of the liver disease. This opinion is backed by (35), as he concluded that when evaluating the connections between health literacy, disease-specific knowledge, and disease awareness among patients with chronic kidney disease (CKD) in Taiwan. The individuals with CKD who were aware of and understood their condition did better in the evaluation.

Raising awareness is an important step before any program can be implemented to solve the problems. Awareness programs short and long-term should be continued to improve nasopharyngeal carcinoma knowledge [27]. Insufficient knowledge also affects a person's understanding of the risk factors of a disease. According to a study conducted by [30], a high percentage of women (50%) were unaware of breast cancer risk factors even though it is a common type of cancer among women, whereas 42% of women believed long-term contraceptive use was a risk factor. This outcome illustrates that there is still a lack of essential awareness regarding the risks linked with common cancer. However, the situation may be much direr for nasopharyngeal carcinoma as it is uncommon cancer.

Knowledge plays a vital role especially in practicing a healthy lifestyle, whereas inadequate knowledge will be exposed to many problems, as discussed by [31]. This finding is also parallel with [32] in comparison to healthy people, who found patients have poorer awareness of pathology, symptoms, prevention and treatment, and risk factors.

In addition, it is necessary to narrow the information gap that exists between the rural population. This situation had structural limitations, such as a lack of specialists and limited media exposure, making it more difficult for rural areas to receive health information, particularly those with a low health literacy level[33]. According to [34], the information gap needs to be addressed carefully so that every piece of information can be conveyed accurately to the desired target population.

4.2 Individual Acceptance

Individual acceptance was the second theme seen as a barrier for the Kadazandusun community to adopt a healthy lifestyle. At the same time, attitudes toward change, beliefs, and perceptions are sub-themes under this umbrella. According to research carried out by [35], a lack of willpower may influence an individual's attitude toward the need for change. Furthermore, the belief that taking risks is just a normal part of life can make a person less open to positive change and may worsen the condition [36]. This belief can be seen in drinking tapai, this race believes that drinking tapai is a regular practice for them, even though it is unhealthy activity. They claimed it contains natural ingredients and does not contain chemicals like other alcoholic beverages. As a result of belief, Ghanaian society faces

challenges in adopting a healthier diet; as explained by [37], individual experiences, family dynamics, and community factors all shape people's beliefs on healthy and unhealthy eating habits.

However, belief in diet can also have a positive effect on health, as the people of Japan believe in a traditional Japanese diet that places a strong emphasis on the consumption of fish, vegetables, and soy products [38]. Studies have shown that consuming Japan diet will reduce the risk of death from all causes and cardiovascular in various locations throughout Japan [39].

4.3 Culture Pressure

Kadazandusun is distinct from others due to its belief and distinctive culture. A family's long-established rules are exceedingly difficult to break. They may inadvertently cause conflict or be considered insulting to community customs if they are not followed, as claimed by a participant in the focus group. According to [40], social and environmental influences at multiple levels, including cultural practices, can exacerbate food choices. Societal influences with peer pressure are one of the contributors to transitioning to a healthy diet. The study by [41], [42] discovered that co-workers prevented plans for a healthy diet on a regular or occasional basis in 75% of participants in his research. This situation illustrates that social pressures affect the choice of nutritious foods, as well as the fact that members of the Kadazandusun community would experience sentiments of being left aside if they did not stick to the diet that their neighbors and friends followed.

Food is not just a sign of social background but serves as a symbol or culture of a particular ethnic or religious group [43]. Lihing and a tajau containing rice tapai fermented into alcohol must be brought to a wedding in the Kadazandusun community. It is one of four fundamental marriage transmissions for the Kadazan people. This reinforces the opinion expressed in the focus group discussion that alcohol is an old tradition that must be included in their functions.

Study limitations: Participants may be biased in answering the question because it depends on their exposure since childhood. The lack of generalizability due small sample size limits the study output.

V. CONCLUSION

This study provides Kadazandusun barriers to adopting a healthier lifestyle for nasopharyngeal carcinoma. Our finding shows the need for community-based approaches to improving community understanding of this malignancy. Cultural beliefs must effectively address to gain public awareness and establishment of cancer preventive strategies.

RECOMMENDATION

A regular awareness campaign among the target or high-risk group with community-based approaches related to a nasopharyngeal carcinoma risk factor is needed to reduce the incidence.

ACKNOWLEDGMENT

We wish to sincerely thank the Ministry of Health and the Sabah State Health Department for their assistance and cooperation. This research received no external funding.

REFERENCES

- [1] A. Ahmad *et al.*, "The incidence of nasopharyngeal carcinoma in Pahang state of Malaysia from 2012 to 2017," *Malaysian J. Med. Sci.*, vol. 28, no. 1, pp. 66–74, 2021.
- [2] National Cancer Registry Department, "Malaysia national cancer registry report (MNCRR) 2012-2016," 2019 [Online], June 2019. Available: [https://www.moh.gov.my/moh/resources/Penerbitan/Laporan/Umum/2012-2016%20\(MNCRR\)/MNCRR_2012-2016_FINAL_\(PUBLISHED_2019\).pdf](https://www.moh.gov.my/moh/resources/Penerbitan/Laporan/Umum/2012-2016%20(MNCRR)/MNCRR_2012-2016_FINAL_(PUBLISHED_2019).pdf)
- [3] Non-Communicable Diseases Unit, Public Health Division, "Sabah cancer registry report 2012-2016," 2019. [Online], June 2019. Available: <http://www.jknsabah.gov.my/v8/muatturun/borangdokumen/kesihatanawam/Sabah%20Cancer%20Registry%20Report%202012-2016.pdf>
- [4] E. Hung, C. Wong, Y. Tan, and M. Dompok, "The first report on incidence of nasopharyngeal carcinoma in Sabah , Borneo," *S.Karger Ag. Basel*, pp. 258–262, 2021.
- [5] Malaysia, "National strategic plan for cancer control," [Online], 2021. Available: https://www.moh.gov.my/moh/resources/Penerbitan/Rujukan/NCD/Kanser/National_Strategic_Plan_for_Cancer_Control_Programme_2021-2025.pdf
- [6] S. I. Okekepa *et al.*, "Nasopharyngeal carcinoma (NPC) risk factors: A systematic review and meta-analysis of the association with lifestyle, diets, socioeconomic and sociodemographic in asian region," *Asian Pacific J. Cancer Prev.*, vol. 20, no. 11, pp. 3505–3514, 2019.
- [7] Z. M. Mai *et al.*, "Dietary fiber intake from fresh and preserved food and risk of nasopharyngeal carcinoma: observational evidence from a Chinese population," *Nutr. J.*, vol. 20, no. 1, pp. 1–10, 2021.
- [8] W. Ekburanawat *et al.*, "Evaluation of non-viral risk factors for nasopharyngeal carcinoma in Thailand: Results from a case-control

- study,” *Asian Pacific J. Cancer Prev.*, vol. 11, no. 4, pp. 929–932, 2010.
- [9] S. K. Yong, T. C. Ha, M. C. R. Yeo, V. Gaborieau, J. D. McKay, and J. Wee, “Associations of lifestyle and diet with the risk of nasopharyngeal carcinoma in Singapore: A case–control study,” *Chin. J. Cancer*, vol. 36, no. 1, pp. 3–10, 2017.
- [10] M. Long, Z. Fu, P. Li, and Z. Nie, “Cigarette smoking and the risk of nasopharyngeal carcinoma: A meta-analysis of epidemiological studies,” *BMJ Open*, vol. 7, no. 10, pp. 14–17, 2017.
- [11] Department Statistic of Malaysia (DOSM), “Key finding population and housing census of Malaysia 2020: Administrative District,” 2022. [Online], July 2022, Available: <https://www.mycensus.gov.my>
- [12] K. Akuoko, “Traditional values, socio-cultural factors and human resource management practices in public sector organisations in Ghana,” *J. Sci. Technol.*, vol. 28, no. 3, pp. 58–69, 2009.
- [13] J. Pugh-Kitingan, “Cultural and religious diversity in sabah and relationships with surrounding areas,” *Islam Cult. Divers. Southeast Asia*, pp. 269–294, 2015.
- [14] S. T. Teoh, B. Bent, T. Fong, and M. C. C. Lee, “A Nutrition study of the interior, west coast and kudat divisions Sabah,” 1981. Kuala Lumpur: Faculty Of Medicine, University Of Malaya, 1981.pp 83-98
- [15] F. J. He, Y. Ma, and G. A. MacGregor, “Salt reduction to prevent hypertension and cardiovascular disease: JACC State-of-the-Art Review,” *J. Am. Coll. Cardiol.*, vol. 75, no. 6, pp. 632–647, 2020.
- [16] D. K. A. Sapawi, Y. B. H. Ooi, S. Ibrahim, and Y. C. Lai, “Food safety concerns influence neophobic response towards kadazandusun traditional food in domestic tourists,” *J. Tour. Hosp. Environ. Manag.*, vol. 4, no. 13, pp. 34–58, 2019.
- [17] B. Yan, L. Zhang, and Z. Shao, “Consumption of processed and pickled food and esophageal cancer risk: A systematic review and meta-analysis,” *Bull. Cancer*, vol. 105, no. 11, pp. 992–1002, 2018.
- [18] D. P. Huang, J. H. C. Ho, K. S. Webb, B. J. Wood, and T. A. Gough, “Volatile nitrosamines in salt-preserved fish before and after cooking,” *Food Cosmet. Toxicol.*, vol. 19, no. C, pp. 167–171, 1981.
- [19] J. E. Al khaid Hakimi, Talal Thubaity, Al and N. al solami. Al, “Smoked cooked meat as a risk factor for Nasopharyngeal Carcinoma : A case control study among Saudi populations,” *Saudi J. Oto-Rhino-Laryngology Head Neck Surg.*, vol. 20, no. 1, pp. 13–19, 2018.
- [20] H. Parada *et al.*, “Grilled , barbecued , and smoked meat intake and survival following breast cancer,” *JNCI J Natl Cancer Inst*, 2017, vol. 109, pp. 1–8, 2017.
- [21] C. B. Seok, “The perception of characteristics, behaviors, cultures and traditions toward own and other ethnic groups,” *Eur. Cent. Res. Train. Dev. UK*, vol. 1, no. 1, pp. 1–10, 2013.
- [22] H. Hussin, “Ritual, identity and changes in the west coast of sabah: the experience of the kadazan penampang community,” *J. Southeast Asian Stud.*, vol. 12, pp. 189–210, 2007.
- [23] E. De Stcfani, L. Fierrob, M. T. Larrinagab, J. C. Balbib, A. Roncoa, and M. Mendilaharsu, “Smoking of hand-rolled cigarettes as a risk factor for small cell lung cancer in men : a case-control study from Uruguay,” *J. lung cancer , elsevier*, vol. 11, pp. 191–199, 1994.
- [24] W. L. Hsu *et al.*, “Cigarette smoking increases the risk of nasopharyngeal carcinoma through the elevated level of IgA antibody against Epstein-Barr virus capsid antigen: A mediation analysis,” *Cancer Med.*, vol. 9, no. 5, pp. 1867–1876, 2020.
- [25] A. Kocyigit, S. Selek, H. Celik, and M. Dikilitas, “Mutation research / genetic toxicology and environmental mutagenesis mononuclear leukocyte dna damage and oxidative stress : the association with smoking of hand-rolled and filter-cigarettes,” *Mutat. Res. - Genet. Toxicol. Environ. Mutagen.*, vol. 721, no. 2, pp. 136–141, 2011.
- [26] B. and Clark, “Appendix 9 : A 15-point checklist of criteria for good thematic analysis process (Braun and Clarke , 2006),” p. 37, 2006.
- [27] R. Fles *et al.*, “Effectiveness of a multicentre nasopharyngeal carcinoma awareness programme in Indonesia,” *BMJ Open*, vol. 6, no. 1, 2016.
- [28] W. Hsu *et al.*, “Lowered risk of nasopharyngeal carcinoma and intake of plant vitamin , fresh fish , green tea and coffee : a case-control study in Taiwan,” *PLoS One*, vol. 7, no. 7, 2012.
- [29] C. Tan, G. B. Goh, J. Youn, J. C. Yu, and S. Singh, “Public awareness and knowledge of liver health and diseases in Singapore,” *Gastroenterol. Hepatol.*, pp. 1–11, 2021.
- [30] C. A. Chao, L. Huang, K. Visvanathan, K. Mwakatobe, N. Masalu, and A. F. Rositch, “Understanding women ’ s perspectives on breast cancer is essential for cancer control : knowledge , risk awareness , and care- seeking in Mwanza , Tanzania,” *BMC Public Health*, vol. 20, no. 930, pp. 1–11, 2020.
- [31] M. Jeruszka-bielak *et al.*, “Are nutrition-related knowledge and attitudes reflected in lifestyle and health among elderly people ? a study across five european countries,” *Front. Physiol.*, vol. 9, no. July, pp. 1–13, 2018.
- [32] D. X. Pham, T. T. T. Pham, T. N. Pham, and T. D. Bui, “A Cross—sectional study about knowledge, awareness and perception of risk factors for cancer among cancer-patients relatives and healthy adults in Ho Chi Minh City, Vietnam,” *Asian Pacific J. Cancer Prev.*, vol. 22, no. 1, pp. 277–285, 2021.
- [33] X. Chen *et al.*, “Differences in rural and urban health information access and use,” *J. Rural Heal.*, vol. 0, pp. 1–13, 2018.
- [34] M. L. Scalvedi, L. Gennaro, A. Saba, and L. Rossi, “Relationship between nutrition knowledge and dietary intake : an assessment among a sample of Italian Adults,” *Front. Nutr.*, vol. 8, no. September, pp. 1–13, 2021.
- [35] L. McMorro, A. Ludbrook, J. I. Macdiarmid, and D. Olajide, “Perceived barriers towards healthy eating and their association with fruit and vegetable consumption,” *J. Public Heal. (United Kingdom)*, vol. 39, no. 2, pp. 330–338, 2017.
- [36] R. Seguin, L. Connor, M. Nelson, A. Lacroix, and G. Eldridge, “Understanding barriers and facilitators to healthy eating and active

- living in rural communities,” *J. Nutr. Metab.*, vol. 2014, pp. 23–25, 2014.
- [37] S. Boatemaa, D. M. Badasu, and A. Aikins, “Food beliefs and practices in urban poor communities in Accra : implications for health interventions,” *BMC Public Health*, vol. 18, no. 434, pp. 1–12, 2018.
- [38] Tamio Teramoto, “‘Japan diet ’ and health — the present and future,” *J. Nutr. Sci. Vitaminol. Vitaminol.*, vol. 65, pp. 29–33, 2019.
- [39] S. Matsuyama, N. Sawada, Y. Tomata, S. Zhang, A. Goto, and T. Yamaji, “Association between adherence to the Japanese diet and all - cause and cause - specific mortality : the Japan Public health center - based prospective study,” *Eur. J. Nutr.*, vol. 60, no. 3, pp. 1327–1336, 2021.
- [40] E. C. Monterrosa, E. A. Frongillo, A. Drewnowski, S. De Pee, and S. Vandevijvere, “Sociocultural influences on food choices and implications for sustainable healthy diets,” *Food Nutr. Bull.*, vol. 41, pp. 559–573, 2020.
- [41] Y. E. Miassi, F. K. Dossa, O. Zannou, Ş. Akdemir, and I. Koca, “Socio - cultural and economic factors affecting the choice of food diet in West Africa : a two - stage Heckman approach,” *Discov. Food*, vol. 2, no. 16, pp. 2–10, 2022.
- [42] N. Alqahtani, “The effects of peer pressure on nutrition attitudes and food selection,” *Int. J. Med. Res. Heal. Sci.*, vol. 9, no. 11, pp. 23–30, 2020.
- [43] G. Ma, “Food , eating behavior , and culture in Chinese society,” *J. Ethn. food*, vol. 2, pp. 195–199, 2015.

AUTHORS

First Author – Dr. Raja Muhammaad Raja Omar (MPH), Otorhinolaryngology Department of Hospital Queen Elizabeth Kota Kinabalu Sabah. Malaysia. royalmds@hotmail.com

Second Author – Dr. Che Wan Ilmiyah (MPH) Community & Family Medicine Department, Faculty of Medicine and Health Sciences, UMS. ilmiyah84@gmail.com

Third Author – Dr. Haryati Abdul Karim (Ph.D.) Faculty of Social Science and Humanities University Malaysia Sabah UMS. haryati@ums.edu.my

Fourth Author – Prof. Freddie Robinson (Ph.D.) Community & Family Medicine Department, Faculty of Medicine and Health Sciences, UMS. freddie@ums.edu.my

Correspondence Author – Prof. Freddie Robinson (Ph.D.) Community & Family Medicine Department, Faculty of Medicine and Health Sciences, UMS. freddie@ums.edu.my. +6088-320 000.

Transformational Leadership and Learning Organizations through the Organizational Culture of the Indonesian Police

Sigit Dany Setiyono, Abdul Hakim, Tjahjanulin Domai, Siswidiyanto

Professor, Faculty of Administration Science, Universitas Brawijaya, Jl. MT. Haryono 163 Malang, Jawa Timur, Indonesia 65145
Email: hakimend16@gmail.com

DOI: 10.29322/IJSRP.12.10.2022.p13068

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13068>

Paper Received Date: 14th September 2022

Paper Acceptance Date: 15th October 2022

Paper Publication Date: 21st October 2022

Abstract- In the last three months, the Indonesian police have been hit by several cases that have tarnished the organization and reduced the image of the police. Efforts to improve the situation cannot be separated from improving organizational culture through certain leadership patterns. This study reviews transformational leadership, Organizational Citizenship Behavior (OCB) and efforts to implement it in the Indonesian police. This review is divided into four parts, namely transformational leadership, OCB, the influence of transformational leadership on organizational culture and efforts to implement it in the Indonesian police. The results of the review show the importance of

Learning Organizations in OCB. Therefore, leaders need to develop new ways that are up to date but still maintain the old ways that are still efficient to be applied, so that the value of Transformational Leadership can increase which has a good impact on Organizational Culture and Organizational Citizenship Behavior (OCB) of Indonesian Police Members.

Key words- transformational leadership, Organizational Citizenship Behavior (OCB), organizational culture, the police

I. INTRODUCTION

In the last three months, the Indonesian police encountered several cases that have tarnished the organization and declined the image of the police, such as the case of the general's involvement in the murder of his subordinates [1], as well as the case of football riots in Malang [2]. The cases that occur cannot be separated from problems of leadership, management and organizational culture in the police in responding to social and political dynamics in the community. In the internal police organization, many efforts have been made to increase the capacity, performance and competence of human resources. In this study, one of these efforts is described through the application of leadership patterns in the Integrity Zone (IZ) of the Corruption Free Area or Clean and Serving Bureaucratic Region.

Many leadership theories discuss the efforts of leaders to regulate organizations through leadership patterns. One of the theories of leadership that has received much attention is transformational leadership. Transformational leadership as a process that influences changes in the attitudes and assumptions of organizational members and the formation of commitment to the mission and goals of the organization [3]. Transformational leadership is a leadership approach that can change individuals and social systems [4]. In its ideal form, Transformational Leadership creates valuable

value and positive change for its followers with the ultimate goal of following the leader. In its authentic form, Transformational Leadership improves the motivation, morale and performance of followers through a variety of mechanisms, including linking followers' identities and the organization's collective mission and identity. Including being a role model for followers who inspire them; challenges followers to have a sense of belonging to their work and also understand the strengths and weaknesses of their followers so that leaders can associate followers with tasks that optimize their performance. Transformational leadership can increase awareness of what is right, good, important, and beautiful. This leadership pattern can help increase followers' needs for achievement and self-actualization, fostering followers' high moral maturity; and moving followers to go beyond their interests for the good of their group, organization, or society [5]. The performance of the Indonesian police, which has received sharp attention even from the international community, needs to be responded to through various changes, one of which is the Transformational Leadership pattern. Transformational Leadership is an important factor in predicting police officers' perceptions of OCB. OCB contains values that exceed the standard so members of the police need to be encouraged by leaders who can provide values of transformation/change from current conditions to expected

conditions. This paper aims to review transformational leadership, Organizational Citizenship Behavior (OCB) and efforts to implement it in the Indonesian police. This review is divided into four parts, namely transformational leadership, OCB, the influence of transformational leadership on organizational culture and efforts to implement it in the Indonesian police.

II. TRANSFORMATIONAL LEADERSHIP

Leadership is a process of social influence in which the leader encourages the voluntary participation of members to achieve organizational goals [6]. A leader is someone who delegates or influences others to act towards certain goals. Today's organizations need leaders who are effective and understand the complexities of the rapidly changing global environment. If the task structure is high and the leader has a good relationship with the members of the organization, the effectiveness of the leader will be higher for the work of the members. Transformational leaders will involve all members to discuss and dialogue and motivate them to behave beyond formal standards. One pattern of leadership that has received much attention is transformational leadership.

The rise of Transformational Leadership occurs in the late 1970s. It was initiated by Cousto study of economic development. Further study led to Bass who proposed that leadership can be conceptualized in two factors, namely as transactional or transformational [5]. Transformational leadership is considered better able to deal with major changes in society because transformational leadership provides a better fit for leading today's complex work groups and organizations, where followers not only seek an inspirational leader to help guide them through an uncertain environment but where followers also want to be challenged and to feel empowered, if they are to be loyal, high performers. In Bass's view, many experts are increasingly considering Transformational Leadership to be practiced for organizational change partly because Transformational Leadership provides a better fit for leading today's complex workgroups and organizations, where followers are not only looking for inspiring leaders to help guide them through an uncertain environment but one in which followers also want to be challenged and feel empowered, if they are to be loyal, and high performers [5].

Transformational leaders, on the other hand, are those who stimulate and inspire followers to both achieve extraordinary outcomes and, in the process, develop their leadership capacity [5]. Transformational leaders help followers grow and develop into leaders by responding to individual followers' needs empowering them and by aligning the objectives and goals of the individual followers, the leader, the group, and the larger organization. The concept emphasizes the definition of Transformational Leadership as leadership that stimulates and inspires followers to achieve extraordinary results, and in the process, develops their leadership capacity (followers). Transformational leaders help followers to grow and develop into leaders by responding to the needs of individual followers, empowering them, and aligning the goals and objectives of individuals, leaders, groups, and the larger organization.

The meaning of transformation or the meaning of changing in transformational leadership means to change the

orientation of followers to the desired behavior of the organization, where followers adjust because they feel following the feedback received from organizational leadership with the efforts made to realize the vision of the organization. Transformational Leadership carries out transformation through leader behavior. To some extent, the Transformational Leadership component has evolved from its original idea since the 1990s. Evolution occurs when improvements have been made in both the conceptualization and actual measurement of Transformational Leadership in the field. Conceptually, leadership is charismatic, and followers seek to identify the leader and imitate him. Leadership inspires followers with challenge and persuasion, providing meaning and understanding. Leadership is intellectually stimulating, expanding the use of their abilities by followers. Finally, leadership is considered on an individual basis, providing support and guidance to followers. Thus, according to Bass, four components of leadership have so far been developed into standardized instruments, namely idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration. Each of these components can be measured using the Multifactor Leadership Questionnaire [8]. Transformational leaders have distinctive behavioral characteristics based on interactions with their followers.

Transformational Leadership influences the basic attitudes and assumptions of organizational members, creating the same mentality to achieve company goals. This leadership style usually results in higher performance than transactional leadership [9]. Although evidence suggests that transformational leaders exert a substantial influence on performance, understanding the processes through which they exert this influence is limited and largely speculative. Several studies have explored the causal pathway of the effect of Transformational Leadership on performance systematically by examining the effect of leaders' perceptions on different strategic variables related to knowledge and innovation [10]. In today's information society, knowledge management and innovation are key processes that make it possible to create, exploit, update, and apply knowledge flows in new ways to create critical competencies for organizational performance improvement [11]. From this perspective, transformational leaders must manage an organization that is understood as a system based on knowledge, a system through which information and basic knowledge are disseminated, knowledge acquired from outside the organization, or existing knowledge within the organization. This circulation of knowledge creates a flow of knowledge that creates new knowledge. When applied as an innovation, it will produce important competencies for the company [12]. It is not the knowledge of the members themselves that are strategically important, but the presence of good leadership enables the organization to integrate, share and use this knowledge innovatively. Transformational leaders stimulate the transfer of explicit and tacit knowledge within individuals and organizations [13]. Tacit knowledge is more strategic than explicit; which results in sustainable competitive advantage and improved organizational performance. Understanding this requires a more complete study. Transformational Leadership typically influences innovative behavior positively – hence the importance of the leader's accurate perception of organizational innovation. Through intellectual stimulation

and individual consideration, transformational leaders generate different ways of thinking, seek new opportunities or solutions to problems and adopt generative and exploratory thought processes. They also contribute to intrinsic motivation, and inspire, and stimulate the higher-order needs that breed creativity. They serve as role models and guides, articulating a shared vision of innovation [14]. Thus, it can be understood that Transformational Leadership is categorized as effective because it makes the organization a learner to solve the problems it faces and formulate what strategies the organization needs for the future.

III. ORGANIZATIONAL CITIZENSHIP BEHAVIOR

Organizational Citizenship Behavior (OCB) is the social behavior of an individual in an organization that is not limited to roles, functions and tasks that are formally regulated in the job description that has been regulated by the organization [15]. The OCB behavior can be interpreted as extra behavior beyond the scope of one's work, namely the performance of individual members of the organization that goes beyond the work specified and regulated in the job description as a member of the organization [16]. The development of the OCB concept stems from the concept stated by Katz study which identifies three basic types of behavior that are important for a functioning organization (a) people must be persuaded to enter and remain in the system, (b) people must carry out the requirements of certain roles with reliable way, and (c) there must be the innovative and spontaneous activity that goes beyond the rules of the role. In the third category, an organization that depends solely upon its blueprints of prescribed behavior is a very fragile social system [17]. The quote has the meaning that an organization that relies too much on blueprints (rules) for regulated behavior or roles has a vulnerability in its social system, so there must be various initiatives that produce spontaneous behavior that becomes an inherent value in individuals. representing the organization in which he works. Strengthening Katz's opinion, or two decades after the opinion was introduced, Smith et al study stated that "every factory, office, or bureau depends daily on a myriad of acts of cooperation, helpfulness, suggestions, gestures of goodwill, altruism, and other instances of what we might call citizenship behavior" [18]. The meaning contained in the quote is that every organization depends on a series of interactions that work together, help each other, have altruistic nature and noble and spontaneous values that are inherent so that it can be referred to as OCB. It is important to note that in the Indonesian context, citizenship is translated as citizenship, so in the context of this study it is important to interpret OCB as organizational citizenship behavior or behavior as a good organizational citizen. Furthermore, OCB's emphasis is on individual behavior based on (a) discretion, (b) not directly or explicitly recognized by the formal reward system, and (c) that overall promotes the effective functioning of the organization. By discretion, it is intended that such conduct is not an enforceable requirement of the role or job description, i.e., the terms of the individual's employment contract with the organization that are clearly defined; such behavior is more a matter of personal choice, so its negligence is not generally understood to be a punishment [19].

In its development, the concept of OCB has been manifested in various approaches other than organizational behavior, including human resource management, marketing, strategic management, economics and leadership [20]. Although there has been researching on OCB, the concept of OCB has received less attention from law enforcement agencies, including the police. Therefore, it is very important to examine OCB because of its ability to increase the effectiveness and success of the organization [19]. Citizenship behavior is pro-social behavior that is discretionary and not a detailed role. Such behavior is not directly or explicitly recognized by the applicable reward system and is used to improve performance beyond the established "job requirements" [16]. The importance of research on OCB in police organizations is due to the consideration that OCB is an important phenomenon because OCB behavior can strengthen social relations in organizations [18, 21]. OCB behavior can provide flexibility beyond the job description and provide direction for work behavior that is continuously improved following job developments or an ever-changing environment. OCB is not easily enforced by the provisions of the organization, because OCB is not part of the job description that has been set by the organization. The OCB phenomenon is sometimes not easy to measure because individuals belonging to OCB may have a much better performance than other individuals who have descriptions according to the tasks they perform. Therefore, OCB is quite strategic and important to support the success of an organization in the long term, even though OCB is not included in the performance appraisal function. Theoretically, this OCB research is very relevant to the discretion of members of the police, especially in improving organizational performance. Specifically related to voluntary behavior and social behavior to help achieve job goals and increase the effectiveness of organizational functions. For example, helping colleagues or creativity in increasing interaction with members of the organization through volunteering principles and pro-social behavior. Such behavior has been carried out in several cross-organizational studies [22] and was given the term for the first time as Organizational Citizenship Behavior (OCB) which refers to behaviors that can increase organizational effectiveness, even though their work is not part of the assigned task description [18,23]. Since that time, research on OCB has expanded widely in various types of organizations.

IV. TRANSFORMATIONAL LEADERSHIP INFLUENCE ORGANIZATIONAL CULTURE

Several previous studies can be identified to describe various real conditions so far in various places and at the same time position this research from the research that has been done. Some of the research results are described in the description below. Research conducted by Rudi Gunawan study aims to evaluate the effect of Transformational Leadership on OCB [24]. The results of the study reveal that there is a strong positive relationship between Transformational Leadership and OCB. Giving rewards to employees in the form of salary (material compensation), and social cognition (social compensation) can improve with OCB [25]. Therefore, Choi introduced staffing institutions that include the broad material provision, social knowledge,

job interests, job interests, job challenges to improve OCB and narrow ranking differences in the service industry. Choi et al suggest that future research needs to select subjects and collect samples within the scope of extension, and also needs to diversify and define different types of rewards. Another study focuses on the Effect of Organizational Justice on Organizational Citizenship Behavior: A Study of the Health Sector of Pakistan. According to Ali, work-related behaviors and attitudes are influenced by Organizational Citizenship Behavior and Organizational Justice. Both play an important role in the effective working of an organization. The study revealed that: 1) Procedural fairness has a significant and positive impact on politeness; 2) Procedural justice has an insignificant and negative impact on Altruism; 3) Distributive justice has an insignificant and negative impact on decency; 4) Distributive justice has a significant and positive impact on Altruism; 5) Interactional justice has a significant and positive impact on politeness; 6) Interactional justice has an insignificant and negative impact on Altruism. In addition, other studies reveal that stress and fatigue can affect OCB. One of the results of previous research shows that: 1) Job stress has a significant positive effect on OCB; 2) Organizational Culture does not have a significant influence on OCB; 3) Work motivation has a significant positive effect on OCB; 4) The results of the analysis from the F test show that work stress, organizational culture, and work motivation simultaneously have a significant influence on OCB at the Pati Police [26]. One of the main solutions when facing challenges in the market is effective leadership). Authentic Leadership Theory is defined as "A process that utilizes positive psychological capacities and highly developed organizational contexts, which results in greater self-awareness and positive self-regulated behavior by leaders and colleagues, which promotes positive self-development", which leads to positive organizational behavior [27]. Organizational leaders can play a proactive role in the development of OCB awareness by guiding employees to adopt extra-role behaviors. Intrinsic motivation is seen as mediating the Servant Leadership-OCB relationship in the context of the Jordanian telecommunications sector. The research model was developed for large-scale telecommunications companies so that it can be easily extended to large-scale organizations [28]. There is a significant relationship in the literature between the relationship of team commitment, human resource policy, self-concept and organizational citizenship behavior. The results of Sofiah Kadar Khan et al's research show that team commitment and self-concept play an important role in influencing OCB among employees in the fitness industry. Fitness facility management needs to encourage teamwork among their staff and also to increase the sense of belonging [29]. Organizational Culture has a significant effect on the company's competitive strategy, the learning organization has a significant effect on competitive strategy, but has no significant effect on company performance. In addition, the Competitive Strategy has a significant effect on the Company's Performance [30]. The results of the study show that in general OCB has a significant positive relationship with organizational factors such as job satisfaction, organizational justice, organizational commitment, organizational culture, management style and organizational motivation [31]. In a

company, a study on Perceived Organizational Support (POS) on performance mediated by Organizational Citizenship Behavior (OCB) on employees of Kendari Express Enterprise shows that 1) Perceived Organizational Support (POS) has a positive and significant impact on employee performance. Perception of Organizational Support (POS) by employees includes; respecting employee contributions and extra efforts; employee complaints; employee welfare; notifying employees who are not doing a good job; caring about employees; attention to employees; and taking pride in employee success. 2). OCB has a positive and significant effect on employee performance. Attitudes and behavior shown by employees to the company expression at work are caring, discipline, positive attitude, kindness and awareness as a member of the organization/company. 3). Perceived Organizational Support (POS) has a positive and significant effect on OCB for employees. The better the perception of organizational support (POS), the better the attitude of OCB employees in showing their performance. 4). Perceived Organizational Support (POS) has a positive and significant influence on employee performance through OCB mediation on employees [32].

Other research shows that Transformational Leadership does not affect OCB, OCB directly affects employee performance, Transformational Leadership directly affects employee performance, job satisfaction directly affects employee performance, OCB does not mediate the effect of Transformational Leadership on employee performance, OCB mediates the effect of job satisfaction on employee performance. Based on these results, it can be interpreted that Transformational Leadership, job satisfaction and OCB are valuable components of an organization. This component can be a core competency to improve organizational performance. It is a source of organizational competitive advantage to face the rapidly changing business environment [33]. In addition to the strategic leadership aspects and IT performance, Organizational Culture and Knowledge Management are important factors that improve company performance. Therefore, there is a relationship between IT strategy and Knowledge Management, Organizational Culture and knowledge management, organizational learning and knowledge management, knowledge management and performance, IT strategy and performance, organizational culture and performance, and organizational learning and performance [34]. Furthermore, research conducted at the Ministry of Communication and Information Technology in Jordan shows that Idealized Influence, Inspirational Motivation, Intellectual Stimulation, and Individualized Consideration have a significant and positive effect on Organizational Learning at the Ministry of Communication and Information Technology in Jordan. Based on the results of this study, the researcher recommends managers and decision-makers at the Ministry of Communication and Information Technology in Jordan strengthen the capacity of leaders to increase loyalty and a sense of belonging to the work by involving subordinates in the decision-making process and solving problems encountered [35].

Research conducted by Lee and Yang Research aimed to investigate the effect of Learning Organizational Building activities on Organizational Citizenship Behavior (OCB) in business service firms providing converged services to

producers and the moderating role of Perceived Organizational Support (POS) between learning organization building and behavior. citizen organization. The results showed that both of the seven activities of building a learning organization and POS had a positive effect on employees' OCB. In addition, it also found that only one of the seven factors for building a learning organization, namely 'Strategic Learning Leadership' had a moderate role between the activities of building a Learning Organization and OCB [36]. Organizational culture to the organization which includes unique values, behavior, and psychology is needed by the organization. Furthermore, researchers also include beliefs, experiences, ways of thinking, and organizational expectations. Improving employee behavior to become OCB is needed by every organization. To present OCB to employees, a well-formed commitment is needed. The results of this study are as follows: 1) Organizational Culture can directly affect OCB and indirectly affect Organizational Culture on Organizational Commitment (as an intervening variable) then to OCB, 2) mediator plays a maximum role between organizational culture and OCB, 3) there is a significant indirect effect of organizational commitment on OCB through commitment intermediaries [37]. Furthermore, another study on people-organization theory, moving beyond the theories of motivation and social exchange relations frequently used in the commitment literature, shows that respect for people is an influential factor in OC for AC, while empowerment plays an important role in LO culture that is mediate the relationship between OC and AC. HRD practitioners must strategically plan organizational activities, norms, and policies that promote organizational learning processes and learning cultures to enhance AC [38]. For this reason, Organizational Learning and Knowledge Management need to be considered because they have an impact on organizational culture. to have a positive impact on Organizational Learning and Knowledge Management, Organizational Culture must contain certain assumptions, values and norms regarding four issues: individual development; change; interaction, cooperation and communication; and the environment. A review of research on the impact of Organizational Culture on Organizational Learning and Knowledge Management provides answers to two important questions posed in this article. As far as the mechanism of influence of Organizational Culture on Organizational Learning is concerned, the basic idea is that Organizational Culture positively impacts and stimulates Organizational Learning in the degree to which its assumptions, values, and norms are consistent with the activities it is taken to create and use. organizational knowledge. This study concludes that Organizational Culture is a key element of the context in which the process of Organizational Learning and Knowledge Management takes place in organizations, and it is one of the most important factors that develop from these processes and their effectiveness depends [39]. Transformational leadership has a positive effect on organizational performance and learning. This study also confirms a positive relationship between organizational learning and performance. This study is useful for managers in the telecommunications sector to understand the impact of transformational leaders to improve employee learning capabilities which ultimately improves employee

performance in the telecommunications sector [40]. The mediating effect of organizational culture on the relationship between Transformational Leadership styles and Organizational Learning is a response to many calls for further research in this area and will interest them in the field of Mahmoud Elshanti. Transformational Leadership has a significant positive effect on Organizational Learning and knowledge management process skills, and partially mediates the relationship between Transformational Leadership and Organizational Learning. In addition, a knowledge-intensive culture has strengthened the relationship between Transformational Leadership and knowledge management process capabilities. Originality/value: This is a comprehensive and unique conceptual model [41].

V. EFFORTS TO APPLY TRANSFORMATIONAL LEADERSHIP AND ITS INFLUENCE ON ORGANIZATIONAL CITIZENSHIP BEHAVIOR (OCB) IN THE INDONESIAN POLICE

This paper review OCF with several variables, Transformational Leadership as one of the independent variables which are assumed to influence police officers' perceptions of Organizational Citizenship Behavior (OCB) [42]. Leadership is an important component in management, especially in realizing and maintaining a police organization in the Regional Unit with the predicate of IZ. At present and in the future, all police organizations are striving hard to achieve their goal of achieving an Integrity Zone predicate. To build OCB in an era filled with changes and environmental challenges, of course, leadership is needed that can transform changes in the internal environment, especially in building a Police Organizational Culture that upholds the professional values of Tri Brata and Catur Prasetya as members of the police. Leaders play a significant role in the organization and help members achieve organizational goals and objectives. Leadership is a person's ability to motivate a group of organizational members to realize democratic policing that upholds new values such as accountability and transparency, prioritizes the public interest, and upholds justice and human rights [43]. Furthermore, in this study, Transformational Leadership becomes a predictor variable that has the characteristics of influencing individuals and encouraging spiritual and intellectual stimulation to members of the organization. Transformational Leadership Style is very strong in considering individuals, setting vision and goals, creating a culture of openness, trusting members to achieve goals and providing opportunities for members to maximize their potential. Therefore, the characteristics of this leadership style are interesting to study its effect on the perception of police officers about OCB. Following the nature of confirmatory quantitative research, the Transformational Leadership variable will be studied for its influence on Organizational Culture and OCB. The logical reason for choosing the Transformational Leadership variable in this study as a predictor variable is because Transformational Leadership is an important factor in predicting police officers' perceptions of OCB. OCB contains values that exceed the standard so members of the police need to be encouraged by leaders who can provide

values of transformation/change from current conditions to expected conditions.

Transformational leadership is needed today in police organizations because it has the potential to inspire members to do their jobs well, develop their skills to increase the intellectual level of organizational members, and exceed the work targets set. Transformational leadership can encourage followers to achieve more than expected. Transformational Leadership, provides high incentives to high-performing members, developing and encouraging the intellectual and creativity of organizational members, and transforming their concerns into an important part of the organization's mission. The realization of the unit area organization with the predicate of IZ is an important task for the police that must be supported by a leadership capable of directing its members to adhere to the values of accountability and realize the principles of good governance in policing. What is the relevance of OCB research to police work? The police agency is a law enforcement organization that has a role, duty and function to maintain security and public order, as well as to create a quality of life for citizens so the study and application of the OCB perspective is important. Although some say that the image of the police is to become a machine against crime [44], in reality many tasks are carried out by the police in providing services related to the community in addition to tasks related to problems of security and order disturbances. According to Bayley study, the main cause of crime is mostly caused by social and economic factors (poverty, unemployment, household, place of residence and the like), which these factors are variables that cannot be intervened by the police [45]. Therefore, an important role for members of the police is to prevent crime, provide services in law enforcement that is just and maintain public order [46]. To be able to carry out the police's roles optimally, namely preemptive, preventive, and repressive actions, it is necessary to have members who have OCB characteristics. OCB can support increasing organizational effectiveness if OCB behavior can be carried out by a large number of organizational members with a continuous time process [19]. There are several reasons why OCB can support increasing the effectiveness of an organization, among others, that: (1) OCB can improve the relationship between members, organizations and leaders; (2) providing flexibility in the use of resources for more productive purposes; (3) improve coordination between working groups in the organization; (4) assist the recruitment of the best employees into the organization; (5) improve the effectiveness of the performance of members and the organization; and (6) helping to increase the organization's ability to adapt to the dynamics of the changing external environment of the organization.

The OCB phenomenon is difficult to explain with the phenomenon of organizational behavior in organizations [23], meaning that the motivation for the OCB phenomenon is different from other work behaviors, so it is necessary to research the influence of factors that support the realization of OCB in police organizations. Three factors are assumed to have a positive influence on the emergence and development of OCB, namely: Transformational Leadership and Learning Organizations which are moderated by Organizational Culture factors. These three factors were chosen because of the necessity of being involved in changing any entity in the current era of digitalization and

social turbulence which is thick with the VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) phenomenon. Leadership is always present and attached to every history of the rise and fall of a nation, organization, and all entities. Meanwhile, learning culture has been recognized as a determining factor for an entity to continue to exist and survive in the face of various changes and challenges. Meanwhile, Organizational Culture is a forum for the struggle for values that are believed, lived and protected by every organizational entity, including the learning culture and the core of the organization, namely leadership. The tasks faced by the police are often faced with conditions filled with uncertainty, given the dynamics of the social environment that is rapidly changing and developing so that the prevention and handling of criminal cases are increasingly varied, sophisticated and modern. Police officers have discretion in carrying out their duties in the field so that discretion must be addressed according to their best judgment and integrity. Police officers have sufficient discretion in carrying out their roles, but when police officers are not equipped with clear guidelines on how to use this discretionary policy, there is the potential for deviant behavior from the ethics of police officers. The interaction between the police and the community is not accompanied by sufficient direct supervision, even though the discretionary policies that can be carried out by the police are adequate, so this phenomenon is often referred to as street-level bureaucrats [47]. The performance and image of police officers are greatly influenced by how police officers use their policies properly and correctly in the field. In the context of OCB research at the District Police Department with the IZ predicate, it is important to understand the phenomenon of irregularities committed by Indonesian Police (Polri) personnel, especially at the research locus. However, before looking at the specific microscopic at the research locus, it is necessary to understand the general condition of the Polri institution from the point of view of public opinion. Departing from the general picture of the National Police, namely the Trust Index to institutions in 2021 which initially increased to 80.2 points in November 2021 but fell at the end of December 2021 to 74.1 points. This data is in line with the sharpness of the public's assessment at the end of 2021 when several cases of irregularities by unscrupulous members of the National Police occurred such as the rape by the East Luwu Police Chief (12 October 2021), Polri members slamming students who were demonstrating in Tangerang (13 October 2021), the involvement of unscrupulous individuals. Members of the Lampung Police in the theft (18 October 2021), police officers using official vehicles for dating (21 October 2021), police officers asking for a sack of onions to replace the ticket (2 November 2021), and other cases recorded to degrade the image of the Police. The results of the Public Opinion Survey conducted by Politica Research and Consulting reflect several things, namely the public does not like the Police who abuse their authority, are arrogant, arbitrarily, accept bribes, are slow, and unfair, make it difficult for the community and carry out immoral actions. Meanwhile, the public likes the National Police who are exemplary, nurturing and protecting, mingling, authoritative, firm, willing to help, professional and disciplined. The three things he disliked the most were an abuse of authority (16.40%), arrogance (14.80%), and being

slow in handling cases (9.20%). While the three things he likes the most are being firm (11.30%), being kind (8.80%) and willing to help the community (7.50%) [48]. Another data source from the Research and Development of *Kompas* Newspaper confirms the dynamics of the public's assessment of the National Police. The *Kompas* Research and Development survey in June 2022 showed that the positive image of the Indonesian Police (Polri) was at 65.7 percent. This figure is the lowest in more than a year in the *Kompas* R&D survey. In January 2021, the positive image of the National Police reached 71 percent and skyrocketed to 78.7 percent in April 2021, placing it as a state institution with the best image after the military organization. However, after skyrocketing to 78.7 percent, the positive image of the National Police continues to decline. In October 2021, the image of the National Police is at 77.5 percent. The decline occurred more sharply in January 2022, namely 74.8 percent, then to 65.7 percent in June 2022. Research and Development *Kompas* noted that the National Police was in the spotlight because the public questioned its seriousness in handling criminal cases since the beginning of October 2021. For example, the rise of stories from netizens on social media who claimed to be dissatisfied with the handling of the police in responding to reports of cases of sexual violence. Several videos showing police violence have also circulated on social media. In addition to public dissatisfaction with handling criminal cases, the National Police also received attention when placing Brotoseno (a middle-level commissioned police) as an investigator at the Criminal Investigation Agency.

Regarding the results of the *Kompas* Research and Development survey, the Deputy Coordinator of the Commission for Missing Persons and Victims of Violence (CMPVV) Rivanlee Anandar said that it was natural for the public's assessment of the Police to decline. According to Rivanlee, so far the corrective measures taken by the police are reactionary and only focus on improving the image. In addition, the implementation of the Precision Police concept is more trapped in jargon than implementation in the field. The latent problem that causes the performance of the Police to be criticized by the public has not been optimally addressed, namely the culture of violence. CMPVV also highlighted the issue of police work not being optimal without the distribution factor on social media. This prompted the emergence of several hashtags, including #PercumaLaporPolisi, #1Day1Oknum, #NoViralNoJustice, and #ViralForJustice. Several cases related to these hashtags were handled quickly by the police. On the other hand, cases that are not in the spotlight are left idle for a long time. The failure to identify problems, according to Rivanlee, shows a fundamental problem for the police, namely the failure to identify problems. There is also a tendency to be discriminatory and sort out cases to be followed up, especially if the case in question is politically charged [49]. The general description above will be confirmed with data at the regional level and will serve as a comparison for the District Police Department which will be the locus of OCB research. The 7 District Police Department with the predicate IZ at the East Java Regional Police will be the research locus consisting of the Surabaya Police, Sidoarjo Police, Jember Police, Banyuwangi Police, Gresik Police, Situbondo Police, and Mojokerto City Police. The data on these District Police Departments throughout 2018 to 2021

can illustrate that the number of crimes (total crimes) generally declines, the number of case settlements (crime clearance) is relatively dynamic following the trend in the number of cases, and the performance of case settlements (clearance rate) shows a fairly large disparity (Figure 1).

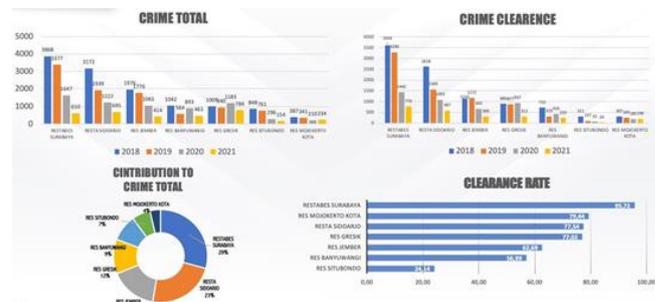


Figure 1. Profile of the Number of Crimes and Their Settlement at District Police Departments with the predicate of IZ

Source: East Java Regional Police *Bidpropam* 2021 [50] Meanwhile, it is associated with Figure 2 where the number of criminal, disciplinary, and code of ethics violations is evenly distributed according to the proportion of vulnerability and the level of performance of the regional unit.

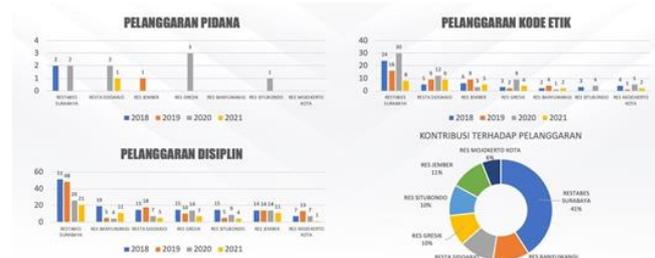


Figure 2. Profile of the Number of Discipline (*Pelanggaran disiplin*), Code of Ethics (*pelanggaran kode etik*) and Criminal (*pelanggaran pidana*) Violations at District Police Department with the predicate of IZ

Source: East Java Regional Police *Bidpropam* 2021 [50] It can be seen the relationship between the level of vulnerability, performance and violations associated with the authority of the police. The higher the vulnerability in an area and the higher the performance of handling cases in an area that is related to the authority of the police, correlates with the high number of violations of discipline, code of ethics and crime in *Polri* personnel. This indicates in line with the results of the *Politica* Research and Consulting survey that the biggest violation is the abuse of authority, where the opportunity for the police to commit a violation is due to abuse the authority they have, either in the context of duty or outside of duty. The study of OCB, including the provision of services by police agencies, becomes very critical in the context mentioned above because the decision to use policies responsibly and with quality can reflect on the delivery of better, professional and quality services. Some police experts view that the police paradigm is too law enforcement oriented and has not done much with the crime prevention paradigm. For example, a problem-oriented policing strategy is a paradigm that prioritizes crime prevention with a proactive policing approach. In this context, the partnership between the police and the

community becomes very important and strategic. Therefore, the community is the main stakeholder of the police in preventing crime and creating security and public order. Apart from the partnership between the police and the community, another thing that is no less important in crime prevention is the role of the police as problem solvers. Every member of the police must have the ability to solve problems so that every small problem can be handled completely from the lowest level. The OCB perspective and its dimensions have relevance and relevance to the characteristics of police work, namely: Organizational Loyalty, Service Delivery, Altruism, and Compliance. Considering the role of excellent service by the police, of course, the concept of OCB that is related and relevant for members of the police is OCB which has been used and identified in previous research for organizations that have service characteristics. Members of the police have the main role and function of interacting with the community to carry out their main duties in preventing and enforcing the law. Police members who are in contact with the community act as strategic liaisons between the external environment consisting of citizens and the general public and the internal environment of the police institution. Officers can provide valuable information about the needs of citizens so that the police agency can improve the quality of service to the community. The provision of services can include individual initiatives through positive discretion and integrity so that public service in the field of security and order is a fundamental principle to meet the changing needs of community members [51]. Therefore, the second dimension of OCB that is relevant and related to the duties of members of the police is the dimension of quality service delivery. Another major dimension of OCB that is related and relevant in research involving members of the police is the Compliance Dimension [18, 52, 53]. In general, compliance can be interpreted as a sense of compliance with organizational regulations, maximizing organizational resources, reducing high absenteeism, using time off with permission and according to regulations, and using organizational resources efficiently and effectively [18, 54, 55]. The dimensions of compliance and efficient and effective use of time can be considered as part of the OCB dimension [16]. Police officers' behavior undermines the legitimacy of the organization, such as doing things that violate the code of ethics, neglecting their duties during working hours, not showing interest in work and using organizational resources in inefficient ways which are considered contrary to the Compliance Dimension [56]. Therefore, the third dimension of OCB that is considered relevant and related to members of the police is the Compliance Dimension [23]. The next OCB dimension that is relevant and related to the police in this study is the Dimension of Unselfishness (Altruism) which is a behavior that directly and intentionally aims to help fellow police officers in their work. Examples of this dimension are helping recruits or helping fellow police officers who have a heavy workload [23]. The dimension of Selflessness (Altruism) refers to a situation that members of the organization voluntarily carry out work and help fellow members of the organization, even though they are not asked or ordered to do so [57]. In contrast, the Selfish Dimension is a behavior that is less motivated to help the work of fellow members of the organization and tends to

have selfish behavior. Selfish behavior includes behavior that does not like helping co-workers and generally wants to carry out work with special orders and prioritizes self-interest [58]. Dimensions of Selflessness and Compliance are OCB dimensions that have been widely used and identified in research [18]. The assumption is that the two dimensions mentioned above in the OCB concept tend to have similarities in both private organizations and police organizations, especially the influence of these dimensions on OCB behavior. Consistency and differences in empirical findings from the OCB phenomenon in research at police institutions with the predicate IZ are believed to broaden knowledge about the application of the OCB concept in an organization.

The dimensions of loyalty and service in OCB are dimensions that have been researched and identified [51]. Bettencourt, et al., study found that these dimensions are more relevant and related to service-oriented organizations. Thus, the police institution is included in the category of service-oriented organizations according to the vision and mission of the National Police, namely: "The realization of excellent public order and security services, the establishment of law and strong domestic security and the establishment of proactive police synergies". These two dimensions (Loyalty and Service) also seem to be appropriate and relevant to police institutions in addition to the previous two dimensions, namely the Unselfish and Compliance Dimensions. Therefore, research on OCB in this study was placed as the dependent variable and examined from the factors of Transformational Leadership and Learning Organizations, with Organizational Culture moderation to see the factors that most strongly influence OCB of police officers. The next important variable in the context of quantitative research that is assumed to influence the perception of police officers at the District Police Department level with the predicate IZ about OCB is Organizational Culture. Although research in policing generally assumes that there is a relationship between Organizational Culture and policing practices, there is not much empirical evidence validating the relationship between Organizational Culture and OCB. Culture, in general, can be described as a complex set of values, attitudes, symbols, rules, and practices. Discretionary choices are influenced and informed by cultural practices that have developed in police culture and are arguably difficult to control. Although wisdom is associated with negative connotations, positively describes it in his report on the Brixton riots as the art of taking action against certain circumstances, as the better part of police courage [59]. However, one of the problems with wisdom is not that it exists, but how it is done. Some groups or community members are more likely to be harmed by the exercise of police powers and policies than others. According to Wilson, there are three forms of policing organizations, namely legalistic, watchman and services. Each form is very effective in shaping the behavior of members of the organization and shaping the organizational structure of the police force. The watchman style of policing holds a great deal of discretion and focuses on maintaining order in societies with high crime rates. In the legalistic style, members of the police force are governed by the policies of the police organization and lack discretion. In the service style, the behavior of the police is between the watchman style and the legalistic style, which is related to

how members of the police respond to issues of maintaining security and order. In this form of organization, members of the police take police action in the context of maintaining security and order more seriously.

Researchers pay a lot of attention to the organizational culture of the police. Research finds that police culture is very informative in explaining the behavior of police officers in America. Karatay study is one of the researchers who has conducted a study on the patterns of police culture and has considered the perspective of police organizations in America as very important [60]. Karatay's research has shown that the behavior of police officers is shared by values, norms and behavior patterns in their work, which may differ from individual and social perspectives. For example, a study conducted by Skolnick on police culture found different working personalities of police officers [61]. Similarly, a study conducted by Muir describes a certain typology of police attitudes and "police cynicism" is noted as a form of the cultural dimension of the police organization. Therefore, one of the variables that are assumed to affect the perception of police members towards OCB in this dissertation is the organizational culture of the police [62].

The next variable that is the focus of the research is Learning Organizations which are assumed to influence the perception of police officers on organizational citizenship behavior in organizations with the predicate of IZ. In general, a Learning Organization is a change or advance of a person's mental patterns and organizational norms, procedures or rules through the creation or acquisition of new knowledge. OCB as behavior that exceeds the implementation of formal tasks needs to be supported by the mindset and behavior patterns and attitudes of police officers that lead to the interest in implementing OCB. Learning organization theory is a view that focuses on changing the mindset of organizational members so that it affects the realization of OCB in police institutions.

Learning Organization emphasizes that an organization will be more effective, competitive and successful if the organization adapts the thinking of the Learning Organization. Senge's study suggests that learning organizations have five characteristics, namely: personal mastery, mental models, shared vision, team learning, and systems thinking. These five things are needed to create a Learning Organization [63]. The characteristics of the Learning Organization developed by Senge include continuous learning opportunities, using learning to achieve goals, linking individual performance and organizational performance, encouraging dialogue and inquiry, so that organizational members feel comfortable in dialogue, encouraging creativity as a source of energy and renewal, and continuously interacting with the environment. Characteristics of the Learning Organization as a whole are expected to be able to transform the values of change following the development of the organizational environment. Police organizations with the predicate IZ will need organizational citizenship behavior and of course require organizational members who have innovative, creative and integrity values as expected. Research conducted by Eisenberg, et al. study shows that the survival of today's organizations depends on their ability to learn how to improve efficiency and performance correctly and quickly and adapt to a changing environment [64]. Creating

an organizational learning culture has achieved improvements in organizational sustainability. Several variables were empirically tested as determinants of sustainability behavior without understanding and developing the five interrelated learning organizational subsystems such as those based on the experience of Marquadt study for 15 (fifteen) years of interacting with various learning organizations. The five dimensions of a learning organization include (1) learning; (2) organizations; (3) people; (4) knowledge; and (5) technology. The five subsystems are important elements for the sustainability or continuity of the organization [65]. The learning organization variable with these five dimensions is one of the variables that is assumed to affect the OCB of police members at the District Police Department with the predicate of IZ. As described in the background and significance of the research, the title of this study describes the study of the influence of the variable Transformational Leadership and Learning Organizations moderated by the Organizational Culture variable on the OCB variable. The main purpose of this study is to show the behavior patterns of police officers at the District Police Department with the predicate IZ by focusing on OCB and its relationship to factors that theoretically and empirically affect OCB.

One of the determinants assumed to have an effect on OCB in this study is the Transformational Leadership Style which is a contemporary leadership style in transforming changes in values and behavior that theoretically affect OCB behavior. The theoretical basis of OCB and its determinant factors are studied to identify and measure the key characteristics. Theoretically, to be more specific, this research was conducted to further illustrate the foundation of OCB, by directing attention to the most influential approach and perhaps the "building block" for the realization of "extra-role behavior" which is the essence of OCB. Attention is also focused on the variable Learning Organization "Learning Organization" because theoretically, the Learning Organization is a new paradigm of the organization that emphasizes the importance of a learning culture for *Polri's* human resources to create a Learning Organization. Learning Organizations are needed to be able to put forward the importance of the quality and professionalism of the organization's human resources in creating a Learning Organization. The police organization, which is characterized by bureaucratic characteristics, seems to be no longer suitable to face the changing environment that is increasingly advanced and complex. Learning Organizations are expected to be able to transform new values that are in line with the nature of OCB behavior in realizing organizational goals. OCB behavior certainly needs to be supported by an organizational environment that is not rigid, so that it limits the innovation and creativity of organizational members. The rationale for using the Transformational Leadership variable in this research model as a predictor variable is because Transformational Leadership is an important factor in predicting police officers' perceptions of OCB. OCB contains values that exceed the standard so that police officers need to be encouraged by leaders who can provide values for transforming changes from current conditions to expected conditions. Furthermore, Transformational Leadership is theoretically expected to influence OCB behavior because Transformational Leadership is a leadership style that

transforms changes in the organization according to the challenges and dynamics of external changes that affect the organization. Theoretically, the Transformational Leadership style is a leadership style that seeks to influence the behavior of organizational members to implement and realize new values and work patterns in the organization. OCB behavior must be internalized into the work culture of organizational members so that building OCB Organizational Culture is influenced by the Learning Organization and Transformational Leadership style. Organizational culture, which is assumed to be a mediating variable in this study, is theoretically also influenced by the leadership [66]. Leadership and Organizational Culture are like "two-side at the same coin" which implies that Organizational Culture is formed by Leadership, and Organizational Culture that has been internalized into organizational life will demand the presence and existence of leaders who can maintain the values that have been internalized into behavior. and habits of organizational members. Thus, it can be underlined that the rationality of choosing a title leads to the OCB Behavior variable which is internalized in the police organization, theoretically assumed to be influenced by the variables of Transformational Leadership, Learning Organizations, and Organizational Culture.

Government policies regulated in the Utilization of State Apparatus and Bureaucracy Reform Indonesia Ministerial Regulation Number 52 of 2014 concerning the Development of the Integrity Zone which has been updated with the Utilization of State Apparatus and Bureaucracy Reform Ministerial Regulation Number 10 of 2019, are fundamentally aimed at creating a pilot organizational model. For the *Polri* institution, which has initiated reforms since 1999, this IZ development policy is very much in line. So since 2014, the National Police has been trying to implement this policy by creating law enforcement agencies that are oriented towards improving performance and public services, supporting the legal order and upholding the rule of law which is the main pillar of democracy in Indonesia. Therefore, the development of IZ in police institutions is focused as an important strategy to reduce problems of integrity, accountability and quality of organizational performance. Integrity development in running the government [67], through the role of state apparatus, including police officers, can be seen from two indices, namely: Government Effectiveness Index and Corruption Perception Index (Utilization of State Apparatus and Bureaucracy Reform Ministerial Regulation Number 52 of 2014). Assessment of the National Police from 2015 to 2017, the Government Effectiveness Index showed a significant increase of 19 levels from rank 103 to rank 84, as well as the Corruption Perception Index which rose from rank 96 (score 37) in 2017 to rank 89 (score 38) in 2018. The Corruption Perception Index as seen from the Public Service Perception indicator and Anti-Corruption Perception indicator increased at all levels of government, indicating that the public is more satisfied with public services, the lower level of corruption perceived by the public, as well as improving levels of trust, satisfaction and public legitimacy on the performance of the Indonesian government in a democracy. In essence, the work police have discretion in carrying out their duties, so that members of the police can choose to follow one of several discretionary actions they

have. As bureaucrats at the street level, members of the police have a lot of discretion with very limited supervision [47], so the amount of discretion can potentially lead to abuse of authority by members of the police [22]. The American Bar Foundation study found that the criminal justice system brings legal practice to be more harmonious than the law in books [22].

II. CONCLUSION

The results of the review show the importance of Learning Organizations in OCB. Therefore, leaders need to develop new ways that are up to date but still maintain the old ways that are still efficient to be applied, so that the value of Transformational Leadership can increase which has a good impact on Organizational Culture and Organizational Citizenship Behavior (OCB) of Indonesian Police Members.

ACKNOWLEDGEMENT

The authors thanks to Dean of Faculty of Administration Science and Head of East Java Regional Pollice Department for permitting the study. We thank to all informant for providing the data and information.

REFERENCES

- [1] Hartini, S., & Ferrary, A. A. I. (2022). PERLINDUNGAN HUKUM TERHADAP KORBAN OLEH KEPOLISIAN DALAM HUKUM ACARA PIDANA. *YUSTISI*, 9(2).
- [2] New York Times, 2022. Indonesian Soccer Tragedy Fans Fled as Police Fired Tear Gas, Causing Deadly Rush For Exits. <https://www.nytimes.com/live/2022/10/02/world/indonesia-soccer-football-stadium>
- [3] Bass, B. M., & Bass Bernard, M. (1985). Leadership and performance beyond expectations.
- [4] Burns, J.M. (1978). *Leadership*. New York. Harper & Row.
- [5] Bass, B. M. (1997). Does the transactional–transformational leadership paradigm transcend organizational and national boundaries?. *American psychologist*, 52(2), 130.
- [6] Bunmi Omolayo (2007). “Effect of Leadership Styles on Job-Related Tension and Psychological Sense of Community in Work Organizations: A Case Study of Four Organizations in Lagos State, Nigeria”. In *Bangladesh e- Journal of Sociology*, 2007.
- [7] Couto, R. A. (1978). Transformational leadership and economic development. In *World Ethics Forum* (Vol. 19, No. 20, p. 73).
- [8] Bass, Bernard M. (2006). *Transformational Leadership*. 2nd ed. New Jersey: Lawrence Erlbaum Associates, Inc. Aerospace Survey and Earth Sciences (ITC).
- [9] Bass, B. and B. J. Avolio (2000). *MLQ Multifactor Leadership Questionnaire Technical Report*. Thousand Oaks, CA: Sage Publication.
- [10] Yulk, G. (1999). “An evaluation of conceptual

- weaknesses in transformational and charismatic leadership theories". In *Leadership Quarterly*, 10 (2), pp. 285–305.1000198.
- [11] Barrett, P. and M. Sexton (2006). "Innovation in small, projectbased construction firms". In *British Journal of Management*, 17, pp. 331–346.
- [12] Nonaka, I and H Takeuchi (1995). *The Knowledge Creating Company: How Japanese Companies Create the Dynamics of Innovation*. Oxford: Oxford University Press.
- [13] Argyris, C., and Schön, D. A. (1978). *Organizational Learning: A Theory of Action Perspective*. Reading, MA: Addison-Wesley.
- [14] Senge, P. (1990). *The Fifth Discipline: The Art and Practice of The Learning Organization*. Century Business, London.
- [15] Organ, D.W., Podsakof, M.P., MacKenzie, B.S. (2006). *Organizational Citizenship Behavior*. USA: Sage Publications.159
- [16] Van Dyne, L., Cummings, L. L., & Parks, J. M. (1995). "Extra-role behaviors: In pursuit of construct and definitional clarity (A bridge over muddied waters)". In L. L. Cummings & B. M. Staw (eds.), *Research in Organizational Behavior* (Vol. 17): 215–285. Greenwich, CT: JAI Press.
- [17] Katz, D., & Kahn, R. L. 1966, 1978. *The Social Psychology of Organizations*. New York: Wiley.
- [18] Smith, C. A., Organ, D. W., & Near, J. P. (1983). Organizational citizenship behavior: Its nature and antecedents. *Journal of applied psychology*, 68(4), 653.
- [19] Vigoda-Gadot, E., & Cohen, A. (Eds.). (2004). *Citizenship and management in public administration: Integrating behavioral theories and managerial thinking*. Edward Elgar Publishing.
- [20] Organ, D. W. 1988. *Organizational Citizenship Behavior: The Good Soldier Syndrome*. Lexington, MA: Lexington Books.
- [21] Podsakoff, P. M., S. B. MacKenzie, J. B. Paine, D. G. Bachrach (2000). "Organizational Citizenship Behavior: A Critical Review of the Theoretical and Empirical Literature and Suggestion for the Future Research". In *Journal of Management*.(2019), PP 15-28.
- [22] Qureshi, Hanif. (2015). *A Study of Organizational Citizenship Behavior (OCB) and Its Antecedents in an Indian Police Agency*. University of Cincinnati, USA.
- [23] Bateman, T. S., & Organ, D. W. (1983). Job satisfaction and the good soldier: The relationship between affect and employee "citizenship". *Academy of management Journal*, 26(4), 587-595.
- [24] Rudi Gunawan (2016). "Pengaruh Kepemimpinan Transformasional Terhadap Organizational Citizenship Behavior (OCB) Pada PT. First Machinery Tradeco Cabang Surabaya". In *AGORA* Vol. 4, No. 1, (2016), 60-66.
- [25] Woo Seok Choi, Jun Seok Heo, and Lee-Jeong Kim. (2015). "A Study on the Impact of Material, Social, Symbolic Reward on OCB: Moderate Effect of the Rank". In *Journal of Economics, Business and Management*, Vol. 3, No. 3, March 2015. 377-382.
- [26] HD Herdiany. 2019. Effect Of Stress, Organizational Culture, Motivation On Organizational Citizenship Behaviour At Pati Police Resort.
- [27] Mohamed Abdelkarim Murad Mohamed, dan Kamarul Zaman Bin Ahmad. (2017). "Organizational Citizenship Behavior, Authentic Leadership and Organizational Justice Interplay In Uae Police Sector: Moral Values As A Moderator". Proceedings of Researchfora 4th International Conference, Dubai, UAE, 2nd - 3rd April 2017, ISBN: 978-93-86291-88-2. 2-5.
- [28] Amneh Abdallah Yousef Al Maqableh dan Idris Bin Mohd Noor. (2013). "Antecedents of Organizational Citizenship Behaviour (OCB): A Critical Review and Suggestion for Future Research in Jordanian Telecommunication Sector". In *International Journal of Economics, Commerce and Management*. Vol. V, Issue 11, November 2017. 465- 473.
- [29] Sofiah Kadar Khan dkk. (2015). "The Factors affecting Organization Citizenship Behavior: A Study in the Fitness Industry". In *International Journal of Recent Advances in Organizational Behaviour and Decision Sciences (IJRAOB) An Online International Research Journal (ISSN: 2311-3197) 2015 Vol: 1 Issue 2*. 373-383.
- [30] Wanto, H. S., & Suryasaputra, R. (2012). The Effect of Organizational Culture and Organizational Learning towards the Competitive Strategy and Company Performance. Vol. 4, No. 9.
- [31] Yavuz Demirel, Iman Elhusadi, dan Aza Alhasadi. (2018). "The Relationship between Organizational Citizenship Behavior and Organizational Factors". In *International Journal of Business and Management Invention (IJBMI)*. Volume 7 Issue 3 Ver. IV, March. 2018, P27-39.
- [32] Debi La Husen, Adnan Hakim, dan Muhamad Masri. (2019). "The Effect of Percived Organizational Support (POS) of Performance Educated by Organizational Citizenship Behavior (OCB) in Employees PT. Kendari Express". In *IOSR Journal of Business and Management (IOSR-JBM) e- ISSN: 2278-487X, p-ISSN: 2319- 7668*. Volume 21, Issue 7. Ser. II (July).
- [33] Vivin Maharani, Eka Afnan Troena, dan Noermijati. (2013). "Organizational Citizenship Behavior Role in Mediating the Effect of Transformational Leadership, Job Satisfaction on Employee Performance: Studies in PT Bank Syariah Mandiri Malang East Java". In *International Journal of Business and Management*; Vol. 8, No. 17; 2013. 1-12.
- [34] Shu-Hung Hsu. (2014). "Effects of Organization Culture, Organizational Learning and IT Strategy on Knowledge Management and Performance". In *The Journal of International Management Studies*, Volume 9 Number 1, February, 2014 issue. 50-58.
- [35] Abazeed, R. A. M. (2018). The impact of talent management on organizational commitment of the employees of telecommunication companies in Jordan: the mediating role of employee work engagement. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, 8(4), 153-162.
- [36] Kang-Seok Lee dan Hae-Sool Yang. (2015). "Effects of Learning Organization Building Activities in Convergence Service Companies on Organization Citizenship Behavior- Considering the Moderating

- effect of Perceived Organization Support”. In *Journal of Digital Convergence* 2015 Nov; 13(11): 71-84.
- [37] Arumi, M. S., Aldrin, N., & Murti, T. R. (2019). Effect of organizational culture on organizational citizenship behavior with organizational commitment as a mediator. *International Journal of Research in Business and Social Science (2147-4478)*, 8(4), 124-132.
- [38] Patricia, Yin; Yin Lau, Gary N. McLean, Yen-Chen Hsu & Bella Ya-Hui Lien (2016). “Learning organization, organizational culture, and affective commitment in Malaysia: A person–organization fit theory”. In *Human Resource Development International*, DOI: 10.1080/13678868.2016.1246306.
- [39] Janićijević, N. (2015). Impact of Organizational Culture on Organizational Learning and Knowledge Management. *ENTRENOVA-ENTERPRISE RESEARCH INNOVATION*, 1(1), 331-337.
- [40] Mutahar, A. Y., Rasli, A. M., & Al-Ghazali, B. M. (2015). Relationship of transformational leadership, organizational learning and organizational performance. *International Journal of Economics and Financial Issues*, 5(1), 406-411.
- [41] Imran, M. K., Ilyas, M., & Aslam, U. (2016). Organizational learning through transformational leadership. *The learning organization*.
- [42] Hougyun, Kim. (2012). “Transformational Leadership and Organisational Citizenship Behavior in the Public Sector in South Korea: The Mediating Role of Affective Commitment”. In *Local Government Studies*, Vol. 38, No. 6, 867–892, December 2012. DOI: 10.1080/03003930.2012.707617.
- [43] Tito Karnavian dan Hermawan Sulisty (2017). *Democratic Policing*. Pensil, Jakarta.
- [44] Bittner, E. (1970). The functions of the police in modern society: A review of background factors, current practices, and possible role models.
- [45] Bayley, D. H., & Shearing, C. D. (1996). The future of policing. *Law and society review*, 585-606.
- [46] Wilson, J. Q. (1968). *Varieties of Police Behavior: The Management of Law and Order in Eight Communities*. Cambridge, MA: Harvard University Press. Hal. 140.
- [47] Hupe, P., & Hill, M. (2007). Street-level bureaucracy and public accountability. *Public administration*, 85(2), 279-299.
- [48] Poliri staff. 2021. Personal Communication
- [49] Kompas, 2022, Source: <https://www.kompas.com/tren/read/2022/07/04/170000665/survei-litbang-kompas--citra-polisi-terus-menurun-apa-pengebannya-?page=all>, accessed September 26, 2022, 10.00 WIB.
- [50] East Java Regional Police Bidpropam 2021. East Java Regional Police Profile.
- [51] Bettencourt, L. A., Gwinner, K. P., & Meuter, M. L. (2001). A comparison of attitude, personality, and knowledge predictors of service-oriented organizational citizenship behaviors. *Journal of applied psychology*, 86(1), 29.
- [52] Williams, L. J., & Anderson, S. E. (1991). “Job satisfaction and organizational commitment as predictors of organizational citizenship and in-role behaviors”. In *Journal of Management*, 17: 601–617.
- [53] Marinova, S. V., Moon, H., & Van Dyne, L. (2010). Are all good soldier behaviors the same? Supporting multidimensionality of organizational citizenship behaviors based on rewards and roles. *Human relations*, 63(10), 1463-1485.
- [54] Podsakoff, P. M., MacKenzie, S. B., Podsakoff, N. P., & Lee, J. Y. (2003). The mismeasure of man (agement) and its implications for leadership research. *The Leadership Quarterly*, 14(6), 615-656.
- [55] Podsakoff, P. M., Ahearne, M., & MacKenzie, S. B. (1997). Organizational citizenship behavior and the quantity and quality of work group performance. *Journal of applied psychology*, 82(2), 262.
- [56] Dalal, R. S. (2005). A meta-analysis of the relationship between organizational citizenship behavior and counterproductive work behavior. *Journal of applied psychology*, 90(6), 1241.
- [57] Donovan, D. T., Brown, T. J., & Mowen, J. C. (2004). Internal benefits of service-worker customer orientation: Job satisfaction, commitment, and organizational citizenship behaviors. *Journal of marketing*, 68(1), 128-146.
- [58] Lambert, E. G., Kelley, T., & Hogan, N. L. (2013). Work-family conflict and organizational citizenship behaviors. *Journal of Crime and Justice*, 36(3), 398-417.
- [59] Scarman Lord. (1981). *The Brixton Disorders* 10–12 April 1981, Cmnd 84–27,
- [60] Akin Karatay. *An Assessment of Democratic Policing in the Turkish National Police: Police Officials’ Attitudes Toward Recent Police Reforms*. The University of Southern Mississippi. The Aquila Digital Community, 2009.
- [61] Skolnick, J. (1975). *Justice Without Trial*. New York: Wiley.
- [62] Muir, W. K. (1977). *Police: Street corner politicians*. Chicago: University of Chicago Press.
- [63] Senge, P. (1990). *The Fifth Discipline*. New York: Doubleday.
- [64] Alona Eisenberg, Jelena Davidova, Svetlana Ignatjeva, Alona Rauckienė- Michaelsson. (2018). “Assessing The Interrelations Between Organizational Learning Culture And Organizational Citizenship Behavior In The Public Sector”. In *TILTAI*, 2018, 2, 85–98 ISSN 1392-
- [65] Marquardt, Michael J. (2002). *Building The Learning Organization: Mastering The 5 Elements for Corporate Learning*. (second edition). United States of America: Davies-Black Publishing.
- [66] Schein, Edgar H. (2004). *Organizational Culture and Leadership*. (3rd Edition)
- [67] Maskály, J., Donner, C. M., & Chen, T. (2019). Improving the measurement of police integrity: An application of LTM to the Klockars et al.(1997) scales. In *Exploring police integrity* (pp. 315-339). Springer, Cham.
- [68] Phillips, S. W. (2016). Police discretion and boredom: What officers do when there is nothing to do. *Journal of Contemporary Ethnography*, 45(5), 580-601. *and Practice*. London: Addison-Wesley.

AUTHORS

Sigit Dany Setiyono – Student, Faculty of Administration Science, Universitas Brawijaya, Jl. MT. Haryono 163 Malang, Jawa Timur, Indonesia 65145

Abdul Hakim – Professor, Faculty of Administration Science, Universitas Brawijaya, Jl. MT. Haryono 163 Malang, Jawa Timur, Indonesia 65145, Email: hakimend16@gmail.com

Tjahjanulin Domai – Associate Professor, Faculty of Administration Science, Universitas Brawijaya, Jl. MT. Haryono 163 Malang, Jawa Timur, Indonesia 65145, Email: lin_fia@ub.ac.id

Siswidiyanto – Associate Professor, Faculty of Administration Science, Universitas Brawijaya, Jl. MT. Haryono 163 Malang, Jawa Timur, Indonesia 65145, Email: Siswidiyanto@ub.ac.id

Corresponding author – Abdul Hakim – Professor, Faculty of Administration Science, Universitas Brawijaya, Jl. MT. Haryono 163 Malang, Jawa Timur, Indonesia 65145, Email: hakimend16@gmail.com

Mott Transition in Strongly Correlated Fermionic Systems: Hubbard Model Review

Moukouri Mikano Jonas^{1,7*}, Ndjacka Jean-Marie Bienvenu¹, Mane Mane Jeannot², Epesse Misse Samuel³, Guefano Serge³, Nyangono Kouma Jean Michel^{4,7}, Bwanga Thomas Christophe⁵, Abanda Esomba Christian Gilles⁵, Asse Jean Bernard³, Libog Laurent⁶, Kouoh Sone Paul-Michel Adolphe⁸

¹Laboratory of Mechanics, Materials and Structure, Faculty of Science, University of Yaoundé I, Yaoundé, Cameroon

²Department of Mathematics and Physical Sciences, National Advanced school of Engineering, University of Yaoundé I, Yaoundé, Cameroon

³Laboratory of Technology and Applied Sciences, University Institute of Technology, University of Douala, Douala, Cameroon

⁴Laboratory of Computer and Automatic Engineering, Advanced Teachers Training College for Technical Education, University of Douala, Douala, Cameroon

⁵Laboratory of Mechanics and Materials, University Institute of Technology, University of Douala, Douala, Cameroon

⁶Department of Mechanical Engineering, Advanced Teachers Training College for Technical Education, University of Douala, Douala, Cameroon

⁷Basical Scientific Teachings Department, Advanced Teachers Training College for Technical Education, University of Douala, Douala, Cameroon

⁸Laboratory of Applied Physical and Analytical Chemistry, Faculty of Science, University of Yaoundé I, Yaoundé, Cameroon

*Corresponding author: jonasmmoukouri2018@gmail.com

DOI: 10.29322/IJSRP.12.10.2022.p13069

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13069>

Paper Received Date: 14th September 2022

Paper Acceptance Date: 15th October 2022

Paper Publication Date: 21st October 2022

ABSTRACT : --The Hubbard model is one of the lattice models that enables successful treatment of problems of electronic correlations in quantum materials. The centrality of the Hubbard model in the quantum statistical mechanics of interacting fermions is comparable with the Ising model in classical mechanics. The constant expansion of Hubbard Hamiltonians indicates the great interest in the physics related to the Hubbard model. The present paper reviews this important model which plays a major role in the study of strong correlated fermionic systems. Starting with the basic approach of the model (the one-band model), we introduce others aspects, such as the multi-band and the extended Hubbard model. Due to presence of the repulsive Coulomb interaction, Mott insulators are different from the conventional insulators, and they are one of the strongest correlated fermionic systems. Mott insulators have been analyzed as well as the metal-insulator transition (MIT) in the perspective of the Hubbard model. The Mott transition addresses directly the competition between the kinetic energy and correlation energy, that is the wavelike and the particle character of electrons in the solid. Thus, the Hubbard model turns out to be appropriate in the study of such phase transition, this is the reason why it is still called Mott-Hubbard transition.

KEYWORDS: Hubbard model, local Coulomb interaction, Mott insulator, metal-insulator transition, correlated fermionic systems, second quantization

1. Introduction

Electronic transport mechanisms in materials always attract more attention of the scientists since the discovery of the electron by Sir Joseph John Thomson in 1897. Three years after that discovery, Paul Drude was the first physicist to present a microscopic theory to explain the transport properties of electron in materials (especially metals) [1- 4].

Drude model provides a classical mechanics approach to describing conductivity in metals. This model makes several key assumptions. Here are two of them:

- Electrons in metal behave much like particles in an ideal gas (no Coulomb interaction and no collisions between particles). This is called the independent electron approximation.
- Positive charges are located on immobile ions. The electrons do not experience Coulomb interaction with the ions (free electron approximation), but they do collide with the ions and can change direction and velocity. The so-called free electrons are ruled by the Maxwell-Boltzmann statistics.

The conductivity of metal (solid) is computed by the formula below:

$$\sigma = \frac{n e^2 \tau}{m} \tag{1}$$

with τ called relaxation time, n is the number of free electrons per volume (the density), e is the charge of an electron and m the mass of an electron.

The electronic velocity distribution, like that of an ordinary classical gas of density n is given in equilibrium at temperature T by Maxwell-Boltzmann distribution:

$$f_{MB}(v) = n \left(\frac{m}{2\pi k_B T} \right)^{3/2} e^{-\frac{mv^2}{2k_B T}} \tag{2}$$

where v is the electronic velocity and k_B is the Boltzmann's constant.

This simplistic model is pre-quantum mechanical semi-classical model which is still roughly applicable for simple alkaline metals.

Arnold Sommerfeld was the first physicist to successfully apply quantum mechanics to the physics of transport in solids. Shortly after the discovery that the Pauli exclusion principle was needed to account the bound electronic states of atoms, Sommerfeld applied the same principle to the free electrons gas of metals [1]. In accordance with the Pauli exclusion principle, the classical Maxwell-Boltzmann velocity distribution was replaced by a new distribution, named Fermi-Dirac distribution and expressed as follows:

$$f_{FD}(v) = \frac{(m/\hbar)^3}{4\pi^3} \frac{1}{\exp\left[\left(\frac{mv^2}{2} - k_B T_0\right)/k_B T\right] + 1} \tag{3}$$

where \hbar is the Planck's constant divided par 2π and T_0 is temperature determined by the normalized condition. The density of states ($D(\epsilon)=\alpha\sqrt{\epsilon}$) of conduction electrons in 3D systems indicates that the electron states are fully occupied below the Fermi energy ϵ_F (Fermi-Dirac statistics) [4]. The conductivity has the same form, but the relaxation time is now a function of energy Fermi ($\tau(\epsilon_F)$). This energy dependence on the relaxation time has little significant effect on the most of quantities of interest in a metal [1].

Although the free electron model has recorded interesting results, it has however experienced many failures. The conventional theory of solids has emerged as being able to overcome some of these failures. This theory is based on the quantum mechanics of single electrons moving in periodic potentials and it has provided an excellent description of substances ranging from semiconducting silicon to superconducting aluminum [5]. Unfortunately, the conventional theory has also experienced limitations due to the electronic correlations present in certain substances.

The present review aims to show, on the one hand, the importance of Hubbard model in the attempt of probing electronic properties of strong correlated fermionic systems, and on another hand, how the strong repulsive Coulomb interaction affects the behavior of these systems. This paper is organized as follows: in section 2, the basic approach of

the Hubbard model (one-band model) is presented, and also the multi-band and extended versions of the Hubbard Hamiltonian. Section 3 is devoted to describing the metal-insulator transition (MIT) and the Mott insulators (Mott-Hubbard- and charge-transfer insulators). Conclusions are presented in section 4.

2. Hubbard model

Lacking a working *ab-initio* theory, strongly-correlated systems have been studied for a long time through low-energy model Hamiltonians. The minimal model to describe a system with a narrow band at the Fermi level is the Hubbard model [6] and is one of the fundamental models in condensed matter physics. The centrality of the Hubbard model in the quantum statistical mechanics of interacting fermions is comparable with the Ising model in classical mechanics [7]. It offers one of the most simple ways to get insight into how the interactions between electrons give rise to insulating, magnetic, and even novel superconducting effects in a solid [8]. This model was introduced independently by J. Hubbard, M. C. Gutzwiller and J. Kanomori around the same period [9 -13]. It was written down in the early 1960's and initially applied to understanding the behavior of the transition metal monoxides (FeO, NiO, CoO). These compounds exhibit antiferromagnetic insulator behavior, while they were predicted to be metallic by studies which do not deal with strongest electronic interactions [8].

The Hubbard model describes the fundamental dichotomy between itinerancy and locality for correlated electrons on a lattice [6]. This Hubbard Hamiltonian is expressed in a real-space second quantization formalism which is ideally suited to describe systems with electrons localized at the atomic orbital [14].

2.1- One-band Hubbard model

A conventional starting point for the study of strongly correlated electron systems is the single-band version of the Hubbard Hamiltonian [6] written as follows:

$$H = -t \sum_{\langle ij \rangle, \sigma} (c_{i\sigma}^\dagger c_{j\sigma} + \text{h.c.}) + U \sum_i n_{i\uparrow} n_{i\downarrow} \quad (4)$$

where $\langle ij \rangle$ denotes the nearest-neighbor atomic sites, $c_{i\sigma}^\dagger$ ($c_{i\sigma}$) is the fermion creation operator (fermion annihilation operator) at site i with spin $\sigma \in \{\uparrow, \downarrow\}$, $n_{i\sigma} = c_{i\sigma}^\dagger c_{i\sigma}$ is the density of fermions with spin σ , t parameterizes the hopping amplitude, the so-called Hubbard U is the on-site Coulomb interaction and h.c. denotes the Hermitian conjugate. The hopping parameter t for the kinetic energy of the electrons is determined by the overlap of atomic wave functions on neighboring sites [15]. Imada *et al.* [16] in their important study of Metal-Insulator Transitions (MIT) have expressed the hopping integral t :

$$t = \int d\mathbf{r} \varphi_{i\sigma}^*(\mathbf{r}) \frac{1}{2m} \nabla^2 \varphi_{j\sigma}(\mathbf{r}) \quad (5)$$

where $\varphi_{i\sigma}(\mathbf{r})$ and $\varphi_{j\sigma}(\mathbf{r})$ are two atomic Wannier orbitals on sites i and j respectively, m is the electron mass and the Planck constant \hbar is set to unity.

The Hubbard U means the repulsive Coulomb interaction between electrons on the same lattice site. The term $U n_{i\uparrow} n_{i\downarrow}$ represents an energy cost U for the site i has two electrons and describes a local repulsion between electrons [15]. U is also an integral calculated in the following equation [16]:

$$U = \int d\mathbf{r} d\mathbf{r}' \varphi_{i\sigma}^*(\mathbf{r}) \varphi_{i\sigma}(\mathbf{r}) \frac{e^2}{|\mathbf{r}-\mathbf{r}'|} \varphi_{i-\sigma}^*(\mathbf{r}') \varphi_{i-\sigma}(\mathbf{r}') \quad (6)$$

The hopping amplitude and the on-site Coulomb repulsion represent the minimal set of parameters necessary to capture the physics of Mott insulators. A schematic picture of the Hubbard model is shown in the Fig.1.

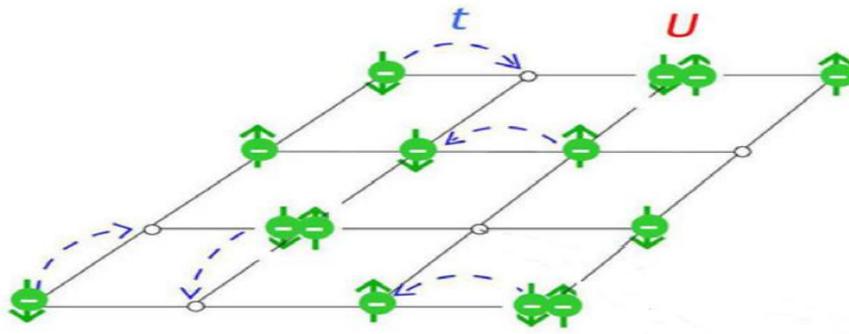


Fig. 1. Pictorial representation of the terms in the Hubbard Hamiltonian [17].

$$H = \sum_{ij} \sum_{\sigma=\uparrow, \downarrow} t_{ij} c_{i\sigma}^\dagger c_{j\sigma} + U \sum_i n_{i\uparrow} n_{i\downarrow} \tag{7}$$

where t_{ij} is a bond-dependent hopping matrix element on near-neighbor sites $\langle ij \rangle$ [18].

Y. Claveau *et al.* [19] has considered the simplest Hubbard model as the non-degenerate band Hubbard Hamiltonian which is expressed in this way:

$$H = - \sum_{ij\sigma=\uparrow, \downarrow} t_{ij} c_{i\sigma}^\dagger c_{j\sigma} + U \sum_i n_{i\uparrow} n_{i\downarrow} \tag{8}$$

And the same authors have defined the term t_{ij} as the translation in the second-quantization language of both the kinetic energy and the crystal-potential energy associated with an electron at site i :

$$t_{ij} = \int d\mathbf{r} \phi_{i\sigma}^*(\mathbf{r}) \left(-\frac{\hbar^2}{2m} \nabla^2 + V(\mathbf{r}) \right) \phi_{j\sigma}(\mathbf{r}) \tag{9}$$

The term $V(\mathbf{r})$ represents the periodic crystal-potential energy, and $t_{ij} = (t_{ji})^*$ because the Hamiltonian is Hermitian. An approximation that is usually employed for the hopping term t_{ij} is to consider it as being different from zero only when i and j are considered to be the nearest-neighbor ($t_{ij} = t$) [19].

Equations (7) and (8) are identical insofar as both terms of itinerancy and locality are present. This two terms demonstrate the interplay between kinetic energy gain and cost of Coulomb interaction. F. Lechermann in his notes of *Model Hamiltonians and Basic Techniques* [20] add another term scaling by the local single-particle level energy ϵ_0 which is not strictly mandatory:

$$H = - \sum_{ij\sigma=\uparrow, \downarrow} t_{ij} c_{i\sigma}^\dagger c_{j\sigma} + \epsilon_0 \sum_{i\sigma} n_{i\sigma} + U \sum_i n_{i\uparrow} n_{i\downarrow} \tag{10}$$

The Fourier transform of t_{ij} is the dispersion relation ϵ_k [6]. Finally, the Fourier transform of the kinetic energy term involves the dispersion ϵ_k and the momentum distribution operator $n_{k\sigma}$:

$$\sum_{ij\sigma} t_{ij} c_{i\sigma}^\dagger c_{j\sigma} = \sum_{k\sigma} \epsilon_k c_{k\sigma}^\dagger c_{k\sigma} = \sum_{k\sigma} \epsilon_k n_{k\sigma} \tag{11}$$

J. Bünnemann, in the study of the Gutzwiller variational theory [6] has presented the single-band Hubbard Hamiltonian in another form:

Let's remind some useful Fourier transform relations concerning fermion creation and annihilation operators:

$$c_{\mathbf{k}\sigma}^\dagger = \frac{1}{\sqrt{N}} \sum_{\mathbf{R}_j} e^{-i\mathbf{k}\cdot\mathbf{R}_j} c_{\mathbf{R}_j\sigma}^\dagger \tag{12}$$

$$c_{\mathbf{k}\sigma} = \frac{1}{\sqrt{N}} \sum_{\mathbf{R}_j} e^{i\mathbf{k}\cdot\mathbf{R}_j} c_{\mathbf{R}_j\sigma} \tag{13}$$

The creation operator $c_{i\sigma}^\dagger$ and annihilation operator $c_{i\sigma}$ are anticommuting:

$$\{c_{i\sigma}, c_{j\sigma'}^\dagger\} = \delta_{ij} \delta_{\sigma\sigma'} \tag{14}$$

$$\{c_{i\sigma}^\dagger, c_{j\sigma'}^\dagger\} = 0 \tag{15}$$

$$\{c_{i\sigma}, c_{j\sigma'}\} = 0 \tag{16}$$

The change in “ basis ” from the site indices to momentum indices does not affect the anticommutation relations.

Richard T. Scalettar [8] has presented another formulation of the single-band Hubbard Hamiltonian :

$$H = -t \sum_{\langle ij \rangle, \sigma} (c_{i\sigma}^\dagger c_{j\sigma} + \text{h.c.}) + U \sum_i n_{i\uparrow} n_{i\downarrow} - \mu \sum_i (n_{i\uparrow} + n_{i\downarrow}) \tag{17}$$

The final term is a chemical potential which controls the filling. The situation where the filling is one electron per site is referred to as ‘half-filling’ since the lattice contains half as many electrons as the maximum number (two per site) [18]. At the half-filling, $\mu = \frac{U}{2}$. Studies of the Hubbard Hamiltonian (HH) often focus on the half-filled case because it exhibits a lot of interesting phenomena (Mott insulating behavior, anti-ferromagnetic order, etc.) [8]. Therefore, it has been found convenient to rewrite (17) in the following form called PHS-form :

$$H = -t \sum_{\langle ij \rangle, \sigma} (c_{i\sigma}^\dagger c_{j\sigma} + \text{h.c.}) + U \sum_i (n_{i\uparrow} - \frac{1}{2})(n_{i\downarrow} - \frac{1}{2}) - \mu \sum_i (n_{i\uparrow} + n_{i\downarrow}) \tag{18}$$

The PHS-form is a Hubbard Hamiltonian version which takes into account the Particle-Hole Symmetry (PHS). The latter is important because it is the basis of very useful mappings between the attractive and repulsive HH and because it plays a crucial role in QMC (Quantum Monte Carlo) simulations.

Clearly, the one-band HH is a simplification that is valid in the strict sense only when the atom has only one *s* orbital, as in hydrogen atom. The next subsection will present the multi-band HH.

2.2- Multi-band Hubbard model

The applicability of the one-band Hubbard model to *d* or *f* electron systems is a priori questionable since the partially filled bands correspond to atomic orbitals which are 5-fold and 7-fold degenerate (for each spin direction), respectively. Bands in a lattice are more complicated than orbitals of isolated atoms [6]. The bands that are formed are under the strong influence of anisotropic crystal fields in solids. Because the 3*d* orbital has the total angular momentum *L* = 2, it has fivefold degeneracy (*L_z* = 2, 1, 0, -1, -2) for each spin and hence a total of tenfold degeneracy including spins. This degeneracy is lifted by the anisotropic crystal field.

Fig. 2 shows an example of the crystal field splitting, where the cubic lattice symmetry leads to a higher energy level of fourfold degenerate *e_g* orbitals and sixfold degenerate lower orbitals, *t_{2g}* [16]. The *t_{2g}* orbitals ($|d_{xy}\rangle, |d_{yz}\rangle, |d_{zx}\rangle$) and the *e_g* orbitals ($|d_{x^2-y^2}\rangle, |d_{3z^2-r^2}\rangle$) give rise to threefold degenerate and twofold degenerate band respectively [6]. For light elements of transition-metal, such as V and Ti, the Fermi level is on the *t_{2g}* bands, which are threefold degenerate under the cubic crystal field -as this has been noticed before- with possible weak splitting of this degeneracy under the Jahn-Teller distortion in the perovskite structure ($L_{1-x}Sr_xVO_3$; $R_{1-x}A_xTiO_3$). When the Fermi level is on the *e_g* bands, as in Ni and Cu compounds, the degeneracy is twofold in the absence of the Jahn-Teller

distortion. In the compounds with light transition-metal elements such as Ti, V, Cr,..., only a few bands formed from 3d orbitals are occupied by electrons per atom. By contrast, in transition-metal compounds with heavy transition-metal elements such as Cu and Ni, the t_{2g} band is fully occupied far below the Fermi level [16].

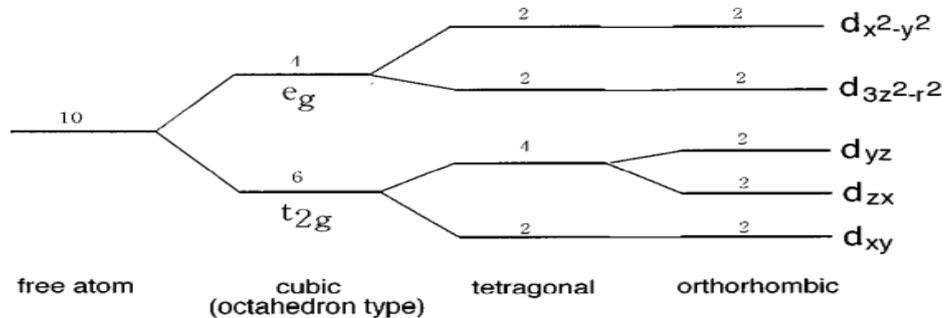


Fig. 2. Crystal-field splitting of 3d orbitals under cubic, tetragonal, and orthorhombic symmetries. The numbers cited near the levels are the degeneracy including spins [16].

The Hubbard model in multi-band approach has many forms according to authors' works. E. Pavarini [21] has written the so-called generalized multi-band

HH in transition-metal systems:

$$H_{\text{mband}} = - \sum_{i i'} \sum_{\sigma} \sum_{m m'} t_{i i'}^{m m'} c_{i m \sigma}^{\dagger} c_{i' m' \sigma} + \frac{1}{2} \sum_i \sum_{\sigma \sigma'} \sum_{m_{\alpha} m'_{\alpha}} \sum_{m_{\beta} m'_{\beta}} U_{m_{\alpha} m_{\beta} m'_{\alpha} m'_{\beta}} c_{i m_{\alpha} \sigma}^{\dagger} c_{i m_{\beta} \sigma'}^{\dagger} c_{i m'_{\beta} \sigma'} c_{i m'_{\alpha} \sigma} \quad (19)$$

Where $c_{i m \sigma}^{\dagger}$ creates an electron at site i with spin σ and orbital quantum number m , and the parameter $t_{i i'}^{m m'}$ are the hopping integrals ($i \neq i'$) or the crystal-field splittings ($i = i'$). $U_{m_{\alpha} m_{\beta} m'_{\alpha} m'_{\beta}}$ is the Coulomb interaction tensor and its elements can be expressed in terms of Slater integrals.

Another formulation of the multi-band Hubbard Hamiltonian called generalized rotationally invariant multi-band Hubbard Hamiltonian is given in [20]. This Hubbard model is derived from the rotationally invariant slave boson (RISB) theory [22], an elaborate generalization of original ideas for manifest multi-orbital problems:

$$H_{\text{mband}} = \sum_{i j, m m', \sigma} t_{i j}^{m m'} c_{i m \sigma}^{\dagger} c_{j m' \sigma} + U \sum_{i m} n_{i m \uparrow} n_{i m \downarrow} + \frac{1}{2} \sum_{i, m \neq m', \sigma} [U' n_{i m \sigma} n_{i m' \bar{\sigma}} + U'' n_{i m \sigma} n_{i m' \sigma}] + \frac{1}{2} \sum_{i, m \neq m', \sigma} [J_C c_{i m \sigma}^{\dagger} c_{i m' \bar{\sigma}}^{\dagger} c_{i m \bar{\sigma}} c_{i m' \sigma} + J_C c_{i m \sigma}^{\dagger} c_{i m' \bar{\sigma}}^{\dagger} c_{i m \bar{\sigma}} c_{i m' \sigma}] \quad (20)$$

where m, m' are here either t_{2g} or e_g states, $U_{m m' m m'} = U_{m, m'} = U - 2J(1 - \delta_{m, m'})$ and, for $m \neq m'$, $U_{m m' m' m} = J_{m, m'} = J$.

Y. Claveau *et al.* [19] have underlined in the study of multi-orbital Hubbard Hamiltonian that several intra-atomic Coulomb terms appear, depending on whether intra-orbital ($U_{m, m'}$ with $m = m'$) or inter-orbital ($U_{m, m'}$ with $m \neq m'$) Coulomb repulsion is concerned. And the Hund's exchange term J for ($m \neq m'$) also appears because of the multi-dimensional orbital of the degree of freedom. B. Himmetoglu *et al.* [23], M. Cococcioni [14] and R. Eder [8] have expressed the interactions parameters in terms of the Slater Condon parameters F^k and the products of Gaunt coefficients a^k and b^k :

$$U_{m, m'} = \sum_{k \in \{0, 2, 4\}} a^k(m, m') F^k ; \quad J_{m, m'} = \sum_{k \in \{0, 2, 4\}} b^k(m, m') F^k \quad (21)$$

For more information about these coefficients and parameters, one can be referred to [8] and [14].

J. Bünenman has proposed another version of multi-band Hubbard Hamiltonian by distinguishing *localized* orbitals and *delocalized* orbitals. And he observed that localized orbitals require more sophisticated treatment of the local Coulomb interaction [14]. More precisely, multi-band Hubbard models are those where several atomic species are present; not all characterized by the same Hubbard U [19].

In the following subsection, another formulation of Hubbard model taking into account off-site interaction will be analyzed.

2.3- Extended Hubbard model

The centrality of the Hubbard model in describing in the most basic way strongly correlated materials is well known. This model exhibits phenomena such as magnetism and metal-insulator transitions with or without magnetic transitions. However, particularly due to neglecting nonlocal interaction, the Hubbard model can be quite far from describing real materials whenever nonlocal interactions are not efficiently screened [24].

The interest of the extended Hubbard model has been revamped in the last decades by the discovery of high T_c superconductors and the intense research activity focusing around them [25]. Several numerical studies suggest that the inter-site interaction plays indeed an important role [26] and superconductivity is predicted in a regime with repulsive on-site ($U > 0$) and attractive inter-site ($V < 0$) couplings [25]. In low-dimensional systems, especially quasi-1D compounds, the nearest-neighbor (NN) Coulomb integral V is often relevant at specific fillings to drive e.g. charge – density-wave (CDW) or spin-density-wave (SDW) instabilities [20]. M. Schüler *et al.* have used in their study of the first-order metal-insulator transition with the extended Hubbard model this formulation [24]:

$$H_{\text{exhub}} = -t \sum_{\langle ij \rangle, \sigma} c_{i\sigma}^\dagger c_{j\sigma} + U \sum_i n_{i\uparrow} n_{i\downarrow} + \frac{1}{2} \sum_{i \neq j} V_{ij} n_i n_j \quad (22)$$

with U the local interaction (on-site Coulomb interaction) and V_{ij} the nonlocal interaction (inter-site Coulomb interaction) between electrons at sites i and j .

F. Dolcini and his colleague [27], investigating the integrable extended Hubbard Hamiltonians from symmetric group equations, have considered the most general form of extended Hubbard model, invariant under spin-flip and conserving the total number of electrons and the magnetization:

$$H_{\text{exhub}} = - \sum_{\langle ij \rangle, \sigma} [t - X(n_{i,-\sigma} + n_{j,-\sigma}) + \tilde{X} n_{i,-\sigma} n_{j,-\sigma}] c_{i\sigma}^\dagger c_{j\sigma} + U \sum_i n_{i\uparrow} n_{i\downarrow} + \frac{V}{2} \sum_{\langle ij \rangle} n_i n_j + \frac{W}{2} \sum_{\langle ij \rangle, \sigma, \sigma'} c_{i\sigma}^\dagger c_{j\sigma}^\dagger c_{i\sigma'} c_{j\sigma'} \\ + Y \sum_{\langle ij \rangle} c_{i\uparrow}^\dagger c_{i\downarrow}^\dagger c_{j\downarrow} c_{j\uparrow} + P \sum_{\langle ij \rangle} n_{i\uparrow} n_{i\downarrow} n_j + \frac{Q}{2} \sum_{\langle ij \rangle} n_{i\uparrow} n_{i\downarrow} n_{j\uparrow} n_{j\downarrow} + \mu \sum_{i\sigma} n_{i\sigma} \quad (23)$$

This Extended Hubbard Hamiltonian contains 10 coefficients $t, X, \tilde{X}, U, V, W, Y, P, Q, \mu$ such that t is a hopping constant, U - on-site Coulomb interaction as in the ordinary Hubbard model, V is the neighboring site charge interaction, X the bond-charge interaction, W the exchange term, and Y the pair-hopping term. X correlates hopping with on-site occupation number, and P and Q describe three and four-electron interactions. And μ is the chemical potential. The choice of these parameters t, X, \tilde{X} and others implies the Hamiltonian symmetry [28].

Gurin and Gulácsi analyzed an extended Hubbard model containing next-nearest-neighbor terms, the reader can refer to their paper in [29]. Delannoy *et al.* also presented an extended Hubbard model with next-nearest-neighbor (first, second and third neighbors) in the study of interaction strengths in cuprate superconductors and an effective spin-only description of La_2CuO_4 by the so-called low energy theory of the t - t' - t'' - U Hubbard Model at half-filling [30]. The t - t' - t'' - U Hubbard Hamiltonian is:

$$H_{\text{exhub}} = -t \sum_{\langle ij \rangle, \sigma} c_{i\sigma}^\dagger c_{j\sigma} - t' \sum_{\langle\langle ij \rangle\rangle, \sigma} c_{i\sigma}^\dagger c_{j\sigma} - t'' \sum_{\langle\langle\langle ij \rangle\rangle\rangle, \sigma} c_{i\sigma}^\dagger c_{j\sigma} + U \sum_i n_{i\uparrow} n_{i\downarrow} \quad (24)$$

where t , t' and t'' are energy scales which characterize direct hopping to first ($\langle ij \rangle$), second $\langle\langle ij \rangle\rangle$ and third $\langle\langle\langle ij \rangle\rangle\rangle$ nearest-neighbor respectively.

3. Metal – insulator transition (MIT) and Mott insulator

3.1- Metal – insulator transition

Although the metal-insulator transition (MIT) has certainly been one of the most studied phenomenon in condensed-matter physics, it is only in recent years that important progress has been achieved. This is mainly due to careful experimental and numerical studies but also to the improvement of the theoretical tools [31]. The insulating phase and its fluctuations in metals are indeed the most outstanding and prominent features of strongly correlated electrons [16]. The Mott transition is central to the problem of modeling strongly correlated electrons because it addresses directly the competition between the kinetic energy and correlation energy - that is the wavelike and the particle character of electrons in the solid [32]. In another words, D. Vollhardt [17] has observed that the Mott transition also called “Mott-Hubbard Metal-Insulator Transition” (MIT) is a delocalization-localization transition, demonstrating the particle-wave duality of electrons.

The two important parameters in the Hubbard model are the electron correlation strength U/t and the band filling n . In the case of a nondegenerate band, the $n=0$ and $n=2$ fillings correspond to the band insulator. For the half-filled case ($n=1$), it is believed that the change of U/t drives the insulator-to-metal transition (Mott transition) at a critical value of U/t except in the case of perfect nesting, where the critical value U_c is zero. This transition at a finite U_c is called a bandwidth control (BC)-MIT. The schematic metal-insulator phase diagram in terms of parameters U/t and n is shown in Fig.3. The shaded area in that figure is in principle metallic but under the strong influence of the metal-insulator transition, in which carriers are easily localized by extrinsic forces such as randomness and electron-lattice coupling. Two routes for the MIT (metal-insulator transition) are shown: the FC-MIT (filling-control MIT) and the BC-MIT (bandwidth-control MIT) [16].

According to Kotliar and Vollhardt [32] the parameters that determine the properties described by the Hubbard model are the ratio of the Coulomb interaction U and the bandwidth W , the temperature T , and the doping or number of electrons. The computation of the DOS (density of state) as a function of U/W in the framework of DMFT (Dynamic Mean Field Theory), a numerical approach to solve HH, has shown the opening of a gap ($E_g=U-W$) with the increasing of U [32][33].

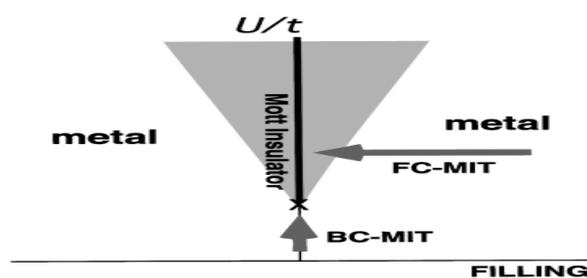


Fig.3 Metal-insulator phase diagram based on the Hubbard model in the plane of U/t and filling n [16].

3.2- Mott insulator

Mott insulator is defined by Imada *et al.* as an insulator caused by intrasite Coulomb repulsion, as in the Hubbard model [16]. Unlike conventional band insulators (which are shown in Fig.4) and semiconductors, Mott insulators contain unpaired electrons in their ground state [34].

According to the band theory of metals (Bloch theorem), a half-filled band (valence band) leads to a metallic conductivity. A fully filled band (valence band) leads to an insulator. There is an energy gap between the valence band and the conduction band. There is no electrical conduction. In this band theory no interaction between electrons is taken

into account and depending on the number of electrons, the system becomes metallic for the odd number and insulator for the even number [36]. Considering the same band theory (the independent-electron description of crystals), according to P. Fazekas [37], a material predicted to be metallic if the density of states at the Fermi level in non-vanishing ($\rho(E_F) \neq 0$) and the material must be insulator (or semi-conductor, etc) if ($\rho(E_F) = 0$).

The failure of the band theory was recorded in 1937, when de Boer and Verwey [38] reported that many transition metal oxides such as NiO and CoO are insulator, but not a metal in spite of the fact that the *d*-band of these systems is partially filled by electrons. Peierls pointed out that such a behavior may be caused by the electron correlation. In 1949, Mott [39] proposed a model for NiO as insulator with the bandgap energy E_g . The latter can be understood as the competition between the Coulomb potential U between *3d*-electrons and the transfer integral t between *3d*-electrons of neighboring atoms. Let's remind that $E_g = U - W$ with $W \approx 2zt$, where z is the number of the nearest-neighbor atoms.

In general, Mott insulators occur when the repulsive Coulomb potential U is large enough to create an energy gap. In that conditions, where U exceeds the bandwidth W , the half-filled band splits into two sub-bands, the lower (LHB) and the upper (UHB) Hubbard bands [34] (see Fig.5). Frésard and Kotliar expressed in thy paper titled “Interplay of Mott transition and ferromagnetism in the orbitally degenerate Hubbard model” the (LHB) and (UHB) bandwidths by $W_{LHB} = \langle \{c_{L\alpha}, c_{L\alpha}^\dagger\} \rangle$ and $W_{UHB} = \langle \{c_{U\alpha}, c_{U\alpha}^\dagger\} \rangle$ respectively. And $c_{L\alpha}^\dagger$ ($c_{U\alpha}^\dagger$) is the contribution to c_α^\dagger (see more in [40]).

In their insulating phase, transition-metal oxides can present two types of insulators: the Mott-Hubbard insulator and the charge transfer insulator (CT) [16] [35] [41]. These compounds made of *3d*-orbital and *p*-orbital have characterized by two parameters: $\Delta = |\epsilon_d - \epsilon_p|$ (charge transfer energy) and U . When the oxygen *p*-level, ϵ_p , is much lower than ϵ_d , the oxygen *p*-orbital contributes only through virtual processes and $|\epsilon_d - \epsilon_p| > U_{dd}$; this type of transition-metal oxide is called a Mott-Hubbard-type compound. In contrast, if $|\epsilon_d - \epsilon_p| < U_{dd}$, in this case, the type of transition-

metal oxide is called charge-transfer-type compound. The difference between the two cases is schematically illustrated in Fig.6.

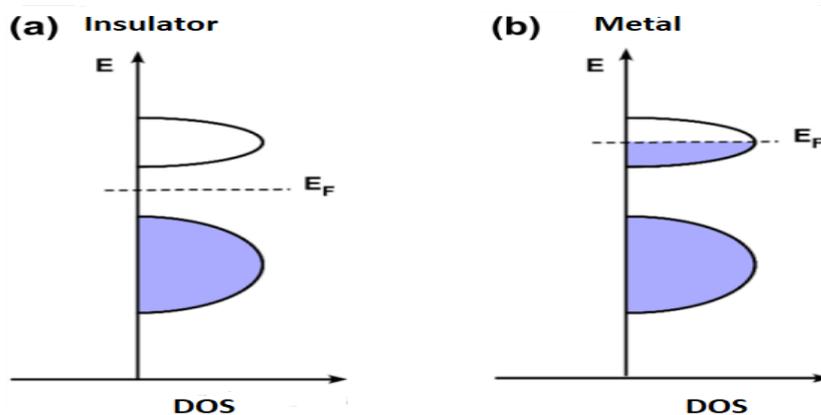


Fig.4 : Conventional band insulator (a) and metal (b) in band theory [35].

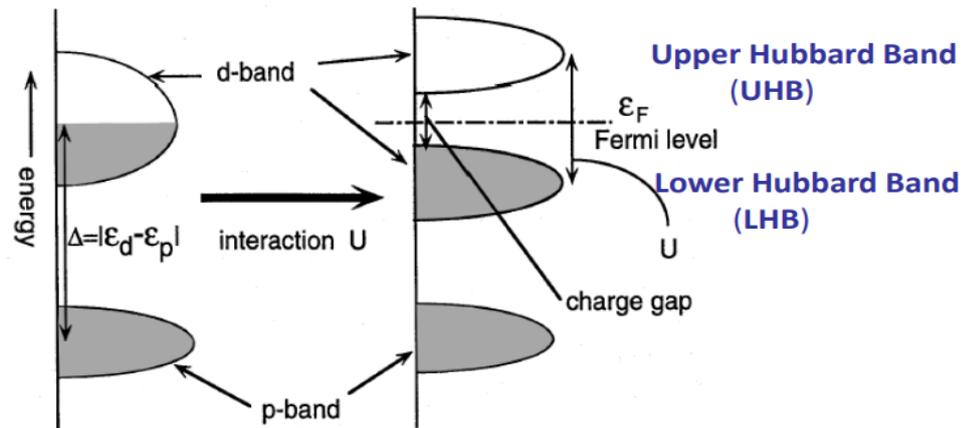


Fig.5 : Splitting of the *d*-band into two sub-bands (UHB) and (LHB) [41].

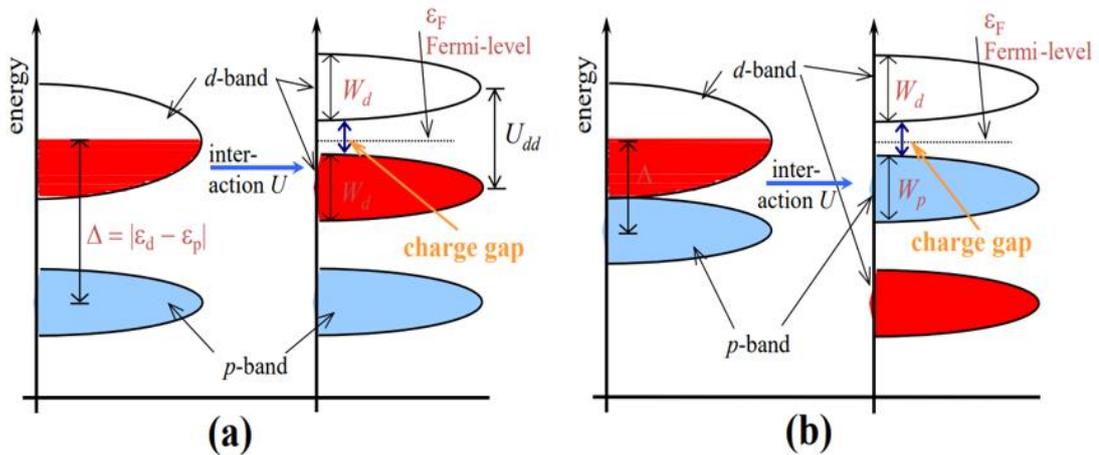


Fig.6 : Two types of Mott insulators: a) Mott-Hubbard insulator, b) Charge-transfer insulator (CT) [41].

LaMO_3 compounds are Mott-Hubbard-type with M corresponding to Co and Fe, and CT-type if M is Ti or V [41]. Moreover, the most prominent examples of strongly correlated systems, known as Mott insulators, are $(\text{V}_{1-x}\text{Cr}_x)_2\text{O}_3$, $\text{NiS}_{2-x}\text{Se}_x$ and AM_4Q_8 [34]. The so-called the narrow gap Mott insulator AM_4Q_8 ($A = \text{Ga, Ge; } M = \text{V, Nb, Ta; } Q = \text{S, Se}$) exhibit very interesting electronic properties such as a very small Mott-Hubbard gap (0.2 ± 0.1 eV). And the direct consequence of this low gap value is the high sensitivity of this compounds to external perturbations. AM_4Q_8 materials belong to a new class of Mott-memories for which Joule heating, thermochemical or electrochemical effects are not involved [42].

4. Conclusion

Problems of strongly interacting electrons can be greatly simplified by reducing them to effective quantum spin models, such as the Hubbard model. As that has been observed, the literature of Hubbard model is vast. This paper has provided an overview of different approaches to the Hubbard model such as: the basic approach (the one-band approximation) and others versions which are the multi-band and the extended Hubbard model. Although various symmetries that the Hubbard model exhibits have not been discussed, little attention has been paid to the so-called

Particle-Hole Symmetry (PHS), due to the crucial role it plays in QMC simulations. Mott insulator and Metal-Insulator Transition (MIT) have actually been analyzed. The MIT is a delocalization-localization transition, demonstrating the particle-wave duality of electrons. Some compounds which are Mott-Hubbard type have also been presented. It is finally necessary to underline that analytical solutions of HH are not possible in all dimensions.

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- [1] Ashcroft, N. W., & Mermin, N. D. (1976). *Solid State Physics*. ISBN 0-03-083993-9.
- [2] Drude, P. (1900). *Annalen der Physik*. 306 (3) 566-613.
- [3] Drude, P. (1900). *Annalen der Physik*. 308 (11) 369-402.
- [4] Sukuzi, M. (2020). "Electrical conductivity in the metal" in *Lecture notes of solid state physics*. <https://bingweb.binghamton.edu>.
- [5] Gariglio, S. (2003). Transport properties $\text{LaTiO}_{3+\delta}$ and $\text{REBa}_2\text{Cu}_3\text{O}_{7-\delta}$ Thin Films: a Study of Correlation Effects. PhD-thesis. University of Geneva. Switzerland.
- [6] Pavarini, E., Koch, E., Vollhardt, D., & Lichtenstein, A. (2011). The LDA+DMFT approach to strongly correlated materials. *Modelling and Simulation Vol. 1* Forschungszentrum Jülich, ISBN 978-3-89336-734-4. <http://www.cond-mat.de/events/correl11>.
- [7] Arovas, D. P., Baerg, E., Kivelson, S. A., & Raghu, S. (2020). The Hubbard Model. *Annual Review of Condensed Matter Physics*. <https://doi.org/10.1146/annurev-conmatphys-031620-102024>.
- [8] Pavarini, E., Koch, E., van den Brink, J., Sawatzky, G. (2016). Quantum Materials: Experiments and Theory *Modeling and Simulation Vol. 6* Forschungszentrum Jülich, ISBN 978-3-95806-159-0. <http://www.cond-mat.de/events/correl16>.
- [9] Essler, F. H. L., Frahm, H., Göhmann, F., Klumper, A., & Korepin, V. E. (2005). *The one-dimensional Hubbard model*. Cambridge, Cambridge University, 1st Edition February 7, 2005.
- [10] Gutzwiller, M.C. (1963). *Phys. Rev. Lett.* 10, 159.
- [11] Kanamori, J. (1963). *Prog. Theor. Phys.* 30, 275.
- [12] Hubbard, J. (1963). *Proc. R. Soc. A* 276, 237.
- [13] Hubbard, J. (1964). *Proc. R. Soc. A* 281, 401.
- [14] Pavarini, E., Koch, E., Anders, F., & Jarrell, M. (2012). Correlated Electrons: From Models to Materials. *Modeling and Simulation Vol. 2* Forschungszentrum Jülich, ISBN 978-3-89336-796-2. <http://www.cond-mat.de/events/correl12>.
- [15] Bai, Z., Chen, W., Scalettar, R., & Yamazaki, I. (2013). Numerical Methods for Quantum Monte Carlo Simulations of the Hubbard Model. DOI:[10.1142/9789814273268_0001](https://doi.org/10.1142/9789814273268_0001)
- [16] Imada, M., Fujimori, A., & Tokura, Y. (1998). Metal-insulator transitions. *Reviews of Modern Physics*. 70 (1039). <https://doi.org/10.1103/PhysRevB.49.10869>.
- [17] Vollhardt, D. (2011). "Dynamical Mean-Field Approach for Strongly Correlated Materials" in *The LDA+DMFT approach to strongly correlated materials*. *Modelling and Simulation Vol. 1* Forschungszentrum Jülich, ISBN 978-3-89336-734-4. pp. 1-29. <http://www.cond-mat.de/events/correl11>.

- [18] Scalettar, R.T. (2007) . Numerical Studies of Disordered Tight-Binding Hamiltonians. <https://doi.org/10.1063/1.2751991>.
- [19] Claveau, Y., Arnaud, B., & Di Matteo, S. (2014). Mean-field solution of the Hubbard model: the magnetic phase diagram. <http://dx.doi.org/10.1088/0143-0807/35/3/035023>.
- [20] Lechermann, F. (2011). “Model Hamiltonians and Basic Techniques” in *The LDA+DMFT approach to strongly correlated materials*. Modelling and Simulation Vol. 1 Forschungszentrum Jülich, ISBN 978-3-89336-734-4. pp.1-29. <http://www.cond-mat.de/events/correl11>.
- [21] Pavarini, E. (2011). “The LDA+U Approach: A Simple Hubbard Correction for Correlated Ground States,” in *The LDA+DMFT approach to strongly correlated materials*. Modelling and Simulation Vol. 1 Forschungszentrum Jülich, ISBN 978-3-89336-734-4. pp. 6.1-6.38. <http://www.cond-mat.de/events/correl11>.
- [22] Lechermann, F., Georges, A., Kotliar, G., & Parcollet, O. (2007). Rotationally invariant slave-boson formalism and momentum dependence of the quasiparticle weight. *Physical Review B* 76, 155102. 2007.
- [23] Himmetoglu, B., Floris, A., Gironcoli, S., & Cococcioni, M. (2014). Hubbard-corrected DFT energy functionals: the LDA+U description of correlated systems. *Int. J. Quantum Chem.* 114 14–49 <https://doi.org/10.1002/qua.24521>.
- [24] Schüler, M., van Loon, E. G. C. P., Katsnelson, M. I., & Wehling, T. O. (2018). First-order metal-insulator transitions in the extended Hubbard model due to self-consistent screening of the effective interaction. DOI: [10.1103/PhysRevB.97.165135](https://doi.org/10.1103/PhysRevB.97.165135).
- [25] Cococcioni, M. (2012). “The LDA+U Approach: A Simple Hubbard Correction for Correlated Ground States,” in *Correlated Electrons: From Models to Materials*. Modeling and Simulation Vol. 2 Forschungszentrum Jülich, ISBN 978-3-89336-796-2. pp 4.1-4.40. <http://www.cond-mat.de/events/correl12>.
- [26] Campo Jr, V. L., & Cococcioni, M. (2010). Extended DFT + U + V method with on-site and inter-site electronic interactions. <http://dx.doi.org/10.1088/0953-8984/22/5/055602>.
- [27] Dolcini, F. & Montorsi, A. (2000). Integrable Extended Hubbard Hamiltonians from Symmetric Group Equations. *International Journal of Modern Physics B* 14(17):1719-1728. DOI: [10.1142/S0217979200001540](https://doi.org/10.1142/S0217979200001540).
- [28] Fomin, V. (2010). Modèles de Hubbard unidimensionnels généralisés. Mathematical Physics [math-ph]. PhD-Thesis. Université de Savoie, 2010. English. tel-00608340.
- [29] Gurin, P., & Gulácsi, Z. (1997). “ Hubbard model with next-nearest neighbor interaction terms in higher dimensions: New, exactly solvable cases, ” *Philosophical Magazine Part B*, 76:5, 827-831, DOI: [10.1080/01418639708241146](https://doi.org/10.1080/01418639708241146).
- [30] Delannoy, J. -Y., Gingras, M. J. P., Holdsworth, Peter., & Tremblay, A. -M. S. (2008). Low energy theory of the t-t'-t''-U Hubbard Model at half-filling: interaction strengths in cuprate superconductors and an effective spin-only description of La2CuO4. 2008. DOI: [10.1103/PhysRevB.79.235130](https://doi.org/10.1103/PhysRevB.79.235130).
- [31] Assaraf, R., Azaria, P., Caffarel, M., & Lecheminant, P. (1999). Metal-insulator transition in the one-dimensional SU(N) Hubbard model. <http://dx.doi.org/10.1103/PhysRevB.60.2299>.
- [32] Kotliar, G., & Vollhardt, D. (2004) . Strongly correlated materials: Insights from dynamical mean- field theory. *Physics Today*, 57(3) :53–60. <https://doi.org/10.1063/1.1712502>.
- [33] Georges, A., Kotliar, G., Krauth, W., & Rozenberg, M. J. (1996). Dynamical mean-field theory of strongly correlated fermion systems and the limit of infinite dimensions. *Reviews of Modern Physics*, 68(1) :13, 1996.
- [34] Janod, E., Tranchant, J., Corraze, B., Querré, M., Stoliar, P., Rozenberg, M., Cren, T., Roditchev, D., Ta Phuoc, V., Besland, M. -P., & Cario, L. (2015). Resistive Switching in Mott Insulators and Correlated Systems. <https://doi.org/10.1002/adfm.201500823>

- [35] Émond, N. (2017). Synthèse et caractérisation de couches minces de VO_2 et de $\text{W}_x\text{V}_{1-x}\text{O}_2$ pour des applications dans les domaines infrarouge et térahertz . Université du Québec. Ph. D-thesis.
- [36] Sukuzi, M. (2019). "Mott insulator and Hubbard model" in *Lecture notes of solid state physics*. <https://bingweb.binghamton.edu>.
- [37] Fazekas, P. (1999). Lecture Notes on Electron Correlation and Magnetism. *Physics: Vol. 5*. ISBN: 978-981-4499-62-0/ ISBN: 978-981-02-2474-5. (pages 796, Budapest). <https://doi.org/10.1142/2945>.
- [38] de Boer, J. H., & Verwey, E. J. W. (1937). Semi-conductors with partially and with completely filled $3d$ -lattice bands. *Proceedings of the Physical Society*. 49 (4S): 59.
- [39] Mott, N.F. (1949). The basis of the electron theory of metals, with special reference to the transition metals. *Proceedings of the Physical Society*. Series A. 62 (7): 416.
- [40] Frésard, R. & Kotliar, G. (1997). Interplay of Mott transition and ferromagnetism in the orbitally degenerate Hubbard model. *Physical Review B* Vol. 5(20). <https://doi.org/10.1103/PhysRevB.56.12909>.
- [41] Abd-Elmeguid, M.M. (2022). Introduction to Strongly Correlated Electron System (Lecture notes). <https://ph2.uni-koeln.de>.
- [42] Cario, L., Janod, E., Tranchant, J., Stoliar, P., Rozenberg, M., Besland, M.-P., & Corraze, B. (2013). Mott-memories Based on the Narrow Gap Mott Insulators AM_4Q_8 (A=Ga, Ge ; M = V, Nb, Ta ; Q = S, Se). *Mater. Res. Soc. Symp. Proc.* Vol. 1562. <http://dx.doi.org/10.1557/opl.2013.581>

The Status of South Sudan's Peace Agreement Outputs Enabling Disarmament, Demobilisation and Reintegration

¹Mwanyika, M. E., ¹Professor Okoth, P. G and ²Professor Were, M. E

¹Department of Peace and Conflict Studies, Masinde Muliro University of Science and Technology

² Department of Political Science and Peace Studies

DOI: 10.29322/IJSRP.12.10.2022.p13070

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13070>

Paper Received Date: 14th September 2022

Paper Acceptance Date: 15th October 2022

Paper Publication Date: 21st October 2022

Abstract- Security Sector Reforms (SSRs) are at the centre of post-conflict reconstruction, and they have been marked as an integral pillar of a reconstruction strategy, which demands a holistic approach to prevent the state from relapsing into armed conflict. The Southern part of Sudan has been plagued by armed conflict, despite numerous conflict resolution efforts. The study examined the status of South Sudan's peace agreement outputs enabling disarmament, demobilisation and reintegration. John Paul Lederach's peace-building theory, social constructivism, Arnstein's ladder of Citizen participation and securitisation theory guided the study. The study primarily adopted a descriptive cross-sectional survey design, with correlational and explanatory research elements. Quantitative and qualitative data collection methods were used coupled with questionnaires, Content Analysis Guides and focus Group discussions. Target population was former and current members of armed groups in South Sudan. Snowball sampling was used to identify the respondents that were surveyed. Key informants were purposively sampled based on the individuals that provided comprehensive information on the variables under the study. Collected data was presented using descriptive statistics such as tables, pie charts, bar graphs, and percentages, as well as inferential statistics. Findings indicated that the outputs, measured primarily by behaviour change among the armed groups, reflected the weaknesses in the agreements designed to bring these changes, status of armed violence and recruitment into armed groups. Interpretation, implementation, monitoring and evaluation of the peace agreements were similarly found to be largely deficient affecting transition into effective DDR process. Although there was some use of lessons learnt from previous agreements, there is generally a need to refrain from recycling old ideas in order to realise new results. Disarmament, demobilisation and re integration (DDR) should include inclusivity, transparency to enhance trust and acceptance by all parties to the conflict

Index Terms- Conflict Mitigating Security Sector Reforms; Security Sector Transformation; Mediation

I. INTRODUCTION

Peace Agreements have long been used by states as a way out of long-standing conflict, paving the way for security sector reforms and transformation. The architectural (or structural) design of a Peace Agreement refers to the components that affect its outcomes. The structural design of a peace agreement, and the processes followed from inception to implementation dictates whether not it will be strong enough to stand the test of time and bear positive fruit.

After the overthrow of Saddam Hussein's government in Iraq, the United States and its coalition partners faced challenges in implementing the SSRs. Since the entire military was dissolved and armed groups were required to be disbanded on the order of the coalition, the SSRs process was perceived as imposed and therefore lacked local support (Steffen, 2016). The security gap left through the disbandment of all security forces could not be filled by the coalition. In the process, most of the ex-combatants melted into the civilian society thereby creating a security challenge in Iraq.

In Sierra Leone following a peace agreement between the Government and the Revolutionary United Front (RUF) and the end of the war in 2002, all armed elements including the government forces had to be screened as provided for in the peace agreement (Berdal, 1996). This subsequently led to the peaceful transformation of the security sector. The peace agreement was a culmination of a series of Accords; Abidjan accord of 1996, Conakry Accord of 1997, Lomé accord of 1999 and finally the Abuja Ceasefire Agreement of 2000. In this case, the United Nations and Economic Community for the West Africa States (ECOWAS) member states played a pivotal role during the mediation process (Government of Sierra Leone, 1999).

One of Africa's longest civil wars ended in 2011 when South Sudan declared its independence from Sudan following the effective implementation of a Comprehensive Peace Agreement (CPA) reached in 2005. (Einas, 2009). Late in 2013, just over two years after attaining independence, the South Sudanese were pushed into a horrific new conflict when a political issue that intersected with pre-existing ethnic and political fault lines started a war, bringing immense displacement and misery.

A peace symposium hosted by IGAD in Addis Abeba in June 2014 brought together members from the Government of the Republic of South Sudan (GRSS), the South Sudan Armed Opposition, ex-prisoners, and other political organizations. Most of the provisions of the agreement apart from the formation of the TGoNU, were either lagging or have not been implemented at all (Blackings, 2018). Most of the timelines in the agreement were unachievable due to their lofty goals. The simple awareness that one could defy the international community's will and get away with it spawned a slew of issues, including armed groups reorganizing and rearming, wilful resistance, abuse, and coercion of individuals or parties attempting or willing to enforce stipulated provisions. Because of the SPLA's lack of professionalism and discipline, the army was unable to rise above the political squabbles as they erupted (Blackings, 2018).

Despite all these efforts, the solutions tailored to ensure successful implementation of SSRs in the post-conflict reconstruction process in South Sudan have been hampered by several challenges stemming from both national and institutional shortcomings. One of the major impediments to this is that the legitimacy of political authority has always been challenged. In addition to being a source of instability and a barrier to the development of an inclusive national identity, "the lack of a legitimate political authority makes it impossible to determine a strategic direction and make the difficult decisions necessary to achieve security sector change" (Detzner, 2017). As a result, no distinction exists between the Army (SPLA) and the ruling party, (SPLM) (Rolandsen, 2007). Because of these overlapping roles, every political difficulty is a security challenge, and every security challenge is a political one. Juma and Odhiambo (2021), posit that the fervor for regionalism is etched in the minds of the political class globally. Some advocate for continental integration while others call for regional groupings that consist of few states whose defining criterion is territorial contiguity.

1.2 Statement of the Problem

Conflict in South Sudan has continued to escalate despite IGAD's and international community efforts to cease hostility between the warring parties in the country through the formulation and implementation of successive peace agreements. It can thus be argued that failure to address the gaps in the previous agreements and loopholes in the architectural design of the agreements explains the reason of the relapse into violent conflict. For example, the failure and challenges that engulfed the implementation of the ARCSS (2015), hampered efforts meant to secure tangible conflict mitigating SSRs in South Sudan; consequently, prompting the formulation of the R-ARCISS 2018. The new agreement R-ACRISS (2018) was aimed at filling in the gaps associated with the former Agreement (ARCISS 2015). Regrettably, the new agreement does not seem to have had the desired impact in creating responsive SSRs.

Although numerous studies have examined the nexus between the architectural design of peace agreements on SSR (Blackings, 2018; Young, 2007; Huber & Karim, 2017; Bhattacharya & Burns, 2019; Tshibangu, 2020), a systematic and comparative examination of the influence of the architectural design of ARCISS 2015 and R-ARCISS 2018 peace agreements on SSRs is yet to be undertaken. DDR being an important process that creates a conducive environment for SSR especially in countries emerging from prolonged armed conflict, there is scanty literature on the status of South Sudan's peace agreement outputs enabling DDR.

In view of the foregoing discourse, it is evident that understanding the contribution of the architectural design of peace agreements on conflict mitigating SSR in South Sudan since 2015 remains largely unexplored. This ought not to be so in a country facing a conundrum of security challenges. As such, making empirically informed recommendations on how peace agreements in conflict-prone societies can be designed to achieve conflict-mitigating security sector reforms such as security forces reorganisation, citizen participation for receptivity of improved security, and security sector reforms marked by cultural, human, organisational and political change.

1.3 Objective of the Study

Examine the status of South Sudan's peace agreement outputs enabling disarmament, demobilisation and reintegration.

1.4 Research Question

Have South Sudan's peace agreement outputs enabled disarmament, demobilisation and reintegration?

1.5 Justification of the Study

1.5.1 Academic Justification

This study supplements the limited literature that exists explaining how peace agreements impact the post conflicts security reforms in South Sudan and the effective implementation of SSRs in the country. Therefore, it will offer academicians an in-depth understanding of the relationship between peace agreements and post-conflict SSRs. Providing a platform for the analysis of the relationship in countries that could still be facing such challenges following the end of prolonged armed conflicts. This would result in more research on the study.

1.5.2 Philosophical Justification

The philosophical grounding of this work came from three main theories, namely John Paul Lederach's Peace building Theory, the Securitisation Theory, and Arnstein's Citizen Participation Ladder. The three in conjunction lent themselves well to the discussion of the key constructs of the work which were the structural design of peace agreements, the outputs of the agreements (DDR) and the eventual security sector reform outcomes. It was pertinent to understand how the concepts of the architectural design of peace agreements interact with its outputs to inform the direction of security sector reforms and transformation. The discourse on the application of these theories and models to the study concepts served to extend the boundaries of knowledge in the discipline of peace and conflict studies.

1.5.3 Policy Justification

The study will be essential in guiding the formulation of responsive peace agreements in future. The study would produce empirically tailored policy recommendations rooted in the current socio-economic and political environment prevailing in the country which can offer an acceptable academic discourse that can inform policy direction, consequently, facilitating cessation of hostilities, protection of human rights and a return to the peace process. It would also be instrumental in informing regional bodies in Africa that have taken leadership roles in the mediation of conflict on how best to; approach a conflict situation, compose/constitute the mediation teams, undertake the process and the importance of the actors in the implementation to attain sustainable peace.

II. PEACE AGREEMENT OUTPUTS AND THE DDR PROCESS

DDR process has been considered as preliminary efforts towards SSRs in countries recovering from protracted armed conflicts. UN has played a key role in the process aimed at "contributing towards security and stability in post-conflict environments so that recovery and development can begin" (Humphreys & Weinstein, 2008). However, in many cases, peace is critical for a successful DDR (Ballentine, 2002). In most cases, the DDR process is preceded by the cessation of hostilities and a peace agreement between warring parties. Failure to reach an agreement may result in a process of recycling of combatants by the armed groups in the recruitment camps or centres (Ballentine, 2002). Additionally, if there are divergent interests between the groups which have not been addressed in the peace agreement, the process faces a myriad of challenges (Carames *et al.*, 2006).

Transparency and inclusivity which encouraged trust and confidence between parties, in-depth analysis of the causes of the conflict in formulation and designing of DDR programmes were the issues raised during the DDR conference held by the UN in "Angola, Burundi, Democratic Republic of Congo, Liberia, Mozambique, Rwanda, the Republic of Sierra Leone and Zimbabwe." DDR programmes should be fully entrenched in post-conflict reconstruction frameworks and if not adequately addressed in any post-conflict State, the chances of failure are high (Knight, 2008). Success in the DDR process requires concerted efforts of all the actors involved in the peace agreement process. However, the national government and rebel groups play a pivotal role in planning, designing and proper implementation of DDR programmes.

The Importance of Trust-building transparency and Inclusivity cannot be overemphasized. The main objective of an agreement is national implementation which includes assigning roles, responsibilities, and resources to all people both in rural and urban areas (Collier & Hoeffler, 2002). The process involves local, regional, and international actors for its success. In this light, the prospects for the success of peace agreements depend on the existent framework for the participation of the various actors. It is generally believed that the peace agreements should be all-inclusive, address the root causes of the conflict, come out at the ripe moment, be promoted by a neutral facilitator, provide a peaceful solution, and be locally owned by the conflicting parties (Paffenholz, 2015). In this context, it can be argued that any new agreements in South Sudan should be as inclusive as possible.

The implementation process of the ARCISS 2015 was expected to be based on transparency and inclusivity which build trust and confidence locally and internationally (Kelly, 2016). The process comprised of local and international actors who were required to be flexible and reflect the specific context and character of South Sudan. Additionally, the process encouraged public participation in decision-making and implementation. Prospects for the success of peace agreements were however affected by weakened or lack of government structures and institutions, the abundance of ex-combatants, ineffective Disarmament, Demobilization and Reconstruction (DDR) programmes, traditional cultural practices, ethnicity, and lack of political will, which often contribute relapse into conflict. This was exemplified in Darfur where these factors often led to relapse to conflict and failure of peace agreements between 1997 and 2000. Structural weaknesses related to the inability to reign in the proliferation of small arms and the inability to deal with ethnic-based militia groups also contributed to the failure of peace agreements (Ahere, 2012).

It is equally important to ensure the concerted efforts of all the actors. Islam (2017) studied "Conflict Resolution and Civil Society: Experiences of Nepal in Post-Maoist Revolution." This study focused on the process of peace-making to prevent armed conflicts. This process involves various actors participating in the social, economic, and political sectors of a country, although the civil sector has been left out in the case of Nepal. Nepal has witnessed a decade of violence which was ended by the pro-democracy movement launched by the Seven Party Alliance (SPA) and the Communist Party of Nepal (Maoist) (CPN-M) and the resigning of King Gyanendra in 2006. The findings show that the role of civil societies in post-Maoist Nepal was well defined and effective as they helped the people in searching for a common ground for conflict mediation and peace in Nepal after years of conflicts. This literature is useful in providing

a variable for measure, the importance of concerted efforts by all actors. However, it left a gap regarding whether this was the case for South Sudan, which the current study endeavoured to fill.

2.1. Conceptual Framework

Wasike and Odhiambo (2016) discuss the role of theories in guiding the thrust of academic studies. They emphasize the importance of theories in offering compelling and incisive causal explanations with calculated precision. They buttress their argument by quoting Smith (1986) who asserts that theories play the role of predicting, prescribing, and evaluating socio-political phenomena hence they cannot be ignored.

2.1.1. John Paul Lederach's Peace Building Theory

The theory was proposed by John Paul Lederach in the late 1980s and early 1990s during the end of the cold war. John Paul Lederach argues that due to the complexity of contemporary conflicts there is a need for holistic approaches away from traditional diplomacy in order to prevent and end the escalation of these conflicts. He suggests holistic approaches that include peace building and peacekeeping as long-term solutions to war that will lead to peace and stability. Since many conflicts are based on identity and relationships between the groups, there is a need to identify and determine the various shared meaning, explore different shared cultures, the experience of different actors, and their perceptions (Wilkin, 2016).

According to Lederach's theory, a change in personal, structural, relational, and cultural aspects of conflict will eventually translate into peace, justice, mercy, truth, and stability (Lederach, 1997). In this case, South Sudan is an example of a society that has lived by the gun for over two decades that requires a total transformation to accept any change. The hardened culture may influence the fallacious belief that "if peace was gotten by the gun, it can be maintained by the gun"; and may remain committed to this culture. It is important to note that post-conflict reconstruction and building stakeholders' confidence in security requires changing the attitude, training, and balancing the ethnic and regional composition of all (Michael, 2003). Lederach's theory, stresses the need for reconciliation and peace building as solutions for building long-term prospects and rebuilding destroyed relationships within the society.

2.1.2. Arnstein's (1969) Citizen Participation Ladder

Arnstein (1969) created a model of a "ladder of citizen engagement" that defines eight categories that correlate to the eight rungs of a ladder. The ladder's rungs represent increasing intensities of participation. The lowest tier of partnerships is the manipulative type, in which citizens are involved by being appointed to rubberstamp advisory boards and committees for the sole aim of educating them and engineering their support. The lowest level represents the perversion of participation into a public relations vehicle by those in power, rather than genuine citizen participation. A situation is presented in which it is the government officials, not the public, who do the educating, the convincing, and the advising. Members of the community are often asked to put their names on documents endorsing policies on which they had no input. Further step, there is the therapeutic partnership. Group therapy is masked as citizen participation' with administrators (typically mental health professionals such as social workers or psychiatrists) assuming that helplessness is synonymous with mental illness and then imposing their own brand of clinical group therapy on the citizens. Many people are working hard, but their efforts are focused on helping people overcome their "pathology" rather than addressing the prejudice and trauma that gives rise to it (Arnstein, 1969).

The next tier up, the Informing Type of Relationship, is characterized by a one-way flow of information from officials to citizens, with no outlet for feedback and no power for bargaining. Citizens are informed of their rights, obligations, and options in this partnership. This type typically shows itself at meetings where attendees are given only the most cursory information and are discouraged from asking pertinent questions. On the fourth level, the Consultative Type of Partnership, officials typically solicit community input but offer no assurances of action based on that feedback. Attitude surveys, neighbourhood gatherings, and public hearings are the most common approaches to gathering public input.

Arnstein (1969) contends that the threshold at which citizens start to have some impact, although tokenism, is the Placation Type of Partnership. Placing a small number of "deserving" impoverished people on the boards of Community Action Agencies or other public organisations is an example of a placation tactic. While citizens are welcome to provide their opinions, they have no meaningful say in policymaking. It is the level of community organization and the quality of technical aid citizens receive in identifying and articulating their goals that determines the amount to which they are appeased. At the next stage, Meaningful Partnership, citizens and those in authority come together to negotiate a new balance of power. They've settled on joint policy boards, planning committees, and methods for resolving impasses as means of dividing and conquering the planning and decision-making workload. No one party can force a shift (Arnstein, 1969). Next comes the Delegated Power Partnership, in which individuals negotiate with government officials to get preponderant say over a certain initiative. At this juncture, citizens are in a position of power that allows them to ensure the program is accountable to them.

The model was found useful in informing the study regarding the variables to be measured so as to determine the level of community participation in the processes of both the Peace Agreement and establishment of the security sector reforms. More importantly, it also provided a means of assessing the type and level of community engagement by government and non-governmental

organisations. The model helps to overcome the weaknesses of Lederach's model, because it goes beyond suggesting the importance of inclusivity to prescribing indicators that can be used to ensure meaningful participation.

2.1.3. Securitization Theory

State actors engage in securitization when they elevate previously mundane political issues to the status of "security," justifying the employment of extreme measures in the name of protecting the nation's citizens (Buzan, 1998). Problems that have been turned into security threats are not always those that are necessary for the objective survival of a state; rather, they are problems that someone has successfully constructed into an existential threat (Giovanni, 2006).

Theorists of securitization argue that the subjects that are most easily securitized receive a disproportionate share of resources and attention at the expense of those that are more difficult to securitize but result in more human suffering. The goal of the study of securitization is to determine "who securitizes, on what issues (threats), for whom (referent object), why, with what effects, and least of all, under what conditions" (emphasis added).

2.1.4. Social Constructivism Theory

Social constructivism contends that societies shape the identities, interests, and capacities of individuals (Barnett, 2006). The theory stresses that human action is linked to the subjective constitution of social reality and interests are constructed by the environment and interactions (Williams, 2007; Barnett, 2006). That acceptable action may inform how the state organizes its security structure and how to defend its interests. Constructivism acknowledges that culture matters to some degree, and it is generally accepted that both cultural factors and realist imperatives are inextricably linked with state and military behaviour.

Social constructivism and organisational culture inform the design of socio-political structures of societies and states. They also influence how that society will react to the changes in the security environment and the socio-political structures. Resistance to change can be informed by history, the experience of that society, how often has change been initiated over the years, and how this change is likely to affect the social structures related to power. Change can be categorised in terms of structure, interests, behaviour, and roles of various components within that society. The socio-political environment that has been shaped by the 'hardened' culture of violence and militarization of the society to an extent that the military assumes the lead role in both the political and social arena may pose a challenge towards post-conflict SSRs. South Sudan is an example of a society that has lived by the gun for over two decades that requires a total transformation to accept any change.

The socio-political landscape in South Sudan is influenced by the supremacy and dominance of SPLA (Military wing) over SPLM (political wing). Interests, capacities, and identities of the society were informed and continue to be informed by the character and nature of SPLA and its organisational structure. This environment shaped the society's thinking, beliefs, and behaviour to the extent that certain post-conflict reconstruction activities may not be informed by the interests of the populace but by those of SPLM/A and its elite. The decision by most of the political class to retain their military ranks is informed by their past military dominance. Retiring from the military is linked to loss of the power to control and dominate. Such organisational culture alludes to social constructivism. Change in the organisation of the security sector may occur only when the political class is willing to institute such changes. This study, therefore, adopts the theories of social constructivism and rational choice together with the organisational culture concept as the conceptual framework since it attempts to explain the socio-political challenges that could affect the architectural design of peace agreements the associated SSRs, and post-conflict reconstruction in South Sudan.

2.2. Conceptual Framework Model

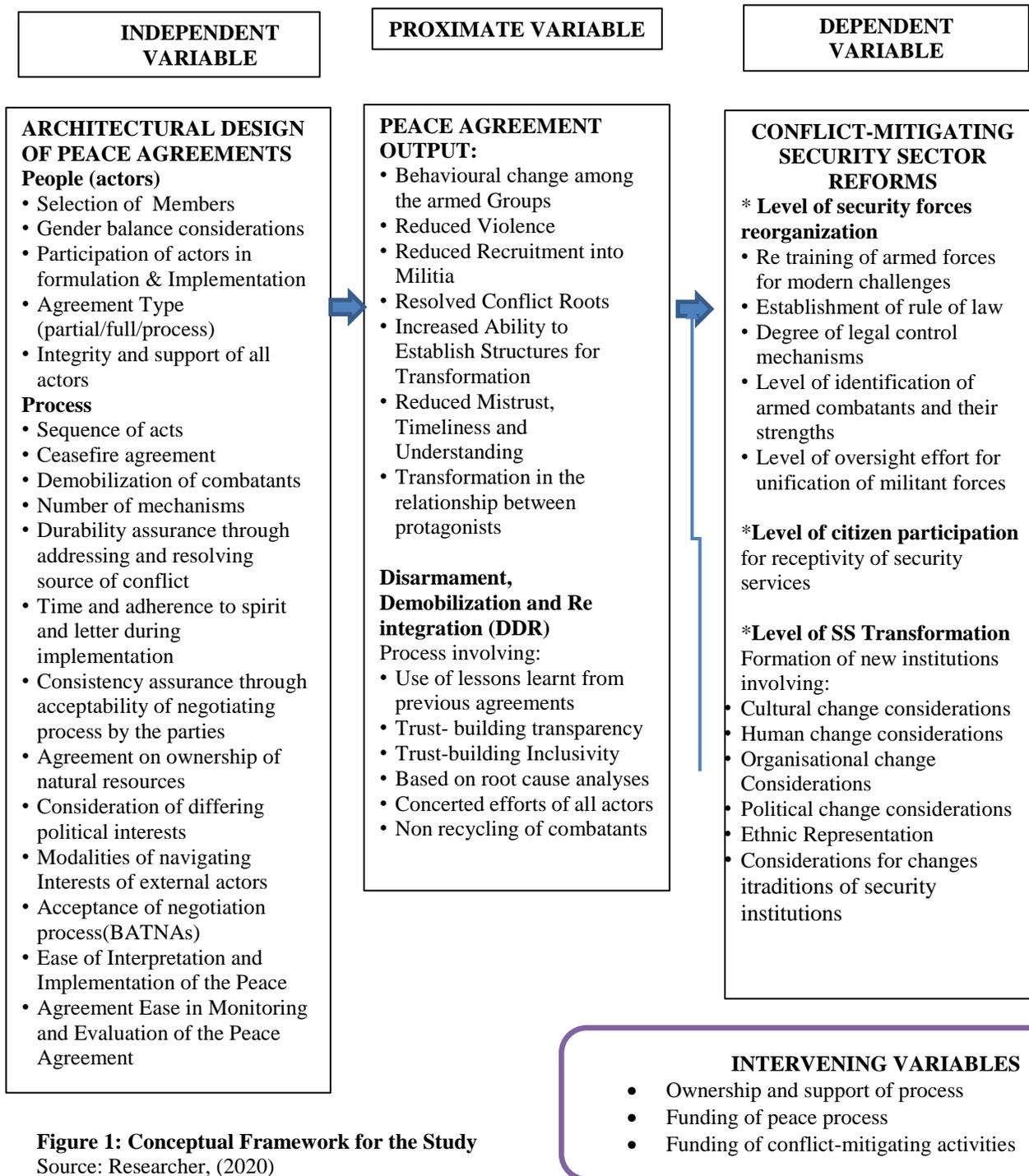


Figure 1: Conceptual Framework for the Study
Source: Researcher, (2020)

III. RESEARCH METHODOLOGY

3.1. Research Design

This study primarily adopted a descriptive cross-sectional survey design, with correlational and explanatory research elements to investigate the effect of the architectural design of peace agreements on conflict-mitigating security sector reforms in South Sudan since 2015.

A descriptive cross-sectional survey design was utilized because ensured the expansiveness of data and exact distinct investigation of attributes of a specimen were utilized to make deductions about the populace.

3.2. Study Area

This publication is licensed under Creative Commons Attribution CC BY.

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13070>

www.ijsrp.org

South Sudan is a landlocked country of the East-Central Africa region. The country gained independence from Sudan in July 2011. Its capital city is Juba. The country borders Sudan, Ethiopia, Kenya, Uganda, the Democratic Republic of Congo, the Central Africa Republic, and Ethiopia. The study was conducted in South Sudan, in the regions of Upper Nile, Jonglei, Unity, Warrap, Northern Bahr El Ghazal, Western Bahr El Ghazal, Warrap, Western Equatoria, Central Equatoria, and Eastern Equatoria. These regions served as the cluster study sites.

South Sudan is traversed by the White Nile, which forms the vast swampy areas known as the Sudd. South Sudan has a population of about 12 million people, with most people being of the Nilotic peoples, (UNDESA, 2017). The main religion is Christianity. Due to persistent conflict, the country ranks the highest score on the American Fund for Peace's Fragile States Index (2018). The main ethnic groups are the Dinka (about 15% of the population and Nuer (about 10%). The main export from the country is oil. Like most other developing countries, the country is highly reliant on agriculture which includes crop and livestock production. On average, the temperatures are always high. The country experiences both rainfall and dry seasons but on average, the coolest month is January.



Figure 2. Map showing South Sudan Regions under Influence of Different Armed Groups
Source: UNMISS, 2014

3.3. Study Population

The target population was Former and current members of armed groups in South Sudan which is estimated to be more than 300,000. The units of analysis, corresponding were the individual that once belonged to an armed group within the study cluster, and the peace agreement elements that touch on its design, its implementation, monitoring and evaluation.

The study population comprised key informants representing religious leaders, politicians, academicians, media houses, non-governmental organisations, IGAD mediators, JMEC members, and UNMISS staff. The study population also included ordinary community members and members of security agencies participating in separate focus Group discussions.

3.4. Sample strategy and sample Size Determination

The total population (N) of members of armed groups (whether actively or formerly) was approximately 300,000 which is more than 10,000. The sample size for the study (n), was calculated using the formula proposed by Fisher *et al.* (1983), which is quoted in Mugenda and Mugenda (2003) for use in social science surveys. It produces a desired sample size of 384:

$$n = z^2 pq / d^2$$

Where n is the desired sample size if the target population > 10,000

z is the standard normal deviate at the required confidence level i.e. 1.96

p is the proportion in the target population estimated to have the characteristic

(Assume 50% if unknown)

q = 1-p (i.e. 0.5)

d is the level of statistical significance or Alpha

Therefore, the number of respondents sampled was 384.

The study employed a multistage sampling strategy to arrive the study subjects. The whole area was divided up into clusters, each representing the main zones where the groups are located. The zones, were the Pro government zone; anti-government zone; Contested Zone; Government-aligned zone; declared 'peace zone' between SPLA and SSDM/Cobra; Sudan People's Liberation Army

(SPLA) concentration zone and SPLA in Opposition concentration Zone. The distribution of these groups roughly coincided with the administrative areas of Upper Nile, Jonglei, Unity, Warrap, Northern Bahr El Ghazal, Western Bahr El Ghazal, Warrap, Western Equatoria, Central Equatoria, and Eastern Equatoria. These areas formed the 10 clusters of the study.

3.5. Data Collection

The data collected was from both primary and secondary sources, and both quantitative and qualitative tools were used. The primary data tools included a pre coded structured individual questionnaire, Key Informant Interview Guides, Focus Group Discussion Guides, Document Content Analysis Guide and a Digital Camera.

3.6. Data Analysis and Presentation

Questionnaires were cleaned and verified while still in the field. After the data was collected, it was edited, coded, classified, tabulated, and analysed. To make data collection easier, all statements were given numeric codes based on their context. The quantitative data was analysed in tables and charts using SPSS version 20 and the Microsoft Excel Statistical Packages. For explanation and clarification, data from the study were presented using descriptive statistics such as tables, pie charts, bar graphs, and percentages, as well as inferential statistics (Pearson correlation and, regression analysis). Data from Key Informant Interviews and Focus Group Discussions were analysed and presented according to the themes of the study and presented alongside the quantitative data in a synchronised manner. Direct quotations were used to present verbal reports that occurred during the research process. Document Content analysis was similarly done according to the themes corresponding with the objectives of the study and presented alongside the other data.

IV. FINDINGS

4.1. Reduced Violence as an Output Indicator

The study results reveal that reduced cases of violence were not realized as an output of the agreement, as only 73 (19.1%) respondents responded in the affirmative when asked about this. The majority (175) of the respondents which makes 45.6% responded in the negative, while 135 (35.3%) responded that this was somehow the case (Figure 3).

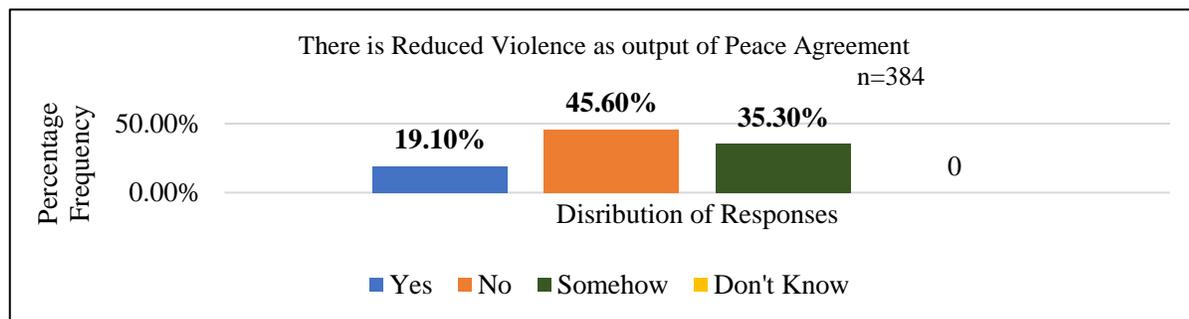


Figure 3: Distribution of Responses Regarding Reduced Violence

Source: Field Data, 2020

The results clearly indicate that there was some return to violence after the peace agreement. Most of the critical phase and implementation mechanisms/institutions in both agreements were predicated on the formation of the transitional government of national unity (TGoNU) which in both cases took a long time to be formed. Comparatively, in the case of the Lomé Accord, an agreement between the Government of Sierra Leone and RUF in 1999, instead of the formation of the TGoNU, a “Commission for the Consolidation of Peace (hereinafter termed the CCP), was established to implement a post-conflict programme that ensures reconciliation and the welfare of all parties to the conflict, especially the victims of war”. The peace accord was not as rigid as the case of ARCISS 2015 and R-ARCISS 2018 where the opposition leader was to occupy a position that was almost at the same level as the President but rather in the case of Sierra Leone, the RUF leader Foday Sankoh was to be appointed to “the chairmanship of the Board of the Commission for the Management of Strategic Resources, National Reconstruction and Development (CMRRD) and enjoyed the status of Vice President and therefore be answerable only to the President of Sierra Leone.” This agreement can be seen as one where the opposition was made to understand and acknowledge the existence of the President of Sierra Leone and in no way they the agreement was raising them to his level like was in the case of the ARCISS 2015 where there were to be two Commanders in Chief during the transition period. By giving Riek Machar such an appointment was to assume that he is equal to the elected president and could be in a way legitimizing his actions to engage in armed conflict. This notion can be seen as one that gave him such audacity that led to the ‘palace coup’ in December 2013 sparking the return to violence.

Document Content Analysis findings showed that, after the formulation of the R-ARCISS 2018, violence declined but was never completely eradicated. Between December 1, 2019, and February 15, 2020, there were more than 449 civilian casualties (EASO, 2020). These conflicts were perpetrated by community-based militias and armed elements such as the SSPDF and SPLM-IO. There was insecurity related to Upper Nile state (Maiwut and Jikou), Western Equatoria state, Central Equatoria state (Yei and Lobonok), Lakes state, Jonglei state (including Pibor), Western Bahr el-Ghazal state, Warrap state, and Unity state. Policing the whole country remained very challenging for the security forces and their authority continues to be challenged by the armed groups.

4.2. Results Regarding Reduced Recruitment into Militia as an Output Indicator

Respondents were asked whether there was reduced recruitment of people into the militia, as positive output indicator of the peace agreements. The results are displayed in Figure 4; out of 384 respondents, 189 (49.1%) responded in the negative while 25 (6.5%) claimed to not know. A third of 30% (115 respondents) said that this was somehow the case.

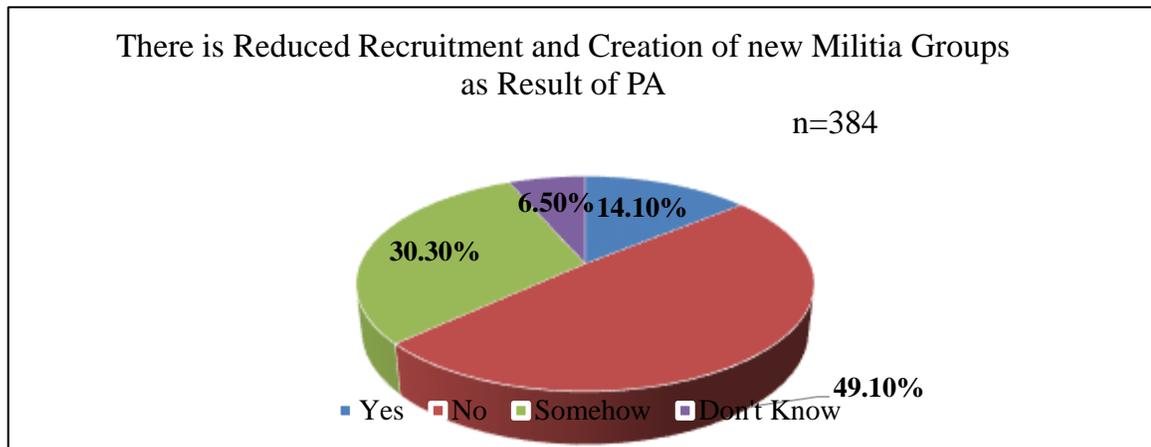


Figure 4: Distribution of Responses Regarding Reduced Recruitment into Militia
Source: Field Data, 2020

Document Content Analysis findings are congruent with this. It is asserted that factionalism, splits, and loose affiliation remain common in SPLM/A and other armed groups in South Sudan. Armed groups continue to coalesce so frequently to an extent that the implementation of a peace agreement becomes a challenge. At the same time, as alluded to earlier it becomes difficult to hold into account most of the armed groups that do not respect the agreement. Peace agreements were expected to reduce this and therefore, respondents were presented with the statement, “peace agreements have addressed loose affiliations of the armed groups.” A summary of the respondents’ opinions is in Table.1.

To this, 127 (33.1%) respondents pointed out that they were not sure. This was followed by 109 (28.4%) who agreed. It can thus be deduced that the peace agreements had sought to address some of the issues related to how military groups were organized in the bid to move them to cantonment areas. However, these efforts were not as strong as shown by 94 (24.5%) who disagreed. This means that some of the groups could continue shifting affiliations; challenging SSRs in the country as argued by Steadman (2001).

According to the international crisis group report (2020), “managing the many armed groups across the country is a particularly pressing concern and the promised army reform is a huge challenge. The other key challenge to SSR is that ex-combatants and various armed groups rank, and file are normally interested in short-term benefits rather than waiting for long periods without knowing their fate. Most combatants expect to be integrated into in South Sudan Peoples Defence Force (SSPDF).

The peace agreement was silent on the recruitment process by the various groups, and it is evident that as they wait for the SSRs armed groups including those that signed the peace agreement are recruiting new members. This situation has monetary implications for the planning and subsequent execution of the DDR process and the SSRs. The numbers of combatants are critical to the commanders and the communities since DDR and SSRs will determine their integration to SSPDF or be given compensation to reintegrate. Combatants are less likely to give up arms or participate in the DDR process if the peace process is shaky and does not guarantee their security and their future as “civilians”. (Hopwood, *et al.*, 2008). This was affirmed by one of the Key Informants said:

The 2015 ARCISS, cognisant of the deep and historical hatred between the Dinka and the Nuer, suggested a military leadership with two Commanders in Chief(C-in-C). This type of organisation sought to entrench division rather than bridge the gap. It was a short-term solution to a deep-rooted problem (Juba, August 10, 2019).

It is thus evident that peace agreements had not dealt with the issue of entrenched ethnicity among the various armed groups which could derail SSRs implementation. A study by Hutchinson (2001) shows that SSRs in South Sudan were challenged by lack of

clarity in the objectives of political movements. When this clarity lacks, like in the case of SPLM/A, the movement remains perpetually susceptible to internal and external manipulation (Hutchinson, 2001). The SPLM/A thus remains largely susceptible to the influences of neighbouring states such as Sudan, Ethiopia, and Uganda as well as the international community.

4.3. Resolved Conflict Roots as an Output Indicator

Respondents were asked whether there was indication that conflict roots had been resolved. A large majority, 294 (76.6%) out of 384, responded in the negative. Only 8 (2.2%) responded in the affirmative, and 81 (21.2%) said somehow.

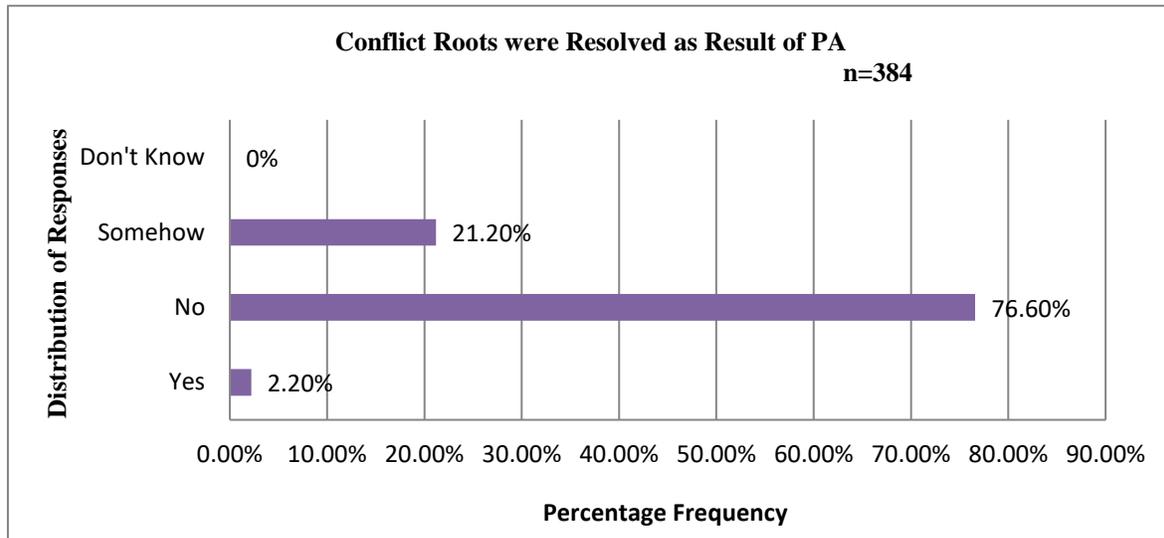


Figure 5: Distribution of Responses Regarding Resolved Conflict Roots

Source: Field Data, 2020

Without the root causes being resolved, there is unlikely to be meaningful support for the process, particularly of the DDR by senior military officials. In this regard, shifting loyalties and rebellion could have negative effects on SSR in South Sudan as revealed in an interview with a South Sudan general who opined;

The resignation and declaration of rebellion against the government of several high-ranking military officers such as “the SPLA Deputy Chief of General Staff for Logistics, the SPLA Head of Military Courts, the SPLA Director of Military Justice, the SPLA Logistics Support Brigade Commander, as well as former Chief of General Staff Paul Malong,” signal further factionalization that will need to be overcome (Nairobi, 8 December 2020).

These findings show that lack of support by senior military officials remained a major challenge to DDR. There should thus be mechanisms for enforcing compliance with peace agreements by military generals irrespective of rank in addition to political, ethnic, and armed group affiliation. These findings can be linked to several factors that have continued to bedevil SPLM/A since its formation and the political environment in South Sudan since independence in 2011. These factors are lack of a strong ideology within SPLM/A, ethnicity, mistrust among ethnic communities, the dominance of the military over the political wing in SPLM/A, and the inability to develop a national conscience.

In South Sudan, the major communities still mistrust each other and often revert to their ethnic cocoons wherever they are required to coalesce as communities within a state thereby reinforcing their ethnic ideologies. Young (2003) contends that the problem of SPLM/A is not that it’s dominated by one ethnic community, but it has done little to fully embrace other ethnicities. This situation continues to exacerbate the proliferation of armed groups thereby emboldening the perceived notion of military dominance. According to Metelits (2004), the continued dominance of the army over the civilian element ensures that the military is focused on command and control of the Government.

4.4. Increased Ability to Establish Structures for Transformation as an Output Indicator

The respondents were asked whether there was an increased ability to establish structures for transformation. Most of them, 255, (66.5%) of the respondents answered no and 46 (11.9%) said they did not know. The remainder 77 (20.1%) answered in the affirmative.

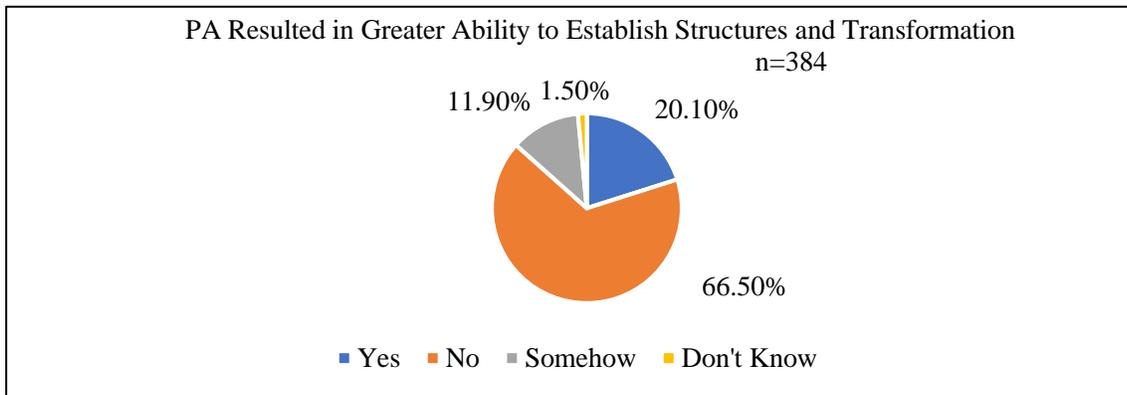


Figure 6: Distribution of Responses Regarding Increased Ability to Establish Structures for Transformation
Source: Field Data, 2020

Document Content Analysis findings from the “Report on the status of implementation of the Revitalized Agreement on the Resolution of the Conflict in the Republic of South Sudan (1st January to 31st March 2020)” reveal that as of March 31st, 2020, the Permanent Ceasefire between the signatories of the R-ARCISS 2018 had continued to hold (Njoroge, 2020). This showed a high level of commitment by the different parties to the agreement which could have positive ramifications on SSRs in South Sudan. However, the inability of the transitional government to police the country was still evident. Also, a security vacuum emanating from the delay in the restructuring and reconstitution of State authorities including but not limited to the appointment of governors created a rich ground for this violence. There were also cases of continued violent inter-communal clashes, cattle raids, and revenge attacks. Most of these, as already pointed out, took place in Greater Bahr el Ghazal, Lakes, Unity, Jonglei, Greater Upper Nile, and Abyei. Violence was more protracted among the youth and led to the loss of life, injuries, and destruction of property. Odhiambo (2014) argues that: Track Two diplomacy has two broad objectives; first of all, it aims to reduce conflict between groups and nations by improving communication and understanding. It tries to lower anger, tension, fear, and misunderstanding. It tries to humanize the face of the enemy and get one group to understand the other group’s point of view.

The findings further reveal that there had also been delays in the “screening, selection training, and redeployment of the Necessary Unified Forces (NUF).” Although these tasks were supposed to take place in the Pre-Transitional Period, they could not take place and be carried forward into the Transitional Period. By the end of March 2020, the various cantonment sites, barracks, and training centres saw the registration of about 78,500 personnel (Njoroge, 2020). Out of these, about 45,000 organised forces from the government as well as the opposition had moved from cantonment sites to training centres. This was done as a prelude to unification training as well as redeployment thereafter. Commencement of training was however hampered by significant imbalances in the number of government and opposition forces and challenges related to the provision of logistic support. At the same time, the commencement of training prior to DDR was procedurally wrong. One of the JMEC staff noted that:

“Although efforts had been put in place to ensure immediate demilitarization of all civilian areas during the Pre-Transitional Period as envisaged by Article 2.2.3.1 of the R-ARCISS 2018, 19 civilian centres remain occupied by the SSPDF. These include 8 centres in Torit, 5 in Yei, 3 in Malakal and 3 in Yambio” (Juba, August 12, 2021).

Although the number of occupied centres has dropped significantly, defiance to the requirements of the R-ARCISS 2018 by security forces shows a lack of serious commitment to some pertinent issues of security concern by government forces.

V. RESULTS REGARDING EASE OF INTERPRETATION AND IMPLEMENTATION OF THE PEACE AGREEMENT

Respondents revealed that, overall, it was not easy to interpret and evaluate the Peace Agreement. Out of 384 respondents, 263(68.4%) responded in the negative when the question was posed to them regarding whether the PA was easy to interpret and implement. Another 115 (30%) answered in the affirmative while 4 (1.1%) did not know whether or not it was.

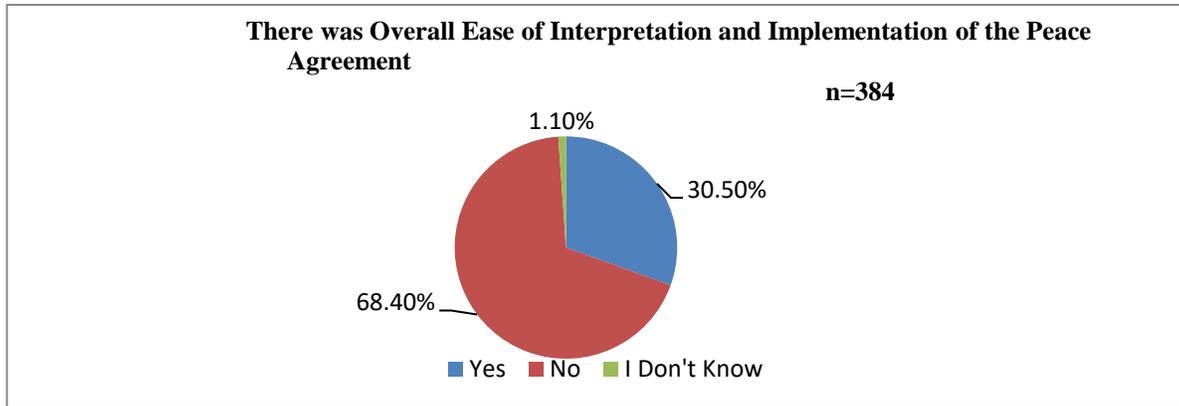


Figure 7: Distribution of Responses Regarding Ease of Interpretation and Implementation of the Peace Agreement
Source: Field Data, 2020

The implementation of a peace agreement determines its success, and it is paramount that the agreement’s framework includes a mechanism that effectively monitors its implementation. At the same time, the mediators must be cognisant of the spoilers and put in place punitive measures should any of the parties renege on their commitments to peace. Juma and Odhiambo (2021) in their article titled “Geo-Political factors Influencing Kenya and Tanzania Foreign Policy Behaviour Since 1967” said that: Geopolitical factors have an overwhelming influence on formulation and projection of foreign policy. The Indian Ocean and the rivalry of superpowers, the Horn of Africa, war on terror originating from the Horn, China and US rivalry, the instability in the Great Lakes region, the discovery of fossil fuels in Kenya and the Nile Basin are well articulated as the geopolitical factors that must be taken into account regarding foreign policy formulation and projection.

The challenges facing interpretation of the peace agreement also led to challenges in ensuring speedy SSRs in South Sudan. One of the key issues entailed cantonment (Blackings, 2018). Cantonment was a controversial issue therefore it took a long time to take stock of the number of troops, both on the side of the government and the various armed combatants. With SPLM and SPLM-IO having differing motives as well as different interpretations for cantonment, it became at tall order implementing some provisions of ARCISS 2015 and the R-ARCISS 2018 in general. Peace agreements should be designed to create a common understanding with little or no room for individual party’s own interpretation. In this regard, SPLM-IO for example saw cantonment as an avenue to stamp their presence and authority in Juba, Jonglei, Unity, and Upper Nile which has been hotbeds for conflict. By so doing, this looked like an opportune moment created by the peace agreement to bolster their national outlook.

Conversely, the government felt that they would gain less from the cantonment provisions within ARCISS 2015 (Blackings, 2018). The requirement of demilitarization of Juba, as espoused in ARCISS 2015, for example, was perceived to be SPLM-IO to a position of advantage since the seat of GoSS is domiciled there. This led to immense reluctance by SPLA to implement the cantonment provision especially in the Equatoria region and Juba. The argument was before the 2013-armed conflict SPLM/A-IO did not have any presence in Juba so the establishment of a cantonment was not necessary. This lukewarm commitment and lack of trust between the signatories to the peace agreement arising from conflicting interpretations led to a dilemma that partially accounted for the collapse of the ARCISS 2015. This makes it apparent the failure to create mechanisms for mitigating challenges related to self-centred interpretations of ceasefire and peace agreements by the different factions in South Sudan can be blamed for the woes that faced ARCISS 2015 as well the delayed implementation of some provisions of the R-ARCISS 2018. Odhiambo *et al* (2013) in their article “War Termination in Somalia & Kenya Defence Forces’ (KDF) Role” stated that: Wars have a political agenda and to effectively bring a conflict to termination, the political nature of the conflict must be addressed. The military as a professional establishment is charged with the means to achieve these political objectives. Decisive military advantage alone however does not necessarily confer an end to the war. The decision to terminate the war is primarily a political decision due to the underlying nature of war as an instrument of policy

There are at least “three types of defects in South Sudan that either enable or block rebel-to-party conversions for the sake of boosting post-war nations' prospects for peace and democracy” (Kovacs & Sophia, 2016). These weaknesses have affected the peace agreements that underpin the interpretation and implementation procedures; slowed the pace of implementation, put a strain on hostile party relations, and in the worst-case scenario, caused some parties to back out of their commitment to a negotiated settlement. During drafting of peace agreements, uncertainty is the most prevalent and most benign of these vulnerabilities. Mediators, or those drafting peace agreements reason that if two parties have clear and opposing desires, and neither side seems to be willing to accept part of its full demand, at the same time the parties are unable to negotiate those compromises in more detail, the question of competing interests

can be resolved by creating a compromise position in a rather rudimentary manner. Mediators may create a formula that is open to at least two different interpretations, which may have at least two definitions, one to satisfy Party A's interests and the other to satisfy Party B's interests.

The mediators, thus, preserve the credibility and comprehensiveness of the draft and, at the same time, take a small step towards elaboration. In other words, ambiguities ensure that, on the one hand, the parties maintain their individual opinions of "how things should proceed" and that, on the other, a shared language is adopted that can be used fairly by all parties later (Van den Berg, *et al.*, 2014). Ambiguities are dangerous because they contribute to misinterpretation and non-compliance with the peace agreement, as compliance is almost difficult to explain if the parties to the agreement lack a clear understanding of compliance conditions. Therefore, the application of a vague or ambiguous arrangement cannot, in good faith, lead the parties to the treaty to comply or to enforce the treaty. This infers that the mediators create such scenarios so that parties can sign the agreement while fully aware that there may be challenges in the implementation.

Table 2 Influence of External Actors in Internal Political Arrangements and Implementation of Peace Agreements

Statement	Strongly Disagree		Disagree		Not Sure		Agree		Strongly Agree		TOTAL		Weighted Mean	Std. Deviation
	F	%	F	%	F	%	F	%	F	%	F	%		
Influence of external actors in the internal political arrangements of the country affects the implementation of peace agreements	23	6	68	17.6	86	22.3	161	41.9	46	12.2	384	100	3	1.095

Source: Field Data, 2020

In response, 161 (41.9%) respondents agreed. Since another 46 (12.2%) strongly agreed, this shows that those who agreed with the statements were more than half (54.1%). As such, it can be deduced that interference with the internal political arrangements as envisaged by the peace plans could frustrate SSRs by deepening political animosities between various warring groups. This agrees with Katja (2009) in "should peacemakers take sides? Major power mediation, coercion, and bias" who argues that external interference is a major challenge facing the success of peace agreements.

The thin line between political and military jurisdictions and responsibility in South Sudan has led to political interference thus complicating the socio-political environment. Such interference has often challenged commitment to and implementation of peace agreements in line with the report by Smock and Smith (2008). The unwillingness on both sides to fully embrace any of the peace offerings in South Sudan struggle points to the fact that South Sudan parties have not been able to distinguish between political and military responsibilities in the peace agreement. As lawmakers haggle over equations that share authority, commanders in the field are worried about what will happen to their men and their rank and position. Some are comparatively doing well in the war while others do not envisage laying down their weapons. The complexities of any security sector reform plan and the security provisions of a peace agreement are compounded as the number of active combatants rises.

VI. SUMMARY AND CONCLUSIONS

The outputs, measured primarily by behaviour change among the armed groups, reflected the weaknesses in the agreements designed to bring them about these changes, status of armed violence and recruitment into armed groups. Mistrust has not reduced as desired, and there is little increased ability to establish structures for transformation. Interpretation, implementation, monitoring and evaluation of the peace agreements were similarly found to be largely deficient. As such, transition into an effective DDR process was not possible, as a result of the foregoing; there was little trust building transparency and inclusivity, deficiency in efforts of all actors, recycling of combatants, and limited acceptance of the negotiating process. Although there was some use of lessons learnt from previous agreements, there was generally a need to refrain from recycling old ideas in order to realise new results.

VII. RECOMMENDATION

Disarmament, demobilisation and re integration (DDR) should include inclusivity, transparency to enhance trust and acceptance by all parties to the conflict.

REFERENCES

- [1] Ahere, J. (2012). The peace process in the DRC: A transformation quagmire. ACCORD Publication. Lieven Anatol (2020). "Chapter 1". Climate Change and the Nation State. Penguin Random House. pp. 6–9. ISBN 978-0-241-39407-6.
- [2] Arnstein, S. R. (1969) "A Ladder of Citizen Participation," JAIP, Vol. 35, No. 4, July 1969, pp. 216-224
- [3] Ballentine, K. (2002). Symposium Explores UN Role in Addressing Economic Dimensions of Armed Conflict. International Peace Academy. Accessed on March 12, 2021. https://www.ipinst.org/wp-content/uploads/publications/eacw_diplotimes.pdf
- [4] Balzacq, T. (2005). "The Three Faces of Securitization: Political Agency, Audience and Context". European Journal of International Relations. 11 (2): 171–201. doi:10.1177/1354066105052960. S2CID 145147916
- [5] Barry Buzan, Ole Wæver, and Jaap de Wilde, Security: A New Framework for Analysis (Boulder: Lynne Rienner Publishers, 1998), p. 25.
- [6] Barnett, M. (2006). Social Constructivism. In, Baylis J. & Smith, S. (Eds.). The globalization of world politics: An introduction to international relations, 3rd Edition, New York: Oxford University Press. Bennett, J., Kluykens, Morton, J., & Poat, D. (2009). Mid-Term Evaluation of the Joint Donor Team in Juba, Sudan. Evaluation Department. Norad.
- [7] Berdal, M.R. (1996). Disarmament and Demobilisation After Civil Wars: Arms, Soldiers, and the Termination of Armed Conflicts. Adelphi Paper 303, International Institute for Strategic Studies, Oxford University Press, Oxford.
- [8] Bhattacharya, S& Burns, C. (2019). What's War Got to Do with It? Post-conflict Effects on Gender Equality in South and Southeast Asia, 1975–2006. SAGE Journals, 6(1), 55-81.
- [9] Bior, W., Akinyi-Nzioki, E., & Odhiambo, M.O. (2005). Land Tenure Study in Southern Sudan Phase I, Report of a Preliminary Survey of Land Tenure Systems in Parts of Southern Sudan. Secretariat for Agriculture and Animal Resources (SAAR). Washington, D.C: USAID
- [10] Blackings, J. (2018). The Case of South Sudan's Agreement on the Resolution of the Conflict in South Sudan. Friedrich-Ebert-Stiftung 2018
- [11] Blackings, M. (2018). The Case of South Sudan's Agreement on the Resolution of the Conflict in South Sudan. Nairobi: Friedrich-Ebert-Stiftung Kenya and South Sudan Office
- [12] Branch, A., & Mampilly, C. (2005). Winning the War but Loosing the Peace? The Dilemma of SPLM/A Civil Administration and Tasks Ahead. The Journal of Modern African Studies, 43 (1), 1-20.
- [13] Civilians in Conflict (CIVIC). (2016). A Refuge in Flames: The February 17-18 Violence in Malakal POC, April 22, 2016.
- [14] Clayton, V.(2020). The Formation of the Revitalized Transitional Government of National Unity in South Sudan. Durban: ACCORD
- [15] Collier, P., & Hoeffler, A. (2002). On the Incidence of Civil War in Africa. The Journal of Conflict Resolution, 46(1), 13-28.
- [16] Comprehensive Peace Agreement. (2005). Government of the Republic of the Sudan and the Sudan People's Liberation Army/Sudan People's Liberation Movement (Naivasha Agreement). (<https://www.peaceagreements.org/view/337/>).
- [17] Cox, J.M. (2019). Negotiating justice: Ceasefires, peace agreements, and post-conflict justice. SAGE Journals,57 (3), 466-481.
- [18] CSIS/AUSA. (2002). 'Post Conflict Reconstruction Task Framework', Centre for Strategic and International Studies and Association of the United States Army. <https://gsdrc.org/document-library/post-conflict-reconstruction-task-framework>.
- [19] CTSAMM.(2018).Ceasefire and Transitional Security Arrangements Monitoring Mechanism in South Sudan.Africa-eu-partnership. org/sites/default/files/apf_factsheet_ctsamm.pdf
- [20] Deudney, D. (1990). "The Case Against Linking Environmental Degradation and National Security". Millennium. 19 (3): 461–476. doi:10.1177/03058298900190031001. S2CID 143290289.
- [21] Deng, D.K., & Willems, R. (2016). Expanding the Reach of Justice and Accountability in South Sudan. Intersections of Truth, Justice, and Reconciliation in South Sudan, POLICY BRIEF.
- [22] DeRouen, K., & Chowdhury, I. (2018). Mediation, Peacekeeping and Civil War Peace Agreements. Defence and Peace Economics, 29 (1), 130-146.
- [23] DeRouen, K., et al. (2010). Civil war peace agreement implementation and state capacity. <i>Journal of PeaceResearch, </i><i>47</i>(3), 333-346. Accessed August 6, 2021, from <http://www.jstor.org/stable/20752167>
- [24] Detzner, S. (2017). Modern post-conflict security sector reform in Africa: patterns of success and failure.African Peace Missions and Security Sector Governance, 2 (26), 116-142.
- [25] Dixon, P. (2015). The Lessons of the Northern Ireland Peace Process: Realistic Pragmatism and Political Skills. The RUSI Journal, 160(4), 18-23.
- [26] Dylan, H., & Andrzej, K. (2002). The challenges of security sector reform. Stockholm SIPRI.Einas, A. (2009). The Comprehensive Peace Agreement and the Dynamics of Post-Conflict Political Partnership in Sudan. African Spectrum, 44(3), 133-147
- [27] Government of Sierra Leone. (1999). Peace Agreement between the Government of Sierra Leone and the Revolutionary United Front of Sierra Leone. Freetown: Sierra Leone
- [28] Hopwood, J., Osbum, N., Victor, L. & Baines, E. (2008).With or without peace: Disarmament, demobilization and reintegration in Northern Uganda. Field Notes, No. 6, February. Justice and Reconciliation Project Quaker peace and social witness.
- [29] Huber, L & Karim, S. (2017). The internationalization of security sector gender reforms in post-conflict countries. SAGE Journals, 35(3), 263-279.
- [30] Human Rights Watch. (2015). World Report 2015: South Sudan (Events of 2014). Human Rights Watch. <https://www.hrw.org/world-report/2015/country-chapters/south-sudan#>
- [31] Humphreys, M., & Weinstein, J.M. (2008). Who Fights? The Determinants of Participation in Civil War. American Journal of Political Science, 52(2), 436-455.
- [32] Hutchinson, S.E. (2001). A Curse from God? Religious and Political Dimensions of the Post-1991 Rise of Ethnic Violence in South Sudan. The Journal of Modern African Studies, 39 (2), 307-331.

- [33] International Crisis Group (2020). A Major Step toward Ending South Sudan's Civil War. International Crisis Group report. Accessed on February 5, 2022, from: <https://www.crisisgroup.org/africa/horn-africa/south-sudan/major-step-toward-ending-south-sudans-civil-war> 25 Feb 2020
- [35] International Crisis Group. (2016). South Sudan: Rearranging the Chessboard Africa. Report N°243, 20 December.
- [36] Irit, B. (2014). IGAD and South Sudan: Success and Failure in Mediation. Miami, FL: Miami Dade College. Islam, M.T. (2017). Conflict Resolution and Civil Society: Experiences of Nepal in Post-Maoist Revolution. SAGE Journal, 21 (2), 85-97. <https://doi.org/10.1177/0973598417728858>.
- [37] Joseph, F. (2017). The Philippines: The Moro Islamic Liberation Front -A Pragmatic Power Structure? Singapore: The Nanyang Technological University.
- [38] Joseph, J., & Juncos, A. (2020). A Promise not Fulfilled: The (non) Implementation of the Resilience Turn in EU Peacebuilding. Contemporary Security Policy, 41 (2), 287–310.
- [39] Juma, P.W & Odhiambo, E. S. (2021). Geo-Political factors Influencing Kenya and Tanzania Foreign Policy Behaviour Since 1967. Published by Journal of Defence Resources Management Vol. 12 Issue 1(22)/2021.Pp 75-98. ISSN: 2068 - 9403 eISSN: 2247 - 6466 <http://www.jodrm.eu/currentissue.html>
- [40] Katja, F. (2009). Should Peacemakers Take Sides? Major Power Mediation, Coercion, and Bias. American Political Science Review, 103 (02): 248–63.
- [41] Kelly, C. (2016). Implementing a More Inclusive Peace Agreement in South Sudan. Washington, DC. Accessed on August 4, 2018, from: www.inclusivesecurity.org.
- [42] Kimenyi, S.M. (2016). Future Engagement between South Sudan and the Republic of Sudan. Washington D.C: Brooking.
- [43] Knight, W. (2008). Disarmament, Demobilization, and Reintegration and Post-Conflict Peacebuilding in Africa. An Overview, African Security, 1(1), 24-52
- [44] Krause, J., Krause, W., & Bränfors, P. (2018). Women's Participation in Peace Negotiations and the Durability of Peace. International Interactions, 44(6), 985-1016. <https://doi.org/10.1080/03050629.2018.1492386>.
- [45] Krause, K., & Milliken, J. (2009). Introduction: The Challenge of Non-State Armed Groups. Contemporary Security Policy, 30 (1), 202-220.
- [46] Kuol, L. (2019). The 2018 South Sudanese Peace Agreement: A Litmus Test of Coercive Mediation (May 10, 2019). In Peacemaking and Peace Agreements in South Sudan, edited by Christopher Zambakari, Matthew Edwards, Steve DesGeorges, and Sandy DesGeorges. Phoenix, AZ: The Zambakari Advisory.
- [47] Kuol, N. (2015). Challenges of Implementing Peace Agreements in Africa: A Case Study of the Sudan Comprehensive Peace Agreement. Nairobi. University of Nairobi Press
- [48] Lederach, J.P. (1997). Building peace: Sustainable reconciliation in divided societies. Washington, D.C.: United States Institute of Peace
- [49] Miahack, H. & Reuss, A. (2019). How to Make Peace Work in South Sudan Criteria for More Effective Collective Conflict Management in South Sudan. Perspective/ Fes South Sudan.
- [50] Matthew, H., Madhav, J., & Jason, M. (2019). The Status of South Sudan's 2018 Peace Agreement. Oslo, Norway: PRIO.
- [51] McGarry, J. (1998). Political settlements in Northern Ireland and South Africa. Political Studies, 46(5), 1-17.
- [52] Michael, L. (2003). What Kind of Peace is Being Built? Assessing Post-Conflict Peacebuilding Charting Future Directions. Canada: IDRC.
- [53] NEPAD. (2005). African Post-conflict Reconstruction Policy Framework', New Partnership for Africa's Development (NEPAD) Secretariat, Governance, Peace and Security Programme, South Africa. Lusaka, Zambia: NEPAD
- [54] Njoroge, A.S.K. (2020). On the status of implementation of the revitalised agreement on the resolution of the conflict in the Republic of South Sudan for the period (January to 31 to March 2020). RJMEC. Accessed August 21, 2021.
- [55] Odhiambo, E.O.S. (2014). "Use of Track One & a Half Actors as Counter-Radicalization & De-radicalisation in Kenya" published by Journal of International Relations & Foreign Policy. June 2014, Vol. 2, No. 2, pp. 75-100 ISSN: 2333-5866 (Print), 2333-5874 (Online) <http://aripd.org/journal/index/jirfp/vol-2-no-2-june-2014-current-issue-jirfp>
- [56] Odhiambo E.O.S., Kassilly J; Maito T.L., Onkware K & Oboka W (2013). "War Termination in Somalia & Kenya Defence Forces' (KDF) Role" published by Journal of Defense Resources Management Online (JoDRM) Volume 4, Issue no. 1 (6), April 2013 ISSN: 2068-9403 eISSN: 2247-6466, ISSN-L: 2247-6466 Brasov, Romania, pp. 57-68. <http://journal.dresmara.ro/>
- [57] Paffenholz, T. (2013). International peacebuilding goes local: analysing Lederach's conflict transformation theory and its ambivalent encounter with 20 years of practice. Peacebuilding.
- [58] Paffenholz, T. (2015). "Broadening Participation Project." Briefing Paper. Geneva: The Graduate Institute of International and Development Studies: Centre on Conflict, Development and Peacebuilding.
- [59] Paffenholz, T.A.Z., & Cindy, H. (2017). What Makes or Breaks National Dialogues. Geneva: Inclusive Peace & Transition Initiative.
- [60] Rolandsen, H., & Nicki, K. (2017). South Sudan: A political economy analysis. Oslo. Norwegian Institute of International Affairs (NUPI).
- [61] Rolandsen, Ø.H., & Kindersley, N. (2017). South Sudan: A political economy analysis. Norwegian Institute of international affairs.
- [62] Rolandsen, ØH (2007). From Guerrilla Movement to Political Party: The Restructuring of Sudan People's Liberation Movement in Three Southern States. Centre for the Study of Civil War/International Peace Research Institute, Oslo.
- [63] Shanmugaratnam, N. (2008). Post-war Development and the Land Question in South Sudan. Oslo: Norwegian University of Life Sciences
- [64] Smith, S. (1986) Theories of Foreign Policy: An Historic Overview. Review of International Studies, 12, 13-29. <https://doi.org/10.1017/S026021050011410X>
- [65] Steadman, S.J., (2001). International Implementation of Peace Agreements in Civil Wars: Findings from a Study of Sixteen Cases. In Crocker, C.A., Hamson, F.O., Aall, P., Turbulent Peace. United.
- [66] Steffen, E. (2016). The Challenges and Lessons Learned in Supporting Security Sector Reform. Berlin: Friedrich-Ebert-Stiftung (FES) and the Global Public Policy Institute
- [67] Tshibangu, R. (2020). Religion and its relationship to conflict; The case of South Sudan: To what extent do South Sudanese still experience religious oppression post-independence? Thesis. Linnaeus University, Växjö, Sweden.
- [68] UNFCCC. (2016). Republic of South Sudan National Adaptation Programmes of Action (NAPA) to Climate Change. UN Framework Convention on Climate Change.
- [69] Van den Berg, W.L., Curseu, P., & Meeus, M. (2014). Emotion regulation and conflict transformation in multi-team systems. International Journal of Conflict

- Management, 25 (2), 171-188
- [70] Vandeginste, S. (2011). Power-sharing as a Fragile Safety Valve in Times of Electoral Turmoil: The Costs and Benefits of Burundi's 2010 Elections. *The Journal of Modern African Studies*, 49(2), 315–335
- [71] Wasike, S. and Odhiambo, E.O.S. (2016) A Critique of the Usefulness of Theories in Explaining Socio-Political Phenomenon. *Asian Journal of Basic and Applied Sciences*, 3, 29-33.
- [72] Wilkin, L. (2016). John Paul Lederach's Peacebuilding Theory: A Reflective Essay. *Journal of Conflict Management*. 4(1) 1-4
- [73] William, A. (2020). International Actors' Support on Inclusive Peace Processes. K4D, University of Birmingham.
- [74] William, M. (2019). Symbolic Post-Conflict Recovery in the Rwenzori Sub-Region of Uganda. *SAGE Journals*, 55 (5), 699-715.
- [75] Williams, M. (2007). *Culture and Security: Symbolic Power and the Politics of International Security*. London, New York: Routledge.
- [76] Young, J. (2003). Sudan: Liberation movements, regional armies, ethnic militias, and peace. *Review of Political economy*. Retrieved from <http://www.jstor.org/stable/44006985>
- [77] Young, J. (2007). "Emerging North-South Tensions and Prospects for a Return to War," Small Arms Survey HSBA Working Paper 7, July.
- [78] Young, J. (2012). *The fate of Sudan: The origin and consequences of a flawed peace process*. London, New York: Zed Books.

AUTHORS

First Author – Mwanyika, M. E, Department of Peace and Conflict Studies, Masinde Muliro University of Science and Technology

Second Author – Professor Okoth, P. G, Department of Peace and Conflict Studies, Masinde Muliro University of Science and Technology

Third Author – Professor Were, M. E, Department of Political Science and Peace Studies, Kisii University

Data Bias Detection in Machine Learning

Harshaprabha N Shetty*, Sony Asampalli*, Prabhu Vara Prasad Bonam*

*Responsible AI COE, Accenture Technology, Bengaluru, India

DOI: 10.29322/IJSRP.12.10.2022.p13071
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13071>

Paper Received Date: 14th September 2022
Paper Acceptance Date: 15th October 2022
Paper Publication Date: 21st October 2022

Abstract- The paper talks about the various Bias detection methods using statistical measures. The methods are applied on binary as well as multinomial data.

Index Terms- bias, detection, binary, multi-class, detection, hypothesis

I. INTRODUCTION

Bias is defined as 'AI Bias or Machine Learning Bias where model produces results with prejudices due to various erroneous assumptions in the model building process'. We have biases due to data and due to the algorithms. The entire paper is divided into 6 sections- 1) Background and Related work 2) Data Bias 3) Types of Data Biases 4) Detection of data biases 5) Results and Discussion 6) Future work. The paper explains about the bias due to data and how can we detect them using various statistical measures. This helps the machine learning scientists to give an accurate result. Debaised data gives trust to the users in the society.

Background and related work

Background

There is a need for detection of bias in the data as we have seen that the results are not accurate enough. However, there are many measures available in various tools used by various organizations. Most of the tools in the market have used these measures for binary type of data.

Related Work

The existing literature identifies the bias in the data by converting multi-level data into binary data. Sorelle A. Friedler [2] have compared multiple fairness measures and found correlation between them. They also found that these measures are sensitive to fluctuations in the datasets. AI360 has ratio and difference versions of metrics.[1]. The paper on 'Fairness Measures for Machine Learning in Finance' [3] concentrates on the detection measures for data bias. They explain about synergy between bias and legal considerations in the finance industry.

All the above papers and other existing literature talk about the metrics on the datasets where only binary levels are used for calculation of data bias detection.

In this paper we have applied the measures on multiple levels of data on different datasets.

data bias

We have been using various Machine Learning (ML) and Artificial Intelligence (AI) methods for various business problems. The success of these applications has made the scientists to explore in social justice, hiring processes etc. The increasing use of ML/AI in these domains have induced bias in the reports related to gender, race etc. This has created huge impact on some of the existing models and users had to ban those models due to biases. The main source of these biases are the Data used to train the ML/AI models. As the old saying goes 'Garbage in, garbage out'. The bias is due to structural characteristics of the data used in the analysis of business problems.

type of data biases

As we have noticed from various domains, the data collected from people through responses of people, feedback from people, sampling taken from the other data sources, data generated from human for some studies, data generated from social media, or curated data for analysis etc. and so on will definitely are biased data. We should be aware of the different types of biases which may harm the precious data.

Bias due to the survey

The survey data takes input from the people for a specific purpose. Only small portion of the targeted group will contribute to giving the responses. This is highly biased data, and the outcome of that purpose will not give a good result or help in making better decisions.

Bias due to the drift in the system

The system has collected data while starting any process; but after certain years the data might have changed. If we do not update the system with the latest data, then again, we will have bias in the outcomes of our models.

Bias due to the exclusion of critical variables

The data collection and preparation stage are very critical for the business. The data profiling stage needs to be done by people who are experts in that domain. And there are cases where they may miss out business critical features. This may lead to bias in the outcomes of our models.

Bias due to the selection of data from the publicly available data or confirmation bias

The data collection from the social media where it has been posted by the humans are incomplete. We confirm that the

available of the social media are correct all the time. The curated data is biased. This curated data can give improper messages in the outcome of our analysis.

Bias due to the selection of data from recommender systems or selection bias

In retail when we select the items as an output from the recommender systems and the users will not be able to get the full set of data. The selected data may not represent the data which we think. This induces bias in the data. We will miss out the items and the analysis will not be accurate. The decision taken by the analytics will mislead the business groups.

Historical Bias

Sometimes we carry with us the old beliefs and apply that on data. For example: In Indian context, while telling a story about the cook we usually refer that as a female. Other examples like nurse in a hospital is referred as a female. When referring an earning member in the family is most of the times it is referred as man than a woman.

Survivorship Bias

It is a human tendency to favor the winner than the loser. While collecting data we tend to include the characteristics of the winner or rich or poor or loser – any one category based on the situation. This induces bias in the data collected for the purpose. We will get biased results which will focus only on that particular group in the society.

Availability Bias or outlier Bias

This is a very rare case but quite common practice by most of the humans to go behind the rare new invention without doing much analysis. This may affect our business in the long run. The data may not represent the entire population due to availability of few such cases. There is a high possibility that we are biased towards that minimal information.

On the other hand, we can have cases where the average data is available for making some decisions with the data. But this is biased as the outliers are hidden when we have average data values. Always better to use raw values than the average values to get the better picture or for better decision-making process.

Methodology

Outline of the process

The analysis which we are performing while detecting the bias is classification problem. The paper talks about binary classification on target variable being studied.

detection of data biases

Data is most important part in our day-today life while making business decisions. Identifying the biases in our data is crucial part in our analysis. This can help us to take the next steps to mitigate the biases and which helps the business to get a meaningful interpretation.

There are various methods to identify the biases in the data. For the purpose of writing this paper we have considered the Adult.csv, German credit.csv and Comapass.csv from public repository.

We will study these methods in the below sub sections.

Disparity Impact

Disparity Impact is a measure of discrimination in the data [5]. If any outcome is seen to a greater or lesser extent between populations, then there is disparity.

Disparity is based on the four fifth rule which states that if the selection rate for a certain group is less than 80 percent of that of the group with the highest selection rate, there is adverse impact on that group.

Step 1- Find the selection rate for each group. For each group, divide the number of each level selected by the total of all levels.

step 2: Determine the group that is most favored and the group that is least favored. For positive personnel actions, the most favored group has the highest rate. For negative personnel actions, the most favored group has the lowest rate.

Step 3: Calculate the impact ratio analysis for each group. This compares the favorable group selection rate with the selection rates of all other groups.

Step 4: Determine whether the result is less than 80%. If result that is less than 80% then is considered evidence of adverse impact.

Fisher's test

Fisher's exact test is useful for categorical data that result from classifying objects in two different ways; it is used to examine the significance of the association between the two kinds of classification.

Use Fisher's exact test when you have two nominal variables. You want to know whether the proportions for one variable are different among values of the other variable.

Step 1- H_0 : (null hypothesis) The two variables are independent.

H_1 : (alternative hypothesis) The two variables are *not* independent.

Step 2- if $p < 0.05$ then we reject H_0

Chi-squared test of independence

The Chi-square test of independence checks whether two variables are likely to be related or not. We have counts for two categorical or nominal variables. We also have an idea that the two variables are not related,

The basic idea in calculating the test statistic is to compare actual and expected values, given the row and column totals that we have in the data. First, we calculate the difference from actual and expected for each combination of levels.

H_0 : Two or multiple variables are independent

H_1 : Two or multiple variables are dependent

The test statistic is lower than the Chi-square value. You fail to reject the hypothesis of independence.

Class imbalance (CI)

CI is under-representation of the disadvantaged group in the dataset. We want the differences to lie in $(-1; +1)$.

We define, $CI = \frac{(n_a - n_d)}{n} \in (-1, +1)$ (1)

Ex: Assume a dataset of Adult Census on column gender binary class, 21790 are Male and 10771 are Female, $CI = 0.336$. There exists Bias.

Assume the same data for multiclass Race between difference levels,

Class imbalance (CI)	Amer-Indian-Eskimo	Bias
Asian-Pac-Islander	0.539259	Yes
Black	0.818923	Yes
White	-0.068729	Yes
Other	0.977886	Yes

Difference in positive proportions in observed labels(DPL)

Let $q_a = \frac{n_a^{(1)}}{n_a}$ be the ratio of type 1 for the advantaged class and

$q_d = \frac{n_d^{(1)}}{n_d}$ be the same for the disadvantaged class.

$DPL = q_a - q_d$, and $DPL = \frac{q_a - q_d}{q_a + q_d} \in (-1, +1)$

Ex: Assume a dataset of Adult Census on column gender binary class

Assume the same data for multiclass column Race having different levels,

Difference in positive proportions in observed labels(DPL)	Amer-Indian-Eskimo	Bias
Asian-Pac-Islander	0.0143	Yes
Black	0.0196	Yes
White	0.0296	Yes
Other	0.2330	Yes

Kullback and Leibler (1951) Divergence (KL)

We compare the probability distribution of the advantaged class (P_a) with that of the disadvantaged class (P_d), using KL divergence, i.e., relative entropy (Kullback in fact preferred the term “discrimination information”)

$$KL(P_a; P_d) = \sum_y P_a(y) \log \left[\frac{P_a(y)}{P_d(y)} \right] \geq 0$$

Ex: Assume a dataset of Adult Census on column gender binary class

TABLE IX. Gender	TABLE X. Kullback and Leibler (1951) Divergence (KL) TABLE XI.	TABLE XII. Bias
TABLE XIII. Male vs Female	TABLE XIV. 0.1413020752 TABLE XV.	TABLE XVI. Yes

Assume the same data for multiclass column Race having different levels,

TABLE I. Gender	TABLE II. Difference in positive proportions in observed labels (DPL) TABLE III.	TABLE IV. Bias
TABLE V. Male vs Female	TABLE VI. 0.196 TABLE VII.	TABLE VIII. Yes
Kullback and Leibler (1951) Divergence (KL)	Amer-Indian-Eskimo	Bias
Asian-Pac-Islander	0.068080705523 47882	Yes
Black	0.000309957968 3429939	Yes
White	0.060724415110 749067	Yes
Other	0.003075206340 56992	Yes

Jensen-Shannon divergence (JS)

If the distribution of the combined classes is P, then,

$$JS(P_a; P_d; P) = \frac{1}{2} [KL(P_a; P) + KL(P_d; P)] \geq 0$$

Ex: Assume a dataset of Adult Census on column gender binary class

TABLE XVII. Gender	TABLE XVIII. Jensen-Shannon divergence (JS) TABLE XIX.	TABLE XX. Bias
TABLE XXI. Male vs Female	TABLE XXII. 0.030 3	TABLE XXIII. Yes

Assume the same data for multiclass column Race having different levels,

Lp norm (LP)

Instead of the entropy differences in KL and JS, we may consider norm differences. For $P \geq 1$, we have,

$$Lp(Pa; Pd) = \left[\sum_y |Pa(y) - Pd(y)|^p \right]^{1/p} \geq 0$$

Ex: Assume a dataset of Adult Census on column gender binary class

TABLE XXIV. Gender	TABLE XXV. Lp norm (LP) TABLE XXVI.	TABLE XXVII. Bias
TABLE XXVIII. Male vs Female	TABLE XXIX. 0.27856 TABLE XXX.	TABLE XXXI. Yes

Assume the same data for multiclass column Race having different levels,

Lp norm (LP)	Amer-Indian-Eskimo	Bias
Asian-Pac-Islander	0.1498	Yes
Black	0.00812	Yes
White	0.1401	Yes
Other	0.0235	Yes

Total variation distance (TVD)

This is half the L1 distance:

$$TVD = \frac{1}{2} L1(Pa; Pd) \geq 0$$

this measure is non-negative

Ex: Assume a dataset of Adult Census on column gender binary class

TABLE XXXII. Gender	TABLE XXXIII. Total variation distance (TVD) TABLE XXXIV.	TABLE XXXV. Bias
TABLE XXXVI. Male vs Female	TABLE XXXVII. 0.19697796466995765 TABLE XXXVIII.	TABLE XXXIX. Yes

Assume the same data for multiclass column Race having different levels,

Total variation distance (TVD)	Amer-Indian-Eskimo	Bias
Asian-Pac-Islander	0.1498	Yes
Black	0.0081	Yes
White	0.0235	Yes
Other	0.1401	Yes

Kolmogorov-Smirnov (KS), two-sample approximated version

$$KS = \max(|Pa - Pd|) \geq 0$$

Jensen-Shannon divergence (JS)	Amer-Indian-Eskimo	Bias
Asian-Pac-Islander	0.01860518388794966	Yes
Black	7.824046471884439e-05	Yes
White	0.0165547644387824	Yes
Other	0.0007425044248053946	Yes

It is possible to evaluate the KS statistical test from the following distance measure, where the null hypothesis is rejected at level

$$KS > C(\alpha) \sqrt{\frac{n_a + n_d}{n_a \cdot n_d}}$$

The value of $C(\alpha)$ is given by $C(\alpha) = \sqrt{-\ln\left(\frac{\alpha}{2}\right) \cdot \frac{1}{2}}$

Ex: Assume a dataset of Adult Census on column gender binary class

TABLE XL. Gender	TABLE XLI. Kolmogorov-Smirnov (KS) TABLE XLII.	TABLE XLIII. Bias
TABLE XLIV. Male vs Female	TABLE XLV. 0.196 TABLE XLVI.	TABLE XLVII. Yes

Assume the same data for multiclass column Race having different levels,

Kolmogorov-Smirnov (KS)	Amer-Indian-Eskimo	Bias
Asian-Pac-Islander	0.1498	Yes
Black	0.0081	Yes
White	0.0235	Yes
Other	0.1401	Yes

Conditional Demographic Disparity in Labels (CDDL)

The metric asks the following question: Is the disadvantaged class a bigger proportion of the rejected outcomes than the proportion of accepted outcomes for the same class? We note that just this

question alone would lead to an answer to whether demographic disparity exists (DD),

$$D = \frac{\text{No. of rejected applicants from the protect facet}}{\text{Total rejected applicants}} = \frac{n_d^{(0)}}{n_d}$$

$$A = \frac{\text{No. of accepted applicants from the protect facet}}{\text{Total accepted applicants}} = \frac{n_a^{(1)}}{n_a}$$

If $D > A$, then demographic disparity (DD) exists. CDDL arises when demographic disparity exists on average across all strata of the sample on a user-supplied attribute. We will subgroup the sample and compute DD for each subgroup, and then compute the count-weighted average of DD. The function is as follows:

$$CDDL = \frac{1}{n} \sum n_i \cdot DD_i$$

Ex: Assume a dataset of Adult Census on column gender binary class

Gender	Conditional Demographic Disparity in Labels (CDDL)	Bias
Female	0.2573300573300573	Yes
Male	0.2573300573300573	Yes

Assume the same data for multiclass column Race having different levels,

Race	Conditional Demographic Disparity in Labels (CDDL)	Bias
Amer-Indian-Eskimo	0.0146	Yes
Asian-Pac-Islander	0.0445	Yes
Black	0.1889	Yes
Other	0.2025	Yes
White	1.0367	Yes

Figures and Tables

Positioning Figures and Tables: Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation “Fig. 1”, even at the beginning of a sentence.

Table Type Styles

Table Head	Table Column Head		
	Table column subhead	Subhead	Subhead
copy	More table copy ^a		

Sample of a Table footnote. (*Table footnote*)

Example of a figure caption. (*figure caption*)

Figure Labels: Use 8 point Times New Roman for Figure labels. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity “Magnetization”, or “Magnetization, M”, not just “M”. If including units in the label, present them within parentheses. Do not label axes only with units. In the example, write “Magnetization (A/m)” or “Magnetization {A[m(1)]}”, not just “A/m”. Do not label axes with a ratio of quantities and units. For example, write “Temperature (K)”, not “Temperature/K”.

II. RESULTS AND DISCUSSION

The results Shows that we want to make the world equitable to entire society. future work

There is a possibility to explore other measures when the target feature in the model supports multi-level classification.

Acknowledgment

We would like to thank the team who has helped in development of the Data Bias detection Tool.

REFERENCES

- [1] AI Fairness 360 - Resources (mybluemix.net)
- [2] Sorelle A. Friedler, Haverford College, Carlos Scheidegger, University of Arizona, Suresh Venkatasubramanian, University of Utah, Sonam Choudhary, University of Utah, Evan P. Hamilton, Haverford College k Derek Roth, Haverford College, A comparative study of fairness-enhancing interventions in machine learning, arXiv:1802.04422v1 [stat.ML] 13 Feb 2018.
- [3] Sanjiv Das, Michele Donini, Jason Gelman, Kevin Haas, Mila Hardtt, Jared Katzman, Krishnamurthy, Pedro Larroy, Pinar Yilmaz, Bilal Zafar, “Fairness Measures for Machine Learning in Finance”
- [4] Understanding Data Bias. Types and sources of data bias | by Prabhakar Krishnamurthy | Towards Data Science
- [5] Kyle E. Brink, Jeffrey L. Crenshaw, Personnel Board of Jefferson County, ‘Adverse Impact: What is it? How do you calculate it?’

AUTHORS

First Author – Harshaprabha N Shetty, Responsible AI COE Accenture Technology, Bengaluru, India, h.n.shetty@accenture.com

Second Author – Sony Asampalli, Responsible AI COE, Accenture Technology, Hyderabad, India, sony.asampalli@accenture.com

Third Author – Prabhu Vara Prasad Bonam, Responsible AI COE, Accenture Technology, Hyderabad, India h.n.shetty@accenture.com

Cloud Powered AI Based Solar Tracker

AhmedUvesh Mevawala*, Subhadip Ghosh*, Harshaprabha N shetty*, Tanusree De*

*Advanced Technology Centers In India, Accenture Technology, Bangalore, India

DOI: 10.29322/IJSRP.12.10.2022.p13072
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13072>

Paper Received Date: 14th September 2022
Paper Acceptance Date: 15th October 2022
Paper Publication Date: 21st October 2022

Abstract- Solar energy is the most cost-effective form of energy generation among other renewable energy sources. However, structurally the traditional solar panels have a common problem i.e. they are fixed at a particular angle & the sun rotates throughout the day making maximum solar radiations getting reflected from the surface making the traditional solar panel system less effective. In this paper, we have proposed a Cloud-powered AI-based solar tracking system that for a given location forecasts the position of the sun & guides the solar panel controller to move the panels to their respective angel.

Index Terms- Solar, Solar Tracker, AI, Cloud, Azimuth

I. INTRODUCTION

Renewable, Green & clean energy is the need of an hour & it is the prime focus of all the governments across the globe. Every country's vision is to become a self-sustained clean energy producer in two to three decades. There are various renewable energy sources like wind energy, geothermal energy, and solar energy but the most cost-effective of them is solar energy. Hence, solar energy is going to be an integral part of achieving the clean energy revolution vision for each nation. Traditional Photovoltaic (PV) solar system exists for more than 7 decades but they have a fundamental problem which is they are fixed on the supporting vertical frame at a particular angle usually at the longitude of the location.

Since the sun changes its position throughout the day & solar panels are installed at a fixed angle, the maximum amount of solar radiation gets reflected & goes unutilized, making the traditional fixed angle PV solar system inefficient. This results in lesser energy being generated than its potential.

The solution to overcome this issue is to rotate the solar panels as per the direction & movement of the sun. So, we need the solar tracking mechanism which tracks the movement of the sun & the physical hardware that rotates the solar panels at the required angle. There exist various forms of solar tracking systems in the market such as Active tracking, Passive tracking, and Chronological tracking which we have discussed in the subsequent sections in detail. However, these tracking systems have their limitations such as limited scalability, increased cost, and accuracy which makes it hard for them to adapt at mass.

In this paper, we are proposing a novel approach for solar tracking which is based on AI & can be hosted on the cloud to

make it scalable. The proposed AI-based solar tracker is an attempt to resolve the limitations of the other solar tracking system and make them more adaptable at scale. Let's understand some of the key concepts.

Photovoltaic (PV) Cell/ Panel

PV materials and devices convert sunlight into electrical energy [1]. A single PV device is known as a cell. An individual PV cell is usually small, typically producing about 1 or 2 watts of power. To boost the power output of PV cells, they are connected in chains to form larger units known as modules or panels.

Sun Path

As shown in Figure 1, Sun path [2] sometimes also called day arc, refers to the daily and seasonal arc-like path that the Sun appears to follow across the sky as the Earth rotates and orbits the Sun. The Sun's path affects the length of daytime experienced and the amount of daylight received along a certain latitude during a given season. A Sun Path Diagram shows the azimuth angle, elevation angle, sun paths throughout the years, sunrise and sunset time, etc.

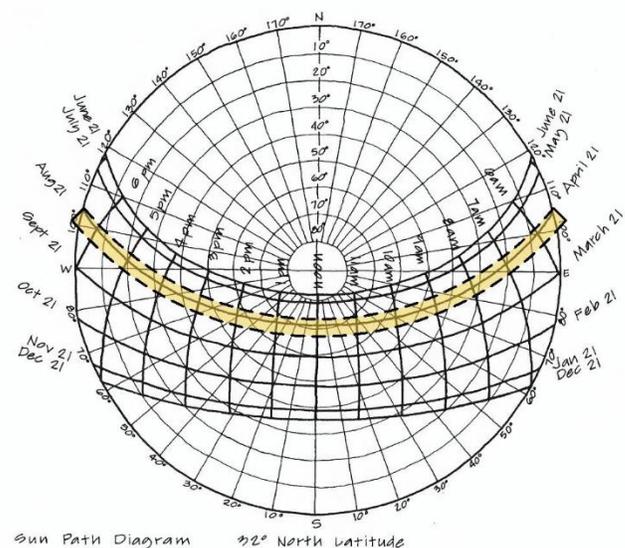


Fig1. Sun Path Diagram

Azimuth Angle

As shown in Fig 2, Azimuth Angle [3] is the direction of the sun from the observer, expressed because of the hour angle from the north point of the line to the point at which a vertical circle passing through the sun intersects the horizon.

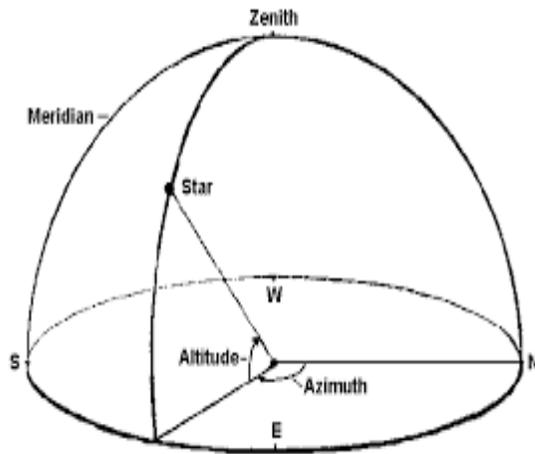


Fig2. Azimuth Angle

Methods For Solar Tracking

There are three basic methods of solar tracking [4].

Active Tracking.

Passive Tracking

Chronological Tracking

Active Tracking

Active trackers use microprocessors and/or sensors to detect the position of the sun. The sensor triggers the motion of the motor or actuator in such a way that the solar panel will always face the sun throughout the day. This type of tracker faces issues false trigger issues during cloudy days as well as this type of sensor is costly compared to its counterparts.

Passive Tracking

The passive tracking method does not use sensors like activity tracking. The most common Passive trackers use a low boiling point compressed gas fluid that is driven to one side or the other (by solar heat creating gas pressure) to cause the tracker to move in response to an imbalance. This method does not have to rely on electrical sensors and requires a negligible amount of power to operate however accuracy is not reliable in this type of tracker.

Chronological Tracking

A chronological tracker is a timer-based tracking system. The structure is moved at a fixed rate throughout the day since the sun moves across the sky at a fixed rate of about 15 degree per hour. This method is better suitable for single axis tracking without sensors. For dual axis tracking a modified version can be implemented. The position of sun throughout the day can be calculated and set by the program implemented on the controller module. The solar tracker rotates according to data sent from control unit's memory of pre-stored data or calculated from given formula. This method of sun-tracking is accurate and reliable.

However, data storage, calculation continuous data transmission is power consuming and unnecessary rotation when sun light is too low can never be avoided. All the three methods are applicable with single axis and dual axis tracking system. Which method is best suitable, is determined by the location of installation, purpose of generation and demand of solar power. Modern trackers combines both the sensor controlled method and sensor less control method at the same time to increase efficiency. Which method is best suitable, is determined by the location of installation, the purpose of generation, and the demand for solar power.

Components of Solar Tracking System

A solar tracking system has several components. But the most basic & important ones are mentioned below.

Sun Tracking Mechanism

As mentioned in the previous section, overall there are three methods of sun-tracking i.e. Active, Passive, and Chronological.

Tracker control unit

The control unit executes the sun-tracking mechanism and necessary calculations. It can also coordinate the movement of the positioning system. A microprocessor or a computer can be used as the center of the control unit.

Panel Positioning System & Drive Mechanism

The positioning system handles the task of rotating the solar panels according to the preference of the control unit. It can be either electronic or hydraulic. The drive mechanism includes mechanical devices- rotary motors, linear actuators, linear drives, hydraulic cylinders, swivel drives, worm gears, planetary gears, and threaded spindles. The fixed PV solar system does not have this drive mechanism as the panels are fixed at a certain angle.

Why Optimization through solar Tracker is required

The fixed PV solar system has limited energy production capacity than its potential because the maximum solar radiation gets lost due to reflection. The solar tracker increases the efficiency & throughput in terms of energy generation as now the panels rotate as per the sun's movement which results in lesser energy loss & increased energy production without a significant increase in the cost.

The increased energy production can meet the ever-increasing energy demand & the electricity can be provided to light more households and industries.

Proposed Methodology

In this paper, we are proposing AI-based trackers that will forecast the position of the sun (azimuth angle) at every 15 minutes time interval for a given location. As shown in Figure 3, the LSTM based time series forecasting model is the core engine of the AI based tracker & the forecasted angle will be fed to the local microcontroller installed at each solar plant which will accept the target angle of the solar panel from the solar tracker engine & will instruct the microcontroller to trigger the panel rotation through the panel positioning system and drive mechanism. This is the novel AI-based solution for solar tracking & optimizing the solar panel angles based on the AI model.

The microcontroller [5] acts as the intermediary communicator between solar tracking engine and the actual hardware that rotates the solar panel. The role of the microcontroller is like translator which helps communicate between two people speaking in different languages.

This solution eliminates the need of having separate solar tracker sensors installed on the individual solar panels which results in saving the cost of the hardware. Also, the angle optimization is done centrally on a cloud for all the panels in the solar farm, only a single Drive Mechanism needed can control panel movement as opposed to multiple in the case of a sensor-based approach. This results in significant cost reduction.

For the solution, LSTM based time series algorithm is used to build the AI model. The proposed solution can forecast the azimuth angle for any location which can be different from the location on which the model is trained.

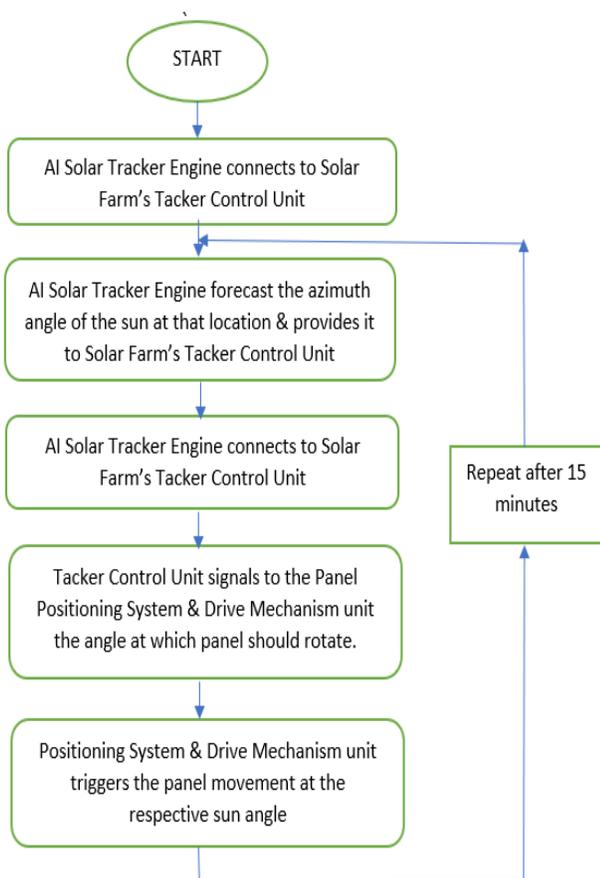


Fig3. Flowchart of proposed approach of AI based solar tracker engine

Dataset

The dataset for this use case is not taken from any open source but it is derived from an open-source website called www.suncalc.org which provides the sun movement information (azimuth angle) for any location, for a given date & time. The dataset has the date & time information along with the azimuth angle of the sun at the given time in a day. The collected data is spaced at 15 minutes timestamp so each data instance represents the sun position in terms of azimuth angle at the 15th minute.

For this research, the model is trained on 45 days of data from Jan 1st, 2022 to Feb 15th, 2022 & model has been validated on the 15 days of data from 16th Feb 2022 to 28th Feb 2022. The model can predict the azimuth angle of the sun for any date & time from March 2022.

The data is preprocessed first before feeding it to the model. The data is arranged in a timestamp window of 100 which means to predict the azimuth angle at timestamp t, t-100 to t-1 are used as input variables.

Model

As shown in Figure 4, The AI solution has been built on the LSTM-based time series model with 3 dense layers of 50 LSTM units each followed by a dense neural network layer on the training dataset. The given model has been trained on 50 epochs with a batch size of 64.

Model: "sequential"

Layer (type)	Output Shape	Param #
lstm (LSTM)	(None, 100, 50)	10400
lstm_1 (LSTM)	(None, 100, 50)	20200
lstm_2 (LSTM)	(None, 50)	20200
dense (Dense)	(None, 1)	51

Total params: 50,851		
Trainable params: 50,851		
Non-trainable params: 0		

Fig4. Solar Tracker Time Series model configuration

Model Performance

The model has been trained on a fairly simple configuration, yet the model performance is high. To evaluate the performance, RMSE is used as the evaluation metric. The model has an RMSE of 186.83 on train data & RMSE of 188.19 on test data. The model performed well to generalize on test data as well.

We have built the UI to showcase the performance of the proposed solution with hardware based solar trackers results to compare the results of the proposed methodology with more prominent solutions in the market.

As shown in figure 5, the result of the LSTM based solar tracker on a specific latitude, longitude shows the forecasted azimuth angle of the sun & comparison of that with the angle derived from the physical solar sensors.

As can be observed in the figure 5, the AI based solar tracker model's forecasted angle movement is smoother as compared to the physical solar sensors-based tracker's result & AI model result is more accurate, precise as compared to sensor data.

Since the sun moves in specific trajectory throughout the day which is getting captured well with AI model-based forecasting method whereas the sensor-based solution's result is jittery & moves up and down which shows the error in the sensor-based method.

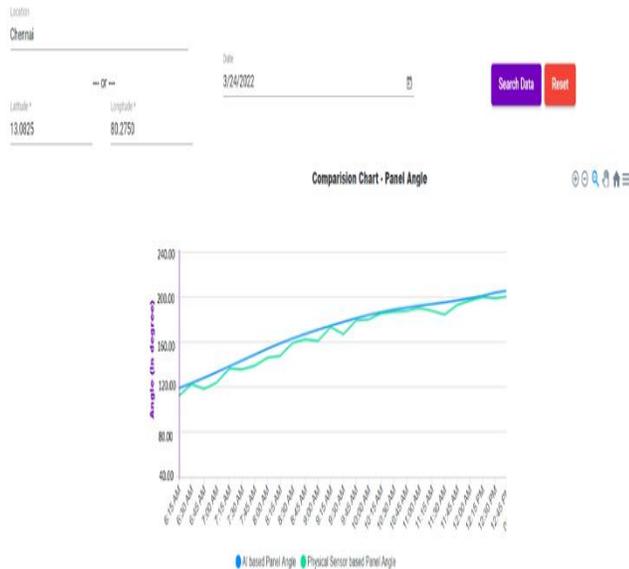


Fig5. Solar Tracker Simulation v/s Sensor based tracker

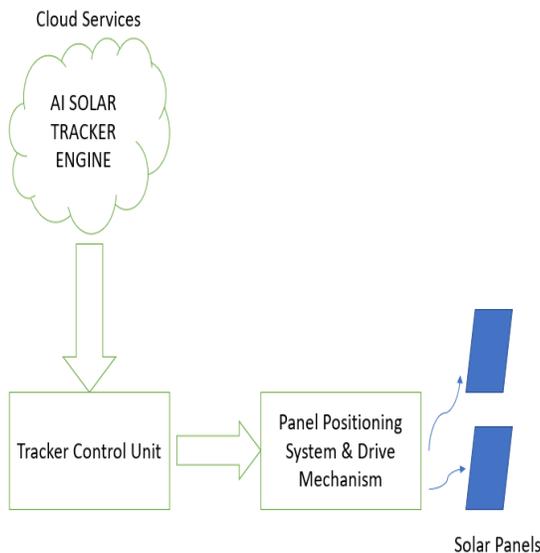


Fig6. Solar Tracker proposed methodology

Proposed Solution Design

The AI-based solar tracker is a unique solution that can be trained on a one Latitude, Longitude data & can be used to forecast the sun position of any other location given solar panel's Latitude, Longitude data. This feature of the solution makes it a global one stop solution for solar position optimization.

As shown in Fig 6, we are proposing to deploy the AI based solar tracker solution on a cloud i.e., AWS or GCP or Azure to make the solution accessible, scalable & adaptable to the any solar farm looking to incorporate the services.

The AI engine will forecast the sun azimuth angle for the client location & the cloud will signal the local solar farm about the position of the sun (azimuth angle) in that location.

The signal gets processed by the Tracker control unit which instructs the Panel Positioning System which commands Drive Mechanism to rotate the panels at their respective azimuth angle. This way multiple solar farms can get connected to the cloud & can avail of the services of solar tracking.

Key characteristics of the model

The finalized model is trained once & used anywhere which means it is trained on one location data & it can be used to forecast the azimuth angle for any other location. This eliminates the need for a separate model for separate locations.

This solution is a novel solution to remove the dependency on the hardware-based solar trackers giving better accuracy at a cheaper cost.

This AI-based solution removes the cons of hardware-based solar trackers such as no service/maintenance being needed or no hassle of faulty/failed physical solar tracker.

In comparison with a fixed PV solar system, the AI-based solar track may provide 40%-45% increased energy production which can be used to meet the increasing energy demands.

II. CONCLUSION

There exist multiple solar tracker solution ranging from the hardware-based sensor to passive temperature-controlled system. These solutions are decent in delivering the result but comes with various limitations & problems which restricts the adaptation of the same at a scale. The Cloud Powered AI based solar tracker system is an attempt to rectify these limitations and to make the solar tracking system more scalable.

The result from the AI based trackers not only is an improvement in terms of accuracy, precision but also the energy efficiency is higher as compared to the hardware-based models.

This solution eliminates the need of maintaining the physical sensors and it is cost effective as it reduces hardware dependency & it makes the solution scalable to all the solar farms across the globe.

REFERENCES

- [1] https://en.wikipedia.org/wiki/Solar_cell
- [2] <https://hyperfinearchitecture.com/how-to-read-sun-path-diagrams/>
- [3] https://en.wikipedia.org/wiki/Solar_azimuth_angle
- [4] A.Z. Hafez, A.M. Yousef, N.M. Harag, Solar tracking systems: Technologies and trackers drive types – A review, Renewable and Sustainable Energy Reviews, Volume 91, 2018, Pages 754-782,
- [5] P. Sharma and N. Malhotra, "Solar tracking system using microcontroller," 2014 1st International Conference on Non Conventional Energy (ICONCE 2014), 2014, pp. 77-79, doi: 10.1109/ICONCE.2014.6808687.

AUTHORS

First Author – AhmedUvesh Mevawala, Advanced Technology Centers In India, Accenture Technology, Bangalore, India, a.i.mevawala@accenture.com

Second Author – Tanusree De, Advanced Technology Centers In India, Accenture Technology, Bangalore, India, tanusree.de@accenture.com

Third Author – Subhadip Ghosh, Advanced Technology Centers In India, Accenture Technology, Bangalore, India, subhadip.b.ghosh@accenture.com

Fourth Author – Harshaprabha N Shetty, Advanced Technology Centers In India, Accenture Technology, Bangalore, India, h.n.shetty@accenture.co

Impact of Real Agricultural Outputs, Human Capital and Power Supply on Nigeria's Real Economic Growth (1981-2020).

¹Simon Ibrahim Achi & ²Lucy Obahor.

^{1.&2}Data and Research Department, Skills Outside School Foundation, Nigeria.

DOI: 10.29322/IJSRP.12.10.2022.p13073
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13073>

Paper Received Date: 13th September 2022
Paper Acceptance Date: 15th October 2022
Paper Publication Date: 21st October 2022

Abstract- For over three decades (1981-2020), the Nigerian government has set out various policies to stimulate the country's real economic growth. The government did this by inducing funds in different sectors: agriculture, education, health and power. Contrastingly, the desired outcome of real economic growth has not been achieved. Hence, this study examined the impact of real agricultural outputs, human capital and power supply on Nigeria's real economic growth using quarterly time-series data from 1981- to 2020; and exploited the Cobb-Douglas Production for theoretical backings. After reviewing relevant works of literature, the analytical techniques (Johansen cointegration (long-run relationship) and Dynamic Ordinary Least Squares (DOLS) (long-run impacts) were found worthy and were employed. The result of Johansen cointegration indicated a long-run equilibrium relationship in the model, while the Dynamic OLS result revealed that real agricultural output has been the key sector contributing the highest level of impact among other variables of interest to Nigeria's real economic growth. Divergently, public spending on health and electricity has not significantly contributed to Nigeria's real economic growth. Thus, we conclude that real agricultural output has yielded a positive and significant impact on the nation's growth, whereas spending on human health and electricity and gas is yet to impact positively on the economy's growth. The study recommends that policymakers in the health and electricity sectors (Ministry of Health and power) should intensify the need for more public investment, and proper monitoring of the allocated funds to these sectors. These should be done so that the funds can be prudently utilized and accounted for which can consequently bring about positive impact in the lives of Nigerians.

Index Terms- Agriculture, Education, Health, Economic Growth, and Nigeria

I. GENERAL INTRODUCTION

Globally, every economy's economic growth and development are hinged on some key sectors (agriculture, education, health, and power supply) impacts which cannot be overridden. These sectors' contributions are classified based on the role that each sector performs in the economy (primary, secondary, or tertiary), and usually, the contributions of these sectors are lumped or interwoven thus, making it difficult to ascertain the impact of each sector at the end of a fiscal year. This is the crux that most third-world economies are yet to vividly explore and optimize as these sectors are not properly guided and lack financial backings (Arikpo, et al., 2019; Aigbenedion, et al., 2017; Oyetade, Shri, and AbdulRazak 2016 Pius and Abel 2015). Distinctively, in America; Europe, and Asia; sectors like Agriculture, education, health, and power are given high priority with great backing in finance, research, and technology. These regions support these sectors because they understand how pivotal they are to the growth of the economy. Thus, the prudent engagement of these sectors by the governments of these regions has translated to positive impacts on their real economic growth outputs. (Joaquín, et al., 2021; David and Stephanie, 2019; Kangjuan, et al., 2017 and Epha, 2016)

For example, in the later years of the 19th and 20th centuries, the American government understood the key role that research plays in the development of the agricultural sector in their economy and that stirred the need for them to establish the public sector agricultural research and development Institute in 1862 and the International Food Policy Research Institute (IFPRI) in 1975 respectively. Since then, have provided evidence-based policy solutions for the sustainable food supply, and assist in fighting hunger, malnutrition, and reduced poverty (FAO, 2017). While in Asia, available information revealed that China¹ with 35 percent of her labour force in agriculture (425million agricultural farmers), can feed 22 percent of the world's population based on her different agricultural produce and products which are outcomes of her modern research, technology and good

¹ Agriculture is a major source of income to most Chinese, as it was stated by Lauren Keane in the Washington Post, "China has a long-

standing policy of food – self-sufficiency, growing about 95% of the grains required to feed its people".

management of key macroeconomic variables. These conscious actions by the Chinese government consequently produced great improvement in her economic growth and development. (*America Farm Bill, 2019*).

In terms of human capital development, key sectors like health, education, and power supply, are upheld in high esteem in the European continent relative to developing countries. This is evidenced by the 2019 World Happiness Report (WHR)² which has the first four happiest, less inequality and most peaceful countries (Finland, Denmark, Norway, and Iceland) in the world to be from Europe. These countries achieved these feats because they had formulated good policies for their health, education, and power sector, with high fiscal discipline ethics thus, minimizing their cost of living, bridging the inequality gap, and boosting their life expectancy (World Happiness Index, 2019). When these are juxtaposed with African countries, we realised that there are lots of policy failures, poor fiscal discipline, and inconsistency in policy implementation with a common pilfering attitude by government officials. The United Nations via the Millennium Development Goals(MDGs) campaign acknowledged education and health services as the key sectors that can expedite any country's economic growth, while others (Stern et al., 2019; FAO, 2017; Yusuf, 2014; and Adeyemi and Ayomide, 2013) argued that agriculture and power supply are key to the economic growth of the least developed nations.

In Nigeria, the 2020 Central Bank(CBN) statistical reports showed that for the past two decades (1999-2020), average public investments in these sectors (Agriculture, Education, and Health) when matched with the Real Gross Domestic Product(RGDP) that the country realizes annually has never exceeded 6% of its Real Gross Domestic Products(RGDP), and despite the inadequate funds allocated to these sectors; the health sector has returned releases of over N70bn between 2009 to 2018 due to late government approvals and poor fiscal discipline (CBN, 2020 and DRPC, 2020). While the agricultural sector has lost over 50% of its outputs to post-harvest storage as reported in 2022 by the Nigerian Stored Products Research Institute. When all these are juxtaposed with what other developed countries are experiencing, big disparity sets in, in the way these sectors are managed in the country, and as such poses some questions like: **a.** What are the magnitudes of the contributions of each of these sectors (Agriculture, Education, Health and Power supply) toward the economic growth of Nigeria from 1981-2020? **b.** Which of these sectors most contributes to Nigeria's real economic growth? and **c.** What are the practical policies that the government can implement to support the performing and non-performing sectors? These among other objectives formed the motivation for this study. To achieve these, the study is structured in five sections: General introduction; literature review, methodology; estimation and findings; and summary, conclusion, and policy recommendations.

II. LITERATURE REVIEW

2.1 Conceptual Literature:

Harris and Fuller (2014) conceptualized agriculture as *practices that involve crop planting and harvesting and domestication of animals to sustain the global human population by providing food and other products*. This definition of agriculture entails three sub-sectors, namely food, animals, and other products that are produce for man's use. In Nigeria, the agricultural sector is shared into four sub-sectors namely; crop production, fishery, forestry, and livestock production (CBN, 2020). When these sectors' outputs are put together and monetized, it's called Agricultural Outputs. This is annually stated in the CBN annual Statistical bulletin. In Nigeria, agriculture and its output have been a major source of living for over 60% of its populace due to its crucial roles that are inevitable for the survival of any society (Pius & Abel, 2015 and Olarinde & Abdullahi, 2014).

Education, on the other hand, is viewed and understood differently by different people, communities, and societies globally. This is because it connotes different things to different people. Thus, there is no generally accepted definition of education worldwide. The main essence of education in any economy is that it does not only help to supply the essential human capital which is a necessary condition for sustainable economic growth but aids reduce poverty, and promote equity and social justice (Todaro, 2007). However, in Nigeria, Uwadia, (2010) asserts that *Education in a broad sense is a process by which an individual acquires the many physical and social capabilities demanded by the society in which he/she is born to function*. The public investment in education is the amount of money that the government supports the sector which is measured annually and published in the CBN annual statistical bulletin (CBN, 2020).

The concept of health has long ago been discussed in different contextual environments and times. Thus, in trying to review this concept, history has it that the concept of health started when man began to balance his body and soul with the environment and against diseases. This concept was upheld by the philosopher Plato (429-347 BC) in his discussion "Dialogue." Where he maintained that "a perfect human society could be achieved by harmonizing the interests of the people and their environs; he asserted that the ideal of ancient Greek citizens was to have "a healthy mind in a healthy body" which can be achieved if people established internal harmony and harmony with the physical and the social environment." This was maintained throughout the Ancient Greece era, which was perverse through the ancient Indian and Chinese ages (Anna, Doncho, Nina, and Srećko, 2017). Nowadays, the concept of health focuses on issues that cover, morbidity(the rate at which diseases occur), mortality rate, and life expectancy. This broadens the scope with which health was earlier perceived in the world. The modern understanding of health became very official in 1948 when the World Health Organization (WHO), came up with its definition in

² The World Happiness Report is an annual report that presents the global findings using the Gallup World Poll Surveys. Nigeria is ranked 85 out of 156 countries in 2019.

its Constitution. The definition was proposed by Dr Andrija Štampar one of the founders of the WHO. The Organisation defines health as the “*state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity*” (World Health Organization Constitution, 2006).

For power supply, it is the quantum of electricity that the electricity industry supplies to a particular group of people for domestic or industrial purposes. The industry is one of the basic and significant industries of the national economy, which is closely related to economic development (Adeyemi and Ayomide, 2013; Sun, Wang & Ma, 2009). On the one hand, the power supply is a propelling force of economic development. Its shortage can seriously affect the healthy development of the economy and can cause large economic losses (Stern, et al., 2019; Adeyemi and Ayomide, 2013).

2.2 Theoretical Literature

Several theories related to economic growth were reviewed, though, some of these theories have different views about the linkages that exist within these sectors and how they impact the economic growth of any economy. From the literature, we found that the Cobb-Douglas production function which is one of the oldest but most renowned production theories is suitable for this study. Besides, studies like Arikpo, Eke, and Obafemi, (2019), Oyetade, Shri, and AbdulRazak, (2016); Pius and Abel (2015) among others have employed this theory in their studies which makes clarity on their findings. From the previous studies, the researchers also deduced that since economic growth is obtained from the outcome of human production activities which are viewed to be efficiently implemented within an economy, there is a need for a good and favourable combination of Macro-inputs from other economic sectors to make it yield the maximum output and positively affect the lives of the people. Further, the theory was adapted and employed in a macro study through what is known as the “Aggregate Production theory” and it was considered valid. Thus, it is used in some macro studies based on how the variables are employed and observed within a given model. (Sloman and Wride, 2009; Koutsoyiannis, 1979).

2.3 Empirical Literature

Bayati, Akbarian, & Kavosi, Z. (2013) using GDP per capita, health expenditure, food production index, employment ratio, education index, measles immunization coverage rate, urbanization, and carbon dioxide emission as explanatory variables, explored the determinants of life expectancy in the Eastern Mediterranean Region (EMR). Estimating a Health Production Function using a fixed-effect model and panel data for 21 EMR countries, their findings showed that GDP per capita, food availability, employment ratio, education, and urbanization had a positive effect on life expectancy, while health expenditure, measles, immunization coverage rate, and carbon dioxide emission showed no significant relationship with life expectancy.

Agheli and Emamgholipour, (2015) in their empirical study, explored the factors affecting the production of health (life expectancy) in Iran. They used per capita income, immunization rate, and share of expenditure on education (as a percent of GDP) as explanatory variables. Following the estimation of their model

using the Johansen-Juselius cointegration and error correction model, their result showed that all the explanatory variables included in the model had a positive and significant effect on life expectancy with immunization having the largest magnitude of the effect. Anthonia, (2012) investigated the impact of primary and secondary school education on economic growth in Nigeria using a Comparative Analytical Approach with annual time series data ranging from 1985 to 2007. The findings show that only recurrent expenditure has significant effects on economic growth in Nigeria.

On the other hand, Salami et al. 2017 empirically examined the relationship between health and education expenditure on economic growth in Nigeria between 1917 and 2013. The study adopted the OLS to determine the relationship between health and education expenditure on economic growth in Nigeria. They found out that capital expenditure and recurrent expenditure showed a negative impact on the economy. While Aigbenedion, Iykwari, and Gyang, 2017 empirically examined the impact of the education sector on economic growth in Nigeria using time series data and an ordinary least squares (OLS) estimation technique in investigating the impact and relationships among the economic variables, a multiple regression model was used. The results revealed that the education sector has a positive impact on economic growth in Nigeria. This implies that economic growth can be improved by increasing education investment. But Government expenditure on education is negatively related to the Real Gross Domestic Product in Nigeria thus negatively affecting the growth rate.

2.3.1 Gaps in the literature

Most studies (Arikpo, et al., 2019; Aigbenedion, et al., 2017; Oyetade, Shri, and AbdulRazak 2016; Pius and Abel 2015; Adeyemi and Ayomide, 2013; among others), approach this problem using different time series data, variables, and techniques. In terms of data and techniques, most studies consider annual and panel time-series data. With few taking incognizance quarterly data. This study uses both quarterly and semi-annual data. The choice for the use of quarterly and semi-annual data is because annual data do not give a suitable account of lead/lag relationships; furthermore, quarterly and semi-annual data give a quick reaction to level shifts and changes in trends more than annual data since it is modelled quarterly and semi-annually (Tom, 2018).

While for techniques, most previous studies do employ the OLS, VAR, Johansen cointegration, and VECM with few studies employing the Computable General Equilibrium and Fully Modified OLS. None to the best of the researcher’s knowledge has considered employing the DOLS technique by Stock and Watson, 1993; which gives a higher order of integration as opposed to OLS and VAR, is suitable for determining long-run relationships and elasticities among variables, produces reliable estimates for small and medium sample size and provides a check for robustness. The DOLS model is based on Monte Carlo simulation which opined that the DOLS estimation is superior in smaller and medium samples as compared to other alternative estimators (Masih, 1996). It also produces robust results, correcting for regressors’ endogeneity and serial correlation which is the major criticism of the single equation method. Besides, the method takes account of

the lead and lags of regressors and has asymptotic optimality properties like the Johansen procedure (Stock and Watson, 1993).

III. METHODOLOGY

3.1 Estimated Model Specification

Adopting the Cobb-Douglas production function which is the framework for our analysis, we have $Y_t = F(K_t, L_t) \dots$ (general form) **3.1**

Where Y is the endogenous variable representing the outcome of the combination of K (capital) and L (labour) at time “ t .” Adapting equation 3.1 like some studies (Simon, 2020; and Arikpo, Eke and Obafemi, 2019; among others) did to achieve their objectives, by incorporating variables like real agricultural output, public spending on education, health and power supply; instead of the usual capital and labour, thus, equation 3.2 was augmented and expressed as:

$$Y_t = F(K_t, L_t, RAGDP_t, EDUEXP_t, EGAS_t, HHSSt) \quad 3.2$$

This was done to determine their impacts on the real economic growth of Nigeria. Where Y is the GDP growth rate (a proxy for economic growth), $RAGDP$, represents Real Agricultural Output, while $EDUEXP$, $EGAS$ and $HHSSt$ represent public spending on Education, Electricity and Gas and Human Health Services. Hence, when capital and labour variables are omitted from the model to examine the variables of interest, the model becomes:

$$Y_t = F(RAGDP_t, EDUEXP_t, EGAS_t, HHSSt) \quad 3.3$$

Which is symbolically stated in stochastic form as:

$$GDPGR_t = \beta_0 + \beta_1 LLAGDP_t + \beta_2 LEDUEXP_t + \beta_3 LEGAS_t + \beta_4 LHHSSt + \mu_t \quad 3.4$$

3.2 Estimation Techniques:

To achieve the objective of the study, we employed these lines of estimations: First, the stationarity test- by Phillip and Perron (PP) (1988) was conducted to determine the degree of integration of each variable, followed by the Johansen cointegration test by Johansen (1991) to determine the existence of a long-run relationship in the model and lastly the Dynamic Ordinary Least Squares by Stock and Watson (1993) was employed to examine the magnitude of the long-run impact (elasticities) of each independent variable on the dependent variable. All estimations were done using E-Views 11 statistical tool.

3.5. A-priori Expectation

We expect from this study that all the variables should have a positive impact on the dependent variables. Hence, the signs of the variables’ coefficients are expected to take the form: $\beta_1 > 0, \beta_2 > 0, \beta_3 > 0$ and $\beta_4 > 0$.

3.4 Sources Of Data:

This study used quarterly data covering 1981Q₁ – 2020Q₄. The sources of the data sets are presented in table 3.5 below. The choice of the period was dictated by the availability of data and the NBS Real GDP rebasing of 2010 constant prices which started from 1981. Hence, table 3.5 contains the variables’ definition, description, measurement and sources of the data used in carrying out the analyses in this study.

Table 3.5. Variables Definition, Description, Measurement and Sources.

S / N	VARIABLE’ S DEFINITION	VARIABLE DESCRIPTION	VARIABLE MEASUREMENT	SOURCE
1	RGDPGR	Real GDP Growth Rate	Relative Value in percentages	2020 CBN Annual Statistical Bulletin.
2	LRAGDP	Real GDP Agricultural Outputs	Nominal Value in Million Naira	2020 CBN Annual Statistical Bulletin.
3	LEDUEXP	Expenditure on Education	Nominal Value in Million Naira	2020 CBN Annual Statistical Bulletin.
4	LHHSSt	Expenditure on Human Health Services	Nominal Value in Million Naira	2020 CBN Annual Statistical Bulletin.
5	LEGAS	Expenditure on Electricity and Gas Supply	Nominal Value in Million Naira	2020 CBN Annual Statistical Bulletin.

Source: Author’s Initiative., 2022.

IV. RESULTS, DISCUSSIONS AND FINDINGS

This section is created to analyze the time series used for this study such that it will reflect two objectives (1 and 2), conduct the preliminary test, present the estimation results, trace the impacts and analyze the variables of concern from the estimation results.

Descriptive Statistics of all the variables from 1981Q₁ to 2020Q₄.

From Table 4.1, the Jarque-Bera test values are used to determine the normality test of the series’ residuals. Thus, all the variables are normally distributed at a 5% level of significance since all the Jarque-Bera probability value is less than 0.05 level of significance as shown in the table. Hence, we fail to reject the null hypotheses that the residuals are normally distributed (Jarque and Bera, 1987)

Table 4.1 Descriptive Statistics of all the variables from 1981Q₁ to 2020Q₄.

	GDPGR	RAGDP	EDU	HHSS	EGAS
Mean	3.422935	8216517.	630149.7	235588.7	108813.0
Median	3.468975	4932757.	353002.6	158730.5	48815.10
Maximum	14.60438	18348176	1519660.	484736.9	328764.4
Minimum	-13.13000	2303505.	242555.9	113464.7	5117.648
Std. Dev.	5.478513	5477976.	457538.4	136451.5	114310.0
Skewness	-0.886041	0.533492	1.011886	0.881016	0.523410
Kurtosis	4.453011	1.733248	2.373729	2.103049	1.690854
Jarque-Bera	35.01011	18.28743	29.91914	26.06184	18.73129
Probability	0.000000	0.000107	0.000000	0.000002	0.000086
Sum Sq. Dev.	4772.243	4.77E+15	3.33E+13	2.96E+12	2.08E+12
Observations	160	160	160	160	160

Source: Author Computation using E-views 11.

Stationarity Test for Unit Roots:

Table. 4.2 Unit Root Table for all the variables.

Phillip-Perron (PP) Levels			Phillip-Perron (PP) First Difference		
Variable	Intercept and Trend (test Statistics)	Prob.	Variable	Intercept and Trend (test Statistics)	Prob.
GDPGR(Y)	-2.888862	0.1690	GDPGR(Y)	-13.92922	0.0000
LRAGDP	-2.114003	0.5337	LRAGDP	-13.77725	0.0000
LEDUEXP	-1.620628	0.7807	LEDUEXP	-13.69303	0.0000
LHHSS	-1.685645	0.7533	LHHSS	-14.39108	0.0000
LEGAS	-2.000896	0.5960	LEGAS	-12.62133	0.0000

Source: Author Computation. * Significant at 1%. ** significant at 5%

In table 4.2, all the variables were integrated in the same order i.e. I(1) after they are subjected to a Philip Perron (PP) unit root test. This implies that all the variables were non-stationary at level, but were all stationary after first differencing. The PP test was used because it corrects for serial correlation and heteroscedasticity in the errors(ϵ_t) in a non-parametrical manner by modifying the Dickey-Fuller t-statistics unlike the Augmented Dickey-Fuller test (ADF) which does not. (Phillip and Perron, 1988).

Cointegration Test for Long-run relationship and DOLS for long-run coefficients for equations 3.4.

Table 4.3a. showed the suitable lag length criteria of 4, which was used for the estimation of the cointegration test.

Table 4.3a Lag Length Criteria.

Lag	AIC	SC	HQ
0	-7.509686	-7.409776	-7.469098
1	-8.924303	-8.324844	-8.680772
2	-8.732242	-7.633233	-8.285767
3	-8.765878	-7.167320	-8.116461
4	-11.19907*	-9.100960*	-10.34671*
5	-11.10180	-8.504138	-10.04649
6	-10.81600	-7.718790	-9.557751
7	-10.55387	-6.957116	-9.092684
8	-11.07155	-6.975246	-9.407421

Source: 2022 Author's Computation, using E-Views 11.

4.3b. Cointegration test for equation 3.4

Table 4.3b contains the results for the cointegration tests; which suggest there is a long-run relationship existing among the variables for the model (equation 3.4) evidenced by the trace statistics.

4.3b. Cointegration test for equation 3.4

No. of Block	Trace				Max-Eigen Value				
	Hypothesized No. Cointegration. Equation.	Trace statistic Value	0.05 Critical value	prob.	No. of Coint. Equation	Max-Eigen statistics Value	0.05 Critical value	prob.	No. of Coint. Equation
None*	182.5164	69.81889	0.0000	5	96.37347*	33.87687	0.0000	5	
At most 1*	86.14294	47.85613	0.0000		37.67775*	27.58434	0.0018		
At most 2*	48.46519	29.79707	0.0001		25.74125*	21.13162	0.0104		
At most 3*	22.72393	15.49471	0.0034		15.78938*	14.26460	0.0285		
At most 4*	6.934551	3.841466	0.0085		6.934551*	3.841466	0.0085		
* denotes rejection of the hypothesis at the 0.05 level					Source: Author's Computation.				

Dynamic Ordinary Least Squares (DOLS).

Having established the existence of a long-run relationship among the variables from the two equations, the DOLS estimation was then employed to determine the magnitude of the impact that each exogenous variable has against the endogenous variable for the two equations in the long run. Considering all the variables of interest, the DOLS result (Table 4.3c) suggests that the coefficient of real agricultural output and public funding on education over the period under review have a positive impact, however, its only real agricultural output that has a significant impact on the dependent variable (real GDP growth rate). The result further reveals that real agricultural output contributes more (17.21) to Nigeria's real GDP growth rate than any other variable in the model

Table 4.3c Dynamic OLS result for Equation 3.4 (the period between 1981Q1 to 2020Q4):

VARIABLES	Dependent Variable: Y (Real GDP Growth Rate)		
	Coefficient	t-Statistic	Prob.
Constant	-31.93093	-0.621067	0.5356
LRAGDP	17.21273	2.862040	0.0049
LEDUEXP	4.010024	0.259672	0.7955
LHHSS	-22.69634	-1.159396	0.2483
LEGAS	-1.008868	-0.702346	0.4836
R-squared	0.52416		
Adjusted R- Squared	0.469783		

Source: Author Computation. * Significant at 1%. ** significant at 5%

This implies that ceteris paribus any 1% increase in real agricultural output agriculture can cause a 17.21 unit increase in the real economic growth rate in Nigeria. Contrastingly, the result revealed electricity and human health services negatively affect the dependent variable, with the most negative being funding for human health(-22.70). This is based on the imprudent spending

and pilfering attitude of public office holders that are very common in most of the sectors of the economy, misallocation and/or diversion of public drugs and vaccines to private hospitals and clinics which are later sold at higher prices; also delay and/or deferment in the release of funds leading to poor fiscal discipline and return of un-utilized funds as it was done in the health sector as over N70bn was returned between 2009 to 2018 to federation account because of late release of funds and poor fiscal discipline(DRPC, 2020). In addition, poor storage equipment such as good vaccine storage (refrigerators/ vaccine boxes, etc.) and standard stores for drug storage are lacking in most communities' PHCs in the country which also exacerbated to quick expiration of vaccines and drugs leading to a huge waste of drugs via-a-vis funds. Thus, not reaching the end-users.

Similarly, the negative impact of electricity and gas funding in the country on the real economic growth rate as revealed in the model is a result of the huge money that was employed for the services of foreign experts to fix the electricity but was fruitless, instead, the projects that were implemented were of trivial life span, and the monies given are taken out of the country by these experts. Furthermore, most standard companies in compact industrial areas and even some public offices in the country depend little on the public supply of electricity and gas due to the shortage and unreliability of the power supply. Thus, most of them preferred importing high voltage diesel generators and other power generating devices for light stability which further contributes to more demand for foreign currency and invariably depreciates the local currency and affects the economic growth negatively. It is also worth noting that there are various incomplete electricity and gas projects (Mambila hydro-station) projects in Nigeria that had drained a large portion of the public funds without good results consequently, becoming liabilities to the nation.

Thus, all these contribute negatively to economic growth over the period under review. These outcomes corroborate with previous studies like Adewolokan, (2016) and Salami et al. (2017) as they pointed out that the reason for the negative impact of public health funding on Nigeria's economic growth may be a result of so many degenerating health facilities in Nigeria that require maintenance rather than the establishment of new ones.

V. SUMMARY, CONCLUSION AND RECOMMENDATIONS

The study seeks to determine the impact of real agricultural output, human capital and power supply on Nigeria's real economic growth from 1981 to 2020. From the estimated Johansen cointegration result, there exists a long-run relationship within the model (real GDP growth rate, real agricultural output, human capital and power supply). While from the estimated DOLS result, agricultural output has been the key sector contributing the highest to economic growth in the country. However, public spending on health and electricity has not significantly contributed to real economic growth in the economy. Thus, the study concludes that real agricultural output has yielded a positive and significant impact on economic growth, whereas spending on human health and electricity and gas is yet to impact positively on the economy's growth. Based on these empirical findings, the study recommends that the responsible policymakers for the health and electricity sectors should intensify the need for more public funding, and proper monitoring of the allocated funds should be done so that the funds allocated to these sectors can be prudently utilized and accounted for. More funding and technical support from the public, private partners and non-governmental organisations should be given to agriculture and education since these sectors have more comparative advantage in boosting the real economic growth of the country compared to other sectors that were considered in the study. Also, a better policy framework for the Nigerian agricultural sector through the ministry of agriculture and adequate infrastructure should be strictly enacted where each crop will have an allocated amount of money that can be kept to support farmers who may need financial assistance and credit facilities.

Output target on crops which are allocated money from farmers can be given. If the target is met, the government should buy the excess produce. This will encourage farmers to produce more such crops in the following year. Again, more infrastructure such as good roads, markets and storage facilities should be provided or raised for farmers to find ease of transportation, store their produce and help reduce post-harvest loss. These will ameliorate the wastage of food in the producing areas.

REFERENCES

[1] Adeyemi A. O., & Ayomide A. (2013) Electricity Consumption and Economic Growth in Nigeria. *Journal of Business Management and Applied Economics*, 2(4),1-14.

[2] Agheli, L., & Emamgholipour, S. (2015). Determinants of Life Expectancy at Birth in Iran: A modified Grossman Health Production Function. *European Online Journal of Natural and Social Sciences*, 4(2), 427-437.

[3] Aigbedion I. M., Iyankwari A. D. B., & Gyang J. E. (2017). Education Sector and Economic Growth in Nigeria: an Impact Analysis. *International Journal of Advanced Studies in Economics and Public Sector Management*, 5(3), 58-69.

[4] Anna, L. S., Doncho, D., Nina, J. K., Srećko, G. (2017). Concepts and definitions of Health and health-related values in the knowledge landscapes of the digital society: Knowledge Landscapes., *Croatian Medical Journal* 58:431-5. <https://doi.org/10.3325/cmj.2017.58.431>.

[5] Anthonia, T. O. (2012). Education and Economic Growth in Nigeria: A Comparative Analytical Approach. *European Journal of Globalization and Development Research*, 6(1), 330-342.

[6] Arikpo, D. I., Eke, F. A., & Obafemi, F. N. (2019). Determinants of Life Expectancy in Nigeria: A Macroeconomic Analysis. *International Journal of Social Science and Economic Research*, 04(4), 2722-2749. ISSN: 2455-8834

[7] Basic Documents, Forty-fifth edition, Supplement, October 2006 This text replaces that on pages 1-18 of the Forty-fifth edition of Basic documents,

following the coming into force of amendments adopted by the Fifty-first World Health Assembly. Constitution Of The World Health Organization.

[8] Bayati, M., Akbarian, R., & Kavosi, Z. (2013). Determinants of Life Expectancy in Eastern Mediterranean Region: A Health Production Function. *International journal of health policy and management*, 1(1), 65-71.

[9] Central Bank of Nigeria (2020) Annual Statistical Bulletin

[10] Development Research and Projects Centre (2020) Research Publication (<https://drpc>)

[11] Food and Agricultural Organisation (FAO) (2017). The future of food and agriculture trends and challenges. Rome, ISBN 978-92-5-109551-5

[12] Harris, D. R. and Fuller, D. Q. (2014). Agriculture: Definition and Overview. In *Encyclopedia of Global Archaeology* (Claire Smith, Ed.). New York: Springer., 104-113.

[13] <https://dx.doi.org/10.1016/j.apenergy.2008.12.008>

[14] Jarque, C. M., & Bera, A. K. (1987). A test for normality of observations and regression residuals. *International Statistical Review/Revue Internationale de Statistique*, 163-172.

[15] Koutsoyiannis, A. (1979). *Modern Microeconomics*, 2nd Ed. Macmillan Press LTD, Hound Mills Basingstoke, Hampshire and London, 67-95.

[16] Masih R. (1996). Stock-Watson dynamic OLS (DOLS) and Error Correction Modeling approaches to estimating long-run and short-run in a demand function. New evidence and methodological implications from an application to the demand for coal in mainland China, *Energy Economics*, 18 (4), 315-334.

[17] Olarinde M. O., & Abdullahi H. (2014). Macroeconomic Policy and Agricultural Output in Nigeria: Implications for Food Security. *American Journal of Economics*, 4(2): 99-113.

[18] Oyetade, P. O., Shri D., & AbdulRazak, N. (2016). Agricultural Export, Oil Export and Economic Growth in Nigeria. *International Journal of Environmental & Agriculture Research*, 2(2), 563-569. doi: 10.1016/j.sbspro.2016.05.035

[19] Phillips, P. C. B., & Perron, P. (1988). Testing for unit roots in time series regression. *Biometrika*, 75, 335-346.

[20] Pius C. I., & Abel E. O. (2015). Response of Nigeria's Agricultural Sector to Selected Macroeconomic Policy Variables. *Journal of Economics and Sustainable Development*, 6(4), 162-168.

[21] Salami, D. K., Olabode, O. S., Atoyebi, K.O., Lawal S. A. & Danmola, R. (2017). Effects of Government Health and Education Expenditures on Economic Growth in Nigeria. *International Journal of Social & Management Sciences (IJSMS)*, 1(1), 118 – 130.

[22] Sloman, J., & Wride, A. (2009). *Economics*. 7th ed. Pearson Education Limited, England. 463–465, 646 – 652.

[23] Stern, D. I., Burke, P. J., & Bruns, S. B. (2019) The Impact of Electricity on Economic Development: A Macroeconomic Perspective. EEG State-of-Knowledge Paper Series, Oxford Policy Management Center for Effective Global Action Energy Institute at Haas. Applied Research Programme. P.1-44. <https://escholarship.org/uc/item/7jb0015q>

[24] Stock, J. H. & Watson M.(1993). A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems. *Journal of Econometric Society*, 61(4), 783-820.

[25] Stock, J.H. & Watson, M.W. (1993). A simple estimator for Cointegrating Vectors in higher order integrated systems. *Econometrica*, 61, 783-820.

[26] Sun, T., Wang, X., Ma, X.,(2009). Relationship between the economic cost and the reliability of the electric power supply system in the city: A case in Shanghai of China. *Applied Energy*, 86, 2262–2267.

[27] The 2018 Farm Bill (P.L.115-334): Summary and Side-by-Side Comparison (2019) Congressional Research Service.

[28] The World Health Organisation Report 2006: working together for health. Geneva. (<http://www.who.int/whr/2006/en>)

[29] Todaro, P. (2007). *Economic Development*: Pearson Education, 8th Edition, India.

[30] Tom, R. (2018). Advantages and disadvantages of using monthly, weekly and Daily Data. *Journal Econometric*, 3, 28-37.

[31] Uwadia O. (2010). Community.vanguardngr.com/profiles/blogs/educationand-national

[32] World Development Indicators, 2020

[33] Yusuf, S. A., (2014). Role of Agriculture in Economic Growth Development: Nigeria Perspective. Munich Personal RePEc Archive(MPRA) Paper No. 55536. <https://mpra.ub.uni-muenchen.de/55536/>

Second Author – Lucy Obahor, Data and Research Department, Skills Outside School Foundation, Nigeria.

Corresponding Mail & Phone Number:

simon.achi@skillsoutsideschool.com / +2347031338809.

AUTHORS

First Author – Simon Ibrahim Achi, Data and Research Department, Skills Outside School Foundation, Nigeria.

Work Breakdown Structure and Project Performance in Rwanda: A Case of Electricity Transmission Line Project in Bugesera District

^{1*} Angel Nabasa & ^{2*} Dr. Eugenia Nkechi Irechukwu (PhD)

^{1*}School of Business and Economics, Mount Kenya University, Kigali, Rwanda

^{2*}School of Business and Economics, Mount Kenya University, Kigali, Rwanda

DOI: 10.29322/IJSRP.12.10.2022.p13074
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13074>

Paper Received Date: 23rd September 2022

Paper Acceptance Date: 24th October 2022

Paper Publication Date: 30th October 2022

Abstract- The general purposive objective of this research was to assess the role of work breakdown structure in enhancing performance of the project. The study was guided by three specific objectives which are to examine the effect of planning activities on performance of electricity transmission line project, to assess the effect of schedule development on performance of electricity transmission line project, to evaluate the relationship between activities monitoring and performance of electricity transmission line project in Bugesera District of Rwanda. A descriptive research design with a mixed approach was used to collect quantitative data by use of a questionnaire to 144 respondents and qualitative data by use of interview guide to 8 respondents from management team. Thus, it means that the sample size of the study is made by 152 respondents drawn from the target population of 250 people working in electricity transmission line project by use of Krejcie and Morgan (1967) table and census method and simple random sampling technique as sampling technique. Quantitative data was analyzed using descriptive and inferential statistics by the help of SPSS 22.0 version. The descriptive results of the first objective indicated an overall mean of 1.347 which implied that a big number of respondents asserted that planning activities play a significant role in performance of electricity transmission line project. The descriptive results of the second objective indicated an overall mean of 1.423 which implied that there is a big number of respondents confirmed that schedule development plays a significant role on performance of electricity transmission line project. The descriptive results of the third objective indicated an overall mean of 1.445 showing that there is a big number of respondents strongly agreed that monitoring of activities play a significant role on performance of electricity transmission line project. The correlation results supported the descriptive results by revealing a strong positive and significant relationship between planning activities and cost performance ($r=0.851$ and $sig=0.000$), between planning of activities and quality performance ($r=0.786$ and $sig=0.000$), between planning of activities and schedule performance ($r=0.837$ and $sig=0.000$), between schedule development and cost performance ($r=0.813$ and $sig=0.000$), between schedule development and quality performance ($r=0.513$ and $sig=0.000$), between schedule development and schedule performance ($r=0.799$ and $sig=0.000$), between monitoring of activities and cost performance ($r=0.911$ and $sig=0.000$), between monitoring of activities and quality performance ($r=0.656$ and $sig=0.000$), monitoring of activities and schedule performance ($r=0.899$ and $sig=0.000$) at 0.01 level of significance. Hence, this implies that work breakdown structure plays a significant and positive role on performance of electricity transmission line project. In conclusion, the results showed that planning of activities, monitoring of activities and schedule development play a significant role on performance of electricity transmission line project in Bugesera District, Rwanda. Therefore, based on the results of the study, the researcher would like to recommend to the management of projects to enhance work breakdown structure in the sense of planning of activities, monitoring of activities and schedule development to ensure project performance.

Index Terms- Work Breakdown Structure, Project Performance, Planning of Activities, Schedule development,, Monitoring of Activities

I. INTRODUCTION

The republic of Rwanda has established REG to primary enhance the national vision of ensuring that all Rwandan have access to sustainable and modern energy services. However, this sector still faces a number of challenges in the implementation of its projects due to poor formulation of work breakdown structure which lead to project delay,

misalignment and failure (MININFRA, 2016). Furthermore, considering the national target of transforming and scaling up access to electricity to all Rwandans from the estimate of 34.5% to 100% by 2024, the electricity transmission related projects need to apply work breakdown structure in order to achieve that much by 2024. However, the report of OAG (2013) highlighted that the country is still facing the issue of high cost power from thermal power plants yet a big number of hydropower plans produce low capacity compared to installed production capacity of the hydropower.

Studies, audits and reports keep showing that due to poor formulation of work breakdown structure, some of the energy related projects keep delaying and other failure to successful performance their projects in the budget finance, time and schedule. For instance, the REG project of Gishoma power project that was expected to be completed 30th May 2014 when it started on 27th February 2013, completed in 2017 without even providing the expected power capacity (Ayinkamiye, 2019). Though, government invested above 40 billion of Rwandan francs on Gishoma power project to produce 15 MW, it produced only 5.28 MW per hour and it keeps stopping working even until the time of the Auditor General's visit on 4th December 2018. Thus, this shows that even though government has tried to boost up this sector, seriousness is still required in terms of work breakdown structure to ensure accountability of assigned team in order to enhance performance of energy related projects.

Therefore, even if these challenges related to the failure in terms of completing the project on time, within the budgeted finance and schedule, are there due to lack of work breakdown structure in most of electricity related project. There is no previous empirical research that assessed the role of work breakdown structure on project performance because even those who attempted such as the study of Uwimana (2015) has concentrated on work breakdown structure and project implementation in Rwanda while Tuyishime and Nyambane (2021) focused on planning and project performance. It is in this regard this research seeks to establish the effect of work breakdown structure on performance of electricity transmission line project in Bugesera District, Rwanda.

1.1 Research Objectives

- i. To assess the role of planning activities on performance of electricity transmission line project in Bugesera District of Rwanda.
- ii. To examine the role of schedule development of activities on performance of electricity transmission line project in Bugesera District of Rwanda.
- iii. To evaluate the role of monitoring of activities on the performance of electricity transmission line project in Bugesera District of Rwanda.

II. LITERATURE REVIEW

2.1 Review of Empirical Studies

The empirical study conducted on the role of project planning and project manager competencies in public sector project success by Irfan, et al., (2021) had a sample of 260 engineers from Balochistan. The results of the study revealed 0.566 coefficient of determination (R^2) implying that project success was explained by 56.6% in both project planning and project manager competencies. Since, the R^2 closer to 1 shows a high level of predictive accuracy, the 0.566 R^2 is considered moderate. The results also calculated the effect size (f^2) hence the results of the study indicated that project planning had a large effect with $f^2=0.351$, whereas project manager competencies had a medium effect with $f^2=0.142$. Hence, this implies that project planning explains the maximum variance in project success which indicates that planning and competency have a positive significant effect on public projects success.

The study conducted in Pakistan on the impact of project planning on project success with a mediating role of risk management and moderating role of culture by Shahzad, et al., (2018) used a sample size of 120 respondents selected using convenient sampling technique. The results of the study indicated $\beta=0.467$ and $p<0.001$ showing that project planning has significant and positive effect on project risk management. The results have also indicated $\beta=0.467$ and $p<0.001$ demonstrating that project planning has a significant and positive effect on project success. Hence, the researcher concluded that the results of the study indicated that project success has significant relationship with project planning, organization culture and project risk management.

The study carried out in Rwanda on the contribution of planning to the project performance in public institutions by Tuyishime and Nyambane (2021) used a causal research design with a sample of 106 respondents and simple random sampling as technique. The results of the study indicated that when the constant is hold on 0.00 the target and

key performance indicators, setting objectives, activities coordination and resource mobilization hold project performance at 0.45. The results also indicated that a unit increase on targets and key performance indicators, setting objectives increase project performance by a factor of 0.183 and the unit increase in resource mobilization increases project performance by a factor of 0.144. The researchers concluded that the metrics of planning confirmed a positive linear relationship to project performance. Hence, the project staffs entrusted with monitoring and evaluation has to have technical Planning of activities to help them to dedicate their function, responsibilities and roles to M&E practices and specify needs at the start of the projects.

The study carried out on the impact of schedule management planning on project management effectiveness by Suresh and Sivakumar (2019) distributed 208 close ended questionnaires to the respondents. The results of the study demonstrated that 0.596 and 0.588 of R2 and adjusted R2 shows 58.8% of variation in project management effective as explained by the indicators of schedule management plan. While, the p-value results were results that 0.05 level of significance which is 0.004, 0.000, 0.000 and 0.001 of proper allocation of schedule development, team incompetency, resource inventory, and raw data of monitoring of activities availability. Hence, it implies that schedule management has significant and positive effect on project management. The study recommended that management of the project should be effective in order to maintain coordination, planning, timely achievement of activities and attainment of project goals in an organization.

The empirical study conducted in Rwanda on the effect determinants of project scope on project performance by Uwanyirigira and Rusibana (2020) has used survey research design with approaches of qualitative and quantitative where 75 respondents from beneficiaries and employees of Huguka Dukore Akazi Kanoze project by applying simple purposive sampling technique. The results of the study revealed that 77.3 % of the respondents agreed that their project has meet deadline. The results on regression analysis has indicated that a unit increase in schedule led to increase in productivity limited by a factor of 0.021 which implies scheduled development affect positively the increase of productivity or performance in the project. Thus, generally the results indicated that there is significant and positive relationship between project scope determinants and project performance. The results geared the researchers to recommend that project managers have to involve beneficiaries in defining project scope to be able to know if the project is taking the right direction to satisfy their needs.

The empirical research conducted in Uganda on contractor monitoring and performance of road infrastructure projects by Byaruhanga and Basheka (2017) used purposive sampling technique to select 190 respondents with response rate of 90.5% since only 172 respondents participated in the study using interviews and closed ended questionnaire. The main results indicate R2 value indicated how much performance is explained by contractor monitoring, hence the adjusted R2 value of 0.841 implied that contractor monitoring predicts performance of road infrastructure projects. Since, performance of road infrastructure projects is dependent on contractor monitoring by 84.1% the researchers recommended procurement to allow best value contracting method and that contractors monitoring has to be done by qualified personnel with experience and competence related to road projects.

The study carried out by Ntambara and Irechukwu (2021) in Rwanda at Busanza Housing Project has concentrated on examining the effects of M&E tools on project performance and employed approaches of qualitative and quantitative to collect data from 94 respondents. The results of the study demonstrated $r=0.348$ and $p=0.001$ showing that monitoring and evaluation plan are correlated with satisfaction of stakeholders, $r=0.750$ and $p=0.002$ showing that planning M&E for enabled is correlated to timely delivery and $r=0.148$ and $p=0.004$ demonstrating that planning M&E facilitated is correlated to delivery within budget. Thus, the researchers recommended project managers to emphasize M&E to promote project performance.

Wanjala, et al. (2017) conducted research on the effect of monitoring techniques on project performance of Kenyan state corporations using simple random sampling where 65 respondents were selected as sample size. Data were collected from the sample size using questionnaires with both open and closed questions. The data were analyzed using descriptive and inferential statistics as well as qualitative methods. Thus, the results revealed relationships between variables which are monitoring techniques and project performance ($r=0.720$ and $\text{sig}=0.00$). Findings also showed that Monitoring techniques ($\beta_3= 0.674$, $p<0.04$) has an effect on project performance.

2.2. Theoretical Framework

The study was guided by theory of change, theory of constraints and program theory.

The theory of change is taken as tool for thinking through the steps from the situation to the goal because it identifies the inter-relationship between project activities as decomposed in work breakdown structure and outcomes in the sense of project performance for the case of the current study. The theory of change has been raised from the

project theory and evaluation in order to effectively develop the thought that concern program philosophy and evaluation as the very vital method and technique to study thoughts that inspire project performance and innovation in socio-political change as a responsibility (Auriacombe, 2011). Therefore, the outcomes in theory of change must be accompanied by key performance indicators that facilitate measurement. Relating the theory of change to this current research, it can be said the idea to apply work breakdown structure is taken as an intervention/programme in the theory of change which must be achieved in a long period of time to ensure performance (Auriacombe, 2011).

Theory of Constraints was developed by Goldratt in 1984 in his novel well-known as *The Goal*, and this theory kept evolving but its structural foundation is based on the philosophical of management best practices as a management tool which emphasizes on the organization's WBS to enhance project performance (Clarizen, 2021). Thus, applying the theory of constraints to work breakdown structure in the sense where work breakdown structure is not only viewed as tool for managing the project rather for promoting effective scheduling, planning, management of Schedule development and risks as well as control without forgetting monitoring of activities. In this current research, this theory of constraints was only focused in project management in order to bring ideas that it encompasses that concern work breakdown structure and project performance as a key tool for management best practices in transforming management and project issues into results that can enhance project performance (Landau, 2021).

This program theory modes frequently used to symbolize the thinking of program recommend how everyday good judgment is used in an intervention to perform large projects. The concept lies in the physics of the thought of choice contrast field and improvement used. The utility of the supporters of these ideas were to trace its application theories to evaluation of Weiss over quite a few years. Uitto (2010) illustrates the benefits of the usage of a theory-based framework in monitoring of activities to promote performance of the project. Work breakdown structure is a necessary input when used very well for decomposing the large projects into small activities to enhance project performance. A theory of program shows a unique outcome on the factor that the project has reached, which helps to recognize if there is change toward a favored stage of performance. It would be from the will of the individual to have intention to prioritize a given conduct by the time to assess it in a positive way (Lin & Wu, 2016). The above theories enabled the researcher to establish the conceptual framework as follows:

2.3 Conceptual Framework

The conceptual framework is presented in Figure 1

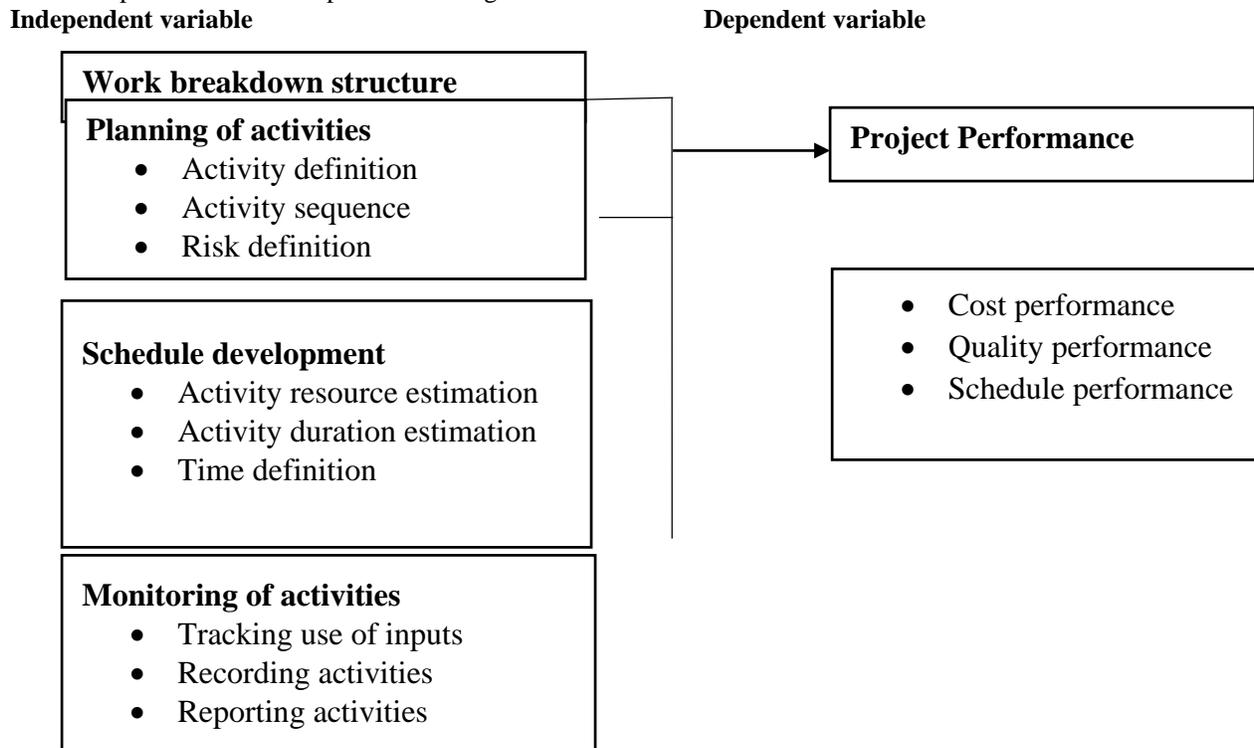


Figure 1 shows work breakdown structure as the independent variable measured with planning of activities which has metrics like activity definition, activity sequence and risk definition; schedule development which has metrics like activity resource estimation, activity duration estimation, and time definition; and monitoring of activities which has metrics like tracking use of inputs and recording activities; and project performance which is measured by cost performance, quality performance and schedule performance.

As shown in Figure 2.1, work breakdown is grouping the project-oriented activities into deliverables within a determined project scope. Thus, it is the code and structure that relates and integrates all the work of the project that is used through the lifecycle of a project in order to assign, identify, plan and track specific work scopes. This includes planning of activities, which is considered a continuous process in the delivery of the project and as an important part of the project which yields project performance and success (Idoro, 2012). The most important part of planning project activities is the involvement of the community in the project in order to provide local knowledge, information and expertise to set up, lead and encourage successful performance of the project (Ahmad, 2012).

Work breakdown structure as a tool to decompose the project into work packages that are required to accomplish the task that are planned and designed in the project held consistent forms in planning activities and project schedule development, which is all about the process that is always reviewed due to uncertainties that can occur at any stage of the project while endeavour is in progress (Brown, 2021). In other words, monitoring of activities is a regular recording and observation of activities of the project which required routine gathering and scrutiny of information in all aspects of the project. To effectively monitor project activities, a regular check on how activities are progressing is required as a systematic and purposeful observation meant to promote performance of the project.

III. RESEARCH METHODOLOGY

The descriptive research design was used together with a mixed approach that collects quantitative and qualitative data which were collected from the field (Eyisi, 2016). Thus, thematic analysis was used to capture

qualitative data as the required detailed information regarding work breakdown structure and performance of electricity transmission line project in Bugesera District. The quantitative approach was used to collect data employing questionnaire and got analyzed into descriptive and inferential statistics by use of mean, standard deviation and both Pearson correlation and regression analysis.

The electricity transmission line project in Bugesera District has a target population of 250 employees. Since, the animals, objects or individuals involved in the study as target population are where the respondents of the study have to be drawn according to Mugenda and Mugenda, (2013); the 20 engineers, 8 people in management team, 100 technicians and 122 project team members make the target population of this study. The 250 employees of electricity transmission line project in Bugesera District was used to determine the sample size of 152 respondents as by the Table 3.1 of sample size classification.

To collect the primary data both questionnaire and interview were used. The collected quantitative data from the 144 respondents who were given questionnaire were coded, cleansed, and entered in SPSS 22.0 version for analysis to descriptive and inferential statistics analysis whereas thematic analysis was done to data from interview as qualitative data. The descriptive statistics used measure of central tendencies to find mean and standard deviation in a Likert scale of 5-point response data.

IV. RESULTS AND DISCUSSION

4.1 The role of planning activities on performance of electricity transmission line project

Table 1 presents the views on the role of planning activities on performance of electricity transmission line project

Table 4. 1: Planning Activities

Statements concerning planning activities	Mean	SD
Activity definition enhances project performance	1.894	.970
Activity sequencing promotes project performance	1.223	.589
Project risk definition enhances project performance	1.203	.531
Project risk responses preparedness is required for project performance	1.210	.582
Training staff on project planning promotes project performance	1.197	.527
Financial analysis and budgeting enhance project performance	1.473	.597
Defining planning resources enhances project performance	1.230	.685
Overall Mean	1.347	

Key: 5 not sure, 4 to no extent, 3 to small extent, 2 to a great extent, 1 to a very great extent, SD= Standard Deviation

The results demonstrate the mean of 1.894 and SD of 0.970 shows that the respondents asserted that activity definition enhances project performance to a very great extent. The mean of 1.223 and 0.589 of SD shows that the respondents asserted that activity sequencing promotes project performance to a very great extent. The mean of 1.203 and 0.531 of SD shows that the respondents asserted that project risk definition enhances project performance to a very great extent. The mean of 1.210 and 0.582 of SD shows that the respondents stipulated that project risk responses preparedness is required for project performance to a very great extent.

The mean of 1.197 and SD of 0.527 show that a big number of respondents asserted that training staff on project planning promotes project performance to a very great extent. The mean of 1.473 and SD of 0.597 indicates that a big number of respondents asserted that financial analysis and budgeting enhance project performance. The mean of 1.230 and SD of 0.685 shows that a big number of respondents asserted that defining planning resources enhances project performance. Thus, since the overall mean is 1.347 it implies that a big number of respondents asserted that planning activities play a significant role on performance of electricity transmission line project in Bugesera District, Rwanda.

Table 4. 2: Assessment of project performance

Assessment of project performance	Mean	SD
Quality performance is achieved	1.085	.362
Schedule performance is achieved	1.078	.373
Cost performance is achieved	1.756	1.196
Overall Mean	1.266	

Key: 5 not sure, 4 to no extent, 3 to small extent, 2 to a great extent, 1 to a very great extent, SD= Standard Deviation

The results show a mean of 1.085 and standard deviation of 0.362 implying that a big number of respondents asserted that quality performance is achieved to a very great extent, a mean of 1.078 and standard deviation of 0.373 implying that a big number of respondents asserted that schedule performance is achieved to a very great extent, a mean of 1.756 and standard deviation of 1.196 implying that a big number respondents asserted that cost performance is achieved to a very great extent. Thus, the overall mean of 1.266 implies that a big number of respondents asserted that project performance was achieved to a very great extent in electricity transmission project in Bugesera District, Rwanda.

Table 4. 3: Correlation Analysis between Planning of Activities and Project Performance

		Cost performance	Quality performance	Schedule performance
	Pearson Correlation	.851**	.786**	.837**
Planning of activities	Sig. (2-tailed)	.000	.000	.000
	N	152	152	152

** . Correlation is significant at the 0.01 level (2-tailed).

Source: Field Data (2022)

The results show a strong positive and significant relationship between planning activities and cost performance (r=0.851 and sig=0.000), between planning of activities and quality performance (r=0.786 and sig=0.000), between planning of activities and schedule performance (r=0.837 and sig=0.000) at 0.01 level of significance. Thus, this implies that planning of activities play a strong significant and positive role on performance of electricity transmission project in Bugesera District, Rwanda.

4.2 The Role of Schedule Development of Activities on Performance of Electricity Transmission Line Project

Table 4 depicts views on the role of schedule development of activities on performance of electricity transmission line project.

Table 4. 4: Schedule Development of Activities

Statement regarding schedule development	Mean	SD
Activity resource estimation defines project schedule	1.506	1.016
Activity duration estimation promotes schedule performance	1.644	1.268
Defining project outputs schedule enhance project performance	1.585	.959
Delivery of activities on time promotes project performance	1.993	1.193
Defining time of project activities implementation promotes timely performance	1.684	.999
Overall Mean	1.423	

Key: 5 not sure, 4 to no extent, 3 to small extent, 2 to a great extent, 1 to a very great extent, SD= Standard Deviation

The results show a mean of 1.506 and standard deviation of 1.016 shows that a big number of respondents confirmed that activity resource estimation defines project schedule to a very great extent. The mean of 1.644 and standard deviation of 1.268 shows that a big number of respondents confirmed that activity duration estimation promotes schedule performance to a very great extent. The mean of 1.585 and standard deviation of 0.959 shows that a big number of respondents confirmed that defining project outputs schedule enhance project performance to a very great extent. The mean of 1.993 and standard deviation of 1.193 shows that a big number of respondents confirmed that delivery of activities on time promotes project performance to a very great extent. The mean of 1.684 and standard deviation of 0.999 show that a big number of respondents stipulated that defining time of project activities implementation promotes timely performance to a very great extent. Hence, since the overall mean is 1.423 it implies that a big number of respondents confirmed that schedule development plays a significant role on performance of electricity transmission line project in Bugesera District, Rwanda.

In an interview conducted with one of the team managers at the project, she asserted in her own words that: “*all the activities you see here are scheduled so that even the supervisor know the activities we are supposed to be doing, it is these schedules the supervisor use to get the information regarding the progress of our activities. That is why for me I don’t consider alone schedule development as process of helping us perform better our activities rather also a tool that help us to monitoring the activities conducted in this project*”.

Table 4. 5: Correlation Analysis between Schedule Development and Project Performance

		Cost performance	Quality performance	Schedule performance
	Pearson Correlation	.813**	.513**	.799**
Schedule development	Sig. (2-tailed)	.000	.000	.000
	N	152	152	152

** . Correlation is significant at the 0.01 level (2-tailed).

The results show a strong positive and significant relationship between schedule development and cost performance ($r=0.813$ and $sig=0.000$), between schedule development and quality performance ($r=0.513$ and $sig=0.000$), between schedule development and schedule performance ($r=0.799$ and $sig=0.000$) at 0.01 level of significance. Thus, this implies that schedule development plays a positive and significant role in performance of electricity transmission line project in Bugesera District, Rwanda.

4.3 The Role of Monitoring Of Activities on the Performance of Electricity Transmission Line Project in Bugesera District of Rwanda

Table 3 illustrates the views on the role of monitoring of activities on the performance of electricity transmission line project in Bugesera District of Rwanda

Table 4. 6: Monitoring of Activities

Statement Regarding Monitoring of Activities	Mean	Std.
Tracking the use of inputs promotes project performance	1.322	0.646
Recording activities enhance budgetary performance	2.611	1.371
Tracking and reporting every single activities in the project enhance performance	1.065	0.274
Auditing project activities basing on monitoring enhance budgetary performance	1.046	0.239
Making project decision basing on monitoring promotes project performance	1.756	1.196
Overall Mean	1.445	

Key: 5 strongly disagree, 4 disagree, 3 not sure, 2 agree, 1 strongly agrees, SD= Standard Deviation

The results show a mean of 1.322 and standard deviation of 0.646 which implies that a big number of respondents strongly agreed that tracking the use of inputs promotes project performance. The mean of 2.611 and standard deviation of 1.371 shows that a big number of respondents strongly agreed that recording activities enhance budgetary performance. The mean of 1.065 and standard deviation of 0.274 shows that a big number of respondents strongly agreed that tracking and reporting simple activities in project enhances performance. The mean of 1.046 and standard deviation of 0.239 shows that a big number of respondents strongly agreed that auditing project activities basing on monitoring data enhance budgetary performance and the mean of 1.756 and standard deviation of 1.196 strongly agreed that making project decision basing on monitoring data promotes project performance. The overall mean of 1.445 shows that a big number of respondents strongly agreed that monitoring of activities play a significant role on performance of electricity transmission line project in Bugesera District, Rwanda.

Table 4. 7: Correlation Analysis between Monitoring of Activities and Project Performance

	Cost performance	Quality performance	Schedule performance
Pearson Correlation	.911**	.656**	.899**
Sig. (2-tailed)	.000	.000	.000
N	152	152	152

** . Correlation is significant at the 0.01 level (2-tailed).

The findings revealed that there is a strong positive and significant relationship between monitoring of activities and cost performance ($r=0.911$ and $sig=0.000$), between monitoring of activities and quality performance ($r=0.656$ and $sig=0.000$), monitoring of activities and schedule performance ($r=0.899$ and $sig=0.000$) at 0.01 level of significance. Thus, this implies that monitoring of activities play a significant and positive role on performance of electricity transmission line project in Bugesera District, Rwanda.

V. DISCUSSION OF THE RESEARCH FINDINGS

The descriptive results of this research concerning the first objective have revealed that planning activities play a significant role in performance of electricity transmission line project which is supported by the results of the study of Irfan, et al., (2021) revealed that project planning had a large effect with $f^2=0.351$, whereas project manager competencies had a medium effect with $f^2=0.142$. Hence, this implies that project planning explains the maximum variance in project success which indicates that planning and competency have a positive significant effect on public projects success. The correlation analysis results of the first objective have revealed that planning of activities play a strong significant and positive role on performance of electricity transmission project which is supported by the results of the research of Shahzad, et al., (2018) which showed $\beta=0.467$ and $p<0.001$ demonstrating that project planning has a significant and positive effect on project success. Thus, the researcher concluded that planning of activities play a significant role on project performance.”

The results of the current research revealed that schedule development plays a significant role on performance of electricity transmission line project which is supported by the findings of the research of Uwanyirigira and Rusibana (2020) who revealed that 77.3 of respondents agreed that their project meet deadlines due to schedule development and hence project performance. Both the results of descriptive and inferential statistics revealed that schedule development plays a positive and significant role in performance of electricity transmission line project which is supported by the results of the study of Sureh and Sivakumar (2019) who demonstrated that 0.596 and 0.588 of R^2 and adjusted R^2 shows 58.8% of variation in project management effective as explained by the indicators of schedule management plan. While, the p-value results were results that 0.05 level of significance which is 0.004, 0.000, 0.000 and 0.001 of proper allocation of schedule development, team incompetency, resource inventory, and raw data of monitoring of activities availability.

The descriptive results of the third objective revealed that monitoring of activities play a significant role on performance of electricity transmission line project which is supported by the results of the study of Byaruhana and

Basheka (2017) who indicate R^2 value indicated how much performance is explained by contractor monitoring, hence the adjusted R^2 value of 0.841 implied that contractor monitoring predicts performance of road infrastructure projects. The correlation results revealed that monitoring of activities play a significant and positive role on performance of electricity transmission line project which is supported by the findings of the research of Ntambara and Irechukwu (2021) who demonstrated $r=0.348$ and $p=0.001$ showing that monitoring and evaluation plan are correlated with satisfaction of stakeholders, $r=0.750$ and $p=0.002$ showing that planning M&E for enabled is correlated to timely delivery and $r=0.148$ and $p=0.004$ demonstrating that planning M&E facilitated is correlated to delivery within budget. The results of the research of Wanjala, et al., (2017) revealed relationships between variables which are monitoring techniques and project performance ($r=0.720$ and $\text{sig}=0.00$) which supports the same current research.

VI. CONCLUSION AND RECOMMENDATIONS

The descriptive results of the first objective concerned with the role of planning activities on performance of electricity transmission line project have revealed that a big number of respondents asserted that planning activities play a significant role in performance of electricity transmission line project. These descriptive results are supported by the correlation results which proved that planning of activities play a strong significant and positive relationship on performance of electricity transmission project in Bugesera District, Rwanda. The descriptive results of the second objective concerned with the role of schedule development on performance of electricity transmission line project indicated that there is a big number of respondents confirmed that schedule development plays a significant role on performance of electricity transmission line project. These descriptive results were also supported by correlation results which revealed that schedule development plays a positive and significant role in performance of electricity transmission line project in Bugesera District, Rwanda. The descriptive results of the third objective concerned with the role of monitoring of activities on the performance of electricity transmission line project showed that there is a big number of respondents strongly agreed that monitoring of activities play a significant role on performance of electricity transmission line project. These descriptive results are also supported by correlation results which revealed that monitoring of activities play a significant and positive role on performance of electricity transmission line project in Bugesera District, Rwanda. Hence, the final conclusion, is that work breakdown affects positively and significantly performance of electricity transmission line project in Bugesera District, Rwanda.

Basing on the findings of the study, the researcher would like to recommend to the management of projects to enhance work breakdown structure in the sense of planning of activities, monitoring of activities and schedule development to ensure project performance. The researcher would also like to recommend to the owners and leadership of the organizations which have numerous project to emphasize on recruiting the managers who are capable of doing work breakdown structure in order to enhance performance because the results of the study revealed that work breakdown structure plays a significant role on performance of electricity transmission line project in Bugesera District, Rwanda.

The researcher would like to recommend to the government and the staff of REG especially those under electricity transmission line project to keep improving their planning, monitoring and schedule development skills in order to keep the project performance on track in terms of cost performance, quality performance and schedule performance since the correlation results revealed that work breakdown structure and project performance have a positive and significant relationship.

Finally, the researcher would like to recommend to the future researcher to conduct further studies in this field of the study in order to assess the effect of project planning on schedule performance of electricity transmission line project; to examine the effect of project monitoring on project performance, to find out the role of work breakdown structure in promoting project success in Rwanda.

REFERENCES

- [1] Ahmad, M. S. (2012). Impact of organizational culture on performance management practices in Pakistan. *Business Intelligence Journal*, 5(1), 50-55
- [2] Auriacombe, C. (2011). Role of theories of change and programme logic models in policy evaluation. *African Journal of Public Affairs*, 4(2), 36-53.
- [3] Ayinkamiye, A. (2019). The role of project planning on the performance of government project in Rwanda: A case study of Gishoma power plant project. Unpublished Master's Thesis at University of Rwanda, Kigali, Rwanda.
- [4] Brown, L. (2021). Defining Sequence Activity in Project Management. Retrieved on 27th December 2021 at <https://www.invensislearning.com/blog/sequence-activity/>
- [5] Byaruhanga, A. and Basheka, B.C. (2017) Contractor Monitoring and Performance of Road Infrastructure Projects in Uganda: A Management Model. *Journal of Building Construction and Planning Research*, 5, 30-44. <https://doi.org/10.4236/jbcpr.2017.51003>
- [6] Clarizen, T. (2021). Work Breakdown Structure: The Basics and Best Practices. Retrieved on 20 January 2022 at <https://blog.planview.com/work-breakdown-structure-the-basics-best-practices/>

- [7] Eyisi, D. (2016). The Usefulness of Qualitative and Quantitative Approaches and Methods in Researching Problem-Solving Ability in Science Education Curriculum. *Journal of Education and Practice*, 7(15), 91-100
- [8] Goldratt in 1984 Leadership competencies of project managers: An empirical study of emotional, intellectual, and managerial dimensions. *Journal of Economic Development, Management, IT, Finance, and Marketing*, 6(1), 35-42.
- [9] Idoro, G. (2012). Evaluating levels of project planning and their effects on performance in the Nigerian construction industry. *Journal of Construction Economics and Building*, 9(2), 39-50.
- [10] Irfan, M.; Khan, S.Z.; Hassan, N.; Hassan, M.; Habib, M.; Khan, S.; Khan, H.H. (2021). Role of Project Planning and Project Manager Competencies on Public Sector Project Success. *Journal of Sustainability*, 13(2), 1421-1440. <https://doi.org/10.3390/su13031421>
- [11] Landau, P. (2012). *Theory of Constraints: A Guide for Project Managers*. Retrieved on 20 January 2022 at <https://www.projectmanager.com/blog/theory-of-constraints>.
- [12] Lin, S. & Wu, M. (2016). Applying Program Theory-Driven Approach to Design and Evaluate a Teacher Professional Development Program. *Journal of Education and Practice*, 7 (24), 138-143.
- [13] Ministry of Finance and Economic Planning. (2014). *Budget Framework Paper 2014/2015- 2016/2017*. Kigali, Rwanda. Retrieved on 12 January 2022 at [Http://www.minecofin.gov.rw](http://www.minecofin.gov.rw).
- [14] Mugenda, A. & Mugenda, O. (2013). *Research methods: Quantitative and qualitative approaches*. ACTS Press. Nairobi, Kenya.
- [15] Ntambara, A. & Irechukwu, N.E (2021). Monitoring & Evaluation Tools and Project Performance in Rwanda. A Case Study of Busanza Housing Project Kicukiro District. *IOSR Journal of Business and Management*, 23 (6), 2319-7668. DOI: 10.9790/487X-2306083241
- [16] Office of the Auditor General of State Finances. (2014). *Report of the Auditor General of State Finances for the year ended 30th June 2014*. AOG, Kigali, Rwanda. Retrieved on 12 January 2022 at www.oag.gov.rw
- [17] Shahzad, N., Khanzada, B. & Talha, M.H. (2018). Impact of Project Planning on Project Success with Mediating Role of Risk Management and Moderating Role of Organizational Culture. *International Journal of Business and Social Science*, 9(1), 88-95.
- [18] Suresh, D. & Sivakumar, A. (2019). Impact of Schedule Management Plan on Project Management Effectiveness, *International Journal of Engineering and Advanced Technology* 9(1), 3350-3355, Doi: 10.35940/ijeat.a1515.109119
- [19] Tuyishime, A. C., & Nyambane, D. (2021). Planning and project performance in public institutions in Rwanda. A case of establishment of a Frequency Spectrum Management and monitoring system project in Rwanda. *The Strategic Journal of Business & Change Management*, 8 (1), 780 – 790.
- [20] Uitto, J. A. (2010). Multi-country co-operation around shared waters: Role of Monitoring and Evaluation. *International Journal of Global Environmental Change*, 14(1): 5 – 14
- [21] Uwanyirigira, V. & Rusibana, C. (2020). Determinants of Project Scope and Project Performance: A Case of Huguka Dukore Akazi Kanoze Project. *International Journal of Scientific and Research Publications*, 10(11), 1098-1114. doi: 10.29322/ijsrp.10.11.2020.p107104
- [22] Uwimana, P. (2015). *Work breakdown structure and project implementation in Rwanda. A case study of the commercial construction project in HYGEBAT*. Unpublished Masters' research project at Mount Kenya University, Rwanda, Kigali.
- [23] Wanjala, M.J., Iravo, A.M., Odhiambo, R., & Shalle, N.S (2017). Effect of Monitoring Techniques on Project Performance of Kenyan State Corporations. *European Scientific Journal*, 13(19), 1857 – 7881, doi: 10.19044/esj.2017.v13n19p264.

AUTHORS

First Author – Angel Nabasa, School of Business and Economics, Mount Kenya University, Kigali, Rwanda

Second Author – Dr. Eugenia Nkechi Irechukwu (PhD), School of Business and Economics, Mount Kenya University Kigali, Rwanda

Use of Information Communication Technology Tools and Teacher's Performance in Rwanda: A case of secondary Schools in Rulindo District

^{1*} Jean d'Amour Ndayisenga & ^{2*}Dr. Hesbon Opiyo Andala

^{1*}School of Education, Mount Kenya University, Kigali, Rwanda

^{2*}School of Education, Mount Kenya University, Kigali, Rwanda

DOI: 10.29322/IJSRP.12.10.2022.p13075

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13075>

Paper Received Date: 24th September 2022

Paper Acceptance Date: 25th October 2022

Paper Publication Date: 30th October 2022

Abstract- This paper examined the relationship between information communication and technology tools and teacher's performance in secondary schools of Rulindo District-Rwanda. Specifically, the paper determined information communication technology tools, level of teacher's performance and relationship between information communication and technology tools and teacher's performance. The research was guided by Task=Technology Fit to ascertain the correlation between information communication technology and teacher's performance. A descriptive study with a mixed approach was used employed to collect data. The target population of 262 teachers and head teachers from secondary schools helped to draw a sample of 159 respondents and key informants. The sample size was selected purposively and randomly. This study used questionnaire, interview guide and observation protocol for collecting primary data. Secondary data was collected using a desk review. The researcher generated descriptive statistics in terms of mean, standard deviation and inferential statistics in term of correlational and regression analysis. To the first objective, results indicated that the most commonly used tools are computers (Mean=2.98, SD= 1.04), starboards/phones (Mean=3.49; SD=1.02>0.5), video clips in lessons (mean=2.58 SD=1.00). To the second objective, results demonstrated that ways of classroom teaching has been improved (Mean=0.067, SD=10.1) improvement of interpersonal relations (Mean=1.04, SD=0.43), students complete homework on time (Mean=1.67, SD=1.12). To the third objective the relationship between using information communication technology tools computer and the success of teaching job $r= 0.843$ between computer/tablets and classroom teaching. It was 0.871 between computer/tablets and the management of students, discipline and regularity and 957 between computer and tablets use and the interpersonal relations. Electronic textbooks is correlated with classroom teaching.962**.Results indicate that a correlation between the instructional software and classroom teaching was .827**. The study recommends that public institution would provide excellent centers to stimulate the use of information communication and technology tools. There is a need to organize in service trainings in order to improve the use of information communication and technology tools.

Index Terms- Competence, Information and Communication Technology, Public Schools, Teachers' ICT experience, Teachers' performance.

I. INTRODUCTION

Technological advancement had affected teaching process. Many researches worldwide had denoted the effect of ICT and the way in which it influenced how persons learn, how they disseminate information and how they do their everyday activities (Nazir, 2015). For execution of this policy, the Ministry of education started and distributed One Lap Top per Child Program in primary education and connected computer laboratories in several secondary schools since the year 2008 in order to facilitate teachers for using ICT in learning-centred method, conducting study and collaboration method (Ministry of Education, 2016).

In Rulindo District, a research carried out by Save the Children (2015) on in service training for teachers in Rwanda, reiterated a shortage of using ICT tools in secondary schools. The ways ICTs were adopted in classrooms may be one of those reasons. The Government continues to distribute computers to schools through the introduction of smart classroom at each secondary school with vision of making education effective (Steinberg & Garrett, 2016). However, this research investigated the contribution of the use of ICT tools in secondary schools in Rulindo District, Rwanda influence performance of teachers.

1.1 Research Objectives

- i. To determine information communication technology tools used within secondary schools in Rulindo District, Rwanda,
- ii. To assess the level of teacher's performance within secondary schools in Rulindo District, Rwanda,
- iii. To establish the relationship between the use of ICT tools and teacher's performance in secondary schools in Rulindo District, Rwanda.

II. LITERATURE REVIEW

2.1 Review of Empirical Studies

Pedrosa, *et al.* (2016) carried out a survey in USA and found that as the use of ICT helped a minority of teachers to apply a more constructivist pedagogy, it has not changed the way of teaching for a majority of secondary subject teachers. However, teachers accepted that in the right conditions, ICT became a precious teaching tool that has an effects on student's success in classroom and also on their external performance.

Thakral, P. (2015), in a study of 170 secondary school teachers of New Zealand, found that 82% of teachers took ICT as it has positive effects to teaching while not in methodology of skills provision and classroom practices. This means that ICT was not changing teachers' philosophy and their pedagogy but it changed good administration of teaching like lesson and scheme of work preparation.

The same results have been found by Andiema (2015) in their view on the effects of ICT in Europe. They reported that using ICT helped teachers for effective time management and enhance productivity in lesson preparation, updating the lesson plan and in maintaining student's records. Teachers emphasized that ICT use has improved collaboration and facilitated them to share ideas and teaching tools. Concerning the pedagogical practices, those teachers continued to use traditional approaches where ICT is taken as a tool to support their didactic approaches. Hence, researchers evidenced that teachers are exploiting the innovative potentiality of ICT and students are passively involved in capacity building.

Considering the effect of ICT on Bansal (2016) undertaken a research on importance of teachers when using information communication and technology in Czech Republic. He realized that ICT will bring some impacts on the class: Learning tools and learning spaces will be shared, they are the promotion of a collaborative learning and they are a step for have autonomy in learning. In addition, Wheeler explained the key reason for which the responsibility of teachers could be adjusted: With ICT, some teaching tools would become out of date and some assessment methods will become unnecessary and finally it was not possible for the teacher simply to teach the content knowledge. According to Blazar and Kraft (2017), teachers who use ICT can share learning tools in different ways: ICT helped teachers and learners to use video system to transmit information and television programs thought all infrastructure of the school even between schools of the same region. This way of working can minimize expenses and ameliorate the quality of teaching and studying process without sufficient teaching tools.

In Drossel, *et al.*, (2017) carried out a research to assess correlation between integration of information communication technology in classroom and pedagogical opinions of teachers. After the study on 1139 elementary school teachers, Liu found that even though teachers were with the student based beliefs, they were unable to incorporate constructivists teaching with ICT utilization and this reveals contradictions between teacher's pedagogical opinions and teaching activities. The study showed that most teachers, regardless of their pedagogical beliefs in favour of ICT integration, were still utilizing lecture based teaching activities when integrating ICT. Moreover Trucano (2015), in the knowledge maps, carried out a survey on the effective of using ICT in education in under development countries. He identified main ICT related factors which are impacting on teacher's performance or service delivery: Pedagogy, teacher technical abilities and knowledge of ICT, teacher's confidence and motivation, and Teacher's professional development and an enabling environment. Trucano found that effects of ICT utilization on leaning and teaching results are not clear and brings too various debates because of unavailability of agreed standards methodologies and measurements to establish the effects of ICT in education.

Hammami (2016) in the context of e-learning, in Kingdom of Saudi Arabia, indicated that when one who wants to adopt ICT should consider the following: have sufficient infrastructure and ICT equipment's, availability of the internet connectivity and to ensure teachers have ICT knowledge. However, different barriers were still being observed in this the Kingdom of Saudi Arabia: lack of sufficient computers to give a computer to each student, teachers were

not working well as they were not asking students to deliver assignments even on CDs. According Lukindo (2016) in his study in mathematics and science teachers at Dar-es-salam University College of education in Tanzania, to teach and learn for mathematics and science pose challenges to teachers and students and this situation is setting an alarm to education stakeholders. To address learning challenges, the government adopted ICT in schools and competency based learning as alternative approaches.

A study done by Nazir (2015) on Secondary school's ICT competences suggested that teachers should be trained on the TPACK framework where they can share experience on how to choose appropriate technological tool for a selected content by using this tool in teaching and learning process with the modification of teaching relying on chosen instrument. The TPACK background evidences teacher's skills in pedagogy, content and technological fields and the way in which they are able to discern methodologically (Osang, 2015). It is a framework that helps to establish how to teach with technological devices that permits teachers to combine content, pedagogy and technology. Nwigbo and Madhu (2016), conducted in Bungoma District of Kenya, admitted that when you want to effectively adopt any educational technology, you should facilitate teachers to have complete confidence in them and the ability to use it in classroom instruction. To evaluate the motivation provided by technology in the classroom Pedrosa, *et al.*, (2016) assessed the influence ICT on students' motivation and achievement in English lessons. He found that in a class, 88 percent of learner confirmed that use ICT complete English lessons more exciting than how it was expected.

The adoption of ICT can also be based on the summary done by Shamim & Raihan (2016) on the results for the research titled "Information Technology works successfully" published by BECTA in 1994; It shows that flexibility of ICT to meet individual needs and ability for every learner can motivate students to enjoy learning. In addition, ICT is viewed to present information in new ways that help learners understand the concepts as they are well visualized and difficult ideas become easier. Basing on those results, the research may prove that the ICT user in teaching and learning activities motivates students to enjoy their lessons and to be involved in learning. ICT is acting as facilitator of cognitive development that augments the abstention of fundamental knowledge pertinent to the community. In Rwanda, it means that the provision of ICT materials to schools or teaching staff unable to provide a discrepancies but main component to be focused on in utilizing ICT in teaching and learning process is the teaching staff technological and pedagogical content knowledge and skills (Save the Children, 2015). Nevertheless, it is very important to conduct other researches to assess the current effects for ICT usage in teaching and learning activities and to suggest the way forward to facilitate and make the teaching more effective.

2.2. Theoretical Framework

This research was by task technology fit theory in learning or teaching process theory. The research use a task-technology model procured by Goodhue and Thompson to describe the association between information communication and technology and the success of teaching process. This approach refers to the level of technological assistance for a person or a teacher in achieving its target and completing their responsibilities. This theory denoted that IT was capable of producing favourable outcome in any institution including secondary schools (Osang, 2015). Finally, this theory was relevant to the present study since it has analyzed the level of teacher's teaching outcomes in the framework of ICT as predicting factor of the level of success (Tripathi & Jigeesh, 2015). The level of success consequences associated with the realization of duties and responsibilities by a person are for instance classroom teaching, management of students, discipline and regularity, and interpersonal relations. The above theories enabled the researcher to establish the conceptual framework as follows:

2.3 Conceptual Framework

The conceptual framework is presented in Figure 1

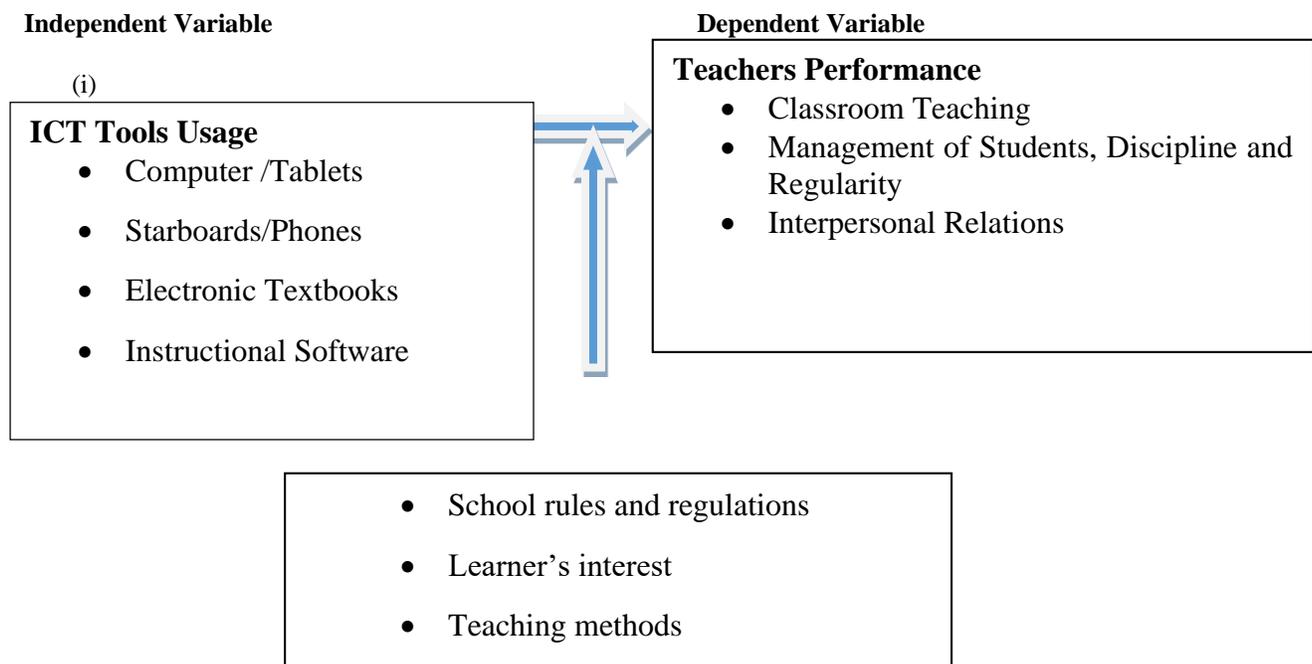


Figure indicates association between the use of ICT tools and teacher's performance. The use of ICT tools was measured using computer /tablets, starboards/hones, electronic textbooks, and instructional Software. The dependent variable (Teacher's performance) was measured using Teaching managing students, discipline and regulation or interpersonal. Both independent and dependent variables were moderated by intervening variables such as school rules and regulations, learner's interest, and teaching methods.

III. RESEARCH METHODOLOGY

The present research adopted a descriptive research design. A descriptive statistics was helpful for two objectives: one is to afford basic data on variables in a dataset and the second pinpoints pertinent correlation between variables. Therefore, the most commonly descriptive statistics used to measure variables. In order to carry out the present research, target population was formed by 262 secondary school teachers from five head teachers from secondary schools offering general education in Rulindo District of Rwanda (Rulindo District, 2022). Therefore, a sample size affects the precision of estimates and the power of the research to elucidate concluding remarks. Slovene's formula (1967) below was adopted to assess the sample size.

$$n = \frac{N}{1 + N(e)^2}$$

From this formula, when the researcher took the target population's size of 159 and the acceptable error of 0.05. During collection of information, the research used questionnaire, interviews and observation. Quantitative data given by closed questions was discussed through the adoption of descriptive and inferential statistics through a computer based software known as Statistical Product and Service Solutions (SPSS). The regression equation was used for quantitative data analysis $Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + e$

Where Y= Teachers' performance in secondary schools of Rulindo District, Rwanda

b=constant

x=Measurement of independent variable

e=Scholastic figures.

In this regards,
 X1=Computer /Tablets
 X2=Starboards/Phones
 X3=Electronic Textbooks
 X4=Instructional Software

Qualitative data given by open end questions were categorized based on content analysis where some of them was written in a narrative way. The answers of questions with a Likert scales was analyzed using the corresponding numbers.

IV. RESULTS AND DISCUSSION

4.1 Determination of information communication technology tools used

Table 1 presents the views on information communication technology tools used

Table 1: Information Communication Technology tools used

Information Communication Technology tools used	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree	Total	
	%	%	%	%	%	Mean	SD
computers or tablets are used in teaching and learning process	10.7	8.9	8.0	37.5	34.8	2.79	1.04
Starboards/phones are used in teaching and learning process	12.5	6.2	7.1	25.9	48.2	3.49	1.02
Electronic Textbooks are used in teaching and learning process	0.9	8.0	4.5	55.4	31.2	3.03	1.08
Instructional Software are used in teaching and learning process	0.9	4.5	5.4	28.6	60.7	3.00	.98
Students watch video clips in lessons	3.6	5.4	2.6	49.1	39.3	2.58	1.00
Teacher used projector and PowerPoint in lesson	4.5	7.1	28.6	41.1	18.8	1.48	.71
There is internet in the school used for lessons	7.1	6.2	5.4	37.5	43.8	1.67	1.12

Results demonstrated that computers or tablets are used in teaching and learning process at moderate level (Mean=2.98, SD= 1.04). The findings indicated that Starboards/phones are used in teaching and learning process among respondents (Mean=3.49; SD=1.02>0.5). The study demonstrated that using electronic Textbooks are used in teaching and learning process. It has been agreed with a mean of 3.03, standard deviation was 1.049 where respondents strongly agreed with the use of electronic textbooks are used in teaching and learning process. It was indicated that electronic textbooks are used in teaching and learning process are at a very low level of usage and teachers refer to them rarely. According to the respondents, the mean of 3.0 and standard dev of 0.98 agreed with instructional software use used in secondary schools within Rulindo District. Students watch video clips in lessons where the means of 2.58

and the standard deviation of 1.00 confirmed the statement. From the finding, it was found that with a mean of 1.48 and sdv of 1.48, respondents evidenced that the teacher used projector and power point in teaching process of the respective lessons among secondary schools in Rulindo District. Finally, the results indicated that there is internet in the school used for lessons. In this regard, 43.8% of respondents a mean was 1.67 and sdv was 1.12 confirmed the use of internet in the school used for lessons.

4.2 Level of Teachers' Performance in Secondary Schools in Rulindo District

Table 2 depicts views on the level of teachers' performance in secondary schools in Rulindo District.

Table 2: Level of Teachers' Performance in Secondary Schools in Rulindo District

Statements	Strongly Agree	Agree	Not Sure	Disagree	Storngly Disagree	Mean	SD
The ways of classroom teaching has been improved	49.4	41.9	7.9	0.8	1.01	.67	0.4
the management of students, discipline and regularity is effective	47.2	41.3	11.1	0.4	1.32	.69	0.2
There is an improvement of interpersonal relations	85.0	14.2	0.0	0.8	1.04	.43	0.01
Students participate in class discussions	0.0	85.8	12.6	1.6	2.31	.41	1.01
Students complete their homework in time	7.1	6.2	5.4	37.5	43.8	1.67	1.12
Student's average marks at the end of the term exams has been increased	9.8	3.6	1.8	48.2	36.6	1.29	.67

Findings The results demonstrated that the ways of classroom teaching has been improved. This was confirmed by 49.4%, a mean of 0.067 and 10.1 for sdv of 0.67. 47.2% strongly agreed that the management of students, discipline and regularity is effective on a mean of 1.32 and sdv of 0.43. Moreover, 85.0% strongly disagreed that there is an improvement of interpersonal relations with a mean of 1.04 and adv. Of 0.43. Moreover, 85.6% disagreed with the participation of students in classroom with a mea of 2.31 and sdv of 0.41. Therefore, 43.8% strongly agreed with students complete their homework in time with a mean of 1.67 and sdv of 1.12. Finally, 48.2% of respondents agreed that the student's average marks at the end of the term exams has been increased with a mean of 1.29 and sdv of 0.67.

4.3 Relationship between ICT Tools and Performance of Teachers in Secondary schools

Table 3 illustrates the views on the relationship between ICT Tools and performance of teachers in Secondary schools

Table 1: Relationship between ICT Tools and Performance of Teachers in Secondary schools

		Classroom Teaching	Management of Students Discipline and Regularity	of Interpersonal relations and
Computer /Tablets	Pearson Correlation	.843**	.871**	.957**
	Sig.(2-tailed)	.000	.000	.000
	N	156	156	156
Starboards/Phones	Pearson Correlation	.852**	.873**	.949**
	Sig.(2-tailed)	.000	.000	.000
	N	156	156	156
Electronic Textbooks	Pearson Correlation	.962**	.934**	.863**
	Sig.(2-tailed)	.000	.000	.000
	N	156	156	156
Instructional Software	Pearson Correlation	.827**	.843**	.934**
	Sig.(2-tailed)	.000	.000	.000
	N	156	156	156

Results in Table 4.3, evidenced that computer/tablets and the success of teachers produced Pearson correlation coefficient $r=0.843$ between computer/tablets and classroom teaching. It was 0.871 between computer/tablets and the management of students, discipline and regularity and 957 between computer and tablets use and the interpersonal relations. This shows that the relationships were all positive and statistically significant. Each of these elements significantly increase teachers' performance when they are improved.

Furthermore, the study findings evidenced that the correlation between starboards/phones on one hand and classroom teaching on the other hand was 0.852^{**} , the correlation between starboards/phones and managing student discipline and regularity was 873^{**} and correlation between starboards/phones and the interpersonal relations was $.949^{**}$.

Moreover, electronic textbooks is correlated with classroom teaching $.962^{**}$, it has a significant relationship with managing student discipline and regularity was $.934^{**}$, with interpersonal relations was at $.863^{**}$. Results indicate that a correlation between the instructional software and classroom teaching was $.827^{**}$, it was $.843^{**}$ between the instructional software and the management of students, while it was $.934^{**}$ between instructional software and interpersonal relations.

V. DISCUSSION OF THE RESEARCH FINDINGS

Results on the use of ICT tools in selected public secondary schools, the findings from the present study concurs with Findings from the present study did not contradict with the observation of Pedrosa, et al. (2016) carried out a survey in USA and found that as the use of ICT helped a minority of teachers to apply a more constructivist pedagogy, it has not changed the way of teaching for a majority of secondary subject teachers. In this regard, teachers accepted that in the right conditions, ICT became a precious teaching tool that has an effects on student's success in classroom and also on their external performance.

The present study concurs with the work done by Thakral (2015) who evidenced that 82% of teachers took ICT as it has positive effects to teaching while not in methodology of skills provision and classroom practices. This means that ICT was not changing teachers' philosophy and their pedagogy but it changed good administration of teaching like lesson and scheme of work preparation. In the same vein, the results have been found by Andiema (2015) in their view on the effects of ICT in Europe. Teachers emphasized that ICT use has improved collaboration and facilitated them to share ideas and teaching tools. Concerning the pedagogical practices, those teachers continued to use traditional approaches where ICT is taken as a tool to support their didactic approaches. Hence, researchers evidenced that teachers are exploiting the innovative potentiality of ICT and students are passively involved in capacity building. Results on the level of teacher's performance in secondary schools owing to the use of ICT tools did not contradict the observations of Blazar and Kraft (2017) who denoted that teachers who use ICT can share learning tools in different ways: ICT helped teachers and learners to use video system to transmit information and television programs thought all infrastructure of the school even between schools of the same region. This way of working can minimize expenses and increase teaching quality in secondary school education specifically in schools without sufficient teaching tools. In the same context of Drossel, et al., (2017) where they found that even though teachers were with the student based beliefs, they were unable to incorporate constructivist teaching with ICT utilization and this reveals contradictions between teacher's pedagogical opinions and teaching activities. The study showed that most teachers, regardless of their pedagogical beliefs in favour of ICT integration, were still utilizing lecture based teaching activities when integrating ICT. Finally, Trucano (2015), in the knowledge maps, carried out a survey on the effectiveness of using ICT in education in under development countries. He identified main ICT related factors which are impacting on teacher's performance or service delivery: Pedagogy, teacher technical abilities and knowledge of ICT, teacher's confidence and motivation, and Teacher's professional development and an enabling environment.

Results on the relationship between the use of ICT tools and teachers performance Results concur with the study of Nazir (2015) who established teachers should be trained on the TPACK framework where they can share experience on how to choose appropriate technological tool for a selected content by using this tool in teaching and learning process with the modification of teaching relying on chosen instrument. It is a framework that helps to establish how to teach with technological devices that permits teachers to combine content, pedagogy and technology..

VI. CONCLUSION AND RECOMMENDATIONS

Relying on results presented and discussed in the fourth chapter, researcher attempted to provide concluding remarks. In this regard, objective one, this concludes that the research felt the most commonly instructional materials usage in selected schools teaching Rulindo District were ICT tools. The most commonly tools were computer /tablets, starboards/phones, electronic textbooks, and instructional Software).

From the second objective and question, the researcher concludes that a big number of teachers were able to improve their classroom teaching. The results demonstrated that the ways of classroom teaching has been improved. This was confirmed by 49.4% with a mean of 0.67 and 10.1 and sdv 0.67. 47.2% strongly disagreed that the management of students, discipline and regularity is effective a mean of 1.32 and sdv was 0.43. Moreover, 85.0% strongly disagreed that there is an improvement of interpersonal relations at a mean of 1.04 and sdv was 0.43. Moreover, 85.6% disagree that students participate in class discussions with a mean of 2.31 and standard deviation of 0.41. Therefore, 43.8% strongly accepted that students complete their homework in time at a mean of 1.67 and standard deviation of 1.12. Finally, 48.2% of respondents agreed that the student's average marks at the end of the term exams has been increased at a mean of 1.29 and standard deviation of 0.67.

To the third objective, the researcher concluded that the majority of ICT tools used are more like to significantly affect the level performance of teachers in secondary schools located in Rulindo District. The ICT tool usage was measured using computer /tablets, starboards/phones, electronic textbooks, instructional software. On the other hand, performance of teachers was assessed through class, managing discipline and student attendance but also relationship between them. This research conclude that relationships are all positive and statistically significant. Each of these elements significantly increase teachers' performance when they are improved. Moreover, electronic textbooks is correlated with classroom teaching. It has a significant relationship with managing learners discipline and attendance and relationship between them. Results indicate that the correlation between the instructional software and classroom teaching, between the instructional software and the management of students

From the results, From this study, a number of recommendations were made possible: reconsidering concluding remarks from the study findings and information argued that the author attempted to make some recommendations to the study. Public institutions must ensure that budgeting could focus on improving electronic-libraries in education secondary.

The ministry of education has to seek enough financial means to stimulate teachers to have access to ICT tools that are capable to increase their teaching success. School principals are recommended to organize in service training and capacity building in order to enhance knowledge related to the use of ICT tools. Head Teachers would make awareness to parental involvement as well as the government on the role of increasing availability, accessibility and usability of suitable ICT tool usage in public secondary schools and that high or low teachers performance would not rely on the content that they obtain in classrooms as well as accessibility to ICT tools for future revision themselves. Teaching staff members must attempt on the generation of simple aids in order to see what they are discussing about in the lessons. Local communities must motivate parents to participate actively to the provision ICT tools use in public and day schools to improve teaching success.

REFERENCES

- [1] Alexandrova, M., & Ivanova, L. (2012). Critical success factors of project management: Alexandrova, M., & Ivanova, L. (2012). Critical success factors of project management: empirical evidence from projects supported by EU programs. *Systematic Economic Crisis: Current issues and perspective*
- [2] City of Kigali, (2020). Project management: Strategies for successful project execution. Austin: TX78731 publication
- [3] Creswell, J. W. (2012). *Qualitative inquiry & research design: Choosing among five approaches* (4th ed.). Thousand Oaks, CA: Sage
- [4] Denis (2012) *Enhancing the contributions of SMEs in Global and digitalised Economy*. Paris: OECD.
- [5] Harries, E. (2018). *Creating your theory of change*. London: New Philanthropy Capital
- [6] Heintz, J. (2015). *Designing project management*. Finland: Volume: III: Building up business operations
- [7] Ipar, R. (2015). Annual analysis of Rwanda's agriculture budget expenditure. Kigali: ActionAid International Rwanda.
- [8] Iqbal, S. M. J., Nawaz, M. S., Bahoo, S., & Abdul, M. L. (2017). Impact of project teamwork on project success in Pakistan. *South Asian Journal of Management*, 11(1), 1-13.
- [9] Irfan, M., Khan, S. Z., Hassan, N., Hassan, M., Habib, M., Khan, S., & Khan, H. H. (2021). Role of project planning and project manager competencies on public sector project success. *Sustainability*, 13(3), 1421.
- [10] Kiragu, P. (2015). Influence of project implementation strategy on performance of community projects in Kenya. Nairobi: University of Kenya.
- [11] Kostalova, J., Tetrevoval, L., & Svedik, J. (2015). Support of project management methods by project management information system. *Procedia-Social and Behavioral Sciences*, 210, 96-104.
- [12] Macharia, I., 2013. Postharvest losses and postharvest innovations on key horticultural crops – Kenya. Contributed Paper accepted for oral presentation at AGRA Expert and Stakeholder Workshop on Waste and Spoilage Issues, Challenges Facing Smallholder Farmers and Potential Intervention Points, April, 2013, Machakos, Kenya.
- [13] Macharia, N. (2017). Project management and implementation of public projects in technical, industrial,. *International Academic Journal of Information Sciences and Project Management* Volume 2, 239-263.
- [14] Matthew, F., Marion, D. (20015). *Agricultural investment and rural transformation: a case study of the Makeni bioenergy project*. Sierra Leone: Stockholm Environment Institute
- [15] Njama, W. (2015). Determinants of effectiveness of a monitoring and evaluation system for projects in Kenya. Nairobi: University of Kenya.
- [16] Patanakul, P., Shenhar, A. J., & Milosevic, D. Z. (2012). How project strategy is used in project management: Cases of new product development and software development projects. *Journal of Engineering and Technology Management - JET-M*, 29(3), 391-414.
- [17] Rwanda Development Board. (2015-2016). *Annual Analysis of Rwanda's Agriculture Budget*. Kigali: Institute of policy analysis and research Rwanda.
- [18] Twahirwa, I. (2013). *Monitoring and evaluation and economic performance of poverty reduction projects*. Rwanda: Mount Kenya University.
- [19] Van (2012). The role of dissemination of monitoring and evaluation results in the promotion of performance of digital education technology project. *IJRDO-Journal of Educational Research*. Vol 3 (11), pp. 26-44.

AUTHORS

First Author – Jean d'Amour Ndayisenga, School of Education, Mount Kenya University, Kigali, Rwanda

Second Author – Dr. Hesbon Opiyo Andala, School of Education, Mount Kenya University, Kigali, Rwanda

Email of the corresponding author: djean3365@gmail.com

Community Inclusivity and Teenage Pregnancy Prevention Project in Rwanda: A case of association of Kigali Women in Sports in Musanze District

^{1*} Marie Grace Nyinawumuntu & ^{2*} Prof. Edwin Odhuno

^{1*}School of Business and Economics, Mount Kenya University, Kigali, Rwanda

²School of Business and Economics, Mount Kenya University, Kigali, Rwanda

DOI: 10.29322/IJSRP.12.10.2022.p13076

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13076>

Paper Received Date: 25th September 2022

Paper Acceptance Date: 25th October 2022

Paper Publication Date: 30th October 2022

Abstract- The study examined the role of community inclusivity on teenage pregnancy prevention project: a case of Association of Kigali Women in Sport project in Musanze District, Rwanda. The specific objectives were to determine effect of community inclusivity in project selection, planning, execution on teenage pregnancy prevention. The significance of this study is based on the extension of researchers' skills on involving beneficiaries in all phases of project. The final work serves as a reference tool to the future research. Results would help the community to note that absence of effective utilization of skills in development activities which cause the project in the community enable to attain its expected outcomes. The study adopted stakeholder theory, and modernization theory. The study used a descriptive and correlation research designs with a mixed approach. The target population was 379 of which a sample of 118 respondents were chosen by simple random sampling technique. The study gathered data using questionnaire and interview guide. Quantitative data was analyzed through descriptive statistics while inferential statistics was used to establish correlation and regression analysis between variables. Results to the first objective show that community inclusivity in project planning and project execution significantly affect teenage pregnancy prevention. Results indicate that the R coefficient .877 reveals that community inclusivity in project selection has a positive relationship with teenage pregnancy prevention. Results to the second objective show that the R coefficient .818 reveals that community inclusivity in planning has a positive relationship with teenage prevention pregnancy. Results to the third objective show that the R coefficient .912 reveals that community inclusivity in execution has a positive relationship with teenage pregnancy prevention. The study concludes that community inclusivity play a very crucial role for ensuring teenage pregnancy prevention. The study recommends that beneficiaries should be trained in order to have active participation in project planning, execution, monitoring and evaluation. The staff of AKWOS project should include all stakeholders and beneficiaries in selecting, planning and executing teenage pregnancy prevention project. Donors should follow ups the application of community inclusivity towards the reduction of teenage pregnancy. Local leaders should advocate for the project beneficiaries.

Index Terms- Project, Community Inclusivity, Project Selection, Project Planning,, Project Execution, Teenage Pregnancy Prevention

I. INTRODUCTION

The growing problem around which this study turns consists in knowing if and how community inclusivity plays a role to the sustainability of teenage pregnancy prevention project in Rwanda. In fact, one of the greatest impediment to the Rwandan society is an increasing problem of teenage pregnancies in Rwanda (Mukundane, 2011). Both scientific and empirical evidence on pregnancy felt that the rate of teenage pregnancy was 12% in Rwandan cities, and 11.4% in rural areas. The Fifth Demographic and Health Survey (DHS5) reported that reveal that 6.8% of adolescent girls between 15 and 19 years had experience sexual relationship. For this perspective, 32.7% were illiterate and 27.0% were not affiliated to any religion (National Institute of Rwanda [NISIR], 2014). In fact, teenage pregnancy in Musanze Distrcit, recorded a high rate (39%) compared to other districts in the country (NISIR, 2014). This has stimulated Association of Kigali Women in Sports to undertake a teenage pregnancy prevention project in this area (Association of Kigali Women in Sports [AKWOS], 2019).

In search of ways to prevent teenage pregnancy in sustainable way, most of Non-Governmental Organizations undertook projects, but most of them were not sustainable. According to the report of Gender Monitoring Office, out of 75 Teenage pregnancy prevention projects, only 19% were sustainable in 2016, 23% in 2017, 39% in 2018 and 41% in 2019 (Gender Monitoring Officer [GMO], 2020). The typical example was a project initiated by Haguruka in the Eastern Province towards the prevention and response teenage pregnancy in Kayonza District where only 7.8% of girls were supported and all most of activities collapsed after one of project termination (Iyakaremye, 2018). Previous studies denoted that about 33% of projects on teenage pregnancy did not succeed (Banenzaki, 2015). Gaitano (2011) has affirmed that 42.0% of project failed after the remove of financial support after project termination (Cusworth & Franks, 2013) were also indicators of unsuccessful projects.

Previous studies pointed out that community inclusivity can play a pertinent role to the sustainability of teenage pregnancy prevention project (Ndengwa, 2015). A study of Mnarana (2010) asserts that 76.4% of respondents confirmed that non-governmental organizations would consult beneficiaries before selecting, planning and executing projects. However, previous studies were conducted especially on monitoring and evaluation, but they did not focus on inclusivity in selection, planning and execution. This become a literature gap. In addition, most of those studies were conducted outside of Rwanda, and using qualitative methods. Therefore, this was a methodological gap. In light with this gap with high rare (39%) of teenage pregnancies in Musanze District (NISIR, 2014) where AKWOS undertook a teenage pregnancy prevention project, this study sought to investigate the role of community inclusivity on teenage prevention project implemented by that NGOs in above District.

1.1 Research Objectives

- i. To determine effect of community inclusivity in project selection on teenage pregnancy prevention in Musanze District.
- ii. To identify the effect of community inclusivity project planning on teenage pregnancy prevention in Musanze District.
- iii. To assess the effect of community inclusivity in project execution on teenage pregnancy prevention in Musanze District.

II. LITERATURE REVIEW

2.1 Review of Empirical Studies

A study carried out in Nigeria by Ofuoku (2011) investigated effect of community inclusion on teenage pregnancy prevention of projects in Delta central agricultural Zone of Delta State. A sample size of 160 respondents provided responses through the utilization of interview schedule. The study found that sexual behavior was the result of a deeper and more complex known as sexual socialization (Shirpak, 2013). This contrary to the approach used by decentralized local entities in Rwanda (MINALOC, 2016) where they involved the community right from the beginning. By doing they feel the project belongs to them and they strive towards teenage pregnancy prevention.

A study carried out in Nyandarua by Kinyanjui and Misaro (2013) assessed socioeconomic position and inclusion development in Kenya. The purpose was to analyze the effect of socio-economic factors on the level of family's inclusion in consistency development project in an effort to reduce rural poverty. Utilizing quantitative survey design, 100 respondents were given interview utilizing a semi-structured questionnaire. The raw information from the field was discussed using a descriptive and inferential statistics. The research revealed that people's inclusivity in project selection is stimulating implying that more locals are being actively included in selecting projects. The study suggested community development fund (CDF) Projects be harmonized with the local development needs and the need to give community based organizational strategies to make easy local inclusion in different projects to ensure teenage pregnancy prevention.

Kinyanjui and Misaro (2013) carried out a research on effect of community participation on project success in Africa referring to a bottom up approach. The study examines the extent to which the community participation contribute to the success of teenage project in Africa. The study analyzed the benefits of community participation and the reason behind the project imposed to locals without their participation in selecting. The study indicated how financial assistance from advanced countries come to Africa, Uganda included in 1980s and 1990s for development projects but most of them were not sustainable. Obviously, the bottom up approach was not respected.

Peter et al. (2013) asserted that, inclusivity would be a part of institution in needs to prevent teenage pregnancies. The research proposed that it was crucial to possess local community in assessing their needs and drawing up societal action, focuses on the use community inherent knowledge and ability to overcome their problems. Therefore, research rely on involvement emanating from development of donor funded project via the focus on the development.

According to Hodgkin (2014) the teenage pregnancy project, this research has been carried out in all United States of America for International Development (USAID) program in the world using qualitative and quantitative and used triangulation methods of collecting information. A report evidenced that prevention of teenage pregnancies requires adolescents in many cultures were not provided any given evidence on sexual matters that analysis of these problems being considered taboo. Therefore, as was provided left to a child's parents and usually this was put until just before a child's marriage Therefore, in contemporary society to show sexual behavior at an early age therefore prompting the need of education (Jerma & Constantine, 2010).

Kiyuni (2011), the research revealed that, sex education in the family may be an excellent chance for teens and parents to cooperate about sex. The study proposed that comprehensive sex education and projects that includes people may help teenagers delay onset of sexuality, decrease frequency that include persons may help sexuality activities. Kinyanjui and Misaro (2013) a quantitative descriptive study found that the information indicates that female who obtained comprehensive sex were not more in sexual activities, increase them and acquire critical outcomes. The study conducted by Shimwa (2019) on the stakeholders participation and project success in Rwanda with a case study of Bye Bye Nyakatsi project have found that 11.90% of respondents said that the sustainability will be based on the responsibility of their groups, while 4 respondents representing 04.76% do not believe in achievement of Bye Bye Nyakatsi expected project. A proportion of 63.09% of all respondents believed that this project was maintained after withdraw of the support from Rwanda Diaspora which initiated the project. In addition, a number of respondents representing 72.61% were actively involved in project process as they were aware of the project while 27.39% were passive because they did not have enough information about the project.

According to Kinyanjui and Misaro (2013), beneficiaries were not included much in active planning and execution of projects. The study evidenced that disadvantaged people are rarely included in the execution committees. Most of these groups are managed by those that have affected owing to their financial status and their positions in the community. Community development process was where beneficiaries were actively and entirely included whereby people make decisions on problems related to their living conditions, formulate policies and come up with actions that brought challenges into their living conditions which finally ended to self-reliance to the beneficiaries (Jaques, 2014). Community inclusivity was where beneficiaries help in continuity of projects in the community (Shimwa, 2019). The society assessed with projects they started and may even want their completion with individual purpose. The role of government was to increase the living standards of beneficiaries and organization included in community development without understanding the needs of the society, the aim of such project was not achieved (Kule & Umugwaneza, 2016). In addition, genuine involvement of Memorandum of understanding and community inclusivity are pertinent for making, sex education was not adequate in Kenya. Few girls obtained comprehensive sex education and usually teachers did not have enough training to provide students correction evidences.

2.2. Theoretical Framework

The study was guided by Stakeholder Engagement Theory and Human Capital Theory. The framework model that reflects interrelationship between the two variables in the study. Defenders of modernization hypothesis express that cutting edge states are all the more intense, more rich and that their residents appreciate a higher expectation for everyday life through advancements like new data technology and the need to bring up to date traditional methods in production, communication and transport. According to Boyes & Melvin, (2010), the training and technology needed to arrive at the stage of modernization is given by the West. In this case the sustainability of pregnancy prevention project was sustainable through participation of community members by providing critical services like conservation of water basins, ensuring water security, water allocation and permitting and conflict resolution.

The stakeholder theory was proposed by Edward Freeman (1984) who detailed the Stakeholder Theory of organizational management and business ethics that addresses morals and values in managing an organization. Stakeholder Theory argues to be adequate in integration of population or stakeholders in project activities and decision-making. It also helped in assessing stakeholder assessment, classification and knowing their attitude for the best management (Boyes & Melvin, 2010). This theory was divided into three perspective that were descriptive, normative and tool. This point of view supports in knowing the correlation between organization and its stakeholders.

The normative view stakeholders as an end in themselves relied on principals of fairness, that all human being were impacted by any decision owing us all have an equal interest in a safe and stable life as demonstrated by Adhiambo (2013).

The above theories enabled the researcher to establish the conceptual framework as follows:

2.3 Conceptual Framework

The conceptual framework is presented in Figure 1

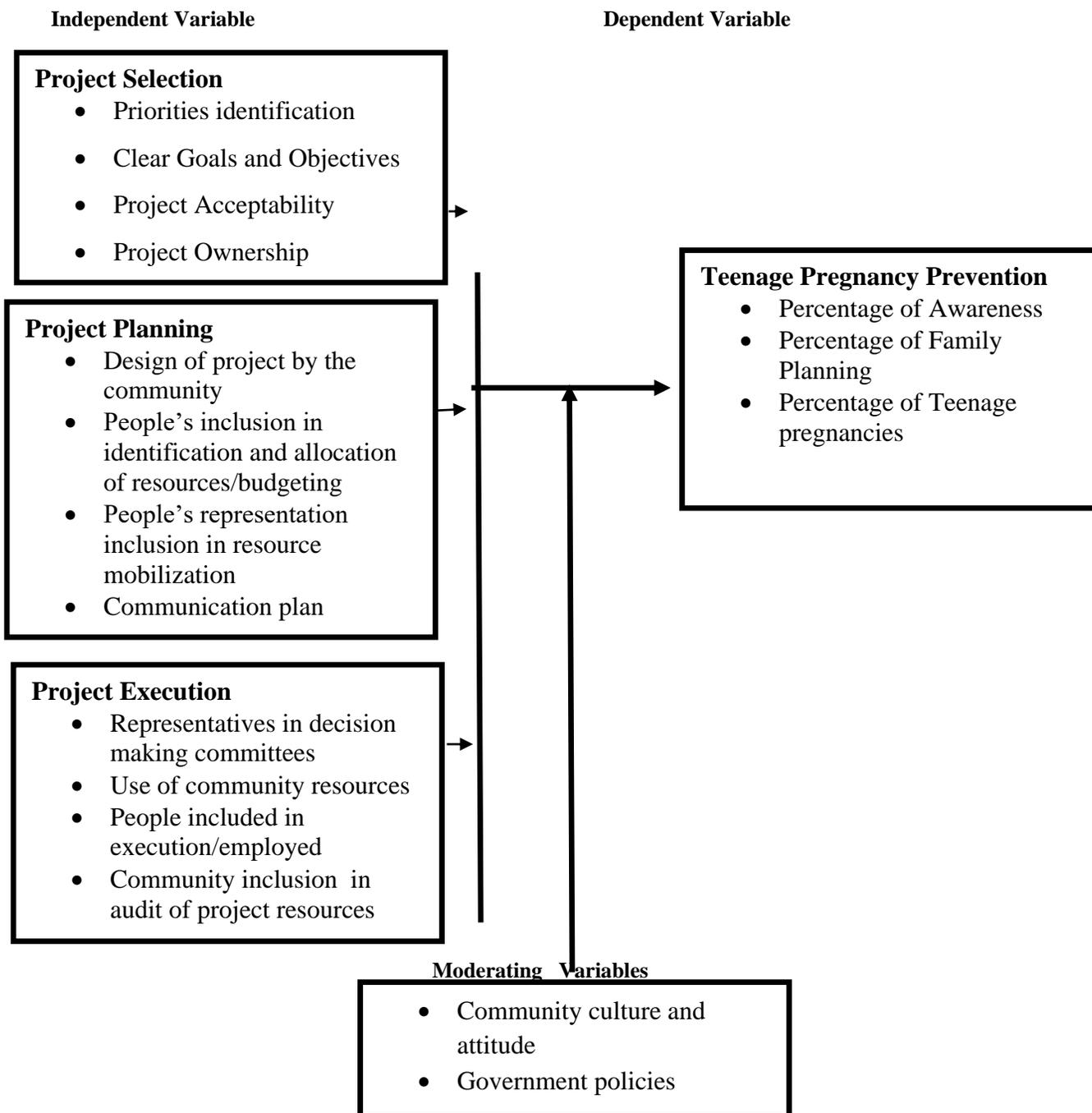


Figure 1 represents correlation between the predicting factors and the outcome. Project indicates the conceptual framework that was establishing the relationship between independent variable; inclusion in project selection, planning and execution with teenage pregnancy prevention project implemented by Association of Kigali Women in Sports. The dependent variable which include sexual health awareness, high demand of family planning, reduction in number of teenage pregnancies. Project selection refers to the process of assessing and examining needs of a

community. The determination of needs was the process of explaining issues of the beneficiaries and possible solutions to these issues. The need was a gap between what is and what should be.

Project selection was conceptualized by problem identification, priorities identification, clear goals and objectives, project acceptability, and project ownership. Project planning and design is defined as communication process where persons with diverse point of view on how an expected condition would look like and how like they were to obtain there any and how to express these options together and attain a consensus. Project planning and design were conceptualized by the design of project and by the community; people's inclusion in identification and allocation of resources/budgeting, people's representation inclusion in resource mobilization and the use of local knowledge. Project execution refers to the implementation of planned action from the planning stage. Project execution was conceptualized by the people's representatives in decision making committees, the use of community resource, and people inclusion in execution, and community inclusion in audit of project resources for better decision making, overcoming challenges, innovation and community training on management and project maintenance. The relationship between community inclusivity and teenage pregnancy prevention project was moderated by use of community culture, attitude, and government policies.

III. RESEARCH METHODOLOGY

This study used both descriptive research design and correlational research design. A descriptive research was adopted for the provision of descriptive statistics to community inclusivity, participatory (selection, planning, execution) and teenage pregnancy prevention project (sexual health awareness, high demand of family planning, reduction in number of teenage pregnancies). A correlational research design to measure effects size –regression was adopted. The design was adopted when this researcher wants to know the feature of the like and relationship occurring between variables. In this study, the target population was 379 out of which 371 were beneficiaries of AKWOS project, 4 staff, 2 local leaders in charge of social affairs and 2 donors. For quantitative data analysis, descriptive and inferential statistics were used while qualitative data analysis applied content analysis.

IV. RESULTS AND DISCUSSION

4.1 Effect of Community Inclusivity in Selection on Teenage Pregnancy Prevention Project in Musanze District

Table 1 presents the views on effect of community inclusivity in selection on teenage pregnancy prevention project in Musanze District

Table 1: Correlation Analysis on Community Inclusivity in Selection and Teenage Pregnancy Prevention Project in Musanze District

		Sexual Awareness	Health High Demand of Family Planning	Reduction of Number of Teenage pregnancies	in of
Priorities identification	Pearson Correlation	.119*	.049	.074	
	Sig.(2-tailed)	.048	.414	.223	
	N	115	115	115	
Clear Goals and Objectives	Pearson Correlation	.025	.007	.098	
	Sig.(2-tailed)	.683	.910	.105	
	N	115	115	115	
Project Acceptability	Pearson Correlation	.121*	102	.005	
	Sig.(2-tailed)	.044	.091	.939	
	N	115	115	115	
Project Ownership	Pearson Correlation	.121*	102	.005	
	Sig.(2-tailed)	.044	.091	.939	
	N	115	115	115	

Findings reveal correlation between variables. For priorities identification, there was a positive insignificant association between priorities identification and sexual health awareness ($r=0.049$, $p=0.414$) and priorities identification with reduction in number of teenage pregnancies ($r=0.074$, $p=0.223$). These correlations were statistically insignificant given that the p value was >0.05 implying that the rise of priorities identification did not affect sexual health awareness, high demand of family planning and reduction in number of teenage pregnancies and vice versa. For clear goals and objectives there were positive and significant correlation between clear goals and objectives and sexual health awareness increase ($r=0.119^*$, $p=0.048$). This was related since the p value <0.05 proposing a variation in clear goals and objectives leads to increase in sexual health awareness and vice versa. Contrary to insignificant correlation between clear goals and objectives and high demand of family planning ($r=0.025$, $p=0.685$), clear goals and objectives and reduction in number of teenage pregnancies ($r=0.007$, $p=0.910$). These correlation were statistically insignificant given that the p value was >0.05 implying that the rise of clear goals and objectives did not affect sexual health awareness, high demand of family planning and reduction in number of teenage pregnancies and vice versa.

Results on the correlation between project acceptability and dependent variables indicate that there is insignificant correlation project acceptability and reduction in number of teenage pregnancies ($r=0.005$, p value= 0.919). These were statistically insignificant given that the p value was >0.05 implying that the rise of project acceptability did not affect reduction in number of teenage pregnancies. However, project acceptability was positively correlated with sexual health awareness increase, ($r=0.121$, $p=0.044$) and high demand of family planning rise

($r=0.102$, $p=0.091$). There were positive and significant correlations between project acceptability and sexual health awareness increase ($r=0.119^*$, $p=0.048$). Results on the correlation between project ownership and dependent variables, there were significant correlation between project ownership and sexual health awareness increase ($r=.121^{**}$, $p\text{ value}=0.044$), project ownership and high demand of family planning rise ($r=102$, $P\text{ value }0.091$). There was positive correlation since the p value was less than 0.05. Contrary, these are insignificant correlation between project ownership and reduction in number of teenage pregnancies ($.005$, $p\text{ value } .939$) given that the p value was >0.05 implying that the rise of project ownership did not affect reduction in number of teenage pregnancies. An interview with AKWOS project manager argues “the community inclusivity in project selection is very important in term of improving sexual health awareness, high demand of family planning rise and reduction in number of teenage pregnancies”..

4.2 Effect of Community Inclusivity in Planning on Teenage Pregnancy Prevention Project in Musanze District of Rwanda

Table 2 depicts views on the effect of community inclusivity in planning on teenage pregnancy prevention project in Musanze District of Rwanda.

Table 2: Correlation between Community Inclusivity in Planning and Teenage Pregnancy Prevention in Musanze District

			Sexual Health Awareness	High Demand of Family Planning	Reduction in Number of Teenage pregnancies
Design of project by the community	Pearson Model	Correlation	0.215	0.244	0.512*
		Sign. (2-tailed)	0.048	0.346	0.036
		N	115	115	115
People’s inclusion in identification and allocation of resources	Pearson Model	Correlation	-0.308	0.680**	0.931**
		Sign. (2-tailed)	0.229	0.003	0.000
		N	115	115	115
People’s representation inclusion in resource mobilization	Pearson Model	Correlation	-0.523*	-0.637**	0.986**
		Sign(2-tailed)	0.031	0.006	0.000
		N	115	115	115
Communication plan	Pearson Model	Correlation	-0.391	-.0301	0.443
		Sign. (2-tailed)	0.120	0.241	0.075
		N	115	115	115

*Correlation is Significant at the 0.5 level (2-tailed).

The results demonstrated that there are clear relationship between design of project by the community and sexual health awareness increase ($r=0.215^*$, $p=0.048$), design of project by the community and Reduction in number of teenage pregnancies (0.512^* , $p= 0.036$). These mean a highly project by community increased sexual health awareness and reduction in number of teenage pregnancies and the vice versa. Contrary, there was insignificant correlation found between project by the community and high demand of family planning ($r= 0.244^*$, $p=0.346$), this correlation was statistically insignificant since the p value is >0.05 for project the community did not affect automatically high demand of family planning and vice versa. For people’s inclusion in identification and allocation of resources and reduction in number of teenage pregnancies ($r=0.931^{**}$, $p=0.000$) people’s inclusion in identification

and allocation of resources within the sector and high demand of family planning ($r=0.680^*$, $p=.003$) were positively correlated. Insignificant correlation was found people’s inclusion in identification and allocation of resources/budgeting within the sector and sexual health awareness increase. This means that people’s inclusion for identification or allocation of resources/budgeting within the sector did not affect sexual health awareness increase. There was a significant correlation found between people’s representation inclusion in resource mobilization and sexual health awareness increase ($r=-0.523^*$, $p=0.031$). Significant positive correlations were found between people’s representation inclusion in resource mobilization and reduction in number of teenage pregnancies ($r=0.986^*$, $p=0.000$), meaning that a change in people’s representation inclusion in resource mobilization improved reduction in number of teenage pregnancies and the vice versa. Negative correlations were communication plan and sexual health awareness increase ($r=-0.391$, $p=0.120$), insignificant correlations also found between communication plan and high demand of family planning ($r=0.301$, $p=0.241$). Furthermore, a positive correlation was found between communication plan and net profit increase ($r=0.443^*$, $p=0.075$).

4.3 Effect of Community Inclusivity in Project Execution on Teenage sustainability of AKWOS project in Musanze District of Rwanda

Table 3 illustrates the views on the effect of community inclusivity in project execution on teenage sustainability of AKWOS project in Musanze District of Rwanda

Table 1: Effect of Community Inclusivity in Project Execution on Teenage sustainability of AKWOS project in Musanze District of Rwanda

		Sexual Awareness	High Health of Planning	Demand Reduction in Family Number of Teenage pregnancies
Representatives in decision making committees	Pearson Correlation	.167	.393**	.560
	Sig.(2-tailed)	.078	.000	.056
	N	115	115	115
Utilization of community resources	Pearson Correlation	-.050	-.159	.167
	Sig. (2-tailed)	.602	.093	.078
	N	115	115	115
People included in execution/employed	Pearson Correlation	.032	.058	-.041
	Sign.(2-tailed)	.741	.545	.669
	N	115	115	115
Community inclusion in audit of project resources	Pearson Correlation Model	-0.391	-.0301	0.443
	Sig.2(2-tailed)	0.120	0.241	0.075
	N	115	115	115

**Correlation is significant at 0.01 level (2-tailed)

The findings demonstrated a positive correlation Adequate Team Members and project quality Statistically there was a significant relationship between representatives in decision making committees and sexual health awareness increase ($r=.167^*$, $p=.078$), representatives in decision making committees and High Demand of Family Planning ($r=.393^*$, $p=.000$), and representatives in decision making committees and reduction in number of teenage pregnancies ($r=.560$, $p\text{ value}=0.56$). It implies that increase in representatives in decision making committees increase sexual health awareness, high demand of family planning and reduction in number of teenage pregnancies and vice versa. There was a negative relationship between narrow, use of community resources and sexual health awareness increase ($r=-.050^*$, $p=.602$), narrow, community resources and high demand of family planning ($r=159$, $.093$) for the

reduction in number of teenage pregnancies ($r=.167$, p value $=.078$). Meaning that community resources sexual health awareness and high demand of family planning.

Significant positive correlations were found between people included in execution and sexual health awareness increase ($r=.032^*$, $p=.741$), people included in execution/employed and high demand of family planning ($r=.058^*$, $p=.549$) and people included in execution/employed and reduction in number of teenage pregnancies ($r=.041$, p value $.669$). The study implies that people included in execution/employed increase Sexual Health Awareness, high demand of family planning and reduction in number of teenage pregnancies and the vice versa. Finally, insignificant correlations were found between community inclusion in audit of project resources and sexual health awareness increase ($r=.0391^*$, $p=.0.120$), community inclusion in audit of project resources and high demand of family planning ($r=.0301^*$, $p=.0.241$). However, a significant relation was found between community inclusion in audit of project resources and reduction in number of teenage pregnancies ($r=-0.443^*$, $p=.0.075$).

V. DISCUSSION OF THE RESEARCH FINDINGS

This paper determined whether inclusivity of beneficiaries in project selection significantly affects teenage pregnancy prevention project implemented by AKWOS. The study results did not contradict with the conclusion of Kinyanjui and Misaro (2013) which found felt that people's inclusivity in project selection is stimulating implying that more locals are being actively included in selecting projects. The study concurs with Peter et al (2013) revealed that many projects were influenced by socio-economic and cultural elements in order to attain project objectives. The study is in line with Hodgkin (2014) the success of supporters given to rural water provision for a research carried it USAID program in the world that pinpoint the factors that may be taken into consideration to preserve sustainable project.

The second objective was to assess whether community inclusivity during project planning significantly affects teenage pregnancy prevention project implemented by AKWOS project in Musanze District of Rwanda. Hodgkin (2014) who felt that sustainable project emanates from constant analysis and discussion through the adoption of strategies that may be taken into consideration whether and interference necessitates to preserve its attainment among beneficiaries by knowing habits and stakeholders. Results from the study was relevant since Kiyuni (2011) found a strongly correlation between responsibility of each stakeholders included in problem a well supporting regime that were for teenage pregnancy prevention project. This research concurs with results of Mukundane (2011) who concluded that progress of project is dependent on stakeholder integration through accessibility to information and consultation that help in preventing teenage pregnancies. The information did not contradict the study conducted by Shimwa (2019) who found that 11.90% said that teenage pregnancy prevention was based on the responsibility of their groups. Moreover, 72.61% were actively involved in project process as they were aware of the project.

The third objective was to establish whether inclusivity of community during project execution significantly affects teenage pregnancy prevention implemented by AKWOS in Musanze District, Rwanda. The measurements used are decision making, overcoming of challenges and encouraging innovation during project implementation. The results did not concur with Kinyanjui and Misaro (2013) who evidenced that disadvantaged people are rarely included in the execution committees. However, a significant relation was found between community inclusion in audit of project resources and reduction in number of teenage pregnancies ($r=-0.443^*$, $p=.0.075$). These were not revealed in the beneficiaries help in continuity of projects in the community (Shimwa, 2019). Although Mnaranara (2010) tried to conduct studies in relationship inclusivity, participation and teenage pregnancy prevention, the researcher did not consider the impact of inclusivity and teenage pregnancy prevention in terms of selection, planning, and execution. In another context, population plays a significant and role in execution of projects and their success (Mukundane, 2011).

VI. CONCLUSION AND RECOMMENDATIONS

In conclusion, it was evident that community inclusivity during project planning play a very crucial contribution to ensure teenage pregnancy prevention. During project planning, beneficiaries come up with project objectives that were achieved, hence solving needs of the community. When clear goals were set by the locals, it is easier to achieve the goals set as the communities know the vision of the project. It was important that training during project planning was done so that beneficiaries fully take part during these phases. Therefore, beneficiaries confirmed to what the donor wants only to benefit from the monetary gains during the project period but after

the donor exits the teenage pregnancies can be prevented. Therefore, AKWOS should consider the needs of the beneficiaries and these needs differ from one community to the other before a project commences.

The study recommends the beneficiaries of the project to commit themselves to other project activities and not only activities regarding sport so that they should be included in all project activities to increase the reduction of early teenage pregnancies in Musanze District of Rwanda. The trainings should enable the community to plan the project at the initial stages and in the actual project implementation. Beneficiaries also become more analytical about situations and are therefore able to come up with adequate measures to overcome shortcomings.

The study suggests the staff of AKWOS project to take part and parcel of the process including all the project stakeholders and project beneficiaries in terms of selection, planning and execution to ensure the reduction of teenage pregnancy prevention in Musanze District of Rwanda. Reconsidering the results, the study recommends that donors of AKWOS project to do follow ups and check whether community inclusivity is applied in the project to enhance AKWOS teenage pregnancy prevention in Musanze District of Rwanda. Local leader in charge of social affairs were proposed to motivate sports activity at local level and make sure that as the project stakeholders, they do advocacy for the project beneficiaries to include beneficiaries of the project in all project activities from needs selection, project planning, project execution to ensure teenage pregnancy prevention in Musanze District of Rwanda. In accordance with results and gaps left out by previous researchers in relation to inclusivity and teenage pregnancy prevention, the researcher would like to recommend that further studies should be conducted on the following: (i) Influence of level of education on teenage pregnancy prevention of projects in Musanze District ;(ii) Influence of economic levels on teenage pregnancies in Musanze District; (iii)Future researches would be conducted in cities in order to compare objective to generalize results to the entire community; (iv) A study should be done to establish causes and effects of teenage pregnancies differently from inclusivity of the urban communities. .

REFERENCES

- [1] Adhiambo, L. (2013). Factor affecting the effectiveness of Donor Funded Project in Kenya. Auckland University.
- [2] AKWOS], (2019). Community as partner: Theory and practice in nursing (6th Ed). New York: Lippincott Williams & Wilkins.
- [3] Banenzaki, (2015). A review of studies of parent-child communication about sexuality and HIV/AIDS in sub-Saharan Africa. *International Journal of Project Management*, 10(2), 4755-8-25
- [4] Boyes, W. & Melvin, M. (2010). *Micro-economics*. (8th Ed). Ohio: Cengage Learning.
- [5] Cusworth & Franks, (2013). Parental Supervision and Alcohol abuse among adolescent girls. *International Journal of Pediatrics*. 136(4):617-624
- [6] Edward Freeman (1984). *The Biodiverse Stakeholder Engagement, Handbook*, Biodiverse, Paris. France.
- [7] Gaitano (2011) American Teens 'Sexual and Reproductive Health. In Guttmacher Institute Fact Sheet; Guttmacher Institute: New York, NY, USA
- [8] Gender Monitoring Officer [GMO], (2020). Facts on American Teens Sources of Information about Sex. In Brief: Fact sheet. February 2012.
- [9] Hodging, J. (2014). Sustainability of donor assisted rural water supply project. Water and Sanitation for Health Project (WASH). Arlington, VA, USA.
- [10] Holman, A. (2014). An exploratory study of family narratives about sexual behavior: How family stories shape adolescents' attitudes and behaviors towards sexual risk-taking. *Communication Studies Theses, Dissertations, and Student Research*. Paper 29.
- [11] Iyakaremye, (2018). Prevalence and Determinants of Unintended Pregnancies among Women in Nairobi, Kenya. Biomed Central Ltd. [Http:// www. Biomed central .com/ 1471-2393/13/69](http://www.biomedcentral.com/1471-2393/13/69)
- [12] Jaques, E., (2014). *The Changing Culture of a Factory*. Tavistock, London
- [13] Jerman, P., & Constantine, N. A., (2010). Demographic and Psychological predictors of parent-adolescent communication about sex: A representative statewide analysis. *Journal of Youth and Adolescence*, 39, 1164-1174.
- [14] Kinyanjui, K.D. & Misaro, J. (2013). Socio-economic status and participatory development in Kenya. *International Journal of Humanities and Social Science*, 3(1), 183-193
- [15] Kiyuni, A. (2011) The Ghana Community-Based rehabilitation program for People with disabilities, what happened at the end of donor support, *Journal of social work in Disabilities and rehabilitation*, 15(36), 243-267.
- [16] Kule & Umugwaneza, (2016). U.S. Teenage Pregnancies, Births and Abortions: National and State Trends and Trends by Race and Ethnicity, New York: Guttmacher Institute.
- [17] Mnararana, T. (2010). The importance of community participation in an ongoing Constructions of Primary Schools. A case study of Mlali and Mzumbe ward, University of Agder.
- [18] Mukundane, M. (2013). Popular Participation in Rural Development Programs. In Uganda Case Study of the National Agricultural Advisory Services Program in Mbarara District. Master's thesis. Kampapla, Uganda
- [19] National Institute of Rwanda (2014). Teenage pregnancy and motherhood statistics in Rwanda. (kalisa, Ed.) *Digitala Vetenskapliga Arkivet*, 7(3), 3-4. doi:1608117&dsid=-9349
- [20] Ndegwa, A. (2015). Factors influencing the sustainability of KEMRI HIV/AIDS Grants funded projects in Kenya, University of United state international Africa. Master's thesis accessed on 21 July 2020 at <http://erepo.usiu.ac.ke/11732/669>
- [21] Ofuoku (2011) Considering sustainable factors in the development Project life cycle: A framework for increase successful Adoption of improved stoves. Retrieved at <https://digitalcommons.mtu.edu/etds/503> on 11 October 2020.
- [22] Peter, G., George, T., Kirui, K. and Luvega, C. (2013). The Dilemma in sustainability of Community Based Approach. *Global Journal of Advanced Research*, 2 (4), 757-768
- [23] Shimwa (2019) An Effective Use of ICT for education and Learning by Drawing on Worldwide Knowledge, Research and Experience. *Journal of ICT in education*. 3(2),1-12..

AUTHORS

First Author – Marie Grace Nyinawumuntu, School of Business and Economics, Mount Kenya University
Kigali, Rwanda

Second Author – Prof. Edwin Odhuno, School of Business and Economics, Mount Kenya University
Kigali, Rwanda

Socio-Economic Factors Associated With Type 2 Diabetes Complications Among Patients In Kigali City, Rwanda

TOM Muhimbise Mudenge¹, Dr Dr. Nasiru Sani²

¹ School of Public Health, Mount Kenya University, Kigali, Rwanda

² School of Public Health, Mount Kenya University, Kigali, Rwanda

DOI: 10.29322/IJSRP.12.10.2022.p13077

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13077>

Paper Received Date: 24th September 2022

Paper Acceptance Date: 25th October 2022

Paper Publication Date: 30th October 2022

Abstract- Diabetes is the growing public health issue where type 2 diabetes, estimating for 85% to 95% of all cases was considered by insulin confrontation as when the body no longer utilizes insulin adequately to control the blood sugar. In Rwanda, the Ministry of Health reported that in 2016, 43% of patients admitted in hospitals located in the City of Kigali were diagnosed with non-communicable diseases where diabetes took a part of 27.3% of the total bed occupancy. The general objective of this research was to examine socio-economic factors associated with Type 2 diabetes complications among Diabetic patients at Rwanda Diabetes Association Clinic. Specific objectives are; to determine diabetes complications among diabetes patients in the City of Kigali, to establish socio-economic factors associated with retinopathy among types 2 diabetes in the City of Kigali, assess socio-economic factors associated with nephropathy among type 2 diabetes in the City of Kigali, to establish socio-economic factors associated with neuropathy among type 2 diabetes patients in the City of Kigali. The study findings provide effective ways for diabetes management and treatment. Findings will also encourage future researchers to undertake feasibility study to ensure that patients are well managed. A cross-sectional researcher design was used. The target population was 748 registered at Rwanda diabetes association clinic the sample size was 261 patients. The sample size was gotten using simple random sampling technique. A structured questionnaire was distributed among diabetes patients in Kigali City to know their socio-economic status and diabetes complications. Qualitative data was analyzed using a content analysis while quantitative data was statistical methods. Results showed that 52.7% had completed secondary school, 48.2% had regular employment, 60.2% had less than 100,000Frws, and 82.7% used other type of insurance than mutual health insurance. Findings show that 23.2% had developed diabetic retinopathy, 8.9% have developed nephropathy, while 7.7% have developed diabetic neuropathy. A multivariable indicates that odds of developing retinopathy are higher for secondary illiterate/primary holders with a low income, beneficiaries of mutual health insurance and patients with no permanent job. The odds of developing nephropathy are higher for illiterate; primary schools (OR 1.34, 95% CI 1.07-5.10), p-value those with a middle income (OR 1.36, 95% CI 0.84-2.19) or low income (OR 1.66, 95% CI 1.02-2.72), those who were covered by mutual health insurance (OR 2.48, 95% CI 1.16-4.95) and no permanent job (OR 2.23, 95% CI 1.12-4.43). Qualitative results show that diabetes complication among patients was aggravated by their respective low socio-economic and living conditions. The odds of developing diabetic neuropathy are higher for illiterate, primary, those with low income, beneficiaries of mutual health insurance and those with no employment. The study recommends the reduction of socioeconomic inequalities and a decrease of high rate of complications related to diabetes mellitus.

Index Terms- Diabetes Complications, Diabetes Mellitus, Mutual Health Insurance, Nephropathy, Neuropathy, Retinopathy Socio-economic Status,

I. INTRODUCTION

The growing problems worth taking up in public health sector is diabetes and its associated complications (IDF, Mbaya, 2010; WHO, 2016). In 2014, 8.5% of diabetes patients were 18 years old and above. In fact, in 2016, diabetes mellitus become the immediate root that caused the death of 1.6 million people. The prevalence of diabetes worldwide is 3% among 170 million infected (Azumah & Amandi, 2011). The study denotes that that

the rate of diabetes in Southern province of Rwanda was 13.1% (WHO 2015). Recently, the rate of diabetes is estimated to 3.2% while 1,918 people dead each year because of diabetes. In Rwanda, 4.4% of diabetic patients had stroke, vascular complications like nephropathy, coronary artery disease (CAD) and erectile dysfunction. Types 2 diabetes was called the killer due to hyperglycemia, leading to pathologic and functional adjustment in target tissues without clinical symptoms. Studies reported that increasing rates of diabetes, and its complications have association with SES (Safraj *et al* 2012; WHO, 2015). Few describe influences of socioeconomic status and the progression of diabetes complications. Furthermore, exploration of socioeconomic factors associated to Type 2 Diabetes among people living with diabetes in the City of Kigali, Rwanda is not known. The researcher sought to assess socioeconomic factors associated with Type 2 Diabetes in terms of impact of level of income, educational attainment and occupational position on the diabetes complications among Type2 diabetes patients.

The research objectives were:

- i. To determine diabetes complications among Type 2 diabetes patients in the City of Kigali;
- ii. To establish socio-economic factors associated with retinopathy among Type 2 diabetes patients in the City of Kigali;
- iii. To assess socioeconomic factors associated with nephropathy among type 2 diabetes patients in Kigali City ;
- iv. To establish socioeconomic factors associated with neuropathy among types diabetes patient in the City of Kigali.

II. REVIEW OF LITERATURE

The researcher revised past documents on diabetes and its associate different factors that can affect the level of diabetes (MoH, 2014). The existing empirical literature was reviewed according to three objective of the present study.

2.1 Common Diabetic complications among Type Diabetes Patients

Therefore, complications connected to diabetes is subdivided into microvascular and macro vascular. People who had diabetes had an enhanced risk of progressing atherosclerotic, cardiovascular, peripherical vascular and cerebrovascular diseases. Difficulties linked with diabetes may subcategorized into microvascular and macro vascular (Nisar, 2015). The microvascular problems appear owing to deterioration of small blood vessels while that of macrovascular appear owing to miscarriage to wider blood vessels. The microvascular disease involve miscarriage to eyes (retinopathy) causing blindness, kidneys (nephropathy) causing renal problems, nerves (Neuropathy) causing ineffectiveness and powerlessness, and foot ulcer causing amputations Nisar, 2015). The microvascular and macro vascular related problems owing to diabetes had pertinent place in public health (Nisar,2015; Tunceli, 2005) argued that people with micro and macrovascular problems devete a total management expenses of up to two and half times in comparison to those without completions. The consideration cost of treatment diabetes was serious by microvascular and macrovascular problems that were the crucial root of healthcare costs (Beulens, 2010).

In sub-Sahara African, the risk of serious diabetes problems was high and expensive (Kapur, 2011). These were emotional distress (Brown *et al*, 2014), stroke (Walker, 2010), neutral damage, food ulcer causing subtraction, heart attack, kidney damage and blindness (American Diabetes Associated, 2010) and decreased life expectancy (Kumar,2014). Therefore, diabetes usually is linked with some commodities in Tanzania, where 4.4% of people living type 2 diabetes had been diagnosed with stroke (Walker, *et al.*, 2010). Type 2 diabetes was seen as silent killer due to hyerglycemia which may be available a long time before diagnosis, leading to pathologic and functional adjustments in target parts without clinical symptoms (Safraj, 2012).The macro vascular complications are for instance heart attack, strokes, and deficiency in blood stream to legs. The micro and macro vascular related problems has clear effect on public health (Nisar, 2015) asserted that people living with micro and macro vascular problems employ 2/3 of total management expenses in comparison with those without those complications. The significant expenses of treatment has been aggravated by microvascular and macro vascular difficulties that were the greatest causes of healthcare expenses (Beulens, *et al.*, 2010).

However, in Sub-Sahara Africa, the risk of serious diabetes related effects are high and expensive (Mayer,2011).Therefore, these are for instance emotional distress (Brown *et al.*, 2014), stroke (Walker *et al.*,2010), neutral damage, foot ulcer causing subtraction of legs, heart attack, kidney damage and blindness (American Diabetes Association, 2010), and decreased life expectancy (Nisar,2015). Therefore, besides the aforementioned complications, diabetes is usally related to some comorbidities. For example, people living with diabetes nephropathy had high risk for having cardiovascular morbidity. In Tanzania, 4.4% of diabetes patients had stroke (Walker, *et al*, 2010). Types 2 diabetes was called the killer due to hyperglycemia, leading to pathologic and functional adjustment in target tissues without clinical symptoms.

2.2 Socio-Economic Factors with Type 2 Diabetes Complications

Socio-economic factors that influence complications include, lack of enough money, inaccessibility to necessary assets for managing patients' conditions, and decreased personal production at working place or stricter education. The financial resources plays a role to expected resources to preserve good health conditions. Moreover, as it reveals, occupation may as well be affected by past diseases. Wealth, the long term buildup of material resources may safeguard the effect of temporarily low income due to consuming a great percentage of income in comparison with those who had high financial resources (Raphael, 2012). Therefore, in 2014, 8.5% of people living with diabetes were 18 years and above and in 2016 diabetes mellitus become greatest disease that cause 1.6 million to lose their life. In addition, the prevalence of diabetes worldwide is 3% among 170 million infected. (Brown, *et al*, 2014). The prevalence of diabetes worldwide is a global disease. However, type 2 diabetes estimates for 90% of diabetes cases. More than 100 million persons generally had diabetes and most they were not diagnosed. The general estimate rate among adult diabetes in USA was 8.4%. However, a research carried out in Nigeria on the prevalence of types 2 diabetes and discovered that 2.7% among people in Nigeria (Ross, 2010).

Diabetes prevalence had enhanced for the past two decades and the estimate was around 30 million patients and in 2010, it has been 285 million and will rise to 438 million by 2030. The prevalence of type 1 and type 2 diabetes is generally increasing (Safraj, 2012). Therefore, type 2 diabetes prevalence is increasing rapidly than type 1 diabetes owing to reduced activity as many countries are becoming more efficient and industrialised stimulating an increased obesity and population aging (Stolar,2010). The prevalence of diabetes in Philippines was 2-3%, 2.3% Malaysia and 1.2% in Japan. 170 million people and three and four millions of new cases appear every year (WHO, 2017). Low prevalence of diabetes is found in United Kingdom, and Scandinavian in percentage between 0.01% to 0.1%, meaning the average of diabetes is less than 1% (Twagirumukiza & Van Bortel, 2011). The higher prevalence was found in Egypt in range of 15% to 20% (IDF, 2013). The prevalence of diabetes in Eastern Africa estimate 3.00%, West Africa 4.14% Central Africa 7.82%, Southern 0.72%, (sub-Saharan Africa:200-2013). The lower prevalence of diabetes of HCV was Zimbabwe (1-3%), (Kenya (1.7%), Sudan (2.8%), Gabon (9.2%), and CAR (2.4%) (Mercy, 2013).

Scholars in USA assessed a relationship between area of residence and personal level of SES (Walker,(2010). There is a fact of positive correlation regarding area of residence and the level of income or revenue. Poverty and material deprivation, is denoted as the lack of resources to attain the expectation for health, can contribute to continuous struggle to create conclusions (Raphael, 2012). Employment become a pertinent indicators of socioeconomic status and respect in advanced communities and it expresses material circumstances. Employment level in advanced communities assesses respect, duties, physical activities and job positions (Kapur, (2011) Meanwhile, diabetes is able to reduce personal production for job they are occupying if is not managed appropriately, which may stimulate to additional occupation associated issues (Wilkinson, 2013). Occupation may affect diabetes complications by establishing conditions that may affect behavior. Patients with the best job allow improved accessibility to health care, facilitate them to acquire financial means to obtain appropriate shelter and good nutritional status for living not in dangerous neighborhoods and enhance the chance to be involved in health promotional behaviors (WHO, 2014). In the current analysis, the extent of discrepancies was examined by several studies. Based on methods used, counties assessed SES measurements (education, income and occupation) selected, the researcher must establish different prevalence's (Aharddh, *et al*, 2011). In accordance with a meta-analysis done by Ahardg *et al.*,(2011), persons with low job position, low level of educational attainment, and low level of income were 1.31 (CI 95% 1.09-1.57), 1.41 (CI 95% 1.28-1.55), and 1.40 (95% CI 1.04-1.88) consecutively with greatest risk of Type 2 diabetes than those with favorable SES (Aharddh, *et al.*,2011).

The few study conducted in Rwanda show that the general population of about 11.9 million prevalence of diabetes was 45.7% (RBC, 2017). The study conducted among 324 patients attending Rwanda Military Hospital found the rate of diabetes 28.4% among respondents above 55 old, 28.4% among younger respondents aged (18-35 years). The diabetes was positively and highly related to adults persons (>55 years) and disclosure to booster from traditional practices was determined in positive way (P value = 0.036) risk factors of infection the prevalence of diabetes in general population is not clear (Umumararungu *et al*, 2017). In Rwanda there are not exact risk factors for diabetes. The few study reiterate that the rate of Type 2 Diabetes in Southern province of Rwanda was 13.1% and 3.9% outside of Rwanda (WHO 2015). Recently, Diabetes Atlas show that the rate of diabetes in Rwanda is estimated to 3.2% of people living with diabetes and 1,918 patients are losing their life each year.

Limited level of education attainment decrease individual production and cause additional issues related to their job occupation (Wilkinson, 2013). Education is fixed after early adulthood. In some countries, possibly including Rwanda, education may be affected by the level of income and it is possible that disadvantaged health conditions in childhood may affect the quantity and quality of education obtained (Group Health Research Institute, 2012).

2.2.3 Relationship between Socioeconomic Factors and Type 2 Diabetes Complications

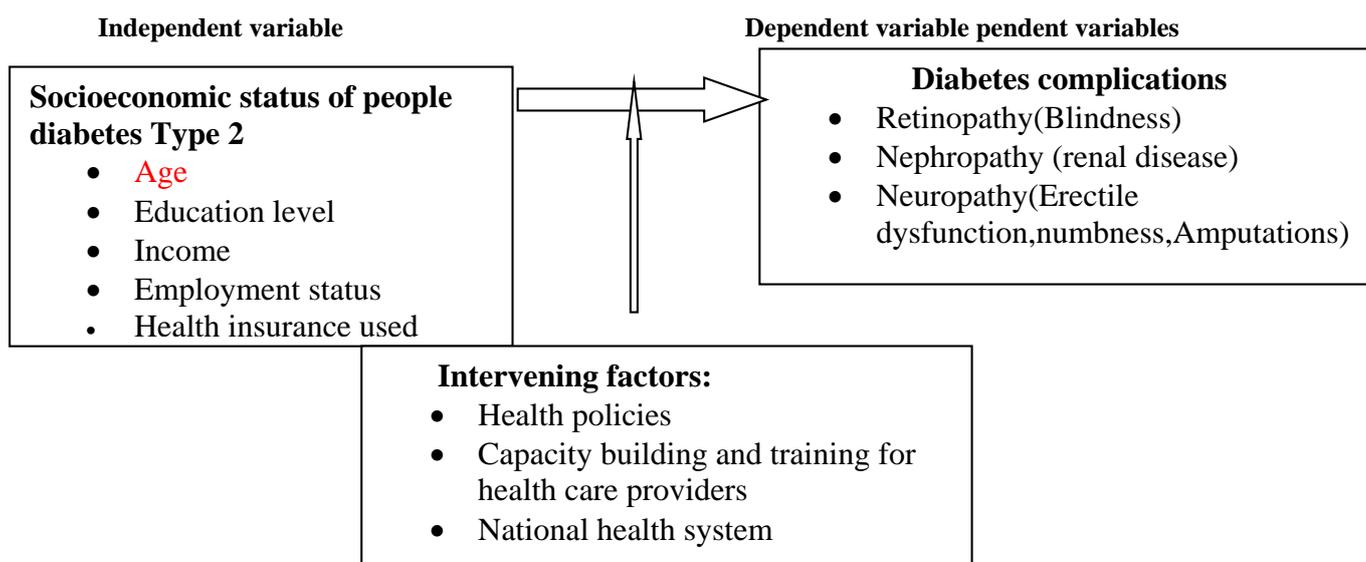
Most of studies at international level have endeavored to demonstrate the association between the prevalence of diabetes and its complications. The impact of health elements, diabetes can be positively correlated below 16 years of age (Berihun & Nuru, 2012). A study carried out in America show that the diabetes related

hypertension demonstrated as statistically significant with diabetes in multivariate inferential analysis (Safraj, 2012). Regional studies in Africa demonstrated the way in which the rate of diabetes has been connected to several factors. A study conducted in Nigeria revealed that factors influencing diabetes are marital status, employment, location, availability of health facilities and other complication were demonstrated as factors associated with diabetes (Oladeinde *et al*, 2012). Regional studies have been conducted in Kenya, Ethiopia, Uganda and Tanzania evidenced the relationship between these factors and diabetes incidence of low birth weight is highly linked to the accessibility to medicaments (Walker, 2010).

Therefore, SES discrepancies affect different stages of type 2 diabetes as pre-diabetes, onset, illness and mortality. The biological and social factors had effect on health of persons from fetus period to death (WHO, 2014) and diabetes without expectation. The biological determinants at birth impact the development of diabetes later and it was assumed that about 40% of tendencies to diabetes were associated with heredity problems (Woolf & Braveman, 2011). They were preventable as persons would be affected by factors connected to parent's biological factors, age and onset, region and ethnic group (WEF (2015). All the above considerations evidenced that the quality of life relies on capacity to have a nutrition, physical activities, upholding an effective follow up of blood glucose level (Youssef, 2013). The study had evidenced that the role of clinical elements and behavior option to anticipate and manage T2D did not suitably demote associated results, for people on low poor status (Dinca-Panaitescu, et al, 2011). Preventive measures had tried to discourse carefully chosen challenges that emanate from social factors like in cultural terms taken copying strategies (Dinca-Panaitescu, et al, 2011). However, most of important copying strategies to provide care include respecting the promotion of using community resources to fulfill people's expectations (Group Health Research Institute, 2012).

2.4 Conceptual Framework

This section provides a systematic schema indicating the link among independent, dependent and intervening variables. In this regards, about conceptualizing socio-economic status and diabetes complications.



Socio-economic factors were using respondents' educational attainment, income status, employment status and types of public health insurance. Education level as classified as illiteracy, primary education, secondary education, university (tertiary). The categories of household net income were high, middle and low income level which were calculated according to household monthly income. The types of public health insurance dichotomized by mutual health insurance scheme. Therefore, occupation status was categorized as regular, irregular or no occupation. Diabetes complications was measured by retinopathy (blindness), nephropathy (renal disease) and neuropathy (erectile dysfunction). Therefore, all of these were moderated by intervening factors such as health policies, capacity building and training for health care providers and national health system. In this regard, the researcher assessed effects of each indicator of independent variable to each indicator in dependent variable.

III. MATERIALS AND METHODS

This paper used a cross sectional research design. This design refers to a design in which the investigator assess the effect and exposure in the research respondents at the same time. The reasons of using a cross-sectional research involve the assessment of burden of disease in a population and was pertinent in reporting to plan and

allocation of health facilities. This design would be descriptive and used to assess the burden of a special disease in a defined a population.

Diabetic patients are the epicenter of data related to socioeconomic status and diabetes mellitus patients. The total population of this study was 748 patients who were registered in the clinic during the period concerned with the study. 625 patients are registered in January and 123 patients are registered up to February in 2020. The size of the sample from the total population was calculated using Yamane’s formula (Yamane, 1967) as follows

$$n = \frac{N}{1 + N(e^2)}$$

Whereby= Sample Size; N=Population Size; e= Level of Significance that was given as 0.05

$$n = \frac{748}{1 + 748(0.0025)}$$

$$n = \frac{748}{2.87}$$

$n = 260.62 \approx 261$ the sample size was 261 patients.

This paper used simple random sampling techniques. Simple random sampling technique was denoted as a technique where every subject of the entire population takes equal and autonomous chance of selection. In addition, purposive sampling technique involves the choice of a representative group from the entire population taking into consideration the availability of evidences supposing as whether they were representative of the whole population. Generally, this technique was suitable when the research focused on assessment of several and particular specific variables. This study used a well-designed questionnaire to gather quantitative information. The researcher used quantitative approach and the questionnaire was distributed in the community screened diabetes living in Kigali City for further investigation of socio- demographic factors among people and to know the medical history for diabetes. The study carried out a pre-test before the actual data. The neighboring health facilities located in in Rwamagana District was used as a pilot study setting among patient with diabetes who were not comprised in the final sampled population. This study adopted quantitative data analysis using Statistical Package for Social Sciences (SPSS) version 21.0 for the evaluation of statistical significance helped in analyzing statistical information in order to establish the relationship between socioeconomic factors and diabetes complications among people living with diabetes. Therefore, descriptive statics were used to demonstrated and calculate frequency, percentages, mean and standard deviation while inferential statistics was used for generating both bivariate and multivariate analysis.

IV. 4. RESULTS PRESENTATION

4.1 Socio-Demographic Characteristics

Some of respondents are patients that have selected to attend Rwanda Diabetes Association Clinic in the City of Kigali.

Table 4. 1 Characteristics of Patients Diagnosed with Diabetes

Variables	Values	Frequency	Percentage
Gender	Male	88	33.7
	Female	173	66.3
Age	18-34	147	56.3
	>35 years	114	43.7
Marital Status	Married	238	91.2
	Not Married	23	8.8
Duration of Diabetes	<10 years	138	52.7
	10-20 years	88	33.8
	>20 years	35	13.5
Education level	Illetrate& Primary	66	25.3
	Secondary Level	138	52.7
	University level	57	22.0
Employment	No employment	72	27.5
	Irregular employment	63	24.3
	Regular employment	126	48.2
Monthly Income level	<100,000Frws	157	60.2
	100,001Frws-200,000Frws	58	22.2

	>200.001Frws	46	17.6
Type of health insurance	Mutual Health Insurance	45	17.3
	Others	216	82.7

Source: Primary data (2022)

The characteristics of all participants presented in Table 4.1 demonstrated that 88 (33.7%) studied patients are male and 173(66.3%) respondents female. About 147(56.3%) respondents were between 18-34 years old, while 114(43.7%) were more than 35 years old. Furthermore, 238(91.2%) respondents were married and 23(8.8%) respondents were unmarried. Finally, 138(52.7%) respondents have a duration of diabetes less than 10 years, 88(33.8%) have between 10 and 20 years duration of diabetes and 35(13.5%) respondents have more than 20 years duration of diabetes. Socio-economic factors of all participants are shown in Table 4.2. Concerning educational profile of diabetic patients, 66 (25.3%) respondents are illiterate or completed their primary school, 138(52.7%) had completed secondary school, 57(22.0%) had completed tertiary education. Findings on employment status, found out that 72 (27.5%) were unemployed, 63(24.3%) had irregular employment while 126(48.2%) had regular employment. The average monthly household income in Rwandan Francs was used to assess the level of income, in this regards, 157(60.2%) had less than 100,000Frws, 58(22.2%) respondents earned between 100,001Frws and 200,000Frws. In addition, 46 (17.6%) earned more than 200,000Frws Thus the overall, participants are living in low socio-economic situation. Finally, about type of health insurance, 45(17.3%) used mutual health insurance, while 216 (82.7%) of diabetes patients are using other type of insurance (SORAS, SONARWA).

4.2.

4.3. Diabetes Complications among Type 2 Diabetes Patients in the City of Kigali

The third research objective identified diabetes complications among Type 2 diabetes patients in Kigali City. There were three outcomes in the research, all connecting to diabetes completions: retinopathy, neuropathy and nephropathy. These were three main long term microvascular complications among patients typically developed.

Table 4. 2 Identification of Diabetes Complications among Type 2 Diabetes Patients in the City of Kigali

Diabetes Complication	Total (N=261)	
	Frequency	Percentage
Retinopathy(Blindness)		
Yes	61	23.2
No	200	76.8
Nephropathy(renal disease)		
Yes	23	8.9
No	238	91.1
Neuropathy		
Yes	20	7.7
No	241	92.3

Source: Primary Data (2022)

Results presented in Table 4.2, it has shown that 61(23.2%) respondents developed retinopathy while 200 (76.8%) did not present retinopathy, 23(8.9%) respondents had nephropathy while 238(91.1%) did not have nephropathy. About neuropathy, 20 (7.7%) had developed neuropathy complication while 241 (92.3%) did not present neuropathy.

4.3 Socioeconomic Factors Associated with Retinopathy among Type 2 Diabetes in the City of Kigali

The second objective determined socioeconomic factors associated with retinopathy among type 2 diabetes patients in Kigali City. The following Table 4.3 depicts on the perception of respondents.

Table 4.3 Bivariate Associated SES with Diabetic Retinopathy

Variables	Description	Diabetic Retinopathy				Chi-Square	P-Value
		Developed Retinopathy		Not Developed Retinopathy			
		N	%	N	%		
Gender	Male	9	14.8	79	39.5	1.455	0.22
	Female	52	85.2	121	60.5		
Age	18-34	21	34.4	126	63.0	12.564	0.004
	>35 Years	40	65.6	74	37.0		
Marital Status	Married	43	70.5	195	97.5	4.941	0.026
	Not Married	18	29.5	5	2.5		
Duration	<10Years	24	39.4	114	57.0	4.400	0.033
	10-20Years	6	9.8	82	41.0		
	>20 Years	31	50.8	4	2.0		
Education	University	11	18.0	55	27.5	12.567	0.002
	Secondary	30	49.2	108	54.0		
	Illiterate/Primary	20	32.8	37	18.5		
Income	High	9	14.8	37	18.5	12.702	0.002
	Middle	16	26.2	42	21.0		
	Low	36	59.0	121	60.5		
Employment	Regular	23	37.7	103	51.5	7.724	0.102
	Irregular	17	27.9	46	23.0		
	No employment	21	34.4	51	25.5		
Type of insurance	Other insurance	47	77.1	169	84.5	12.670	0.005
	Mutual Health Insurance	14	22.9	31	15.5		

Source: Primary Data (2022)

The study findings presented in Table 4.3 presents a bivariate analysis between SES and diabetic retinopathy where $X^2 = 12.567$ at p-value 0.002 educational profile of diabetes patients is associated with developing diabetic retinopathy, $X^2 = 12.702$ at p-value 0.002 income level is associated with diabetic retinopathy. Moreover, employment status of diabetic patients is associated with diabetic retinopathy with 7.724 at p value < 0.102. Therefore, it was revealed that different types of insurance used can lead to the degree of diabetic retinopathy complications with $X^2 = 12.670$ at p-value 0.005. In conclusion, socioeconomic factors presented in Table 4.4 are taken as factors associated with diabetic retinopathy owing the p values being significant (p value < 0.005). Except employment where p value is > 0.005.

Table 4.4 Multivariable Logistic Regression Analysis for SES and Diabetic Retinopathy

Variable	AOR	95% C.I		P-Value	
		Lower	Upper		
Education level					
University	57	1.00			
Secondary	138	1.28	0.84	1.95	0.007
Illiterate/Primary	66	1.85	1.07	3.17	0.101
Income level					
High	46				
Middle	58	1.36	0.84	2.19	0.014
Low	157	1.66	1.02	2.72	0.122
Employment					
Regular	126	1.00			
Irregular	63	1.80	1.13	2.85	0.001
No employment	72	2.00	1.30	3.09	0.361
Health insurance					
Other insurance	216	1.00			0.005
Mutal Health Insurance	45	2.27	1.29	3.92	0.814

Table 4.4 demonstrated the adjusted ORs for diabetic retinopathy in accordance with socioeconomic factors. The researcher found out that odds of developing retinopathy are higher for secondary illiterate/primary level holders (OR1.85, 95% CI 1.07-3.17) with low income (OR 1.66, 95% CI 1.02-2.72), beneficiaries of mutual health insurance (OR 2.27, 95% CI 1.29-3.92) and patients with irregular (OR 1.80, 95% CI 1.13-2.85) or no occupation (OR 2.00, 95% CI 1.30-3.09) in comparison with those with higher socioeconomic factors.

4.3 Socio-economic Factors Associated with Nephropathy among Type 2 Diabetes Patients in the City of Kigali

Table 4. 5 Bivariate associated SES with Diabetic Nephropathy

Variables	Description	Diabetic Retinopathy				Chi-Square	P-value
		Developed Nephropathy		Not Developed Nephropathy			
		N	%	N	%		
Gender	Male	10	43.5	78	32.8	131.061	0.001
	Female	13	56.5	160	67.2		
Age	18-34	19	82.6	128	53.8	0.681	0.409
	>35Years	4	17.4	110	46.2		
Marital Status	Married	3	13.0	235	98.7	33.676	0.001
	Not Married	20	87.0	3	1.3		
Duration	<10	16	69.6	122	51.3	4.133	0.042
	10-20	6	26.1	82	34.5		
Education	>20Years	1	4.3	34	14.2	12.567	0.002
	University	3	13.1	54	22.7		
Income Level	Secondary	13	56.5	125	52.5	12.702	0.002
	Illiterate/Primary	7	30.4	59	24.8		
	High	2	8.7	44	18.5		
Employment	Middle	8	34.8	50	21.0	7.724	0.102
	Low	13	56.5	144	60.5		
	Regular	7	30.4	119	50.0		
Type of insurance	Irregular	7	30.4	56	23.5	12.670	0.005
	No employment	9	39.2	63	26.5		
	Other insurance	17	73.9	199	83.6		
	Mutual Health Insurance	6	26.1	39	16.4		

Source: Primary Data (2022)

Information in Table 4.5 depicts on a bivariate analysis between SES and diabetic nephropathy where $X^2 = 12.567$ at p-value 0.002 educational profile of diabetes patients is associated with developing diabetic nephropathy, $X^2 = 12.702$ at p-value 0.002 income is associated with diabetic nephropathy. Moreover, employment status of diabetes patients is associated with diabetic nephropathy with 7.724 at p-value < 0.102. Therefore, the study revealed that type of insurance used can lead to the degree of diabetic nephropathy complications with $X^2 = 12.670$ at p-value 0.005. In conclusion socioeconomic factors presented in Table 4.4 are taken as factors associated with diabetic nephropathy owing the p value are significant (p value < 0.005). Except employment which its p value is > 0.005.

Table 4.6 Multivariable Logistic Regression Analysis for SES and Diabetic Nephropathy

Variable	AOR	95% C.I		P Value	
		Lower	Upper		
Education level					
University	57	1.00			
Secondary	138	1.47	0.78	2.87	0.002
Illiterate/Primary	66	1.34	1.07	5.10	0.423
Income level					
High	46	1.00			
Middle	58	1.36	0.84	2.19	0.001
Low	157	1.66	1.02	2.72	0.101
Employment					
Regular	126	1.00			
Irregular	63	2.23	1.12	4.43	0.001
No employment	72	2.42	1.27	4.65	0.005
Health insurance					
Other insurance	216	1.00			
Mutual Health Insurance	45	2.48	1.16	4.95	0.001

Source: Primary Data (2022)

The study findings indicated that adjusted ORs for diabetic nephropathy relied on SES variables. In this regards, greater odds of developing nephropathy for illiterate. Primary graduates school (OR 1.34, 95% 1.07-5.10), those with a middle income (OR 1.34, 95% 1.05-5.10) or low income (OR 1.66, 95% CI 1.02-2.72), for beneficiaries of mutual health insurance (OR 2.48, 95% CI 1.16-4.95) and with irregular (OR 2.23, 95% CI 1.12-4.4.3) or job (OR 2.42, 95% CI 1.27-4.65).

4.4 Socio-economic Factors Associated wth Neuropathy among Type 2 Diabetes Patients in Kigali City.

Table 4. 7 Bivariate associated SES with Diabetic Neuropathy

Variables	Description	Diabetic Neuropahy				Chi-Square	P-value
		Developed Neuropathy		Not Developed Neuropathy			
		N	%	N	%		
Gender	Male	13	65.0	75	31.1	7.813	0.005
	Female	7	35.0	166	68.9		
Age	18-34	5	25.0	142	58.9	14.046	0.002
	>35 Years	15	75.0	99	41.1		
Marital Status	Married	6	30.0	232	96.3	7.765	0.005
	Not Married	14	70.0	9	3.7		
Duration	<10	16	80.0	122	50.6	8.012	0.004
	10-20	2	10.0	86	35.7		
	>20Years	2	10.0	33	13.7		
Education	University	3	15.0	54	22.4	12.567	0.002
	Secondary	4	20.0	134	55.6		
	Illiterate/Primary	13	65.0	53	22.0		
Occupation	High	1	5.0	45	18.7	12.702	0.002
	Middle	1	5.0	57	23.6		
	Low	18	90.0	139	57.7		
Employment	Regular	4	20.0	122	50.6	7.724	0.102
	Irregular	7	35.0	56	23.2		
	No employment	9	45	63	26.2		
Type of insurance	Other insurance	13	65.0	203	84.2	12.670	0.005
	Mutual Health Insurance	7	35.0	38	15.8		

Source: Primary Data (2022)

Information reflected in Table 4.7 depicts on a bivariate analysis between SES and diabetic neuropathy where $X^2 = 12.567$ at p-value 0.002 educational profile of diabetic patients is associated with developing diabetic neuropathy, $X^2 = 12.702$ at p-value 0.002 income is associated with diabetic neuropathy. Moreover, employment status of diabetic patients is associated with diabetic neuropathy with 7.724 at p-value < 0.102. This study revealed that type of insurance used can lead to the degree of diabetic neuropathy complications with $X^2 = 12.670$ at p-value 0.005. In conclusion socioeconomic factors presented in Table 4.4 are taken as factors associated with diabetic neuropathy owing their p value being significant (p value < 0.005). Except employment which has p value is > 0.005.

Table 4.8 Multivariable Logistic Regression Analysis for SES and Diabetic Neuropathy

Variable		AOR	95% C.I Lower	Upper	P Vluce
Education level					
University	57	1.00			
Secondary	138	1.47	0.78	2.87	0.004
Illiterate/Primary	66	1.34	1.07	5.10	0.340
Income level					
High	46				
Middle	58	1.36	0.84	2.19	0.002
Low	157	1.66	1.02	2.72	0.107
Employment					
Regular	126	1.00			
Irregular	63	2.23	1.12	4.43	0.031
No employment	72	2.42	1.27	4.65	0.109
Health insurance					
Other insurance	216	1.00			0.001
Mutal Health Insurance	45	2.48	1.16	4.95	0.103

Source: Primary Data (2022)

The study findings given in Table 4.9 evidenced that the adjusted ORs for diabetic neuropathy in accordance with SES variables. In this regards, higher odds of developing diabetic neuropathy for illiterate or primary graduates persons (OR 1.32, 95% CI 1.07-5-10), low income (OR 1.66, 95% CI 1.02 -2.72), beneficiaries of mutual health insurance (OR 2.48, 95% CI 1.16-4.95) AND persons with no occupation (OR 2.42, 95% CI 1.27-4.65).

V. DISCUSSION OF FINDINGS

The study investigated the correlation between socio-economic factors and diabetic complications of retinopathy, neuropathy and nephropathy among diabetes patients, findings demonstrated that among patients with diabetes, the odds of developing retinopathy, neuropathy and nephropathy are greater for persons with low SES, like those with primary and secondary education level, those with a lower or middle income level, those in the first and second category of social classification and those with no occupation. The present study retaliated that education is the most commonly used measure of SES in epidemiological studies. Those with the lowest educational attainment have been report to exhibit the highest prevalence of diabetes complication (Stringhini, *et al.*,2012).Moreover, educational level is a strong predictor of mortality among adults with diabetes (Fano, *et al.*, 2013). In the present study, educational level, high education was suggestive of of a lower risk of developing diabetes complication such as nephropathy, neuropathy and retinopathy, and the correlations were strong and all types of complications. Therefore, future studies in patients with high levels of education are needed to explain these findings according to several aspects of lifestyle. Unexpectedly, people with secondary and tertiary education level did not show a strong point in attaining all specific objectives.

Occupation level was correlated with high rate of diabetes in Asia and Europe (Gary-Webb, 2013) probably owing to the fact that income facilitates persons to buy various goods and services to improve lifestyle. It has been reported that people with low income have presented more diabetes complications than those with high income. However, in the present study, employed patients had less chance of developing diabetes complications. Consistent with the present study findings, another clinical study in Rwanda indicated that higher income is related to a greater prevalence of type 2 diabetes and high BMI was responsible for this association (Mukeshimana, 2010).In Rwanda, only four past researches had assessed the correlation between SES with Types 2 Types. The

study relying on public servants established that public servants found that prevalence of diabetes was higher among those with low educational attainment and low work (Mukeshimana, 2010). Even though a research aiming at target population observed at low income persons aimed to possess higher diabetes treatment rate. As to the association of SES and with diabetes complications in Rwanda, there was no examination to date, this makes ours the first, as other assessment of this correlation in Rwanda must be assessed.

VI. CONCLUSIONS AND RECOMMENDATIONS

In conclusion, this study examined socioeconomic factors influencing development of diabetes complications for patients at Rwanda Diabetes Association. In this regards, three diabetic complications are retinopathy, nephropathy and neuropathy. Three complications were the most common and significant microvascular types of complications among diabetes. The research demonstrated that low SES as shown by low educational attainment, low income and lack of occupation, first and second category of social classification was associated with a high percentage of diabetes complications among young people. Results from predictive model were gotten to acquire good awareness of those factors that stimulate diabetes complications. However, odds analysis for predictive factors have been established. Generally, retinopathy came from predictive factors than for nephropathy and neuropathy.

Reconsidering results discussed in chapter, and conclusion drawn from the concluding remarks, the following recommendations would ameliorate the living conditions of diabetes patients: Design and implement program to increase raise awareness about dangers of diabetes in Kigali city and entire country especially among Diabetes patients. To ensure that diabetes patients attend such awareness programs, considering using patient friendly approaches to increase its effectiveness; to encourage patients to have interventions that should decrease complication and social determinants. The study recommends that people living with diabetes should increase management and treatment strategies using social assist ace to decrease further complications and additional problem, stimulating metabolic control and ameliorate health outcomes. Good diet, physical exercises and education should be the core of patient treatment to help to control and stabilize their level of diabetes. Patients should be aware of diabetes control importance and consequences. The study recommends to conduct further research on socioeconomic status and diabetes complications among patients at Rwanda Diabetes Association in the City of Kigali. It is crucial to evaluate the application of diabetes general guidelines of international diabetes forum. The study finding proposes that attention should be paid to considering determinants such as health expenditure for diabetes, duration of diabetes, and smoking and health related behaviour. The study suggests a need to conduct further research on socioeconomic status and diabetes complications among patients at Rwanda Diabetes Association in the City of Kigali. Further research can be undertaken to evaluate the application of diabetes general guidelines of international diabetes forum. The study findings suggest that attention should be paid to considering determinants such as health expenditure for diabetes, duration of diabetes, smoking and health related behavior.

Acknowledgments

I wish to acknowledge Dr. NASIRU SANI for his contribution to this work from the beginning up to it's the completion. I also wish to extend my acknowledgement to the Mount Kenya University, RDA authorities for their support and collaborative in term of data collection.

REFERENCES

- [1] American Diabetes Association-Diabetes Care (2013). Economic Costs of Diabetes in the US in 2012. *Diabetes Care Journal* 36(4), 1033-1046.
- [2] Azumah, YC, Amandi, A.N (2011). Diabetes Mellitus and Some of its Effects on Eyes among Adults of Rural Communities of Ohafia LGA. *International Journal of Advanced Medical Service and Applied Research*, 11(1):13-29.
- [3] Beulens, J.W.(2010). The Global Burden of Diabetes and Its Complications; an Emerging Pandemic. *European Journal of Cardiovascular Prevention & Rehabilitation*, 17 (1),3-8.
- [4] Booth GL (2010), Bhattacharya O, et al. Diabetes. In: Bierman AS, editor. Project for an Ontario Women's Health Evidence-Based Report: Volume 2. Toronto; 2010.
- [5] Brown, J. B., Ramaiya, K., Besançon, S., Rheeder, P., Tassou, C. M. Mbanya, J.-C., Schneider, E. (2014). Use of Medical Services and Medicines Attributable to Diabetes in Sub-Saharan Africa. *Journal Pone.9* (9),10-67
- [6] Dall, T. M., Zhang, Y., Chen, Y. J., Quick, W. W., Yang, W. G., & Fogli, J. (2010). The economic burden of diabetes. *Journal of Health Affairs*, 29(2), 297 -303.
- [7] Dinca-Panaitescu S, Dinca-Panaitescu M, Bryant T, Daiski I, Pilkington B, Raphael D.(2011).Diabetes prevalence and income: results of the Canadian Community Health Survey. *Health Policy* 99(2):116-23.
- [8] IDF (2012), *The IDF Diabetes Atlas*. 6th Edition edn. Brussels: International Diabetes Federation; 2012.
- [9] IDF (2013), *Chapter 1-4 in Diabetes Atlas Brussels: The International Diabetes Federation*, 2013
- [10] Kapur A (2011) Influence of Socio-Economic Factors On Diabetes Care. *International. Journal of Diabetes for Developed. Countries* 2011; 21: 77- 85.
- [11] Kumar A (2014), Pathologic Basis of Disease, 7th ed, Saunders Company, 1189-1206.
- [12] Liburd LC, Jack L Jr, Williams S, Tucher P Intervening on the Social Determinants of Cardiovascular Disease and Diabetes. *Am J Prev*; 29 (5): 18-24..
- [13] Mayer D (2011). The long-term impact of health on economic growth in Latin America. *World Development*. 29, 1025-1033. 2001
- [14] MedicineNet.com (2015). <http://www.medicinenet.com/diabetes/focus.htm>
- [15] MoH (2015), Ministry of Health. Annual Report. Kigali-Rwanda
- [16] Nisar, A (2015). Association of Diabetic Neuropathy with Duration of Type 2 Diabetes and Glycemic Control. *Cureus*, 7(8).
- [17] Raphael D (2013). The Social Determinants of the Incidence and Management of Type 2 Diabetes Mellitus: are we prepared to rethink our Questions and redirect our Research Activities? *Intel J Health Care Aaur*. 16(3).
- [18] RDA (2015). Rwandan Diabetes Association education needs assessment. Kigali Rwanda
- [19] RDA (2016) Diabetes in Rwanda against all odds. Kigali Rwanda.
- [20] Ross N.(2010). 14-Year Diabetes Incidence: The role of Socioeconomic Status. *Health Re* [p.21(3):19-28.
- [21] Safraj, S (2012). Socioeconomic Position and Prevalence of Self-Reported Diabetes in Rural Kerala, India Results from the Prolife Study. *Asia-Pacific Journal of Public Health*, 24(3), 480-486.
- [22] Stolar, M (2010). Glycemic Control and Complications in Type 2 Diabetes Mellitus. *The American Journal of Medicine*, 123 (3), 3-11.
- [23] Twagirumukiza M, Van Bortel LM (2011).Management of hypertension at the community level in Sub-Saharan Africa towards a rational use of available resources *Hum Hypertension* 25(1):47-56
- [24] Walker, R., (2010). Stroke incidence in rural and urban Tanzania: a prospective, community-based study. *The Lancet Neurology*, 9 (8), 786-792.
- [25] WEF (2015). Global Competitiveness Report, 2014-2015. <http://www.cfr.org/search/?Ntt=noncommunicable+disease&submit.x=0&submit.y=0>
- [26] WHO (2014) *Global status report on non communicable diseases*. Geneva: World Health Organization; 2014.
- [27] WHO (2015) *World Health Organization*. Global Report on Diabetes. Available at:<http://www.who.int/diabetes/en/>
- [28] Marquis, B.(2012). Leadership roles and management functions in nursing: Theory and application; Lippincott Williams; China
- [29] WHO (2016) *WHO. Diabetes: World Health Organization*; Available from: <http://www.who.int/mediacentre/factsheets/fs312/en/>.
- [30] Wilkinson R, Marmot M, editors. Social Determinants of Health : the Solid facts. 2nd ed. [Monography on the Internet]. Copenhagen,Denmark:World.
- [31] Woolf SH, Braveman P.(2011) Where health disparities begin: the role of social and economic determinants and why current policies may make matters worse. *Health Aff (Millwood)* 30(10):1852-9.
- [32] Youssef N.(2013).Associations of depression anxiety and antidepressants with histological severity of nonalcoholic fatty liver disease. *Liver International*, 33(7), 1062-1070.
- [33] Stringhini S, Tabak AG, Akbaraly TN, Sabia S, Shipley MJ, Marmot MG, (2012). *Contribution of modifiable risk factors to social inequalities in type 2 diabetes: prospective Whitehall II cohort study*. *BMJ*. <https://doi.org/10.1136/bmj.e5452> PMID: 22915665
- [34] Fano V, Pezzotti P, Gnani R, Bontempi K, Miceli M, Pagnozzi E, (2012). The role of socio-economic factors on prevalence and health outcomes of persons with diabetes in Rome, Italy. *Eur J Public Health*. 23(6):991-7.
- [35] Kondo N. (2012).Socioeconomic disparities and health: impacts and pathways. *Journal of Epidemiology*. 2012; 22(1):2-6.
- [36] Reisig V, Reitmeir P, Doring A, Rathmann W, Mielck A.(2017) Social inequalities and outcomes in type 2 diabetes in the German region of Augsburg. A cross-sectional survey. *International Journal of Public Health*.52 (3):158-65.
- [37] Gary-Webb TL, Suglia SF, Tehranifar P.(2013) Social epidemiology of diabetes and associated conditions. *Curr Diab Rep*. 13(6):850-9.

AUTHORS

First Author – TOM Muhimbise Mudenge, School of Public Health, Mount Kenya University, Kigali, Rwanda

Second Author – Dr Dr. Nasiru Sani, School of Public Health, Mount Kenya University, Kigali, Rwanda

Project Implementation Practices and Project Performance in Rwanda: A case of Masaka Farm Supported by Africa to Africa Green Solutions Ltd

^{1*} Assoumpta Mukamugenga & ^{2*}Dr. Eugenia Irechukwu Nkechi

^{1*}School of Business and Economics, Mount Kenya University
Kigali, Rwanda

^{2*}School of Business and Economics, Mount Kenya University
Kigali, Rwanda

Email of the corresponding author: mugengassoumpta@gmail.com

DOI: 10.29322/IJSRP.12.10.2022.p13078

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13078>

Paper Received Date: 24th September 2022

Paper Acceptance Date: 25th October 2022

Paper Publication Date: 30th October 2022

Abstract: The purpose of this research was to assess implementation practices and project performance using a case of Masaka Farm Project. Specifically, the researcher assessed effect of project design, project monitoring and project team management on project performance. The research used a descriptive survey design, both quantitative and qualitative research approach were used. This study targeted 108 project stakeholders. The researcher used questionnaire. Data collected was analyzed through descriptive and inferential statistics. Results to the first objective was indicated that 53.8% agreed that Masaka farm has good project scope, 60.6% agreed that project design is shared to all stakeholders involved in the project, 78.8% agreed that they have project work plan during project execution. Correlation analysis felt that a positive correlation between good project scope and project quality ($r=0.914$; p value=0.000); the good project scope and project timely delivery was not correlated ($r=0.901$; p value=0.000); the good project scope significantly correlated with project cost efficiency and effectiveness ($r=0.901$; p -value=0.000). Findings showed 65.7% strongly agreed with the creation of a good monitoring system, 65.7% agreed with good monitoring and evaluation reporting system. A multivariate analysis indicated positive correlation between good monitoring system and project quality ($r=0.887$, p -value=0.000), time ($r=0.848$, p -value=0.00) and with cost efficiency ($r=0.906$, p -value=0.000). Results for conduct monitoring on a daily basis indicated that carry out monitoring and evaluation was associated with project quality ($r=0.955$, p -value=0.000), with service delivery ($r=0.928$, p -value=0.000) and with cost efficiency ($r=0.924$, p -value=0.000). Findings felt that 68.3% agreed with adequate team members, 76.0% agreed with staff motivation that motivate them toward consistent performance, 64.4% agreed with training opportunities, and 65.3% agreed that adequate project fund for team member salaries. The study recommended that company's senior staffs should identify well all the key elements needed in designing project and share project design to all stakeholders involved. In addition, the company's Owners should ensure that team management is efficiently and effectively developed in terms of financial team, human skills and production team; as the findings r that an improvement in project team management practice is needed to increase project performance.

Keywords: *Project Implementation Practices, Project Design, Project Monitoring, Project Team Management, Project Performance*

1.0 Introduction

In Rwanda some projects did not perform well among the reasons of failure are poor planning, inappropriate objectives and targets, inadequate project implementation practices, coordination of activities, team and poor feasibility study (RDB, 2013). Masaka farm, is a 7 years (2018-2024) project funded by a local company Africa to Africa Green Solutions with the purpose to produce vegetables and fruits (horticulture) and poultry farming to raise chicken. From season 2018 A to 2020 B Africa to Africa Green solutions faced a huge loss of 90% due to the challenges faced during the implementation of the Masaka farm project.

Different factors cause challenges and failure to some projects during the initial phase of the implementation practices; project stakeholders evidenced that 10% of project implemented did not succeed due to the lack of proper project design and monitoring

This publication is licensed under Creative Commons Attribution CC BY.

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13078>

www.ijsrp.org

practices. Therefore, 30% failed use the lack of proper team management. A study was conducted in Kenya by Ouma (2012) felt that near 33 percent of projects did not attained their expected objectives. Njama (2015) established a positive effect of availability of funds, stakeholder involvement and organizational leadership on monitoring and evaluation effectiveness. Studies of Ouma (2012) and Njama (2015) did not establish effects of project implementation practices including project design, project monitoring, and project team management on project performance.

In Kigali, most of SMEs project failed to achieve their expected targets. Only 29% are attained high level of sustainability in 2016, in 2017 were 33 percent, and 49% in 2019 (City of Kigali, 2020). It was against that gap that the study assessed the effects of project implementation practices on project performance of Masaka Farm within Africa to Africa Green Solutions Ltd. Rwanda.

1.1 Research Objectives

- i. To determine effect of project design practice on Masaka farm project performance;
- ii. To identify effect of project monitoring practice on Masaka farm project performance;
- iii. To assess effect of project team management practice on Masaka farm project performance.

2.0 Literature Review

2.1 Review of Empirical Studies

A study conducted by Machari (2013) on agriculture projects assessed factors influencing performance. This research adopted a correlation research study on 345 participants. This research findings demonstrated that using a budget of 250,000 USD and most of beneficiaries were hundred persons who participated in the project execution. This research concluded that process of the project design had an important influence on the performance of the National Agriculture and Livestock Extension Program (NALEP) project, followed by project initiation process, project execution and project monitoring & evaluation. This research felt that managers for those project allocated 76% of timeframe on its implementation through effective team management.

In addition, the inefficient project design and inadequate management of changing the baseline project plans had a major negative impact on the implementation of the project and even on the overall projects performance. The author recommended that project design must be elaborated cautiously as this is the phase where the allocation of team is defined (Macharia, 2017).

Kiragu (2013) conducted a study at the level of the project implementation. He investigated factors associate with control of project design calendar during the period of execution. The study showed that the main factors of the planned schedule control were the funders' policies, project complexity and its associated risks. Different factors cause challenges and failure to some projects during the initial phase of the implementation practices; project stakeholders evidenced that 10% of project implemented did not succeed due to the lack of proper project design and monitoring practices. Therefore, 30% failed use the lack of proper team management. This failure is mostly attributed to the approaches that are adopted and used during the implementation. It is recommended that project plans and designs must be based on these factors at the preparation phase (Kiragu, 2013).

Heintz (2015) conducted a study on designing project management. The study concluded the existence of a research gap for project management and effective strategies use by project managers. This research study showed that a designedly project management is a form of solving wicked problems where more than 33 percent of implemented project did not attain their expected outcomes.

Innocent, (2013) conducted a research on effect of monitoring on economic success of poverty reduction project in Rwanda; a case study of one cow per poor family project in Gatsibo district. According to George and Mallery (2003) demonstrated the following rules of thumb where $\alpha > 0.9$, excellent, > 0.8 , good, > 0.7 acceptable and > 0.5 not acceptable. However, the Cronbach Alpha would be > 0.7 for being relevant and acceptable. This research study revealed that monitoring system when well-done leads to better project performance. But that is not the way it was done in Gatsibo district even if some achievements were gained where people got cows and milk, money and manures. Data were collected, analyzed based on researcher's objectives.

Poor systems of monitoring and evaluation were used. Poor selection of project beneficiaries also involved the favoritism and corruptions where cows were given to people who are not needy. Some cows were sold by the people who got them, this was more especially those given to the rich people. Performance has been achieved but it could have been good when all those problems had been solved. Moreover, the most factor ranked for 43.614% of total variance and second factor 80.174 for the total variance. The adequate sampling strategy had been examined using Kaiser-meyer-Olkin Measure of sampling suitability.

The suggestion drawn was that monitoring and evaluation should be the main importance tool and done in appropriate manner as far as the project objectives are concerned. There should be good practice of selecting who are to be given cows, monitoring should be done regularly to comply with the better project objectives (Twahirwa, 2013). A study was conducted in Kenya by Ouma, (2012) on factors influencing the effective monitoring of projects. The study indicated that the monitoring evaluation officers themselves, their abilities and training were critical in the accomplishment of the organizational goals.

Njama (2015) carried out a research on factors affecting M&E system and project performance. However, the study assessed the effect of M&E system, stakeholder involvement and organizational leadership. In this regard, the Levene statistic for equal variance for assumption of homoscedasticity.

Mariette, (2015) did a study on project team management practices and labor retention in Rwandan manufacturing industries a case study of Sulfo-Rwanda industries limited. This study examined the responsibilities of project team management practices on workforce retention. The study findings show the project team management practices applied in Sulfo-Rwanda industries Ltd.

They were recruiting and selecting personnel, capacity building, human resource relation and welfare and rewards and salaries and the level of success. The results also disclosed that the team management practices that influence labor retention are: recognition and rewards, human relations practices, health, safety and well-being practices as well as remuneration and incentive practices. The correlation between team management practices and project success has been significant ($r=0.701$, $p<0.01$). In context, of lack of adequate project success team management framework has a negative impact on project performance.

Obadia, (2018) carried out a research on team management on project performance for execution in Rwanda. The resource planning, availability and maximization were taken into consideration. The allocation of restricted team was relied on priority provided to each of project activities. The study established a higher multicollinearity indicated where inter-relationship for independent was more than 0.0, 0.9 and 0.7. In Rwanda, it has been indicated that most of project did not success owing to poor resource planning, when it emanates from the level of execution, many of the activities were not realized on time owing to poor team management. Findings demonstrated that team management had an effect on project success for its execution.

2.2. Theoretical Framework

The theoretical framework shows an understanding of theories related to project implementation practices and project performance. The study was guided by theories of change and constraint.

This research used theory of change developed by Ellen in 2014. A theory of change helps you define the need you are trying to meet, the changes you want to make, and what you plan to do. The theory of change helps managers to have clarity outcome chain and explains which strategies have been chosen (Harries, 2014). According to Paina, (2017), theory of change is used to inform project implementation and innovation. The following methods are necessary to construct a theory of change in relation to both project implementation practices and project performance: planning, communication, learning, and accountability. By planning the process, establishing timetables, and planning team, as well as articulating your long-term outcomes, it assists in the development of a theory of change based on project performance and project execution.

This study also used the theory of constraint developed by Elsevier in 2014. The theory of constraints states that a minor number of constraints stops any management system from accomplishing more among its aims. The theory identified challenges, then rearranges itself to deal with it (Elsevier, 2014). The triple constraint theory in project management illustrates that every project works within scope, time, and cost. A change in one factor will consistently affect the others. It is vital for the manager to balance or make equilibrium of these triple aspects and manage expectations so everyone comprehends the value to achieve performance of the project (Van, 2012).

The above theories enabled the researcher to establish the conceptual framework as follows:

2.3 Conceptual Framework

The conceptual framework is presented in Figure 1

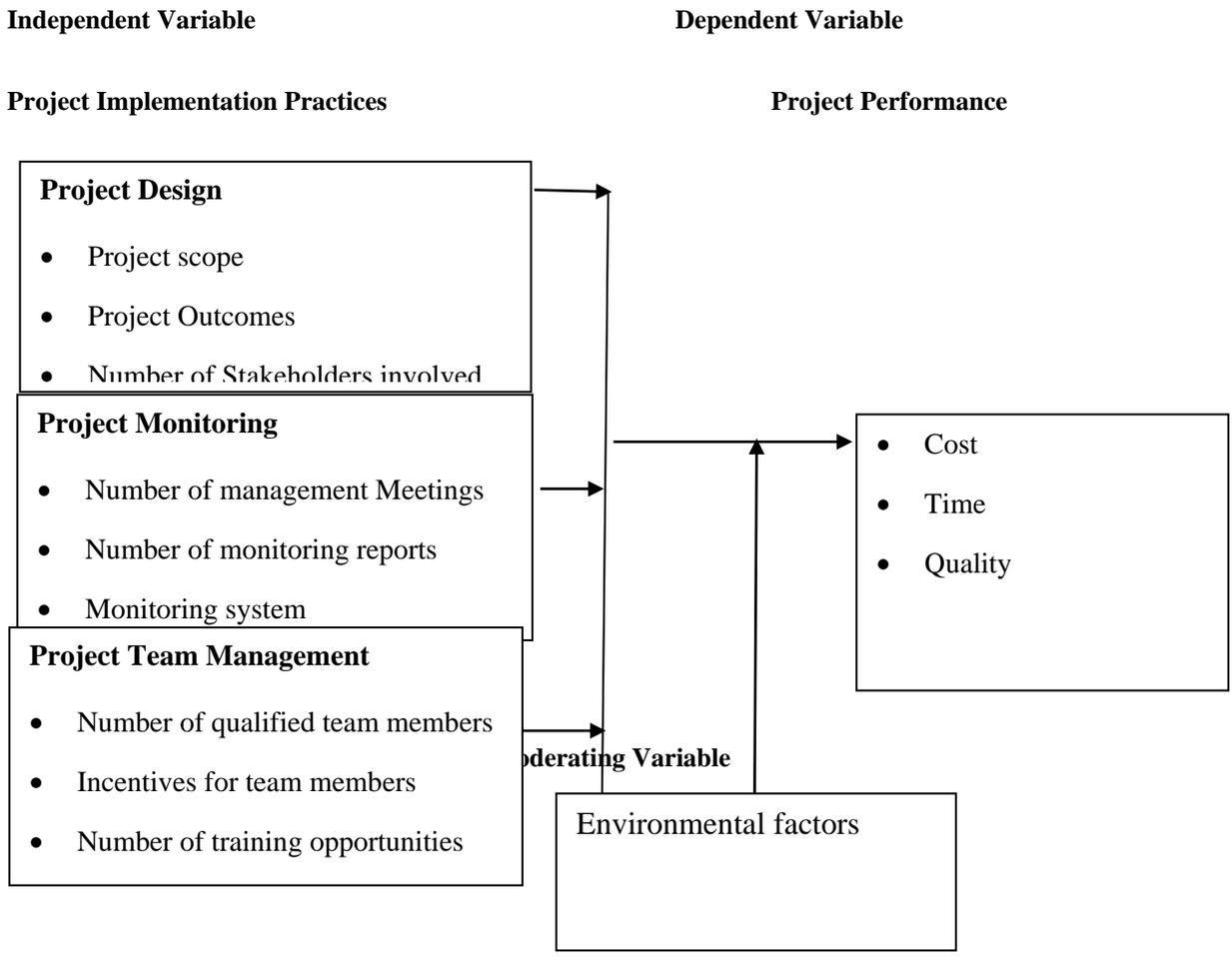


Figure 1 represents correlation between the predicting factors and the outcome. Project implementation practices can lead to project performance. The concept model indicates the existence of correlation between project design, project monitoring and project team management practices and project performance with the influence of other intervening factors.

The empirical literature indicated positive relationship between project implementation practices on project, organization performance, and this study measured the outcome of project implementation practices on project performance using a case study of Masaka farm project.

3. 0 Research Methodology

This study used the descriptive method with both qualitative and quantitative approaches. The research design helped to draw inferences related of project implementation practices and project performance at Masaka farm supported by Africa to Africa Green Solutions Ltd in Rwanda through the use of percentages, frequencies, mean, standard deviation, correlation and regression analysis. The study targeted senior staff of 2AG solutions Ltd who have an experience in project management, as well as company agronomists and farmers working in the Masaka farm, the target population was 108 employees using a sampling and purposive sampling techniques. For quantitative data analysis, descriptive and inferential statistics were used while qualitative data analysis applied content analysis.

4.0 Results and Discussion

4.1 Effect of Project Design Practice on Performance of Masaka Farm Project

Table 1 presents the views on effect of project design practice on performance of Masaka Farm Project.

Table 1: Correlation Analysis on Project Design Practice and Project Performance

		Good Project Scope	Project Design shared to all stakeholders	Project work plan during execution	Project Design is used during outcome evaluation	Quality of Services	Timely Delivery	Cost Efficiency and Effectiveness
Good Project Scope	Pearson Correlation	1						
	Sig.(2-tailed)							
	N	104						
Project Design shared to all stakeholders	Pearson Correlation	.935**	1					
	Sig.(2-tailed)	.000						
	N	104	104					
Project work plan during execution	Pearson Correlation	.768**	.780**	1				
	Sig. (2-tailed)	.000	.000					
	N	104	104	104				
Project Design is used during outcome evaluation	Pearson Correlation	.843**	.787**	.682**	1			
	Sig.(2-tailed)	.000	.000	.000				
	N	104	104	104	104			
Quality of Services	Pearson Correlation	.918**	.950**	.767**	.813**	1		
	Sig.(2-tailed)	.000	.000	.000	.000			
	N	104	104	104	104	104		
Timely Delivery	Pearson Correlation	.941**	.939**	.744**	.798**	.958**	1	
	Sig.(2-tailed)	.000	.000	.000	.000	.000		
	N	104	104	104	104	104	104	
Cost Efficiency and Effectiveness	Pearson Correlation	.901**	.889**	.728**	.851**	.897**	.893**	1
	Sig.(2-tailed)	.000	.000	.000	.000	.000	.000	
	N	104	104	104	104	104	104	104

** .Correlation is Significant at 0.01 level (2-tailed).

Results indicate an association between variables. Therefore, for good project scope, the study showed significant relationship between good project scope and project quality ($r=0.914$; p value= 0.000); the good project scope and project timely delivery was not correlated ($r=0.901$; p value= 0.000); the good project scope significantly correlated with project cost efficiency and effectiveness (0.901 ; p -value= 0.000). Correlation analysis between the project design shared to all stakeholders and Masaka farm project performance show that the project design shared to all stakeholders is significantly associated with quality ($r=0.950$; p -value= 0.000); timely service delivery ($r=0.939$; p -value= 0.000), cost efficiency and effectiveness ($r=0.889$, p -value= 0.000). Results for project work plan during execution, the study found significant correlation between project work plan during execution and project quality ($r=0.767$, p -value= 0.000), and service delivery ($r=0.744$, p -value= 0.000) and cost efficiency and effectiveness($r=0.728$, and p -value= 0.000).

Results on the correlation between project design is used during outcome evaluation and project quality ($r=0.813$; p -value= 0.000). In addition, project design is used during outcome evaluation significantly correlated with timely delivery ($r=0.798$; p value= 0.000). Finally, project design is used during outcome evaluation was associated with cost efficiency ($r=0.851$, p -value = 0.000). The relationship was positive since the level of significance was less than 0.05 meaning that an adjustment of project design is used during outcome evaluation affect performance of Masaka Farm project. For the project to be successful, it must first comprehend the steps involved in project design (Kate, 2016). Also Denis (2012) asserted that project design practice was essential in performance of projects. The results in above table indicates that the hypotheses (H1) stating the existence of association between variables and project research design and performance of Masaka farm project is accepted.

4.2 Effect of Project Monitoring Practice on Performance of Masaka farm Project

Table 2 depicts views on the effect of project monitoring practice on performance of Masaka farm Project.

Table 2: Effect of Project Monitoring Practice on Performance of Masaka farm Project

		Good Monitoring System	Monitoring reports	Conduct Management Meeting	Conduct Monitoring on a daily basis	Quality of Services	Timely Delivery	Cost Efficiency and Effectiveness
Good Monitoring System	Pearson Correlation		1					
	Sig. (2-tailed)							
	N	104						
Monitoring reports	Pearson Correlation	.970**		1				
	Sig.(2-tailed)	.000						
	N	104	104					
Conduct Management Meeting	Pearson Correlation	.664**	.666**		1			
	Sig.(2-tailed)	.000	.000					
	N	104	104	104				
Conduct Monitoring on a daily basis	Pearson Correlation	.930**	.893**	.736**		1		
	Sig.(2-tailed)	.000	.000	.000				
	N	104	104	104	104			
Quality of Services	Pearson Correlation	.887**	.853**	.812**	.955**		1	
	Sig.(2-tailed)	.000	.000	.000	.000			
	N	104	104	104	104	104		
Timely Delivery	Pearson Correlation	.848**	.826**	.837**	.927**	.958**		1

	Sig.(2-tailed)	.000	.000	.000	.000	.000		
	N	104	104	104	104	104	104	
Cost Efficiency and Effectiveness	Pearson Correlation	.906**	.883**	.720**	.924**	.897**	.893**	1
	Sig.(2-tailed)	.000	.000	.000	.000	.000	.000	
	N	104	104	104	104	104	104	104

**Correlation is significant at the 0.01 level(2-tailed)

Findings demonstrated a significant relationship between Good monitoring system and project quality (r=0.887, p-value=0.000), with service delivery on time (r=0.848, p-value=0.00) and with cost efficiency and effectiveness (r=0.906, p-value=0.000). This implies that there was correlation between two variables whereby a change in monitoring system produced a change in Masaka project performance. Results for monitoring reports, it was indicated that monitoring reports was associated with project quality (r=0.853, p-value=0.000), with timely service delivery (r=0.826, p-value=0.000) and with cost effectiveness (r=0.883, p-value=0.000). Moreover, conduct management meeting was associated with project quality (r=0.812, p-value=0.000, with timely delivery of services (r=0.837, p-value=0.000) and cost efficiency and effectiveness (r=0.720, p-value=0.00). Finally, results for conduct monitoring on a daily basis indicated that carry out monitoring was associated with project quality (Pearson =0.955, p-value=0.000), with timely implementation (r=0.927, p-value=0.000) and with cost efficiency and effectiveness (r=0.924, p-value=0.000). Hence, the second alternative hypothesis (H2) stating that there was significant correlation between project monitoring and performance of Masaka farm project is accepted.

4.3 Effect of Project Team Management Practice on Performance of Masaka farm Project

Table 3 illustrates the views on the determination of the effect of project team management practice on performance of Masaka farm Project

Table 1: Effect of Project Team Management Practice on Performance of Masaka farm Project

		Adequate Team Members	Incentives given to team members	Training Opportunities for Team members	Adequate project fund for Team Members 'salaries	Quality of Services	Timely Delivery	Cost Efficiency and Effectiveness
Adequate Team Members	Pearson Correlation	1						
	Sig.(2-tailed)							
	N	104						
Incentives given to team members	Pearson Correlation	.688**	1					
	Sig.(2-tailed)	.000						
	N	104	104					
Training Opportunities for Team members	Pearson Correlation	.629**	.796**	1				
	Sig.(Sig-tailed)	.000	.000					
	N	104	104	104				
Adequate project fund for Team Members'salaries	Pearson Correlation	.873**	.754**	.773**	1			
	Sig.(2-tailed)	.000	.000	.000				

	N	104	104	104	104			
Quality of Services	Pearson Correlation	.711**	.828**	.901**	.827**	1		
	Sig.(2-tailed)	.000	.000	.000	.000			
	N	104	104	104	104	104		
Timely Delivery	Pearson Correlation	.701**	.793**	.919**	.806**	.958**	1	
	Sig.(2-tailed)	.000	.000	.000	.000	.000		
	N	104	104	104	104	104	104	
Cost Efficiency and Effectiveness	Pearson Correlation	.885**	.766**	.819**	.916**	.897**	.893**	1
	Sig.(2-tailed)	.000	.000	.000	.000	.000	.000	
	N	104	104	104	104	104	104	104

**Correlation is significant at the 0.01 level.

The findings demonstrated a positive correlation Adequate Team Members and project quality ($r=0.711$, $p\text{-value}=0.000$), with service delivery ($r=0.701$, $p\text{-value}=0.000$) and with cost efficiency and effectiveness ($r=0.885$, $p\text{-value}=0.000$). This implies the existence of association between variables whereby a change in Adequate Team Members produced a change in Masaka project performance. Results for Incentives given to team members, it was indicated that Incentives given to team members is positively associated with project quality ($r=0.828$, $p\text{-value}=0.000$), delivery on time ($r=0.793$, $p\text{-value}=0.000$), cost effectiveness ($r=0.766$, $p\text{-value}=0.000$). Moreover, training opportunities for team members was associated with project quality ($r=0.901$ and $p\text{-value}=0.000$), with timely delivery of services ($r=0.919$, $p\text{-value}=0.000$) and cost efficiency and effectiveness ($r=0.819$, $p\text{-value}=0.000$).

Finally, results for Adequate project fund for Team Members 'salaries indicated that Adequate project fund for Team Members 'salaries was positively impacting project quality ($r=0.827$, $p\text{-value}=0.000$), with timely delivery of services ($r=0.806$, $p\text{-value}=0.000$) and with cost efficiency and effectiveness ($r=0.916$, $p\text{-value}=0.000$). Hence, the third alternative hypothesis (H3) stating that there was significant association between project team management and performance of Masaka farm project is accepted.

5.0 Discussion of the Research Findings

Results on the effect of project design practice on Masaka farm project performance concur with the observation and conclusion of Irfan et al., (2021); projects perform well once they are divided into smaller components where each corresponding team is given specific objectives and scope to meet their goals. After assessing how project design practice influence Masaka farm project performance, the researcher made inferential statistics for establishing the association between variables and establishing r-size effect of each measurement on Masaka farm project success. This research did not contradict the results from project to be successful, it must first comprehend the steps involved in project design (Kate, 2016). Also Denis (2012) asserted that project design practice was essential in performance of projects. The results in above table indicates that hypothesis (H1) stating that there was significant correlation between project design and performance of Masaka farm project is accepted. This study concurs with Kiragu (2013) who conducted a study at the level of the project implementation. He investigated factors associated with control of calendar of project design during the period of execution. The study showed that the main factors of the planned schedule control were the funders' policies, project complexity and its associated risks. It is recommended that project plans and designs must be based on these factors at the preparation phase.

Results on the effect of project monitoring practice on Masaka Farm project performance were relevant in the context of Kostalova et al., (2015) where it specified that the project management was designing ,coordinating and following up all types of project though project life cycle to achieve the project objectives safely and within agreed criteria for time, cost, scope and performance. Ouma, (2012) asserted that M&E officers were pertinent in attaining organizational objectives and their capacity building, skills are pertinent. The correlation findings between the project monitoring practice and performance of Masaka farm project. Hence, the second alternative hypothesis (H2) stating the existence of association between project monitoring and evaluation and project success of Masaka farm project is accepted.

Results on the effect of project team management practice on Masaka Farm Project Performance concur with the findings implying positive correlation between variables. The study concur with According to Iqbal et al., (2017), good project team members are essential for project success and project leader will be effective only in case of proper, operative and competent project team members. Once there is adequate team members, teamwork is assured. Technical skills are shared which is a good point in project management, whereby the technical skills are essential for team members to identify and solve problems during working of a project. Edward Back and Mejia-Aguilar (2013) argued that incentives stands for proactive methods to encourage behaviors toward expected results. This was the case of the current study whereby given incentives made project team members to establish cooperative, trust and thus improving and guarantying project performance. This concur with findings of Alexandrova and Ivanova, (2012) explaining that project managers had examined project design and paying attention to both organizational environment of project capacity building provided to project team managers and project performance. The correlation findings between the project team management practice and performance of Masaka farm project. Hence, the third alternative hypothesis (H3) stating that there was significant association between project team management and project performance of Masaka farm project is accepted.

6. 0 Conclusion and Recommendations

From analysis and discussion of information, it is undisputable research objective has been adequately addressed. A strong point discovered in this study was a significant correlation between the project implementation practices and its effect in the project performance in Rwanda. Concerning the determination of effect of project design practice on performance of Masaka farm project, the researcher concluded that there was a positively association between two variables. It develops a project scope, shared project design to all stakeholders involved and expected the good project outcomes to help in accomplishing their goals. The regression coefficient result for project design practice shows a strong correlation between project design and project success. It means that for every additional unit project design results in increase in project performance

The second objective which focused on project monitoring practice on the success of Masaka farm project; findings showed that the company created a good monitoring system, provides good ways and tools to report all activities and conducts management meeting to help in accomplishing their goals. The third research objective that endeavored to establish effect of project team management practice on performance of Masaka farm project. The company formed adequate team members, generated appropriate staff motivation and recognition and the company members are allowed trainings opportunities to help in accomplishing their goals. The regression coefficient result for project resource management practice. This means that the association between project team management and project performance was positive. This implies that with an improvement in project resource management, project performance increases by units.

Out of this, there are still amelioration toward project performance though the following recommendations are proposed. From the results, organization's senior staffs should identify all the key elements needed in designing project and also should share project design to all stakeholders involved. The company's Owners should ensure that team management is efficient and effective well organized. Since the finding found that an improvement in project team management practice is needed to increase project performance. Project design, project monitoring and project team management practices should be further used during implementation as the study has showed the project implementation practices contribute to project performance. Therefore, future researches should be undertaken on project implementation practice in different sectors of the study.

References

- Alexandrova, M., & Ivanova, L. (2012). Critical success factors of project management: Alexandrova, M., & Ivanova, L. (2012). Critical success factors of project management: empirical evidence from projects supported by EU programs. *Systematic Economic Crisis: Current issues and perspective*
- City of Kigali, (2020). Project management: Strategies for successful project execution. Austin: TX78731 publication
- Creswell, J. W. (2012). *Qualitative inquiry & research design: Choosing among five approaches* (4th ed.). Thousand Oaks, CA: Sage
- Denis (2012) *Enhancing the contributions of SMEs in Global and digitalised Economy*. Paris: OECD.
- Harries, E. (2018). *Creating your theory of change*. London: New Philanthropy Capital
- Heintz, J. (2015). *Designing project management*. Finland: Volume: III: Building up business operations
- Ipar, R. (2015). *Annual analysis of Rwanda's agriculture budget expenditure*. Kigali: ActionAid International Rwanda.
- Iqbal, S. M. J., Nawaz, M. S., Bahoo, S., & Abdul, M. L. (2017). Impact of project teamwork on project success in Pakistan. *South Asian Journal of Management*, 11(1), 1-13.
- Irfan, M., Khan, S. Z., Hassan, N., Hassan, M., Habib, M., Khan, S., & Khan, H. H. (2021). Role of project planning and project manager competencies on public sector project success. *Sustainability*, 13(3), 1421.
- Kiragu, P. (2015). *Influence of project implementation strategy on performace of community projects in Kenya*. Nairobi: University of Kenya.
- Kostalova, J., Tetrevoval, L., & Svedik, J. (2015). Support of project management methods by project management information system. *Procedia-Social and Behavioral Sciences*, 210, 96-104.
- Macharia, I., 2013. *Postharvest losses and postharvest innovations on key horticultural crops – Kenya*. Contributed Paper accepted for oral presentation at AGRA Expert and Stakeholder Workshop on Waste and Spoilage Issues, Challenges Facing Smallholder Farmers and Potential Intervention Points, April, 2013, Machakos, Kenya.

- Macharia, N. (2017). Project management and implementation of public projects in technical, industrial,. *International Academic Journal of Information Sciences and Project Management Volume 2*, 239-263.
- Matthew, F., Marion, D. (20015). *Agricultural investment and rural transformation: a case study of the Makeni bioenergy project*. Sierra Leone: Stockholm Environment Institute
- Njama, W. (2015). *Determinants of effectiveness of a monitoring and evaluation system for projects in Kenya*. Nairobi: University of Kenya.
- Patanakul, P., Shenhar, A. J., & Milosevic, D. Z. (2012). How project strategy is used in project management: Cases of new product development and software development projects. *Journal of Engineering and Technology Management - JET-M*, 29(3), 391-414.
- Rwanda Development Board. (2015-2016). *Annual Analysis of Rwanda's Agriculture Budget*. Kigali: Institute of police analysis and research rwanda.
- Twahirwa, I. (2013). *Monitoring and evaluation and economic performance of poverty reduction projects*. Rwanda: Mount Kenya University.
- Van (2012). The role of dissemination of monitoring and evaluation results in the promotion of performance of digital education technology project. *IJRDO-Journal of Educational Research*. Vol 3 (11), pp. 26-44.

The antibiotic efficacy of levofloxacin tablet was determined utilizing a verification method that included computational and experimental techniques. DFT, UV-VIS, and HPLC-20 AD

Zain Iqbal¹, Rakshanda Javaid¹, Muhammad Tahir¹, Sohaib Hasnain¹, Bakar Bin Khatab Abbasi², Faiza Shafiq³,
Muhammad Ishaq³

¹ Govt. College University Faisalabad Pakistan

²COMSATS university Islamabad, Lahore campus Pakistan

³Department of Chemistry, University of Agriculture Faisalabad, Pakistan

DOI: 10.29322/IJSRP.12.10.2022.p13079

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13079>

Paper Received Date: 23rd September 2022

Paper Acceptance Date: 25th October 2022

Paper Publication Date: 30th October 2022

Abstract- Levofloxacin is an antibiotic that is sold under the brand names Levaquin and others. It is used to treat a variety of bacterial diseases, including acute bacterial sinusitis, pneumonia, *Helicobacter pylori* (in conjunction with other drugs), urinary tract infections, chronic prostatitis, and certain types of gastroenteritis. It may be used in conjunction with other antibiotics to treat tuberculosis, meningitis, or pelvic inflammatory illness. Use is normally advised only when no other options are available. It is offered orally, intravenously, and as an eye drop. In this study, we are executing verification analysis to determine the efficacy of levofloxacin at several phases such as linearity, repeatability, precision, accuracy, and robustness to determine how stable our product is in these circumstances.

Index Terms- Levofloxacin, Verification, HPLC, UV-VIS, DFT

I. INTRODUCTION

Levofloxacin is an antibacterial drug in the class of fluoroquinolones. It works against bacteria that cause serious infections in the respiratory, skin, and genitourinary tracts[1, 2]. Levofloxacin is currently used to treat respiratory tract infections, such as acute bacterial exacerbations of chronic bronchitis, acute bacterial sinusitis, and community-acquired and nosocomial pneumonia; complicated and uncomplicated skin and skin structure infections; post-inhalational anthrax; and genitourinary infections, such as uncomplicated and complicated urinary tract infections, acute pyelonephritis[3, 4], 1 and In Europe (Tavanic®) and Asia (Cravit®), levofloxacin has been approved for the same kinds of uses.

As our understanding of pharmacodynamics and the drug's safety and tolerability grew, many different dosing schedules were tested in clinical trials[5]. Initial research mostly looked at regimens with a maximum daily dose of 500 mg. Patients with urinary tract infections were given 250 mg regimens, and patients with respiratory tract infections were given 500 mg regimens[6]. Then, 750 mg dosing regimens were used to study people with skin and skin structure infections² and patients with nosocomial pneumonia[7, 8]. Recently, 750 mg dose schedules given over 5 days instead of 10 days have been looked at in people with respiratory tract infections. This is because this change could help reduce medication resistance[9, 10].

Some common side effects are feeling sick, having diarrhea, and having trouble sleeping[11, 12]. Some serious side effects include tendon rupture, inflammation of the tendon, seizure, psychosis, and possibly permanent damage to the peripheral nerves[13, 14]. Damage to tendons can show up months after treatment is done. People may also burn more easily in the sun. Muscle weakness and trouble breathing can get worse in people with myasthenia gravis. Even though it's not a good idea to use while pregnant, the risk seems to be low[15]. It seems safe to use other drugs in this class while breastfeeding, but it's not clear if levofloxacin is safe. Levofloxacin is a drug in the class of fluoroquinolones that is an antibiotic with a wide range of effects[16, 17]. Most of the time, it kills the bacteria. It is the drug ofloxacin left-handed isomer[18].

Levofloxacin is used to treat infections in the lungs, the urinary tract, and the stomach. As of 2007, the Infectious Disease Society of America (IDSA) and the American Thoracic Society recommended levofloxacin and other respiratory fluoroquinolones as the first line treatment for community-acquired pneumonia when co-morbidities like heart, lung, or liver disease are present or when in-patient treatment is needed. Levofloxacin is also an important part of the recommended treatment plans for ventilator-associated pneumonia and pneumonia caused by medical care [19, 20].

In this research, we intend to investigate the effect of various parameters on the process of determining the assay for levofloxacin at its various stages of verification analysis. In order to provide an explanation for the absorption spectra while also receiving support from theoretical results and proving it with relation to the absorption value.



Levofloxacin

Fig 1 Chemical structure of Levofloxacin

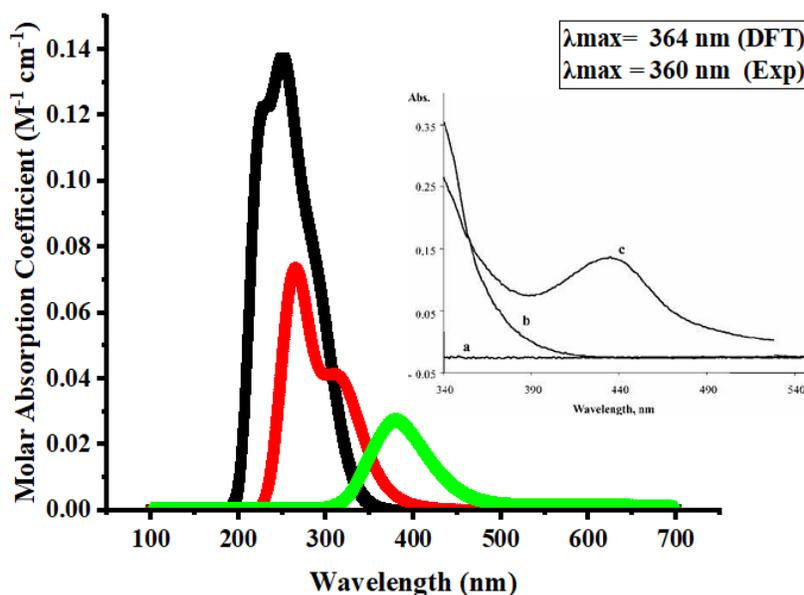


Figure 2 Absorption profile using DFT and UV-1900i with solvent acetonitrile

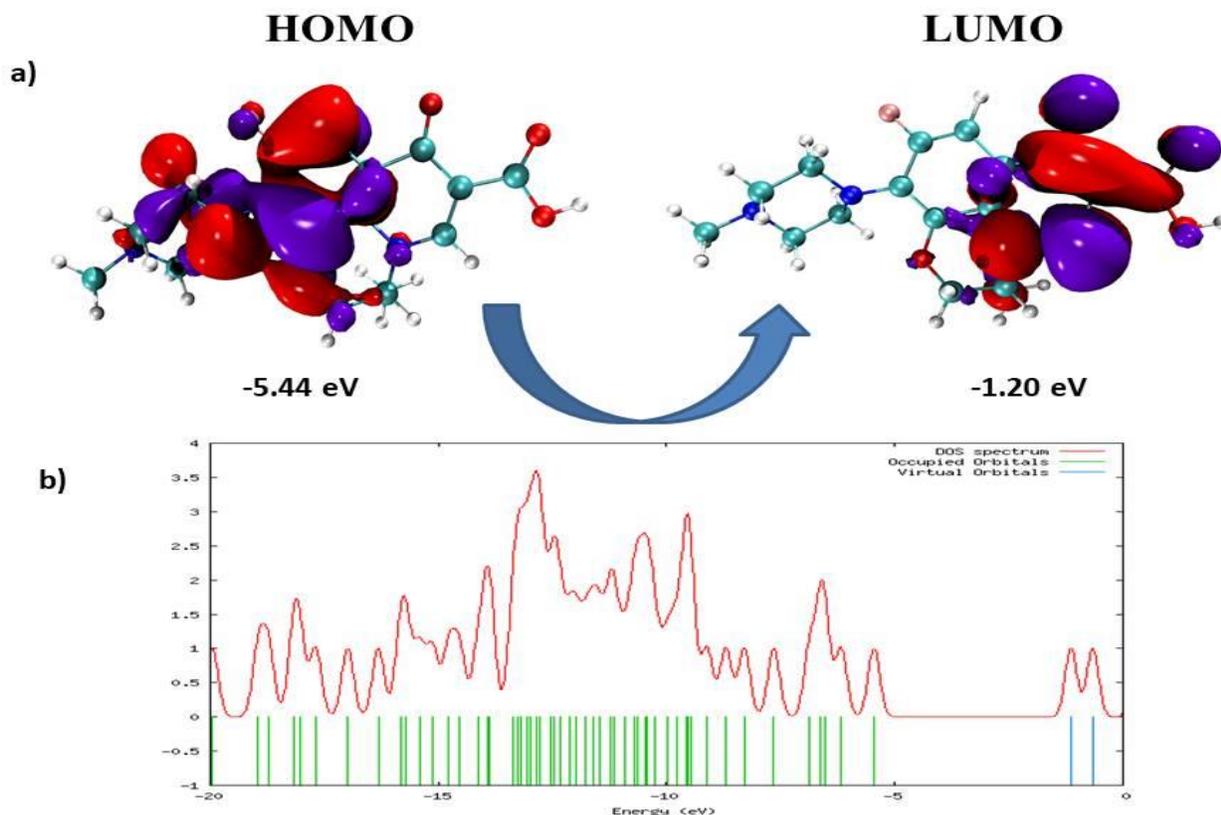


Figure 3 a) Frontiers molecular orbitals for levofloxacin b) Density of state analysis

Analyzing the distribution pattern of the frontier molecular orbitals (FMOs) is a method that is used to characterize the optical as well as the electronic properties of the donor molecules that have been constructed. The distribution pattern of charges in LUMO (lowest unoccupied molecular orbital) and HOMO (highest occupied molecular orbital) can be estimated using frontier molecular orbitals.

The density of state (DOS) analysis of these molecules was also carried out, and the findings that were obtained from the density of state contribution confirmed the facts that were proven by the FMO results. Additional study of FMOs concerning percentage composition in addition to DOS around HOMOs and LUMOs also indicated that acceptor components with variable electron withdrawing intensities have the potential to affect the distribution of electron density on molecular orbitals (MOs). In a similar manner, the DOS illustrates the energies of all of the intended organic donor molecules' MOs, including those that are occupied and those that are not.

In order to validate the test technique in accordance with the protocol, quantitative determination of levofloxacin, an active component of levofloxacin 250/500 mg tablet, final product, is to be performed by high-performance liquid chromatography (HPLC). The verification procedure was carried out in order to assess the assay's linearity, precision, accuracy, detection limit, quantitation limit, and robustness.

The intended use of this test method is for quantitative determination of Levofloxacin, an active ingredient of Levofloxacin 250/500 mg tablet.

The scope of this study applies to quantitative determination of Levofloxacin, an active ingredient of Levofloxacin 250/500 mg tablet.

HPLC Method:

The use of HPLC as a method for determining the concentration of active pharmaceutical ingredients is a reliable and accurate technique (API). The solubility of the sample in the solvent serves as the foundation for this HPLC procedure. In general, the solvent is comprised of a combination of buffer and methanol solvent (70:30). In this validation study, the following validation parameters, precision, accuracy, linearity, limit of detection, limit of quantitation, and robustness will be assessed and analyzed.

Material and methods:

HPLC (Isocratic Shimadzu SPD-20AD or equivalent), Calibrated Balance, Calibrated PH meter, Purified water, Acetonitrile, filter paper, solution polyamide.

Isocratic USP Method:

Mobile Phase Preparations

Buffer A: In 700 ml water, dissolve 874 mg of cupric sulphate pentahydrate, 918 mg of L-Isoleucine, and 5.94 mg of ammonium acetate using a stirrer.

Mobile phase: Mix the following solvents in a given ratio,

Methanol : Buffer A
30% : 70%

Filter through 0.45µm filter paper and degas the mobile phase in an Ultra sonic bath for 5 minute

Diluents: Acetonitrile: Water (20:80)

Chromatographic Conditions:

The following conditions have been found suitable

Dimensions : 25cm x 4.6mm
Packing : 5-µm Packing L1
Temperature : 45°C
Flow rate : 0.8 ml/min
Detector : UV at 360 nm.
Injection volume : 25 µl

System suitability requirement: Tailing factor: NMT 1.8; Standard solution RSD: NMT 2.0%, Standard solution.

Sample solution preparation:

Take NLT 20 tablets of sample of Levofloxacin 250 mg tablet and grind to powder and take powder equivalent to 5 tablet and transfer to 250 ml volumetric flask and add about 75% diluents of the final volume, and allow to stand for 15 minutes and sonicate for 2-5 minutes, and dilute to volume with diluents and mix for 10 minutes with stirring.

Filter the above solution with a suitable filter and Take 2 ml of above solution in a 50 ml volumetric flask and dilute to volume with mobile phase for the final concentration 0.2 mg/ml.

Standard preparation:

Weigh accurately equivalent to 100 mg of USP Levofloxacin (.....mg) or working standard, and transfer to 50ml volumetric flask and dissolve it in diluents to the volume and mix for 2-5 minutes.

Take 10 ml of above solution in a 100 ml volumetric flask and dilute to volume with mobile phase for the final concentration 0.2mg/ml.

1. Linearity of Levofloxacin

Linearity experiments were conducted to identify the range over which Levofloxacin exhibit linear response. The stock solution of Levofloxacin was prepared by dissolving equivalent to 100 mg (Levofloxacin) of finely powder homogeneous sample of Levofloxacin 500 mg tablet into 100 ml of diluents for final concentration of 1.0 mg/ ml of Levofloxacin.

The stock solution was gravimetrically diluted in diluents to concentrations of 50 ppm (0.05 mg/ml) ,100 ppm (0.1 mg/ml) ,200 ppm (0.2 mg/ml) ,300 ppm (0.3 mg/ml) , and 500 ppm (0.5 mg/ml) respectively. The calibration graph is shown below, indicates linear relationship observed between the concentration and absorbance of the solutions. The R2 of calibration data point was calculated to 0.9999. This indicates that the test procedure obeys Beer’s law.

Table.1 Average peak area of different concentration samples using stock solution to find the linearity curve using calibration curve method

Sr. No.	Concentration (mg/ml)	injections	Retention time	Peak areas	Average areas of solution	peak test
1	0.05	1	21.846	993030	993030	
2	0.1	1	21.905	2011403	2011403	
3	0.2	1	22.047	4037275	4037275	

4	0.3	1	22.194	6229148	6229148
5	0.5	1	22.397	10051526	10051526

The calibration graph showing linear relationship between the absorbance and concentration of analyte in the solution is shown below.

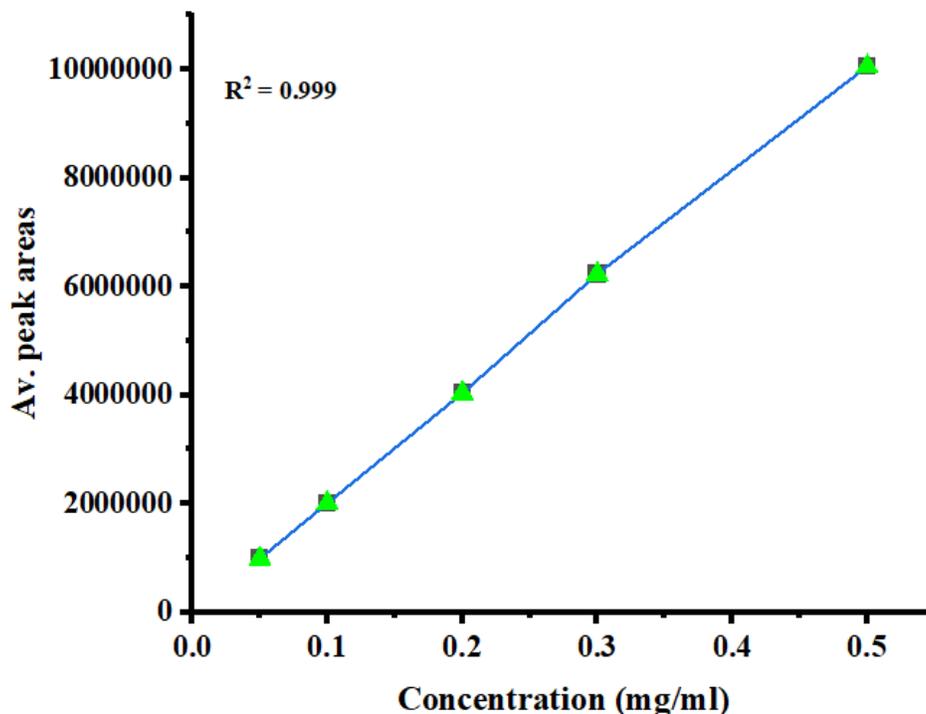


Figure 4 Line graph of all different concentrations (PPM) with peak areas

The connection between the concentration of the solutions and their absorbance may be seen to be linear in the calibration graph. Therefore, this demonstrates that Beer's law is followed by the testing technique.

2. Precision

An inquiry into precision is part of the verification process for tests used for the assay. If the testing procedure was found to be repeatable and reproducible, this will be put through its paces by the repeatability and reproducibility tests.

Repeatability (Levofloxacin)

In other words, repeatability is how close together a series of measurements of the same thing or area are when taken in a row by the same person with the same tool or machine. Repeatability is also called test-retest reliability, which means that when you retest or measure an item or area, you get pretty much the same result. We say that there is variability when the same measurement is not made, which means that a tool or device is not reliable. Variability can be caused by the quality of the tool being used to measure, the fact that the tool isn't calibrated, the person using the tool, or things like the room temperature or the stability of the thing being measured. A measurement that can be done over and over again means that the operator will always get the same measurement value. For a measurement to be truly accurate, it must be repeatable and accurate. Repeatability, on the other hand, is a very important part of accurate measurements in and of itself. We wanted to tell you what repeatability is, why it's so important to us at Higher Precision, and why you should too.

It was worked out by adding up the results of six separate calculations. Six samples were taken and test solutions were made and tested according to the test procedure. This was done to see if the results could be repeated.

Repeatability can be measured by figuring out the concentration of six samples at 100%, or by making three samples with concentrations of 80%, 100%, and 120%. This part of precision looks at how well the conditions of the method work and estimate how much variation can be expected for a single analyst and HPLC system for a given sample.

Weight of Reference Standard = 51.6 mg Purity 99 %
 Peak areas of Reference Standard are 5124273, 5128919, 5122598, 5123760, and 5126915
 Average peak area of reference standard = 5125293
 Average weight /tablet = 780 mg/tab (Levofloxacin 500 mg tablet)

Table 2 Six readings are taken at the same retention time, concentration to find the difference between the real results and the theoretical ones in percentage.

Sr. No.	Concentration (mg/ml)	Injections	Retention time	Peak areas	Average peak areas of test solution	% Results of LC	Variation from theoretical Results
1	0.2	1	16.983	5021803	5021509	98.08%	-1.92%
		2	16.983	5022284			
		3	16.982	5020441			
2	0.2	1	16.973	4881324	4877610	99.08%	-0.90%
		2	16.970	4880824			
		3	16.968	4870681			
3	0.2	1	16.797	5022430	5026040	98.55%	-1.45%
		2	16.986	5028481			
		3	16.987	5027209			
4	0.2	1	16.989	4991687	4992245	98.01%	-1.99%
		2	16.980	4993173			
		3	16.981	4991975			
5	0.2	1	16.977	5015322	5019213	98.04%	-1.96%
		2	16.979	5024688			
		3	16.979	5017630			
6	0.2	1	16.977	5032776	5033654	98.32%	-1.68%
		2	16.976	5032442			
		3	16.974	5035723			

After analyzing the six different replicates with the same concentration, peak area, and differences from the theoretical results, they came to the following conclusions. Range: (98.01 --- 99.55%), Mean: 98.34%, Standard Deviation = 0.4475%, Relative Standard Deviation = 0.4551% ± 2.00 %

3. Reproducibility of (Levofloxacin)

The capability of carrying out the test once more is the third and last component of testing for precision. In order to facilitate comparisons between testing locations, samples are created here. This is something that typically occurs when a piece of technology is transferred from one location to another. At both locations, samples are prepared in the same manner, and then they are compared to a predetermined list of acceptability criteria that was previously discussed and agreed upon. According to the ICH, repeatability studies are not required to be included in a submission; nonetheless, conducting them is highly recommended in order to guarantee that all testing facilities are capable of performing the technique in the same manner. It is possible to validate a method using a reproducibility study rather than intermediate precision; however, doing so is not required and will not cause any issues. Either way may be examined.

Analyst 01

Weight of Reference Standard = 51.8 mg Purity 97.01%

Peak areas of Reference Standard = 5136283, 5139459, 5139121, 5138709, 513789

Average peak area of reference standard = 5137893

Average weight / tablet = 390 mg/tab (Levofloxacin 250 mg tablet)

This publication is licensed under Creative Commons Attribution CC BY.

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13079>

www.ijsrp.org

Table 3 Reproducibility 1 at same concentration with some variations from the theoretical results

Sr. No.	Concentration (mg/ml)	Injections	Retention time	Peak areas	Average peak areas of test solution	% age Results of LC	Variation from theoretical Results
1	0.2	1	16.975	5021447	5021496	98.22%	-1.78%
		2	16.975	5020408			
		3	16.976	5022634			
2	0.2	1	16.983	5100753	5101131	99.78%	-0.22%
		2	16.984	5103297			
		3	16.984	5099342			
3	0.2	1	16.984	5035964	5035770	98.50%	-1.50%
		2	16.987	5033202			
		3	16.989	5038143			
4	0.2	1	16.990	4996807	4999053	98.01%	-1.99%
		2	16.993	5002056			
		3	16.994	4998295			
5	0.2	1	16.998	5030130	5033893	98.46%	-1.54%
		2	17.024	5037656			

Range: (98.01 – 99.78%) Mean: 98.59% Standard Deviation = 0.69179 Relative Standard Deviation = 0.7017 % ± 2.00 % **Analyst 02**
 Weight of Reference Standard = 51.8 mg Purity 97.01
 Peak areas of Reference Standard = 4176143, 4181512, 4170976, 4181644, 418185
 Average peak area of reference standard = 417842
 Average weight /tablet = 390 mg/tab (Levofloxacin 250 mg tablet)

Table 4 confirmation of analysis by analyst 2 at same concentration with same retention time

Sr. No.	Concentration (mg/ml)	injections	Retention time	Peak areas	Average peak areas of test solution	% age Results of LC	Variation from theoretical Results
1	0.2	1	16.914	4079625	4076144	98.04%	-1.96%
		2	16.912	4072068			
		3	16.909	4076738			
2	0.2	1	16.907	4057708	4057333	98.09%	-1.91%
		2	16.905	4055955			
		3	16.905	4058337			

3	0.2	1	16.987	4024729	4026130	98.01%	-1.99%
		2	16.897	4026565			
		3	16.895	4027096			
4	0.2	1	16.898	4060827	4062918	98.22%	-1.78%
		2	16.894	4063591			
		3	16.897	4064336			
5	0.2	1	16.918	4189404	4189795	99.75%	0.25%
		2	16.917	4190183			
		3	16.917	4189798			

Range: (98.01 – 99.75%), Mean : 98.42%, Standard Deviation = 0.7467%, Relative Standard Deviation = 0.7587% ± 2.00 %

4.0 Accuracy (Levofloxacin)

In the laboratory, three samples with a total weight of 250 grams were prepared in accordance with the steps involved in the production of the product. Quantities of analyte that were comparable to 80%, 100%, and 120% of the quantity that was stated on the label were added to each placebo. In order to test the product, test solutions of each concentration (namely 80%, 100%, and 120%) were produced, analyzed, and tested in duplicate in accordance with the product's testing process. The following are the tabulated results:

Weight of Reference Standard = 51.8 mg, Purity 97.01%

Peak areas of Reference Standard = 4201337, 4199890, 4200504, 4199613, 4200406

Average peak area of reference standard = 4200350

Table 5 at different percentages of active material find the assay of each sample with respect to label claim

Contents of Active Added in Placebo (% of Label Claim)	80 % (200mg/tab)		100 % (250mg/tab)		120 % (300 mg/tablet)	
	Weight of Placebo for each tablet	122 mg/tablet				
Standard Compression weights for each sample	328 mg/Tab	328 mg/Tab	380 mg/Tab	380 mg/Tab	431 mg/Tab	431 mg/Tab
Weights of each concentration Samples taken for analysis eq. to 1250 mg Levofloxacin	2040 mg	2040 mg	1900 mg	1900 mg	1800 mg	1800 mg
Peak area of test solution	4095425	4081430	3973972	4084779	4221416	4111303
Recovery for each concentration	200.8 mg/tab	200.19 mg/tab	245.46 mg/tab	248.26 mg/tab	298.90 mg/tab	294.43 mg/tab
% age of label claim	100.44%	100.09%	98.18%	99.30%	99.66%	98.14%
Variation from Theoretical Results or Difference	0.44%	0.09%	-1.816%	-0.70%	-0.34	-1.86%
Average results of each concentration	100.26%		98.74%		98.90%	
Standard Deviation	0.26%		-1.26%		-1.1%	

5.0 Robustness (Levofloxacin)

It is the measure how stable the test procedure is under slight variation in test procedure. The following changes were made deliberately in testing procedure. The test solution prepared according to the test procedure and kept at 15°C and 35°C for 24 hours and assayed according to the test procedure. The results are compound with initial results and tabulated below.

Weight of Reference Standard = 51 mg, Purity 97.01%

Peak areas of Reference Standard = 4065095, 4073895, 4071783, 4069561, 4069561

Average peak area of reference standard = 4070083

Average weight /tablet = 780 mg/tab (Levofloxacin 500 mg tablet)

Table 6 to validate the stability of product at various temperatures to find its efficiency

Storage Condition	15°C		25°C		35°C	
	Sample I	Sample II	Sample I	Sample II	Sample I	Sample II
Weight of Samples	780 mg	780 mg	780 mg	780 mg	780 mg	780 mg
Peak area of test solution	4078236	3962988	4235366	4092135	4099778	4025494
% of Label Claim	99.14%	98.88%	99.89%	99.48%	99.67%	98.36%
Average	99.89%		99.68%		99.01%	

The test samples are stable for up to twenty-four hours at temperatures ranging between 15°C and 35°C.

II. CONCLUSION

The purpose of this study is to reflect the efficacy of levofloxacin under different conditions in order to meet the USP requirements by assessing it using the verification method. Our results show that the product levofloxacin is stable at the following stages: linearity curve using different ppm solutions to find the calibration curve, repeatability to find the replicates peak areas at the same concentration, reproducibility to determine whether or not our results are reproducible, accuracy to make active material mixing with inactive at different percentages 80%, 100%, and 120% to compare the obtained results from HPLC chromatogram with theoretical values.

Conflict of interest

The writers have no financial or other competing interests.

REFERENCES

- [1] 1. Abidi, A., A Case Report: Levofloxacin Induced Steven Johnson Syndrome.
- [2] 2. Melega, M.V., M. Alves, and R.P.C. Lira, Why do scientific advances take so long to be incorporated into clinical practice? The case of intracameral injection of antibiotics to prevent acute endophthalmitis after cataract surgery. *Arquivos Brasileiros de Oftalmologia*, 2022. 85: p. V-VI.
- [3] 3. Graham, D.R., et al., Once-daily, high-dose levofloxacin versus ticarcillin-clavulanate alone or followed by amoxicillin-clavulanate for complicated skin and skin-structure infections: a randomized, open-label trial. *Clinical infectious diseases*, 2002. 35(4): p. 381-389.
- [4] 4. Riffel, J. and A. Quick, Rate of Endophthalmitis Following Cataract Surgery Using Intracameral Moxifloxacin without Postoperative Topical Antibiotics. 2021.
- [5] 5. West, M., et al., Levofloxacin compared with imipenem/cilastatin followed by ciprofloxacin in adult patients with nosocomial pneumonia: a multicenter, prospective, randomized, open-label study. *Clinical therapeutics*, 2003. 25(2): p. 485-506.
- [6] 6. Jumbe, N., et al., Application of a mathematical model to prevent in vivo amplification of antibiotic-resistant bacterial populations during therapy. *The Journal of clinical investigation*, 2003. 112(2): p. 275-285.
- [7] 7. Canton, R., et al., Worldwide incidence, molecular epidemiology and mutations implicated in fluoroquinolone-resistant *Streptococcus pneumoniae*: data from the global PROTEKT surveillance programme. *Journal of Antimicrobial Chemotherapy*, 2003. 52(6): p. 944-952.
- [8] 8. Molnar, D.M. and M.E. Kremzner, Fluoroquinolones: A hot topic for pharmacists and the Food and Drug Administration's Division of Drug Information. *Journal of the American Pharmacists Association*, 2019. 59(1): p. 13-16.
- [9] 9. Hurst, M.L.H., Scott, J., et al., Levofloxacin: An updated review of its use in the treatment of bacterial infections. *Drugs*, 2002. 62: p. 2127-2167.
- [10] 10. Croom, K.F. and K.L. Goa, Levofloxacin. *Drugs*, 2003. 63(24): p. 2769-2802.
- [11] 11. Swapna, G., B. Pravallika, and J. Poojitha, A Review on Drug-drug interaction studies on Amiodarone and Levofloxacin. *Research journal of Pharmacology and Pharmacodynamics*, 2019. 11(4): p. 147-152.
- [12] 12. Reese, M.G., et al., Genie—gene finding in *Drosophila melanogaster*. *Genome Research*, 2000. 10(4): p. 529-538.
- [13] 13. Austin, S., et al., APhA 2019 abstracts of contributed papers. *Journal of the American Pharmacists Association*, 2019. 59: p. e38ee250.
- [14] 14. SUNITHA, P., V. KUCHANA, and P. RAJESH, A NOVEL AND RAPID ANALYTICAL METHOD DEVELOPMENT AND VALIDATION FOR THE QUANTITATIVE ESTIMATION OF PITAVASTATIN IN BULK AND TABLET DOSAGE FORMS BY RP-HPLC.

This publication is licensed under Creative Commons Attribution CC BY.

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13079>

www.ijsrp.org

- [15] 15. Organization, W.H., World Health Organization model list of essential medicines: 21st list 2019. Geneva: World Health Organization. hdl: 10665/325771. 2019, WHO/MVP/EMP/IAU/2019.06. License: CC BY-NC-SA 3.0 IGO.
- [16] 16. Pletz, M.W., et al., International perspective on the new 2019 American Thoracic Society/infectious diseases society of america community-acquired pneumonia guideline: a critical appraisal by a global expert panel. *Chest*, 2020. 158(5): p. 1912-1918.
- [17] 17. Hawkey, P.M., Mechanisms of quinolone action and microbial response. *Journal of Antimicrobial Chemotherapy*, 2003. 51(suppl_1): p. 29-35.
- [18] 18. Wang, J.-g., et al., Assessment of the risk of musculoskeletal adverse events associated with fluoroquinolone use in children: A meta-analysis. *Medicine*, 2020. 99(34).
- [19] 19. Bradley, J.S., et al., Safety and efficacy of ceftazidime-avibactam plus metronidazole in the treatment of children \geq 3 months to < 18 years with complicated intra-abdominal infection: results from a phase 2, randomized, controlled trial. *The Pediatric infectious disease journal*, 2019. 38(8): p. 816-824.
- [20] 20. Li, C., et al., The global state of clinical research and trends in periprosthetic joint infection: A bibliometric analysis. *International Journal of Infectious Diseases*, 2020. 96: p. 696-709.

AUTHORS

First Author – Zain Iqbal, Govt. College University Faisalabad Pakistan

Second Author – Rakshanda Javaid, Govt. College University Faisalabad Pakistan

Third Author – Muhammad Tahir, Govt. College University Faisalabad Pakistan

Fourth Author – Sohaib Hasnain, Govt. College University Faisalabad Pakistan

Fifth Author – Bakar Bin Khatab Abbasi, COMSATS university Islamabad, Lahore campus Pakistan

Sixth Author – Faiza Shafiq, Department of Chemistry, University of Agriculture Faisalabad, Pakistan

Seventh Author – Muhammad Ishaq, Department of Chemistry, University of Agriculture Faisalabad, Pakistan

Corresponding author: ishaqmuhammad930@gmail.com

Green Currency Based On Green Asset Valuation Has The Potential To Mitigate Poverty, Inequality, And Global Warming

Dr. (Prof.) Suman Pamecha¹, 'Kailashi' Punit D. Sharma², Dr. Indu Sharma³

¹.Dean and Principal MVS College, Rajasthan Vidyapeeth Deemed to be University, Udaipur, Rajasthan, India.

².Scholar, Department of Economics, MVS College, Rajasthan Vidyapeeth Deemed to be University & Chief Planning Officer, Udaipur, Rajasthan, India.

³.Associate Professor Economics, Government Meera Girls College, Udaipur, Rajasthan, India.

DOI: 10.29322/IJSRP.12.10.2022.p13080

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13080>

Paper Received Date: 24th September 2022

Paper Acceptance Date: 25th October 2022

Paper Publication Date: 30th October 2022

Abstract- English poet Samuel T. Coleridge wrote “O! lady, we receive but what we give? And nature alone lives in our lives.”(SAMUEL TAYLOR COLERIDGE, n.d.). Earth is one, but nations are not. This study attempts to explain the core causes of two major global issues: poverty and inequality. Infrastructure development is vital for sustainable development. Population growth, migration, and urbanization trends demand an increase in infrastructure development, especially in emerging economies and developing countries. (Casier, 2015). For almost 25 years, the number of people living in extreme poverty — on less than \$1.90 per person per day — was steadily declining. But the trend was interrupted in 2020, due to the COVID-19 crisis combined with climate change — which had already been slowing poverty reduction. Research suggests that the effects of the current crises will almost certainly be felt in most countries through 2030. (Bank, n.d.). Because so far emerging and underdeveloped economies have worked on **tangible infrastructure development**, but **nontangible infrastructure development** such as digital and environmental infrastructure has been neglected. Under these conditions, the goal of bringing the global absolute poverty rate to less than 3 percent by 2030, which was already at risk before the pandemic, is now beyond reach unless countries take swift, significant, and substantial policy action. (Bank, n.d.) The article argues that bridging the information divide through digital infrastructure by introducing green currency can reduce poverty. The poor are poor more because of a lack of information (Barja & Gigler, 2007). Unless and until the information is not easily accessible to the poor, poverty remains in an information-led economy. At the same time, global inequality can be reduced by addressing environmental infrastructure (Guivarch et al., 2021) through the introduction of virtual green currency. Compensating those economies which have flourished alongside environmental conservation. Development has its cost, and those who remain behind in the development race, are those who have least utilized the natural resources of the environment. Less developed countries (LDCs) have abundant natural resources compared to developing or developed nations (Traeger et al., 2020). The other side of the development process i.e., environmental alignment must be considered and compensated.

Why not resources or products are for all like Bad by-products are? There is a market for good but not for bad. As the costs of public Bads are hidden(Wikipedia, 2021). The introduction of Green Currency via blockchain technology helps to create a market for bad by-products. Therefore, we strive for nature's royalty parity for sustainable development. Only modern technologies facilitate development while protecting and maintaining nature(SENSORS, 2019) & (WWF-Australia, 2017)

Index Terms- Poverty and Inequality, Sustainable Development, Green Currency, Digital Infrastructure, Environment Infrastructure, Environment Budget, Nature's Royalty.

I. INTRODUCTION

At present, the whole world is suffering from two serious problems one is poverty and another is inequality. As not all economies started their development journey from the same starting point. Starting the race with a different time scale, our desire to be the same does not fulfil, unless and until compensated properly. With these problems, there is another problem that is troubling us at present, which is global in the real sense, is the problem of global warming. This problem has prompted all the economies to pay more attention. This affects the growth badly and somewhere we come to the tradeoff, to conserve the environment. According to poverty and inequality platform of world bank based on the 2017 PPP the global poverty lines have been revised, extreme global poverty is now US \$ 2.15 (international poverty line)from US\$ 1.90 and for lower middle income countries this has moved to US\$ 3.65 from US\$ 3.20. The global poverty rate is 8.9%. Still about 674 million people live below \$2.15 per day.(R. ANDRES, 2022)

"Taken as a whole, the range of published evidence indicates that the net damage costs of climate change are likely to be significant and to increase over time."

- Intergovernmental Panel on Climate Change

"Policymakers should aim to establish environmental priorities and goals that are consistent with the real tradeoffs that all regulatory activities inevitably require." —**Robert N. Stavins** (Richard A. Clarke, Robert N. Stavins, J. Ladd Greeno, Joan L. Bavaria, Frances Cairncross, Daniel C. Esty, Bruce Smart, Johan Piet, Richard P. Wells, Rob Gray, Kurt Fischer, 1994)

This also worsens the condition of global poverty and inequality, as global warming hits the fundamental right to life and livelihood (Mohammad Ehsanul Kabir & Silvia Serrao-Neumann, 2019). The broadest meaning of development is the process by which human liberties are expanded. According to Sen's perspective (SEN, 2000), the increase of freedoms serves as a means and ultimate objective of development. Sen emphasizes a variety of freedoms as a way of development, including political freedom¹, economic possibilities², social inclusion³, and assurances of transparency⁴ and safety⁵. These liberties enhance a person's capacity; **poverty, in this sense, is the absence of fundamental capabilities**. As a result, in order to provide an accurate multidimensional assessment of the increase in the poor's standard of life, it is necessary to look at their accomplishments and acquired skills. Attanasio and Székely (1999) developed an asset-based approach to poverty analysis, which states that the main structural causes of poverty are; **ownership of income-generating assets**, which can be physical (housing and basic services), human (health, education), or social (community resources) (social networks and rules) and **Rate of asset utilization**, because the higher the utilization, the greater the income (employment opportunity, gender, credit access).

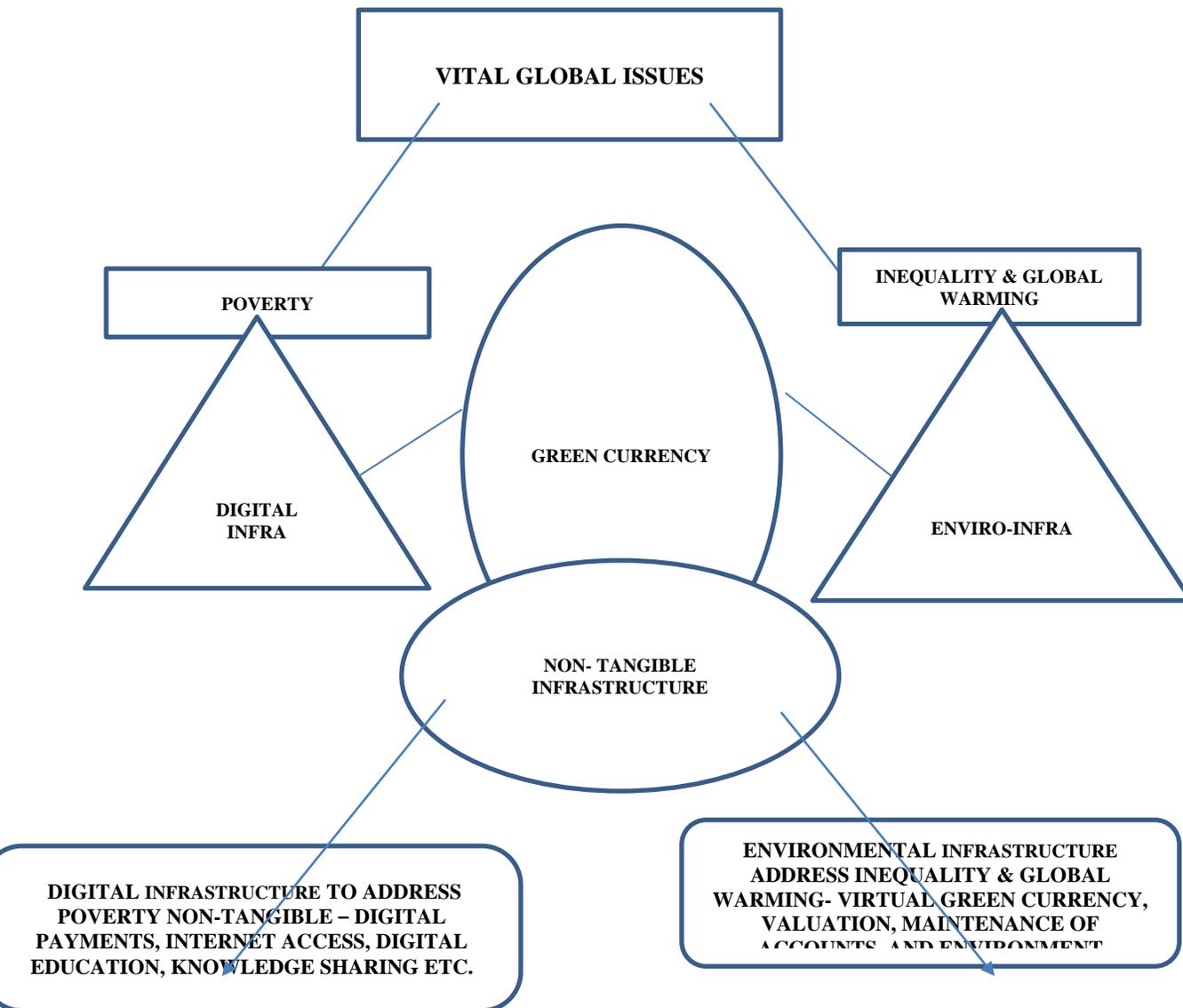
"Digital divide," as several scholars have noted (Kenny, 2003); (B. S. (2001) Gigler, 2001); (B. S. Gigler, 2005), (McNamara, 2000) (McNamara, 2003), concentrates on examining how well various groups (such as women or minorities in society) can connect to the internet without considering the underlying causes of the disparity.

Because of this, information can be used to further economic, social, political, and cultural liberties, as noted by (B. S. Gigler, 2005). Access and usage of information and communications are key prerequisites for growth since they touch every aspect of human existence. In the same way, lack of access to information and communication is simply one facet of poverty, but it impacts all of it. As a result, the other aspects are interconnected in terms of reducing it effectively.

We could argue that the expansion of human liberties should also be a primary goal in the establishment of an information society, as a method to aiding in the growth process. **People who lack the basic capacities required to fully participate in the information society are said to be living in a state of "communication and information poverty."** (Barja et al., 2007)

Today, it is critical that we address these two pressing challenges in a way that protects the environment, ensuring long-term development. It is crucial to remember that homogenous access to technology is the only means by which both issues might be resolved. Special emphasis is given to the infrastructural development of economies through global institutions. Infrastructural development is also of two types, one is tangible and another one is nontangible. Tangible infrastructure development which viz. means of transportation, electricity, water, and basic services such as health and education, has made good progress in the last few decades, but nontangible infrastructural development which includes digital infrastructure and environmental infrastructure. Economies have done a lot of work to improve digital infrastructure, and lots need to be done to fill the digital divide but the expected progress on environmental infrastructure reforms has not been addressed properly.

Haskell and Westlake argue that intangible assets or infrastructure have "unusual economic characteristics" — namely, scalability, sunkness, spillovers, and synergies (the "Four S's"). Above four 'S' makes defines the power and importance of intangible infra over tangible for the knowledge-led economy. (Jonathan Haskel and Stian Westlake, 2018)



Green Assets and Valuation-

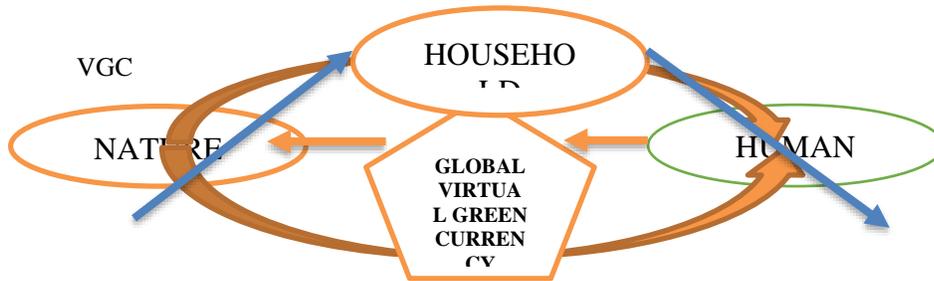
The term "green assets" refers to all the planet's natural resources that let people live comfortably and shield them from the dangers of global warming caused by the rapid destruction of the planet's forests. Primitive peoples (planet guardians) hold and protect these resources especially well, and we can learn a lot from them. (Pamecha & Sharma, 2022).

- "Green Assets" are things like forests, open space, trees, bodies of water, waste recycling plants, water treatment plants, grazing land, farms, etc. that are good for the environment and owned by people, the government, NGOs, businesses, and institutions. It's made up of Natural Assets, Environmental Assets, and Soft Assets. (GREEN ASSETS, n.d.).
- Biological assets, land, water areas, and their ecosystems, subsoil assets, and air are all examples of natural assets that humans did not create or cause.
- Environmental assets are those that occur naturally but also include those that have been enhanced by human effort to serve a greater purpose or provide more value to society. Nature's ability to recycle and absorb society's garbage is just one example of the many benefits that nature provides (Regoniel, 2020; BCESCU-CRBUNARU, 2018).
- Soft Assets- Soft assets of nature are non-infrastructure assets of nature or intangible assets of nature, for example, biodiversity, ecosystem services, etc.

Concept of Green Currency

What we get comes from nature. But what we give back - nothing. Green currency based on green asset valuation provides a mechanism for us to give back to nature and sustain it. In a circular economy there are exchanges between households, firms, government and the rest of the world but no exchange takes place between humans and nature, as it is assumed that nature is there to give and asks for nothing in return. As we introduce the concept of green currency, it is possible to pay royalties to nature. Till now we pay environment

tax to the government like other taxes but there is no guarantee that this amount will definitely be used for the revival of nature. Green assets are of nature but held by humans (individuals, families, firms, industries, organizations or government). When all green assets held by humans are enumerated and given a value based on a globally accepted formula, a market for green assets based on blockchain technology can be created that will lead to a new world and paves the way where it is possible to give back the royalty of nature to preserve nature naturally.



Dig-2 Establishing Nature-Human Networking Through Global Virtual Green Currency

Green Currency market determines the prospects for growth and development. Presently a nation's development trajectory is decided only by the capital such as plant, machinery and human capital. Natural capital is completely ignored. The price mechanism is determined globally because the odds are against nature or natural resources. On the basis of R&D and advanced technologies, very low price/royalty is obtained by countries with untapped natural resources. Nations that hold, preserve or protect the resources get nothing. The guiding principles will be determined by the value of green assets held by individuals, industries or the government. We can understand this with a simple example that economies do not value a tree until it is cut down, or in economics we value a tree not for its existence but for its use. Green money market provides us a platform to give importance to nature or natural resources even for its existence.

Assumptions of the Green Currency Model-

1. Green assets valuation is done globally by a global authorized agency.
2. Methodology of green assets valuation should be transparent and free from subjectivity.
3. Green asset valuation should be done through a scientific methodology or a calculator.
4. This currency should be accepted globally and operates through blockchain technology.
5. The GC should base on green assets valuation, having intrinsic value equivalent to green assets.
6. Green currency market operates through blockchain technology globally.
7. No exchange is permissible between current various national currencies and GC.
8. GC should be used as a guiding principle for all development works by government and also control demand by various sectors so that nature remains intact.

Digital Infrastructure and Poverty

We all are living in an information age. The growth and development of a nation or people depends upon accessibility of information, as follow of right information to the right people decides the right move. Information is the means through which the mind expands and increases its capacity to achieve its goals, often as the result of an input from another mind(Mason, 2007). Digital infrastructure is an infrastructure that is making all types of information available on the digital screen through technology, but even today the digital divide remains. With Almost Half of World's Population Still Offline, Digital Divide Risks Becoming 'New Face of Inequality' - Deputy Secretary-General UN.

Due to which the world is constantly being divided into two parts.

Haves-are those who have technical knowledge and availability of internet

Haves not - are those who lack the knowledge of technology and also do not have the availability of internet

While on one hand, the whole world is turning into a small market through the communication revolution, some people are still being left behind due to lack of technical knowledge.

The information revolution has provided an opportunity to all the consumers of the world to behave like a king because all types of information are available to everyone but those who are not techno-friendly are missing out on this benefit.

Developed countries are developing more rapidly due to technological progress and information revolution, whereas the underdeveloped countries are leaving behind in this race.

Worldwide Internet Users

Year	2005	2019
Developing Nations	8%	47%
Developed Nations	51%	86.6%

Source: - International Telecommunication Union ITU

In the changing parameters of development, we have given importance to the education, R&D, health, banking, and finance sectors. which are completely dependent on technological progress, knowledge, and its use. The government has long to provide high-quality services and facilities to the last person. The economic development is still referred to as the economies less reliance on agriculture globally (*The development of the share of agriculture in GDP and employment*, 2015). Most of the poverty is found in the workers working in agriculture and allied sector, change can be brought through the information revolution. Ways to deal with poverty and hunger are being explored on the global stage for the last 50 years, today technology is playing an important role, which we can understand from these examples.

Education - Techniques in ensuring access to education to the lowest level - YouTube, different educational platforms, etc., at very low cost, remote areas, they are ensuring the availability of high quality and skill education in small villages, so that the backward class can also get quality education.

With the help of health technology, different Medicare apps are able to ensure health facilities in remote areas, even with the use of robots, it is possible to get treatment and diagnosis in remote areas.

Information about renewable resources of energy is rapidly reaching everyone so that we can speed up environmental protection by spreading solar and wind energy to the people, as well as developing sources of affordable energy for all.

Agriculture Sector - Meteorology Department is able to help the farmers only through technology, most of the people associated with the agriculture sector are poor, in such a situation, by adopting this forecasting model through technology, by providing weather data, production, productivity in the agriculture sector can be increased. It may be possible to increase it as well as a transparent mechanism can be done through which farmers can easily sell their produce at a good price in the market on the basis of demand information

Successful implementation of government schemes can also be improved through technology, digital payment and direct cash transfer is a big weapon to remove poverty, which also directly attacks corruption, the poorest section of the society unskilled workers through public welfare schemes in India. And in the accounts of small farmers, with a single click by JAM Trinity, crores of rupees have been easily transferred in the accounts of these sections even during the epidemic in a transparent manner, which has been helpful for the poor in the Covid period, such a digital available in India. This has been possible only due to digital infra, similarly the education system on online classes and digital platforms has been satisfactory due to the closure of educational institutions due to the pandemic. We all have considered the irony of the IT sector during the pandemic, which has saved the market from recession in education, health, banking, finance and has played an important role in providing facilities to the lowest level.

[Gideon Fakomogbon](#) suggests 6 Ways to Improve the Digital Divide's Impact on Education-(Gideon Fakomogbon, 2022), that address poverty.

- *Improve Affordability of Digital Resources*
- *Digital Skills Acquisition and Empowerment for Schools, Teachers, and Students*
- *Digital Literacy Awareness*
- *Inclusion of Local Languages in Education Content Creation*
- *Improving Opportunities for Learners with Disabilities*
- *Addressing the Gender Digital Divide*

This is the age of the digital world. World is becoming a global village. But the question arises why nations uses different currencies in physical form without having any intrinsic value. In a digital world this must be changed. We must move towards a digital global green currency based on green assets valuation. We are quickly moving towards real time digital transactions; means we do not need any physical currency by 2026. According to a report by ACI worldwide in 2021 India stood at first position in real time transaction in the world with 48 billion transactions about 26% of the world's total transaction(Sunnaina Chadha, 2022).

Thus, digital green currency based on blockchain technology (green) plays vital role in poverty eradication.

Green Assets Valuation, Green Currency and Global Warming

Every year we are warming up our planet if the promises made by the nations in COP are not fulfilled properly and on time. And this affects more to those who are not responsible for it i.e., underdeveloped and developing nations than developed ones. All the climate pledges announced to date, if met in full and on time, would be enough to hold the rise in global temperatures to 1.8 °C by 2100. But all the climate pledges made globally as of today still leave a 70% gap in the emissions reductions needed by 2030 to keep 1.5 °C within reach. Governments are making bold promises for future decades, but short-term action is insufficient.(Birol & Dr Fatih Birol, Executive Director, 2021).

We are not in a situation to deal with this problem as we are using the same old weapons to fight, knowing the fact that this one is a global problem in true sense. To deal with this we need global weapons viz Virtual Global Green Currency. Unless and until all nations join hands to establish international authority to monitor and control all development projects, linking with green asset account. With this example we can understand the role and responsibility of international authority for green assets valuation and regulatory authority for green currency market (IAGAV & RAGCM)

The demand for goods and services by an individual or firm depend on say price of the commodity, income of the consumer etc. Means a consumer can demand whatever he wishes to purchase from the market if he has willingness to pay for that particular commodity or services. There is no concept of any check on the demand or there is no methodology to measure the pressure on the nature or carbon footprint, that's why we see that the per capita consumption of developed nations is too much compared to a person residing in a developing or an underdeveloped nation. The introduced new global digital green currency has the power to check demand or we can say rationalize demand with reference to pressure on nature.

Current Demand Function-

$$D_a = f(P_a, P_b, M \dots T)$$

Demand function with Green Assets

$$D_a = f(P_a, P_b, M, GA \dots T)$$

It means that with the introduction of green assets valuation we establish the value of green assets and develop a market for green assets through green currency transaction via blockchain technology globally. This affects the demand for goods and services too as green currency demanded by those who wants to purchase any commodity from the market and GC supplied by those who does any work which enhances the green assets viz plantation of trees, green energy generation and water treatment plant or any waste recycle plant. Each and every commodity in this market will now depicts two prices of its product or service, one is monetary price of the product i.e., MRP and the other one is Green Asset price of the commodity or services. And to purchase any commodity one has to pay both. Green asset price of any commodity can easily be calculated on the basis of the depletion of GA or GA utilized to produce the commodity.

Environmental Infrastructure – Inequality

As stated above Environmental infrastructure has two parts one is tangible and the second one is nontangible. The tangible one is already addressed by most of the economies but the nontangible part of the environmental infrastructure is still undercover. This Non-tangible part of environmental infrastructure consists-

- (1) Creation of Green Currency
- (2) Valuation of Green Assets
- (3) Maintenance of Green Accounts of individuals, firms, and government
- (4) Nature's Royalty Parity

The intangible part of the environmental infrastructure is that such an alternative infrastructure should be created at the global level so that it can be further improved while maintaining the current level of the environment at the global level. It addresses global warming. It provides such a platform that the environment should not become a hindrance in the path of sustainable development but become a driver. **Branko and Milanovic** in their book “Haves and the Haves Not” explain three types of inequality- inequality among individuals within a nation, inequality among nations, and the third one is the sum total of the above two i.e., Global Inequality.

Environmental infrastructure development basically strikes at global inequality between nations and individuals and proves to be a means to minimize it linking with the maintenance of the environment. It provides a global solution to a global problem. Providing royalty to nature.(Sharma Punit, 2022)

What is green currency and how can the environment be protected through it? Green currency is a virtual green currency that is based on environment asset valuation and blockchain technology. As we all know that the census of the year 2021 is yet to take place, so we have enough time to build the intangible infrastructure of the environment, each country in the year 2021 census. The Green Asset being held by the individual/family residing in the State, Village, and City should be counted as it is also an asset as the Census counts the assets of each individual and family, firm in the same way as Green. The asset value should also be computed and a metric should be determined and based on that the value of the green asset being held by each individual firm and the government should be determined. Unit for a green asset may be Tree, T- value. The scale of this pricing can also be determined which can be determined on the basis of parameters like green-covered land, age of the tree, its length, area covered by it, etc. Once the green asset is calculated, this data can be made public all over the world based on blockchain technology.

If it is assumed that development can only be achieved by exploiting the environment, we find that there are tradeoffs between economic prosperity and environmental prosperity as well as between economic inequality and environmental inequality.

Developed countries have achieved economic prosperity, this prosperity was gained by exploiting the environment or those countries which are using more resources, they are causing more damage to the environment, the same thing applies to the inequality between individuals/families because rich families are over-using resources.

Once the green asset is counted and recognized as a digital currency, global inequality can be easily addressed as it strikes at the root of the problem described above, among the efforts so far at the global level. We are all familiar with the establishment and failure of the carbon credit market, in this context a systemic intangible environmental infrastructure can be created through green currency. It is well known that money has played a vital role in motivating the individual, family, firm, and government to solve any problem. Likewise, green currency can also provide a solution to this global problem.

Now, let's have a better understanding of how green cash operates and how it combats inequity. It is now completely obvious that human activity has a negative impact on the natural world; thus, many organizations are starting to address the idea of sustainable development.

In the compensation principle, it is believed that the damage has been done to a person or a firm, on the basis of which the person or firm is compensated, but the environment is ignored, here it is not said that the environment is harmed. What's the damage? And what effect will it have on future generations? And who will compensate the environment? Whereas it is possible through green currency. (Kailashi punit D., Kamal Hiran, 2021)

At present, whenever development is done, there is no monetary exchange of any kind for environmental balance in exchange for this development, whether it is tangible infrastructural development such as the construction of highways, construction of dams, or expansion of cities. Development is being done only on the cost of green land, but surprisingly this green land cannot be reclaimed because the land is a scarce resource and the old trees cut down for development, cannot be reclaimed in any way. The damage cannot be compensated even by planting new trees, so it becomes very necessary that parity should be established by compensating it through green currency, only then the environment can be protected. As well as the organizations working on environmental protection. may be motivated to act because now it has been attached to the virtual monetary value.

We can understand this with the example of development work by a firm and government, whenever a firm produces, it produces pollution as a by-product or it uses natural resources, minerals as the primary input. It is balanced by the government, the government takes mining leases, the government imposes pollution tax or pays compensation to the society by any other means, but the government does not make a difference to the environment. As no separate *environmental budget* is released by the government yearly. Society is unaware of what is being done by the government to reestablish environmental damage.

Similarly, when the government also does development work such as the construction of highways, construction of dams, and expansion of cities, even then the environment is not compensated. Where the person whose land is acquired by the government for development work, that person will get the market value / administered value of that land, but no one talks about the damage to the environment and how this will be reestablished. That's why the environment can't be conserved.

Now we understand how green currency can remove inequality as we have seen that no compensation has been given to those countries which have not developed whereas the underdeveloped countries should have been compensated by the developed countries. The development of countries did not suffer from the problem of sustainable development for a very long time because underdeveloped countries did not join the race for development and if this is compensated, then there will be no problem of inequality, we can understand this from the example below.

When the government builds a highway, it does not add the loss to the green land in its cost, the farmer is compensated equal to the value of his land, but the damage to the environment is not compensated, that is, it is not seen in the government's account. Green currency should have been debited from the government account should have been credited to the environment account.

That is, whenever the government builds a highway or does any other development work, it can do it only if it has enough green money in its account or it will have to buy this currency from another person or firm at a price equal to the current cost of the currency so that the environment will be protected.

Similarly importing countries should additionally pay the green cost of the products and services which are imported. When a nationwide green account will be maintained some countries will be green rich and some others will be green poor. By adding the green cost of the product and service will ultimately make economically poorer countries better off. This is how the introduction of green currency will resolve the problem of global inequality.

Thus, by strengthening digital and environmental infrastructure through the introduction of green currency we can resolve the problem of poverty and inequality at global level.

NOTES-

1. People's opportunities to determine who should govern and under which principles, freedom to evaluate and criticize authorities, freedom of expression, right to dialogue, to oppose, to criticize, to vote, to choose among political parties, to be involved in Legislative and Executive elections.
2. An individual's opportunities to use economic resources with the purpose of consumption, production or exchange. The economic ownership of a person depends on the possession of resources, use availability, exchange conditions and its distribution
3. It refers to the way a society organizes itself to provide education, health and social services, which contribute to an effective participation on political and economic activities.
4. It refers to the fact that social interaction is based on the basic assumption of confidence. Such expected confidence guarantees an open and clear attitude among involved parties, contributing to prevent corruption, financial irresponsibility and obscure agreements.

5. It refers to a vulnerable situation people may be experiencing, which requires safety nets, unemployment benefits, income for the needy, emergency funds.

REFERENCES

- [1] The development of the share of agriculture in GDP and employment, (2015). <https://edepot.wur.nl/342795>
- [2] Bank, W. (n.d.). poverty. <https://www.worldbank.org/en/topic/poverty/overview>
- [3] Barja, G., BOLIVIANA, U. C., Gigler, B.-S., & ECONOMICS, L. S. O. (2007). The Concept of Information Poverty and How to Measure it in the Latin American Context.
- [4] Barja, G., & Gigler, B.-S. (2007). The concept of Information Poverty and How to Measure it in the Latin American Context. *Digital Poverty*, 11–28. <https://doi.org/10.3362/9781780441115.001>
- [5] Birol, D. F., & Dr Fatih Birol, Executive Director, I. E. A. (2021). COP26 climate pledges could help limit global warming to 1.8 °C, but implementing them will be the key. <https://www.iaea.org/commentaries/cop26-climate-pledges-could-help-limit-global-warming-to-1-8-c-but-implementing-them-will-be-the-key>
- [6] Casier, L. (2015). Why Infrastructure is Key to the Success of the SDGs | IISD. *Iisd*, 12, 1–4. <https://www.iisd.org/articles/insight/why-infrastructure-key-success-sdgs>
- [7] Gideon Fakomogbon. (2022). 6 Ways We Can Improve the Digital Divide's Impact on Education in 2022. *Global Citizen Life Defeat Poverty*. <https://www.globalcitizen.org/en/content/digital-divide-education-impact-improve/>
- [8] Gigler, B. S. (2005). Enacting and interpreting technology from usage to well-being: Experiences of indigenous peoples with ICT. Rahman, H., *Empowering Marginal Communities with Information Networking*. Idea Group.
- [9] Gigler, B. S. (2001). (2001). Empowerment through the Internet: Opportunities and Challenges for Indigenous Peoples. *Technology for Social Action*. TechKnowLogia, ermet: Opplenges for Indigenous Peoples. In: *Technology for Social Actioortu*.
- [10] GREEN ASSETS. (n.d.). LOCAL GOVT AND MUNICIPAL KNOWLEDGE BASE AUSTRAILA. <http://lgam.wikidot.com/green-asset>
- [11] Guivarch, C., Taconet, N., & Méjean, A. (2021). *Linking Climate and Inequality*. International Monetary Fund ; Springer.
- [12] Jonathan Haskel and Stian Westlake. (2018). *Capitalism without Capital-Infrastructure for Intangibles, and Intangible Infrastructure*. In Princeton University Press 2018. <https://doi.org/10.2307/j.ctvc77hhj>
- [13] Kailashi punit D., Kamal Hiran, I. S. (2021). *Essence of life Divide By Zero*. notion press.
- [14] Kenny, C. (2003). Kenny, C. (2003). Development's False Divid-Giving Internet Access to the World's Poorest Will Cost a Lot and Accomplish Little. *Foreign Policy*. *Foreign Policy*, 76–77.
- [15] Mason, R. O. (2007). *Four Ethical Issues of the Information Age: Vol. first (1st ed.)*. ROUTLEDGE.
- [16] McNamara, K. S. (2000). Why Wired? The Importance of Access to Information and Communication Technologies. *International Journal of Technologies for the Advance of Knowledge and Learning*.
- [17] McNamara, K. S. (2003). *Information and Communication Technologies, Poverty and Development: Learning from Experience*. ODev Annual Symposium. Washington, D.C.: The World Bank.
- [18] Mohammad Ehsanul Kabir & Silvia Serrao-Neumann. (2019). *Climate Change Effects on People's Livelihood*. Springer. https://link.springer.com/referenceworkentry/10.1007/978-3-319-95885-9_7
- [19] Pamecha, S., & Sharma, P. (2022). Waste Management Under Swachh Bharat Mission With Reference to National Green Tribunal's Guidelines in Smart City Udaipur. *Sanshodhan*, 11(1), 12. <https://doi.org/10.53957/sanshodhan/2022/v11i1/169814>
- [20] R. ANDRES, C. (2022). September 2022 global poverty update : 2017 PPP. *WORLD BANK BLOG*. blogs.worldbank.org
- [21] Richard A. Clarke, Robert N. Stavins, J. Ladd Greeno, Joan L. Bavaria, Frances Cairncross, Daniel C. Esty, Bruce Smart, Johan Piet, Richard P. Wells, Rob Gray, Kurt Fischer, and J. S. (1994). The Challenge of Going Green. *HARVARD BUSINESS REVIEW*. <https://hbr.org/1994/07/the-challenge-of-going-green>
- [22] SAMUEL TAYLOR COLERIDGE. (n.d.). Dejection: An Ode. <https://www.poetryfoundation.org/poems/43973/dejection-an-ode>
- [23] SEN, A. (2000). *DEVELOPMENT AND FREEDOM*. Spanish Edition. Argentina: Editorial Planeta.
- [24] SENSORS. E. (2019). The Impact of Technology on the Environment and How Environmental Technology Could Save Our Planet. *EDINBURG SENSORS*. <https://edinburghsensors.com/news-and-events/impact-of-technology-on-the-environment-and-environmental-technology/>
- [25] Sharma Punit, P. S. (2022). *Advancement in Quantum Blockchain with realtime applications (H. kk shrinivas Mk (Ed.); 1st ed.)*. IGI GLOBAL USA.
- [26] Sunnaina Chadha. (2022). At 48 billion, India accounts for largest number of realtime transactions. *TOI*. <https://timesofindia.indiatimes.com/business/india-business/exclusive-at-48-billion-india-accounts-for-largest-number-of-real-time-transactions-in-the-world/articleshow/91070124.cms>
- [27] Traeger, R., Banda, B. M., Riba, M., Valensisi, G., Joo, K., Lechner, T., Slany, A., Schuster, C., Tsowou, K., Akiwumi, P., & Davis, J. R. (2020). *The Least Developed Countries Report 2020: Productive capacities for the new decade*. In United Nations Conference on Trade and Development.
- [28] Wikipedia. (2021). Public bad. [Wikipedia. https://en.wikipedia.org/wiki/Public_bad](https://en.wikipedia.org/wiki/Public_bad)
- [29] WWF-Australia. (2017). Can technology save the planet? *Eco-Business*, February, 1–8. <https://www.eco-business.com/news/can-technology-save-the-palm-oil-industry/>

Key Terms & Definitions-

- [1] Blockchain Technology- Blockchain is a shared, immutable ledger that facilitates the process of recording transactions and tracking assets in a business network. An asset can be tangible (a house, car, cash, land) or intangible (intellectual property, patents, copyrights, branding).
- [2] Deposit and Refund System- A system that imposes an upfront charge to pay for potential pollution damages that is returned for positive action, such as returning a product for proper disposal or recycling.
- [3] Environmental /Ecological Parity- Green currency market generates demand for and supply of green assets globally. Nations and persons with rich green assets get rewarded and nations having low green assets have to check development or to purchase GA. That's how the global green assets parity is maintained.
- [4] Externalities- A cost or benefit arising from any activity which does not accrue to the person or organization directly involved but extends to a third party outside the market. Externalities are positive or negative. Environment degradation creates negative externality as it generates cost to the third party. Environment is a public common good so those who are responsible for the damage need not to pay for the damage as property rights are not well defined.

- [5] Global Warming- Global warming is the long-term heating of Earth's surface observed since the pre-industrial period (between 1850 and 1900) due to human activities, primarily fossil fuel burning, which increases heat-trapping greenhouse gas levels in Earth's atmosphere. This term is not interchangeable with the term "climate change."
- [6] Green Assets- A green asset is an asset that generates more energy than it consumes. This creates a positive impact on the environment, as well as provides a net positive benefit to the economy. Green assets cover all natural assets that facilitates our lives on this planet and protects us from ills of global warming due to rapid environmental degradation of forest. These assets are particularly protected and possessed by primitives. An asset possessed by individuals, government, NGOs, industries, and institutions that has a positive environmental impact such as forests, open space, trees, water bodies, waste recycling plants, water treatment plants, grazing land, and farms, etc. It includes Natural Assets, Environmental Assets as well as Soft Assets.
- [7] Green Assets Valuation- Green assets are becoming more popular and as a result, new valuation techniques have been developed to measure their value. These techniques take into account the environmental benefits of green assets, such as reduced air pollution and greenhouse gas emissions, and this can translate into higher returns. We can assign value to any green asset according to its CO₂ sequestration capacity or O₂ generation capacity.
- [8] Green Currency based on GAV- On the basis of green asset valuation a value could be assigned to green assets and green currency could be launched based on or operated globally through block chain technology. This GC will be not centrally controlled like the currently money market and also global currency in true sense and will control or check development process considering potential of environment and pressure on it. Apart from this Green Currency has intrinsic value.
- [9] Green Currency Market- Market developed and based on global transaction of green currency through block chain technology. This market will motivate all those who preserve environment and also checks pressure on natural resources. GCM generates demand for and supply of green assets globally.
- [10] Green Subsidy- A payment or tax concession that provides financial assistance for pollution reductions or plans to abate in future using environment friendly techniques of production.
- [11] Green Tax / Pollution Charges – A fee charged to the polluter that varies with the quantity of pollutants released.
- [12] Individual and Social behavior- Individual behavior can be defined as a mix of responses to external and internal stimuli. It is the way a person reacts in different situations and the way someone expresses different emotions like anger, happiness, love, etc. Social behavior is behavior among two or more organisms within the same species, and encompasses any behavior in which one member affects the other. This is due to an interaction among those members. In case of humans, social behavior can be determined by both the individual characteristics of the person, and the situation they are in.
- [13] Inequality- Difference in income between individuals or families, or between different groups, areas or countries. These differences might be due to difference in earning abilities, and in property. In this paper we advocate the main cause of inequality is because green assets are not properly valued. What is possessed by underdeveloped or developing nations or unexplored natural assets should also be valued. To intact the nature.
- [14] Pollution Permits Trading system- The establishment of a market for rights to pollute, using either credits or allowances.
- [15] Potential for Development- Nature can meet our needs but not greed's. Nature nurtures naturally to all living beings but it has its own limitations. Unless and until it revies which takes too much time resources are limited. Introduction of green asset valuation and green currency market presents a guiding principle to control unsustainable growth. As growth of a country depends upon the use of natural resources globally but the current economic models have no checks on growth and development process as all models never takes into account the capacity or the potential of growth.
- [16] Poverty- Inability to afford an adequate standard of consumption. According to the most recent estimates, in 2015, 10 percent of the world's population or 734 million people lived on less than \$1.90 a day. Even before COVID-19, baseline projections suggested that 6 per cent of the global population would still be living in extreme poverty in 2030, missing the target of ending poverty. The fallout from the pandemic threatens to push over 70 million people into extreme poverty. In this paper we advocate that poor is poor because he is not compensated for what he possesses or protects (that is environment). A poor person or nations have low pressure on environment compared to rich or developed nations. Globally these calls for the budget provisions accordingly.
- [17] Property Rights- The rights of an owner over property. As property rights of environment green assets and public goods or common goods are not well defined it hinders the economic efficiency. So, to enhance economic efficiency green assets possessed by individuals, firms, government or organizations must be calculated and an asset value must be assigned to the owner. Due to negative externality too much of the good will be produced as market price does not reflect external costs.
- [18] Sustainable Development- Sustainable development is an organizing principle for meeting human development goals while also sustaining the ability of natural systems to provide the natural resources and ecosystem services on which the economy and society depend.

Additional Readings-

- [1] OP Singh-Valuation of Environmental Goods and Services Regency Publications, New Delhi First Edition, July 2006.
- [2] Charles D. Kolstad- Intermediate Environmental Economics, Oxford University Press 2nd Edition 2011.
- [3] Scott J. Callan & Janet M. Thomas- Environmental Economics and Management Theory, Policy and Applications, SWCL, 6e 2013.
- [4] Kailashi Punit D, Kamal Hiran and Indu Sharma- Essence of Life Divide by Zero A Scientific Approach to Sustainable Development, Notion Press India, 1e 2021.
- [5] Stiglitz & Walsh-Economics, ISE Norton, 4e, 2006.
- [6] Tim Jackson- Prosperity Without Growth: Economics for a Finite Planet, Routledge 2e, 2016.
- [7] Naomi Klein - This Changes Everything: Capitalism vs. The Climate, Penguin 2015
- [8] Frank Ackerman and Lisa Heinzerling - Priceless: On Knowing the Price of Everything and the Value of Nothing, The New Press, 2004.
- [9] Stephen Smith - Environmental Economics: A Very Short Introduction, Oxford University Press UK 1e, 2011.
- [10] Jonathon Porritt - Capitalism: As If the World Matters, Routledge 1e, 2016.
- [11] Mariana Mazzucato – The Value of Everything, Public Affairs, 2018
- [12] Environmental Economics an Indian Perspective Edited by R. N. Bhattacharya. Oxford University Press 2002.

AUTHORS

First Author – Dr. (Prof.) Suman Pamecha, Dean and Principal MVS College, Rajasthan Vidyapeeth Deemed to be University, Udaipur, Rajasthan, India.

Second Author – 'Kailashi' Punit D. Sharma, Scholar, Department of Economics, MVS College, Rajasthan Vidyapeeth Deemed to be University & Chief Planning Officer, Udaipur, Rajasthan, India.

Third Author – Dr. Indu Sharma, Associate Professor Economics, Government Meera Girls College, Udaipur, Rajasthan, India

Bioplastic formation from wasted paper

Rovan Ashraf

* High School, Red Sea STEM

DOI: 10.29322/IJSRP.12.10.2022.p13081

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13081>

Paper Received Date: 24th September 2022

Paper Acceptance Date: 25th October 2022

Paper Publication Date: 30th October 2022

Abstract- Plastics created from fossil fuels are quite widespread in our lives, and we cannot imagine our existence without them. At the same time, they are non-biodegradable and emit greenhouse gases, posing an environmental issue. Biodegradable bioplastic is the solution to this issue. Plastics created from renewable biomass sources, such as vegetable fats and oils, corn starch, pea starch, or microbiota, are known as bioplastics. Bioplastics can be made from a range of sources, including starches, cellulose, and other biopolymers. In this work, we will discuss the production of bioplastics from cellulose, with waste papers serving as our raw material and the pH sensor serving as our feedback control mechanism.

Our research is focused on improving the plastic industry through the recycling of wastepaper. The prototype that we built on a modest scale was made up of three parts. Notably, the method of converting wastepaper into bioplastic was accomplished through chemical treatment using acetic acid (CH₃COOH) and sulfuric acid (H₂SO₄). And three test designs were created; the first and second were successful in producing plastic, but they did not accomplish the intended outcomes. The third one succeeded in meeting the design requirements by creating bioplastic with high efficiency that can be utilized to make plastic. The project is finished after the feedback control system is installed. Meanwhile, our prototype is running automatically, thanks to a DC motor, a water pump, an Arduino, and a PH sensor that measures the pH of the solution and modifies it until it is neutralized. Finally, countries' environmental pollution will be regulated during the large-scale development of our prototype. In addition to expanding the industrial sector.

Index Terms- Paper, Recycling, Esterification, Cellulose Diacetate, Feedback control system

I. INTRODUCTION

Bioplastics are synthetic polymers derived from renewable biomass such as vegetable fats, oils, starch, or microbes. Petroleum-derived polymers, such as fossil-fuel plastics, rely more on fossil fuels and release more greenhouse gases. Some bioplastics, but not all, are biodegradable. Biodegradable bioplastics can deteriorate in either anaerobic or aerobic environments, depending on how they are made. Bioplastic can be manufactured from a variety of materials such as starches, cellulose, and other biopolymers. Bioplastics are widely utilized in packaging, tableware, food packaging, and insulation.

Polylactic acid is the world's second most important bioplastic in terms of volume usage. Polylactic acid is a transparent plastic derived from corn or dextrose. Its qualities are like those of traditional petrochemical-based mass polymers, and it can also be processed using common equipment that is already used to make some conventional plastics. Polylactic Acid mixes of various grades are granulated and used in the plastic processing sector to manufacture films, fibers, plastic containers, cups, and bottles. Polylactic Acid, a plastic substitute made from fermented plant starch (typically maize), is quickly gaining traction as a viable alternative to traditional petroleum-based polymers. Some countries have outlawed plastic shopping bags, which are responsible for much of the world's "white pollution." Bioplastics are now made from corn starch, potato starch, or banana starch, which are all edible to humans and animals. Paper, as we all know, is the world's second greatest producer of garbage, accounting for 17% of total waste, and the third largest industrial polluter of the environment. So, instead of using starch excreted from food items, I recommend employing wastepaper, which is largely constituted of cellulose and is disposed of in the seas. We will look at how to convert wastepaper into biodegradable plastic and how to eliminate errors that occur throughout the process by incorporating a feedback control system in this study.

Paper is made up of short cellulose fibers that can be easily converted into bioplastic by a chemical treatment. So, in this process, cellulose is recovered from waste papers using an acetic acid pretreatment reaction. The cellulose is then esterified with acetic anhydride to produce cellulose triacetate. After removing the acetyl group from cellulose triacetate, it is converted into cellulose diacetate. Finally, bioplastic is created by combining it with acetone or another solvent.

II. MATERIALS

Wasted paper or any source of cellulose as I used filter paper, Acetic acid, Sulphuric acid, Acetone, and Acetic anhydride from a chemicals company, Plasticizers from the plastic industry
The electronic components are Arduino UNO, H-bridge, Water pump, DC motor, Wires, Power supply, Breadboard, LCD, Regulator, And finally Constant & variable resistance from an electronic shop.

III. PREPARATION OF CELLULOSE FIBERS BY ESTERIFICATION

The method has described the preparation of cellulose fibers. 10 grams of cut paper were transferred into a 1-L beaker and treated with 50ml of acetic acid and half a gram of sulphuric acid solution. Then mixed it around for a couple of minutes to make sure that all the paper was wet. The mixture was heated with occasional stirring for 1 h at a temperature range of 60–65°C. it is a pre-treatment process that helps open the normally tightly packed cellulose fibers. This allows the fibers to be acetylated more evenly, and it'll also speed up the reaction. After 1 hour, the pre-treatment is done and now it was time to acetylate it. a mixture of acetic acid and acetic anhydride was added, to cover the top, and put the beaker in a hot water bath for 30 minutes at a temperature range of 60–65°C. What happened here is a reaction between the acetic anhydride and the hydroxyl groups of cellulose. Each glucose subunit has three hydroxyl groups and almost all of them will get acetylated This type of reaction is known as the ESTERIFICATION Reaction, and it leads to the formation of cellulose triacetate Which is soluble in the acid mixture. as the reaction progresses all the paper should slowly disappear. After that take the beaker out of the hot water bath and separate the solution evenly into two round bottom flasks to make two forms of cellulose acetate and to compare the results between them.

The formation of cellulose triacetate

Take one of the round beakers and put it back in the hot water bath and add a stir bar This time though the water bath is slightly hotter, and it's held around 60 C Then pour 25ml of 80% acetic acid into the solution. The other 20% of this is just water and up until this point, everything was completely water free the purpose of adding it now is to destroy any excess acetic anhydride that remains. After the addition keep it here for about 15 minutes and then pour it all into a beaker and slowly mix in about 25ml of distilled water, and a whole bunch of triacetate starts to appear Then on top of this then pour in 200ml more to completely knock out the rest then mix it up well, and let it sit for a couple of minutes To separate the triacetate just dump it into my vacuum filter, and turn on the pump. All the water is quickly pulled out, but unfortunately, this is the beginning of the kind of annoying part. The reaction mixture that I'm filtering off is highly acidic and well this [acidity] gets all absorbed into the cellulose, so just pulling away the water isn't good enough, and there's a whole bunch of acid that's still trapped inside, and then transfer it to the vacuum filter to pull away all of the liquid, and then just like last time put them both in my toaster at low heat for a couple of hours to dry.

The Formation of cellulose diacetate

Using the second-round flask, drop in a stir bar in it and wait for it to warm up to about 60 C then add a dilute mixture of acetic acid with a small amount of sulfuric acid by adding water here as well as sulfuric acid it will be hydrolyzing some of the acetyl groups and converting them back to hydroxyls. run it under these conditions for about three hours Which should on average remove one acetyl group for every glucose unit. the major product will be cellulose diacetate, but sometimes some triacetate will remain unaffected and will form some monoacetate when it's done, Finally, transfer everything to a beaker, and from this point on the workup is the same as the last run. slowly add 25 mils of distilled water with stirring in between in the previous run it seemed like once the precipitate appeared It was there to stay, but this time all Reda's all's back into solution to knock it out. I must add a bunch more water, so pour in 200 mils and mix it thoroughly let it sit for a couple of minutes, and then transfer it to the vacuum filter to pull away all of the liquid, and then just like last time then put them both in my toaster at low heat for a couple of hours to dry.

Testing the powders with acetone

When they're both dry left with some nice hard and crunchy powders, in Any case, I'm gone move on and do a quick test on both to see if they are two forms of cellulose acetate the test is easy. And just need to see if they dissolve in acetone. So, add a small amount of each to two test tubes followed by an equal amount of acetone. ended up adding more acetone to speed things up and all the diacetates eventually dissolved however most of the triacetate remained This is exactly what's expected to happen, and it confirms that we did make two different products.

The products of two crunchy samples

The triacetate powders

moved on to trying the same things with the triacetate except for this time. I can't use acetone because the triacetate isn't soluble in it so instead I use a mixture of nine to one DCM to methanol I started with a bit more solvent than I needed here, so I just kept adding the triacetate until I got to a saturated solution I Poured it all into a glass dish and this time I decided to do a time-lapse I also want to see what would happen if I lightly blew on it with a fan and the answer is that it's not good The solvent evaporated way too quickly and the triacetate contracted in on itself by the time all the solvent disappeared and as I expected it was brittle There was little to no flexibility and it snapped and shattered with only a bit of bending so, the triacetate powder didn't achieve the design requirements and failed in its mission to form the plastic films

The diacetate powder with and without plasticizers:

threw a random amount that was enough into a beaker, and then shot in some acetone the Quantities here aren't super important, and I'm just trying to make a concentrated solution it took quite a bit of stirring and something like five minutes, but eventually, everything disappeared and let it evaporate on something thought it would just stick to the sides and be a complete mess, but it was extremely easy to remove It's not the most beautiful piece of plastic. it seemed to be a little bit more flexible, then I wanted to try next to see if I can make the plastic less brittle by adding a plasticizer The thali beast plasticizers are the most used ones. I decided to go with 20% I Went with 20 because it seemed to offer a good combination of strength as well as flexibility Anyway, just like before. It was all dissolved in a minimal amount of acetone and then pour it into a glass dish I Wait for all the solvent to evaporate and I remove it from the dish Parts of it were still pretty brittle, but in general, It was a lot more flexible the quality of my film is still not very good But you can see that the addition of the plasticizer did get it closer to being a usable product I think the reason why it's still kind of brittle is because of the low-quality cellulose acetate amusing Even after everything was dissolved in the acetone. I did snap off a small portion of it this small section was extremely flexible but it was also pretty strong I was able to completely bend it in half and it was very elastic

IV. FEEDBACK CONTROL SYSTEM

The feedback is an electric signal transmitted from the output to the controller, allowing the controller to calculate how the output differs from the desired value. With the help of this feedback signal, the controller would be able to determine the previous state of the system output. To obtain the appropriate output, the controller would calculate the error and modify the system input. The closed-loop system is also known as a feedback system because it feeds back the output into the input to clear mistakes and maintain the required output quality. The feedback control's purpose is to eliminate the measured disturbances. The feedback controls are automated, and they should do the detecting, calculating, and manipulating that the equipment should do, and each element in the control system must interact with the others.

The products generated throughout the test plans had various flaws that damaged the product itself. These flaws can be increased by the product's pH. As is customary, the product has a high acidity due to the addition of acids during the processes, and it was discovered that the acidic medium affects the product's flexibility and tensile strength.

The feedback control system was used to solve this problem. It will include a pH sensor, an Arduino board, a water pump, and a DC motor. It will be placed in the last step of the product before it dries. The goal is to transmit positive or negative feedback to the microcontroller, which will then act based on its nature. If the feedback is positive, it means that the pH of the product is approaching 7, and the project's program will stop at this point and go on to the next step. However, negative feedback indicates that the pH of the solution is still acidic. In this case, the water pump and DC motor will be opened and immersed in water until the pH of the product becomes neutral.

As Most of the time, the solution will be acidic and it will affect the final product, this problem will be solved by making a feedback system on the solution. This is by using the pH sensor which will measure the pH of the solution, water pump, and DC motor to stir the solution. The program was made to continue inserting water until the pH approaches 7 then the pump will stop and at this time a buzzer will make a sound means the program is ended and the product is ready the results of changing the pH will be shown on LCD.

The connection of the feedback control system

a cubic stand was designed to place the components above it which are: Arduino, H bridge, breadboard, LCD, resistance, and the buzzer for the feedback system. In addition, make a hole on the top of it for the DC motor to be connected to a stick that will stir the solution and a water pump in a container behind the cubic stand to add water to the solution.

Next, the LCD was connected to the breadboard and the pins of the breadboard were connected to the Arduino. Moreover, the variable resistance was connected to an LCD to control the intensity of the light.

Moreover, the PH sensor was connected to the Arduino and got its voltage from the breadboard, and the buzzer was connected to the constant resistance and the resistance to the breadboard. In addition to the second pin from the buzzer was connected directly to the Arduino. Then, the water pump and the Dc motor were connected to the H bridge, and the pins of the H bridge were connected to the Arduino. in addition, we have connected the project to a power supply by using a regulator as shown in the figures (1&2).

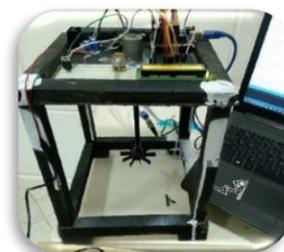


Fig (1)



Fig (2)

Following that, the Arduino was connected to the laptop by using an Arduino wire “USB2.0 printer cable” to upload the codes.

The Nernst equation will be utilized to compute the PH value of a solution. The Nernst Equation governs the glass electrode response and can be written as

$$E_{\text{cell}} = E_{\text{cell}}^{\ominus} - \frac{RT}{zF} \ln Q_r$$

Where:

Q= Reaction coefficient / E = mV output from the electrode / E0 = Zero offset for the electrode / N = Ionic Charge / R = Ideal gas constant= 8.314 J/mol-K / T = Temperature in °K / F = Faraday constant = 95,484.56 C/mol

The most common form of the motor is a DC motor (Direct Current motor). There are only two leads in most DC motors: one positive and one negative. The motor will rotate if these two leads are connected directly to a battery. The motor will rotate oppositely if the leads are switched, so we will utilize it to stir the solution.

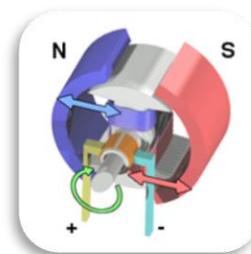


Fig (3)

Fig (4) shows a simulation of the connection of the feedback control system.

This is the finished project code link <https://bit.ly/3FGNT12>

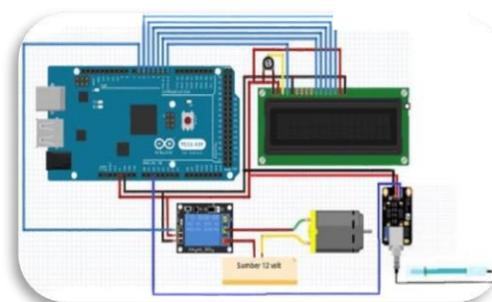


Fig (4)

V. REFLUX REACTION:

Reflux involves heating the chemical reaction for a set length of time while employing a condenser to continuously cool the vapor produced back into liquid form. The vapors created above the reaction are constantly condensed and return to the flask as a condensate. It ensures that the temperature of the reaction remains constant in this manner.

The acetic anhydride is required to complete the reaction during the project, but it is not available to gain, therefore we will make it use the reflux reaction. The goods will be of the same high quality as the original.

Acetic acid and sulphuric acid will be the only ingredients used in the reaction. They will install an air conditioner for two hours. Acetic acid to sulphuric acid concentration is a 2:1 ratio of concentrated acids.

The reaction will take 2 hours to complete before the product is created.

Figure (5) shows the air condenser device



Fig (5)

VI. PROTOTYPE DESIGN

The prototype was supposed to convert paper into plastic in three stages:

1-The first stage consists of the clamp stand being put to hold the flask which is in a beaker containing the water heater. And a beaker contains cut wastepaper that will be mixed with acetic acid and sulfuric acid before passing through another container that is the water pass with a water heater, all of which are held together by a clamp stand as in figure (6)



Fig (6)

2-The second stage will take the solution after the chemical treatment to neutralize it using a feedback control system, which consists of the cubic stand. comprised of a water pump that is responsible for adding water to the solution and a PH sensor that will determine the acidity of the solution and send signals to the water pump to stop adding water until the PH reaches 7. Furthermore, the DC motor is linked to a stick that is used to stir the solution. As shown in figure (7)

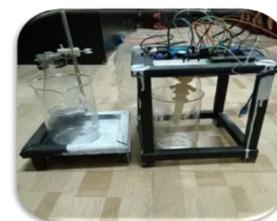


Fig (7)

3-The third stage consists of the vacuum filter prepared to separate the diacetate from the water as shown in figure (8)



Fig (8)

figure (9) shows the final prototype

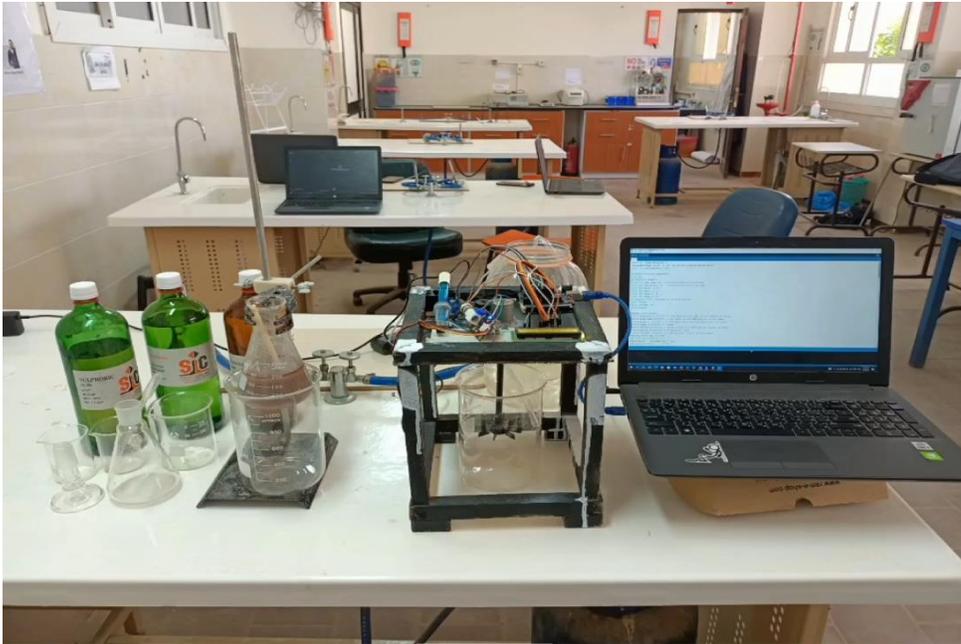


Fig (9)

VII. TEST PLANS

The test plan is completed to check that the solution met the design specifications. the efficiency of our prototype was increased, as evidenced by the tests that we conducted. Three trials were used in the test plan:

The first trial is as follows:

It was done manually without measuring the PH or using a feedback control mechanism, however, the powder of the combination after drying was not as expected. The product was cellulose triacetate. It was yellow because it was acidic, and its texture was like fine sand that might be broken; therefore, its flexibility was poor.

The second trial:

Here the process was modified to produce cellulose diacetate instead of cellulose triacetate Utilizing After drying the mixture, we obtain the diacetate. Its qualities were superior to the first. The yellowish color faded, and the flexibility improved. It had a plastic-like texture, but it also has some problems with flexibility and strength, however, the results were better than in the first trial.

The third trial:

we attempt to correct the problem by utilizing the feedback control method. Arduino did it automatically since it regulates the neutralizing reaction of the mixture. Utilizing After drying the mixture, we obtain the diacetate. Its qualities were superior to the first. The yellowish color faded, and the flexibility improved. It had a plastic-like texture and was more difficult to break than the first and second ones.

it involves adding Plasticizers to the mixture in addition to using the feedback control mechanism. This greatly increased its elasticity, making it difficult to break. The powder was white in color and had a texture like that of plastic.

VIII. RESULTS

The product was cellulose triacetate, and it failed due to insufficient flexibility and strength. Because plastic shrinks after drying, it did not take the shape of the template, and this product does not match our criteria. In this case, we modify the results (second test plan) by adding some acetic acid and water to the solution. By adding acetic acid, the solution is converted from cellulose triacetate to cellulose diacetate. Although cellulose diacetate is not easily soluble in acetone, it overcomes the problem of creating a plastic shape and does not shrink. However, it has several issues, such as the product's color being dark yellow when the desired outcome was light beige, which affects the color of the plastic liquid. The texture was grainy rather than smooth, as expected, and it has a lot of problems with solubility because it requires more work to dissolve. So, while the second test results did not match the requirements, they were very close. Flexibility and strength improve, but they are far from ideal. We determined that the problem was in the pH of the solution because it was acidic, and the ideal pH for cellulose acetates is 7. So, we add another component, the feedback control mechanism. The feedback control method eliminates the majority of the previous issues, and our third test plan is successful.

So, fig (10) shows the final plastic sheets from our project.

The diacetate product is seen in fig (11).

The triacetate product is seen in fig (12).



Fig (12)

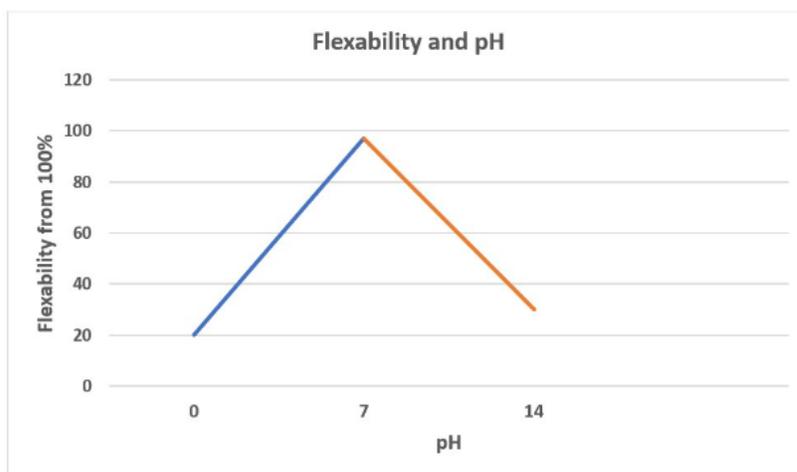
Fig (11)

Fig (10)

The following graphs show our results:

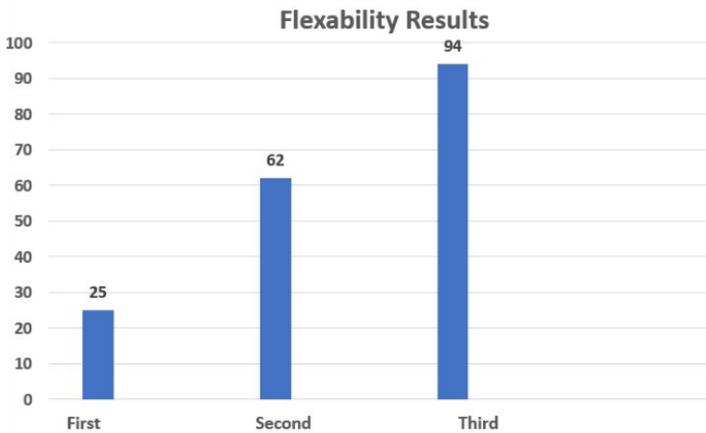
Three tests were performed, the first of which created triacetate, the second of which involved adding acids to produce diacetate, and the third of which included the feedback control system.

Graph (2) displays the relationship between flexibility and the pH of the mixture and demonstrates that adding acids to convert it to diacetate lowers the pH level, which increases flexibility, and when the solution is neutralized, it reaches its maximum flexibility, which meets the project's requirements.

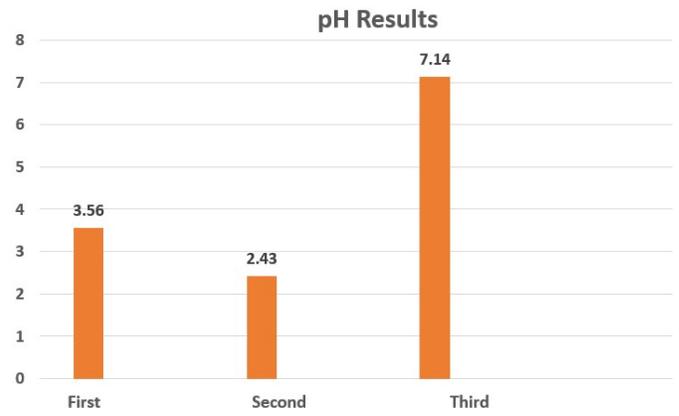


Graph (1)

Graphs (2&3 and) depict the relationship between pH value and flexibility. According to research and observations, increasing the pH from 0 to 7 enhances flexibility, but when the pH hits 7, it is regarded as a breakdown point where flexibility diminishes as the solution becomes more basic.



Graph (2)



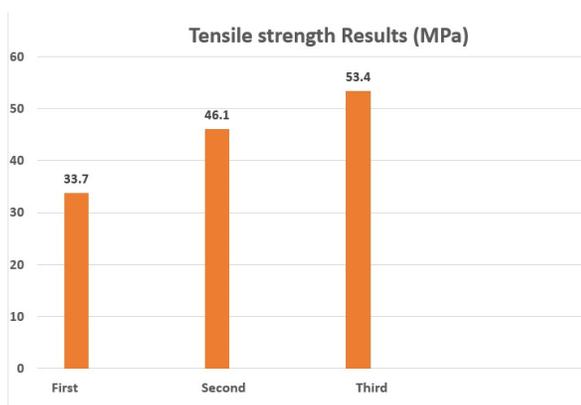
Graph (3)

	First	Second	Third
Flexibility	25%	62%	94%
pH value	3.56	2.43	7.14

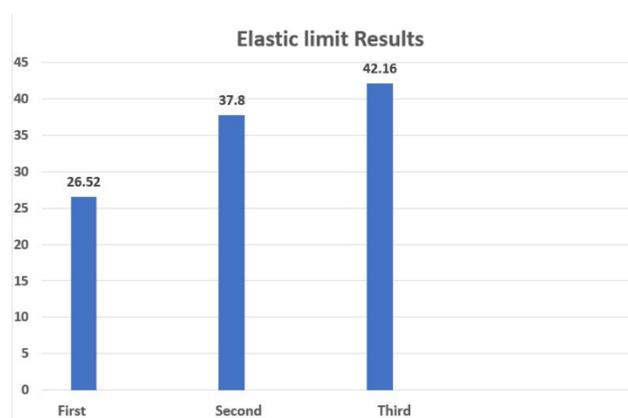
Table (1)

The tensile strength and elastic limits data are shown in graphs (4&5 and) to determine the product's durability. In this case, increasing the pH increases both the tensile strength and the elastic limits.

A tensile tester was used to determine the tensile strength, which can also be calculated using the formula $\sigma_{max} = P_{max} / A_0$. where P_{max} = maximum load, A_0 = original cross-sectional area.



Graph (4)

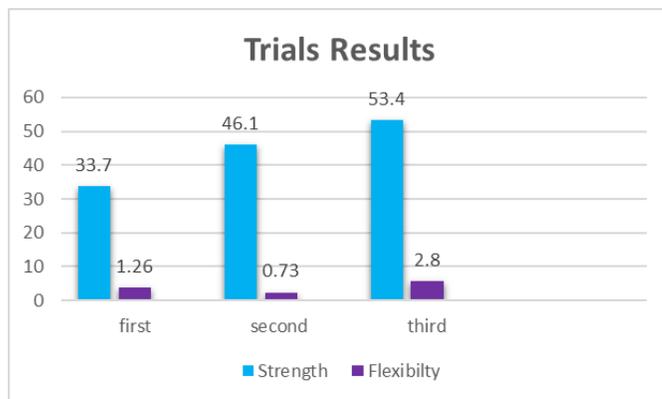


Graph (5)

	First	Second	Third
Elastic limit	26.32	37.8	42.16
Tensile strength	33.7	46.1	53.4

Table (2)

Graph (6) represents the final data that was collected during the project. it shows the tensile strength and the flexibility of the 3 trials. The third trial was the perfect one in which her results were approached to the real plastic as the flexibility and the tensile strength of the real plastic are 3 and 56.9 respectively. So, the project succeeds and achieves its design requirements.



Graph (6)

	First	Second	Third
Strength	33.7	46.1	53.4
Flexibility	1.26	0.73	2.8

Table (3)

IX. Discussion

The world generates 2.01 billion tons of municipal solid waste annually, with at least 33 percent of that—extremely conservatively—not managed in an environmentally safe manner.

When looking forward, global waste is expected to grow to 3.40 billion tons by 2050. Paper is the second-largest amount of waste globally as it presents 28.5% of the total wasted and is the 3rd largest industrial polluter of the environment. As shown in figure (13).

Fossil fuel plastics derived from petroleum are very common in our lives and we cannot think of our day without their use. At the same time, they are non-biodegradable and produce greenhouse gases, thus causing an environmental problem.

The solution to this problem is biodegradable bioplastic. Bioplastics are plastics derived from renewable biomass sources, such as vegetable fats, oils, or corn starch.

Fig (14) shows the structure of the bioplastic. There is a variety of materials in that bioplastics can be composed of cellulose or other biopolymers. The raw material used here is wasted paper, paper is short cellulose fibers, and thread-like structures can easily convert into bioplastic by a chemical treatment.

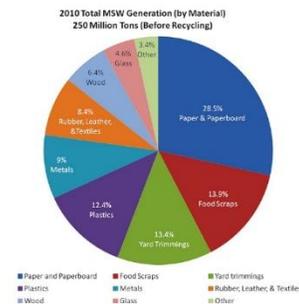


Fig (13)

the main idea of the solution is to convert the wasted paper into bioplastic. And this will be done a converting the cellulose fibers to acetate easier by the esterification reaction according to the organic chemistry and then to cellulose triacetate, and from cellulose triacetate to cellulose diacetate to meet the design requirement.

Fig (15) shows a summary of all the project reactions.

The prototype is designed to meet the project's procedures as it consists of 3 main parts. The first part represents half of the project, as most of the steps and chemical reactions will take place in it. The first part consists of a clamp stand, a movable flask on it, a glass container with water, and a glass heater. The second part is the feedback control system, which consists of a beaker, pH sensor, DC motor, and water pump to form the final product. The third part consists of a vacuum filter to remove excess water from the diacetate. The final product is left to dry, and a powder is formed. In this case, we dissolve the powder in acetone until

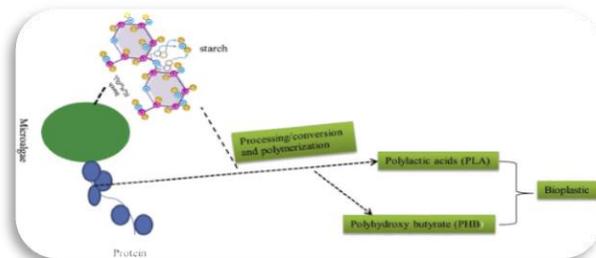


Fig (14)

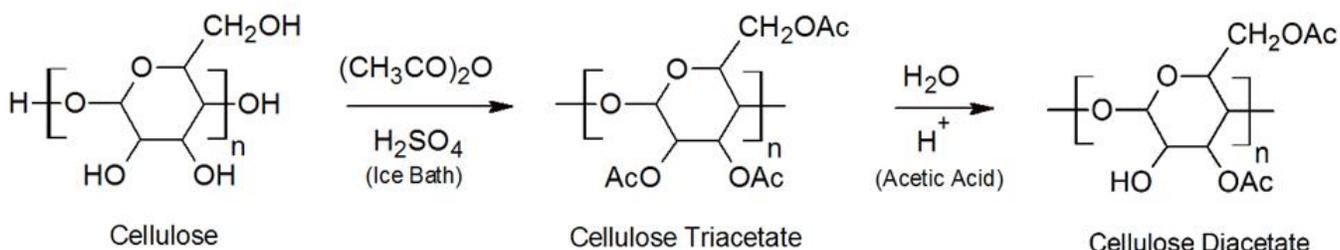


Fig (15)

the plastic is formed and put in the temple to take its shape.

Testing the prototype was done 3 times. the first-time product of the project was cellulose triacetate which is produced from cellulose as a source of acetate esters (triacetate). To form a plastic liquid, the resulting powder will dissolve in acetone, but the cellulose triacetate doesn't dissolve easily and needs some extra effort to dissolve. After dissolving it we pour it into a glass pot and let it dry.

Fig (16) shows the plastic resulting from cellulose triacetate and how it has a lot of problems. the product does not meet the design requirements. So, a chemical modification was done on cellulose triacetate to prepare cellulose diacetate. Cellulose diacetate is prepared consecutively from the cellulose triacetate solution by diluting acetic acid with water and heating. When the diacetate is dissolved in acetone and let it dry. The results were perfect but there were some problems firstly in the shape and the characteristics of the diacetate powder as the color of the powder was dark yellow, and the expected color was light beige. Secondly, the texture of the triacetate powder was rough. Thirdly, the solubility of diacetate was not easy. after searching we find that the cellulose diacetate will be soluble in acetone when its pH becomes 7. And in our solution, the product was an acidic mixture. not suitable pH can change its properties as shown. So, the feedback control system will be put to solve this error and achieve the design requirements which are the efficiency of the plastic and its applicability during preparation as shown in figure (17) the product of diacetate after inserting the feedback control system



Fig (16)



Fig (17)

X. CONCLUSION

After extensive study, it was discovered that the rate of wasted paper is the third cause of pollution in the environment, and the plastic industry consumes a lot of energy, therefore it was critical to find a solution to enhance the plastics industry while also lowering this type of pollution. As a result, our proposal, which is based on converting wastepaper into bioplastic, was chosen to be implemented because the plastic sector consumes a lot of energy, which can be reduced. We determined that the plastic met the design requirements in the third trial, where it has a higher proportion of hardness and flexibility, at the end of our prototype and after evaluating our solution. It has also been discovered to be more effective than other alternatives since it addresses three additional major challenges: pollution, waste recycling, and industry development.

Advantages of cellulose bioplastic over petroleum-based bioplastic

- What distinguishes bioplastic from petroleum-based plastic is that the manufacturing process can be reversed when the plastic ends up in a compost heap. Fungi and bacteria in the soil begin to degrade the cellulose bioplastic into its constituent pieces. The bioplastic will compost like any other organic material under aerobic (oxygen-rich) conditions, with heat and moisture. Compost bioplastic is broken down by microorganisms into humus, a nutrient-rich, soil-like substance that works as natural plant food. Carbon dioxide and water are the waste products.
- Cellulose bioplastic aids in the reduction of greenhouse gas emissions. Proponents also praise the use of cellulose, which is technically carbon neutral because it is derived from renewable, carbon-absorbing plants, as yet another approach to cutting greenhouse gas emissions on a rapidly warming planet. When burnt, cellulose bioplastic will not release any toxic fumes.

XI. ACKNOWLEDGMENT

It is an excellent opportunity for us to write on a topic such as BIO-PLASTICS. We read many books and websites while preparing this paper, which helped us become acquainted with new themes. We are concentrating on the things that are essential for us to learn this subject quickly.

We are grateful to prof. Saif Soliman, our respective teacher, has always been supportive.

been serious and helpful in helping us comprehend the many research systems and conceptual challenges in our article.

Apart from us, this report will undoubtedly be of great interest to anyone who wishes to learn more about this subject. We hope they will find it understandable.

We worked hard and sacrificed our souls to collect all essential documents on this issue. We don't know how far we'll be able to go.

Furthermore, we do not claim that all the information in this document is completely accurate. There may be shortcomings, factual errors, and incorrect opinions that are all our fault, and we are all liable for them, but we will attempt to provide a better volume in the future.

XII. REFERENCES

- [1] Ndis-brochure - prime minister of Jamaica. (n.d.). Retrieved April 25, 2022, from <https://opm.gov.jm/wp-content/uploads/2017/02/NIDS-brochure.pdf>
- [2] Making plastics: From monomer to polymer. AIChE. (2016, July 26). Retrieved April 25, 2022, from <https://www.aiche.org/resources/publications/cep/2015/september/making-plastics-monomer-polymer>
- [3] How plastics are made • plastics Europe. Plastics Europe. (2022, January 14). Retrieved April 25, 2022, from <https://plasticseurope.org/plastics-explained/how-plastics-are-made/>
- [4] Does your car's oxygen sensor need replacing? Burt Brothers. (2019, April 1). Retrieved April 25, 2022, from <https://burtbrothers.com/blog/does-your-cars-oxygen-sensor-need-replacing/>
- [5] Foam recycling services: Foam recycles LLC: Sunnyvale. foam. (n.d.). Retrieved April 25, 2022, from <https://www.foamrecycle.org/>
- [6] Does your car's oxygen sensor need replacing? Burt Brothers. (2019, April 1). Retrieved April 25, 2022, from <https://burtbrothers.com/blog/does-your-cars-oxygen-sensor-need-replacing/>
- [7] Cellulose acetate. Cellulose Acetate - an overview | ScienceDirect Topics. (n.d.). Retrieved April 25, 2022, from <https://www.sciencedirect.com/topics/engineering/cellulose-acetate#:~:text=Cellulose%20acetate%20is%20obtained%20by,essential%20change%20in%20its%20biostability.>
- [8] Sulphuric acid + acetic acid. Sulphuric acid + acetic acid - Sandvik Materials Technology. (n.d.). Retrieved April 25, 2022, from <https://www.materials.sandvik/en/materials-center/corrosion-tables/sulphuric-acid-acetic-acid/>
- [9] Encyclopædia Britannica, inc. (n.d.). Esterification. Encyclopædia Britannica. Retrieved May 10, 2022, from <https://www.britannica.com/science/alcohol/Esterification>
- [10] Bio-based, biodegradable, and Compostable Plastics. Environment. (n.d.). Retrieved May 10, 2022, from https://ec.europa.eu/environment/topics/plastics/bio-based-biodegradable-and-compostable-plastics_en
- [11] Plastic factory in Egypt: Egypt yellow pages. plastic factory in Egypt | Egypt Yellow Pages. (n.d.). Retrieved May 10, 2022, from <https://yellowpages.com.eg/en/condensed-search/plastic-factory>
- [12] U.S. National Library of Medicine. (n.d.). Acetate. National Center for Biotechnology Information. PubChem Compound Database. Retrieved May 10, 2022, from <https://pubchem.ncbi.nlm.nih.gov/compound/Acetate#:~:text=Acetate%20%7C%20C2H3O2%2D%20%2D%20PubChem>

- [11] Libre texts. (2022, May 5). 1.4K: Reflux. Chemistry Libre Texts. Retrieved May 10, 2022, from [https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Organic_Chemistry_Lab_Techniques_\(Nichols\)/01%3A_General_Techniques/1.04%3A_Heating_and_Cooling_Methods/1.4K%3A_Reflux](https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Organic_Chemistry_Lab_Techniques_(Nichols)/01%3A_General_Techniques/1.04%3A_Heating_and_Cooling_Methods/1.4K%3A_Reflux)
- [12] Home. Arduino. (n.d.). Retrieved May 10, 2022, from <https://www.arduino.cc/>
- Gaz. (2022, May 9). Improving waste management in Egypt. Stateside. Retrieved May 10, 2022, from <https://www.giz.de/en/worldwide/22230.html>
- [13] The importance of recycling - international nuclear information system. (n.d.). Retrieved May 10, 2022, from https://inis.iaea.org/collection/NCLCollectionStore/_Public/46/062/46062898.pdf
- [14] Joshi, S., Sharma, U., & Goswami, D. G. (2018, July 30). Bioplastic from Waste Newspaper. International Journal of Engineering Research & Technology. Retrieved May 10, 2022, from <https://www.ijert.org/bio-plastic-from-waste-newspaper>
- [15] Bio-based, biodegradable, and Compostable Plastics. Environment. (n.d.). Retrieved May 10, 2022, from https://ec.europa.eu/environment/topics/plastics/bio-based-biodegradable-and-compostable-plastics_en

AUTHORS

First Author – Rován Ashraf, a student at one of the international schools associated with science and scientific research, STEM High School, rovan.1620527@stemredsea.moe.edu.eg

Correspondence Author – Sarah Fathy, sarah.el-shamy@stemredsea.moe.edu.eg, 01285829276.

Correspondence Author – Amina Mohamed, amina.ahmed@stemredsea.moe.edu.eg, 01116121515.

Correspondence Author – Saif Soliman, drsaifsoliman@gmail.com, 01001684710.

The effect of e-Banking on Tanzania commercial banks' Return on investments: A case of CRDB bank in Same district Kilimanjaro Region

Fadhili E. Maseko

Institute of Accountancy Arusha, Dodoma campus

DOI: 10.29322/IJSRP.12.10.2022.p13082
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13082>

Paper Received Date: 24th September 2022

Paper Acceptance Date: 25th October 2022

Paper Publication Date: 30th October 2022

Abstract- The objective of the study is to assess the performance of electronic banking on Return on Investment of CRDB Bank. There is a mixed result on relationship between e-banking, bank performance. A survey design was adopted wherein CRDB branches in Same district were involved. The study collected information from 120 respondents, out of whom 100 were bank customers and 20 were bank officials. The study established that e-banking played a great role in providing financial services to the customers and that the e-banking has a positive effect on return on investment of CRDB bank. The study recommends, BOT to issue policies and guidelines which will help bank customers, on dealing with electronic banking and there is a need to have proper laws on adoption and cover of E-banking as the Banks and Financial Act of 2006 do not cover the E-banking practice.

Index Terms- Electronic banking, Return, Investment, Financial performance

I. INTRODUCTION

The use of information communication technology such like electronic banking is of paramount importance in the age of globalization. E-banking has brought significant improvement in the banking industry as it has eased provision of bank services and operations in general. Steven (2002) cited in Wisdom (2012) stated that e-banking has become not only an option but also a need that is useful to all banks as it improves bank activities and increases customer satisfaction. Electronic banking has been defined by Georgescu (2005) as cited by Kinyua (2014), as providing retail banking products and services as well as large payments and other wholesale banking services delivered electronically. Daniel, (1999) cited by Husni, (2011) stated that electronic banking is a system that enables all financial institutions stakeholders to make use of bank service such as accessibility of bank accounts and transactions of business and other activities.

According to Chang (2003), electronic banking is significant towards bank performance and customer satisfaction. That means that banks which use e-banking services are seen as having a better brand image both in the eye of the customer as coined by (Keremet et al., 2003). It has been discovered that the

forms of electronic banking include internet banking, telephone banking and personal computers banking. Telephone banking is undertaken through call centers depending where the customer is (Peter, 2003), personal computer banking consist of using a personal computer to make banking transaction with a financial institution while mobile banking exploits the mobile phone system by making transactions between the customer and the bank (Chovanova, 2006). ATMs make clients to withdraw cash, transfer money and make balance inquiries without necessarily visiting the bank hall (Sing & Komal, 2009).

Robert (2011) found that electronic banking has landed in Tanzania and several based electronic banking services exist until today such as automated teller machines (ATM), internet banking, smart cards, credit cards, m-banking, phone banking and anywhere-anytime banking. All these services have provided a number of convenient services to the customer, increased service quality while increasing as well customer satisfaction and bank financial performance. For example, to adopt Automated Teller Machines in various banks and financial institutions has become of pride leading to a successful financial performance, the adoption of m-banking by various communication companies such as Tigo, Vodacom, Airtel and Halotel gear have made quick deposits and transfers of money or payments (Robert, 2011).

CRDB bank is one amongst the commercial banks which uses electronic banking and has been attractive to many bank stakeholders because it accepts deposits and makes loans (Saunders & Cornett, 2003). It was expected that, provision of electronic banking services should result in cost reduction, performance improvement, wider coverage, revenue growth, and customer convenience and profit maximization (Bradley & Stewart, 2002; Chau & Lai, 2003). However there is documented questioning of the usefulness of electronic banking on bank financial performance, although as found out by (Rotchanakitumunai & Speece 2003), electronic banking helps bank customers to manage personal finances and make transactions 24 hours a day in 365 days in a year without visiting the bank and from any locations of the globe. Electronic banking has undoubtedly brought a significant impact on the overall performance of both the banks and customers. Therefore, electronic banking services have been of great importance even

thought, there is a debate about whether and how their adoption improves bank performance. This study assessed the effects of e-banking on financial performance using return on Investments of commercial Banks in Tanzania, taking CRDB bank at Same district in Kilimanjaro, as a case study.

1.1 Problem statement

In the time of globalization and competition, most financial institutions have moved up the performance chart by serving at competitive price (Chase, 2003). For example, commercial banks in both developed and developing world have adopted electronic banking in order to maximize their profit and minimize operational costs. Munaye (2009) found out that electronic banking services help a bank customer to access banking service from their bank accounts 24-hours access throughout the year. However, despite the benefits that e-banking has brought towards banking performance (Sathye 1999), there is a debate in the literature about whether and how the adoption of that technology improves bank financial performance. This is because, according to Shuqair (2003), electronic banking service will have a negative impact on the bank's performance in the short run because of employee training costs and electronic infrastructure costs. Shuqair's study is similar to Sullivan (2000) who studied banks comparing those that had adopted electronic bank and those which did not. The findings of the study were that performance for both were similar. Thus from the study, it was concluded that e-banking has no relationship with performance. However, (Onay, Ozsoz and Helvacioglu, 2008) found that electronic banking has a positive impact on bank financial performance. This study is consistent with that of Munyoki et al (2015) who found that electronic banking has a positive impact on financial performance of banks. Basing on the discussions above, one can conclude that there is no exact effects of e-banking on the bank performance proved since there are mixed results which render the conclusion to be vague. It was due to the mixed conclusions that triggered the researcher to undertake this study from Tanzanian context to establish the effects of e-banking on financial performance of commercial banks with a case of CRDB bank. The purpose of the paper therefore is to assess the effects of electronic banking on the financial performance of commercial banks using CRDB bank as a case study and in so doing the study specifically expected to determine electronic banking services provided by CRDB bank in Same district, examine the effects of e-banking services on Return on Investments of the CRDB Bank, and investigate challenges of e-banking on provision of financial services. The study is relevant due to the fact that e-banking is necessary innovations which hamper bank operations, in urban and rural areas; furthermore the study is expected to fill the gap which has been identified, also e-banking is considered as one of the strategies to meet more customers.

2.0 Conceptual Considerations

The term e-banking is defined in different ways across the world because electronic banking includes several types of services done at the bank level which can be done via devices such as computer, television or mobile phone (Daniel, 1999; Sathye, 1999). According to Salehi and Zhila, (2008), e-banking involves an electronic connection between bank and customer in order to prepare, manage and control financial transactions of the customer

by the bank while it is reaching its peak of financial performance and customer satisfaction. This type of banking can be done through the following channels as it has been discovered by Daniel (1999); Internet banking, Telephone-banking, TV-based banking, and Mobile phone-banking.

According to Daniel (1999), the introduction of the Information Technology within the banking sector has improved the quality services and improved customer satisfaction that in turn has harnessed banking performance. It has been discovered in the literature that e-banking refers to the use of internet banking (Daniel, 1999); while elsewhere electronic banking refers to retail banking and corporate banking as it was mentioned by Simpson (2002). Al-Gahtani (2001) found that electronic banking has for ages been recognized as an engine of socio-economic development because they create liquidity in the economy through financial intermediation between savers and borrowers and improve the life of the one doing it. Electronic banking have for long provided financial services and products and pushed the completion of transactions and in the process of operation have reduced cash intensity in the financial system, encouraged banking culture, and catalysed economic growth and life improvement as noted by Al-Gahtani (2001). However, electronic banking transactions should be done in a safe and efficient way in order to avoid disturbances from financial system that may affect both the bank and customer as further uttered by Al-Gahtani (2001). A study about the e-banking over 1999–2006 shows that the application of e-banking can improve banks' performance in terms of the growth in assets, reduction in operating expenses and portfolio enhancement (Dandapani et al., 2008). Even in 1990s, Sraael (1996) emphasizes that creating virtual banking will not only create a new service delivery channel, but also lead to value creation to both banks and customers (Hwang et al., 2007; Murphy, 2007). AmatoMcCoy (2005) further argues that customers will be attracted to e-banking when the advanced e-banking services like e-transfer and e-bill options are available.

Financial performance

Financial performance is a measure of a firm's ability to use its assets for the purpose of generating revenues. There are many different ways of measuring financial performance, which include line items such as revenue from operations, operating income and cash flow from operations, etc (Business Dictionary, 2017). Performance measure is a process of measuring efficiency, effectiveness and capability of an action or process or system against a given standards or targets. The term efficiency refers to the relationship between the output in terms of goods, services or other results and the resources used to produce them (Maseko, F, 2013). From time to time other indicators of performance like return on investments are also engaged, Loof, et al (2002).

2.1 Theory to guide the study on e-banking

Normally a study can be guided by a theory or theories depending on the nature of the study and data to be collected. This specific study is guided by one theory known as Technological acceptance model explained herein below.

2.1.1 Technological acceptance model

The technology acceptance model (TAM) is an information systems theory that models how users come to accept and use a technology (Venkatesh and Davis, 2000). This model was originally developed from another theory, called the Theory of Reasoned Action (TRA) that describes a person's behavior by their intentions (Fishbein and Ajzen, 1975). The TRA model intends to create a theory which describes human behavior in general, whereas TAM focuses on the factors which influence a person's general technological acceptance. The TAM consists of two main factors, Perceived Usefulness (PU) and Perceived Ease of Use (PEU) that influence a person's intention to make use of a technology. The concept of perceived usefulness proclaims that, technology (ATM, internet banking, mobile banking Electronic Funds Transfer, and agency banking) can be accepted by the person or community if he/she or they believe that the use of that technology will be useful and add value in their daily job performance (Davis, 1986). TAM argues that the degree of usefulness is, in part, dependent upon how easy the system/technology is to use. A system/technology which is difficult to use is simply not going to be very useful, as it will take too much effort to reap the rewards.

Perceived Ease of Use (PEU) mostly describe that the acceptance of technology base in how easy and effortless to use, so basically claim that the society are willing to use any kind of technology as long as its effortless in using and not difficult in terms of cost and time consuming (Davis, 1986). With the connection to the acceptance of electronic banking services; one of the main reasons for some people to hesitate utilization of these channels can be difficultness of applying them in their financial transactions therefore some people would prefer to use branch tellers in performing banking activities rather than use electronic banking. The assumptions of this theory is that, TAM tells us that we need to make sure that any given bank alternative channel should finds the correct level of each of these two factors (perceived ease of use and perceived usefulness). A channel that is extremely useful may be accepted by users, even if it is difficult to use. Equally, a channel that is not particularly useful may still be employed if it is very easy to use. But a channel which receives high marks for both perceived ease of use and perceived usefulness is one that will tend to be the most readily accepted. According to this theory, as researcher became more aware of how people can accept and use a newly introduced technology in the banking industry. As related to the theory that an easy technology it's very easy to be accepted within the society compares to the difficult technology which people tends to be hesitated to use. With the relation to electronic banking in Tanzanian society, some banks' customers can be hesitant to use electronic banking because of difficulty technology associate with them.

E-Banking and Bank Financial Performance

Sameni, Jouzbarcan, Khodadadi (2015) found out and concluded that e-banking has become an area that facilitates electronic business transaction without necessarily being at the bank hall. In order to evaluate the financial performance for commercial banks as the result of e-banking activities, several metrics have been used by different researchers. One method proposed is by assessing the capital adequacy, assets quality, management quality, earnings and liquidity (or CAMEL according to Gilbert, Meyer and Vaughan, 2000 as cited by Elisha, 2000).

The Challenges of electronic banking

A research study conducted by Daft (1982) discovered that the use of electronic banking has eased the work to bank while increasing customer satisfaction even though both bank and customers may face numerous risks and challenges connected with that innovative technology called e-banking. Here, what Daft (1982) identified was the strategic risk based on the management of financial institutions that commercial banks are facing. For example Daft (1982) found that poor e-banking planning and investment decisions have increased a financial institution's strategic risk. This means that costs of establishing e-banking services has been very high. Earl (2000) demonstrated that establishing a brand which can be trusted costs too much as it requires the purchase of expensive technology in order to set it. The following are some of the problems that customers encounter while using electronic banking services including risk arising from fraud cause by the technology, network and system errors including congestion and other challenges resulting in the organization's inability to be more useful to provide product and services at the expected time. Earl (2000) further pointed out that banking activities can employ their activities of implementation and the amount of its transaction and operations can be high.

Another security problem which is associated with electronic banking as introduced by the Economist journal (1999) is that the electronic banking services insecurities as put into three ways namely those associated with fraud and theft, those by hackers and flaws in systems design are pronounced in the system of electronic banking. As found out by Earl (2002), electronic banking service challenges are lack of knowledge and the level of understanding by manager of the technology and the operation process and the lack of skills and experience to adapt the software technologies and educate their customers on how to use the technology.

Several studies which have been undertaken on the topic of electronic banking have revealed that those using the technology have got better assets turnover than those which do not use the technology, while other researcher have proved not improving bank performance as indicated by Robinson (2000) and Nyangosi (2006). Simpson (2002) found that electronic banking have led to operating costs and operating revenues maximization. A study conducted that Nader (2011) on the profit efficiency of the Saudi Arabia Commercial banks during the period 1998- 2007 indicated that the presence of phone banking, number of ATMs and number of branches had a positive impact of profit efficiency of Saudi banks. However, the same study conducted by Nader (2011) revealed that the introduction of point of sale terminals, personal computer banking and availability of mobile banking did not have any impact or improve profit efficiency and quality service delivery of commercial banks of Saudi Arabia. Kariuki (2005) found that there is a positive impact of introducing information technology in the banking industries when using bank return on investments and profits as tools of measurement of performance. He concluded that introducing electronic banking system has brought high profit growth and are using more advanced technology. He finally stated that electronic banking leads to profits in the long run though in short term the technology cost a lot due to initial expenditures (Kariuki, 2005).

Agboola (2006) studied Information and Communication Technology (ICT) in banking operations in Nigeria and he used

the nature and degree of introduction of technologies; and the impact of the adoption of those technologies on the performance of banks, and this study found that technology was the main tool of competition in the banking system. This study found that there is an increase of ATMs, EFT, smart cards, electronic home and office banking and telephone banking in the study area. And he stated that the adoption of electronic banking improves the banks' image and leads to a wider, faster and more efficient market than those which do not use the technology. He said that banks especially those which are commercial banks should use electronic banking system in order to facilitate speed, convenience, and accurate services, which done otherwise would lose customers.

A study conducted by Osage (2012) on the adoption of electronic banking by Kenyan Commercial banks found that its adoption has been useful to both banks and customer because it made availability of services 24/7, made fast transactions and customer convenience. Besides, in his study on the impact of electronic banking on service delivery to customers of Ghana commercial bank limited, Wisdom (2012) found that the negative perception of customers about bank has significantly changed many Ghana because over 76% of the respondents agreed strongly to this assertion while the rest do not. Also the study revealed that electronic banking services have impacted positively on the service delivered of Ghana commercial bank and affected negatively the customer perception on the use of these products. A research conducted by Ishengoma (2011) on the analysis of mobile banking for financial inclusions in Tanzania found out that most respondents using the service could find the technology saving them from bank charges (affordable charges with M-banking), but time serving and the perceived ease use of M-banking was not the same to every respondents in the study area because there were some of the respondents who were not able to read and write seemed to find the technology difficult while those knowing reading and writing seems to find the technology simple and understandable. The study finally concluded that there is a close relationship between the problems of not having access to an m-money agent where network agents are on the ground of the representative especially when needed by the customer.

2.2 Conceptual Framework

In Tanzania the introduction of electronic banking system like many other developing countries, is not old just like that in developed countries though it is becoming spread everywhere in the country and have proved successful. As discovered by Robert (2011), there are several innovative IT based service including ATM, smart cards, mobile banking, Internet banking, credit cards, phone banking and anywhere anytime banking are found in the country and have provided to customers a number of services to customers and improve the service quality of the commercial banks including CRDB bank. However, increased bank performance while increasing the use of electronic banking, is debatable thus desires the set of the study to assess in order to bridge this gap. The researcher is motivated by this controversy and employed the simple descriptive statistical Model, to investigate the relationship between Rate of Assets turnover and Electronic banking in commercial banks in Tanzania. Figure 2.2 appended shows the conceptual framework of the study. From the above conceptual framework the independent variable includes the electronic banking measured in terms of ATM, mobile money,

and electronic funds while dependent variable includes the financial performance as measured by Return on Investments.

3.0 Methodology

The study has set model specification to examine the relationship between Electronic banking and the Return on Investments, on commercial banks in Tanzania. On the basis of the empirical model specification below;

Research study model

$$ROI = \beta_0 + \beta_1EB + \beta_2EB + \beta_3EB + \varepsilon_i \tag{1}$$

Where,

ROI = Return on Investment, β_0 = Constant, β_1EB = e-Banking (Agency banking), β_2EB = e – banking(ATM), β_3EB = e- banking (Internet banking) and ε_i = Error

Thus, Return on Investment is used to measure performance of commercial banks while EB is an independent variable considered for the study. β_1 , Indicates how a unit changes in independent variable affects the dependent variable and ε_i is the error term to capture other variables which were not included in the model.

3.1 Type of data and sources

The analysis in this study is based on primary and secondary data which were collected from CRDB bank branches in Same district. The area of the study was chosen because it has respondents who use electronic banking, at the same time the area has significant sources of data to be collected sufficient to cover the study such as internet documentary information that could be accessed easily. The study is a descriptive one that according to Kothari (2004), includes surveys and fact-finding enquiries of different kinds. The major purpose of descriptive research is description of the state of affairs as it exists at present. The main characteristic of this method was that the researcher had no control over the variables; he could only report what has happened. The study tried to describe the implication of e-banking services on the financial performance of commercial banks using CRDB Bank as a case study. The study employed research design which consists of a combination of quantitative and qualitative analysis.

A sample size of about one hundred and twenty (120) respondents was considered by the study, which was consistent to Kish (1965) and Sudman (1976) content that the sample size of between 100 and 200 respondents is suitable for statistical analysis. Simple random sampling technique which is also known as probability sampling was used to randomly select 100 customers of CRDB bank to represent the whole population and purposive sampling technique that is known as non probability sampling in selecting respondents was used to collect data from 20 key informants particularly the managers and the heads of different units of CRDB bank. The study seemed to be representing employees and customers come from all walls of organization of life and diverse areas.

Reliability was tested by use of twenty four questionnaires which were piloted with randomly selected bank employees who were not included in the final study sample to avoid response bias. Their views were evaluated and incorporated to enhance content and construct validity of the questionnaire. The rule of the thumb suggests that 5% to 10% of the target sample should constitute the

pilot test (Cooper and Schilder, 2011; Creswell, 2003; Gall and Borg, 2007). The pilot test sample was within the recommendation. The twenty four questionnaires were coded and input into Statistical Package for Social Sciences [SPSS] version 20 for running the Cronbach reliability test. The reliability of the questionnaire was tested using the Cronbach's alpha correlation coefficient with the aid of Statistical Package for Social Sciences (SPSS) software. The results of the reliability test produced an overall Cronbach Alpha correlation coefficient of 0.887. The closer Cronbach's alpha coefficient is to 1, the higher the internal consistency reliability (Sekaran, 2003). A coefficient of 0.7 is recommended for a newly developed questionnaire and therefore 0.887 was adequate for this study.

4.0 FINDINGS AND ANALYSIS

The impact of electronic banking on the Rate of Return on Assets

The study analyzed the effect of electronic banking have on return on investments of CRDB bank in Same district. The researcher verified from respondents by the use of likert scale statements in a set of questionnaire, where different variables of e-banking were tested.

4.1 The extent to which electronic banking services have used CRDB bank in Same district

The study intended to determine the extent to which electronic banking services have been used. Questions were structured with response mode of five Likert scale points ranging from 1= not used to 5= used regularly. The questions for this first specific objective were answered by selected banks' customers only. The variables used to present electronic banking were ATMs, agency banking, mobile banking and internet banking. Also, the use of bank counters was included in the questions as the contextual variable for comparison reason. Therefore, the study compared the use of electronic banking with the use of bank over the counters.

The analysis of data for this first specific objective was conducted using descriptive analysis (table 4.1) and t-test (table 4.2). Descriptive analysis was performed in order to explore the extent to which electronic banking were used by the banks' customers while t-test was used to identify channels which were significantly used by the banks' customers. In interpreting the results of descriptive statistics the mean score of 1.00-1.80 indicates that the electronic banking was "not used", the mean score of 1.81-2.60 indicates that the electronic banking was "used very rarely", the mean score of 2.61-3.40 indicates that the e-banking was "used rarely", the mean score of 3.41-4.20 indicate the e-banking was "used sometimes" and the mean core of 4.21-5.00 indicated that the e-banking was "used regularly".

The results indicated that ATMs and mobile banking are the electronic banking item which have been highly used compare to the traditional method of using bank tellers or over the counters. It was noted that ATM (mean 4.57) was used regularly by Banks' customers in accessing financial services from the bank followed by mobile banking (mean 4.06) which was used sometimes but more frequently compare with the use of bank tellers. Internet banking (mean 2.71) and agency banking (mean 2.66) have been used rarely compare to the use of bank tellers/counter. One sample t-test was conducted in order to investigate whether the use of

electronic banking items (ATM, mobile banking, agency banking and internet banking) was significant or not. T-test which is non-parametric analysis was used because there was no clear dependent variable (dependent variable was latent) therefore the mean of each variable was compared against hypothesized mean (weighted mean) which was calculated and found to be 3.58. Table 4.2 appended depicts the results of t-test.

The results show that all four electronic banking items were significantly used by the banks' customers. Statistically, it was indicated that ATMs ($p < 0.0001$, CI = 0.78-1.2), agency banking ($p < 0.0001$, CI = -1.32 - -0.52), mobile banking ($p = 0.004$, CI = 0.16 -0.8), internet banking ($p < 0.0001$, CI= -1.33 - -0.41). Additionally, it was noted that the use of bank tellers/counters was not significant ($p = 0.059$, CI -0.01 - 0.69) but the researcher was interested to the results pertain to the four mentioned electronic banking items rather than the result concern the use of bank tellers. Now it was concluded that electronic banking were significantly used by banks' customers whereby ATMs and mobile banking were highly used while banking agency was least used.

Besides the analysis made customers had the following comments for two items of electronic banking, that is ATMs and Mobile banking. It was argued that originally ATMs were only used to withdraw cash, but nowadays the ATMs have evolved to support a wide variety of banking services. These include deposits, withdraw and account details. Respondents argued that ATMs are frequently used by banks' customers to withdraw money from their accounts and obtain account details. The study argued that due to scatted ATMs in many places, within the city, made it easy for the banks' customers to use them in accessing some of the financial services provided via ATMs, especially cash withdrawal. They claimed that the use of ATMs was queuing effective compared to the time taken over the counter, as customers do not take long to withdraw the cash from ATM. One of the bank customer known as , Mrs. Magwero, commented as follows,"Baba we used to stand for a long time awaiting for the services, we consider these improvements as miracles, that we can get services through ATMs in short time"

Mobile banking was another electronic banking item that was highly used by banks' customers in Same district, it was argued that banks' customers could easily obtain information about their bank accounts through text messages and make payments and other transactions within few minutes using cell phones. The electronic banking item was mentioned to be time saving and more privacy method of performing bank transactions. Mr. Kangalu, one of respondents had the following comments, that " Mobile banking saves time that could have been consumed at the bank counters waiting for the same services, Mobile saving is more privacy since one use his/her own mobile phone and perform banking activities at any place convenience to him/her."

4.2 The effect of electronic banking services on financial performance measured by Return on Investments

4.2.1 ATMs and Return on Investments

The study revealed that seventy percent (70%) agreed and ten percent (10%) strongly agreed, this essentially mean eighty percent (80%) of the respondents agreed that ATMs influenced operational costs of commercial banks hence had an implication on return on investment. Besides the study revealed that five percent (5%) were neutral and fifteen percent (15%) of the

respondents disagreed, this in total is equivalent to twenty percent (20%) of the respondents disagreed that ATMs had an influence on operational costs of commercial banks and hence return on Investments. The study investigated on whether ATMs could recoup the initial investments within three years or not and the results were seventy five percent (75%) agreed, five percent (5%) strongly agreed this is as good as saying eighty percent (80%) of the respondents agreed that ATMs can recoup the cost of investment initially put in the project and twenty percent (20%) were indifferent or rather disagreed that the ATMs can recoup the initial cost invested. On the other hand a five point likert scale revealed a mean score for the effect of ATMs on return on Investment to be 3.47. The mean score indicates that there were more respondents who agreed to the statements that ATMs influenced return on investments of commercial banks positively. The standard deviation of the responses is 0.666 indicating a spread of within one standard deviation from the mean. Table 4.3 below is of reference.

The findings indicate that ATMs have the ability to generate income for banks and hence the aggressive ATM network expansion by CRDB bank may lead to reasonable return on investments. Moreover, ATM machines are now located at non-traditional locations like at the petrol stations, supermarkets, universities and colleges and in the rural areas, indicating the importance that banks attach to ATM machines in reaching and maintaining customers and strategically earning fees for their use. The findings of the study are in consistent to the study conducted by Akram and Allam (2010) in Jordan and found that use of information technology which is embodied in ATMs improved the matrix of financial and operational performance. The study concluded that information technology had an impact on return on Investments. The results of the study are also consistent with the study done by Nadia, Anthony and Scholnick (2003) in United States of America, which found the use of ICT platforms such like ATMs facilitate responses on internal cost cutting leading to better return on investments.

4.2.2 Mobile Banking and Return on Investments

The study revealed that mobile banking has a capacity of reducing operational costs, this was justified by respondents to the tune of eighty six percent (86%) of the respondents agreed that mobile banking has reduce operational costs while ten percent (10%) were neutral and 2% disagreed which was equivalent to twelve percent (12%) of the respondents disagree that mobile banking reduces operational costs. On the other side the study wanted to know if the investments made to facilitate electronic banking can be recouped within three years, and about eighty percent (80%) of the respondents agreed and it was revealed that mobile banking had a capability of having a positive impact on bank margins this was justified by respondents who agreed by sixty five percent (65%). The mean score of the responses was 3.79 implying that mobile banking influences return on investments positively. The standard deviation was 0.477 which meant the existence of the responses clustered within one standard deviation from the mean. Table 4.4 appended refers.

The findings were in consistent to the study done in Africa and Bangladesh respectively by (Aker and Mbiti (2010) and Rayhan, Sohel, Islam and Mahjabin (2012) which found out that mobile phones offered an opportunity for banks to improve their

incomes and hence better return on investments by having a large number of virtual mobile accounts especially for the unbanked individuals. CRDB bank in Same district has embraced the use of mobile banking which in a short has made transformation of their business operations transformed which leads to more income. There is increased collaboration between bank and mobile phone, telephone service providers which are mainly driven by income sharing and customer retention. The competition for income generating initiatives through the mobile phones has made CRDB bank to participate in competing for space in the SIM card. This means that the more a bank makes its activities visible on the SIM card the more income it is likely to make towards recovering its investments in mobile banking.

4.2.3 Agency Banking and Return on Investments

The study collected information relating to the influence of Agency banking on return on investments and the results are summarized in Table 4.5 below. Thirty six percent (36%) of the respondents agreed, forty two percent (42%) were neutral and twenty three percent (23%) disagreed, this essentially mean sixty five percent (65%) of the respondents disagree with the statement that Agency banking could influence the reduction of operational costs. The study further investigated on whether the income earned through Agency banking contributed positively to bank margins, and the results were as follows, sixty one percent (61%) agreed, of the respondents while thirty five percent (35%) were neutral and five percent (5%) disagreed this means forty percent (40%) of the respondents disagreed with the statement that income earned through Agency banking contributed positively to bank margins. The responses had a mean score of 3.52 indicating the existence of more agreement with the statements on the positive influence of Agency banking on banks' return on assets. The standard deviation for the results was 0.737. The findings of the study was supported by the study conducted in Italy, Spain and USA respectively by (Hasan, Schimiedel and Song (2010), Hernado and Nieto (2006) and DeYoung (2005)), which concluded that investment in electronic technology seemed to influence positively the performance of banks as measured by return on investments and return on equity. The conclusions also suggested that electronic technology like Agency banking was used more as a complement than as a substitute for physical branches, suggesting the dominance of a multi channel banking model. The findings of this study and corroborations from previous empirical studies suggest that Agency banking technology has been helpful to both the banks and their customers. Agency banking has been popular among Tanzanian banks due to the ease of transferring funds from one bank to another and from one customer to another.

4.2.4 Regression Analysis – Return on Investments and electronic banking

The regression Analysis shows the effectiveness of the model in measuring the influence of electronic banking on return on Investments of CRDB bank as per Table 4.6. The overall correlation coefficient (R) between return on Investments and electronic banking is a strong positive correlation of 0.972. The coefficient of determination R Square indicates that the e-banking in the regression model can explain 94.4% of the variations in return on investments of CRDB bank in Same district holding other factors constant.

Table 4.6: Model Fitness – Return on Investments and Electronic Banking

Indicator	Coefficient
R	0.972
R Square	0.944
Std. Error of the Estimate	0.77288

Source: Field data 2022

The researcher did variance analysis of the innovations, which are included to explain the return on investments of CRDB bank. The overall significance of the model is 0.000 which is at level of significance of 0.05 and conclude that e-banking have a positive influence of return on investments of CRDB bank. This shows that the electronic banking included in the model have an overall high significance in explaining the return on investments of CRDB bank. The individual significance levels of the bank innovations are presented on Table 4.7

Table 4.7: ANOVA – Return on Investments and e-banking

Indicator	Sum of Squares	df	Mean Square	F	Sig.
Regression	880.061	5	176.012	294.66	0.000
Residual	52.036	87	0.597		
Total	932.097	92			

Source: Field data 2022

4.2.5 Regression Coefficients – Return on Investments and electronic banking

The study has run the regression coefficients of the individual independent variables which have been portrayed in Table 4.8 below. The study concluded that investment in electronic technology had a positive influence on the performance of banks measured by return on investments. The conclusions suggested that electronic technology like the ATM, Mobile banking and EFT were used more as a complement than as a substitute for physical branches, suggesting the dominance of a multi channel banking model. Mobile banking requires heavy initial investment outlay and hence, initially they have lower income margins and therefore lesser contribution to return on investments.

Table 4.8: Regression Coefficients – Return on Investments and electronic banking

Indicator	Beta	Std. Error	t	Sig.
ATM	-0.104	0.333	-0.312	0.755
Mobile Banking	0.16	0.17	0.945	0.347
Agency Banking	-0.245	0.17	-1.44	0.154

Source: Field data 2022

The effects of electronic banking on Return on Investments of CRDB bank in Same district

The study revealed that e-banking had positive influence on return on investments of commercial banks in Tanzania. This is supported by the coefficient of determination which shows that banks innovations explain the variations in return on investments

of CRDB Bank. The test for significance also showed that the influence was statistically significant. This means that e-banking are good at skimming out incomes and having a good return earlier from the initial outlay. E-banking innovations are also able to be modified and upgraded to improve their capabilities and hence improving return on investments for the CRDB bank.

4.3 The challenges of electronic banking on provision of financial services

The study wanted to identify challenges that affecting usefulness of electronic banking. Some variables were prepared with the aim of capturing respondents suggestions concern factors challenge usefulness of electronic banking. Correlation analysis was used to analyze the findings obtained so as to identify common factors that hinder effectiveness and efficiency of electronic banking. The results of such correlation analysis are given in the table 4.9 appended below: The study revealed lack of knowledge and awareness to the customers of the banks is among the challenging factors which hinder efficiency and effectiveness of electronic banking services. It was also revealed that weak or failure of internet and network was the challenge ($p < 0.0001$). Furthermore language barrier in using internet banking was the challenge and security problem hinder to some degrees efficiency of e-banking services ($p = 0.0001$). It was concluded that lack of knowledge and awareness of the existence of electronic banking services to customers, weak or failure of internet and network due to low investment in them, some security problem especially on mobile banking, language barrier in using internet banking since some details were written in English were the common factors affecting usefulness of electronic banking services in Same district.

5.0 Conclusion

Based on the findings of the study, it can be concluded that electronic banking influence financial performance of CRDB positively. The adoption of e-banking in CRDB Bank at Same district has got high potential of improving financial performance and hence better returns to the shareholders. The versatility of electronic banking has made their adoption rate to be high among both the bank and their customers. It could have been challenging if the adoption was only with either the banks or the customers. CRDB Bank has continued to perform well even when other sectors of the economy show lagged performance. This can be explained by the use of electronic banking which has enabled bank to start making income away from traditional sources like interest, trade and asset financing. The bank has been able to make more commission income from transactions done through e-channels like; ATM, mobile phones and electronic fund transfer and so on.

The study recommends that the government should pursue a strategy to provide incentives for technology transfer from more developed economies in order to promote the adoption of world first class innovations this will enable customers to get super services and banks will definitely have super profits. Besides the government of Tanzania and the Bank of Tanzania (BOT), have to issue guidelines or policies concerned adoption of e-banking in Tanzania banking industry. Tanzania has adopted e-banking without guidelines or policies, at the same time we do not have proper laws on adoption of e-banking. The Banks and Financial

Act of 2006 do not cover the e-banking practice. The law still insists on documentary evidence and signature recognition, while under e-banking PIN is used for recognition. Therefore, our Tanzania's laws do not help to decide cases under cyber crimes which are on increasing rate in the banking industry today. This being the case customers are hesitant to use e-banking because they do not trust it since there is no security and also risky on operation. The guidelines, policies, and laws will help customers to know their liability once financial loss occur; currently banks tend to shift burden to customers.

Another issue is that banks are dealers to the Central Bank (BOT) while mobile phone operators are dealers to Tanzania Communication Regulatory Authority (TCRA). It is their duty to enable (agent) network growth as a precursor for mobile banking enhancing and scaling-up mobile banking or mobile phone financial services up-scale, encouraging implementation of second generation financial services for deepening financial access, encouraging interoperability of mobile banking and consumer protection in mobile services. Moreover the regulators have a critical role in providing appropriate regulatory and supervisory frameworks that ensure safety and credibility of mobile banking that ultimately contribute to scaling-up of financial services. Consumer protection is a fundamental in the mobile banking/financial services by maintaining consumer trust through ascertaining credibility and safety of mobile payment services. Mobile phone operators should make sure that the mobile users benefit from access to financial services and it will accelerate the introduction of electronic services to the rural areas. Furthermore banks should create awareness to customers on e-banking and allied services offered through mobile banking in order to increase customers especially in rural areas who do not have banking services

REFERENCES

- [1] Agboola, A. (2006). Information and communication technology (ICT) in banking operations in Nigeria: An evaluation of recent experiences. From <http://unpan1.un.org/intradoc/groups/public/documents/AAPAM/UNPAN026533.pdf>. Retrieved on 10th September 2021
- [2] Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179-211.
- [3] Ajzen, I. (2002). Perceived Behavioral Control, Self Efficacy, Locus of Control, and the Theory of Planned Behavior. *Journal of applied social psychology*, 32(4), 665-683.
- [4] Aker, J. C., & Mbiti, I. M. (2010). Mobile phones and economic development in Africa *Journal of Economic Perspectives*, 24(3), 207-232, Summer 2010
- [5] Akram, J. K., & Allam, M. H. (2010). The impact of information technology on improving banking performance matrix: Jordanian banks as case study. *European, Mediterranean & Middle Eastern Conference on Information Systems 2010*. April 12-13 2010, Abu Dhabi, UAE.
- [6] Al-Gahtani, S. (2001). The applicability of TAM outside North America: an empirical test in the United Kingdom. *Information Resource management Journal* Vol. 14 (3), 37-46
- [7] Basel committee (1998) "Bank supervision." Basel committee (2001) "Cheng, T. C. E., (2006). "Adoption of internet banking: An empirical study in Hong Kong." *Decision Support Systems* 42: 1558-1572
- [8] Cheung, M.I. and Liao, Z. (2002). Internet-based e-banking and consumer attitudes: an empirical study. *Information and Management* 39(4): 283 - 295.
- [9] Daniel, E. (199) Provision of Electronic Banking in the UK and the Republic of Ireland, *International Journal of Bank Marketing*, Vol. 17, No. 2, pp. 72-82
- [10] DeYoung, R. (2005). The performance of internet-based business models: Evidence from the banking industry. *Journal of Business* 78 (3), 893-947.
- [11] DeYoung, R., Lang, W.W., & Nolle, D.L. (2007). How the internet affects output and performance at community banks. *Journal of Banking & Finance*, 31 1033-1060.
- [12] Earl, M. (2000). *Evolving the E-Business*, Business Strategy Review, Vol.11, No. 2, pp 33-38.
- [13] Fadhili E. Maseko (2013). *Performance of Savings and Credit Co operative Societies in Arusha City Council*.
- [14] Fishbein, M. and I. Ajzen (1975,1980). "Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research." Boston, Ma: Addison Wesley.
- [15] https://en.wikipedia.org/wiki/Theory_of_planned_behavior. retrieved on 6/6/2017
- [16] <https://quizlet.com/19884483/health-psychology-lecture-10-flash-cards/> accessed on 6/6/2017
- [17] Iftikhar, H., Schmiedel, H., & Song, L. (2009). Return to retail banking and payments. Working Paper Series 1135, European Central Bank
- [18] Jushua, A. (2010). Technological innovations and banking: An evaluation of customers' perceptions. *Academic leadership online journal*, 8(4).
- [19] Kombo, D.K. and Tromp, D.L.A (2006) "Proposal and Thesis writing: An Introduction.
- [20] Kothari, C.R. (2004). *Research Methodology, methods and techniques* (2nd ed.). India, Jaipur: New Age International limited publishers
- [21] Liao, S. and Y. P. Shao, (1999). "The adoption of virtual banking: an empirical study." *International Journal of Information Management* 19 63-74.
- [22] Mabrouk, A., & Mamoghli, C. (2010). Dynamic of financial innovation and performance of banking firms: Context of an emerging banking industry. *International Research Journal of Finance and Economics*, 5, 2010
- [23] Misati, R. N. M., Njoroge, L., Kamau, A., & Ouma, S. (2010). Financial innovation and monetary policy transmission in Kenya. <http://www.eurojournals.com/finance.htm>
- [24] Mols, N., Bukh, P and Neilsen, J. (1999). Distribution channel strategies in Danish retail banking. *International Journal of Banking Marketing*, 27 (1): 37-47.
- [25] Mols, N.P. (1998). The behavioural consequences of PC banking: *International Journal of Bank Marketing*, 16 (5):195-201.
- [26] Munyoki S, Rotich G, Anyango W. Effect of mobile banking on the financial performance of banking institutions in Kenya. *Journal of management* 2015.
- [27] N. Kariuki, Six Puzzles in Electronic Money and Banking, IMF Working Paper, IMF Institute, (February, 2005).
- [28] Ndung'u, N. (2011). Governor Central Bank of Kenya in his speech during the Launch of the Mobile Payment Tangaza E-Commerce and Money Transfer Service on 24th January 2011. Speech available at <http://www.centralbank.go.ke/downloads/speeches/2011/Tangaza%20ECommerce%20Jan%20.p> Accessed 14 July 2017
- [29] Nofie, I. (2011). The diffusion of electronic banking in Indonesia, Manchester Business School
- [30] Nyangosi, Arora (2009), *Emergence of Information Technology in the Kenyan Banking Sector: An Empirical Study*, Khalsa College, G.N.D. University Amritsar 143005. (unpublished)
- [31] Ogare, H.O. (2013) The relationship between e-banking and performance of commercial banks in Kenya. Unpublished MBA project University of Nairobi.
- [32] Onay C, Ozsoz E, Helvacioğlu AD. The impact of Internet Banking on bank profitability. Turkey, Oxford & Economics Conference Programme 2008.
- [33] Porteous, D. (2006). *The Enabling Environment for Mobile Banking in Africa*, London: DFID. <http://www.bankablefrontier.com/assets/ee.mobil.bankreport.v3.1.pdf>
- [34] Robinson T. (2000). Internet banking-still not a perfect marriage: *Information Week*, 17(4):104-106.
- [35] Rogers, E. M. (1962, 1983, 1995). "Diffusion of Innovations, 1st, 2nd and 3rd edition" Free Press, New York Times 4.

- [36] Rotchanakitumnuai, S. and Speece, M. (2003) Barriers to Internet banking adoption: A qualitative study among customers in Thailand. *International Journal of Bank Marketing*, 21 (6/7), 312-323
- [37] Sathye, M., (1999). Adoption of Internet banking by Australian consumer: An empirical investigation. *International*
- [38] Shu, W., & Strassmann, P. A. (2005). Does information technology provide banks with profit? *Information and Management*, 42(5), 781-787.
- [39] Simpson, J. (2002) The Impact of the Internet in Banking: Observations and Evidence from Developed and Emerging Markets, *Telematics and Informatics*, Vol.19 No. 4, 2002, pp. 315–330.
- [40] Smith, A.M. (1992), The Consumers' Evaluation of Service Quality: some methodological issues, *University of Salford*.
- [41] Sullivan RJ. How Has the Adoption of Internet banking Affected Performance and Risk of Banks? A look at *Internet Banking in the 10th Federal Reserve District. FRB Financial Industry Perspectives*, 2000; 1-16.
- [42] Tan, M., & Teo, T. (2000). Factors influencing the adoption of Internet banking. *Journal of the Association for Information Sciences*, 1, 1-42.
- [43] Venkatesh, V. M. G. Morris (2003). "User acceptance of information technology: towards a unified view." *MIS Quarterly* 27(2): 425-478.
- [44] Wisdom, K. (2012). The impact of electronic banking on service delivery to customers of *Ghanacommercial bank limited: A study of Ghana commercial bank Ltd, polytechnic branch*. A Thesis for award degree of commonwealth executive masters of business administration, Ghana

AUTHORS

First Author – Fadhili E. Maseko from Institute of Accountancy Arusha, Dodoma campus

ANNEXTURES

Table 4.1: Extent to which electronic banking services have been used

Variables	Scale					N	Mean	STD
	1	2	3	4	5			
ATMs	0	1	5	9	36	51	4.57	.755
Mobile banking	2	3	8	13	23	49	4.06	1.126
Counter/tellers	2	7	7	11	23	50	3.92	1.243
Internet banking	18	6	4	12	8	48	2.71	1.584
Agency banking	12	9	8	12	3	44	2.66	1.328
WEIGHTED MEAN							3.58	

Source: Field Data (2022)

Table 4.2: Significance of using electronic banking items

Variables	Test Value = 3.58					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
ATMs	9.350	50	.000	.989	.78	1.20
Agency banking	-4.598	43	.000	-.921	-1.32	-.52
Mobile banking	2.993	48	.004	.481	.16	.80
Internet banking	-3.813	47	.000	-.872	-1.33	-.41

Counter/tellers	1.935	49	.059	.340	-.01	.69
-----------------	-------	----	------	------	------	-----

Source: Field data (2022)

Table 4.3: The effect of ATMs on return on Investments

Variable	Scale					Mean	StD
	1	2	3	4	5		
ATMs influence reduction of operational costs and hence better return on assets for the bank	0	15	5	70	10	3.75	0.493
ATMs investments have payback period of less than 3 years and hence good return on assets	0	1	20	75	5	3.85	0.493
Incomes from ATMs have had positive impact on bank income margins	7	37	23	30	2	2.82	1.011
Average						3.47	0.666

Source: *Field data, 2022*

Table 4.4: The effect of Mobile Banking on Return on Investments

Variables	Scale					Mean	StD
	1	2	3	4	5		
Mobile banking influence reduction of operational costs and hence better return on assets for the bank	0	2	10	77	1	3.98	0.448
Mobile banking investments have payback period of less than 3 years and hence good return on assets	3	2	15	77	3	3.76	0.448
Incomes from mobile banking have had positive impact on bank income margins	0	5	30	61	4	3.63	0.536
Average						3.79	0.477

Source: *Field data, 2022*

Table 4.5 Agency banking and Return on Investments

Variables	Scale	Mean	StD
-----------	-------	------	-----

	1	2	3	4	5		
Agency banking influence reduction of operational costs and hence better return on assets for the bank	2	21	42	35	1	3.13	0.802
Agency banking investments have payback period of less than 3 years and hence good return on assets	1	2	25	62	10	3.79	0.685
Incomes from Agency banking have had positive impact on bank income margins	0	5	35	51	10	3.66	0.725
Average						3.52	0.737

Source: *Field data, 2022*

Figure 2.2: Conceptual Framework

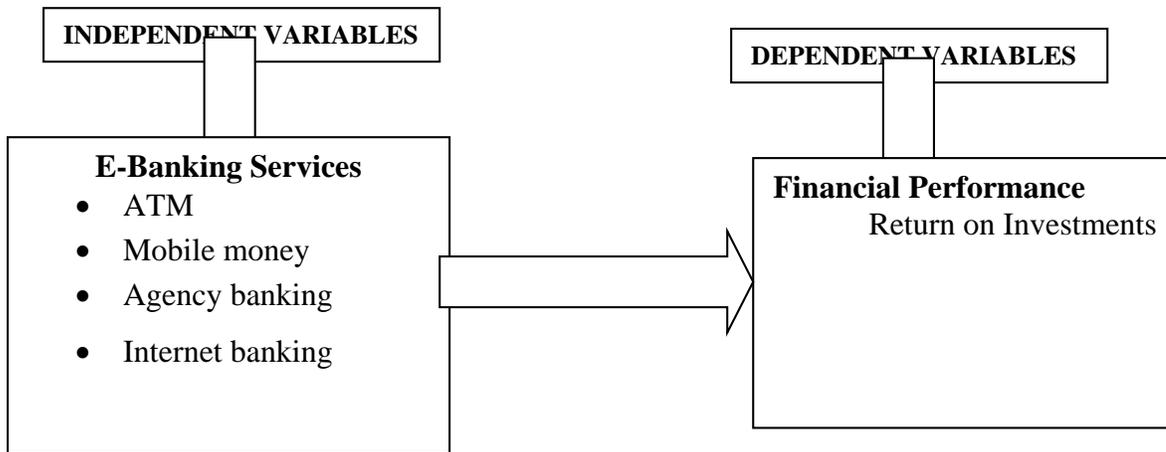


Table 4.9: Factors affecting usefulness of electronic banking services

		Weak or failure of internet network	or of and using internet banking	Language barrier in	Some security problem
Lack of knowledge and awareness to the banks' customers	Pearson Correlation Sig. (2-tailed) N	1 100			
Weak or failure of internet and network	Pearson Correlation Sig. (2-tailed) N	.824** .000 100	1 100		
Language barrier in using internet banking	Pearson Correlation Sig. (2-tailed) N	.688** .000 100	.693** .000 100	1 100	
Some security problem	Pearson Correlation Sig. (2-tailed) N	.761** .000 100	.777** .000 100	.745** .000 100	1 100

** . Correlation is significant at the 0.01 level (2-tailed).

Source: Field Data (2021)

Anthropocentrism Is An Important Paradigm In Linguistics

Prof. Dr. Mahmudov Nizamiddin Mamadalievich

Director of Institute of Uzbek language, literature and folklore under the Uzbekistan Academy of Sciences

city Tashkent, Uzbekistan

DOI: 10.29322/IJSRP.12.10.2022.p13083
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13083>

Paper Received Date: 24th September 2022
Paper Acceptance Date: 25th October 2022
Paper Publication Date: 30th October 2022

Abstract- The paper studies theoretical issues of anthropocentric paradigm of linguistics development as a special field of language science. The purpose of this study is to answer the question about language and culture, language and human, language and ethnos, which are impact on the semiotic system of language. The resource is the specific approaches to anthropological linguistics subject. As well as, the anthropocentric approach on linguistics in focused on the person as a subject of linguistic research that implements his communicative intentions in certain speech acts oriented to the and mental human activities. That is why it is possible to observe that in the history of world linguistics there have been various and different approaches to the phenomenon of language. So, it is better to research about it as a linguistic paradigm having its own background in linguistics and closely related to other related sciences, such as culture, history, psychology, sociology and other. Besides it, in this paper analyzed and introduced the terms concept, linguistic picture of the world and others.

Index Terms- anthropocentric paradigm, anthropocentric linguistics, linguoculturology, human, language, concept, linguistic picture of the world, speech, culture, history.

I. INTRODUCTION

Human language is extremely complex, extremely multifaceted, incredibly unique and regular phenomenon, which the human mind is often unable to imagine all its aspects as a whole and at once. That is why it is possible to observe that in the history of world linguistics there have been various and different approaches to the phenomenon of language. Of course, a certain aspect of the language was taken as a basis for these approaches, an attempt was made to reveal this aspect in depth, and all peculiarities related to the entire complex nature of the language were studied based on this aspect. It is enough to recall the many currents, such as psychologism, sociologism, naturalism, structuralism, aestheticism, formed in the history of linguistics. Naturally, none of the characteristics of these affix "isms" are alien to the essence of language, the presence of one of them in the essence of language does not negate the existence of the other. For

example, the presence of psychic (spiritual aspect) in the essence of language does not negate the presence of aesthetics (beauty, artistic-expressiveness) in it. Therefore, all these features should be taken into account when revealing the essence of the language. However, the experience of several centuries in the history of world linguistics shows that this is not an easy task, and the representatives of these currents also considered their chosen path to be the most appropriate way to study the language, and spent their whole lives on this path to clearly indicate the object of study and its essence. Of course, serious efforts to find ways to perfect the study of language are still going on, and with the unprecedented acceleration of human development, these efforts are gaining more speed and scope.

Today in science, in particular, in the science of linguistics, it was first put into practice by the American scientist T.Kun (in relation to physics) [13, p. 11] the term "paradigm" in the sense of "a holistic model of setting and solving a scientific problem recognized by experts, an overview of the object of science, a system of theoretical rules, methods" has become a tradition. Y.S.Stepanov based on the description of language in three dimensions in semiotics – semantics (the relationship of the sign with the concepts of the objects and objects it represents), syntax (the relationship of the signs with each other), pragmatics (the relationship of the sign with the person who uses the language) "paradigm" uses the term a little wider than this meaning, that is, as a concept related to the philosophy of language (views of language in connection with one or another philosophical movement), a way of thinking [24, p. 4-5] and devotes the entire monograph to a detailed study of the following three paradigms: 1. Semantic paradigm ("philosophy of names" as an expression of semantic approach to language). 2. Syntactic paradigm ("predicate philosophy" as an expression of syntactic approach to language). 3. Pragmatic paradigm ("philosophy of egocentric words" as an expression of pragmatic approach to language). Naturally, since a famous linguist understands a paradigm as a dominant view of language in a certain period in connection with a certain philosophical trend, for example, he analyzes the semantic paradigm from the earliest, antiquity, when such a paradigm was almost formed (at least, the debate about the correctness of names can be recalled).

It should be said that the third paradigm in this classification is particularly noteworthy. Y.S. Stepanov writes about this in particular: "The new paradigm of the philosophy of language is characterized by two absolute differences compared to the previous two paradigms: 1) the whole language is connected with the subject that uses it - "I"; 2) all concepts used for language description are relativized (attributed to a task): names, predicates, sentences – all of them, although different from each other, are considered as tasks" [24, p. 216]. The important thing is that in this paradigm, not only the language itself, but also the language user, the owner of the language is naturally part of the research object. As you can see, Y.S. Stepanov applies the concept of paradigm to the periods of linguistics from the earliest times to the present day. Most linguists tend to apply this concept to the history of the period after the 19th century, which is considered the date of formation of the science of linguistics in Europe. Although today there are different opinions about the number of paradigms in the science of linguistics, mainly it is customary to distinguish three paradigms, i.e. 1) comparative-historical, 2) system-structural and 3) anthropocentric paradigms [16, p. 5; 26, p. 144].

II. IDENTIFY, RESEARCH AND COLLECT IDEA

V.A. Maslova emphasizes that in linguistics one paradigm does not completely give way to another, these paradigms can live side by side at a certain moment, and briefly describes these paradigms as follows: Comparative-historical paradigm was the first scientific paradigm in linguistics, already, comparative-historical method was the first special method of language research. The whole XIX century passed under the rule of this method. In the system-structural paradigm, attention was focused on the subject, thing, name, so the focus was on the word. Even in the third millennium, language can be studied within the framework of the systemic-structural paradigm, because this paradigm still continues in linguistics, the number of its successors is quite large. The fundamental work created within this paradigm can serve as a valuable source of information not only for current researchers, but also for future generations of linguists conducting research in other paradigms. The anthropocentric paradigm is a shift of the researcher's attention from the object of knowledge to the subject, that is, the person is studied in the language and the language in the person. After these thoughts, V.A. Maslova rightly pointed out that "the idea of anthropocentricity of language is a key idea in modern linguistics. In our time, simply creating different descriptions of the language system cannot be the goal of linguistic analysis" [16, p. 5-6].

At this point, it should also be mentioned that it is not the right way to completely oppose one particular paradigm to another. For example, no matter how advanced and positive direction the system-structural paradigm is, it considers learning the language in an immanent state, that is, completely separated from the owner, as the basis of research. But some Uzbek linguists started to absolutize this paradigm, to announce it as the only correct way to learn the language, they presented it as an idea that rejects traditional linguistics, if not at all. However, traditional linguistics is not a science that is completely methodless, sloppy, and risky, so to speak, it is a strong science that synthesizes different paradigms, consciously advances different aspects of language, intelligently generalizes, and prepares the ground for

many directions. Traditional linguistics is concerned only with the practical, emotional-empirical description of language facts "given in direct observation", language phenomena "at the theoretical stage in a perceptual way" [14, p. 12] is not an outdated science next to structural linguistics. To be honest, in traditional Uzbek linguistics, there was a system-structural approach, that is, "research using the cognitive method at the theoretical stage", although not as a system.

The wise father of Uzbek linguists, Prof. Sh. Rakhmatullaev wrote in his time about incorrect interpretations in this regard: "F. de Saussure's teaching was already known as a direction of systematic-structural research of language phenomena, but to most national linguists, including Uzbek not applied to linguistics. The application of certain aspects of F. de Saussure's teaching to Uzbek linguistics began in the 90s of the 20th century with the initiative of Prof. Hamid Nematov... It is commendable to call Uzbek linguists to study language development in a systemic-structural direction. But it was not correct to assess the previous stage of development of Uzbek linguistics as a period of empirical study of the language, a period of inventorying language phenomena... It is not fair to discriminate that there was no system-structural study of the language in the previous stage of development of Uzbek linguistics. For example, Ayub Gulom's monograph "Determinants in Uzbek language" (T.: UzFan publishing house, 1941), created at the stage when the science of Uzbek linguistics was being formed, cannot be said to have been written in the direction of empiricism, inventory... In general, approaching the construction of the Uzbek language as a system, at the same time Uzbek There are many works written taking into account the national characteristics of the language" [21, p. 4]. To think that the great linguist A. Gulom, who had scientific debates, wrote letters, and had friendly relations with such linguists of the world, was not aware of the works of F. de Saussure or Baudouin de Courtenay or other linguists who made a turning point in the history of world linguistics is, at least, ignorant of scientific honesty. Therefore, it cannot be completely denied that there is a system-structural approach to a certain extent in the researches of A. Gulom and other famous Uzbek linguists, and fundamental theoretical ideas have been put forward.

As A. Nurmonov, explaining the essence and specific aspects of structural linguistics, rightly noted that studying the relationship between the structural units of the language is one of the important tasks of linguistics, but in this linguistics "the relationship between language and society, language and speaking person, language evolution, literary language and folk dialects A number of issues such as attitude, language and thinking, text linguistics, language aesthetics remain out of his view. At the same time, A. Nurmonov says that "traditional linguistics cannot be evaluated as "old, backward", and systematic linguistics as "new, advanced" linguistics" [19, p. 11-12].

III. IMPROVEMENT AS PER REVIEWER COMMENTS

It should be noted separately that language is a multitasking phenomenon, its integral essence cannot be defined based on one specific task, often, especially in systemic-structural linguistics, only the communicative function of language is relied on as a means of communication. In fact, in addition to the communicative task, "language performs a number of tasks such

as knowing the world, collecting and storing knowledge, conveying it to the next generations, reflecting spiritual relationships, and realizing the categories of beauty... Interpreting language only as a means of communication between people is the natural language of a person, which is nothing more than animating a complex and magnificent phenomenon, equating it with an artificial language (for example, Esperanto) that is completely similar to a specific national image or national-spiritual ground, equating it with a conditional "language" created for the purpose of regulating traffic" [14, p. 44].

That is why the formation of anthropocentrism as a separate paradigm in linguistics and the increasing number of researches in this direction in world linguistics is extremely gratifying. It should be said that anthropocentrism is not a concept or paradigm attributed by linguists only to the study of language, anthropocentrism is a phenomenon directly related to the essence of language. Russian linguist T.B.Radbil, explaining in detail that anthropocentrism is a fundamental, basic feature of language, cites Yu. S. Stepanov's words that "language is created in the human model, and this dimension is sealed in the structure of the language itself, and language should be studied accordingly" [20, p. 89]. Remembering countless metaphors in the language, it is easy to imagine that a person perceives the outside world with his own measure, his own example: *daraxtlar ko'z yosh to'kdi, mezonlar kezar, asablar tuproqqa cho'kkan edi tiz, ojiz jasorat, saratan mudraydi, hayratan lol qotgan ofiob, shu'lalar o'ynaydi, birovdan xijolat bo'lgan tol, yellar ham uyg'ondi ishqalab kaftin, maysa silkitadi bosh, hovliqma jilg'alar chopar, azaliy hukmini o'qidi hayot, bahor kelayotir, ivirsir bahor, gul o'qib turar bayt, maysa uyg'onar, yel kezar, uchqur zamon, nomard tabiat, uyg'onguvchi bog'lar, quyosh chekar oh, shamollar o'ynaydi, to'lqinlar qutursin, dono tabiat, qahqaha uradi qadim bu hayot* (А.Орипов). A person evaluates and names qualities and actions in the external world "through his own body", based on his own way of looking, as if relative to himself. It can be seen that the concept of man is at the basis of these metaphors, and it should be noted that it is extremely difficult to interpret their essence completely separate from man.

In accordance with such an objective nature of language, in the anthropocentric paradigm, man is given the main place, and language is the main element that makes up the human personality. Experts cite the famous Russian writer S. Dovlatov's wise saying that "language makes up 90 percent of a person's personality". As stated by V.A.Maslova, the human mind cannot be imagined outside of language and the ability to create and perceive speech. As he rightly pointed out, the directions of cognitive linguistics and linguoculturology (linguistic cultural studies) formed within the framework of this paradigm in modern linguistics in the following decades should be focused on the cultural factor in language and the linguistic factor in man. "Linguocultural science studies language as a cultural phenomenon. This is a unique way of seeing the world through the prism of a national language, in which language participates as an expression of a separate national mentality" [16, p. 8]. Today, linguoculturalism has been formed and is developing as a separate linguistic direction in Russian and other foreign linguistics, and has entered the system of philological higher education as an academic subject [6; 27; 5]. "The task was to describe and study the relationship between language and culture, language and ethnicity, language and

mentality" [5, p. 64] this trend is also prominent in Uzbek linguistics, especially in comparative research.

In almost all scientific research and educational literature devoted to linguistic culture, it is noted that the anthropocentric approach to language, although it appeared anew in the late 20th and early 21st centuries, has its roots in the famous ideas of the German scientist W. von Humboldt. Indeed, his "Language is the outward manifestation of the people's soul: the language of the people is its soul, and the soul of the people is its language, and nothing else can be imagined that corresponds to each other"; "Language diversity is not only due to differences in sounds and symbols, but also due to differences in the worldview itself"; "It can be considered universally recognized that different languages are the organs of the original thought and imagination of nations"; "Thinking is not only dependent on language in general, it is conditioned by each individual language to a certain extent"; "Language is the most convenient tool for creating character; the whole national character is imprinted only in language"; "The character of a nation can be known more easily by its language than by its morals, customs, and behavior" [7, p. 68-324], so to speak, the linguo-anthropological philosophy of Alloma found its open expression. These ideas of W. Humboldt were later developed and promoted by several scientists such as Y. L. Weisgerber, E. Sepir, B. Whorf, A. A. Potebnya. In today's world, the priority role of language in knowing the world, its active influence on real existence and consciousness, the main factor and main source in all mental and cognitive activity of a person is almost recognized, this fact is the solid foundation of an anthropocentric approach to language. Enlightener A. Avloni said without a doubt that "To lose the national language is to lose the soul of the nation" [1, p. 60] did not say.

Y.L.Weisgerber, who was one of the first to introduce the concept of "linguistic landscape of the world" to linguistics, said that "language gives its owner a general view of the world that is different from other languages", "the mother tongue and the mental formation of each person are closely related" and "that". For that reason, linguistics should study languages as a reflection of people's culture" [3, p. 120-173]. In linguistics, not only in linguistics, but also in the humanities in general, the "theory of linguistic relativity", that is, the Sepir-Whorf hypothesis, according to researchers, after 80 years of debate, strong and weak versions have been formed today, that is, the judgment in the strong version: language determines thinking; and the weak version of the sentence: language affects thinking [2]. As it can be seen, in both versions, the close connection between language and thinking is expressed. In any case, it is an obvious fact that language actively affects thinking, and thinking actively affects language. Already, this connection is recognized in many terms that are widely used today, such as "national consciousness", "national thinking", "national culture", "national spirituality", "national mentality", "national character".

The idea "Language is a mirror of culture" based on W.Humboldt has a very deep meaning. S.G.Ter-Minasova, who researched the place of language in intercultural communication, understood in language not only the real world around man, not only his lifestyle and conditions, but also the social self-awareness of the people, their mentality, national character, way of life, traditions, customs, says that it also reflects morals, value system, perception and vision of the world, language as a tool of culture

perfects the human personality [25, p. 15]. He writes: "Thus, language, thought and culture are so closely connected with each other that in practice they form a whole consisting of the same three elements, none of which can live (ie, exist) without the other two. All of them interact with the real world, contradict it, depend on it, reflect it and at the same time shape it" [25, p. 40] The anthropocentric paradigm is aimed at researching this system of problems in which man is at the center.

It should also be said that there are different views on naming this new paradigm. Some linguists prefer to call this paradigm the "cognitive paradigm". As V.A.Maslova rightly pointed out, "one cannot agree with this opinion, because cognitive linguistics is only one of the aspects of the problem of "a person in a language and a language in a person". The term "anthropocentric paradigm" is more appropriate because it includes not only cognitive linguistics, but also linguoculturalism, communicative linguistics, and ethnolinguistics" [15, p. 12].

Linguoculturology is the youngest direction that arose in the cooperation of linguistics and cultural studies, but in the priority of linguistics, therefore this new direction was born directly in the bosom of the science of language. In linguistic culture (both in cognitive linguistics and in general, in the anthropological paradigm), there are a number of basic concepts such as "linguistic landscape of the world", "linguistic person" (*yazykovaya lichnost*), "concept" [23, p. 64-72]. Despite the fact that a lot has been written about these concepts and, therefore, terms in linguistics, there is still no consensus on the interpretation of some of them. For example, there is almost a consensus in the use and interpretation of the term "national linguistic landscape of the world": "There are as many national linguistic landscapes of the world as there are languages, each of these languages reflects the unique results of the centuries-old work of the collective ethnic consciousness to understand and categorize human existence in the universe. makes" [11, p. 140]. But this cannot be said about the terms "linguistic person", "concept" [9, p. 24-32; 18, p. 452-454]. A. M. Nadyochkin points out that there is too much abstraction and variety in the scientific interpretations of the concept, and says that the theory of the concept needs serious methodological research. Uzbek linguist prof. Sh. Safarov, while talking about the concept, does not pay enough attention to its linguistic, cultural and ethno-national aspects [22, p. 17-18]. It is true that the concept is a meaningful, mental concept related to thinking, but it is quite controversial to consider it as a phenomenon completely free from national and cultural elements. S.G. Vorkachev, who created a number of works devoted to the study of this issue, even states that "the leading distinguishing feature of the linguistic concept is its ethnocultural character" [5, p. 76]. Among the many definitions given to the concept in Russian linguistics, the definition put forward by V.A.Maslova, in my opinion, reflects reality more clearly. According to him, the concept "is a semantic structure in which the linguistic and cultural identity is recorded and describes the owners of a certain ethnoculture in one way or another" [15, p. 50]. In linguistic and cultural studies, a lot of attention is paid to the problems of expression of the concept, when you get acquainted with the Internet materials, for example, you can see that this direction is extremely widespread in Russian linguistics, and it is difficult to enumerate the works in this regard. Even in recent years, a very large number of candidate's dissertations have been devoted to the linguistic and cultural research of the concept

in one or another language. For example, some of them: O.V.Golovan. "Semantic-associative structure of the concept of "voyna"" (2003); L.N.Venediktova "Koncept "voyna" in language painting (sopostavitelnoe issledovanie na materiale angliyskogo i russkogo yazykov)" (2004); Z.A.Motygullina. "The concept of "destiny" in Tatar and English language paintings" (2006); A.Sh.Vasilova. "Linguocultural concept "sagysh" (toska) and the Tatar language picture mira" (2006); L.H.Shayakhmetova. "Koncept "ut" i ego otrazhenie v lirike R. Minnullina" (2007); L.R.Garipova. "Kontsepty Tatarskoy yazykovoy kartinny mira: presenatsii v lekseme "dönya"" (2007) and others [8, p. 4]. There are many works of this type in other linguistics, as well as in Uzbek comparative linguistics. In any case, works like "Expression of such and such a concept in such and such a language" are increasing, and have even taken the form of a certain template. This type of work is, of course, very necessary, but it is better to avoid stereotypes.

When the main problem in linguoculturology is about the relationship between language and culture, it is necessary to correctly imagine the concept of culture. While Sh. Safarov thinks about the relationship between language and culture in linguistic culture, about "determinism, i.e. mutual dependence" between them, for some reason he includes "culture" in the expression of "speech culture" as part of culture in linguistic culture [22, p. 65], which is not appropriate at all. When speaking of language and culture, the problem called "speech culture" often comes to mind associatively, but this does not at all indicate the exact nature of the culture in the two places [10]. Language and culture are usually (*correctly*) meant to explain this or that culture through language or, conversely, to explain this or that language through the study of culture. (*speech culture*) means "a set of achievements of human society in production, social and spiritual-educational life (*cultural history, Uzbek culture*)". Therefore, the learning problems of speech culture are different, and the object of study of linguistic culture is completely different.

In general, the search for the most effective ways to perfectly study a complex phenomenon like language by the people of the world is a very positive and noble action. Naturally, it is difficult to get to the essence of this phenomenon by studying it only within one paradigm or direction. That's why V.N.Teliya, Yu.S.Stepanov, V.A.Maslova and many other linguists believe that linguistics is polyparadigmatic, that it is impossible to abandon the achievements of any paradigm or direction, that all problems in the language can be solved with a certain method or approach. they emphasize that it cannot be done, only their cooperation will lead to serious results [15, p. 18; 26, p. 146]. T.N.Khomutova writes that the judgments that language learning is on a cognitive basis are untrue: "Cognitive direction is not the only "base point" in language research, it is one of many directions that can be used in communicative, cultural, social, structural and so on. is one, they can give a true description and explanation of the language only when taken together" [26, p. 146].

IV. CONCLUSION

As mentioned, an anthropocentric paradigm was formed in linguistics in the following decades. With the formation of this new paradigm, almost all linguists began to search within this direction, and more and more new terms were coined. So to speak,

many of these terms are not free from abstraction, even confusion (for example, we have seen this case in the description of "concept"), many are redundant. Moreover, it is becoming a tradition for researchers to make unnecessary terms and use them unnecessarily. The following comments of the Russian linguist V.V.Krasnykh, who created serious research within this paradigm, are noteworthy: "In such cases, that is, when a direction begins to develop rapidly, as usually happens, a lot of extra "bubbles" and "bubbles" appear. I must note with regret that today "discourse", "concept", "cognitiveness", "linguistic personality", "mental-linguistic complex", "linguoculturalology", "ethnopsycholinguistics", "intercultural communication", ... have been introduced relatively recently. the terms "cognitive base" and "precedent phenomena" (precedentnyye phenomeny), as well as a bunch of other terms of this "field" are heard at every step in the speech of scientists, ladies and gentlemen, like fashion accessories that cannot be entered into the society without wearing them. Moreover, most of the time, the use of these concepts does not justify itself (it is nothing more than following a fashion) and has no real connection to the subject the author is talking about" [12, p. 5]. It seems that one should not forget the standard when using terms in this direction as well.

In general, it can be said that linguists all over the world have always been looking for the best ways to study language. Serious successes have also been achieved in these processes. One such success so far is undoubtedly the emergence of the anthropocentric paradigm in linguistics and its rapid development in various guises and directions.

REFERENCES

- [1] 1. Avloniy A. Tanlangan asarlar. 2-jild. Toshkent: Ma'naviyat, 1998.
- [2] 2. Buras M., Krongauz M. Jizn' i sud'ba gipotezi lingvisticheskoy otositel'nosti. "Nauka i jizn", N8, 2011 / <http://elementy.ru/lib/431410>.
- [3] 3. Vaysgerber Y.L. Rodnoy yazyk i formirovanie duxa. –M.: Yeditorial URSS, 2004.
- [4] 4. Vorkachev S.G. Lingvokul'turologiya, yazykovaya lichnost', konsept: stanovlenie antroposentricheskoy paradigmi v yazykoznanii // Filologicheskie nauki. 2001. №1. –S.64 – 72.
- [5] 5. Vorkachev S.G. Lingvokonseptologiya i mejkul'turnaya kommunikasiya: istoki i seli // Filologicheskie nauki. 2005. № 4. -S. 76.
- [6] 6. Vorob'ev V.V. Lingvokul'turologiya (teoriya i metodi). - M. : Izd-vo Ros. un-ta drujbi narodov, 1997.
- [7] 7. Gumbol'dt V. Izbrannie trudi po yazykoznaniiyu. –M.: Progress, 1984.

- [8] 8. Ziatdinova G.I. Konsept "sugish (voyna)" v tatarskoy yazykovoy kartine mira: Avtoref. diss. kand. nauk. –Kazan', 2009.
- [9] 9. Ivansova Ye.V. O termine «yazykovaya lichnost'»: istoki, problemi, perspektivi ispol'zovaniya / Vestnik Tomskogo gosudarstvennogo universiteta. Filologiya. N4 (12). 2010. – S.24 – 32.
- [10] 10. Kasevich V.B. Yazyk i kul'tura / files.zipsites.ru/
- [11] 11. Kornilov O.A. Yazykovie kartini mira kak proizvodnie nasional'nix mentalitetov. –M.: CheRo, 2003.
- [12] 12. Krasnix V.V. Tochki nad i ili mnogotochie?.. (k voprosu o sovremennoy nauchnoy paradigme) / Yazyk, sozanie, kommunikasiya. Vipusk 16. –M.: Makspress, 2001. – S.5.
- [13] 13. Kun T. Struktura nauchnix revolyusiy. – M., 1977.
- [14] 14. Qurbonova M.M. Hozirgi zamon o'zbek tili. –Toshkent, 2002.
- [15] 15. Maslova V.A. Kognitivnaya lingvistika. –Minsk: TetraSistems, 2008.
- [16] 16. Maslova V.A. Lingvokul'turologiya. –M.: Academia, 2001.
- [17] 17. Mahmudov N. Ma'rifat manzillari. –Toshkent: Ma'naviyat, 1999.
- [18] 18. Nadyojkin A.M. "Zakat" konsepti // Vestnik Nijegorodskogo universiteta im. N.I.Lobachevskogo. N6 (2). 2011. – S.452 – 454.
- [19] 19. Nurmonov A. Struktur tilshunoslik: ildizlari va yo'nalishlari. –Andijon, 2006.
- [20] 20. Radbil' T.B. Osnovi izucheniya yazykovogo mentaliteta. –M.: Flinta: Nauka, 2009.
- [21] 21. Rahmatullaev Sh. Sistem tilshunoslik asoslari. –Toshkent: Universitet, 2007.
- [22] 22. Safarov Sh. Kognitiv tilshunoslik. – Jizzax: Sangzor, 2006.
- [23] 23. Svetonosova T.A. Kognitivnaya lingvistika i lingvokul'turologiya: cherti i razlichiya // Filologicheskie nauki v MGIMO. Sbornik nauch. trudov. N27 (42). – M.: MGIMO-Universitet, 2007. –S.39 – 46.
- [24] 24. Stepanov Yu.S. V trexmernom prostranstve yazyka. Semioticheskie problemi lingvistiki, filosofii, iskusstva. – M.: Nauka, 1985.
- [25] 25. Ter-Minasova S.G. Yazyk i mejkul'turnaya kommunikasiya. –M.: Slovo/ Slovo, 2000.
- [26] 26. Xomutova T.N. Nauchnie paradigmi v lingvistike / Vestnik Chelyabinskogo gosudarstvennogo un-ta. 2009. N35 (173). Filologiya. Iskusstvovedenie. Vip. 37. –S.144.
- [27] 27. Xrolenko A.T. Osnovi lingvokul'turologii. 5-izd. –M.: Flinta: Nauka, 2009. Alefirenko N.F. Lingvokul'turologiya. Sennostno-smislovoe prostranstvo yazyka. –M.: Flinta: Nauka, 2010.

AUTHORS

First Author – Prof. Dr. Mahmudov Nizamiddin Mamadalievich, Director of Institute of Uzbek language, literature and folklore under the Uzbekistan Academy of Sciences, city Tashkent, Uzbekistan

Corporate Governance And The Financial Performance Of Deposit-Taking Savings And Credit Co-Operative Societies In Nairobi City County, Kenya

Charles Katua Kithandi

PhD. Business Administration (Finance- Ongoing), MSC (Finance & Economics), MBA (Finance), BA. (Economics), CPA.K, CPS-F
Lecturer: School of Business and Economics - Daystar University

DOI: 10.29322/IJSRP.12.10.2022.p13084
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13084>

Paper Received Date: 24th September 2022

Paper Acceptance Date: 25th October 2022

Paper Publication Date: 30th October 2022

Abstract- Corporate governance is the backbone of transparency, accountability, integrity and security of shareholders' interest in an organization. An organization with poor corporate governance structure is likely to fail to achieve its objectives as well as have exposure to financial losses. The purpose of this study is to examine the effect of corporate governance on the financial performance of Deposit-taking Savings and Credit Co-operative Societies in Nairobi City County, Kenya. A purposive sampling method integrating qualitative and quantitative design methods was employed in this study. The target and sample population were all the 42 Deposit-taking Savings and Credit Co-operative Societies in Nairobi City County, Kenya while a sample of 30 deposit-taking SACCOS was used for this study. For the 30 deposit-taking SACCOS, the company secretaries and other two executive top management members were each subjected to the study through the administration of questionnaires, hence three respondents per deposit-taking SACCOS. The published annual reports of the 30 deposit-taking SACCOS were used to collect secondary data. SPSS research analysis tool was used emphasizing on the Multiple Regression Analysis and the Spearman Correlation Coefficient among others to assess the magnitude and relationship and thus come up with a finding of the relationship of the independent and dependent variables. The research found that corporate governance practices greatly affect Deposit-taking Savings and Credit Co-operative Societies in Nairobi City County, Kenya

Index Terms- Corporate governance, financial performance, Deposit-taking Savings and Credit Co-operative Societies

I. INTRODUCTION

Corporate governance refers to a system of policies, set of policies, and set of rules that mandate how an organization's management (Board of directors & Board of management) oversees the operations of the organization. Corporate governance also refers to the way the management of a corporate organization uses the power at its disposal in the organization. Good corporate governance practices in an organization are vital in minimizing

management misconduct risks that may lead to financial misappropriations and poor performance of an organization (Akdogan & Boyacioglu, 2022). The primary concern of corporate governance is the practices, processes, rules, policies and procedures set out in an organization to govern how management uses its power to direct and control the use of resources.

According to Ahmed (2016), The main concern of corporate governance the way power is used in an organization in a manner that maintains the best interest of the organization.. Corporate governance also targets the members of organizations. These are primarily shareholders in companies; whether public or private, listed or unlisted. Members are the owners or part owners of the organizations. They are often the people whose money is invested in the organizations (Clark, 2004). This means shareholders are the paramount beneficiaries and paramount losers of well-governed organizations and poorly governed organizations respectively, therefore, they are the ones faced with the burden of ensuring that the organizations are governed in a way that takes care of their interests.

Good corporate governance is indispensable in an organization that strives to ensure that managerial power is exercised in a manner that ensures efficiency, effectiveness, fairness, discipline, responsibility, accountability, probity, and good social responsibility and independence (World Bank, 2015). Adherence to good corporate governance practices does aim at ensuring that organizations are sustainable in the long run (Barako, Hancock, & Izan, 2006).

II. LITERATURE REVIEW

1.1 EMPIRICAL LITERATURE REVIEW

Majority of the previous researches have focused on the composition of board of directors and particularly the importance of outside directors. Outside directors are expected to represent the interests of shareholders by mitigating agency problems between management and shareholders (Fama, 1980). This careful thought may lead one to assert that firms perform better when they are being monitored by a board dominated by independent outside

directors. Contrary to this proposition, (Liang & Li, 1999) carrying out a research on Singapore firms, which looked at whether boards dominated by independent outside directors performed financially better, plays down the importance of boards dominated by independent outside directors rather stressing the importance of business experience and entrepreneurship to influence the better financial performance. According to them, firms managed by dynamic CEO's tend to perform financially better than other categories of firms on the assumption that foreign firms are managed by more experienced CEOs.

A large boardroom size may also be inimical to the decision-making pattern of a firm (Yermack, 1996) hence less performance. Yermack posits in a study carried out in Turkey that the smaller the board size the better the financial performance and proposes an optimal board size of 10 or fewer. This study looked at the board size and its effect on firm's financial performance for banks in Turkey. The findings by Tanko and Oladale (2008), in a similar study in Nigeria on the board size and its effect on firm's financial performance, supports the negative relationship between the board size and bank's financial performance. Following their work, it was suggested that on an average 10-15 board members for a firm is large. I totally agree with these findings as smaller boards are more cohesive and can be better controlled and managed.

During the 2007-2008 economic crisis period, a study to establish whether firms with more independent board and higher institutional ownership perform was carried out by Erken, Hung, and Motos (2006) using a sample of 296 financial firms from 30 countries in Europe and the Americas, it was established that firms with more independent boards and higher institutional ownership experienced worse stock returns as a result of taking more risk which led to loss of many shareholders (Erken, Hung, & Motos, 2010). However, Bekaert and Harvey (2002) argue that firms with more independent boards raised more equity capital during the crisis, which led to a wealth transfer from existing shareholders to debt holders. This research was carried out in the USA which aimed at establishing the financial performance of firms with more independent boards and higher institutional ownership.

Although the value of the firm increases with foreign ownership, firm performance decreases with state ownership (Hung & Chen, 2009). This study was conducted in China to establish the influence of firm performance when the firm ownership structure is foreign owned or state owned. The study noted that state owned majority firms have directors with less keen interest in the firm and hence are more likely to make decisions affecting the firm that are not well thought out.

2.2 THEORITICAL LITERATURE

2.2.1 Agency Theory

Agency theory refers the relationship between one person called the principal and another person called the agent, in which the principal instructs the agent to act on his or her behalf regarding certain matters (Jensen & Mackling, 2016). In an organization, the principal is the shareholder who appoints managers as his agents to act on their behalf on matters relating to the management of the company (Clark, 2004). The proponent of this theory argued that shareholders who are the principals hire managers who become agents to make decisions and perform key duties in an organization. Shareholders delegate the running of the

organization to the managers who act as the shareholder's agents in all business activities (Fama, 1980).

In this agency relationship, the agents may at times be self-centered and act out of self-interest which brings friction and conflict between the principal and the agent. The divergence from the aspirations of the principal by the agent in pursuit of the personal interest of the agent may bring conflict between the principal and agent. This agency relationship create separation between ownership and control of resources in an organization which generates concern on how to effectively align the actions of the managers with the interest of the shareholders. According to Smith (1776), who suggested that the separation of ownership and control of -business resources leads to poor management of the organizations since managers and directors mostly pursued their self-interest in the management of the affairs of the firm.

There have been various theoretical underpinnings in the current framework of corporate governance, for instance, Ansari (2014) argued that the agency problem has become prevalent in the recent past and in modern firms and has majorly been caused by the separation of ownership and control of organizations. In a business setting the shareholders to provide and raise finances for acquiring assets, while managers are tasked by the shareholders to ensure that they use the assets to generate revenues. The main premise for shareholders appointing managers is shareholders' wealth maximization and growth through the management of business resources and finances provided by the shareholders. The manager's dilemma is how to use the funds provided by the shareholders and making the right decision on how to effectively utilize the funds. (Ansari, 2014). The agency theory has been criticized as it identifies shareholders as the only interest group of an organization. This has led to the development of the stakeholder theory (Cuevas-Rodriguez, Gomez-Mejia, & Wiseman, 2012).

2.2.2 Stakeholder Theory

This theory was pioneered by Freeman (1994) who asked two key questions: |What is the purpose of the firm? What is the responsibility of the management of the firm to its stakeholders?. In regard, to the first question the proponent argued that managers of every firm should ensure that there is a shared purpose for the firm. The main purpose of the firms revolves around the reason why shareholders invest funds in a business, that is, shareholders invest with a purpose and the purpose is to have stake in the earnings of the firm. This question implied that a business goal is to ensure all stakeholders of the business benefit from the firm.

The second question of the proponent on the responsibility of the management of the firm to its stakeholder implied that managers need to define how to contact the business in a manner that caters for the interest of the shareholders, that is, clearly understand what needs to be done and how it should be done. The managers also needed to understand what type of relationship was needed with the stakeholders for smooth running of the business (Adams, & Mehran, 2015).

Even though, the current legal framework under which most companies operate dictates that directors are accountable to shareholders as the primary stakeholders in the business such argument does not take care of the other stakeholders in a business.

III. RESEARCH METHODOLOGY AND MODEL SPECIFICATION

This study integrated both qualitative and quantitative design methods. For the purposes of this study. The target population of the study was also the 30 deposit-taking SACCOS was used for this study. For the 30 deposit-taking SACCOS. The research study was carried out at the various head offices since this is where the company secretary and other senior executive management, the target respondents in the deposit-taking

SACCOS are based. Structured questionnaires were used to collect data and were administered to the company secretaries and top executive management staff. The study also utilized secondary data that was obtained from the 2019 to 2021 annual reports of the deposit-taking SACCOS

IV. PRESENTATION AND DISCUSSION OF RESULTS

4.1 Descriptive Statistics

Table 1 : Source Financial Reports (2019-2021)

	N	Minimum	Maximum	Mean	Standard Deviation
Measure of financial performance (ROE)	11	.10	.27	.2127	.05503
Valid N (list wise)	11				

The data analysis revealed that the lowest earner 30 deposit-taking SACCOS returned 10 cents for every one shilling of shareholders equity while the highest earner returned 27 cents for every shilling of shareholder’s investment. The mean was 21 cents with a standard deviation of 0.055. The data was analysed from

the ROE of the years 2019 through to 2021. The interpretation of the data revealed that deposit-taking SACCOS over the three years varied, hence the need to carry out the study to reveal how corporate governance practices impacted on this variance.

4.2 Correlations

Table 2 : Correlations matrix between the dependent variable and the independent variables

		Mean ROE	SRR	CGPR	CGPO	DPP
Mean_ROE	Pearson Correlation	1	0.753**	0.404	0.614*	0.668*
	Sig. (2-tailed)		0.007	0.217	0.045	0.025
	N	11	11	11	11	11
SRR	Pearson Correlation	0.753**	1	0.009	0.420	0.646*
	Sig. (2-tailed)	0.007		0.978	0.198	0.032
	N	11	11	11	11	11
CGPR	Pearson Correlation	0.404	0.009	1	0.002	0.529
	Sig. (2-tailed)	0.217	0.978		0.995	0.094
	N	11	11	11	11	11
CGPO	Pearson Correlation	0.614*	0.420	0.002	1	0.209
	Sig. (2-tailed)	0.045	0.198	0.995		0.536
	N	11	11	11	11	11
DPP	Pearson Correlation	0.668*	0.646*	0.529	0.209	1
	Sig. (2-tailed)	0.025	0.032	0.094	0.536	
	N	11	11	11	11	11

** . Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

With N being the number of financial data collected from the deposit-taking SACCOS, the matrix above gives the correlation of the financial performance against the four corporate governance indices.

The matrix indicates that there was a significant correlation between the return on equity and shareholder’s rights and responsibilities, corporate governance policies and disclosure policies and practices. There was also a correlation between return on equity and corporate governance practices though it was not a statistically significant level. The correlations indicate that as the

response value increased from strongly disagreed to strongly agreed, the return on equity also increased. Shareholder’s rights and responsibilities showed a particularly strong correlation of 0.753 significant at the 0.01 level as was the finding by Miseda (2012).

Corporate governance policies recorded a correlation value of 0.614 with P value of 0.045 which is statistically significant at the 5% level. This indicates that there is a statistically significant correlation between corporate governance policies and the deposit-taking SACCOS’s profitability. As the responses

increased from strongly disagreed to strongly agreed, the mean return on equity value also increased.

Disclosure policies and practices recorded a Pearson's correlation value 0.668 with a P value of 0.025 which is statistically significant at the 5% level. This also shows that as the responses on disclosure policies and practices increased from strongly disagree to strongly agree, the mean return on equity also increased and this correlation was statistically significant as was the finding by Miseda (2012).

Corporate governance practices recorded a Pearson's correlation value of 0.404 which means that as the responses grew from strongly disagreed to strongly agreed, the mean return on

equity also increased but it had a P value of 0.217 which infers that it was not statistically significant at the 5% level.

4.3 Regression Analysis

The statistics above were made clearer with the regression model below:

$$ROE = \beta_0 + \beta_1 CGPR + \beta_2 SRR + \beta_3 CGPO + \beta_4 DPP + u$$

Where;

ROE: Return on equity

β_i = coefficient estimators of the predictor variables

u = error

CGPR: Corporate governance practices

SRR: Shareholders rights and responsibilities

CGPO: Corporate governance policies

DPP: Disclosure policies and practices

Table 3: Regression model summary

Model	R	R Square	Adjusted Square	RStd. Error of the Estimate
1	.913 ^a	.833	.722	.02902

a. Predictors: (Constant), SRR, CGPR, CGPO, DPP

The R Square in the model summary indicates how much of the variance in the response is explained by the predictors. The R square 0.833 shows a relationship between the observed and predicted values of the dependent variable. In conclusion it can be authoritatively said that the CGPP, CGPO, DPP and SRR account

for about 83.3% of the variance observed in the mean return on equity. Therefore this informs the fact that corporate governance practices play a big role in the financial performance of deposit-taking SACCOS.

Table 4: ANOVA: Analysis of Variance

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	.025	4	.006	7.488	.016 ^b
Residual	.005	6	.001		
Total	.030	10			

a. Dependent Variable: ROE

b. Predictors: (Constant), SRR, CGPR, CGPO, DPP

Table 5: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients Beta	T	Sig.	Collinearity Statistics	
	B	Std. Error				Tolerance	VIF
(Constant)	1.612	.463		3.485	.000		
CGPO	.053	.027	.361	1.948	.039	.811	1.233
CGPR	.300	.170	.406	1.766	.128	.527	1.896
DPP	-.004	.085	-.014	.048	.002	.305	3.281
SRR	.771	.348	.607	2.216	.000	.371	2.698

The table 5 above shows the B column which are the beta values and they give the coefficient estimates of the predictor variables for the regression model. The table shows that three of the variables namely corporate governance policies, disclosure practices and policies and shareholders rights and responsibilities have P values which were significant at the 5% level (0.05).

Interpreting the values of the beta coefficients, it shows that holding all other factors constant, every positive unit change in corporate governance policies will increase the mean return on equity by 0.053 while still holding all factors constant, a unit change in shareholders rights and responsibilities will increase the mean return on equity by 0.771 units. However, a unit increase in disclosure policies and practices will bring about a negative change by 0.04.

Collinearity statistics is used to check for correlation between the predictor variables. For each predictor variable, the tolerance level is more than 0.1 and the VIF value is less than 10, it shows that there is no correlation between the predictor variables.

4.4 Summary of Findings

Corporate governance policies recorded a correlation value of 0.614 to the mean return on equity showing that similarly, as the responses under this category rose from strongly disagree to strongly agree, the mean return on equity increased and as the responses decreased, the mean return on equity increased. This correlation value was significant at the 0.05 level as it had a significant F value of 0.045.

Corporate governance practices showed a correlation of 0.404 to the mean return on equity but it had an F value of 0.217 which is not significant at the 0.05 level. In the regression matrix, corporate governance practices also recorded an F value of 0.128 which is not significant at the 0.05 level.

From table 3 which gives a summary of the regression model, it was found that the four group indices analyzed (the independent variables), the independent factors accounted for 83.3% of the variance in the rate of change from the Mean of the ROE. Of the four indices, three factors namely corporate governance policies, disclosure policies and practices and shareholder's rights and responsibilities were the most significant with shareholders rights showing high significance.

Though corporate governance showed strong correlation, it did not show any statistical significance as it had a p value of 0.128 which is greater than 0.05. In table 2, a collinearity test performed to test if there was any correlation between one independent variable and another showed that there was no correlation indeed between one predictor variable and another. This was ascertained since all the tolerance levels were greater than 0.1 and the TIF values were all less than 10. This is a strong indication that the regression model was valid.

V. CONCLUSION AND RECOMMENDATION

The study concluded that corporate governance practices cannot be down played as they indeed do play a very vital role on

the financial performance of deposit-taking SACCOS. From the regression results, it is important to note that the extent of the firm's performance is dependent on the predictors examined.

Corporate governance is very important to the deposit-taking SACCOS as it involves the way the deposit-taking SACCOS business and affairs are managed by the board and the top management, thus affecting how the deposit-taking SACCOS objectives are arrived at, plans and policies.

The core of the study proves that good corporate governance structures are very important to the financial performance of deposit-taking SACCOS. The further upshot of this study is that it does not only aim at ensuring that deposit-taking SACCOS observe sound corporate governance practices, but equally important is to emphasize the need to ensure that the collapse of deposit-taking SACCOS as a result of unsound corporate governance practices is nipped at the bud.

The study recommended that deposit-taking SACCOS should also ensure that shareholders and other stakeholders are timely provided with relevant information regarding the financial performance of the deposit-taking SACCOS and also the management analysis as shareholders rights and responsibilities showed a significant correlation with the financial output of the deposit-taking SACCOS

The study also recommended that the The SACCO Societies Regulatory Authority (SASRA) should further monitor compliance with the corporate governance codes and guidelines by them as this will ensure that deposit-taking SACCOS are well aligned in observing good corporate governance practices, which shall correlate in good performance of the deposit-taking SACCOS. The ICPSK should ensure that all company secretaries of deposit-taking SACCOS in Kenya are registered certified public secretaries, so that they can ensure that good corporate governance practices as they are the custodians of good corporate governance practices.

REFERENCES

- [1] Adams, B., Hermalin, N & Weisbach, V. (2010). The relationship between corporate governance practices and dividend pay-out of commercial banks in Kenya. *Journal of Corporate Finance*, 8, 49-66.
- [2] Adams, W. & Mehran, S. (2015). Is corporate governance different in bank holding companies? Working Paper, Federal Reserve Bank of New York, 124.
- [3] Ahmed, N. (2016). Board composition, CEO duality and performance among Malaysia Listed Companies. *Journal of Corporate Governance*, 4, (4), 47-61.
- [4] Ansari, V. A. (2014). A theoretical framework for corporate governance. *Indian Journal of Corporate Governance*, 7, 56-72.
- [5] Banking Act. (2004, March). The Central Bank of Kenya, Chapter 491, Laws of Kenya. Nairobi: The Central Bank of Kenya.
- [6] Barako, G. D., Hancock, P., & Izan, Y. H. (2006). Factors influencing voluntary corporate disclosures by Kenyan companies. *Corporate Governance Journal*, 13(1), 107-127.
- [7] Bekaert, G., & Harvey, C. (2002). Chronology of economic, political and financial events in emerging markets. Retrieved June 18th, 2014, from http://people.duke.edu/~charvey/Country_risk/chronology/kenya.htm
- [8] Betham, B., Anumba, C., Thompe, T., & Hedges, I. (2004). KPI's: A critical appraisal of their use in construction. *Benchmarking: An International Journal*, 11(1), 93-117.

- [9] Brownbridge, M. (1998, March). The causes of financial distress in local banks in Africa. Retrieved July 18th, 2014, from http://unctad.org/en/docs/dp_132.en.pdf
- [10] Chirchir (2014). Effects of corporate governance on financial performance of savings and credit cooperative societies in Machakos and Athi-river subcounties (Doctoral dissertation).
- [11] Clark, T. (2004). Theories of corporate governance: The philosophical foundations of corporate governance. London and New York: Routledge.
- [12] Clarkson, M. B. (1995). Corporate social performance and organizational attractiveness to prospective employees. *Academy of Management Review*, 20, 92-117.
- [13] Cooper, T., & Schindler, P. S. (2003). *Business research methods* (8th ed.). Boston: Irwin Mc Graw-Hill.
- [14] Conyon, M., Judge, Q. W., & Useem, M. (2011). Corporate governance and the 2008-2009 financial crisis. *Corporate governance: An International Review*, 19(5), 399-404.
- [15] Davis, H. J., Schoorman, D. F., & Donaldson, L. (1997). Stewardship theory or agency theory: CEO. *Academy of Management Review*, 22, 20-36.
- [16] Erken, S. D., Hung, M., & Motos, P. (2010). Corporate governance in the 2007 - 2008 financial crisis: Evidence from financial institutions worldwide. Working paper, University of Southern California.
- [17] Fama, E. F. (1980). Agency problems and the theory of the firm. *Journal of Political Economy*, 88, 288-307.
- [18] Fraser, R. D., & Phillips, S. P. (1974, March). A canonical analysis of bank performance. *Journal of Financial and Quantitative Analysis*, 8(2), 345-361.
- [19] Freeman, R. E. (1994). The politics of stakeholder theory. *Business Ethics Quart*, 4(4), 409-421.
- [20] Freeman, R. E., Wicks, A. C., & Parmar, B. (2014). Stakeholder theory and "the corporate objective revisited". *Organization science*, 15(3), 364-369.
- [21] Garg, A. K. (2007). Influence of board size and independence on firm performance: A study of Indian companies. *Vikalpa*, 32(3), 39-41.
- [22] Gay, L. R. (1987). *Education research: Competitiveness for analysis and application* (Vol. 3rd). Columbus: Merrill.
- [23] Governance Forum Global Corporate. (2001). *Corporate governance developments*. Washington, DC: World Bank.
- [24] Guler, A., & Crowther, D. (2013). *Corporate governance and corporate social responsibility in context*. Chicago: Gower.
- [25] Hellman, J., & Kaufmann, D. (2001). *Confronting grand corruption head on, convergence achieving global competitiveness*. New Jersey, USA: University of Southern California.
- [26] Hillman, A. J., Canella, A. A., & Paetzold, R. L. (2000). The resource dependency role of corporate directors: Strategic adoption of board composition in response to environmental change. *Journal of Management Studies*, 37, 235-256
- [27] Holy, L. G. (2000). *The globalization of corporate governance*. New York: Gotshal & manges LL.P.
- [28] Ifeanyi, D. N., Olagunju, A., & Adeyanju, D. O. (2011). Corporate governance and bank failure in Nigeria: Issues, challenges and opportunities. *Research Journal of Finance and Accounting*, 2(2), 68-80.
- [29] Iryna, A., & Schiwodiauer, G. (2004). Ownership structure corporate governance and enterprise performance: empirical results of Ukraine. *IAE*, 10(1), 28-45.
- [30] Jackling, B. & Johl, S. (2009). Board structure and firm performance: Evidence from India's top companies. *Corporate Governance: An International Review*, 17(4), 492-509.
- [31] Jensen, M. C. & Mackling, H. (2016). Agency costs of free cash flow, corporate finance, and takeovers. *The American economic review*, 76(2), 323-329.
- [32] Kihumba, A. K. (2000). Corporate governance, Risk Management and bank Performance. (Unpublished master's thesis). Moi University, Eldoret.
- [33] Liang, N., & Li, J. (1999). Board structure and firm performance: New evidence from China's private firms. China Centre for Economic Research: China.
- [34] Linyiru, B. M. (2006). Survey of corporate governance practices in banks in Kenya. (Unpublished MBA project). School of Business, University of Nairobi, Nairobi.
- [35] Maina, C. W. (2012). The role of the company secretary in corporate governance in Kenya listed companies. (Unpublished master's dissertation). University of Nairobi, Nairobi.
- [36] Miseda, F. O. (2012, November). The effect of corporate governance on financial performance of commercial banks in Kenya. (Unpublished project). University of Nairobi, Nairobi.
- [37] Morekwa, A., & Kebede, T. (2013). The effect of governance on performance of commercial banks in Kenya: a panel study. *Corporate Governance*, 13(3), 236-248.
- [38] Mugenda, M. O., & Mugenda, G. A. (2003). *Research methods: Quantitative and qualitative approaches*. Nairobi, Kenya: Acts Press.
- [39] Mwangi, A. K. (2002). A survey of Corporate Governance Practices Among Insurance Companies in Kenya. (Unpublished master's thesis). University of Nairobi, Nairobi.
- [40] Njoka, P. G. (2010). The relationship between corporate governance practices and financial performance of property management Companies in Kenya. (Unpublished MBA project). School of Business, University of Nairobi, Nairobi.
- [41] Okike, M. E. (2002). Corporate governance in Nigeria: The status quo. *Corporate Governance Journal*, 15(2), 1-23.
- [42] Ongore, V., & Gemechu, B. K. (2013). Determinants of financial performance of commercial banks in Kenya. *International Journal of Economics and Financial Issues*, 3(1), 237-252.
- [43] Sahu, N. T., & Manna, A. (2013). Impact of board composition on board meeting on firm's performance: A study of selected Indian companies. *Vilakshan XIMB Journal*, 10(2), 99-114.
- [44] Schostak, J., Davis, M., Hanson, J., Schostak, J., Brown, T., & Driscoll, P. (2010). *The effectiveness of continuing professional development*. London: College of Emergency Medicine.
- [45] Sensarme, R., & Ghosh, S. (2004). Net interest margin: Does ownership matter? *Vikalpa*, 29 (1), 41-49.
- [46] Solomon, J. J., & Solomon, A. A. (2004). *Corporate governance and accountability*. New York, NY: John Wiley.
- [47] Tanko, M., & Oladale, K. (2008). Corporate governance and firm performance. *Journal of Management Sciences*, 1(4), 1-11.
- [48] The Private Corporate Governance Trust. (2002). *Principles for corporate governance in Kenya and a sample of best practice for corporate governance*. Nairobi: PSCGT.
- [49] Utama, A. C., & Musa, H. (2011). The causality between corporate governance practice and bank performance: Empirical evidence from Indonesia. *Gadjah Mada International Journal of Business*, 13(1), 227-247.
- [50] Williamson, E. O. (1979). Transaction cost economies: The governance of transactional relations. *Journal of Law and Economics*, 22(2), 233-261.
- [51] World Bank (2015). *Understanding corporate governance, USA*. Washington DC.
- [52] Yermack (2016). Higher market valuation of companies a small board of directors. *Journal of Financial Economics*, 40, 185-202.

AUTHORS

First Author – Charles Katua Kithandi , PhD. Business Administration (Finance- Ongoing), MSc (Finance & Economics), MBA (Finance), BA. (Economics), CPA.K, CPS-F Lecturer: School of Business and Economics - Daystar University

Influence Of Monitoring And Evaluation Practices On Implementation Of Road Construction Projects In Kiambu County, Kenya

Mercy Wambui Rubia*, DR. Serah Wairimu Kimaru**

* Author's Designation/Present Work Status: Master Student, Department Name: Social sciences, Institution Name: Mount Kenya University

** Author's Designation/Present Work Status: Supervisor, Department Name: Social sciences, Institution Name: Mount Kenya University

DOI: 10.29322/IJSRP.12.10.2022.p13085
<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13085>

Paper Received Date: 25th September 2022

Paper Acceptance Date: 25th October 2022

Paper Publication Date: 30th October 2022

Abstract- County governments in Kenya are implementing monitoring and evaluation systems in an effort improve efficiency in public service delivery. M&E practices are an integral part of the road project cycle and of good management practice in government development projects. The study objective was to examine the influence of leadership in monitoring and evaluation process on implementation of road construction project in Kiambu County. Stakeholder theory has been used widely in various fields and has been applied in different and distinct ways that involve different methodologies, concepts and criteria of evaluation and types of evidence. Interest in the concept of Stakeholders has been growing rapidly and this has led to the increase in the number of perspectives on the subject. The study adopted a descriptive survey design. Descriptive survey research design helped in collecting quantitative data to answer to a study research question or testing of study hypothesis which aimed at carrying out an assess determine influence of monitoring and evaluation practices on the implementation of road construction projects in Kiambu County. the population comprised of target population of who included 12 engineers, 15 Architectures, 25 Kerra officer's county officials, 30 project managers, 31 Clerk of Works, 25 contractors, 16 financial project officers and 75 road construction supervisors a total study population of 229. A sample proportion was therefore be 59% of the study population. Statetified random sampling was used in selection of sample size. A sample proportion of 59% was adopted in determining number of respondents from each management level in the study population. The study concluded that road construction projects in Kiambu County involves a number of Monitoring and evaluation practices that strengthen monitoring and evaluation team in having successful implementation of road construction projects in Kiambu County. The study concludes that leadership in monitoring and evaluation plays a critical role in planning, setting out objectives and charting out the course of action to achieve the set objectives, project organization, project team staffing control and monitor and influence implementation of road construction projects in Kiambu County.

Index Terms- Monitoring and Evaluation, leadership in monitoring and evaluation, Kiambu County

I. INTRODUCTION

In recent times, government across the world undertakes implementing monitoring and evaluation systems in an effort improve efficiency in public service delivery. This has influenced formulation and implementation of policy regulations that enhance application of monitoring and evaluation systems to ensure project success. According to Nabulu (2015) successful completion of an organizational project within budget allocation, scope, without delays is determined by the extent to which monitoring and evaluation (M&E) systems, laying of development project achieve success and completion (Musau, 2016). M&E practices are said to be effective when they can assist project managers to make corrective action and to make decisions that can aid in future project initiation and implementation (Albert, 2012). Implementation of monitoring and evaluation practices influences project performance (Benington & Moore, 2011). Local governments in developing and developed countries are motivated by influence of monitoring and evaluation practices on road construction project success. This view is supported Passia (2013) who indicated that implementation of M&E practices enhances information collection and provision of project progress feedbacks, promote transparency and accountability to implement projects successfully. Government has adopted M&E practices in efforts to achieve success in the implementation road construction project. Mackay (2007) opined that M&E practices have emerged as a key determinant of project implementation success in the road sector.

In Africa, road construction project has instituted monitoring and evaluation practices in efforts to achieve performance in development projects and programs and promote economic growth. With effective results-driven reform agenda constituting incentives, budgeting, monitoring and evaluation systems play a key role in achieving project success in road construction in government sector. However, most road constructions' M&E systems in Africa operate in complex

regulatory framework characterized by highly bureaucratic framework (Nabulu, 2015). However, only a few countries have been able to achieve project success due to effective monitoring and evaluation practices. In Libya, Ayarkwa, Ayirebiand Amoah (2010) indicated effective implementation of M&E systems influence successful implementation of 15 tertiary colleges and 25 secondary schools. In Ghana, implementing the national M&E system led to significant progress in government development (Clear, 2012).

This have resulted to poor implementation of projects, or stalled or abandoned mega projects altogether (GOK, 2016). After the inception of county governments following promulgation of constitution 2010 county governments manage and initiate development projects and programs. However, World bank (2014) paint a gloomy performance of development projects in most county government where delays in implementation of the road project are high. This has attributed to monitoring and evaluation in implementation of assessment tools making it difficult to assess progress (GOK, 2016). In Kenya, monitoring and evaluation has been implemented in the execution of projects. The extents to which it contributes to implementation of road project remain elusive. This motivates the undertaking of the study. Most studies done locally have not have focused on determining the effect of M&E practices on implementation of road projects in Kenya.

Objective

- i. To examine the influence of leadership in monitoring and evaluation process on implementation of road construction project in Kiambu County

II. STATEMENT OF THE PROBLEM

In Kenya, the government is focus on achieving success in the implementation of development projects foster implementation of M&E practices. The new devolved structures of county governments and the development of fiscal devolution about development policies, programs and projects in Kenya, there is critical requirement for effective national wide M&E systems and practices in Kenya. Accountability in new governance structure in Kenya is responsible for core project execution in county level. Completion of development projects both at the county and national level of government has not been a success in counties in Kenya.

The County is keen on completing the project on time and implement monitoring and evaluation practices an enabling infrastructural system on the above area that links various pillars of development to enable timely access of services and market at minimal cost. Empirical studies such as have identified institutional framework, training, stakeholder participation, budgetary allocation, politics, M&E tools, planning, lack of knowledge skilled staff amongst others as factors determining effective monitoring and evaluation of projects in organization. Most of these studies focused on factors affecting monitoring and evaluation in project management in organizations. Despite utilization of monitoring and evaluation practices in county governments road constructions, there are few empirical studies that have focused on determining the influence of M&E practices

on implementation of road construction project in County government levels. Therefore, this study aimed at bridging the existing knowledge gap by examining the influence of M&E practices on the implementation of road construction project in Kiambu County, Kenya.

Stakeholder Theory

The proponents of the stakeholder theory were Morrissey in 1960. The stakeholder theory helps us to understand the firm in its environment (Oakley, 2011). The initial purpose of the Stakeholder theory was to enable project managers to comprehend the stakeholders and how to effectively manage them (Patton, 2008). Stakeholder theory has been used widely in various fields and has been applied in different and distinct ways that involve different methodologies, concepts and criteria of evaluation and types of evidence. Interest in the concept of Stakeholders has been growing rapidly and this has led to the increase in the number of perspectives on the subject (Oakley, 2011). The aim of this approach is to educate the management on its roles and responsibilities that go past their profit maximization duties and their duties to the stakeholders identified in the firm's input-output model to include the interests and claims of non-stockholding groups. Patton (2008) in reviewing the stakeholder theory said that people or groups who have legitimate interest in an enterprise only do so because of the benefits that they obtain and added that no set of benefits and interests are prioritized over the others. Karl, 2007 added that future employees and customers, associated corporations, and the public in general, need to be taken into consideration.

The county leadership role in stakeholder involvement has been to illustrate that how stakeholders are treated is directly related to the success of monitoring and evaluation practices on implementation of the project (McManus, 2004). The stakeholder theory emphasizes the importance of synergy between the project leadership with the project stakeholders. The stakeholder's theory supports engagement of project manager as stakeholder to influence M&E practices to achieve project outcomes.

III. METHODS AND PROCEDURES

The study adopted a descriptive survey design. Descriptive survey research design helped in collecting quantitative data to answer to a study research question or testing of study hypothesis which aimed at carrying out an assess determine influence of monitoring and evaluation practices on the implementation of road construction projects in Kiambu County.

the population comprised of target population of who included 12 engineers, 15 Architectures, 25 Kerra officer's county officials, 30 project managers, 31 Clerk of Works, 25 contractors, 16 financial project officers and 75 road construction supervisors a total study population of 229 (Kiambu County, 2020).

The study used Krejcie and Morgan Table for determining Sample size to select a sample size of 136 respondents. A sample proportion was therefore be 59% of the study population. Statetified random sampling was used in selection of sample size. A sample proportion of 59% was adopted in determining number of respondents from each management level in the study population.

Table 1: sample size

Management Level	Population	Sample Proportion	Sample Size
Engineers	12	0.59	7
Architectures	15	0.59	9
Kerra officers	25	0.59	15
Project managers	30	0.59	18
Clerk of Works	31	0.59	19
Financial project officers	16	0.59	9
Contractors	25	0.59	14
Road construction supervisors	75	0.59	45
Total	229		136

Data was collected using a questionnaire. The questionnaire had both closed and open-ended items. This enabled collection of quantitative and qualitative data.

Findings and Discussion

The respondents were administered using drop and pick later method. Out of 136 questionnaires administered, 126 project team members working on road implementation projects in Kiambu County responded and returned the questionnaires. This represented a response rate of 92% hence the response rate was adequate for data analysis.

Leadership in M&E and implementation of road construction projects in Kiambu County.

Respondents were requested to indicate whether project leaders are effective in allocation of road construction projects in Kiambu County. The respondent indicated that project leaders are effective in allocation of road construction projects in Kiambu County. Respondents stated that project leaders through M&E practices project leaders are determined to achieve success in the implementation of road construction projects in Kiambu County, and that they ensure for construction materials, time, finances and adequate allocation of staff to the project. This is in line with Benington and Moore, (2011) who stated that governments in developing and developed countries are motivated to deployment of monitoring and evaluation practices to achieve success in implementation of road construction projects in Kiambu County.

Involvement in Setting Monitoring and Evaluation Objectives
Table 2: Extent to which leaders are involved in setting monitoring and evaluation objectives

Response on Leadership Involvement	Frequency	Percentages
Very great Extent	56	45
Great Extent	39	31
Moderate Extent	31	24
Total	126	100

Respondents were requested to indicate the extent to which leaders were involved in setting monitoring and evaluation objectives. From the finding, majority 45% (56) of the respondents indicated that leaders are involved in setting monitoring and

evaluation objectives to a very great extent. Most 31% (39) of the respondents indicated that leaders are involved in setting monitoring and evaluation objectives to a great extent while 24% (26) of the respondents indicated that leaders are involved in setting monitoring and evaluation objectives to a moderate extent. Respondents explained that leaders have been fully responsible for objectives of road construction projects in Kiambu County as it affects every step of the project life cycle. Leaders plan the course of action to achieve set objectives and are fully responsible for the activities and inputs in road construction systems project success. This implies that leaders are involved in setting monitoring and evaluation objectives thus influencing implementation of road construction projects in Kiambu County.

Leadership in Monitoring and Evaluation and implementation of road construction projects in Kiambu County

Table 3: Leadership in Monitoring and Evaluation and implementation of Road Construction Projects in Kiambu County

Responses on extent of monitoring and evaluation	Leadership in monitoring and evaluation	Mean
The leaders provide adequate resources for monitoring and evaluation	4.87	0.75
There is effective setting of objectives for monitoring and evaluation	4.72	0.76
Instituting effective project team staff and	4.86	0.84
Leaders motivate project team members	4.89	0.87
There is accountability and transparency in road construction projects in Kiambu County	4.62	0.59
Enhancement of coordination of road construction implementation activities	4.61	0.66
Project leaders provide support required for implementation of road construction projects	4.46	0.49

Table 3 shows respondents' response on the extent to which they agreed with the given statements on leadership in monitoring and evaluation and implementation of road construction projects in Kiambu County. From the findings, majority of the respondents strongly agreed that leaders motivate project team members,

provide adequate resources for monitoring and evaluation instituting effective project team staff and control as indicated by mean of 4.89, 4.87 and 4.86 with of 0.87, 0.75 and 0.84. Most of the respondents strongly agreed that there is effective setting of objectives for monitoring and evaluation, there is accountability and transparency in road construction projects implementation and there is enhancement of coordination of road construction projects in Kiambu County implementation activities as indicated by mean of 4.72, 4.62 and 4.61 with SD of 0.76, 0.59 and 0.66. Most of the respondents agreed that project leaders provide support required for implementation of road construction projects in Kiambu County as indicated by mean of 4.46 with mean of 0.49. This implies that the County's leaders support and involvement in the M&E activities influence effective and successful implementation of road construction projects in Kiambu County. This is in line with Kerzner, (2006) that implementation of road construction project in is dependent of effective leadership in monitoring and evaluation process.

On the respondent's opinion on other ways through which leadership in monitoring and evaluation influence implementation of road construction projects in Kiambu County, the study found that leadership in local government do monitor the road construction projects in Kiambu County project plan, actual plan, actual work and work complete value to see if the road construction projects in Kiambu County project is on track. It was revealed that communication, quality management and documentation or administration system influence implementation of road construction projects in Kiambu County. The respondents further explained that reliable way to keep the project momentum going is to continuously monitor and evaluate the project through effective leadership. This implies that leadership in monitoring and evaluation processes in organization is critical element to learn the proper implementation of road construction projects in Kiambu County. This is in line with Kerzner, (2006) that application of leadership in monitoring and evaluation improves coordination and control of road construction system projects.

The results were further supported by findings from interviewees that strong leadership during the monitoring and evaluation process can help ensure that limited resources are used effectively, that all components of a project leverage and complement one another, that work does not need to be discarded or redone, and that the results of the road construction projects in Kiambu County are achieved. The leadership does the assessment on where the road construction project is in relation to its expected outcomes in order to continuously improve implementation. This

implies that the leadership support and be involved in the monitoring and evaluation activities influence successful implementation of road construction projects in Kiambu County. This concurred with further Williams (2013) that leadership is critical in motivation of project team members and influence success in the implementation of the project.

The respondents indicated that a leadership in monitoring and evaluation enable project staff to track specific indicators and measures on their own to promote accountability. Its through leadership that there is recognition of the implications that any changes may have for all those involved in a project and thus carefully monitors that project implementation progress. This implies that application of leadership in monitoring and evaluation improves coordination and control of road construction projects in Kiambu County. This concurred with Faqih, (2010) that commitment of senior management plays a critical responsibility in motivating the project team, provide feedback of project progress and enhance control of project execution hence achieve success implementation of the road construction project.

IV. CONCLUSION

The study concluded that road construction projects in Kiambu County involves a number of Monitoring and evaluation practices that strengthen monitoring and evaluation team in having successful implementation of road construction projects in Kiambu County. The study concludes that leadership in monitoring and evaluation plays a critical role in planning, setting out objectives and charting out the course of action to achieve the set objectives, project organization, project team staffing control and monitor and influence implementation of road construction projects in Kiambu County.

V. RECOMMENDATIONS

The findings clearly demonstrated that implementation of project is dependent of effective leadership and that leadership in monitoring and evaluation processes in organization is critical element to learn the proper implementation and areas for improvement, the study recommends that management in road construction projects in County government should continue supporting and be involved in the monitoring and evaluation activities for effective and successful implementation of road construction projects in Kiambu County.

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.773 ^a	.597	.529	.56895

a. Predictors: (Constant), Leadership in M&E, Communication in M&E, Planning in M&E, Capacity Building in M&E
 Implementation of road construction projects in Kiambu County

The model summary results indicated that proportion variation of 52.9% of implementation of road construction projects in Kiambu County due to the influence of M&E practises.

REFERENCES

[1] Albert, H.(2012) *Handbook of Project Management Procedures*. England: TTL publishing Ltd.

- [2] Benington and Moore, (2011) Impacts of the implementation of a project management information system: *A case study of a small R&D company. Organizacija*, 47(1), 14-23.
- [3] Clear, (2012) *Monitoring and Evaluation Planning: Guiding Tools*. USA: Catholic Relief Services and American Red Cross.
- [4] GoK, (2003). *Progress Report, Internal Working Document*. Government Printers. Nairobi: Kenya.
- [5] Musau, (2016) Assessing project management maturity. *Project Management Journal*, Vol. 31 No 1, pp.32-43.
- [6] Kiambu County, (2020). *Social science research; Theory and principles*. Nairobi: ARTS press.
- [7]
- [8] Kerzner, (2006), The role of project management information system towards the success of a project: The case of construction Projects in Nairobi Kenya. *International Journal of Academic Research in Business and Social Sciences*, 3(9),104-116
- [9] Benington & Moore, (2011) The role of project management information systems towards the success of a project: The case of Construction Projects in Nairobi Kenya. *International Journal of Academic: Research in Business and Social Sciences*, 3(9),104-116
- [10] McManus, (2004) Handbook on monitoring and evaluation for the CINDI Networks. 47 Temple Street, Pieter Maritzburg 3201.
- [11] Nalkur, M.L. (2009). The enterprise project system experience – from adoption to success
- [12] Mackay (2007) The Awareness of Stakeholder Management amongst Project Managers in the Construction Industry In Ireland.
- [13] Oakley, P. (2011). *Projects with people: The practice of participation in rural development*. Geneva: International Labour Office
- [14] Passia (2013). *Monitoring and Evaluation in the United States Government: Overview*. Washington DC: Independent Evaluation Group, The World Bank Group
- [15] Patton, (2008). Supply Chain Management (SCM) and organizational key factors for the successful implementation of Ent projects rise resource planning (PROJECTS) systems, *Proceedings of the Americas Pinnaflex Educational Resources, Inc.*, Cincinnati, OH, pp. 173-207. pp.167–175.
- [16] Williams, R.D. (2013). *Mass media research: an introduction*, (6th ed.). Belmont, CA: Wadsworth Publishing Company.
- [17] World Bank. (2014). *Global Monitoring framework and strategy for the Global Plan to wards the elimination of new HIV infections among children by 2015 and keeping mothers alive (EMTCT)*.

AUTHORS

First Author – Mercy Wambui Rubia, Author's Designation/Present Work Status: Master Student , Department Name: Social sciences, Institution Name: Mount Kenya University

Second Author – DR. Serah Wairimu Kimaru, Author's Designation/Present Work Status: Supervisor , Department Name: Social sciences, Institution Name: Mount Kenya University

The Barriers to Resolving Human Security Challenges In Light of The Current Protracted Refugee Crisis In Kenya With Specific Reference To Garissa County

¹Lusiola, A.O., ¹Professor Matanga, K. F and ¹Dr. Simiyu, R.

Department of Peace and Conflict Studies
Masinde Muliro University of Science and Technology

DOI: 10.29322/IJSRP.12.10.2022.p13086

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13086>

Paper Received Date: 24th September 2022

Paper Acceptance Date: 25th October 2022

Paper Publication Date: 30th October 2022

ABSTRACT

Refugees are individuals who seek improved conditions of human security in a region remote from their place of origin. By the end of 2019, the UNHCR estimated that 42.5 million people had been displaced around the world. As a result, short- and long-term effects were felt on host communities, from humanitarian disasters to security threats. Therefore, the goal of the research was to assess the barriers to resolving human security challenges in light of the current protracted refugee crisis in Kenya with specific reference to Garissa County. New Security Paradigm and Critical Theory guided the research. A descriptive survey research design was used with a study sample comprising 339 household heads including refugees' and community household heads, UN Refugee Agency staff, NGOs officials, County and National Government officials. Primary data was collected using structured questionnaires and interview schedules. Secondary data was gathered from textbooks, newspapers, periodicals, and articles. Quantitative data was coded and put into SPSS Version 21.0, and descriptive and inferential statistics such as Pearson Correlation, Spearman Rank Correlation, and multiple regression analysis were used to analyze it. Qualitative data was analyzed based on the content matter of the responses. The study found that some of the major challenges to achieving human security included: the proliferation of small arms and light weapons and the perpetuation of terrorism by some refugees. The study concludes that the main reasons of the refugee crisis in Kenya are push factors from their home countries, such as civil war, lawlessness and high crime rates. The study recommends a need for measures aimed at reining in on the protracted refugee crisis and also enhancement of human security which can be achieved via funding to deal with deplorable living conditions in refugee camps.

1.INTRODUCTION

The procedure by which refugees opt to relocate to their desired country of asylum has a considerable impact on their human security challenges, and it differs from region to region, regardless of whether they reside in developed or developing countries. The current refugee problem is the worst since the conclusion of the world wars. According to estimates, one in every 113 individuals in the globe is a refugee (Wildman, 2017). In 2014 alone, about 42,500 people abandoned their homes each and every day, which is four times as many as in 2010. (Clark, 2016). Currently, Middle-Eastern countries, particularly Syria, Iraq, and Yemen, are experiencing civil turmoil. Asian nations include Nigeria, South Sudan, Burundi, and the Central African Republic. The Rakhine province in Myanmar has caused an influx of refugees.

It is believed that there are 65 million refugees, roughly the size of six Swedens (Slaughter, 2015). During travel, refugees confront numerous obstacles, including mortality; it is estimated that 7,500 migrants died in 2016 alone (Haque, 2017), and another 2,000 died crossing the Mediterranean (Khasru, 2017). Approximately 5 million migrants originate from Syria, although refugees from Iraq, Afghanistan, Somalia, and South Sudan are also present. The Middle East and North Africa are home to 39% of asylum-seekers, Sub-Saharan Africa to 29%, the United States to 18%, Asia-Pacific to 18%, and Europe, particularly Germany, Hungary, and Sweden, to the greatest number of refugees in the region (Ross, 2017).

Currently, the number of refugees in Africa remains alarmingly high, as many flee deadly local conflicts or political persecution. According to Schultheis (1989), the escalation of environmental issues such as drought and the endurance of famine have also produced a substantial number of migrants. In 2017, the UNHCR was responsible for an estimated 43 million refugees, a third of whom resided in Africa, with 13 million in Sub-Saharan Africa and over 400,000 in Northern Africa. According to the UNHCR, the refugee population in Africa in 2018 consists of 7.7 million internally displaced persons, 3.4 million refugees, of which more than 2.9 million are in Sub-Saharan Africa and more than 400,000 are in Northern Africa, and 721,000 stateless people.

This study proposes that there is a close relationship between refugee crises and global human security. Due to the shifting global stage, human security is becoming an increasingly novel idea in terms of security. Security is not just the protection of territory, but also of people; it is the protection of nations and individuals.

Every day, millions of people flee their own countries for safety in other countries. Moving from one nation to another is not a simple task, and refugees typically confront a variety of difficulties upon arrival. Although it is assumed that refugees will integrate into their new communities, this is not always the case (Penninx, 2004). In the majority of instances, the new society is expected to accommodate new inhabitants despite cultural differences. Sadly, this frequently results in unanticipated issues for the recipient society. At the grassroots level, growing multiculturalism and fast demographic shifts are experienced. Consequently, competition for resources and limited possibilities may result in conflict between refugees and indigenous. To be investigated, however, is the extent to which refugees influence human security in certain regions of Kenya.

In certain cases, refugees are viewed as usurpers of opportunity that are legitimately due to the natives, so inciting violence. This is evident in South Africa, where people from other African nations are frequently compared to white colonizers. In that nation, land expropriation spawned two separate economies. During the long apartheid era, locals were frequently forced into enclaves with worse living standards than those of white settlers. In post-independence South Africa, the sharp decline in living standards (Acemoglu & Robinson, 2012) fostered a culture of intolerance toward others. Juma and Odhiambo (2021), posit that the fervor for regionalism is etched in the minds of the political class globally. Some advocate for continental integration while others call for regional groupings that consist of few states whose defining criterion is territorial contiguity for the desire of sustainable peace.

In Kenya, the refugee crisis has led to tensions and violence between community members and refugees in Turkana County, where the Kakuma Refugee Camp is situated. The primary cause of these conflicts has been rivalry for scarce resources. In most instances, the local populace continues to believe that refugees are economically better off than natives due to aid from refugee aid organizations (Ali *et al.*, 2017). Conflict is also fueled by the differential treatment of the host community and refugees by the government and relief organizations. As a result of help, refugees have better access to health care, education, and living conditions than the majority of the local population, which frequently leads to hostility and conflict.

Massive Somali refugee numbers in Kenya's Dadaab Camp have presented enormous hurdles to the Kenyan government. Kenya has borne the cost of hosting refugees for extended periods of time, frequently with adverse implications on national security (Manyala, 2016). In the war against terrorism, refugees in the Dadaab Camps have frequently found themselves in the firing line. Kenya has conducted police and military operations to combat insecurity, which is frequently attributed to refugees. This has had a significant toll on refugees, who have been subjected to forced repatriation and intimidation. Maito & Odhiambo (2013) rightly asserted that: Drought triggers livelihood crises, but the underlying causes of vulnerability in the pastoral areas of the horn of Africa are social and political and not natural. Droughts are part of the natural cycle in semi-arid areas, and local livelihoods are sensitively adapted to the certainty that can come but can be overcome. Vulnerability to drought can increase, if there is inadequate support to economic, social and political coping mechanisms, rather than increasingly frequent or abnormally severe drought events.

The predicament refugees face is a result of the growing consensus that there is an unmistakable connection between refugees and factors that threaten human security. According to Salehyan and Gleditsch (2006) in *Refugees and the Dissemination of Civil War*, the flood of refugees has led to the proliferation of weapons, the importation of combatants, and the spread of harmful ideas from neighboring nations into the host countries. These contributed to the conflict. In *Victims as threats: Refugee influence on host state security in Africa*, Mogire (2011) asserts that refugee crises result in the breakdown of law and order within and surrounding refugee camps. This results in injuries and deaths among refugees, host populations, and relief workers. It also results in the misallocation of government resources, which strains civilian lifestyles.

In Kenya, refugees are regarded as a major source of terrorism (Kilonzo, 2017). The majority of Kenyans view refugee camps as breeding grounds for terrorist organizations. They are regarded as breeding grounds for radicalisation and launching pads for violent terrorism in other regions of the country. Refugees frequently utilize their proximity to Kenya's weak borders to support the proliferation of Small and Light Weapons (SALWs) into the country. The extent to which these and other issues provided by the refugee crisis impact human security in Kenya with relation to the Dadaab Refugee Camp has not been extensively explored. According to Chitembwe & Odhiambo (2021), a renewed movement to fight for the self-determination of citizens in the coastal region emerged in the counties of Mombasa and Kwale in 2008 when the MRC regained traction, calling for secession from Kenya. Among the 32 classes that were prohibited by the Ministry of Internal Security in Gazette Notice 125855 was the MRC might have been instigated by the sympathizers of Terrorism.

In contrast, refugees are viewed as unwilling contributors to the decline in human security in their host countries. Refugees only pose a threat to human security, according to Barasa and Matanga (2018), in the context of other organized local and transnational criminal groups in the country. The majority of the time, refugees are concerned with their own safety and

financial well-being and do not have ulterior objectives regarding the safety of the host population. However, outsider parties take advantage of their weakness to further their own illegal purposes. This study aims to examine this hypothesized complex relationship in the Dadaab Refugee Camp.

1.1 Statement of the Problem

The prolonged refugee crisis in Kenya is a persistent problem, and the state of the refugees living in camps remains tenuous in many parts. In 2020, there were 490,000 refugees in Kenya (Julia, 2022). More than half were children and young people, and more than half of them were from the Horn of Africa. Most were fleeing from Somalia, although there are also significant numbers of refugees from Burundi, the Central African Republic, South Sudan, and Democratic Republic of Congo.

According to the UNHCR Situation Report (2017), there were 247,798 refugees in Garissa County's Dadaab Refugee Camps. This is a significant number in a camp that was built to accommodate 90,000 refugees. An earlier UNHCR report (2016), showed that the population in Dadaab increased dramatically from 90,000 to 439,000 between 1992 and 2010. As a result, the number of refugees in Dadaab has fluctuated dramatically over time. This has had substantial negative consequences for the Garissa County host community, including humanitarian and security problems, competition for few resources, and environmental damage, among other things (Kumssa & Jones, 2014; Williams, 2011; Iteyo, 2018).

The aforementioned predicament should not be the case, as the county already suffers enormous livelihood issues as a result of ongoing drought and a very arid climate (Kumssa & Jones, 2014). However, little research has been done on the true impact of the refugee crisis on regional security. This has resulted in significant, though not empirically confirmed, assumptions about the real and assumed contribution of refugees to regional human security. Despite the constant outcry about the obstacles posed by refugees in multiple humanitarian reports, a complete academic representation of the impact of refugees on human security in Garissa County remains virtually absent from the public realm. This study thus sets out to bridge this knowledge gap by assessing the influence of the protracted refugee crisis on human security in Kenya with specific reference to Garissa County

1.2 Objective of the Study

To assess the barriers to resolving human security challenges in light of the current protracted refugee crisis in Kenya with specific reference to Garissa County.

1.3 Research Question

What are the barriers to resolving human security challenges in light of the current protracted refugee crisis in Kenya with specific reference to Garissa County?

1.4 Justification of the Study

1.4.1 Academic Justification

The research on the link between Kenya's long-running refugee crisis and human security dynamics, particularly in Garissa County, is limited. This generates an empirical gap that needs to be filled. The main reason for this has been a lack of understanding of how the refugee crisis is putting a strain on scarce resources in developing countries like Kenya, due to increasing demand on education, health services, infrastructure, water supply, sanitation, natural resources, and security, all of which have an impact on the host country's economic, social, political, and environmental aspects (UNHCR, 2004).

As a result, critical questions have arisen, such as what is the relationship between the refugee crisis and human security in Kenya, with a focus on Garissa County. What are the obstacles to attaining human security in Kenya as a result of the refugee crisis, with a focus on Garissa County? are still unsolved. With this in mind, the current study sets out to determine the link between Kenya's long-running refugee crisis and human security dynamics, with a focus on Garissa County.

The conclusions of this investigation would thus be crucial to the academic community. Academicians would obtain a better knowledge of the link between refugee crises and human security in the camp in this way. The findings could pave the way for more research into the association between the two variables in other parts of the world, as the number of refugees continues to climb as a result of global terrorism, war, and other factors. The findings acquired would also serve as helpful literature for other human security investigations. Students interested in peace and conflict studies, political science and diplomacy, and international relations at all levels can benefit from this course.

1.4.2 Philosophical Justification

There are significant philosophical gaps in our knowledge of the true impact of refugees on human security that need to be addressed. Most academics ignore the issue of human security in the context of refugees, choosing to focus on other types of security. This explains the abundance of peace and conflict resolution literature. Despite growing evidence that migrants frequently transition from victims in need of humanitarian aid to willing participants in crimes against the host population, this conception remains merely rhetoric in the lack of empirical data.

In Kenya, for example, the local populace has long held the belief that refugees are better off economically than locals as a result of refugee aid (Ali *et al.*, 2017). However, because international help to refugees may not have a significant impact on local resource competitiveness, the conversation is diverted away from the main implications of refugees on human security in the

country. Thus, in the context of external (international) help, it is necessary to investigate the impact of the refugee crisis on resource competition with local people.

This research is particularly essential because it will clarify the hazy areas between the refugee crisis and terrorism. The reason for this is because terrorism has an impact on the physical security of local inhabitants, among other things. However, the link between refugees and human security is frequently left to conjecture. Frequent terrorist assaults in Garissa County, Kenya, where the Dadaab refugee camp is located; have raised various human security concerns, prompting lawmakers to call for the camp's relocation to Somalia and the eventual shutdown of its Kenyan operations. However, the relative importance of the contribution to the rise in terrorism may be difficult to assess in the context of the region's other geopolitical concerns.

1.4.3 Policy Justification

The study would produce policy recommendations that are empirically tested and that could inform policy formulation on dealing with refugee crises the world over. The study would also provide valuable information that could help policymakers come up with policies aimed at dealing with such crises the world over. Furthermore, the findings obtained would be crucial in facilitating policy direction regarding ways of enhancing human security the world over. In this regard, the bodies that deal with refugees, governments as well as regional bodies would gain valuable literature for use in the formulation of policies aimed at dealing with refugees' crises as well as the associated challenges. National security agencies would also gain pertinent information for use in the formulation of policies aimed at strengthening their operations against the negative influences associated with refugees' crises.

2. LITERATURE REVIEW

2.1 Barriers to Resolving Human Security Challenges in Refugees Host Countries

According to Mitchell (2009), the increased numbers of refugees have brought several humanitarian concerns not just for the millions of people forced into exile but also for the social, political, and economic stability of the host countries that have to shelter them. The host countries are then forced to strike a balance between the need to maintain control over their borders and the need to protect the refugees who are seeking asylum (Kirui & Mwaruvie, 2012).

Alix-Garcia and Saah (2009) observed that in metropolitan regions of Tanzania, food costs had increased, particularly for food products that suited the diet of the refugees, while the prices of other types of food had decreased as the refugees sold their food quota aids that did not match their diet. The result was a rocky market for food suppliers and unstable prices for urban Tanzanian families. Irbid and Mefriq, two cities in Jordan that saw a large influx of Syrian refugees between 2010 and 2013, saw price increases of 15.4 percent as a result of this surge. Apartment rents, grocery prices, and retail clothing prices all increased. Sixty-four percent of the Jordanians in these two cities reported water shortages, and many also voiced concerns about the lack of suitable educational and medical resources for both locals and refugees (Sobh, 2014).

As Salehyan and Gleditsch (2006) point out, there are a number of ways in which the presence of refugees might contribute to the instability of host countries. The refugee camps, especially those near the border of the nation of origin, can operate as a base from which the rebels can carry out their operations and recruit additional members in their organization, especially among the youth. A recent increase in terror attacks, including one on the Dusit Hotel by homegrown terrorists, illustrates this trend in Kenya. Terrorist cells have found the refugee camps to be a welcoming environment, where they may operate undetected and recruit the most defenseless of the displaced to commit acts of violence against the host country. The global spread of armaments, combatants, and ideologies that led to violence was facilitated by the flood of refugees (Salehyan & Gleditsch, 2006).

Refugees typically do not have a working knowledge of the official language of their host country. This separates them from the community and makes it hard for them to communicate with its residents. Most indigenous are resentful of the refugees because of the economic danger they pose. Refugees are seen as threats by locals since they are often hired while receiving lower pay than locals do. Syrian refugees in Jordan impacted the informal labor market badly due to their willingness to work longer hours for lower compensation (Stave & Hillesund, 2015).

According to an article written by Tariq (2017) Human security challenges in India, India is one of the fastest-growing economies, thus it is the home of both the world's richest people and the poorest people as the wealth is not distributed evenly across the population. There are significant indicators that dictate that India is still a fragile state. These indicators include poverty, hunger, increased economic disparity, number of refugees, internally displaced people, population growth, corruption, violent groups within the state, and inadequate social services. All these indicators fall under the broader term of human security.

The threats to human security can take many forms and affect people in different ways based on their background, gender, and race. Threats to human security are enormous, pervasive, and complex in the Latin American setting. Since this region has the highest levels of inequality and criminal violence in the world, all research and publications on human security in this area concur that these two factors pose the greatest threat to human security. ECLAC (2010) estimates that 71 million, or 12%, of the population in this region live in extreme poverty. These people are a subset of the poor, who make up 33% of the population, because they lack the financial resources to provide for themselves with necessities like food (about 180 million people)

The ILO (2010) estimates that approximately 18 million people living in metropolitan areas are currently unemployed. A staggering 15.8% of Latin American women are employed in the domestic sector, and the ILO reports that their working conditions are extremely unsafe. Among the most discriminated against are the region's 58 million Indigenous people and 174 million individuals of African descent. Most have below-poverty incomes, poor levels of education, and limited or no access to social safety. Women in these communities have it much tougher, as they face more barriers to economic advancement and family provision. ECLAC (2010) reports that forty percent of women in the region suffer physical violence and sixty percent experience emotional violence. Statistical surveys in Colombia, Bolivia, and Peru suggest that between 5.5 and 11.5% of women in the Dominican Republic and Colombia are victims of sexual violence, and that the number of women affected by emotional abuse is typically very high. Women in the Dominican Republic are almost 16% less likely than women in Peru to have experienced physical abuse (ECLAC, 2010).

Human security in Nigeria has been seriously compromised by the country's several wars and civil uprisings since its independence. Numerous human rights violations have taken place, and the country is currently experiencing alarmingly high levels of poverty, starvation, unemployment, health hazards, discrimination, and ecological destruction. Terrorist strikes in the country have greatly reduced citizens' sense of safety. There are over 68.8 million people in this country, and of those, approximately half live below the poverty line on extremely low wages. One of the primary reasons there is so much poverty in the country is that wealth is so unevenly distributed (Obadan, 2001). Lamido (2013) reports that the unemployment rate increased from 15% in 2008 to 20% in 2011, with those aged 15-25 (Akande & Okuwa, 2009) and those aged 18-45 being the most negatively impacted (Rotimi, 2011). One of the factors that contribute to the widespread poverty in the country is the high rate of unemployment and underemployment. Unemployment disproportionately affects young people since they make up a sizable proportion of the population and are more likely to become bitter and criminal as a result (Akande and Okuwa, 2009).

Muoka's (2015) studied Urban refugees in Kenya: The Case of Banyamulenge Refugees in Nairobi: 1996-2012 used Alex Honneth's theory of the battle for recognition to illustrate that refugees from this community fought to be recognized by the Kenyan government and other urban communities. As a result of persecution in Congo, these people fled to Kenya, where they were promised safety and access to social services like housing, education, healthcare, and more. The research drew from a variety of primary and secondary resources. According to the study's findings, these refugees continue to face challenges in Kenya, particularly in the country's capital of Nairobi, where they are frequently harassed by police and other security organs for being viewed as a potential threat to public safety.

2.2 Conceptual Framework

Wasike and Odhiambo (2016) discuss the role of theories in guiding the thrust of academic studies. They emphasize the importance of theories in offering compelling and incisive causal explanations with calculated precision. They buttress their argument by quoting Smith (1986) who asserts that theories play the role of predicting, prescribing, and evaluating socio-political phenomena hence they cannot be ignored.

2.2.1 New Security Paradigm

The new security paradigm approach to understanding global vulnerabilities that make it pertinent to reconsider traditional notions about national security. It is attributable to a report by UNDP (1994) and focuses on people as the key and main objects while underplaying the role of the state. Before the cold war era, security was state-based but the post-cold war has witnessed new threats that have emerged leading to the expansion of the concept of 'security'. Security has expanded to include human, economic, environmental, social, and political security. The UNDP Report (1994) identifies human security to involve two main components which include freedom from fear and freedom from want. The new security paradigm relates to this study since human security fits into its expanded definition of security. It can thus explain the extent of the protracted refugee crisis in Garissa County as well as, the challenges posed by the protracted refugee crisis on human security in the County.

There are several proponents of the theory including but not limited to Paris in "Human Security: Paradigm Shift or Hot Air?" MacFarlane and Khong (2006) in "Human Security and the UN: A Critical History," and Richmond (2013) in "Human Security in Turkey: Challenges for the 21st Century among others." The essentials of human security have been captured in a poetic yet practical way by Pettman (2005). According to Pettman (2005) human security about the young child that did not die of neglect, the serious epidemic that did not break out, the job that was not cut, the gun that was not run, the ethnic prejudice that did not result in violence, the dissident voice that was not made silent, the landmine that was not sold and installed, the woman who was not trafficked across state borders and sexually abused, the agricultural product that was not dumped to the detriment of poor farmers, the short-term capital investment that was not allowed to wreck an infant industry, the addictive drug that was not produced and shipped, the refugee who was not forced to flee or remain abroad, and soon (UNDP, 1994). It's believed that these are violated by incessant increases in refugees' crises. Since extant literature shows that, refugees contribute to human security challenges, the new security paradigm is fitting to this current study.

2.2.2 Critical Theory

The idea of human security widened the scope of security while also challenging the realists' emphasis on state protection. It was believed that the government couldn't protect its citizens from the new dangers posed by globalization. This school of thought, often referred to as the Frankfurt School, is concerned with the critique of modernity and capitalist society, the defining of social emancipation, and the discovery of social illnesses. It provides a distinctive interpretation of Marxist philosophy

with respect to some of its core economic and political conceptions, such as commodification, reification, and critique of mass culture (Corradeti). Theorizing is always for somebody and some purpose, as Cox (1981) puts it. It places an emphasis on struggles for power and their distribution, as well as its underlying political, social, institutional, and ideological reasons (Bostanolu & Okur, 2009). It discusses the effects of the post-Cold War shift from a unipolar to a multipolar world order on the relationships between individual states. It contends that states are not the only basic actors in international systems and that there is a fight for influence among non-state entities as well.

The importance of civil society, which prioritizes the well-being of its members, is also acknowledged (Cox, 1999). Even civil society itself is a political construct, not an apolitical area or apolitical to economic and political objectives (Bostanolu & Okur, 2009). Human security is a strategy that prioritizes the needs of the people, although it has been criticized for being a cover for interventionist, neocolonial, and neoimperialist practices because of its reliance on altruism (Papavac, 2005; Duffield & Waddell, 2006). (Peterson, 2006). Cox agrees with me that the international system is defined by anarchy, and that this affects the social, political, and economic concerns of each nation-state. However, the industrialized nations continually want dominance over the weaker governments to advance their own economic and political goals. Therefore, it is important to place an emphasis on human security in order to guarantee parity in all fields and prevent the abuse of human rights.

There are glaring advantages to using critical theory to this investigation. To begin with, it broadens the scope of who is considered liable for ensuring the safety of individuals. Human security is a shared duty, as the idea argues, involving not just governments but also businesses, nonprofits, and private citizens. This theory is useful because it can direct the investigation of the broad measures put in place to deal with the refugee crises, where various parties are accountable for security in refugee camps and their environs. Garissa County will use this framework to analyze the effectiveness of state and non-state human security activities. The theory is flawed, however, because it does not offer any empirical explanations for the causes of human security threats or the effectiveness of the measures taken to counteract them. On the other hand, it doesn't delve far enough into what causes human insecurity, at least from the perpetrators' point of view. This raises questions about the efficacy of measures designed to address certain underlying causes of human insecurity in refugee camps and its environs, such as the current study. This is why we'll be using the securitization theory to shed light on the connection between the intake of refugees and national safety. An important factor being studied is how the refugee crisis, terrorism, and human security in Garissa County all interact with one another, and the securitization theory will be used to explain this.

2.2.3 Securitization theory

The securitization hypothesis is also the theoretical underpinning of this investigation. Within the context of international perspectives, the theory is a theoretical reflection of the Copenhagen school (Huysmans, 2006). Ole Wæver first proposed the idea of securitization in 1995 with the intent of refining the terminological means of security. It does this by critiquing and questioning all prior theoretical approaches to security that tend to be ontologically materialistic (Wæver, 1998).

When an industry is named as potentially dangerous in conversation or writing, securitization begins. In the next step, the possible danger is confirmed (defined) as an actual danger requiring immediate measures to be taken. Ultimately, the target audience realizes the threat is real and calls for action (Léonard, 2010).

The theory is being utilized to explain the connection between the intake of migrants and security within the context of the discourse surrounding the refugee crisis. Many African countries that have taken in large numbers of refugees now view this influx of people as a huge security risk. Furthermore, transnational threats to security, like terrorism, make the situation worse (Schneider, 2015). Some of the countries of origin for refugees are also hotbeds for terrorist organizations, so a connection is often drawn between the two. This has resulted in the militarization of refugee camps, which were formerly recognized as non-security issues but are now viewed as possible risks to human security, as predicted by the current study.

The securitization theory is pertinent to the current investigation because it provides insights into the rationale behind the wide range of security measures enacted by Kenya in response to real and perceived security risks like terrorism brought on by refugee crises. It also clarifies why people believe that refugee camps foster the spread of terrorists and small arms and light weapons. Refugees, according to many UN systems, pose a security risk, thus they agree with this assessment (UNHCR News, 2013). As a result, countries dealing with large numbers of refugees should take precautions to reduce these threats to national security. However, the securitization theory does have certain flaws, primarily because it does not account for the primary drivers of refugee crises. The hypothesis may fail to account for the influx of migrants into Kenya because it assumes their presence in a given region. In this context, Lee's Push-Pull Theory (1966) will be utilized to explain the origins and implications of the ongoing refugee situation in Garissa County.

2.2.4 Lee's Push-Pull Theory (1966)

Lee's Push-Pull Idea from 1966 is another relevant theory that helps to explain the current investigation. According to proponents of this view, all migratory patterns are the product of something in the home nation that is actively discouraging departure. On the other side, they are inspired to move by some sort of attractive feature in their new home. Intervening difficulties like transportation costs and migratory regulatory constraints affect the strength of the link between these two

variables (Lee, 1966). These factors may promote migration, slow it down, or even halt it in its tracks. One of the driving forces behind migration is the individual's circumstances.

The push-pull theory has two primary flaws. To begin, its representation of the factors that influence people to move are oversimplified. Thus, it conceals the primary drivers of migration, both pull and push (De Hass, 2008). Although the theory's validity has been shown elsewhere, its micro-level applications remain controversial. So, it has little usefulness in understanding rural-to-urban migration (Mabogunje, 1970).

According to the findings of this analysis, war and domestic insecurity are two of the most common push factors. The vast majority of Kenya's displaced people fall under this category. Attractive factors include of the new country's peace and stability, as well as its economic potential. Refugees have been drawn to Kenya largely due to the country's relatively stable political climate. As most of the refugees in Kenya have come from the Horn of Africa and the Great Lakes Regions, it is clear that distance and transportation have not been major hurdles for entering the country. The country's open land and marine borders make it an attractive destination for Somali refugees.

There has been a steady influx of migrants into Kenya for the better part of three decades, and for good reason. Because of this, refugee camps are under extreme stress. The refugee problem in Kenya has been exacerbated by the presence of push factors, such civil conflict, in some of Kenya's neighboring nations. As this study suggests, this has had diverse effects on the nation's human security.

2.3 Conceptual Framework Model

Independent Variable

- Protracted Refugees' Crisis**
- Causes of the protracted crisis
 - Nature of the protracted crisis
 - Large Number of refugees,
 - Poor Living conditions of refugees

Dependent Variable

- Human Security Dynamics**
- Competition for economic opportunities
 - Access to food and healthcare
 - Educational opportunities
 - Environmental effects
 - Local and national security
 - Increase in terrorism and crime

- Policies on Refugees
 - Refugee Funding
 - Resettlement of and reintegration of refugees
- Activities of various actors (e.g. INGOs, NGOs, CBOs,

Figure 1: Conceptualization of the Nexus between Protracted Refugees' Crisis and Human Security Dynamics
 Source: Researcher (2022)

3. RESEARCH METHODOLOGY

3.1 Research Design

The researcher utilized a descriptive research approach. The design is accepted because it accurately, clearly, and credibly represents the findings (Marczyc *et al.*, 2005). According to Cooper and Schindler (2003), descriptive research is concerned with determining who, what, when, where, and how something will be described. In this view, the design explains the current state of affairs at a certain location, the parties accountable for it, and those affected within a specified time frame. In comprehending the relationship between the refugee crisis and human security, this design has been found suitable. Since descriptive studies collect data using quantitative and qualitative methodologies, Primary data for this study were collected through interviews and questionnaires. Therefore, this study design is regarded optimal for achieving the study's aims.

3.2 Study Area

The research was conducted in Garissa County. The county, which shares an eastern border with the Republic of Somalia, is home to the Dadaab Refugee Camps, which as of 2016 housed more than 260,000 Somali refugees. The county is situated in Kenya's northeastern area. Its headquarters are located in Garissa Town. The land area of the county is approximately 45,720.2 square kilometers. Islam is the predominant religion in the region. Due to recurrent drought, the county has a severely arid climate, and pastoralism is the primary agricultural and economic activity. Due to insufficient precipitation, Garissa County has limited arable land. This typically results in increased food prices. This results in malnutrition because individuals cannot afford the meals they want. Consequently, the majority of people who receive food assistance have no control over what they consume. Consequently, food insecurity is a significant issue in Garissa County (UNDP, 1994). This is another reason for conducting this research, as the inability to buy food would exacerbate the problems associated with human insecurity.

The majority of the county's residents are Somalis. According to Kumssa and Jones (2014), the living conditions in the Dadaab refugee camp in Garissa County were inadequate for the Somali refugees who were housed there. Nonetheless, the extent to which these refugees contributed to human security issues in the camp has not yet been rigorously determined.

Garissa County presents particular issues, despite not being the only county in Kenya to house refugees. Although Kakuma in Garissa County is home to one of Kenya's largest refugee populations, it does not face the same issues as Garissa County, such as constant terrorist threats and attacks (Kilonzo, 2017). In terms of the security challenges created by the enormous refugee population, this renders Garissa unusual. The conflict dynamics in Somalia impose additional difficulties on Garissa County, such as the periodic migration of refugees (Manyala, 2016). The bulk of Garissa County's inhabitants are ethnic Somali Kenyans. This compounds the refugee issue because locals are frequently mistaken for Somali refugees.

In Dadaab Refugee Camp, there are 218,873 refugees (UNHCR, 2020). The average number of children per refugee camp household is four (UNHCR, 2015). This is equivalent to around 54,718 households. According to Kenya Population and Housing Census (KPHC, 2019), there are 35,793 households in Dadaab. In Dadaab, there are 26 implementing partner NGOs (local and international) working with the UNHCR. These include Action Africa Help International, CARE International - Kenya, Danish Refugee Council, Africa Inland Church - Kenya, Salesians of Don Bosco - Kenya, Film Aid International - USA, Fafi Integrated Development Association, Fondation Terre Des Hommes, Francis Xavier Project, Haki Centre Organization, Finn Church Aid, Hebrew Immigrant Aid Society (HIAS), Kenya Human Rights Commission, International Rescue Committee, Jesuit Refugee Services, Kenya Red Cross Society, and Kenya Human Rights Commission.

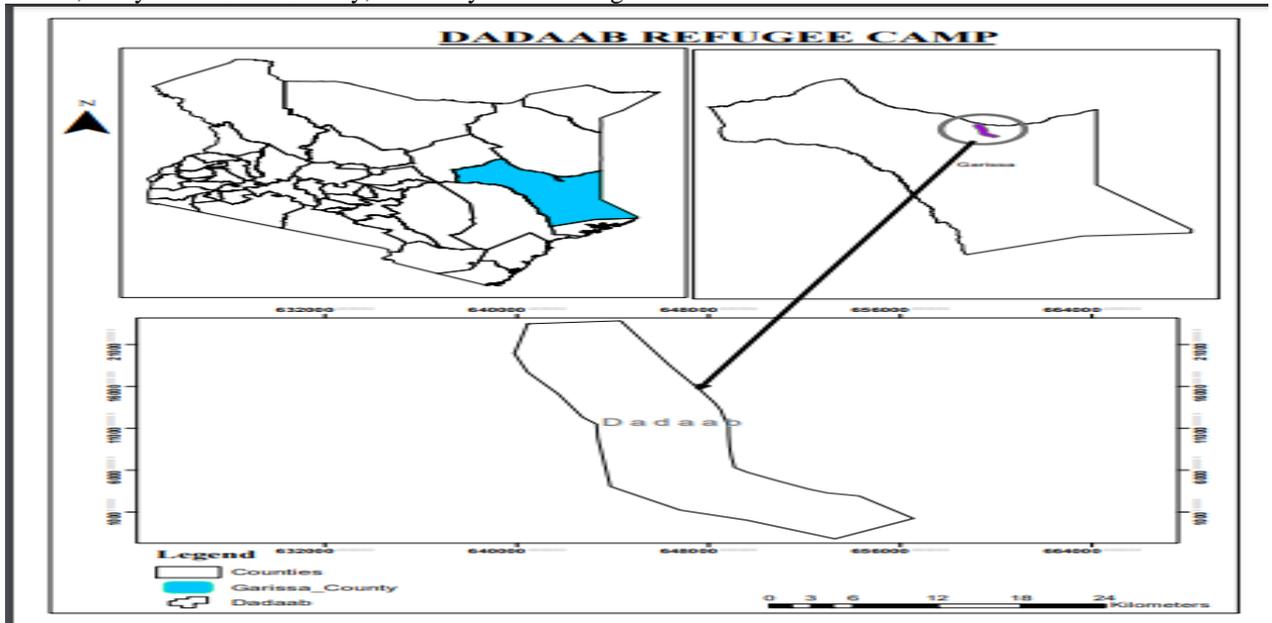


Figure 2. Map of Dadaab Refugee Camp

Source: County Government (Amendment Act), 2022

3.3 Study Population

The target population for this study consists of 90,797 diverse individuals. These include 54,718 host community households, 35,793 refugee household heads in Dadaab, 200 UN Refugee Agency employees, 20 national government officials from ministries that partner with UNHCR, 20 Garissa County government officials, an official from each of the 26 UNHCR implementing partner NGOs, and 20 security agency officers. The survey only included officials from non-governmental organizations active in agriculture, health, and sanitation, as well as water and sanitation. The target population provided the information necessary for this study to meet its goals.

3.4 Sampling Techniques and Sample size

To determine the sample size, the study will use the following formula on the 90,797 targeted participants as suggested by Kothari (2003). The sample size will be obtained using the formula developed by Taro Yamane in 1967.

$$n = \frac{N}{1 + N * (e)^2}$$

Where:

n=the sample size, N=population size, e= acceptable sampling error (assumed at 0.1)

The formula was applied for each stratum (category) .Thereafter, the samples for each stratum were added up to make the overall sample size 339.

The study used proportionate stratified random sampling to pick household heads from each of the specified study categories who participated in the study. Consequently, each category constituted a stratum (Cohen, 2013). Within each stratum, people who fit the requirements of easy accessibility, availability at a given time, and willingness to engage in this study were selected using simple random sampling.

3.5 Data Collection Instruments

3.5.1 Primary Data

The researcher collected primary data from the respondents using structured questionnaires, interview guides for key informants (Appendix III), and Focus Group Discussions (FGDs) (Appendix IV). These tools were constructed based on the objectives of the study. Questionnaires were administered to the respondents on the agreed time, answered, and collected by the researcher for analysis; while the interviews and FGDs were physically conducted by the researcher.

3.5.2 Secondary Data

Secondary data was collected from relevant secondary materials such as research articles, reports by government and humanitarian agencies, research dissertations, and policy documents among others. Each material was assessed based on its relevance to the study objectives. The data obtained was used to buttress the findings from primary data sources.

3.6 Data Analysis and Presentation

Descriptive statistics were used to data that had been coded and entered into SPSS 21.0, a statistical program designed for social scientists. The researcher drew upon secondary sources such textbooks, newspapers, journals, and articles to fill up the gaps in primary data. These were used in addition to questionnaires and interview instructions. Research findings were compiled after being cleaned, edited, coded, and tallied. It was organized and classified in accordance with the goals and hypotheses. Because of this, the report-writing process went more smoothly. All of the information we gathered went through a thorough editing process to ensure its precision and completeness. The questionnaires and interview guidelines were edited to make sure they achieved their intended purposes. The interview data was analyzed using a theme framework (Kothari, 2004). Thus, it was transcribed, and the resulting transcript was further sorted according to the themes and categories that emerged from the data. The correlation between the variables was analyzed using Pearson's, Spearman's, and multivariate regression.

4. Findings

4.1 Contribution of Refugees to Humanitarian and Security Concerns in Kenya

The respondents were presented with the statement, "Refugees are accused of contributing to humanitarian and security concerns in this country." This statement was motivated by the fact that humanitarian and security concerns could affect the realization of human security.

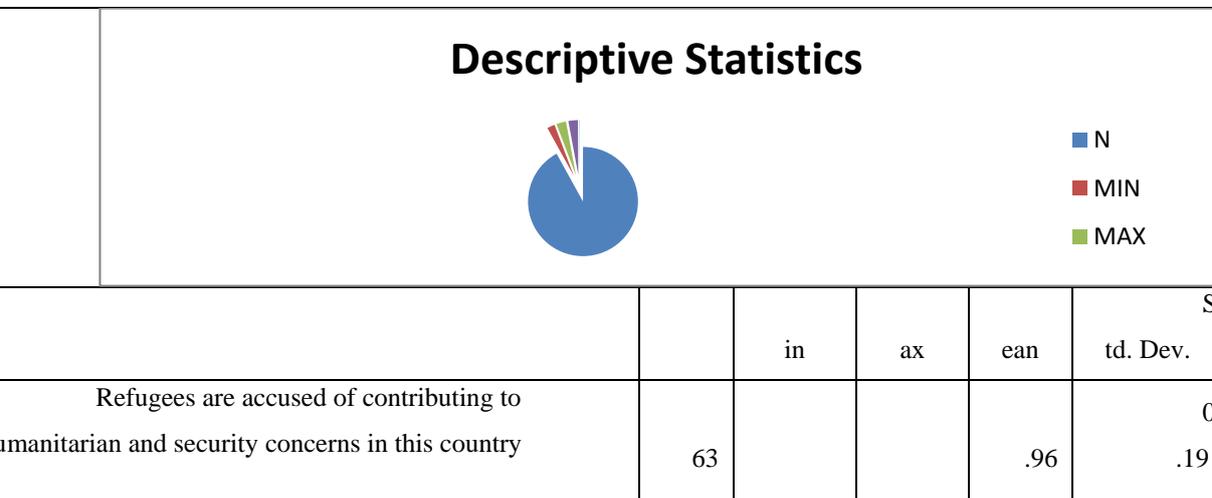


Figure 3 Contribution of Refugees to Humanitarian and Security in Kenya

Source: Researcher, 2022

Most of the respondents strongly agreed with the statement (mean of 5) as shown in Table 1. Thus, it can be argued that indeed refugees contribute to humanitarian and security concerns in Kenya. This could make the realization of human security untenable. These findings corroborate the study by Iteyo (2018, p.400) in "state conflicts and the refugee problem in Eastern Africa" that shows that the influx of refugees in Eastern Africa poses both humanitarian as well as security concerns. This agrees with Ligawa *et al.* (2016) that points out that the security capacities of a country to offer security could lead to increases in human insecurity.

The findings highlighted above were underlined by the interview and FGD participants who also drew a link between the protracted refugee crisis and humanitarian and security concerns. A government official supports this by saying:

The high influx of refugees leads to a humanitarian and security crisis. This makes it untenable for UN agencies, NGOs, and the government to provide the requisite physical and human security needed in the country. Physical, financial, and human resources are pushed to the limit; reducing the prospects of the refugee camp ever achieving total human security. (R5, 17/05/2021).

Given the large number of people seeking sanctuary and the complexity of the humanitarian crisis, it is clear from the foregoing that achieving human security was a challenge. This is consistent with Iteyo's (2018) results that relate humanitarian crises to the inability to achieve human security.

The social effects of refugees on host countries are much more difficult to measure. The United Nations High Commissioner for Refugees (UNHCR) warns that "social tensions, disagreements, and even violence" can arise whenever large numbers of refugees enter a country, especially if they are poor and have no ties to the host society's ethnicity or culture (UNHCR 2011). Others have discovered that while economic adaptation is straightforward for migrants, social integration might be trickier (Institute for Market Economics 1999). Similarly, several studies have looked at how refugee camps are blamed for things like crime, prostitution, and alcoholism in the surrounding communities (Codjoe *et al.* 2013). The long-term mental health implications of hosting refugees or other displaced groups have been the subject of growing concern in recent years, as evidenced by an increasing body of research (Messiah *et al.*, 2016).

Fears about the effects on national security are the most frequently voiced concern among host nations. There have been multiple studies conducted to ascertain the security effects of refugees on their host countries. Some research suggests that countries that take in refugees may become more unstable as a result. One possible cause of this is political activists' attempts to use the host country as a staging ground for a rebellion (Zolberg *at al.*,1989). Host countries risk becoming vectors for spillover violence if individuals arrive with weapons or militant ideology, or if militants disguise themselves as refugees (Lischer, 2005).

There are many who argue that refugee influxes can actually make local communities more unstable and violent. If solutions aren't discovered, protracted refugee situations may also provide a number of other security challenges. These may be specific to the location of the host organization, or they may relate to security issues in the region. Additionally, resettlement countries have voiced security concerns, notably in the areas of counterterrorism and violent extremism (Loescher and Milner, 2005).

Hosting refugees and other displaced people can have both positive and negative effects on society. According to studies, the presence of refugees and their "pursuit of livelihoods can increase human security since economic activities assist in reestablishing social and economic relationships within and beyond communities" (Jacobsen, 2002). Refugees and their host communities both gain from inclusive policies, which make them more self-sufficient and less reliant on outside support.

Furthermore, the evidence demonstrates that the living conditions in which migrants are kept exacerbate or exaggerate many of the security concerns that they face. While there can be no absolute guarantee of safety, especially in countries that do extensive screening, the risks associated with sheltering refugees are often fairly low. As shown, for instance, by (Byman, 2015), the belief that terrorist combatants will seek refuge among refugees being resettled is founded on flawed reasoning. The results are unambiguous: "refugee numbers are not associated with subsequent outbreaks of civil unrest." But it's equally possible that the opposite is true (Byman, 2015).

4.2 Contribution of Refugees to the Proliferation of Small Arms and Light Weapons in Kenya

The respondents were presented with the statement, "Refugees contribute to the proliferation of small arms and light weapons in the country." This is an important question since the proliferation of small and light weapons could affect security in and around the refugee camps.

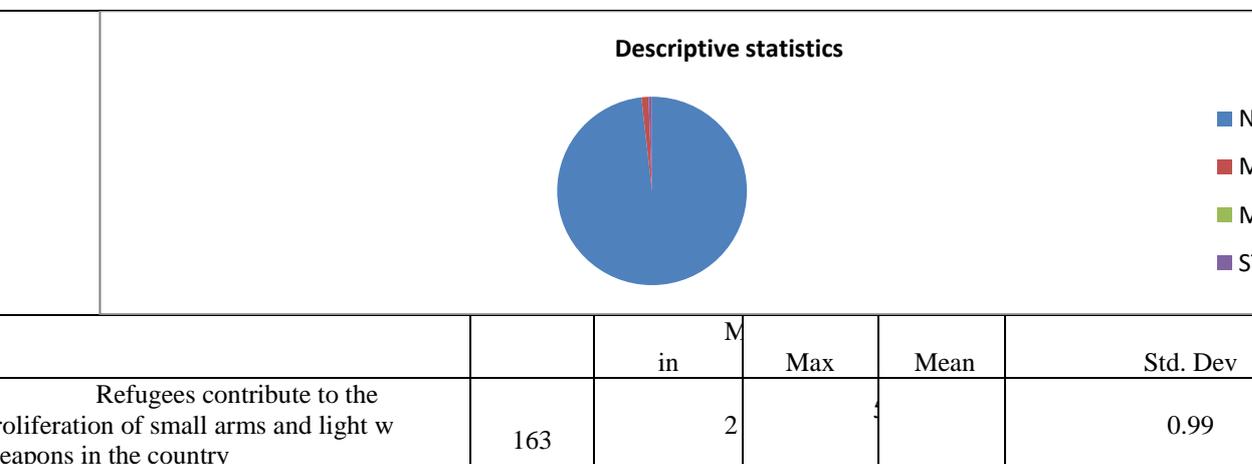


Figure 4 Contribution of Refugees to the Proliferation of Small Arms and Light Weapons in Kenya
 Source: Researcher, 2022

As shown in Table 2, most of the respondents agreed with the statement (mean of 4). According to Mutwiri (2014), small arms and light weapons proliferation plays major roles in regional insecurity and affects Kenya not only economically but also politically and internationally and refugees play a role in arms proliferation. Thus, it can be concluded that the refugee crisis has a major impact on human security in the host country.

The findings depicted above are corroborated by the findings from the interview and FGD participants who show that there was a clear nexus between refugees and the proliferation of small and light weapons in the country. In this light, some of the respondents pointed out that refugees could harbour or act as conduits to gun traffickers. Although most refugees were innocent, it was hard to keep members of terrorist cells as well as criminals at bay. This was affirmed by one of the respondents who said:

It is not easy to keep camps free of terrorists. Most likely, criminals and gun traffickers could disguise themselves as refugees. This could lead to the proliferation of small and light weapons unhindered to the entire Garissa County and other parts of Kenya. (F3, 23/04/2021).

The aforementioned research highlights the ease with which criminals can blend into refugee camps. This made refugee camps a perfect cover for arms dealers. In the refugee camps and surrounding areas, this creates genuine dangers to the safety of people. These results corroborate the findings of a study by Kilonzo (2017), which suggests that the vast majority of Kenyans view refugee camps as incubators for terrorist groups and that refugees frequently take advantage of the porous borders surrounding Kenya in order to facilitate the spread of small arms and light weapons within Kenya.

Migration has long been associated with apprehensions about increased weaponry because to fears that migrants bring it with them. Dadaab refugee camp was established in 1991 in response to fears of an influx of migrants (rumored to be armed) into the region's northeast. However, it is not just refugees who are suspected of playing a significant role in the spread of SALW. In actuality, many Kenyan pastoral communities, especially in border areas, have long faced allegations that they are arming themselves illegally.

Three studies by Klare (1995), Mogire (2003), and Njoroge (2001) establish a connection between the use of small guns and light weapons and the escalation of violent conflict (2007). The proliferation of small arms and light weapons, especially in refugee camps that are thought to be safe because they are staffed by security personnel from the host country, has not been systematically examined, despite the growing body of literature on refugees' participation in violent conflict in both their host countries and their countries of origin.

Proliferation refers to the spread of small arms and light weapons from a small number of producing countries to an ever-increasing number of recipient states and non-state entities. Proliferation, on the other hand, is the spread of arms to other non-state players, such as private armies and militias, insurgent groups, criminal organizations, and other non-state actors, as defined by Klare (1995).

According to the peacekeepers, Garissa County is stocked with a wide variety of weapons. The AK-47, FN, MK 4, G3 FMP, and G3 COF are the most commonly used weapons in security incidents. The AK-47 is the most common firearm in the region due to its portability and affordability. Many people in the area believe that an AK-47 can be purchased for between four and six goats. The AK-47 is more ubiquitous in the surrounding area and less so among refugees. G3 is another well-liked short arm in the area. For the same reason as the AK-47, plus the fact that it's easier to get your hands on one, this is the case. For about Khs.3500, or about two to three goats or sheep, you can get G3.

4.3 Use of Terror Techniques by Refugees Challenges National Security, Territorial Integrity, and Political Integrity

The respondents were presented with the statement, "Some refugees are accused of employing terror techniques which challenge national security, territorial integrity, and political integrity." This question was informed by extant literature that shows that refugees are often accused of perpetrating terrorism.

Table 3. Use of Terror Techniques by Refugees Which Challenges National Security, Territorial Integrity, and Political Integrity

Descriptive Statistics					
		Min	Max	Mean	t Std. Dev
Some refugees are accused of employing terror techniques that challenge national security, territorial integrity, and political integrity	163			4.94	0.23

Source: Researcher, 2022

As shown in Table 3, the respondents strongly agree (mean of 5) with the statement. Thus, it is deducible that indeed refugees are accused by the host country to be a threat to national security. This in turn confirms the human security threat that refugees pose to the host country through terrorism. This is in line with a study by Manyala (2016) who posits that in the fight against terrorism, refugees at the Dadaab Camps have often been caught in the line of fire.

The role of refugees in supporting international terrorism was also confirmed by qualitative data from interviews and FGD respondents. For example, one of the respondents supported the findings above by saying that:

Some terrorist cells endeavour to create cells within the camp. During the registration of refugees, it is often hard to know who is who. Some members of terrorist groups can infiltrate the refugee camps. Others can also be radicalized within the premises of the refugee camps. This perpetuates security threats in the refugee camps as well as the large Garissa County and Kenya as a whole. (F5, 14/05/2021).

The findings show that there is a close relationship between refugees and the perpetuation of terrorism. In some cases, refugees could be radicalized in the camps, making them agents of terrorist cells. This further buttresses the findings of Kilonzo, (2017) who points out that most Kenyans regard refugee camps act as breeding grounds for terrorist groups and they are considered grounds for radicalization and launching pads for violent terrorism into other parts of the country.

In other instances, refugees are harassed by police officers and accused of being terrorists. To support this, an NGO official said:

One of the refugees I know was walking home from the shop when he was stopped by two police officers. They all stomped on him and tore up his clothes apart, yelling, "All Somalis are Al-Shabaab and terrorists!" Then they loaded him into their car and drove away to an unknown location. Because it was dark, he had no idea where they were. They motioned for me to exit the vehicle. They then simply drove away. (R6, 8/05/2021).

According to Manyala (2016), Kenya has frequently deployed police and military operations within and without its borders with Somalia to deal with insecurity, which has often been blamed on refugees. The aforementioned facts confirm this conclusion. This explains why innocent refugees are frequently accused of being involved in terrorist operations. When compared to the UNDP's ideal, this treatment is demeaning (1994).

There are no more important national interests than maintaining one's country's territorial integrity and sovereignty. Over the past decade, al-Shabaab, ISIS, and al Qaeda have posed a continual danger of terrorism in Kenya. Kenya's very survival is at risk as a result of these threats to the country's independence. This means the government has put in place infrastructure, programs, policies, laws, and institutions to deal with potential terrorist threats and to protect its citizens from them.

Terrorism is "a consequence of extreme beliefs, acts, and feelings supporting perceived oppression or threat to the existence of a community," as defined by McCauley and Moskalenko (2017). Religion-based extremism has been the primary source of terrorism, contrary to the claims of many academics throughout the world who point to "diversity in political beliefs and feelings of disorientation that leads to radicalization" as the root of the problem. According to Huntington's Collision of Civilizations, the clash between Western and non-Western ideals (Islamic civilizations) is one of the main sources of conflict in the postmodern world (Huntington, 1996). Because of this, we now understand why terrorist attacks continue to happen even in democracies. Consequently, there has been no effective countermeasure to terrorism that has avoided dealing with religious radicalization.

Psychologically, victims of terror attacks often experience shock, stress, and sadness. Terrorism deters potential financiers, especially when it occurs in public places like eating establishments and retail centers. Terrorism has severely damaged Kenya's tourist and service industries. According to Mwangi, the economy is one of the three pillars that make up the instruments of national power that any nation's grand strategy must address. It's the third leg of the stool, yet diplomacy and military can't stand without it. There have been a large number of terrorist attacks against hotels and shopping malls around the world. Terrorist attacks on hotels are all too common, as evidenced by the recent events in Sri Lanka over the Easter weekend and in other countries like the United States, Great Britain, and France.

4.4 Refugee Camps Used for Recruiting Terrorist Fighters and Providing Them with Food and Shelter

The respondents were presented with the statement, "Refugee camps are often used as camps for recruiting terrorist fighters as well as providing them with food and shelter." The purpose of these questions was to find out if there were cases of recruitment of terrorist fighters in refugee camps as argued by extant literature.

Table 4. Refugee Camps Used for Recruiting Terrorist Fighters and Providing Them with Food and Shelter

Descriptive Statistics				
	N			S

		Min	Max	Mean	Std. Dev
Refugee ca Refugee camps are often used as camps for recruiting terrorist fighters as well as providing them with food and shelter	163				0.29

Source: Researcher, 2022

Most of the respondents strongly agreed with the statement. The mean was 5 as shown in Table 7.8. Thus, it can be argued that refugee camps are used as camps for recruiting terrorist fighters as well as providing them with food and shelter presenting a serious human security challenge to the host country. These findings buttress extant literature as posited by Ngao (2018) who argue that refugees presented a security problem in Kenya since refugee camps have often been used as camps for recruiting fighters as well as providing them with food and shelter

The interview and FGD participants affirmed these findings by pointing out that there were clandestine cases of radicalization and recruitment of terrorists. Some hardcore terrorists often got rich ground to plant terrorist propaganda in the watch of international and local NGOs and government officials. In this light, one of the respondents said:

There are cases of radicalization in refugee camps. One may come to the camp being moderate but if he or she comes into contact with radicalized individuals in the camp, they are likely to change their worldview and become radicals and terrorists. This has been the case with several refugees over time. (F4, 11/05/2021).

These results further support the hypothesis that refugee camps are breeding grounds for radicalization and terrorism recruiting. This is consistent with research by Iteyo (2018) and Matanga and Muchilwa (2018), who both postulate that refugee camps have been used to recruit members for terrorist groups.

Terrorists have long used Kenya's largest refugee camps like Dadaab and Kakuma as recruiting hotspots. As criminal and terrorist activity rises in the region, so does the opportunity for recruiting. Concern has been raised by civil society groups and others that young people are an easy target for extremist groups because they are so receptive to the promises they make to them. Boys and young men in the slums are a prime target for al-Shabaab and ISIS recruiters because of their large numbers and because of the lack of social and religious barriers that separate them from them. Those young people who have no chance of getting a good education or a good job are easy victims. The same is said to be true of the country's border regions. Girls, children of the wealthy, and even college students have been among the recruitment in the past, as seen in the 2015 terror attack in Garissa.

Studies reveal that the motivations for joining extremist organizations differ across demographics, highlighting the multifaceted nature of radicalization. Some young people from low-income areas join due to peer or even family pressure, while others are drawn in by the promise of cash rewards or because they are committed to the jihadist ideology. Still others are looking for adventure or a defined set of rules and conventions to live by. The organizations are experts at reaching out to various subsets of young people with tailored promises and messaging. Many young people from the West and elsewhere have joined terrorist groups. But this is simpler to accomplish in regions where poverty, inequality, ethnic and religious strife, political marginalization, and insecurity are already the norm.

As far as anyone who has been keeping an eye on things has seen recently, hiring is currently open. There are allegations that police and security personnel are complicit or complicit in such actions in exchange for bribes and other 'benefits.' Border officers in Kenya are also rumored to be involved in the unlawful admission of foreigners from Somalia, Ethiopia, and elsewhere in exchange for modest fees. The notion that corruption is a major contributor to a lack of safety has been widely recognized as one of the biggest challenges in the war on terrorism. More than 100,000 illegal aliens, including many known criminals and at least one individual who was discovered carrying extremely explosive bomb-making material despite passing through many police checkpoints, were reportedly let into the nation by corrupt officials.

The Kenya National Commission for Human Rights and other human rights groups are at odds with the Kenyan government's security forces over the latter's efforts to bolster national security. Some say the government is wrong to "fight terror with terror," as it is violating citizens' rights and shrinking the public sphere. In the north and along the coast, where the population is predominantly ethnic Somali and Muslim, human rights groups have accused the government and security services of carrying out arbitrary arrests, disappearances, torture, and extrajudicial murders of young Muslim males. Odhiambo *et al* (2015) states that: the Somali militant group Al-Shabaab has given up all pretense of governing and has joined the depths of global jihadi depravity. On April 2, 2015, our gunmen affiliated with Somalia's Al-Shabaab jihadist-terror group, entered Garissa University College in Garissa, Kenya, killing 148 and wounding dozens. "The assault on Garissa a pastoral area that is home to many Somali refugees stands in stark contrast to the group's deadly 2013 attack on Nairobi's Westgate shopping center, which was frequented by expats and rich Kenyans..."

The government's security forces, meanwhile, say that human rights groups in the country are "supporting terror suspects and terrorists." Human rights activists and civil society organizations see this as a worrying resurgence of the practice of "state terrorism," in which government security forces target and silence those who disagree with official policy. Al-attacks,

Shabaab's notably against Kenya's non-Muslim population, have exacerbated the country's preexisting religious tensions. Prejudice towards ethnic Somalis and Muslims, whether Kenyan citizens, refugees, or migrants, has increased as a result of security initiatives in Muslim- and Somali-dominated communities like Eastleigh, Nairobi, and coastal areas. A portion of these communities may sympathize with extremist groups if they feel further marginalized in Kenya. As 'terrorism' has evolved into a political football, the responsibility for its existence has been passed back and forth between the government and the opposition, further clouding the situation. Finally, despite the state's strong security measures, Kenya's inability to coordinate its security personnel and exchange intelligence among them further hinders the country's fight against terrorism.

Although Sude (2020) claims that only a small percentage of refugees and asylum seekers ever become terrorists, a small number of them have carried out significant assaults, causing widespread alarm among governments and the general public in host countries. In this section, we examine the causes and consequences of the proliferation of terrorist organizations and violent militant groups among refugees living in camps during key historical migration crises. Afterwards, it looks at what's being done now to protect camp residents from the same threats that plagued their ancestors. More than half of refugees, however, are not in camps but are instead living with host families in the communities closest to their countries of origin or in third countries where they seek protection in asylum reception centers before starting to reconstruct their lives.

The primary determinants that have been recognized in the past, such as host government policies, security and radicalizer access, living conditions, possibilities for youth, and local economic conditions and resilience, remain relevant to contemporary situations. Refugee integration is difficult in third countries, and they might learn from the experiences of countries like the United States and Canada. There is a growing need to address other personal risk factors among refugees as they become integrated into society in their new countries. In most respects, refugees don't have any advantage over the general population in these areas. Not all of these markers have been empirically confirmed, but to the extent that they are helpful, this chapter will investigate how they apply to refugees in general and propose viable strategies taken from mental health, criminal justice, youth, and community programs to decrease individuals' propensity to radicalization prior to violence.

Key historical cases in which refugee groups based in camps became militarized, conducted cross-border operations, and sometimes became radicalized enough to mount terrorist attacks well outside of their original regions must be addressed in any discussion of radicalization among refugees in camp settings. Lebanese Palestinians, Afghan refugees in Pakistan during and immediately after the Afghan-Soviet conflict, and Rwandans in Zaire/the Democratic Republic of the Congo (DRC) following the Rwandan genocide are all prime examples. As a result of hearing about these "worst examples," the public may conclude that all refugees are potentially dangerous because they may turn into "refugee warriors" fighting for their own cause. Only around 40% of refugees in recent years have lived in camps, and not all refugee situations, even superficially identical camp situations, provide the same risks.

5. Summary and Conclusion

The findings pointed out that refugees are accused of contributing to humanitarian and security concerns in this country (Mean of 5). This limited the realization of human security untenable. In the context of a bulging refugee population, it was hard to manage the humanitarian crisis. Small arms and light weapons proliferation played a major role in regional insecurity and affected Kenya not only economically but also politically and internationally and refugees play a role in arms proliferation.

Some refugees were also accused of employing terror techniques that challenge national security, territorial integrity, and political integrity (mean of 5). Thus, it is deducible that indeed refugees are accused by the host country to be a threat to national security. This in turn confirms the human security threat that refugees pose to the host country through terrorism. This is corroborated by Odhiambo *et al* (2012) when they stated that: Kenya Defence Forces' (KDF) preemptive and preventive actions are justified after the terrorist group known by the name of Al-Shabaab performed a series of kidnappings and cross-border incursions into Kenya, all of which threatened security and the lucrative tourism industry in East Africa's largest economy.

Refugee camps were also sometimes used as camps for recruiting terrorist fighters as well as providing them with food and shelter presenting a serious human security challenge to the host country (mean of 5). The interview and FGD participants affirmed these findings by pointing out that there were clandestine cases of radicalization and recruitment of terrorists.

the study concludes that some of the major challenges limiting achieving human security were bulging refugee population which made it hard to manage humanitarian crisis; small arms and light weapons proliferation which played a major role in regional insecurity and affected Kenya not only economically but also politically; perpetuation of terrorism by some refugees which challenged national security, territorial integrity, and political integrity as well as making it hard to achieve human security.

6. Recommendations of the study

The study recommends that the various challenges to achieving human security should be dealt with through increased funding. This would contribute to the expansion of facilities that cater to the bulging refugee population, the proliferation of small arms and light weapons should be checked through enhanced vigilance in border areas as well as within the camps, adherence to

the rule of law among the refugees should also be enhanced and access to employment and other socioeconomic opportunities should also be enhanced through concerted efforts by the international community.

References

- Abdirahman, A. (2014). *Influx of Somali Refugees and State Security: Kenya as a Case Study (2002-2012)*. Bachelor's Thesis. University of Nairobi, Kenya
- Acemoglu, D., & Robinson, J.A. (2012). *Why Nations Fail*. New York: Crown
- Ali, J.A., Imana, D.K., & Ocha, W. (2017). The Refugee Crisis in Kenya: Exploring Refugee-Host Community Causes of Tensions and Conflicts in Kakuma Refugee Camp. *Journal of International Relations and Foreign Policy*, 5 (2), 39-51.
- Alix-Garcia, J., & Saah, D. (2009). The Effect of Refugee Inflows on Host Communities: Evidence from Tanzania. *The World Bank economic review*, 24 (1), 148–170.
- Barasa, L., & Matanga, F., (2018). Nature of Human Security in Nairobi, Kenya. *IOSR Journal of Humanities and social science (IOSR-JHSS)*, 23(3), 87-95.
- Betts, A. (2009). "Development Assistance and Refugees, Towards a North-South Grand Bargain?" Forced Migration Policy Briefing 2. Refugee Studies Centre, University of Oxford. The United Kingdom.
- Chitembwe, S. J.& Odhiambo,E.O.S (2021). "Role of The Criminal Justice System in Contributing to Youth Radicalization in Mombasa and Kwale Counties" Published by Journal of Defense Resources Management (JoDRM) Vol. 12, Issue 2 (23)/ 2021. Pp 254-280. ISSN: 2068-9403.eISSN: 2247-6466. ISSN-L: 2247-6466. <http://www.jodrm.eu/currentissue.html>
- Cohen, Y. (2018). *Driven to Care: Improving Transportation to Reach Maternal Health Care in Conflict Zones*. New Security Beat.
- Cooper, D.R., &Schindler, P.S. (2003). *Business Research Methods*. 8th Edition, McGraw-Hill Irwin, Boston
- ECLAC. (2010). *Achieving the Millennium Development Goals with equality in Latin America and the Caribbean: Progress and challenges*. United Nations, Santiago, Chile.
- Haq, M. (1995). *Reflections on Human Development*. New York: Oxford University Press
- Huntington, S.P. (2016). *The Clash of Civilizations and the Remaking of World Order*. New York, NY: Simon and Schuster.
- Huysmans, J. (2006). *The Politics of Insecurity: Fear, Migration and Asylum in the EU*. London: Rout ledge, 26-28.
- ILO. (2010). *Decent work and youth in Latin America*. Youth Employment Project in Latin America (PREJAL), Lima.
- Iteyo, C. (2018). State conflicts and the refugee problem in Eastern Africa. *Peace, Security, and Development in 21st Century Africa: theory and practice*. Prolongue Media ltd.
- Julia, F. (2022). *Refugees and Asylum Seekers in Kenya by Country of Origin 2020*. Statista <https://www.statista.com/statistics/1199580/refugees-and-asylum-seekers-in-kenya/>
- Kilonzo, S.N. (2017). *Security challenges in Africa: the role of refugees in Kenya*. Master's Thesis. University of Nairobi.
- Kirui, P., & Mwaruvie, J. (2012). The Dilemma of Hosting Refugees: A Focus on the Insecurity in North-Eastern Kenya. *International Journal of Business and Social Science*, 3 (8), 162-168.
- Kothari, C.R. (2004). *Research Methodology Methods and Techniques*. 2nd Edition, New Age International Publishers, New Delhi.
- Kumssa, A., & Jones, F. (2014) Human security issues of Somali refugees and the host community in Northeastern Kenya. *Journal of immigrant & refugee studies*, 12(1), 27-46.
- Lee, E. (1966). A Theory of Migration. *Demography*, 3(1), 47-57.
- Leedy, P. D., & Ormrod, J. E. (2005). *Practical research: Planning and design* (8th ed.). Upper Saddle River, NJ: Prentice-Hall.
- Léonard, S. (2010). Frontex and the securitization of migrants through practices. *European Security*, 19(2), 231–254.
- Lischer, S. (2005). *Dangerous Sanctuaries: Refugee Camps, Civil War, and the Dilemmas of Humanitarian Aid*. Ithaca, NY: Cornell University Press.
- Mabogunje, A.L. (1970). Systems Approach to a Theory of Rural-Urban Migration. *Geographical Analysis*, 2(1), 1-18.
- MacFarlane, N.S., & Khong, Y.F. (2006). *Human Security and the UN. A Critical History*. Bloomington: Indiana University Press.
- Maito, T. Leshan & Odhiambo. E. O. Standslause (2013). "Adaptation to the Harsh Conditions of the Arid and Semi-Arid Areas of Kenya: Is Pastoralism the Best Livelihood Option?" published by Asian Journal of Natural & Applied Sciences (AJSC) Oyama, Japan. Vol.2, Number 4 December 2013 ISSN: 2186-8476, Print ISSN: 2186-8468, pp.22-29.
- Manyala, F.B. (2016). *States' response to refugee crisis: the case of Somali refugees in Kenya*. Master's Thesis. United States International University-Africa
- Matanga F.K, Okoth and Onkware (Eds), (2018). The refugee crisis and implications for national and international security: *Peace, Security, and Development in 21st Century Africa: theory and practice*. Prolongue Media ltd.
- Menkhaus, K., (2014) State Failure, State-Building, and Prospects for a "Functional Failed State" in Somalia. *The Annals of the American Academy of Political and Social Science*, 656, 154-172.
- Mogire, R. (2011). *Victims as threats: Refugee impact on host state security in Africa* (Eds.). England & USA: Ashgate Publishing Ltd.
- Muoka, B. (2015). *Urban Refugees in Kenya: The Case of Banyamulenge Refugees in Nairobi; 1996-2012*. Master Thesis. University Of Nairobi, Kenya.

- Ngao, O.C. (2018). *Urban Refugees and Human Security Management in Africa: Case Study of Kenya*. Master's Thesis. University of Nairobi.
- Obadan, M.I. (2001). Poverty Reduction in Nigeria the Way Forward, *Central Bank Nigeria, and Financial Review*, 39,
- Penninx, R. (2004). "Integration processes of migrants in the European Union and policies relating to integration." Paper presented to the Conference on Population Challenges, International Migration and Reproductive Health in Turkey and the European Union: Issues and Policy Implications, Istanbul.
- Pettman, R. (2005). Human Security as Global Security: Re-conceptualizing Strategic Studies. *Cambridge Review of International Affairs*, 18(1), 137–150.
- Richmond, O.P. (2013). *Human Security in Turkey: Challenges for the 21st Century*. Taylor & Francis, 11-34.
- Sageman, M. (2008). *Leaderless Jihad: Terror networks in the twenty-first century*. Philadelphia: University of Pennsylvania Press.
- Salehyan, I., & Gleditsch, K. (2006). Refugees and the Spread of Civil War. *International Organization*, 60, 335-366
- Schneider, E. (2015). The Militarization of Refugee Camps. *Philologia*, 7(1). DOI: <http://doi.org/10.21061/ph.v7i1.132>
- Sobh, B. (2014). *Analysis of Impact of Influx of Syrian Refugees on Host Communities*. UNDP and Ministry of Planning & International Cooperation.
- Stave, S.E., & Hillesund, S. (2015). *Impact of Syrian refugees on the Jordanian labor market*. International labor organization and FAFO.
- Sude, B. (2020). "Prevention of Radicalization to Terrorism in Refugee Camps and Asylum Centers." In Alex Schmid (ed.). *The Handbook of Terrorism Prevention and Preparedness*. The Hague: International Centre for Counter-Terrorism.
- UNCHR. (2020). *Dadaab Refugee Complex*. UNHCR. Accessed on September 10, 2021, from <https://www.unhcr.org/ke/dadaab-refugee-complex>
- UNDP. (2015). *Human Development Report*. UNHCR (<http://hdr.undp.org/en/2015-report>)
- UNHCR (2006). *The State of the World's Refugees: Human displacement in the new millennium*. Oxford: Oxford University Press.
- UNHCR (2015). *Worldwide displacement hits all-time high as war and persecution increase*. UNHCR. <http://www.unhcr.org/558193896.html> (Accessed on August 22, 2019).
- UNHCR Environment Strategic Plan. (2011). *Sustainable Environmental Interventions in Refugee Camps and Hosting Areas of Dadaab and Kakuma*. UNHCR.
- UNHCR News. (1997). "Forward," *Refugees Magazine Issue 109*. United Nations, 17 Feb. 1997
- UNHCR. (1951). *Convention and Protocol Relating to the Status of Refugees*. UNHCR. <https://www.unhcr.org/uk/3b66c2aa10> (Accessed on December 11, 2021).
- UNHCR. (2004). "Protracted Refugee Situations Standing Committee 30th Meeting," 10 June 2004. EC/54/SC/CRP/14.
- UNHCR. (2007). *2006 Global Trends*. Geneva: UNHCR.
- UNHCR. (2010). *Improving Maternal Care in Dadaab Refugee camps, Kenya*. UNHCR.
- UNHCR. (2011). *Promoting Livelihoods and Self Reliance*. UNHCR.
- UNHCR. (2015). *Refugees in the Horn of Africa: Somali Displacement Crisis*. UNHCR.
- UNHCR. (2016). *Global Trends. Forced displacement in 2015*. UNHCR
- UNHCR. (2017). *Operational Update: Dadaab, Kenya*. UNHCR. www.unhcr.org/ke/wp-content/uploads/sites/2/2017/10/15-October-Dadaab-Bi-weekly-Operational-Update.pdf
- UNHCR. (2018). *The Other One Percent - Refugee Students in Higher Education*. United Nations High Commissioner for Refugees.
- Wasike, S. and Odhiambo, E.O.S. (2016) A Critique of the Usefulness of Theories in Explaining Socio-Political Phenomenon. *Asian Journal of Basic and Applied Sciences*, 3, 29-33.

Evaluating Peacebuilding Strategies Applied by Sub-County Peacebuilding Committees In Mombasa County

¹Odallo, D.O., ¹Professor Okoth, P. G and ²Professor Were, M. E

¹Department of Peace and Conflict Studies
Masinde Muliro University of Science and Technology
²Department of Political Science and Peace Studies
Kisii University

DOI: 10.29322/IJSRP.12.10.2022.p13087

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13087>

Paper Received Date: 25th September 2022

Paper Acceptance Date: 25th October 2022

Paper Publication Date: 30th October 2022

ABSTRACT

The changing nature of conflict and the emergence of new security challenges alongside a relatively underfunded global peace and security architecture has put to question the continued relevance of the strategies used in peacebuilding. The 2008 Kenya Government directive that each County should have a peacebuilding entity brought into the limelight the work of the Peacebuilding Committees in Kenya. Mombasa Sub-County Peacebuilding Committees have been conducting peacebuilding in the County, against the backdrop of old conflict drivers such as poverty and resource-based conflict, and emerging threats to peace such as drug trafficking and youth radicalisation. Therefore, the ability of the Sub-County Peacebuilding Committees to foster sustainable peacebuilding in these circumstances needs to be interrogated. The objective of this study was to evaluate the strategies applied by the Sub-county peacebuilding committees in advancing sustainable peacebuilding. Conceptual framework was based on Galtung's Theory of Peacebuilding, Galtung's Theory of Structural Violence and Lederach's Conflict Transformation Theory. The study adopted a descriptive survey research design and applied both convenience and purposive sampling techniques. Data were collected through semi-structured questionnaires, key informant interview (KII) and Focus Group Discussion (FGD) guides and observation checklists. Both quantitative and qualitative methods were used for data analysis. The most common strategies for peacebuilding that Sub-County Peacebuilding Committees used were; individual and community dialogue; community mobilisation through theatre and dance; peace *Barazas*, community walks and ad hoc meetings. Sub-County Peacebuilding Committees collaborated with a wide range of other stakeholders including; Government agencies (such as NSC), NGOs, and both local and international and religious organizations. Social media has been used as one of the peacebuilding tools employed by the Sub-County Peacebuilding Committees. To ensure that Sub-County Peacebuilding Committees foster sustainable peacebuilding, the study recommend that strategies need to gradually shift towards those that address the underlying causes of conflict in Mombasa County.

Key Words; *DynPolicy Framework; SubSustainable Peace; Sustainable Peacebuilding*

1. INTRODUCTION

Historically, local peacebuilding committees have functioned as informal spaces where villagers meet, discuss and resolve their conflicts by applying a range of traditional, bottom-up methods of peacebuilding (Mungai *et al*, 2020). These structures still function in the same manner, however, the realisation by national Governments that these entities were a viable partner in peacebuilding led to their rapid formalisation and co-option into Government peace and structures. This was the case of Kenya's Wajir Peace and Development Committee (WPDC) which originally came out of the desire to strengthen social cohesion of local communities in search for sustainable peace, but later got absorbed into the Wajir County peacebuilding agenda (Nganje, 2020). Formal peacebuilding committees are therefore local peacebuilding institutions that have been accorded Government recognition and either coopted into formal Government peace and security systems or supported to foster peacebuilding on their own. Over time, local peacebuilding committees have expanded and formed networks that are now known as the national infrastructures for peace (I4P).

In Kenya, like in other parts of Africa, local peace committees arose from the desires of local communities to respond and manage conflict amongst themselves. In many instances, as was the case of Wajir County, it was the continued conflict and the poor response by the national Government that led to the formation of an informal structure for local peacebuilding which later became a huge and formal peacebuilding and security structure after the Government took it over in 1995 (Ndegwa, 2001).

The Wajir Peace and Development Committee (WPDC) has been cited as the perfect example of a local peacebuilding entity that arose out of the community in response to recurrent violent conflict that had virtually crippled local life in Wajir County. Through persistent effort and careful inclusion of warring parties, and adoption of different voices, Wajir Peace Initiative eventually spurred a county-wide program of local peacebuilding entities that are to be found in all parts of Kenya. The growth of the local peace infrastructure in Kenya has been credited to this initiative. Local peace infrastructures can grow out of a felt need of the people affected by conflict, or out of Government policy in that direction. However, the real impact of these peacebuilding entities is still to be fully realised.

Even with about 235 formal LPCs working at the Sub-county level in Kenya, and many more informal peacebuilding infrastructures in support, the literature suggests that the country still has serious peacebuilding challenges. At the operational level, local peacebuilding structures have been judged as weak in conceptualising and executing peacebuilding strategies. At the structural level, the process of institutionalisation has threatened local agency, and introduced a top-down relationship that has disempowered the local peace committees (Githaiga, 2020). Basing their argument on the loss of control, Githaiga, citing Magotsi (2014) asserts that institutionalisation limits the authority of local level engagement thereby reducing the degree of sustainability of the intervention. Local peacebuilding structures have been affected by a lack of resources. While the Kenyan NSC seems to have placed very high expectations on the LPCs, the entities remain under resources and therefore weak in terms of operational capacity. Moreover, as Nganje (2020) suggests, these entities are most effective in the context of low-key community conflicts that can be addressed using dialogue, mediation, or other problem-solving approaches, and have no enforcement capabilities.

1.1 Statement of the Problem

Mombasa County has been known to experience cyclical and often protracted conflict incidents that have negatively impacted on the peace of the County and by extension, Kenya as a whole. This conflict is prominent with regard to ethnic animosity, political violence, radicalisation, gender-based violence, and domestic terrorism (Elder *et al.*, (2014); County Government of Mombasa, (2018), Rakodi, (2000)). Despite many years and much investment by Government, Civil society and religious leaders, the cycle and long history of conflict has not been broken. The establishment of the Sub-county Peacebuilding Committees, as a policy response in 2008 seems to have made no difference in the County. There are several stakeholders in the peace agenda of Mombasa including; the national and county government of Mombasa, the security forces, politicians and elites, young people who are susceptible to radicalisation and militias. All these have employed different strategies and for peacebuilding that are yet to be interrogated. Secondly, how these different stakeholders interact with the Sub-county Peacebuilding Committees and the factors that come into play greatly influence the peacebuilding agenda of the County and this needs to be probed. There is a clear need to interrogate the dynamics that influence the Sub-county Peacebuilding Committees so as to understand the sustainable peacebuilding potential in Mombasa County.

Mombasa County poses a major peacebuilding challenge for Kenya, and the East African region. It serves as the largest port of entry for Kenya and the larger East African trading block which now includes Kenya, Uganda, Tanzania, South Sudan, Rwanda, Burundi and the Democratic Republic of Congo. These countries have set to be fully economically integrated by 2063, and Mombasa holds the key to this integration process. Mombasa is also the most popular tourist destination in the Eastern Indian Ocean coast. These two factors, in addition to the need for a peaceful and prosperous Kenya makes peacebuilding in Mombasa an important County agenda, in which local peacebuilding committees have a central role. However, even with an elaborate peace policy and County leadership in support, the effectiveness of the formal peacebuilding infrastructure in Mombasa remains unknown.

To date, the only assessment done by Onyango (2010) found that the Mombasa Sub-County Peacebuilding Committees were weak in terms of physical structures and equipment, a fact which severely compromised their functions. Onyango (2010) attributed this situation to the embryonic nature of the Sub-County Peacebuilding Committees even though they were borrowing from already working Sub-County Peacebuilding Committees from other parts of Kenya. Almost 10 years after this assessment, the Sub-County Peacebuilding Committees have continued to expand and work in peacebuilding but with an unknown level of effectiveness. There is no credible knowledge of the challenges that the Sub-County Peacebuilding Committees face nor the opportunities for sustainable peacebuilding within the infrastructure. There is a need to examine the dynamics that impact upon the effectiveness of the Sub-County Peacebuilding because they are the official structures that are supposed to be driving sustainable peacebuilding in Mombasa. As argued by Adan & Pkalya (2006), merely having an entity called a local peace infrastructure does not secure the peace, leave alone sustainable peace. This study interrogated the efficacy of the formal infrastructure for peace in promoting sustainable peacebuilding in Mombasa County, focusing on peacebuilding policy framework, strategies and operational challenges. In the process, sustainable peacebuilding opportunities were also explored.

1.2 Research Objective

Evaluate the strategies applied by the Sub-County Peacebuilding Committees in fostering peacebuilding for sustainable peace in Mombasa County.

1.3 Research Question

Why are the strategies employed by the peacebuilding infrastructure in fostering sustainable peace efforts in Mombasa County able or unable to foster sustainable peacebuilding?

1.4 Justification of the study

1.4.1 Academic Justification

Academic interest in peacebuilding is justified by the fact that research fulfils a very important concern which is to bridge the gap between practice and the conceptualisation of peacebuilding interventions. This is important when considering the question of local level peacebuilding because the efforts of peacebuilding are supposed to percolate and make a difference at the grassroots level. When it comes to local peacebuilding committees, much emphasis has been put in the bottom-up advantage of local peacebuilding approaches as opposed top-down to the programs supported by international peacebuilding organisations. There is still a wide gap in the literature in understanding the dynamics that either link or separate these two approaches, and whether a hybrid of the two could foster sustainable peacebuilding (Neufeldt *et al* (2020).

This study set out to fill this gap by examining the Sub-county Peacebuilding Committees from a policy framework perspective in order to fill this gap in the academic literature. The study further examined the peacebuilding strategies used by the Sub-county Peacebuilding Committees from the angle of prescription or necessity in order to arrive at a more accurate assessment of the efficacy of these entities. By putting these two aspects of Sub-county Peacebuilding Committees assessment, the study hoped to fill this academic gap in the study of peace and conflict studies. Moreover, Paffenholz's (2021) has argued that the assumption of cause-effect problem-solving approaches to peacebuilding is now obsolete, because peacebuilding has so many moving parts that it cannot follow a linear route. Mombasa County offers an opportunity for testing some of these assumptions because old and new threats to peace have converged to make the County a peacebuilding challenge.

1.4.2 Philosophical Justification

An African proverb credited to the Somali people says that "*the best bed that a man can sleep on is peace*". The proverb reflects a community's philosophical approach to peace and likens peace to a state of tranquility, in which, even though sleep may increase a person's vulnerability, peace makes it possible for one to sleep. The analogy of the bed connotes a culture of peace in which the society cultivates a broad consensus of peace which allows hope to turn into trust. The question then becomes; can local peacebuilding foster a culture of peace? In pursuing a culture of peace through Sub-county Peacebuilding Committees, the National Government has put in place the National Policy on Peacebuilding and Conflict Management which envisions a Kenyan peacebuilding architecture in which all stakeholders have an equal say in their peace through equitable participation.

A culture of peace does not assume the non-existence of conflict, but rather a consistent and sustainable way of ensuring that conflicts do not become violent by instituting mechanisms, both formal and informal that ensure that these conflicts do not escalate into violence (Ericksun, 2021). However, Bar-Tal (2009) argues that the challenge for the culture of peace is to be found in the temporary resolution of conflict through approaches like mediation and negotiation and the lack true reconciliation that changes societal view of conflict. This study attempted to view Sub-county Peacebuilding Committees in Mombasa as one way of building a culture for peace given the long history of conflict in the County.

1.4.3 Policy Justification

Kenya has developed and is implementing the National Peacebuilding and Conflict Management Policy of 2011. The optimistic argument in the policy document is that a multi-sectoral, multi-pronged approach to peacebuilding will somehow guarantee a peaceful nation. At the same time, Mombasa County has elaborated its policy framework for preventing and countering violent extremism, (MCAP/PCVE) based on the Kenya National Strategy to Counter Violent Extremism (NSCVE) by the National Counter-Terrorism Centre (NCTC). Both policies need to be informed by credible knowledge of the efficacy of the peacebuilding infrastructure in the county. Kenya has been a beneficiary of foreign assistance in its peacebuilding efforts for a long time, starting from the UN, and the EU and from bilateral such as USAID, DfID. The interest from international benefactors comes with intended and unintended consequences, which at times distorts policy. For, example, the UN has been criticized and praised in equal measure for the intended and unintended outcomes of peacebuilding (Tschigri, 2004; Gisselquist, 2018). This also explored the perspectives of Sub-county Peacebuilding Committees regarding partnerships and how these arrangements either supported or hindered their work.

2. Strategies of Sustainable Peacebuilding and Implications for Local Peacebuilding Committees

2.1 Preventive Diplomacy

The UN has continued to champion PD in nearly all its peace missions. Nathan *et al* (2018) argue that PD makes sense from a sustainability perspective because preventive diplomacy is a form of operational conflict prevention and takes place in moments of acute crisis where the risk of large-scale violence is imminent. Using the examples of UN preventive diplomacy across the world, Nathan *et al* (2018) point out that success depends on a very good understanding of the conflict parties' perspectives on violence and non-violent courses of action. The UN has been able to use its advantage to cause de-escalation of certain conflicts that would have otherwise turned into bigger problems. Nathan *et al* (2018) provide an example of Malawi, where the UN-funded and deployed experts to support the national dialogue and in Nigeria where the UN-funded and supported the National Peace Committee and the Independent National Electoral Commission during the 2015 elections in Nigeria and in Sudan elections which contributed to the successful referendum for southern Sudan.

On the African continent, the African Union has embraced Preventive Diplomacy as a pillar of the African Peace and Security Architecture (APSA). Preventive Diplomacy is outlined in the APSA Roadmap 2016-2020 which was adopted in 2013 that builds on the achievements and challenges resulting from the implementation of the previous APSA Roadmap (2011-2013). The APSA Roadmap 2016-2020 details the AU's vision in the five strategic peace and security areas: Conflict prevention (incl. early warning and preventive diplomacy), crisis/conflict management (including African standby Force and mediation), post-conflict reconstruction and peacebuilding, strategic security issues (such as illegal flows of Small and Light Weapons, Improvised Explosive Devices, and Weapons of Mass Destruction, disarmament, counter-terrorism, illicit financial flows as well as transnational organised crime and cybercrime) and coordination and partnerships. In addition, cross-cutting issues are covered by the Roadmap.

Kenya has had a role in the application of Preventive Diplomacy both as a domestic policy and as a regional partner in the peace discourse of East Africa and other parts of the continent as well. This section starts with a review of the conflict situation in Kenya to set the background for the application of Preventive Diplomacy as a peacebuilding strategy in the country. Much has been written on the conflict situation in Kenya and the strategies for peacebuilding that have been employed over the years. Rohweder (2015) summarises the conflict situation in Kenya as characterised by overlapping conflicts complicated by a large ethnic diversity, high levels of inter-communal violence, sexual and gender-based violence; cycles of election-related violence; and increasing numbers of terrorist attacks. The conflict dynamics that complicate Kenya's conflict situation include; politicised ethnicity, discrimination and marginalisation: corruption and impunity; the long-standing land issue and the menace of terrorist groups like Al-Shabaab who have maximised ethnicity and poor Government response to attack the country at will. Much of the literature has concentrated on conflict resolving recommendations that include addressing inequality, reforming the security sector, tackling corruption and engaging in conflict-sensitive development (Ajulu, 2002; Onguny and Gillies, 2019; Heider, 2020).

2.2 Conflict Early Warning.

The changing nature of conflict and the emergence of new security challenges alongside a relatively underfunded global peace and security architecture has put to question the continued relevance of the early warning idea. This is because the utility value of early warning information has not been proven Wulf and Deibel (2009). A pertinent question regarding early warning is; how early is early? When the conflict that ended up toppling President Mobutu is considered, then it is clear that unless acted upon in the right time, early warning information is completely useless.

The Kenya National Conflict Early Warning and Early Response System (NCEWERS) is a proactive conflict prevention strategy launched in late November 2010, and is designed to gather information from the public domain through crowdsourcing (SMS 108) and peace structures, such as Sub-county peacebuilding Committees. Early Warning is used to forecast and prevent violence at the community and national levels. According to the NSC, the system was instrumental in supporting the peacefully transitioning to the 2010 referendum, and the 2013 general elections through the UWIANO Platform for Peace. It has also been key in picking up the community level conflicts and advising on the formulation of sustainable interventions. The system is a domestication of the IGAD-CEWARN mechanism and is seen as a best practice in the region. This has led to the NSC hosting high-level delegations from Ethiopia, Malawi, Zimbabwe, Nigeria, Ghana, Uganda, the East Africa Community, Uganda, and South Sudan, among others. The system uses the current District Peace Committees (Sub-County Peacebuilding Committees), Peace Monitors and other relevant parties to gather crucial information from the field (NSC, 2021).

An important feature of the Kenya National Conflict Early Warning and Early Response System (NCEWERS) has been its attempt to be as inclusive as possible. In 2016, NSC initiated a move to include peace stakeholders within the NCEWERS which is made up of civil society, informal groups such as *chamas* (defined as an informal self-help group), youth groups, councils of elders, religious councils as well as grassroots persons to ensure that conflict early warning and early responses are effective. In keeping with the United Nations Security Council Resolution (UNSCR) 1325 and the recognition of the role that women have played in Kenya's peace journey, the NSC set out to ensure that the NCEWERS was fully engendered by 2016, so as to maximise on the potential of the system based on the increased role that both men and women could play in early warning (NSC, 2016). NSC further argue that the exclusion of women from early warning processes resulted in limited attention to women's needs in conflict-affected contexts, especially those related the sexual violence. By fully incorporating gender issues in the NCEWERS, the Government through NSC has ensured that the system is more complete (NSC, 2016).

Despite all the good intentions, *Uwiano* platform has not been able to stem the trend in hate speech and other threats to peace because it cannot control social media platforms. Even the launching of the International Day for Countering Hate Speech in 2022 and the inauguration of the "Let Peace Win" campaign, did not deter hate mongers during the 2022 election in Kenya. *The Christian Science Monitor* (June 27 2022) in an expose, detailed how social media platforms such as TikTok, Twitter and Meta were being used to spread political disinformation, hate speech, and incitement against ethnic communities ahead of elections in August. In one such example, a political candidate was likened to Hitler and claimed he would attack other ethnic groups once in power. More than 130 TikTok videos featuring hate and disinformation over a six-month period were identified, which had collectively amassed more than 4 million views. With this kind of media reach, *Uwiano* finds itself incapable of stemming hate speech as a threat to peace.

2.3 Mediation as a Peacebuilding strategy.

The success of any mediation depends very much on the style and approach of the mediator. There are many approaches to mediation and at times the process may stand or fall purely on the personality of the mediator. Waehlich *et al* (2008), differentiate three types of mediation; the power-based mediation in which the mediator can apply a "sticks and carrots" method to reach a goal; the interest-based, problem-solving mediation in which the mediator focuses on generating creative options for an agreement that satisfies the underlying interests of all parties as a basis for conflict resolution; and finally the transformative, long-term mediation in which mediators intervene on different levels to change the relationship between the parties, as well as their perceptions of themselves and other parties. According to the logic of transformative mediation, conflict resolution is a long-term process, which happens through the empowerment and recognition of a broad variety of actors in conflict societies (Waehlich *et al* (2008),).

The issue of mediation is critical to Africa, given the weight of conflict and the potential for lasting peace through mediation. Govender and Ngandu (2009) argue that in the context of Africa, it is critical to take a long-term view of mediation and to develop the necessary relationships that would sustain the proceeds of mediation. Citing Mitchell Govender and Ngandu (2009) who see the product of mediation as a compromise or a settlement of issues between conflicting parties, have argued that compromise and settlements have featured greatly in conflict resolution and peacebuilding in Africa due to the usually very high level of animosity and mistrust whenever conflict occurs in communities and even at the national level.

Mediation has also been carried out by African Union's regional partners, namely ECOWAS, IGAD, SADC and EAC. The Economic Community of West African States (ECOWAS) mediation to bring peace to the region is captured in several protocols and documents. These include the Protocol Relating to Mutual Assistance of Defense, Article 17; Protocol Relating to the Mechanism for Conflict Prevention, Management, Resolution, Peace-Keeping and Security. In Article 58 of this protocol, ECOWAS committed itself to "employ, where appropriate, good offices, conciliation, mediation and other methods of peaceful settlement of disputes." Under Article 4 of the Mechanism, the Authority of Heads of State and Government, the Mediation and Security Council, and the ECOWAS Commission have specific roles to play in mediation and conflict prevention, resolution, and management in West Africa. In line with this responsibility, the president of the ECOWAS Commission deploys fact-finding and mediation missions and appoints members of the Council of Wise. The Commission established the Mediation Facilitation Division (MFD) in June 2015 to backstop mediation efforts by international organisations, such as the African Union Commission (AUC) and the United Nations (UN).

The nature of conflict in West Africa has greatly influenced the kind of mediation that ECOWAS has been able to mount. Odobo *et al* (2017) argue that the root causes of conflicts in Africa are usually traceable to the colonial era when Europeans scrambled for territories and created countries with scant regard for ethnic boundaries. However, the defining feature of West African conflict is corruption, poverty, underdevelopment, political instability, electoral violence, arms proliferation, military incursion in governance; drug trafficking, territorial disputes; the problem of leadership, resurgence of religion and ethno-religious conflict, secessionist tendencies, and the inability of the states to provide and/or guarantee security for the people.

IGAD mediation mandate is captured in the *Letter of Instrument to Amend the IGADD Charter/Agreement* signed on 21 March 1996 in Nairobi, in which the Assembly of Heads of State and Government declared that IGAD would also promote peace and stability, as well as create mechanisms for the prevention, management and resolution of inter-State and intra-State conflicts in the region through dialogue. This new objective was translated into an IGAD Strategic Guidelines on Mediation for IGAD Mediators which came into effect in 2017 (International Crisis Group 2015). However, IGAD's conflict mediation predates the guidelines because the organisation had been mediating peace since the 1990s. South Sudan and Somalia remain good examples of the good intentions of IGAD in peacebuilding, but both countries also point to the challenges of mediating peace in a volatile situation such as South Sudan and Somalia.

The foregoing points to the value of mediation as a peacebuilding strategy, but also the serious shortcoming of the approach as a peacebuilding tool. Being a process that is dependent on the personal skills of the mediator it can be powerful and yield immediate results. This was seen in the case of Kenya in the PEV of 2008. The skills of the lead mediator, Kofi Annan brought back Kenya from the brink of total disaster. As Papagianni (2010) summarises it, mediation by third parties opens the room for a political process that allows the conflicting parties to agree on a process. In Africa and Kenya in particular, mediation has been a tool of choice for peacebuilding (Lindenmayer, 2009). However, the process is full of uncertainties and has been criticised as suitable only for short-term gains. This then introduces the issues of challenges to peacebuilding which is tackled in the next section of the literature review. Odhiambo (2014) argues that: Track Two diplomacy has two broad objectives; first of all, it aims to reduce conflict between groups and nations by improving communication and understanding. It tries to lower anger, tension, fear, and misunderstanding. It tries to humanize the face of the enemy and get one group to understand the other group's point of view.

3 Conceptual Framework

Wasike and Odhiambo (2016) discuss the role of theories in guiding the thrust of academic studies. They emphasize the importance of theories in offering compelling and incisive causal explanations with calculated precision. They buttress their argument by quoting Smith (1986) who asserts that theories play the role of predicting, prescribing, and evaluating socio-political phenomena hence they cannot be ignored.

3.1. Galtung's Theory of Peacebuilding

Galtung's thinking about peace is a long history of lifelong engagement with peace as a concept and the whole question of how the world could experience peace without any threat to that peace. In 1967, Galtung wrote that to write about peace is to write about everything and nothing. By this, Galtung attempted to express the all-encompassing nature of peace because it cannot be separated from life as we know it. Galtung began by suggesting that peace was an umbrella concept and a general expression of human desires, and that which is ultimately to be pursued (Galtung, 1967). Galtung further suggested that peace could not be given only one special meaning for to do so, then it would lose its encompassing meaning. Therefore, Galtung argues, peace cannot mean simply the absence of organized group violence, but it must respond to their lived experiences so that they can endow it with the meanings that are important to them, hence maintain its umbrella concept. Further, Galtung expounded on the idea of peace from three arguments; peace as equilibrium, peace as the absence of violence and peace as cooperation among nations and groups. The ideas have influenced peace thinking for a long time.

In 1975, Galtung coined the term "peacebuilding" in his pioneering work "Three Approaches to Peace: Peacekeeping, Peacemaking, and Peacebuilding. In this treatise, Galtung attempted to place peace in the context of a world that was changing rapidly against the backdrop of WWII which left millions dead and a world very terrified of another similar experience. In the three approaches, Galtung distinguishes the three ideas of peace starting from peacekeeping, which is the exercise of keeping physical distance between two belligerents to peacemaking which is the implementation of peace agreements without attempting to address the root causes of conflict. These two represent what Galtung called negative peace, which is hard to sustain. In Galtung's view, the ideal situation is to have positive peace because this is the only peace that is self-sustaining. Galtung therefore came up with the term peacebuilding which he defines as the process of creating self-supporting structures in society that remove causes of wars and offer alternatives conflict. This definition moves the idea of peace from the traditional peacekeeping and peacemaking both of which Galtung saw as having shortcomings in a world needing sustainable peace. Galtung's view of peace is that it must be positive for it to be sustainable.

According to Galtung, conflicts erupt because of the failure to meet basic human need, not because of scarcity but because of bad policies which introduce inequity in society and perpetuate structural violence. In this situation, peace would then represent the reduction or removal the deleterious impact of these bad policies. Peace according to Galtung has a structure which, if applied correctly should address the root causes conflict and build the way to sustainable peacebuilding. This conceptualisation of peace has not been received without criticisms. Cravo (2017) points out some omissions in Galtung's peace theory, for example the lack of clarity on what criteria is to be used in measuring equitable distribution of state resources. Galtung is also criticised for seemingly suggesting that the reasons behind violence and conflict are purely economic and political. This has not been borne out in today's where faith-based conflicts have also emerged. Juma and Odhiambo (2021), posit that the fervor for regionalism is etched in the minds of the political class globally. Some advocate for continental integration while others call for regional groupings that consist of few states whose defining criterion is territorial contiguity for the desire of sustainable peace.

In 2000, Galtung further advanced his thinking in peacebuilding by introducing the TRANSCEND method of peaceful conflict transformation. According to Galtung, the TRANSCEND method is based on the core idea that to prevent violence and develop the creative potential of a conflict, there has to be transformation. The root of the method is to understanding of conflict as incompatible goals, and incompatible parties. The separation of people and the problem to be solved is achieved through dialogue based on empathy, non-violence and joint creativity (Galtung, 2000).

3.2 Galtung's Concept of Structural Violence.

In his research paper entitled "Violence, Peace, and Peace Research," (Galtung, 1969:168) argued that:

"Violence is present when human beings are being influenced so that their actual somatic and mental realisations are below their potential realisations". Galtung, 1969:168

Galtung further argued that the inequality in the distribution of power is a clear manifestation of structural violence. Dilts *et al* (2012), posit that structural violence, is everything that hinders individuals from developing their capabilities, dispositions, or possibilities to meet their basic needs. On the other hand, Christie (1997), arguing from a human needs theory, posits that structural violence occurs when economic and political structures systematically deprive certain segments of society in meeting their basic needs, such as security, identity, well-being, and self-determination.

Structural violence produces and reproduces episodes of human rights abuse in almost all its forms because of its insidious nature. In South Africa provides an example where long after the collapse of the apartheid regime and ascendance of a democratically elected Government to power, the legacy of apartheid which perpetuated both direct and structural violence against the majority still lingers.

Taking a human rights perspective, Evans (2016) argues that the continued lack of access to land for most South Africans, post-apartheid, is, in fact structural violence in continuation of apartheid.

Structural violence has been studied in Kenya by many students of peacebuilding, for example, Roberts (2009), Murithi (2008) and Ochieng (2010). Murithi (2008), using the example of post-election violence in 2008, argues that the election seemed to have been a trigger of deep-seated structural violence in Kenya, as demonstrated by continued poor governance and corruption that has kept the majority landless, poor, unemployed and hungry. The same conclusion was arrived at by Sifuma (2011) who, in a study of post-election structural violence in Kenya argues that the post-election violence was caused by inadequate structures that did not address the plight of many Kenyans such as equitable distribution of resources, access to land, discrimination of women, entrenched corruption and impunity, marginalisation of minority communities, poverty and unemployment among the youth. The author further suggested that perpetrators of structural violence need to be held accountable for their crimes if the country is to move forward.

Mombasa County has been determined to suffer from poverty and historical injustices which can be defined as structural violence (Otieno, 2019). A rapid assessment in Mombasa County, in June 2017 under the Crime and Violence Prevention Training (CVPT) project of the Kenya Accountable Devolution Program found that Mombasa County's troubled history of conquest and subjugation, has contributed to marginalisation of the indigenous population in terms of lack of access to land, education, and citizenship rights, all of which have been defined as structural violence. These factors have greatly contributed to the current challenges around youth unemployment and associated dangers such as petty crimes and gang activity. Marginalisation and land grievances feed into the radicalisation narratives which results in the recruitment of youth into terrorism activities. In the same vein, Mtuku *et al* (2021) argues that youth criminality in Mombasa can also be viewed from a structural violence perspective where youth are also victims of marginalisation and unfavourable environments, which constrain life choices, making violent crime a frequent path. Moreover, as studies have shown, criminal justice approaches have failed these youths through inconsistent, corrupt and brutal approach by police serves (Chitembwe *et al* 2021)

3.3 Lederach's Conflict Transformation Theory

In Lederach's (2003) definition, conflict transformation is to envision and respond to the ebb and flow of social conflict as life-giving opportunities for creating constructive change processes that reduce violence, increase justice in direct interaction and social structures, and respond to real-life problems in human relationship. Lederach, cited in Miall (2001) stated that,

Conflict transformation must actively envision, include, respect, and promote the human and cultural resources from within a given setting. This involves a new set of lenses through which we do not primarily "see" the setting and the people in it as the "problem" and the outsider as the "answer". Rather, we understand the long-term goal of transformation as validating and building on people and resources within the setting (Lederach, 2003:15)

Lederach (1995b: 17), further argues that this process provides transformative human construction and reconstruction of social organisation and realities. Conflict transformation involves the complete change of the situations that support violence, in comparison to the other two approaches to peace that is, conflict resolution and conflict management, which do not seek to uproot conflict as it were.

Lederach (2003) likens conflict transformation with the workings of a human being who has a head, heart, arms and feet. These components are similar to those in society where different dynamics operate in what can be called "social interaction". The head, argues Lederach refers to the conceptual view of conflict, how it is thought about and therefore prepare to approach conflict. The approach to conflict is influenced by attitudes, perceptions, and orientations. According to Lederach, the capacity to envision and react positively to conflict creates the potential for transformative result. A transformational approach recognizes that conflict is a normal and a continuous dynamic within human relationships, which has ebbs and flows.

3.4 Conceptual Framework Model



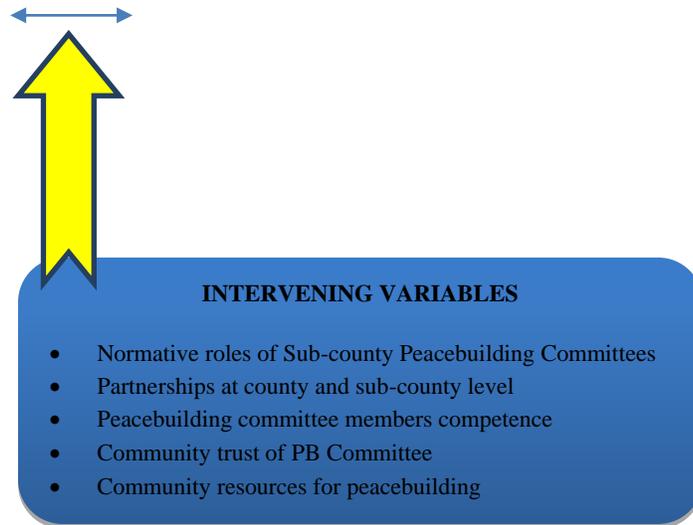


Figure 1: Conceptual Model Showing interaction of variables
 Source: Researcher, 2022

4. RESEARCH METHODOLOGY

4.1 Research Design

The study adopted the descriptive survey design, because of the opportunity that the method offers for studying LPCs. This study took into consideration the versatility of the design as enabling the researcher to describe systematically and accurately the facts and characteristics of the Sub-County Peacebuilding Committees. This study aimed to provide, as accurately as possible, the description of formal peacebuilding entities in Mombasa County and assess their ability to effectively foster a sustainable peacebuilding agenda for Mombasa County.

4.2. Study Area.

This research was done in Mombasa County. The county was selected because of the persistent land-based and ethnic conflicts that has been witnessed in the County, and which, unlike other parts of Kenya, has the potential of internationalising domestic conflict due to the emerging illicit drug trafficking and the advent of international terrorism that have both taken root in the County (Onguny, 2019; Rakodi *et al.* 2000; Botha, 2014). Mombasa County has a long history of many peacebuilding attempts amid new and old challenges, however, not much of it has been studied.

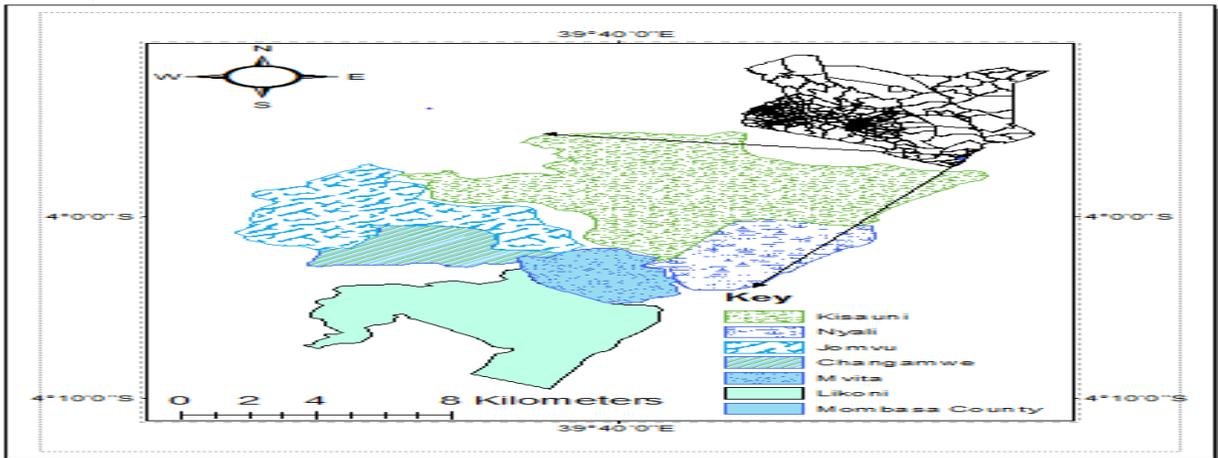


Figure 2. Map of Mombasa County

Source: GIS Expert, prepared from Kenya National Bureaus of Statistics 2021

Mombasa County lies to the east of Kenya, along the Indian Ocean Coast (Lat: -4.043740, Long: 39.658871), and is the premier trading port for Kenya and East Africa, as well as the premier destination for tourists, both local and international. In Kiswahili, Mombasa is called "Kisiwa Cha Mvita", which means "Island of War" due to the many violent changes in its administration over the years. Many nationalities have had a say on the Island at one time or another; Africans, Persians, Arabs, Portuguese and British as far back as the 6th century AD. The County has six sub-counties which also act as electoral constituencies: Mvita, Changamwe, Kisauni, Jomvu, Nyali and Likoni.

The economy of the county can be described as mixed with agriculture, manufacturing, maritime activities and tourism being the mainstay of the County. Among these, tourism which contributes to 68% of the wage employment is the leading employer generating both formal and informal employment. Others economic activities are fishing, farming of sisal, sugarcane, cashew nuts, and coconuts and livestock farming. Much of the farming of foodstuff is for subsistence at the household level. Various manufacturing firms have set up base in the County including cement companies, petroleum refining, food processing, salt production (County Government of Mombasa, 2021).

Rakodi *et. al* (2000) summarise the problem of conflict in Mombasa today as associated with urban poverty that has created the breeding ground for radicalisation, political patronage and corruption. The unresolved land issues and lack of basic services have also affected the peace of the county and built the road to youth radicalisation.

Mombasa's conflict problem cannot be divorced from the 2007/8 post-election conflict because the real drivers of the conflict have remained unresolved since Kenya's independence in 1963. These include exclusionary and oppressive rule, the use of ethnicity for political ends, inequitable distribution and access to vital resources, corruption, limited democratic space, limited rule law, and lack of respect for fundamental rights. The suffering, death, and displacement has been associated with cyclic electoral problems witnessed in Kenya since the return of multiparty politics in 1992. The post-election violence in 2007 and 2008 differed only in geographic scope and impact on lives, communities, and the economy. Ethnicity continues to play an inordinate role in Kenyan political life and the 2008 post-election violence played out largely on ethnic lines, fueled by grievances over land, privilege, and inequality (Gathiaka, 2021).

4.3 Study Population.

The study focused on the members of the 6 Mombasa Sub-county Peacebuilding Committees which was the focus of the study. At the time of field work, the population of the committees was 250 and 113 were recruited into the study. Senior Government officials in Mombasa County including Sub-county Commissioners, Security personnel and Ward Administrators totaled about 51 and 11 were recruited into the study. The study could not ascertain the exact number of youths who collaborate with the Sub-County Peacebuilding Committees and therefore relied on the *maskan* contacts maintained by Ward administrators. From this, 185 youths belonging to different *maskans* were identified and recruited into the study. This process also helped to identify 7 reformed youth who were included into the study as well. Similarly, to arrive at a random sample of villagers, the researcher utilised the Nyumba Kumi register at the ward level to identify and recruit 72 members of households who were recruited into the study. Through working with the Chairpersons of the Sub-County Peacebuilding Committees, 4 representatives of NGOs that collaborate with the committees were also identified and recruited into the study. A total of 392 respondents participated in the study.

4.4 Data collection methods

Data were collected through four methods: Key Informant Interviews (KII), Focus Group Discussions, Semi-structured Questionnaires and an Observation checklist. Secondary data was also collected through the perusal of relevant documents help by Sub-County Peacebuilding Committees, their partners and the National Steering Committee such as annual reports, end of project reports and minutes of meetings.

4.5 Sample Size and sampling technique.

The total sample size for the study was 392 respondents were sampled from seven categories of respondents. The study adopted different sampling technique because of the different kinds of respondents envisaged. In this study, convenience sampling was applied for the selection of the respondents from the Sub-county peacebuilding committee because of their relatively small number and availability driven by the fact that membership into these committees is voluntary and the researcher had to depend on both their availability and willingness to participate.

Convenience sampling had been used in peacebuilding studies, for example, by Palinkas *et al* (2015) point out that this method is widely used for the identification and selection of information-rich cases related to the phenomenon of interest. In this study, the senior government officials, youths and village elders were considered information-rich in terms of the work of the Sub-county Peacebuilding Committees.

4.6 Data Collection Procedures.

The study utilised both primary and secondary data collection techniques. Data collection was done between August 2021 and March, 2022. Out of the total study sample of 392, 113 respondents who were the core members of the Sub-county Peacebuilding Committees were subjected to the semi-structured questionnaire, 20 respondents were interviewed through Key Informant guides, and the balance of the respondents were interviewed in Focus Group Discussions in 32 focus groups.

4.7 Data Analysis.

The study used the identification of patterns in order to make sense of the KIIs and FGDs to supplement the information from the quantitative data. Quantitative data were analysed using version SPSS 24 and 26.

5. Findings

5.1 Peacebuilding Strategies in Mombasa County During Times of Conflict

This study sought to find out what peacebuilding strategies were used by the peacebuilding committees during times of strife. The findings of the study are presented in figure 3. Per the results, the most applied strategy during times of were; community dialogue, 31.8% (N=35), followed by ad hoc public meetings, 26.6% (N=30), then online community sensitisation, 22% (N=25) and lastly peace *Barazas*, 19.5% (N=23).

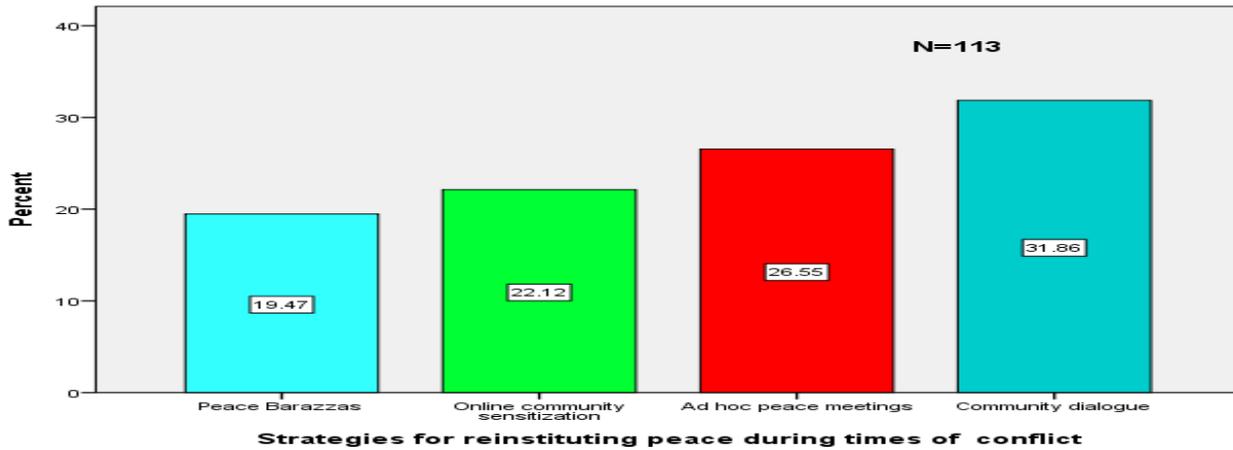


Figure 3. Strategies for maintaining peace during conflict in Mombasa County
Source:Field Data, 2021

5.1.1 Community Dialogue

Community dialogue is a common feature in Africa and has been applied in many issues that impact society. Community dialogue can be defined as a forum that draws participants from different sections of a community to create the opportunity for exchanging information and perspectives, clarifying viewpoints, and developing solutions to issues of interest to the community. The main outcome of community dialogue is to find common ground and increase the constituency base and voices so that an issue can enjoy a broad consensus. Bercovitch (2009) argues that dialogue is one of the approaches that is mostly used and cuts across all other approaches to conflict resolution and transformation. Dialogues are not debating which tend to place people on opposite sides of issues and foster adversarial relations. In dialogue, people are supposed to speak openly and listen respectfully and attentively. Dialogue excludes attack and defense and avoids derogatory attributions based on assumptions about the motives, meanings, or character of others (UNDP, 2016). According to Chitembwe & Odhiambo (2021), a renewed movement to fight for the self-determination of citizens in the coastal region emerged in the counties of Mombasa and Kwale in 2008 when the MRC regained traction, calling for secession from Kenya. Among the 32 classes that were prohibited by the Ministry of Internal Security in Gazette Notice 125855 was the MRC hence there was a need for dialogue.

In this study, focus group discussions were held with community leaders on the peacebuilding strategies and most were quick to point to community dialogue;

We have community dialogue, peer-peer, women to women dialogues, also we have parental dialogues, and also forums where we mainly focus on women who have been affected by violence, we go around school talk to the headteacher and get to know the challenges children face while in schools and give them recommendations. We also do one on one counselling to parents who feel they have too much concerning parental responsibility, we also have *Barazas*, we also do civic education, we also do awareness on equitable sharing of resources, and we also promote cohesion between police and youth through tournaments. We also take youth to do general clean up exercise at the police station. (FGD session with Women leaders, Nyali, December 9 2021)

5.1.2 Ad Hoc Peace Meetings

Respondents indicated that ad hoc peace meetings were also used during times of conflict. Ad hoc peacebuilding meetings are those that take place without prior planning to address an immediate problem. Respondents did mention times when warring youths would be arrested by the police and immediately. An issue that was discussed at length was the fire-fighting role of the Sub-County Peacebuilding Committees.

A respondent added to the above sentiments by stating what it takes for the DPC to actually regain peace in a community.

Mostly what they do is to negotiate with members of the community, especially when there are inter-communal conflicts. They set up meeting where they meet with the disputing group and do conflict resolution through negotiation and most of the time as security actors, we don't move in because it works, they will talk with the disputants and give a report that they have resolved the issue and the community has resolved to live harmoniously. It is better than when we go as security because we go to enforce certain laws which at times is lose-win but with them they make sure it is a win-win situation (Interview with DCC Nyali Subcounty on 30th, Septemeber, 2021).

5.1.3 Community Sensitisation by Social Media (WhatsApp Groups)

The world over, social media has become the dominant tool for communication, providing several platforms such as Twitter, WhatsApp, Facebook, YouTube, Instagram, TikTok, Snapchat, LinkedIn etc. This has been made possible with the widespread availability and use of mobile smartphones through which audio-visual information can be transmitted. Smartphones can browse the Internet and run software programs like a computer. Smartphones use a touch screen to allow users to interact with them. Odera (2013) in examining the role of social media in Kenya argued that the penetration and popularity of social media among the Kenyans highlighted its potential to be a great tool to foster democratic dialogue and freedom of expression. However, owing to the unrestricted nature of the internet and social media, it can be used to circulate misleading information by unscrupulous people to destabilise the peace. For example, Denskus (2019) exposes the problem of how Facebook has become a platform for sectarian violence in Sri Lanka, fueled by misinformation. Moreover, the power of the corporations behind these platforms, for example, Twitter, Facebook, YouTube, or messaging applications, are unregulated.

In Kenya, the most visible use of social media platform for peacebuilding has been the *Uwiano* Platform which has been in operation since 2008. The *Uwiano* Platform for Peace was used as an early warning media strategy to prevent electoral violence around the 2010 constitutional referendum and the 2013 elections. *Uwiano* is a Swahili word meaning cohesion.

Among the strategies applied by the Mombasa Sub-County Peacebuilding Committees in their peacebuilding efforts is the use of social media techniques to reach out to the community. It was the third most applied technique mentioned by 22% of the respondents. During the focus group discussion, a respondent summarised the use of social media (WhatsApp) as follows as a good thing that could advance the cause of peacebuilding.

5.1.4 Peace Barazas

Kenya's *Barazas* are governed by the Public Participation Bill of 2018 which provides a general framework for effective citizen involvement on issues affecting them such as development, crime, health, and security. The Bill provides for public participation as a requirement in any decisions that will affect them as individuals, communities or organisations. The advantage of public *Barazas* is the participatory nature of proceedings when shaping public policy at the local level (Mutegi and Muna, 2021). By their very nature, *Barazas* are open and people talk freely about the issues they feel most strongly about. *Barazas* act as a forum for not only eliciting frank discussion of pertinent abs curret issues but also also a point of reference for for future action. As indicated by one respondent;

When we get out of chiefs *Barazas*, we go back home and combine with other village elders, call villagers, and tell them what is happening in the community, we do tell parents to speak to their children because if something happens to them no one is to be blamed but them, Villagers inform us on suspected criminals and we respond effectively. (FGD with Women's Group, Mvita, Nov 11, 2021)

Apart from peace *Barazas*, community sensitization, *ad hoc* peace meetings, Sub-County Peacebuilding Committees gather intelligence, which is often used by the police to apprehend criminals in the communities. The role of intelligence gathering was considered of critical importance because the police rely on such information to act against criminal elements of the society.

5.2. Peacebuilding Education

The study sought to establish whether Sub-County Peacebuilding Committees conduct peacebuilding education in Mombasa county. The results are contained in figure 4.

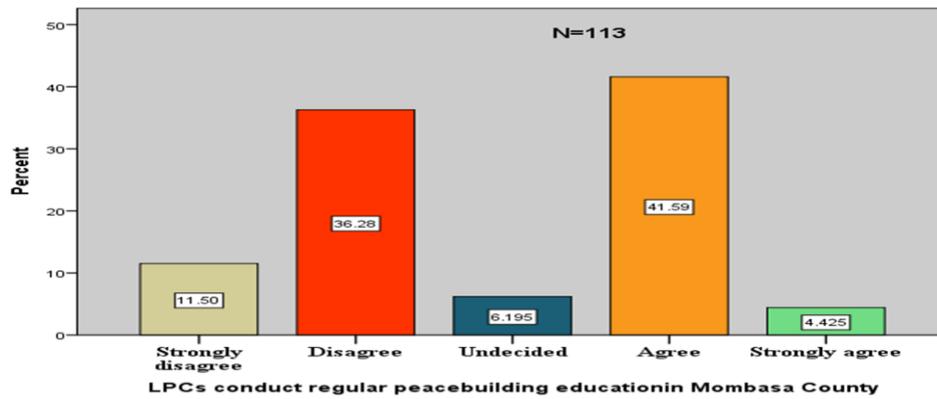


Figure 4. Conduct of Regular Peacebuilding Education
 Source: field data, (2022)

The overall goal of the Peace Education Programme is to promote peaceful co-existence among members of the school community hence contributing to peace and national cohesion in the country. The programme also enhances the capacity of the education sector to promote peaceful coexistence through conflict-sensitive policies and programming. A national monitoring exercise conducted in 2010 revealed that peace education was not being effectively taught due to a lack of adequate capacity among teachers. In some of the schools, life skills education, which is one of the main carrier subjects, was not taught as it is not examined in national examinations. Peace education is also taught in other educational institutions in Kenya. Kenyan Quakers, (Friends Mission) a religious institution which runs schools in Western Kenya obtained Kenya Government authorisation to develop a peace education curriculum in 2009. The curriculum which bases its instruction on facilitating, and not telling focuses on building the capacity of the learner to work with others to acquire behavioural knowledge, skills, attitudes, and values that will enhance peaceful co-existence.

The study found out that Mombasa Sub-County Peacebuilding Committees held regular peacebuilding education in the county. The regularity of the peacebuilding education was not defined because at any one time there is always a workshop or a seminar on peacebuilding going on in the County. Focus group discussions confirmed that the Sub-County Peacebuilding Committees do indeed carry out peacebuilding education. The effectiveness of the the peacebuilding education program therefore remains to be determined but as a strategy, sub-county eacebuilding committees do recognise the value of the same.

5.3 Collaborative efforts –working with other peace stakeholders in Mombasa County

The study sought to assess the steps taken by to collaborate with peace stakeholders in Mombasa County. The results are illustrated in figure 5.

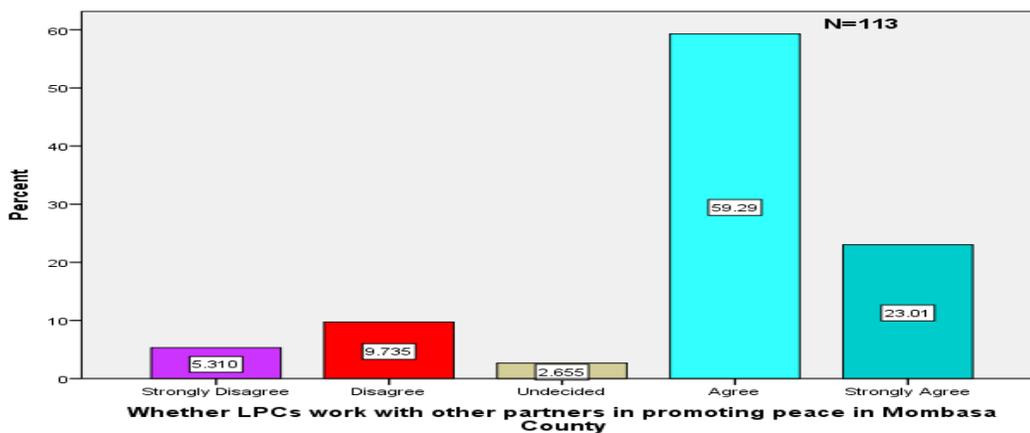


Figure 5. Collaboration with other peacebuilding Stakeholders

Source: Field Data, 2022

As illustrated in figure 5.4 above, out of 113, 5.31% (N=6) strongly disagreed with the inquiry, 9.74% (N=11), disagreed, and 2.66% (N=3) were undecided. On the other hand, Additionally, 59.29% (N=67) agreed with the inquiry while 23.01% (N=26) strongly agreed with the question. A cumulative 82.3% (N=93) agreed with the question thereby confirming that indeed Mombasa Sub-County Peacebuilding Committees do work with other partners.

The Terms of Reference (ToRs) for Kenya peacebuilding committees requires them to work in collaboration with others peace stakeholders in the peacebuilding agenda of the country. The first two responsibilities that the guidelines assign to the local peace committees are; 1) to network with other Peace Forums/Committees and organisations to enhance harmonious relationships and; 2) in consultation with Security and Intelligence Committees and other stakeholders to oversee the implementation of peace agreements and/or contracts. In essence, Sub-County Peacebuilding Committees are not seen as independent organs at the same level as the National Steering Committee (NSC) but as part of the team that works on peacebuilding wherever they are. In our case, it is Mombasa county. The study also sought to find out who the Sub-County Peacebuilding Committees were collaborating with and what the collaboration entailed. Table 1 shows the most mentioned collaborators with the DPC and what areas they collaborate in.

Table 1: Entities that Sub-County Peacebuilding Committees collaborate with

	Collaboration partners	Nature of collaboration
1	Muslims for Human Rights (MUHURI)	Human Rights
2	Kenya Community Support Centre (KECOSCE)	Peacebuilding Conflict Mitigation
3	HAKI Africa	Peace and security
4	Nyumba Kumi	Monitoring of security threats
5	National Cohesion and Integration Commission (NCIC)	Election management Peace development
6	Chiefs	Dispute settlement
7	County Government of Mombasa	Coordination of security matters
8	JUHUDI	Peace Development

Source: Field Data, 2022

Many entities are working in peacebuilding in Mombasa County, ranging from NGOs, CSOs, Governmental and even international organisations, but the most mentioned are summarised in table 1. Further analysis of the data seemed to indicate that the bulk of the collaboration was in the areas that support the primary function of the Sub-County Peacebuilding Committees. However, the study found that there are emergent areas of collaboration that, though only nuanced in the National Policy for Peacebuilding and Conflict Management (2015), have formed significant areas of collaboration in the county peace agenda. These are; Human Rights and Elections Management. The study sought to establish where the weight of the collaboration lay, and the results are presented in figure 5. There are the areas where Sub-County Peacebuilding Committees draw their support from.

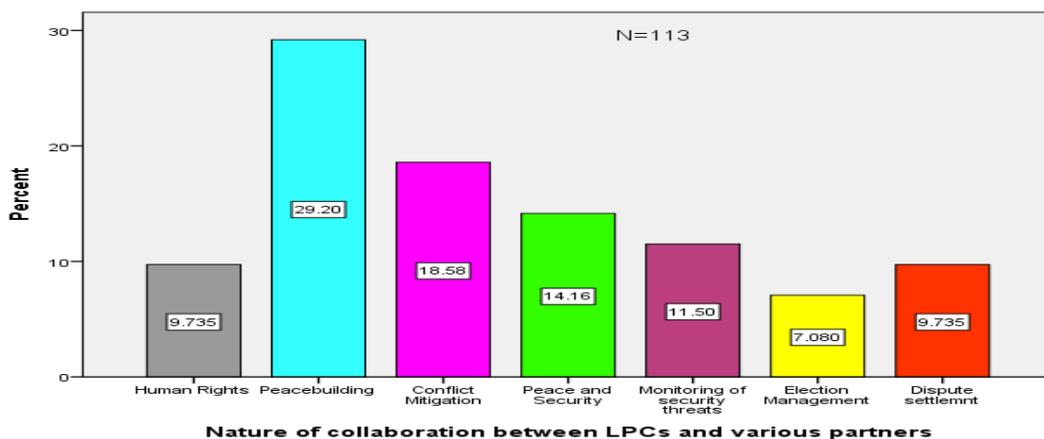


Figure 5. Areas of collaboration
 Source: field Data, 2022

Per the results in figure 5, the respondents agreed that the largest area of collaboration with peacebuilding stakeholders was in: peacebuilding, 29.2% (N=32), followed by conflict mitigation, 18.6% (N=21), next was peace and security, 14.2% (N=16), followed by monitoring of security threats, 11.5% (N=13), then dispute settlement 9.7% (N=11). The last two areas of collaboration, human rights, 9.8% (N=11) and elections management, 7.0% (N=9) are not specified in the Sub-County Peacebuilding Committees ToR but they are important because of the nature of the politic of Mombasa County. These last two issues are discussed in greater detail.

Some of the clearest collaborations that the DPC enjoy are with grassroots NGOs such as JUHUDI which spans many peace and security issues. As a respondent said;

we have been working very closely with the Sub-County Peacebuilding Committees and through the office of the county commissioner...they have a very big role to play because they are intermediaries between the community and the state organs, the security apparatus and when it comes to matters of conflicts and sometimes they even play the role which is supposed to be played by the area chief as a mediator or the leadership within the provision of administration, however, in their linkage they have a lot of mutual trust from the community because community perceive security organs to be of their threat on one angle and there is no good co-operation, however, through the Sub-County Peacebuilding Committees they are there to mitigate that gap and make sure that the communities can see the security apparatus with a different eye. (KII with NGO representative, Kisauni, February 21 2022).

The study found out that the close collaboration and cooperation existing between the Sub-County Peacebuilding Committees and the civil society in the County is because many members of the DPC came into the peacebuilding entities via NGOs in which they are members or somehow associated. Some of the NGOs have been officially coopted into the Sub-County Peacebuilding Committees. At the same time, just one alliance such as the Coast Interfaith Council of Clerics (CICC) is a huge organisation that brings many faith-based organisations under one umbrella for peacebuilding. CICC is made up of; Supreme Council of Kenya Muslims (SUPKEM), Council of Imams and Preachers of Kenya (CIPK), Hindu Council of Kenya (HCK), The Catholic Church (KEC), Archdiocese of Mombasa, and Diocese of Malindi, the National Council of Churches of Kenya (NCCCK), the Organization of African Instituted Churches, the Evangelical Alliance of Kenya (EAK) and Africa Traditional Religions. By working with CICC, the Sub-County Peacebuilding Committees will be partnering with almost all faith-based programs in the County.

6. SUMMARY AND CONCLUSIONS

The most common strategies or approaches for peacebuilding that Sub-County Peacebuilding Committees used were ; individual and community dialogue; community mobilisation through theatre and dance (including cultural festivals); peace *Barazas*, community walks; youth engagement and ad hoc meetings. Much of the peacebuilding work depended on what threat to peace was foremost at the time of response. That Peace *Barazas* seemed most preferred perhaps because of the number of people who attend and the fact that Baraza resolutions are usually binding and enforceable.

The study also established that Sub-County Peacebuilding Committees collaborated with a wide range of other stakeholders including; Government agencies (such as NSC), NGOs, and both local and international and religious organisations. The study found out that social media has been used as one of the peacebuilding tools employed by the Sub-County Peacebuilding Committees. The use of short message services (SMS) and WhatsApp has greatly increased the capacity of Sub-County Peacebuilding Committees to communicate. Yet this effective and cheap means of communication is hampered by the non-funding of committee members' communication needs.

7. Recommendations

To ensure that Sub-County Peacebuilding Committees can foster sustainable peacebuilding, their strategies need to gradually shift towards those that address the underlying causes of conflict in Mombasa County. This study also observed that Sub-County Peacebuilding Committees have opportunities for fostering sustainable peacebuilding through public peace education and acting as the honest broker among other peacebuilding stakeholders.

REFERENCES

- Ajulu, R. (2002). Politicised ethnicity, competitive politics and conflict in Kenya: A historical perspective. *African Studies*, 61(2), 251-268.
- Bercovitch, J. (2009). *Mediation and Conflict Resolution*. The SAGE Handbook of Conflict Resolution. 340-354.
- Botha, A. (2014) Radicalisation in Kenya Recruitment to al-Shabaab and the Mombasa Republican Council. ISS PAPER 265 | SEPTEMBER 2014. Retrieved on February 1 2022
- Chitembwe, S. J.& Odhiambo,E.O.S (2021). "Role of The Criminal Justice System in Contributing to Youth Radicalization in Mombasa and Kwale Counties" Published by Journal of Defense Resources Management (JoDRM) Vol. 12, Issue 2 (23)/ 2021. Pp 254-280. ISSN: 2068-9403.eISSN: 2247-6466. ISSN-L: 2247-6466. <http://www.jodrm.eu/currentissue.html>

- Chitembwe, S. J., Okoth, P. G., & Matanga, F. K. (2021). The Nature, Extent and Impact of Youth Radicalization in Mombasa and Kwale Counties, Kenya. *Open Access Library Journal*, 8(6), 1-21.
- Christie, D. J. (1997). Reducing direct and structural violence: The human needs theory. *Peace and Conflict*, 3(4), 315-332.
- Constitution And Reform Education Consortium-CRECO (2012) Building A Culture Of Peace In Kenya: Baseline Report On Conflict-Mapping And Profiles Of 47 Counties In Kenya.
- Cravo, T.A. (2017) Peacebuilding Assumptions, Practices and Critiques *ASPJ Africa & Francophonie* - 1st Quarter 2018. Accessed on Feb. 17, 202
- Denskus, T. (2007). Peacebuilding does not build peace. *Development in Practice*, 17(4-5), 656-662.
- Denskus, T. (2019): Social media and peacebuilding. In: S. Romaniuk, M. Thapa & P. Marton (Eds.), *The Palgrave Encyclopedia of Global Security Studies*. London: Palgrave Macmillan.
- Dilts, A., Winter, Y., Biebricher, T., Johnson, E. V., Vázquez-Arroyo, A. Y., & Cocks, J. (2012). Revisiting Johan Galtung's concept of structural violence. *New political science*, 34(2), e191-e227.
- Elder C., Susan Stigant, and Jonas Claes (2014) Elections And Violent Conflict In Kenya. *Peaceworks No. 101*. First published 2014. ISBN: 978-1-60127-234-8 by the United States Institute of Peace.
- Evans, M. (2016) Structural Violence, Socioeconomic Rights, and Transformative Justice, *Journal of Human Rights*, 15:1, 1-20, DOI: 10.1080/14754835.2015.1032223
- Galtung, J. (1967). Theories of peace. *A Synthetic Approach to Peace Thinking*. Oslo: International Peace Research Institute.
- Galtung, J. (1969) Violence, Peace and Peace Research', *Journal of Peace Research*, Vol. 6, No. 3, 1969, pp. 167-91
- Galtung, J. (1976). Three Approaches to Peace: Peacekeeping, Peacemaking, and Peacebuilding. In J. Galtung (Ed.), *Peace, War and Defence: Essays in Peace Research Volume II* (Vol. II, pp. 282-304). Copenhagen: Christian Ejlers.
- Galtung J (2008) "Towards a Grand Theory of Negative and Positive Peace: Peace, Security and Conviviality", in: Murakami, Yoichiro; Schoenbaum, Thomas J. (Eds.): *A Grand Design for Peace and Reconciliation: Achieving Kyosei in East Asia* (Cheltenham, UK, and North Hampton, Massachusetts, USA: Edward Elgar): 90-106.
- Galtung, J. (1990). Cultural Violence. *Journal of Peace Research*, 27(3), 291-305. <https://doi.org/10.1177/0022343390027003005>
- Galtung, J., (2000), *Conflict Transformation by Peaceful Means (The Transcend Method)*, participants' and trainers' manual, United Nations Disaster Management Training Programme, Geneva
- Galtung J., Fischer D. (2013) Positive and Negative Peace. In: Johan Galtung. *Springer Briefs on Pioneers in Science and Practice*, vol 5. Springer, Berlin, Heidelberg.
- Gisselquist, R M. (2015), Good Aid in Hard Places: Learning from 'Successful' Interventions in Fragile Situations. *International Peacekeeping*, volume 22, issue 4 (August 2015) pp. 283-301.
- Gisselquist, R, M.,(2018). *Development Assistance for Peacebuilding* (p. 178). Taylor & Francis.
- Githaiga, N. (2020). When Institutionalisation Threatens Peacebuilding: The Case of Kenya's Infrastructure for Peace. *Journal of Peacebuilding & Development*, 15(3).
- Govender, K., & Ngandu, Y. (2009). *Report on seminar Towards Enhancing the Capacity of the African Union in Mediation*. Addis Ababa.
- Government of Kenya (2015). *Sessional Paper No. 5 of 2014 on the National Policy for Peacebuilding and Conflict Management*. Internet Document. Accessed on July 15, 2021. <http://repository.kippra.or.ke/handle/123456789/644>
- Government of Kenya (2014). Education Sector Policy On Peace Education. Published by the Ministry of Education Science and Technology January 2014 Education Website: www.education.go.ke
- Juma, P.W & Odhiambo, E. S. (2021). Geo-Political factors Influencing Kenya and Tanzania Foreign Policy Behaviour Since 1967. Published by Journal of Defence Resources Management Vol. 12 Issue 1(22)/2021.Pp 75-98. ISSN: 2068 - 9403 eISSN: 2247 - 6466 <http://www.jodrm.eu/currentissue.html>
- Kangethe, M. W. (2015). The peace education programme in Kenya. *The Global Campaign for Peace Education*, 121.
- Konde, G. (2019). *Women and Peacebuilding in Kenya: The Case of Wajir Peace and Development Agency (2002-2018)* (Doctoral dissertation, United States International University-Africa).
- Lederach, J. P. (1996). *Preparing for peace: Conflict transformation across cultures*. Syracuse University Press.
- Lederach, J. P. (1997) *Building Peace: Sustainable Reconciliation in Divided Societies*. (Washington, D.C., United States Institute of Peace, 1997), 75.
- Lederach, J. (2015). *Little book of conflict transformation: Clear articulation of the guiding principles by a pioneer in the field*. Simon and Schuster.
- Lederach, J. P. (2003) "Conflict Transformation." Beyond Intractability. Eds. Guy Burgess and Heidi Burgess. *Conflict Information Consortium*, University of Colorado, Boulder.
- Lederach, J. P., Culbertson, H., & Neufeldt, R. (2007). *Reflective peacebuilding: A planning, monitoring and learning toolkit*. Joan B. Kroc Inst. for International Peace Studies.
- Miall, H. (2004): *Conflict Transformation A Multi-Dimensional Task*. Berghof Research Center for Constructive Conflict Management - Edited version Aug 2004 (First launch Mar 2001)

- Mungai, G, Iteyo, C, and Kassilly, J. (2020). Challenges and opportunities faced by informal peace committees in Peace Building in Nairobi County. *International Journal of Scientific and Research Publications (IJSRP)*. 10. 452-467. 10.29322/IJSRP.10.10.2020.p10662.
- Murithi, T. (2008) Peacebuilding or 'UN-Building'? African Institutional Responses to the Peacebuilding Commission, *Journal of Peacebuilding & Development*, 4:2, 89-94, DOI: 10.1080/15423166.2008.661802498267
- Mutegi, M. R., & Muna, W. (2021). Effect of peace barazas on crime control in Machakos County, Kenya. *Journal of Public Policy and Governance*, 1(1), 36-4
- National Cohesion and Integration Commission (NCIC) and Interpeace (2017). Kenya. *Voices of the People: Challenges to Peace in Mandera County. A report on Mandera County*, Edited by Philip Emase Accessed on Feb. 10, 2020
- National Steering Committee on Peace Building and Conflict Management - NSCPBCM, (2013) *Kenya's Infrastructure for Peace; Re-thinking The Peace Agenda A Report of the County Consultations (NSCPBCM, 2013)*.
- Nathan, L. (2018). UN Preventive Diplomacy and Facilitation of Dialogue in Malawi (2011-12). *Policy Paper and Case Studies Capturing UN Preventive Diplomacy Success: How and Why Does It Work?* 62.
- Nathan, L., Day, A., Honwana, J., & Brubaker. R. (2018). *Policy Paper and Case Studies Capturing UN Preventive Diplomacy Success: How and Why Does It Work?*.
- Ndegwa, S (2001). *Peace Building Among Northeastern Pastoralists in Kenya: The Wajir Peace and Development Committee. The Effectiveness of Civil Society Initiatives in Controlling Violent Conflicts and Building Peace*. A Study of Three Approaches in the Greater Horn of Africa. Management Systems International 600 Water Street, SW, Washington, DC 20024 USA
- Neufeldt, R.C, Klassen,M.L, Danboyi,J. Dyck, J & Bako, M.Z (2020): Gaps in knowledge about local peacebuilding: a study in deficiency from Jos, Nigeria, *Third World Quarterly*, DOI: 10.1080/01436597.2020.1761253
- Nganje, F (2020) Pan-Africanism from Below? The Peacebuilding Role of Local Peace Committees in South Africa, *International Journal of African Renaissance Studies - Multi-, Inter- and Transdisciplinarity*, 15:2, 67-86, DOI: 10.1080/18186874.2020.1868270
- Nganje, F. (2021). Local Peace Committees and Grassroots Peacebuilding in Africa, in McNamee, T. and Muyangwa, M 2021, (Editors) *The State of Peacebuilding in Africa Lessons Learned for Policymakers and Practitioners*. ISBN 978-3-030-46635-0 ISBN 978-3-030-46636-7 (eBook) <https://doi.org/10.1007/978-3-030-46636-7>
- Odero, P. W. (2013). *The Role of Social Media as a Tool for Peace Building and Conflict Prevention in Kenya, The case of Nairobi County* (Doctoral dissertation, University of Nairobi).
- Odhiambo, E.O.S. (2014). "Use of Track One & a Half Actors as Counter-Radicalization & De-radicalisation in Kenya" published by Journal of International Relations & Foreign Policy. June 2014, Vol. 2, No. 2, pp. 75-100 ISSN: 2333-5866 (Print), 2333-5874 (Online) <http://aripd.org/journal/index/jirfp/vol-2-no-2-june-2014-current-issue-jirfp>
- Odobo, S. O., Andekin, A. M., & Udegbumam, K. (2017). Analysis of ECOWAS institutional framework for conflict management. *Mediterranean Journal of Social Sciences*, 8(6), 143.
- Oguny, P. and Taylor Gillies (2019); Land Conflict in Kenya: A Comprehensive Overview of Literature », *Les Cahiers d'Afrique de l'Est / The East African Review* [Online], 53 | 2019.
- Organization of African Unity (1992) "Resolving Conflicts in Africa: Proposal for Action," (OAU: OAU Press and Information Series 1, 1992)
- Otieno, B. P. A. (2019). *Influence of Poverty on Violent Extremism in Kenya: A Case Study of Mombasa County Between 2007 To 2017* (Doctoral dissertation, United States International University-Africa).
- Papagianni, K. (2010). Mediation, political engagement, and peacebuilding. *Global Governance*, 243-263.
- Rakodi, C. and Rose Gatabaki-Kamau and Nick Devas (2000); Poverty and Political Conflict in Mombasa. *Environment&Urbanization* Vol 12 No 1 April 2000 1
- Roberts, M. J. (2009). Conflict analysis of the 2007 post-election violence in Kenya. *Managing conflicts in Africa's democratic transitions*, 141-155.
- Sifuma, E. N (2011) *Structural causes of violence: A case of the Post Electoral violence in Kenya, 2002-2008*. Unpublished Thesis. University of Nairobi.
- Smith, S. (1986) Theories of Foreign Policy: An Historic Overview. *Review of International Studies*, 12, 13-29. <https://doi.org/10.1017/S026021050011410X>
- United Nations Guidance for Effective Mediation. (2012) Strengthening the role of mediation in the peaceful settlement of disputes, conflict prevention and resolution (A/66/811, 25 June 2012).
- van Beijnum, M. (2016). Achievements of the UN Peacebuilding Commission and challenges ahead. In *UN Peacebuilding Architecture* (pp. 77-94). Routledge.
- Waehlich, M., Lanz, D., Kirchhoff, L., & Siegfried, M. (2009). Evaluating Peace Mediation.
- Wasike, S. and Odhiambo, E.O.S. (2016) A Critique of the Usefulness of Theories in Explaining Socio-Political Phenomenon. *Asian Journal of Basic and Applied Sciences*, 3, 29-33.

Wulf, H., & Debiel, T. (2009). Conflict early warning and response mechanisms: Tools for enhancing the effectiveness of regional organisations? A comparative study of the AU, ECOWAS, IGAD, ASEAN/ARF and PIF.

Corporate Social Responsibility Strategy and Organizational Image of Commercial Banks in Trans Nzoia County, Kenya

Josephine Atieno Onyango*, Julius Miroga (Ph.D.)**

Department of Business Administration in the School of Human Resource Development.

DOI: 10.29322/IJSRP.12.10.2022.p13088

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13088>

Paper Received Date: 24th September 2022

Paper Acceptance Date: 25th October 2022

Paper Publication Date: 30th October 2022

ABSTRACT

This study aimed at assessing the effect of Corporate Social Responsibility strategy on Organizational Image of commercial banks in Trans Nzoia County, Kenya. This can facilitate each personal and public firm to understand the need of creating CSR for action for competitive advantage and improved performance. It'll additionally define and discuss the advantages and pitfalls of company Social Responsibility programs and effectively let the player(s) in this field be able to improve the implementation of company Social Responsibility programs. To the 11 banks in Trans Nzoia County, the study will provide recommendations for higher implementation of CSR programs and at last, the analysis can contribute to the present literature on the way to assess the effects of company Social Responsibility. The main focus of the study is to investigate the effect of corporate Social Responsibility strategy on organizational image of Commercial Banks in Trans Nzoia County. The study independent variables were: economic strategy, and philanthropic Strategy of CSR while dependent variable was organizational image of commercial banks. Geographically, the study's scope was within Trans Nzoia County and concentrated on 11 commercial banks in Trans Nzoia County and it involved 105 respondents. Relevant information was significantly collected from CSR applicable management workers and also other non-managerial workers at the banks. The study used descriptive survey design and it was conducted in October 2022. Data collection was carried out using questionnaires that were administered by the researcher on face-to-face basis by visiting the respondents in their respective banks. Pilot study was conducted in one bank that was picked for sampling through the rule of the thumb method. After collection of data, both descriptive and inferential data analysis techniques were used. Analyzed data was presented through frequency tables. The study concluded that there is a significant relationship between economic strategy and organizational image. The study suggested that there is a significant relationship between philanthropic strategy and organizational image. The study recommends that another study be conducted on effect of corporate social responsibility in other sectors such as the county governments or national government. Additionally, a replication study must be conducted in another county for there to be conclusive and sufficient results regarding the study.

Index Terms- (Corporate Social Responsibility, Economic Strategy, Organizational Image, Philanthropic Strategy)

INTRODUCTION

Background of the Study

The need for organizations to have a clear image has gained prominence in modern days. The demand for organizational image results from organizations having different experiences, attitudes, beliefs, feelings, information and observation which are essential components of organizational image (Bafo et al. 2020). Management study Guide (2015) explains that organizational image refers to how stakeholders perceive the company and its services and products. It further explains that corporate image plays a critical role in shaping the public impression of the company (Pitkanen, 2001).

In other words, organizational image entails the procedures that show how the company aims to be identified or recognized. This constitutes the expectations that employees, customers and the entire organization have such as: where it is headed, its weaknesses, strengths and principles that organization possesses (Bafo et al. 2020). For Otubanjo (2013) corporate identity is a critical aspect in shaping the image of the company because it unintentionally builds the image the stakeholders have towards the company. It is also

important in determining how the company wants to be seen and how it is currently seen. Therefore, organizational image constitutes the identity of the company that results from the choices that the company makes which shapes the image of the company.

Almost all banks have a unique image and this image is formed on the basis of perception of its stakeholders. This created image shows whether the organization (commercial banks) are doing good jobs or not to its stakeholders (Bafo et al. 2020). In other words, organizational image is concerned with the general perception that the public have towards the company (Villanova, Zinkhan and Hyman, 2002). This means that for a company to have a good image it must address two central concerns namely: overall perception and different segments. The perception in this case is developed through what the banks are likely to do for stakeholders in terms of benefits such as: the benefits the stakeholders may receive in terms of stockholding, board director, supplier, employment, channel members, customers and community. Secondly, it is how the banks deal with the different segments of the public (Carrol, 2013).

The current changes in business environment globally demands that organizations perpetually review and modernize their approaches to management. Enhanced competition needs the company to innovate and modernize in order to win the extremely well-read and authorized customers (Mwangangi, 2018). Various methods together with generic and grant methods are utilized by corporations for competitive advantage to outdo each other for client satisfaction through dynamism in creative thinking and innovation (Newman et al., 2016). Intense competition for industrial merchandise causes social contestability within markets. This is basing mostly on environmental and health connected externalities attributed to the merchandise and processes, and economic difference of opinion from competitors. Corporations use CSR to form shared value for their stakeholders and to mitigate their adverse impacts (Crafo & Forget, 2015).

According to Fadun (2014) CSR involves economic, legal, moral and discretionary considerations for workers, customers, community, government and different stakeholders (Safwat, 2015). Organizations are usually fraught from numerous neutral groups to commit resources to CSR activities (Bagh, Khan, Azad, Saddique & Khan, 2017) thence a key strategy in business operations.

For Mwangangi (2018) Corporate Social Responsibility (CSR) may be a strategy utilized by corporations to attain competitive benefits (Newman et al., 2016). CSR enhances company image and name leading to improved company's aggressiveness (Togun & Nasieku, 2015). It involves managing multiple stakeholders' ties at the same time and therefore mitigates the chance of negative regulative, legislative or commercial enterprise action, and attracts socially aware customers and investors (Freeman et al., 2010). Engagement with stakeholders enhances and sustains a firm's revenue generation through improved relationship with workers, customers and different stakeholders (Harrison & Wicks, 2013). The link between business and society has witnessed a vast transformation occasioned by the need for increased profit and additional moral outlook that analyzes the bigger impact of business on society (Safwat, 2015).

Strategic corporate social responsibility is a day-to-day operation of the firm and is central to the direction business operations work along to realize goals which square measure worth making activities thus building competitive advantage for the firm (Chandler, 2014). It also refers to any accountable activity that enables a firm to realize a properly competitive advantage in spite of motive (McWilliams & Siegel, 2010).

Global Perspective of Strategic Corporate Social Responsibility

Generally, some of the first world countries like the USA are undergoing a major banking crisis with the Citibank group recording an excess of 40 billion dollars in losses (Elliot 2016). However, Canadian Banks have been able to withstand the challenges in the global financial market with Elliot (2016) crediting this to regulatory discipline as well as the cultural mindset that is present among banks in Canada. Most scholars have majored their studies on Specific European Countries. In their study, Acharya, *et al.* (2012), sampling from the Italian banks, find that performance of banks has improved due to the new incursion into the diversity of assets across bank loan portfolios. Hayden *et al.* (2012), used data from several German banking

institutions and their specific bank loan portfolios in order to assess the degree to which the banking activities available in different organizations and areas improved efficiency. They found few benefits, with all current activities being key to decreasing bank efficiency. In the most inclusive similar study by Laeven and Levine (2011), the authors assess how banking activities affected the value of major banking institutions in 42 countries. Their main findings were the selling value of banking and other financial services firms is mostly lesser than that of specialized organizations and institutions. Therefore, the benefits of the economies of scope may not be enough to allow most banks in Europe and the USA to perform at their peak.

Regional Perspective of Strategic Corporate Social Responsibility

In Ghana, different universities adopt different strategies to attract students and enhance loyalty and satisfaction and promote the branding of the university in a very competitive environment (Asare and Amponsah, 2020). The universities use corporate social responsibility as a strategy to promote the image of their institutions. The aim of adopting corporate social responsibility in higher learning institutions in Ghana is to enhance corporate marketing of institutions and to ensure they remain competitive in-service delivery and in admission of new students. However, implementing CSR has not been fully successful due to several challenges such as mismatch between the university corporate image and identity which can result into poor marketing performance (Asare and Amponsah, 2020).

Across Africa, several studies have been conducted to find out the effect of corporate social responsibility in the banking sector. For instance, Kirkpatrick, Murinde, and Tefula (2014) performed an empirical study of 89 commercial banks from several African countries from the year 2001 to 2014. The finding of the study was that banks are usually on an average of 65% profit efficiency and 80% cost efficiency with reference to the DFA and SFA merits. The study by Kirkpatrick, Murinde, and Tefula (2014) also suggest

that the penetration of foreign banks in Africa has yielded more foreign owned banks thus leading to reduced profits and the x-efficiency of most African Banks. Conclusively, it can be argued that banking performance in Africa is better when it is still domesticated as opposed to foreign entry in its management. The impressive performance of the banking sector in Africa is attributed to good strategies adopted by banks such as corporate social responsibility.

Local Perspective of Strategic Social Responsibility

A commercial bank is an institution that receives deposits, lends loans and offers related services (Chege, 2013). The Kenya banking sector comprises of 38 commercial banks (Charter bank under statutory management, Fidelity commercial bank undergoing acquisition and Imperial bank and Chase bank under receivership have been excluded from this study), one mortgage finance company and 6 deposit taking micro-Finance institutions of local and international origin (CBK, 2021).

Due to regional integration taking place within Kenya's banking sector, new entrants such as Nigeria's United Bank for Africa (UBA), Lome-based Eco bank and the Gulf region banks such as Gulf African Bank and First Community Bank have been witnessed lately. There are approximately 8.3 million bank accounts in Kenya, and with a total population of more than 40 million people, clearly there is still a room for further penetration of the market (Nzovah, 2012). The large banks such as KCB, Equity Bank, Co-operative Bank, Barclays Bank, Standard Chartered Bank, DTB, NIC Bank, CFC Stanbic, Commercial bank of Africa and HFC represent 80% of the market share. This leaves approximately 20 percent market share for the remaining banks, leading to cut-throat competition with little market gain. The remaining banks exhibit varying degrees of technical sophistication, capital market expertise, and technology innovation (Chege, 2013).

The banking sector in Kenya is very worthwhile but offer homogenous products and services. Marketing creativities to differentiate and create a lasting competitive advantage has increased over the years with the aim of attracting new while retaining existing customers. Communication efforts have been fruitful in brand building and product/service awareness. However, this has not offered a long-term solution for banks that aim at long-term growth and stakeholder loyalty. To create a long-lasting competitive advantage, banks have been forced to revise both long and short-term goals. The CSR activities have featured prominently as some of the strategies used by some of the commercial banks. Deliberate efforts have been undertaken by some banks to set aside annual budgets to run selected thematic CSR initiatives (Mbithi, 2015). The research will be based on 11 branches within Trans Nzoia County which carried CSR at branch level.

The banking sector is highly competitive and vibrant sector owing to Technology advancement, Privatization of public banks, globalization and deregulation of financial services (Chege, 2013). Thus, to curb these challenges and be sustainable in fragile business environment, Commercial banks have shifted their focus towards strategic corporate social responsibility (Chandler, 2014). This shift is to find a sustainable solution which leads to competitive advantage with only 8.6 million accounts in the sector (Chege, 2013).

Statement of the Problem

Although there are soft benefits associated to practicing CSR there is no information on CSR Strategies linkage between its cost and organizational image of the banks. Consequently, it becomes important to also look at the theoretical ramifications that follow the empirical understanding of CSR strategy and organizational image of commercial banks and this study thus hopes to fill this significant gap.

On a global scale, Marcia, Markus and Oakley, (2013) did a study on corporations in the USA to find out the benefits of CSR to their organizations with their findings being those larger institutions tending to be remunerated for being socially responsible. However, their research did not consider the effect of CSR strategies on the organizations' image considering both measurements in terms of financial and non-financial indicators. Carmen-Pilar, Rosa and Lisa, (2011) on their part looked at service sector companies in Norway and asserted that size of the firm was precisely corresponding to its CSR asset.

According to studies done in Kenya, there is a relationship between the organization's profitability and CSR (Mwangi & Wanjiru, 2019). According to Okiro, Omoro and Kinyua (2013) in their study on influence of CSR on financial performance of commercial banks; they found out that organizations can create a foundation and an avenue for improving their product worth and promote themselves by embracing Corporate Social Responsibility. The study however did not measure any performance elements and was thus incomplete. Further, basing on the findings of these studies, identifying the components of the CSR programs in a specified organization are the link between CSR and their cooperate performance.

For this study's purposes, the philanthropic strategy, Economic strategy, Environmental strategy, and Ethical strategy is the study's main focus. Additionally, most studies given were unsuccessful in showing the force that CSR possesses on an organizational image; thus, creating a gap in knowledge. This study then, intends to close the gap by examining the force exerted by the corporate social responsibility strategy on an organizational image particularly on commercial banks.

Objectives of the Study

General Objectives

The main objective of this study was to investigate the effect of corporate social responsibility strategy on organizational image of commercial banks in Trans Nzoia County, Kenya.

Specific Objectives

1. To determine the effect of economic strategy on organizational image of commercial banks in Trans Nzoia County, Kenya.
2. To examine the effect of philanthropic strategy on organizational image of commercial banks in Trans Nzoia County, Kenya.

Research Hypotheses

H₀₁: Economic strategy has a significant effect on organizational image of commercial banks in Trans Nzoia County, Kenya.

H₀₂: Philanthropic strategy has a significant effect on organizational image of commercial banks in Trans Nzoia County, Kenya.

LITERATURE REVIEW

Stakeholders Theory

This study is guided by the stakeholders' theory. The theory is considered relevant in understanding the effect of CSR Economic Strategy on organizational image of commercial banks and hence providing the model background for this study. It's been argued by economist Friedman (1970) that the Corporation's sole responsibility is to produce most monetary income to shareholders.

Whereas others are of the idea that a business owes responsibility to varied teams within the society cited as stakeholders. Stakeholder, per Bruno and Nichols (1990) may be a term that denotes any distinctive cluster or individual who have an effect on or be suffering from structural performance in terms of its product, policies and work processes. The first cluster includes shareholders and investors, employees, customers and suppliers, in conjunction with what's outlined as the public neutral group; the governments and communities that offer infrastructure and markets; whose laws and laws should be obeyed and to whom taxes and obligations could also be due.

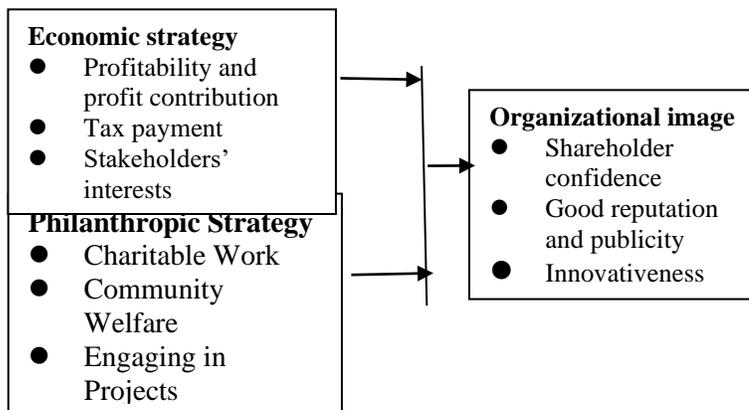
Triple Bottom Line Theory

The triple bottom line (TBL) theory was considerably espoused by Elkington (1994). The theory is carefully weighed relevant in understanding the effect of CSR Philanthropic Strategy on organizational image of commercial banks in Kenya and provides the model background for this study.

Elkington (1994) argued that this theory may be a central part of the CSR platform for organizations to operate on. This is because the triple line is a business concept that posits firms to commit to measuring their social and environmental impact in addition to their financial performance rather than solely focusing on generating profit or the standard "bottom line". Henriques and Richardson, (2004) in articulating the tenets of triple bottom line (TBL) theory linking to CSR, argued that there's an in-depth rapport between company responsibilities and economic, social, and environmental bottom lines (Karaibrahimoglu, 2010).

It's argued that the majority of organizations see the economic bottom line because the universal space of importance in any business is often pictured and is decided by the monetary statistics. On the social bottom line facet, the thought is conferred as problems that entail the resource obtainable and the way stakeholders make use of them whereas the environmental bottom line is concerning the natural capital to make tasks for organizations in their CSR activities (Henriques & Richardson, 2004).

Conceptual framework



Review of Variables

Economic Strategy and Organizational Image

Amin-Chaudhry (2016), understood economic profitability and social responsibility to be positively associated, and profitable companies are better social players. Economic sustainability is the most important pillar of economic CSR, as managers have a duty to ensure that the company can offer returns on shareholders' investment and maximize their wealth. As Nwoke (2017) argues, the current control of the "maximizing shareholder value" model of corporate governance has made it difficult to secure too much hope on contemporary CSR as an effective means for development.

Mittal, Sinha and Singh (2008) did a study on the connection between CSR and organizational gain in terms of quantity and value. The authors found that there exists a positive relationship between CSR and organizational gain in terms of quantity and value and

therefore the company's name. There's very little proof that corporations with a code of ethics would generate considerably more quantity and value intercalary than those without ethical codes.

Skare and Golja (2012) undertook a study to find out if there was a link between company social responsibility and company monetary performance. The analysis was done using comparative analysis of the monetary performances of forty-five firms listed on stock market index property World Index 2009/2010. These represented the highest 100 percent of the leading property corporations out of the most important 2500 corporations within the stock market index international total stock exchange Index compared with non-CSR firms ex-directory. The researchers gave results of the political economy model that further confirmed that CSR companies within the average relish higher monetary performance than non-CSR companies. The study suggested that socially accountable behavior ought to be thought-about as a vital determinant in today's normal business. Firms are perceived as establishments that build a part of the society and so, are going to be judged by whatever they are doing with their business activities which are relevant to completely different stakeholders within the society. Thus, it's of significant importance for companies, particularly huge multinationals that have become a lot more powerful than nation states to speculate in social responsibility. There are varied ways in which to invest further as reasons why to speculate in sensible social practices (Skare & Golja, 2012). The results of this analysis have shown that socially accountable firms surmount different firms in terms of their monetary and social performance. The primary part of the analysis showed that CSR firms have shown a far higher monetary performance within the analyzed amount from 2006 to 2008 compared with the non-CSR firms. This was enriched with the political economy analysis that has confirmed the hypothesis bestowed within the paper that CSR companies within the average relish higher monetary performance than non-CSR companies. The regression results demonstrated the existence of a positive nexus between the corporations' monetary performances and socially accountable behavior. If CSR is increased by a unit, the corporation's monetary performance (MP) will increase by one.798 displaying a positive relationship between monetary performance and socially accountable behavior (Skare & Golja, 2012).

Hossein, Kamran, Mostafa and Hossein (2012) examined the link between CSR and economic performance by examining completely different impacts of positive and negative CSR activities on monetary performance of building, edifice and airline corporations. In theory supporting positivism and negativity effects, the findings urged mixed results across completely different industries causative to companies' acceptable strategic decision-making for CSR activities by providing a lot of precise information concerning the impacts of every directional CSR activity on monetary performance.

Okoth (2012) recognized that CSR was sensible for the monetary performance of enormous and medium sized banks and had no impact on the ROA of little banks. The investigator noted that CSR had a positive and vital impact on ROA and ROE for all business banks once aggregative. However, once classified on the idea of market size, the study discovered that CSR improved monetary performance of enormous and medium sized banks whereas the impact on ROA of little banks was insignificant. This study concluded that CSR had a positive impact on monetary performance of enormous and medium sized banks and no vital impact on the monetary performance of little banks which had been not within the interest of shareholders for little banks to interact in CSR activities as doing thus might solely drain their wealth with none coming back.

A study by Kipruto (2014) was done to work out the impact that CSR has on monetary performance of business banks in the Republic of Kenya. The investigator used cross-sectional research design and a multivariate analysis model and found that CSR incorporates a positive and vital impact on monetary performance. The conclusion of the study was that CSR is suitable for the success of business banks since: it helps to boost monetary performance. CSR could be a noble idea for business banks to interact with their customers. Finally, CSR ought to be thought-about as a part of daily operational activities. Consequently, for a firm to grow and understand its dreams, it's to interact itself virtuously and commit itself to raising the society's social and living standards.

The study by Kipruto (2014) discovered that extremely profitable establishments have heavily invested in CSR activities for several years whereas people who have forever recorded losses are considering CSR as inessential expenses. Therefore, business establishments ought to operate outside their traditional business activities to support the community. Raising the living of a community attracts volunteers, investors and sponsors who can facilitate the business establishment to attain its objectives towards community wants. In return, the institution can pay less on CSR whereas at a similar time come through high returns from being an honest company national. Being an honest company national attracts new and sudden customers, new capital, tax exemptions; government favors and at the end larger gains to the company. Findings of this study justify the explanation why flourishing Kenyan business banks are more aggressive towards financing CSR activities than they need to be towards promoting.

Philanthropic Strategy and Organizational Image

Marcia, Otgontsetseg and Hassan (2013) in a very descriptive survey investigated CSR in its philanthropic format and the study noted that primarily, CSR in its philanthropic format was necessary for the event of system quality and improvement of firms. They additionally mentioned that CSR in its philanthropic format was necessary to accumulate the advantages that accrue out of a decent CSR system. The study used path analysis and located out that marginally, CSR in its philanthropic format had a positive impact on performance in production firms. The study however, didn't verify a similar scenario within the Kenyan context and within the industrial banking service and this gap was probably stuffed by the current study. It additionally didn't think about using inferential statistics as a way to supply comprehensive analysis of findings.

Lothringen (2012) did a descriptive study and examined CSR philanthropic gift and management. The study noted that one in every of the foremost important risk for any project is negative angle by stakeholders to the project and lack of philanthropic CSR. The study that was a qualitative study analysis, detected that philanthropic CSR succeeded proportionately to the improved attitudes of the

stakeholders. There's thus a desire to look at philanthropic CSR and the ways it influences performance in banks in the Republic of Kenya. The study unfortunately didn't think about using inferential statistics as a way to supply comprehensive analysis of findings. A study done by Carmen-Pilar, and Lisa (2011) highlighted in an instructive study the advantages of philanthropic CSR and the way neutral angle impact it. The study was a comparative study that used multivariate analysis to determine the importance of philanthropic CSR on organizational performance within the private sector in the USA. The study noted that several construction companies used philanthropic CSR in many numerous ways in which eventually they settled on one that had positive workers reviews and higher angle. This means that ideally, philanthropic CSR is important for improved banking performance however, to what extent is the reason for the current study.

Kitzmuellery and Shimshack (2012) additionally did a qualitative study on philanthropic CSR and its impact on organizational performance of companies in Scandinavian country. The study used secondary knowledge from the Scandinavian country Securities Exchange and noted sure necessary problems. Firstly, the study noted that philanthropic CSR is important for progressive organizations. The study additionally noted that the same philanthropic CSR was a hinge from the operational success of firms that were listed was realized. This suggests that philanthropic CSR might further prefigure abundance for banking performance. However, to what extent becomes a reason for the current study. Qualitative studies have gaps in quantifying findings and so providing a robust prognostic part for future thought.

Klingebiel and Ram (2011) in their study entitled "philanthropic CSR for Innovation Performance: the results of Breadth, Uncertainty, and Selectiveness", elaborated in their literature review that the choice to pick philanthropic CSR approach will absolutely affect performance. Knowledge was generated out of the 2012 metropolis Innovation Panel that comprised the German part within the EU Innovation Survey. They established that a technique of philanthropic CSR leads to a wider upsurge of sales of recent merchandise. The influence of bigger extensiveness looks to outweigh that of increased resource allocation per every project. However, philanthropic CSR had been used as an element and the way it influences remains considerably uninvestigated. It additionally didn't think about using inferential statistics as a way to supply comprehensive analysis of findings.

Organizational Image

Corporate image is on the receiver's aspect within the Sender-Receiver model (Kapferer, 2008). It's the impressions that affect how shoppers understand a corporation and establish or differentiate the corporate from others. Company image also can be outlined as consumer's perceptions of a corporation as mirrored by the whole associations of command in a consumers' memory (Keller, 2003). Aaker (2001) adds that the affiliation to a whole within the mind of the shoppers is going to be stronger with associations. These associations are divided into: subgroups, likes, attitudes and advantages (Keller, 2003). Attitudes have a right way impact on company image (Faircloth et al., 2001).

Nevertheless, attitudes square measures, often seem to be consumers' overall analysis of the whole and it's seen as a silent perspective of advantages and attributes (Keller, 1993). Advantages square, measures the values shoppers connect with the merchandise or service and a lot of specifics is to what varieties of desires the merchandise or service fulfills for the client (Keller, 2003). Peoples' understanding of the company image is on an individual basis. They interpret the message supported from their life experiences and specific characteristics (Dobni and Zinkhan, 2000).

Establishing a positive company image needs the institution of a robust, favorable and distinctive association. One's a company's pictures square have been measured, they'll enhance a company's self-image, attractiveness, neutrality and thus influence customers' purchase choices and in return have a bearing on the corporation's money revenue (Munoz, 2004). The Interaction with a whole will have an effect on consumers' overall attitudes for example, people can feel a sense of happiness by intense or shopping for an exact product. Although a client will not belong to an elite category, all the same they'll feel a way of happiness simply by sporting a suit from Armani (Graeff, 2006).

According to Hsieh, Pan, and Setiono (2006), a roaring company image allows shoppers to establish the wants that the company satisfies and to differentiate this from its competitors, and consequently increase the probability that customers can purchase from the company. Thus, a corporation's products or services that perpetually holds a good image by the general public, would undoubtedly gain a far better position within the market, property competitive advantage, and increase market share or performance. Additionally, Koo, (2003) points out that a good company image can result in loyalty, whole equity, purchase behavior and whole performance. Additionally, painter (2005) noted that a picture is that mental construct developed by the patron on the premise of a number of selected impressions among the flood of the entire impressions; it comes into being through an explicit method within which these chosen impressions squares are measure detailed, embellished, and ordered.

In a company, image will generate worth in terms of service to a client's method info, differentiate the corporate, generating reasons to shop for, offer positive feelings, and providing a basis for extensions. Finance in disapproval is taken into account to supply a corporation's major competitive advantage. Whole names or whole equity square measure is usually thought of to be a necessary resource that the firm possesses. Therefore, making and maintaining image of the corporate is a very important part of a firm's selling program and disapproval strategy (Keller, 2003). Consequently, it's necessary to perceive the event of image formation and its consequences like satisfaction and loyalty.

Research indicates that customers whole loyalty brings with it advantages like bigger sales, enhanced gain, a client base that's less sensitive to the selling efforts of competitors, and substantial barriers to entry. Loyalty is commonly understood as consisting of each activity associated with a degree of an attitudinal dimension (Dick and Basu, 2014), and so refers to a deeply command of dispositional commitment, that induces users to resist situational influences and selling efforts that may have the potential to cause

brands wizardly behaviors. company image may be a composite of perceived quality and honored dimensions that a client holds and thus reflects a customer’s overall impression. A positive company image is thought of as a vital ability of an organization to carry its market position (Wetzels et al., 2009).

METHODOLOGY

Research Design

This study used a descriptive cross-sectional survey analysis style. Descriptive survey design is appropriate in this study because it enables the researcher to gain certainty and to describe variables under investigation. The researcher adopted the use of qualitative and quantitative approach. The reason for selecting qualitative method is to allow the researcher to measure out perceptions, attitudes, and reactions. While quantitative approach was used in this study to enable the researcher to obtain high levels of validity and to reduce subjectivity.

Target Population

The target population was management staffs of Kenyan Commercial Banks in the Trans Nzoia County. There are 11 commercial banks in Trans Nzoia County. The banks are: The Cooperative Bank of Kenya Ltd, Sidian Bank, Equity Bank Ltd, Barclays Bank Ltd, Family Bank Ltd, I&M Holdings Ltd, K-Rep Ltd Housing Finance Co Ltd, Kenya Commercial Bank Ltd, National Bank of Kenya Ltd, Standard Chartered Bank Ltd NIC Bank Ltd, and Diamond Trust Bank Kenya Ltd.

In this study, all the 238-management staff across the nine departments of the eleven commercial banks in Trans Nzoia County formed the target population. The management staff is preferred in this study because they are the upper echelons of decision making and therefore understand the issues regarding CSR and how they affect the organizational image. The target population is summarized in table 1.

Table 1: Target population

Respondents	Frequency
Corporate strategy	38
Finance	22
Human capital and administration	19
Innovation and payments	33
Corporate and SME Banking	29
Strategic partnerships, collaborations and investor relations	16
Operations and customer experience	32
Credit	14
Special projects	15
TOTAL	238

Data Collection Procedures

Data collection exercise took place in Trans Nzoia County, Kenya involving 11 commercial banks. It lasted for a most of 3 weeks. Before actual collection of information begin, the researcher sought for and introductory letter from Jomo Kenyatta University of Agriculture and Technology. Preliminary visits were created to a number of the banks head offices to enable the researcher familiarizes with the bank office’s locations and to gather preliminary data from explicit banks, departments applicable within the industry, reports, websites, and journals. The researcher then delivered the questionnaires face to face to the respondents by visiting them within the banks (in the case of branch managers) and branch community champions. The study adopted a drop and picks methodology of the questionnaires, and it required the respondents to fill out the forms in time to relinquish them ample time to reply to the items of questionnaire. The questionnaires were then collected once and preparations for data analysis and presentation.

Data Analysis and Presentation

In this study, both descriptive and inferential data analysis techniques were used. According to Mugenda and Mugenda (1999), the first step in data analysis is to describe or summarize the data using descriptive statistics. Data was edited, coded, classified and

summarized into categories. In order to make the data collected amenable to statistical analysis using the Statistical Package for Social Sciences (SPSS) version 28, the data was coded as follows: For nominal data, for example, representing demographics of the respondents and other characteristics of the bank to be studied such as, male = 0 and female = 1. In categorical data where Likert scale is used representing, 1- 5 where, 1 imply strongly disagree, 5- imply strongly agree was used. Descriptive data analysis started during data collection. Descriptive data was analyzed by use of frequencies and central tendencies and presented in form of tables. For inferential purposes, a number of steps and/or analysis are necessary so as to achieve the goal which envisaged in this study.

Multiple regression analysis was conducted to establish inferential data. Multiple regression analysis was used to find the associations between the dependent and independent variables. Multiple regressions are preferred because it is the method that utilizes two or more independent variables to make a prediction about a dependent variable. Analyzed data was presented in form of percentages and through frequency tables.

Because there are four independent variables in this study the multiple regression models generally assumed the following equation;

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \epsilon$$

Where:

Y = Organizational image

β_0 =constant; β_1 , β_2 , β_3 and β_4 = regression coefficients

X₁= Economic strategy

X₂= Philanthropic Strategy

ϵ =Error

RESEARCH FINDINGS AND DISCUSSION

Response Rate

In this study, a total of one hundred and five (105) questionnaires were distributed in 11 commercial banks in Trans Nzoia County. Out of the 105 questionnaires that were distributed, 94 were satisfactorily filled, 7 were not satisfactorily completed and 4 were unreturned for analysis. The ninety-four (94) questionnaires that were satisfactorily filled and returned for analysis yielded a return rate of 89.52 percent. This questionnaire return rate was very reliable response rate to enable generalizations of the study findings. This agrees with Zikmund et al., (2010) who noted that a response rate of 70 percent and above is a reliable response rate.

Table 2: Response Rate

Questionnaire Response	No	Percentage
Satisfactorily Filled	94	89.52
Not Satisfactorily Filled	7	6.66
Un-returned	4	3.81
Total	105	100

Presentation of Findings

Effect of Economic Strategy on Organizational Image

First, the respondents were asked whether the organization has been profitable in the last 1 year. The distribution of findings showed that 42.5 percent of the respondents strongly agreed, 40 percent of them agreed, 13.75 percent of the respondents had no idea, 2.25 percent disagreed while 1.25 percent of them strongly disagreed. These findings indicated that the organization has been profitable in the last 1 year.

The respondents were also asked whether the organization is committed to being as profitable as possible. The distribution of the responses indicated that 28 percent strongly agreed to the statement, 58.75 percent of them agreed, and 11.25 percent of them were neutral, 1.25 percent of them disagreed while 1.25 percent of them strongly disagreed to the statement. The findings showed that the organization is committed to being as profitable as possible.

In addition, the respondents were also asked whether the net profit of the firm for the last 1 year greatly related to expectations. The distribution of the responses indicated that 12.5 percent strongly agreed to the statement, 17.5 percent of them agreed, and 1.25 percent of them were had no idea, 32.5 percent of them disagreed while 36.25 percent of them strongly disagreed to the statement. These findings indicated that the net profit of the firm for the last 1 year was not greatly related to expectations.

The respondents were asked whether the net profit of the firm has consistently been high for the last 1 year. The distribution of the responses indicated that 20 percent strongly agreed to the statement, 32.5 percent of them agreed, 16.25 percent of them were neutral while 21.25 percent and 10 percent of them disagreed strongly and disagreed to the statement respectively. These show that the net profit of the firm has consistently been high for the last 1 year.

The respondents were asked whether the organization has performed in a manner consistent with maximizing earnings per share. The distribution of the responses indicated that 12.5 percent strongly agreed to the statement, 17.5 percent of them agreed, 1.25 percent of them were neutral while 36.7 percent and 32.5 percent of them disagreed strongly and disagreed to the statement respectively. These show that the organization has not performed in a manner consistent with maximizing earnings per share.

The respondents were also asked whether the company has maintained a high level of operating

efficiency. The distribution of the responses indicated that 25 percent strongly agreed to the statement, 58.75 percent of them agreed, and 11.25 percent of them were neutral, 1.25 percent of them disagreed while 1.25 percent of them strongly disagreed to the statement. The findings show that the company has maintained a high level of operating efficiency.

Finally, the respondents were also asked whether the company has achieved a successful position on the market in the last 1 year. The distribution of the responses indicated that 12.5 percent strongly agreed to the statement, 17.5 percent of them agreed, and 1.25 percent of them had no idea, 32.5 percent of them disagreed while 36.25 percent of them strongly disagreed to the statement. These findings indicated that the company has achieved a successful position on the market in the last 1 year.

Table 3: Effect of Economic Strategy on Organizational Change

Effect Image	Statements		SA	A	N	D	SD
From	Our organization has been profitable in the last 1 year	%	43	40	14	20	1
	Our organization is committed to being as profitable as possible	%	25	59	11	1	1
neutral	The net profit of the firm for the last 1 year greatly related to expectations	%	13	17	1	33	36
	The organization has performed in a manner consistent with maximizing earnings per share	%	20	33	16	21	10
The	The company has maintained a high level of operating Efficiency	%	13	18	1	37	33
	The company has achieved a successful position on the market in the last 1 year	%	25	59	11	1	1

of Philanthropic Strategy on Organizational

the table below, the respondents were asked whether the organization performs in a manner consistent with the philanthropic and charitable expectations of society. The distribution of findings showed that none of the respondents strongly agreed to the statement, 15.6 percent of agreed, 30.8 percent of the respondents were while 28.0 percent disagreed, and 20.2 strongly disagreed. These findings implied that the organization performs in a manner consistent with philanthropic and charitable expectations of society.

respondents were also asked whether the organization contributes resources regularly to the community and to charity. The distribution of the responses indicated that 51.5 percent strongly to the statement, 38.2 percent of them agreed and percent of them were neutral while 3.9 percent of

them disagreed. None of the respondents strongly disagreed to the statement. These findings implied that majority of the respondents agreed that the organization contributes resources regularly to the community and to charity.

The respondents were also asked whether the organization voluntarily supports projects that enhance the community's quality of life. The distribution of the responses indicated that 43.5 percent strongly agreed to the statement, 47.5 percent of them agreed, 5.5 percent of them were neutral while 2.9 percent of them disagreed and strongly disagreed to the statement respectively. These findings indicate that the organization voluntarily supports projects that enhance the community's quality of life.

The respondents were asked whether the organization is actively involved in a project(s) with the local community. The distribution of the responses indicated that 52.2 percent strongly agreed to the statement, 31.9 percent of them agreed while 10.9 percent of them were neutral. None of the respondents disagreed or strongly disagreed to the statement. These findings implied that majority of the respondents agreed that the organization is actively involved in a project(s) with the local community.

The respondents were asked whether the staff members are constantly involved in charity and volunteer work on behalf of the firm. The distribution of findings showed that 51.5 percent of the respondents strongly agreed, none of them agreed, 6.4 percent of the respondents were neutral while 38.2 percent disagreed, and 3.9 percent of the respondents strongly disagreed to the statement. These findings implied that majority of the respondents agreed that the staff members are constantly involved in charity and volunteer work on behalf of the firm.

Table 4: Effect of Philanthropic Strategy on Organizational Image

Statements		SA	A	N	D	SD
Our organization performs in a manner consistent with the philanthropic and charitable expectations of society	%	0	16	31	28	20
Our organization contributes resources regularly to the community and to charity	%	4	38	6	0	52
Our organization voluntarily supports projects that enhance the community's quality of life	%	44	47	6	3	1

The	Our organization is actively involved in a project(s) with the local community	%	52	32	16	0	0
	Our staff members are constantly involved in charity and volunteer work on behalf of the firm	%	20	28	5	16	30
	The staffs are usually oriented on gender mainstreaming before they are appointed.	%	4	38	6	0	52

Organizational Image

dependent variable was organizational image commercial banks in Trans Nzoia County, Kenya. In determining this objective, the respondents were requested to respond to several statements regarding organizational image. From the table below, the respondents were asked whether CSR has led to Sales growth. The distribution of findings showed that 37.5 percent of the respondents strongly agreed, 27.5 percent of them agreed, 16.25 percent of them were neutral, 11.25 percent disagreed while 7.5 percent of

them strongly disagreed. The findings show that CSR has led to Sales growth.

The respondents were also asked whether the organization has put in place elaborate policies to ensure it's well managed. The distribution of the responses show that 10.0 percent strongly agreed to the statement, 46.0 percent of them agreed, and 3.75 percent of them were neutral, 12.25 percent of them disagreed while 16.25 percent of them strongly disagreed to the statement. These findings implied that the organization has put in place elaborate policies to ensure it's well managed.

The respondents were also asked whether CSR has led to improved public relationship influenced by philanthropic activities. The distribution of the responses indicated that 29.2 percent strongly agreed to the statement, 29.1 percent of them agreed, and 19.1 percent of them were neutral, 18.2 percent of them disagreed while 4.4 percent of them strongly disagreed to the statement. These findings show that CSR has led to improved public relationship influenced by philanthropic activities.

The respondents were asked whether CSR has led to increased Customer satisfaction through quality products and services. The distribution of the responses indicated that 12.6 percent strongly agreed to the statement, 29.2 percent of them agreed, 27.6 percent of them were neutral while 30.5 percent and 0 percent of them disagreed strongly and disagreed to the statement respectively. These findings indicate that CSR has led to increased Customer satisfaction through quality products and services.

The respondents were further asked whether the organization has maintained positive publicity and reputation with the public. The results obtained indicated t that 37.5 percent of the respondents strongly agreed, 27.5 percent of them agreed, 16.25 percent of them were neutral, 11.25 percent disagreed while 7.5 percent of them strongly disagreed. The findings show that the organization has maintained positive publicity and reputation with the public.

Finally, the study was interested in finding out the organization has put in place practice to foster innovativeness. The study showed that 31.0 percent strongly agreed, 40.8 percent agreed, 21.7 percent were neutral, 6.5 percent disagreed, while none of the respondents strongly disagreed. This means the organization has put in place practice to foster innovativeness.

Table 5: Organizational Image

Statements	SA	A	N	D	SD
CSR has led to Sales growth	% 31	41	22	7	0
The organization has put in place elaborate policies to ensure it's well managed.	% 32	17	27	17	12
CSR has led to improved public relationship influenced by philanthropic activities	% 29	29	19	18	4
CSR has led to increased Customer satisfaction through quality products and services	% 13	29	28	31	0
The organization has maintained positive publicity and reputation with the public.	% 31	41	22	7	0
The organization has put in place practice to foster innovativeness.	% 31	41	22	7	0

Inferential Statistics

Correlation Analysis

6: Correlation Matrix

Organizational image	Economic strategy	Philanthropic strategy
----------------------	-------------------	------------------------

Organizational image	1		
Economic strategy	.196 **	1	
Philanthropic strategy	.520 *	.704 **	1

**Correlation is significant at the .01 level (2-tailed). *Correlation is significant at .05 level (2-tailed).

Correlation analysis was utilized in this study to show the relationship between the independent and dependent variables. In this study, Pearson's correlation coefficient was used to control the magnitude and direction of relationships between dependent and independent variables. Correlation coefficient (R) values are assumed to be between -1 and +1. A value of 0 implies that there is no relationship, a correlation coefficient +1 indicates that the two variables are perfectly correlated in a positive linear sense, i.e., both variables increase together while a correlation coefficient value -1 indicates that two the variables are perfectly correlated in a negative linear sense, i.e., one variable increases as the other decreases (Collis and Roger, 2013; Neuman, 2006; Sekeran, 2008; Kothari, 2012).

Correlation coefficients are the statistical method used to explore the five variables: Economic strategy, legal strategy, ethical strategy, philanthropic strategy, and organizational image of commercial banks in Trans Nzoia County. The results of the correlation analysis are presented in the table below:

Model Summary

The coefficient of determination is used to explain the extent in which changes in the dependent variable can be explained by the change in the independent variables or by the percentage of the change in the dependent variable (organizational image of commercial banks) which is explained by the four independent variables (Economic strategy, legal strategy, ethical strategy, and philanthropic strategy). The four independent variables studied explain only 64.5% of the effects of the independent variables on organizational image represented by R², which means that other factors not studied in this research contribute 35.5% to the effects of independent variables on organizational image. Therefore, more research is needed to investigate the other factors affecting organizational image (35.5%).

Table 7: Model Summary

Model	R	R square	Adjusted R Square	Std. Estimation error
One	.805	0.649	0.645	.000

- a. Predictors: (constant), Economic strategy, and philanthropic strategy.
- b. Dependent variable: organizational image

ANOVA Model

The study results in ANOVA table 4.15 indicated that the coefficient of determination discussed above was significant as evidence of an F ratio of 14.692 with a p-value of 0.000 < 0.05 (significance level). Therefore, the model was adapted to predict organizational image using economic strategy, legal strategy, ethical strategy, and philanthropic strategy.

Table 8: ANOVA

Template	Sum of squares	Df	Medium square	F.	Sig
1 Regression	59.912	4	59.912	14.692	.05 ^b
Residue	1361.945	94	4.078		
Total	1421.857	98			

Regression Coefficients

From the coefficient table (table 9), the regression model can be derived as follows:

$$Y = 1.095 - 0.407x_1 + 0.344x_4$$

Table 9: Regression Coefficients

Coefficients ^a					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
	β	Std Error	Beta		
(Constant)	1.095	.186		5.902	.000
Economic Strategy	-0.407	.051	.307	2.921	.000
Philanthropic Strategy	0.344	.0043	.327	15.631	.000

Test of Hypotheses

Hypothesis One

Ho₁: Economic Strategy do not have a statistically significant effect on Organizational Image.

The first hypothesis of the study stated that there is a significant relationship between economic strategy and organizational image of commercial banks. The results of Table 4.16 showed that economic strategy had estimation coefficients that were significant based on $\beta_1 = -0.307$ (p-value = 0.000 which is less than $\alpha = 0.05$), so we accept the hypothesis and conclude that there is a significant relationship between economic strategy and organizational image. This suggests that there is a decrease of up to 0.307 units in organizational image for each unit of increase in economic strategy. Furthermore, the effect of economic strategy is greater than the effect attributed to the error, this is indicated by the value of the test $t = 2.921$.

Ho: Philanthropic Strategy does not have a statistically significant effect on Organizational Image.

The study's fourth hypothesis suggested that there is a significant relationship between philanthropic strategy and organizational image. This was supported by the findings, as philanthropic strategy had a positive and significant effect on organizational image of commercial banks in Trans Nzoia County based on $\beta_4 = 0.327$ (p-value = 0.000 which is less than $\alpha = 0.05$). This suggests that there is an increase of up to 0.327 units in organizational image for each unit of increase in philanthropic strategy. The effect of philanthropic strategy is eight times that attributed to error.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary of Results

Effect of Economic Strategy on Organizational Image

The first objective of this study was to find out the effect of economic strategy on organizational image of commercial banks in Trans Nzoia County. The study established that the organization has been profitable in the last 1 year. The study further showed that the organization is committed to being as profitable as possible. The findings of the study also indicated that the net profit of the firm for the last 1 year was not greatly related to expectations. The study revealed that net profit of the firm has consistently been high for the last 1 year. The study further showed that the organization has not performed in a manner consistent with maximizing earnings per share. The findings of the study also showed that the company has maintained a high level of operating efficiency. Finally, the study findings indicated that the company has not achieved a successful position on the market in the last 1 year.

Effect of Philanthropic Strategy on Organizational Image

The fourth objective of this study was to find out the effect of philanthropic strategy the organizational image of commercial banks in Trans Nzoia County. The study findings revealed that to some extent the organization performs in a manner consistent with the philanthropic and charitable expectations of society. Additionally, the study findings showed that majority of the respondents agreed that the organization contributes resources regularly to the community and to charity. The study further showed that the organization voluntarily supports projects that enhance the community's quality of life. The study also revealed that majority of the respondents agreed that the organization is actively involved in a project(s) with the local community. Finally, study findings showed that the staff members are constantly involved in charity and volunteer work on behalf of the firm.

Organizational Image

The dependent variable was organizational image of commercial banks in Trans Nzoia County. In determining this objective, the respondents were requested to respond to several statements regarding CSR and how it affects organizational image. The findings the study showed that CSR has led to Sales growth. The study further established that the organization has put in place elaborate policies to ensure it's well managed. Additionally, the findings of the study showed that CSR has led to improved public relationship influenced by philanthropic activities. The study also revealed that CSR has led to increased Customer satisfaction through quality products and services. On the other hand, the findings of the study showed that the organization has maintained positive publicity and reputation with the public. Finally, the study revealed that the organization has put in place practice to foster innovativeness.

Conclusion

The study made the following conclusion in relation to the findings of the study:

Effect of Economic Strategy on Organizational Image

The study concluded that there is a significant relationship between economic strategy and organizational image. This suggests that there is a decrease of up to 0.307 units in organizational image for each unit of increase in economic strategy. Furthermore, the effect of economic strategy is greater than the effect attributed to the error, this is indicated by the value of the test $t = 2.921$.

Effect of Philanthropic Strategy on Organizational Image

The study suggested that there is a significant relationship between philanthropic strategy and organizational image. This was supported by the findings, as philanthropic strategy had a positive and significant effect on organizational image of commercial banks in Trans Nzoia County based on $\beta_4 = 0.327$ (p -value = 0.000 which is less than $\alpha = 0.05$). This suggests that there is an increase of up to 0.327 units in organizational image for each unit of increase in philanthropic strategy. The effect of philanthropic strategy is eight times that attributed to error.

Recommendations

Based on the results, the study recommended the following:

Economic Strategy

The study recommends that the commercial banks should focus on operationalizing economic strategy such as providing loans to the local communities as a way of enhancing and promoting corporate social responsibility.

Philanthropic Strategy

The study findings revealed that to some extent the organization performs in a manner consistent with the philanthropic and charitable expectations of society. This study recommends the commercial banks should have robust and long-term philanthropic plans to enable them maintain and increase the number of customers.

Areas for Further Research

The study analyzed the effect of corporate social responsibility strategy on organizational image of commercial banks in Trans Nzoia County, Kenya. The study recommends that another study be conducted on effect of corporate social responsibility in other sectors such as the county governments or national government. Additionally, a replication study must be conducted in another county for there to be conclusive and sufficient results regarding the study.

ACKNOWLEDGEMENT

First, I thank God the Creator for giving me the opportunity to make this milestone in my life and for His care throughout my studies. Secondly, I am very grateful to my parents: my dad and mum for the support and good care they have showed me throughout my life. I am also grateful to my brothers and sisters for supporting me in different ways. May you keep that spirit of encouraging people in their endeavors. Not forgetting my supervisor Dr. Julius Miroga who has supported me throughout this process of working on this Research Project.

References

1. Abugre, J. B., & Anlesinya, A. (2019). Corporate social responsibility and business value of multinational companies: Lessons from a sub-Saharan African environment. *Journal of African Business*, 20(4), 435-454.
2. Al Mubarak, Z., Ben Hamed, A., & d Al Mubarak, M. (2019). Impact of corporate social responsibility on bank's corporate image. *Social Responsibility Journal*, Vol. 15 No. 5, pp. 710-722.
3. Alam, S. M., & Islam, Z. K. (2021). Examining the role of environmental corporate social responsibility in building green corporate image and green competitive advantage. *International Journal of Corporate Social Responsibility*.
4. Amaeshi, K., Adegbite, E., Ogbechie, C., Idemudia, U., Kan, K. A., Issa, M., & Anakwue, O. I. (2016). Corporate social responsibility in SMEs: a shift from philanthropy to institutional works. *Journal of business Ethics*, 138(2), 385-400.
5. Amin-Chaudhry, A. (2016). Corporate social responsibility—from a mere concept to an expected business practice. *Social Responsibility Journal*, 12, 22-46.
6. Areba, T. (2013). *The society comes first*. Nairobi: Kenya Institute of Management.
7. Arnold, D. G., & Valentin, A. (2013). Corporate social responsibility at the base of the pyramid. *Journal of business research*, 66(10), 1904-1914.
8. Baden, D. (2016). A reconstruction of Carroll's pyramid of corporate social responsibility for the 21st century. *International Journal of Corporate Social Responsibility*, 1(1), 1-15.
9. Bagh, T., Khan, M. A., Azad, T., Saddique, S., & Khan, M. A. (2017). The corporate social responsibility and firm's financial performance: Evidence from financial sector of Pakistan. *International Journal of Economics and Financial Issues*, 7(2), 301-308.
10. Bell, E., Bryman, A., & Harley, B. (2018). *Business research methods*. Oxford university press.
11. LBhattacharjee, A. (2012). *Social science research: Principles, methods, and practices*. Springer Education.
12. Blowfield, M., & Murray, A. (2014). *Corporate responsibility*. USA.: Oxford University Press.
13. Bondy, K., & Starkey, K. (2014). The dilemmas of internationalization: Corporate social responsibility in the multinational corporation. *British Journal of Management*, 25(1), 4-22.

13. Bonnafous-Boucher, M., & Rendtorff, J. D. (2016). Stakeholder theory: A model for strategic management. CIDADE: Springer International Publishing.
14. Bagh, T., Khan, M. A., Azad, T., Saddique, S., & Khan, M. A. (2017). The corporate social responsibility and firm's financial performance: Evidence from financial sector of Pakistan. *International Journal of Economics and Financial Issues*, 7(2), 301-308.
15. Ching, I., Yin, K., Pei, O., Zhi, S., & Pei, Y. (2015). *Does corporate social responsibility affect employees' quality of work life? A study on Malaysian service firms*, Department of commerce and accountancy, University Tunku Abdul Rahman.
16. Fadun, S. (2014). Corporate social responsibility (CSR) practices and stakeholder expectations; The Nigerian perspectives. *Research in Business and Management*, 1(2).
17. Hilson, A. E. (2014). *Resource enclivity and corporate social responsibility in SubSaharan Africa: The case of oil production in Ghana*, Unpublished PhD thesis, UK: Aston University.
18. Kothari, C. R., & Gaurav, G. (2014). *Research methodology: Methods and techniques* (3rd ed.). India: New age techno press.
19. Kung'u, V. W. (2021). Effect of corporate social responsibility on corporate image of commercial government
20. Mwangi, M., & Wanjira, J. (2019). Corporate Social Responsibility and the Performance of
21. Commercial Banks in Kenya: A Case of Equity Bank. *International Journal of Current Aspects*, 3(II), 186-198.
22. Mwangangi, A.S. *Effect of Corporate Social Responsibility on performance of manufacturing firms in Kenya*. Published PhD thesis.
23. Mugesani, P.A. (2018). *Role of corporate social responsibility activities on employees' commitment to firms listed at Nairobi stock exchange in Kenya*. Published PhD thesis.
24. Newman, C., Rand, J., Tarp, F., & Trifkovic, N. (2016). Corporate social responsibility in a competitive business environment. *United Nations University World Institute for Development Economics Research (UNU-WIDER)*. Working paper, 2016/7. Retrieved from <https://www.wider.unu.edu/sites/.../wp2016-7>. p
25. Safwat, A. (2015). Corporate social responsibility: Rewriting the relationship between business and society. *International Journal of Social Sciences*, 4(1), 85-97.
26. Saunders, M., Lewis, P., & Thornhill, A. (2012). *Research methods for business students* (6th ed.). Harlow, England: Pearson Education Limited.
27. Staniskiene, E., Stankeviciute, Z., & Daunoriene, A. 2019. *Corporate Social Responsibility and inter-organizational Trust in a B2B Context*. Quality innovation prosperity.
28. Sweeney, L. (2009). *A study of current practice of Corporate Social Responsibility (CSR) and examination of the relationship between CSR and Financial Performance using Structural Equation Modeling (SEM)*, Unpublished PhD thesis, Ireland: Dublin institute of Technology.
29. owned entities in Kenya [Thesis, Strathmore University
30. Oyaya, J. A. (2012). Corporate social responsibility and the corporate imaging of Kenya Commercial Bank Group. Doctoral dissertation, University of Nairobi, Kenya.
31. Oyewumi, O. R., Ogunmeru, O. A., & Oboh, C. S. (2018). Investment in corporate social responsibility, disclosure practices, and financial performance of banks in Nigeria. *Future Business Journal*, 4(2), 195-205.
32. Sasaka, P. S., Namusonge, G. S., & Sakwa, M. M. (2015). Effect of strategic management practices on the performance of corporate social responsibility of Parastatals in Kenya. *International Journal of Arts and Commerce*, 9(4), 69-91.
33. Saunders, M., Lewis, P., & Thornbill, A. (2012). *Research methods for business students*, (6th ed.). New York: Pearson Education Limited.
34. Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students*. Pearson education.
35. Schwartz, M. S. (1997). *Carroll's Pyramid of Corporate Social Responsibility*. Sage Press
36. Stuart, H. (1998). Exploring the corporate identity/corporate image interface: An empirical study of accountancy firms. *Journal of Communication Management*.
37. Tuan, L. (2012). Corporate social responsibility, ethics, and corporate governance. *Social Responsibility Journal*, 8(4), 547 - 560.
38. Wagana, K., & Kabare, J. (2015). The influence of corporate governance on corporate performance among manufacturing firms in Kenya: A Theoretical Model. *International Journal of Academic Research in Business and Social Sciences*, 5(4): 258-72.
39. Wanyama, M. B. (2020). *Corporate Image Management Strategy and Performance of Sugar Companies in the Western Region of Kenya*. Unpublished MBA
40. Yusuf, M. Y., & Bahari, Z. B. (2015). Islamic corporate social responsibility in Islamic banking: Towards poverty alleviation. *Ethics, Governance and Regulation in Islamic Finance*, 73.
41. Zhang, J., & Cui, Y. H. (2018). Fashion Corporate Social Responsibility, Corporate Image, Product Preference, and Purchase Intention: Chinese Consumers' Perspectives. *Journal of Fashion Business*, 22(6), 14-24.

AUTHORS

JOSEPHINE ATIENO ONYANGO

MBA (Strategic Option) Jomo Kenyatta University of Agriculture & Technology. jeyatieno89@gmail.com

JULIUS MIROGA (PhD)^{*#}

Jomo Kenyatta University of Agriculture & Technology. juliusmiroga@gmail.com.