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Android-Based Education on Self-Care Ability in Improving the Quality of Life of Gynecological Cancer Patients with Chemotherapy: Literature Review

Nursalam Nursalam¹, Awatiful Azza²,³, Chanif²,⁴, Erna Dwi Wahyuni¹,², Machmudah²,⁴, Nurus Safaah²,⁵, Sri Utami²,⁴, Tiyas Kusumaningrum¹,², Wiwit Dwi Nurbadriyah²,⁷

¹Faculty of Nursing Universitas Airlangga Surabaya Indonesia, ²Doctoral Student Faculty of Nursing Universitas Airlangga Surabaya Indonesia, ³Universitas Muhammadiyah Jember, ⁴Universitas Muhammadiyah Semarang, ⁵Institut Ilmu Kesehatan Nahdlatul Ulama Tuban, ⁶Universitas Riau Pekanbaru, ⁷STIKes Kepanjen Malang Indonesia

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Abstract- Gynecological cancer is the most common type of malignancy in women such as cervical, endometrial and ovarian cancer which is the most common and has major effects worldwide in terms of incidence and mortality. Chemotherapy as the main therapy given to gynecologic cancer patients causes various side effects and complications. Interventions in the form of health education, symptom management and psychological social support are important elements in the treatment process. Through android-based education with various easily accessible intervention features with the aim of providing evidence-based information related to cancer, physical and emotional care, and support which is expected to increase understanding and also patient motivation to follow chemotherapy programs properly, so that self-care abilities and quality The survival of gynecological cancer patients with chemotherapy can be achieved. Objective: to describe the use of android-based educational applications on self-care abilities to improve the quality of life of gynecologic cancer patients. Methods: using literature study with observational and descriptive methods using 30 research journals that are in accordance with the topics raised. Journal search using Science direct database and Google Scholar. Results: Android-based applications are effective and useful in providing health education, and can have a positive impact on improving health quality, both physically and psychologically, socially. Recommendation: Android-based educational applications are very possible to use in Indonesia to support gynecological cancer services.

Index Terms- Education, Android, Self Care, Quality of Life, Gynecological Cancer, Chemotherapy.

I. INTRODUCTION

Gynecological cancer is the most common type of malignancy in women, with approximately 1.309 million newly diagnosed cases per year. Cervical, endometrial and ovarian cancers are the most common gynecologic malignancies and have major effects worldwide in terms of incidence and mortality. (International Agency for Research on Cancer, 2020; Ngu et al., 2021; Yeh et al., 2021; Hung et al., 2022). One of the many treatments given to gynecologic cancer patients is chemotherapy (Hermanto et al., 2021), but this treatment has various side effects both physically and psychologically for patients who undergo it (Afiyanti et al., 2019; Hermanto et al., 2021; Nuwa & Kik, 2020). Another impact of chemotherapy is to reduce the patient's self-care ability (Gholap et al., 2019; Haryani et al., 2017). Limitations of self-care occur due to the lack of information delivery to patients and families about daily self-care due to illness and the therapy they are undergoing (Taylor & Renpenning, 2011). Self-care is a form of relationship between knowledge and action (Masmooi et al., 2019). To get good self-care, patients with chemotherapy need to get education to improve their knowledge. Education that has been given to chemotherapy patients in hospitals is given orally, and using media that still uses paper, such as leaflets or booklets.

In conditions of the COVID-19 pandemic, it is not recommended to provide face-to-face education programs (Richards et al., 2019), so it is necessary to update educational methods that are easier and more convenient to access and efficient, one of which is with a mobile application (application) as an easily accessible alternative to support patients (Lin et al., 2021). Referring to this, it is necessary to develop android-based educational media in improving self-care skills in improving the quality of life of gynecological cancer patients with chemotherapy.

Gynecological cancer patients receiving chemotherapy often report various things about the effects of chemotherapy. The most common symptoms as side effects that appear in gynecologic cancer patients undergoing chemotherapy are pain, nausea, vomiting and fatigue. About 80–100% of patients with gynecological cancer experience fatigue (Mulhaeriah et al., 2018). Research result Chan & Ismail (2014) reported the effects of chemotherapy were nausea (83.3%) and vomiting (78.9%), dry mouth or thirst (73.3%), hair loss (64.4%), fatigue or weakness (56.7%), loss of appetite (56.7%) and chills (56.7%), and reduced sense of touch (40.0%).
Some of the other impacts of gynecological cancer patients with chemotherapy are on psychosocial problems: psychological stress, depression and anxiety, and chemotherapy stress disorders. (Milanti et al., 2016), confusion or loss of concentration (43.3%), sadness or depression 43.3% (Chan & Ismail, 2014). Some of these side effects if they occur can cause discomfort and decreased self-care ability, and can also cause a decrease in the quality of life of gynecological cancer patients with chemotherapy. (Afiyanti et al., 2019; Gholap et al., 2019; Osann et al., 2014; Yeh, 2021). A study reported that the self-care ability of patients undergoing chemotherapy, mostly in the moderate category (67.78%), and more than 13.15% in the poor category. (Gholap et al., 2019). Self-care needs in the physical domain include the need to cope with physical symptoms, medication side effects, and to maintain activities of daily living (Afiyanti et al., 2018).

Chemotherapy is used primarily to kill cancer cells and inhibit their development. The basic principle of chemotherapy is a class of drugs that have a cytotoxic effect so that they can inhibit cancer growth and some can even kill cancer cells. Chemotherapy works by damaging the DNA of rapidly dividing cells (Chu & DeVita, 2015; Hermanto et al., 2021). Long-term administration of chemotherapy drugs can increase their accumulation in the body thereby increasing side effects and producing toxicity in various organs, so that it can cause various symptoms both physically and psychologically. (de Sousa et al., 2014; Hermanto et al., 2021). Chemotherapy makes most patients who have been diagnosed with cancer feel worried, anxious and afraid to face the threat of death and pain while undergoing therapy. This situation causes an imbalance both physically and mentally experienced by cancer patients due to chemotherapy so that the patient's self-care becomes hampered and there is a self-care deficit.

Self-care needs that must be met by cancer patients with chemotherapy include universal self-care requisites, developmental self-care requisites, and health deviation requisites. Universal self-care requisites focus on the basic processes of human life, including maintenance of adequate air intake, fulfillment of fluid intake, nutrition, elimination and secretion, balance of activity and rest, and balance of individual needs and social interactions. Developmental self-care requisites focus on life cycle changes, including adaptation to the loss of something important, adaptation to bodily changes, and psychosocial and spiritual control during chemotherapy. Health deviation requisites are related to health care, including appropriate early treatment, meeting chemotherapy needs, and drug regimens with chemotherapy (Allison, 2007; Cavanagh, 1991). Self care in cancer patients with gynecology needs to be considered and fulfilled. Various studies have been conducted to overcome this, including cognitive-behavioral therapy, mindfulness meditation, progressive relaxation, guided imagination and music therapy. (Milanti et al., 2016; Nuwa & Kiik, 2020; Wang et al., 2018). Some of these interventions are still carried out separately and are carried out face-to-face between nurses/therapists and patients. To overcome these weaknesses, an educational application was developed, which is a mobile application that can be applied independently by patients according to their needs, this application is easily accessible and becomes a supportive therapy for patients with gynecologic cancer. Application-based intervention, developed based on the needs of gynecological cancer patients with chemotherapy and self care theory and disease theory, which consists of explanations accompanied by reminders and information on chemotherapy requirements for the next session. This android-based education aims to provide evidence-based information related to cancer, physical and emotional care, and support that is expected to increase understanding and also the motivation of patients to follow chemotherapy programs properly, so that self-care abilities and quality of life of gynecological cancer patients with chemotherapy can be achieved.

Based on the research journal above, several factors were found that did not work. So that researchers are interested in conducting a Literature Review Study on "Android-Based Education on Self-Care Ability in Improving the Quality of Life of Gynecological Cancer Patients With Chemotherapy".

II. METHODS
This study uses a literature review design, namely research that examines scientific articles by integrating and drawing conclusions about Android-Based Education on Self-Care Ability in Improving the Quality of Life of Gynecological Cancer Patients With Chemotherapy. The data used in this study is secondary data obtained not from direct observation, but from the results of research that has been done by previous researchers. Sources of research data obtained in the form of articles or journals that are relevant to the topic of Android-Based Education on Self-Care Ability in Improving the Quality of Life of Gynecological Cancer Patients With Chemotherapy. The data search was carried out using the Science Direct, Google Scholar database. The keywords used in this study are "Education, Android, Gynecological Cancer" OR "Self Care of Quality of Life" AND "Chemotherapy". Data analysis was carried out using literature review techniques including looking for similarities (compare), looking for dissimilarities (contrast), giving views (critite), compare (synthesize), and summarize.
In collecting articles on Android-Based Education on Self-Care Ability in Improving the Quality of Life of Gynecological Cancer Patients With Chemotherapy, the author conducted a search using keywords that had been compiled and after that selection was carried out and produced as many as 100 articles and then re-selected into only 30 articles. The articles that were re-selected were carried out a descriptive approach by covering the discussion requirements, namely in the form of an overview of the Android-Based Education on Self-Care Ability in Improving the Quality of Life of Gynecological Cancer Patients With Chemotherapy in 2021-2022. Based on a literature review conducted on 30 sources from national articles, the results obtained can be seen in table 1.

III. RESULTS

Gambar 1. PRISMA Flow diagram
<table>
<thead>
<tr>
<th>No</th>
<th>Title</th>
<th>Author, year</th>
<th>Methods</th>
<th>Result</th>
<th>Database</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Effectiveness of Relaxation Breathing Exercise on fatigue in gynecological cancer patients undergoing chemotherapy</td>
<td>(Mulhaeriah et al., 2018)</td>
<td>Design: Quasi-experiment with pre- and post-test design.</td>
<td>RBE was more effective in reducing fatigue in patients with gynecologic cancer undergoing chemotherapy when administered four times a day rather than twice (with the mean difference was 0.91 (99% CI: 0.41e1.41; P 0.001).</td>
<td>Science Direct</td>
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<td>Samples: 42 gynecological cancer patients who are undergoing chemotherapy treatment at the Indonesian Cancer Center Hospital.</td>
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<td>Sampling technique: consecutive.</td>
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<td>Instrument: Piper Fatigue Scale (PFS), diary.</td>
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<td>Analysis: ANOVA and independent t test</td>
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<td>2</td>
<td>The Effect of the Mobile Application-Based Symptom Monitoring Process on the Symptom Control and Quality of Life in Breast Cancer Patient</td>
<td>(Ozeri et al., 2021)</td>
<td>Design: Single-center, randomized con-trolled trial with 2 parallel groups.</td>
<td>Initially, 70 participants were divided into treatment and control groups. There were 7 people from the treatment group and 6 people from the control group who dropped out due to resigning, changing care, and getting a change in treatment protocol. Symptoms reported by participants were fatigue, changes in taste sensation, pain, insomnia, feeling sad, dry mouth, worry, dry and itchy skin, loss of appetite, hair loss, nausea and vomiting, canker sores, shallow breath, numbness in the palms and soles. Feet, diarrhea, and constipation. There were significant differences in symptoms of nausea-vomiting after the intervention in the two groups, as well as functional scale, physical function, social function, general health score, symptom scale, weakness, nausea-vomiting, pain, loss of appetite, constipation, diarrhea, and financial difficulties. The process of monitoring symptoms with mobile apps is very effective in controlling physical symptoms.</td>
<td>Science Direct</td>
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</tbody>
</table>
Samples: 102 cancer patients  
Analysis: Student t test (Mann-Whitney U test) or Chi2 test (Fisher exact test) | The intervention group showed a significant reduction in symptom cluster severity (fatigue severity, effect of fatigue on activity, and sleep disturbance), depression, and anxiety. Differences were not found for pain, functional status, and health-related quality of life. The new functional status was seen to improve at the 6th and 12th weeks after the intervention. The results of this study also support the right time to follow up on post-intervention patients, because the results of the program will appear as patients become more proficient in implementing self-management strategies. |
|---|---|---|---|
|   | A Randomized Controlled Trial of mHealth Mindfulness Intervention for Cancer Patients and Informal Cancer Caregivers: A Feasibility Study Within an Integrated Health Care Delivery System. | Design: Randomized Controlled Trial.  
Sample: 97 patients and 31 caregivers.  
Instrument: Headspace application, online surveys DatStat software, NCCN Distress Thermometer, Hospital Anxiety and Depression Scale (HADS)-14, The PROMIS Pain Intensity scale, PROMIS Sleep Disturbance scale, Functional Assessment of Cancer Therapy General Scale (FACT-G)-27, Caregiver Quality of Life Index–Cancer (CQOLC) scale, Brief Fatigue Inventory-9, Posttraumatic Growth Inventory (PTGI)-21, Five Facet Mindfulness Questionnaire–Short Form (FFMQ-SF)24, and phone interview  
Analysis: Cohen's d effect size, software NVivo 12 | In the phone interview, participants suggested that there is an additional social experience feature in the mindfulness program application, besides that the application is introduced and can be downloaded at the chemotherapy clinic. They also said that they wanted a webinar-based program. The call reminder program from the care giver received by the patient is very motivating to do meditation practice.  
We observed a significantly greater improvement in quality of life among patients in the intervention group compared to controls. |
<table>
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<th>No.</th>
<th>Title</th>
<th>Author(s)</th>
<th>Design</th>
<th>Sample Size</th>
<th>Analysis</th>
<th>Results</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Telehealth System: a Randomized Controlled Trial Evaluating of An Internet-Based Exercise Intervention on Quality of Life, Pain, Muscle Strength, and Fatigue in Breast Cancer Survivors.</td>
<td>(Galiano-Castillo et al., 2016)</td>
<td>Design: Randomized controlled trial.</td>
<td>76</td>
<td>Analysis</td>
<td>The results of the study showed that after the intervention, the telearhabilitation group significantly improved global health status, physical, role, cognitive function and arm symptoms compared to the control group. Compliance with the program for 8 weeks was found in 93.9% of participants. Satisfaction with the program reached more than 97%.</td>
<td>Science Direct</td>
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<td>6</td>
<td>The effect of nursing self-care educational intervention on depression in women with breast cancer undergoing post-mastectomy chemotherapy: A quasi-experimental study</td>
<td>(Bouya et al., 2021)</td>
<td>Design: Quasi-experimental study, pre-post test design.</td>
<td>90</td>
<td>Analysis</td>
<td>The results showed that the intervention significantly reduced depression in the intervention group, but in this study, at the pretest there was a difference in the level of depression in the two groups. This intervention has the potential to be an effective and cost-effective adjunct therapy along with general care to reduce depression in women with breast cancer undergoing post-mastectomy chemotherapy.</td>
<td>Science Direct</td>
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<td>7</td>
<td>Effects of a self-monitoring intervention in breast cancer patients suffering from taste alterations induced by chemotherapy: A randomized, parallel group-controlled trial</td>
<td>(Kinjo et al., 2021)</td>
<td>Design: Randomized controlled trial.</td>
<td>34</td>
<td>Analysis</td>
<td>There was an increase in the taste sensation score in the first post-intervention measurement in the treatment group, but decreased in the second measurement and increased slightly in the third measurement. This is different from the control group whose taste sensation scores always increase from the first measurement. There was an identified interaction between the two groups. The self-monitoring intervention reduces negative cognitions of altered taste sensations, increases taste sensation, and reduces anxiety. Self-management carried out by patients will indirectly improve quality of life and stabilize self-efficacy in breast cancer patients who receive chemotherapy and experience changes in taste sensation.</td>
<td>Science Direct</td>
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<td>8</td>
<td>Reproductive Health Care Across the life course of The Female Cancer Patient</td>
<td>(Rubinsak et al., 2019)</td>
<td>Design: Single Item Screener.</td>
<td>516</td>
<td>Analysis</td>
<td>Study results: studies show reproductive health is a key component in the care of female patients with cancer. The population of patients with cancer continues to grow, and the proactive management of reproductive health problems is centered on providing</td>
<td>Science Direct</td>
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</table>
Samples: 148 participants, with a mean age of 52.17 years (range 20-75) and diagnosed with gynecological cancers (such as cervical, ovarian and endometrial).  
Instruments: SOC-13 item, Korean Form of Cancer Coping Questionnaire (K-CCQ), Hospital Anxiety and Depression Scale (HADS), Functional Assessment of Cancer Therapy-General Scale (FACT-G).  
Analysis: T-test and ANOVA, Pearson's correlation, mediation model test. | The most common type of gynecologic cancer in this study was ovarian cancer, most had cancer metastases or recurrence (71.6%) and 43.2% had received the first chemotherapy. The correlation results show that the higher a person's quality of life, the higher the SOC, positive reframing, active coping, and planning scores, while the lower the depression score. SOC is positively correlated with positive reframing and planning, and negatively correlated with depression. Depression is negatively correlated with positive reframing, active coping, and planning.  
Mediation analysis results show that SOC is related sequentially with the first positive reframing and planning as a coping strategy, the second with depression. SOC is directly or indirectly related to quality of life.  
Conclusion: Helping patients with gynecologic cancer undergoing chemotherapy to strengthen SOC can be done by providing patients with efficient coping strategies so as to reduce depression and improve their quality of life. | Science Direct |

| 10 | Factors associated with poor quality of life among cervical cancer survivors: implications for clinical care and clinical trials | (Osann et al., 2014) | Design: Cross sectional  
Samples: 202 cervical cancer patients.  
Analysis: t-tests and analysis of variance, Multivariable linear models (SYSTAT version 13.0), Stepwise linear models | There is a relationship between quality of life and PROMIS scores. Patients who received radiotherapy with or without chemotherapy had a lower quality of life, higher stress, depression, and anxiety. Maladaptive coping and gynecological problems were also more common in patients who received radiotherapy compared to those who only received surgery.  
Patients who had comorbidities before being diagnosed with cervical cancer had a lower quality of life, higher stress, depression, and anxiety, and received less social support. The presence of comorbidities is not related to gynecological or coping problems.  
Based on multivariable analysis, quality of life was determined by depression, somatization, gynecological problems, sleep disturbances, comorbidities before cancer diagnosis, level of adaptive coping, social support, and education. Among the factors that affect the quality of life, gynecological problems, social support, depression, somatization (BSI) is the most powerful factor. | Science Direct |
<table>
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<th></th>
<th>Reducing psychological distress in patients undergoing chemotherapy</th>
<th>(Milanti et al., 2016)</th>
<th>Design: Quasi pretest-posttest quasi-experiment with comparison group. Samples: 100 patients in a cancer hospital in Jakarta, Indonesia. Fifty patients in the intervention group were given a psychoeducational video with positive reassessment, education and relaxation content, while receiving chemotherapy. Instrument: Distress Thermometer</th>
<th>This study examines the relationship between psychoeducational interventions and the level of psychological distress of cervical cancer patients undergoing chemotherapy. Psychological distress is a common problem among cancer patients, but it is largely underreported and untreated. Patients who received psycho-educational interventions had significantly lower levels of distress compared to those in the control group. Psycho-educational therapy is a treatment modality that integrates psychotherapeutic and educational interventions. A self-administered stress management package consisting of information and instructions for dealing with chemotherapy, relaxation techniques and also a self-addressing statement shown in the video significantly improved the psychological status and quality of life of cancer patients undergoing chemotherapy. Cost-effective psycho-educational interventions to reduce the psychological distress experienced by cancer patients are important to consider an easy-to-understand and accessible intervention format</th>
<th>Google Scholar</th>
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<tr>
<td>11</td>
<td>Resilience, Positive Coping, and Quality of Life Among Women Newly Diagnosed with Gynecological Cancers 2016</td>
<td>(Manne et al., 2015)</td>
<td>Design: Cross-sectional Samples: 281 women newly diagnosed with primary gynecologic cancer (ovarian, endometrial, cervical, vulvar and fallopian tubes). Instrument: Block and Block's scale, Positive emotion expression subscale of Emotional Expressiveness Questionnaire, 4-item positive reappraisal subscale of the COPE, The Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being Scale (FACIT-Sp) Peace and Meaning subscale, The Functional Assessment of Cancer Therapy – General (FACT-G), and functional status subscale of the Cancer Rehabilitation Evaluation System (CARES), Medical chart, and demographic data questionnaire Analysis: T-tests and one-way analysis of variance (ANOVA)</td>
<td>More than half of the respondents are women with ovarian cancer and are in stage III or IV. More than eighty-five percent of respondents received chemotherapy. The average age of the respondents is 55 years. Resilience in gynecological cancer patients has a relatively high mean value. This study shows that the better the patient's resilience, the better the quality of life. The presence of symptoms of the disease, the length of time since the diagnosis was made, and the presence of impaired function are associated with low resilience. Age, income, education level, marital status, stage of cancer, and medical intervention were not related to resilience, but respondents who were older or had minimal functional impairment had a better quality of life. The relationship between resilience and quality of life is mediated by coping, the main strategy is the expression of positive emotions. The ability to feel at peace is the most powerful mediator to form resilience which will then improve the quality of life. Positive reappraisal is an indirect mediator of resilience.</td>
<td>Google Scholar</td>
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</table>
| 13 | Family Support for Quality of Life for Cervical Cancer Patients | (Oktaviani & Purwaningsih, 2020) | Design: Correlational descriptive cross sectional approach  
Samples: 88 respondents.  
Instrument: EORTC QLQ C30 Quality of Life Questionnaire,  
Analysis: Chi Square Test | The results showed that respondents who received less family support, most of their quality of life was lacking, namely 8 respondents (47.1%). Respondents whose family support is sufficient, most of them have a poor quality of life, as many as 18 respondents (58.1%). While respondents who received good family support, most of them had a good quality of life as many as 22 respondents (55.0%). The results of the Chi Square test obtained p-value 0.000 < (0.05), so it can be concluded that there is a significant relationship between family support and the quality of life of cervical cancer patients. The better the family support, the better the quality of life for cervical cancer patients | Google Scholar |

| 14 | The effect of informational-emotional support program on illness perceptions and emotional coping of cancer patients undergoing chemotherapy | (Pourfallahi et al., 2020) | Design: Quasi-experimental  
Sample: 80 cancer patients were obtained from the convenient sampling method, divided into treatment and control groups. The control group received routine care.  
Instruments: Brief Cope Scale, Illness Perception Questionnaire-Revised (IPQ-R), Coping Through Emotional Approach Scale.  
Analysis: Multivariate analysis of covariance (MANCOVA) models, t-test, paired t-test, and chi-square | This study initially had 90 participants, but 10 participants dropped out because they did not successfully complete the program. The majority of respondents are women and have stage III cancer. The most cancer suffered by the participants was breast cancer. Illness perception changed in the intervention group in the post-test measurement, but not in the control group. Changes in emotional coping did not occur in both groups. This study shows that the provision of nurse-led informational-emotional support programs causes changes in illness perception, but does not change emotional coping. | Google Scholar |

| 15 | It's never too late - Balance and endurance training improves functional performance, quality of life, and alleviates neuropathic symptoms in cancer survivors suffering from chemotherapy-induced peripheral neuropathy: Results | (Kneis et al., 2019) | Design: Randomized control trial.  
Samples: 41 cancer patients including gynecological cancer who complained of chemotherapy-induced peripheral neuropathy (CIPN).  
Instruments: Force plate Leonardo Mechanograph® GRFP, Novotec MedicalGmbH, Pforzheim, Germany, self-reported CIPN symptoms (EORTC QLQ-CIPN20).  
Endurance training menurunkan CIPN symptoms di kedua group, sedangkan balance training meningkatkan patients' functional status. 37 patients memiliki training compliance ≥70%; kelompok kontrol menurunkan pola ayunan selama latihan demi-tandem stance (−76 mm, 95% CI -141−17; CG: -6 mm, 95% CI -52−50), meningkatkan durasi standing on one leg on unstable surface (11 s, 95% CI 18−17; CG:0s,95%CI0−5) dan melaporkan keluhan motorik (−8points, 95% CI -18−0; CG: -2points 95% CI -6−2).kedua group melaporkan penurunan keluhan secara umum- (IG: -10points, 95% CI -17−4; CG: - | Science Direct |
<p>| 10 | of a randomized controlled trial | Analysis: Mann-Whitney-U-test and Wilcoxon signed-rank test | 6 points, 95% CI -11 to 1) dan sensory symptoms (IG: -7 points, 95% CI -15 to 0; CG: -7 points, 95% CI -15 to 0), hanya kelompok kontrol yang menunjukkan peningkatan vibration sense (knuckle: 0.8 points, 95% CI 0.3 to 1.3; IG: 0.0 points, 95% CI -1.1 to 0.9; patella: 1.0 points, 95% CI 0.4 to 1.6; IG: -0.8 points, 95% CI -0.2 to 0.0). Maximum power output selama cardiopulmonary exercise test meningkat pada kedua groups (IG dan CG: 0.1 W/kg, 95% CI 0.0 to 0.2), hanya group kontrol yang meningkat tinggi lompatan (2 cm, 95% CI 0.5 to 3.5; IG: 1 cm, 95% CI -0.4 to 3.2). |
| 16 | Optimism and social support as contributing factors to spirituality in Cancer patients | Design: Cross Sectional, multi center. | There are differences in the level of spirituality (meaning/peace and belief) in respondents aged 65 with &gt;65 years, gender, marital status, occupation, and cancer management. Cancer patients who are married or have a partner have a greater sense of peace than those who are not married or do not have a partner. Female gender, age &gt;65 years, not working, and receiving chemotherapy and radiotherapy had a higher confidence score than male gender, 65 years old, working, and only receiving chemotherapy. Meaning/peace and confidence are positively correlated with optimism and social support. Optimism and social support correlate with spiritual coping in clients receiving oncology management. |
| 17 | Unmet psycho-social needs, coping strategies and psychological distress among people with cancer: Evidence from Pakistan | Design: Cross Sectional, Correlation Studies. | Most of the respondents are aged 18-40 years, are married, live in urban areas, have a small family system, and are in the early stages of cancer and receiving chemotherapy. The method of care received was significantly related to gender, employment status, family system, and level of education. The need for information is the most dominant, followed by psychological needs. Most of the respondents have maladaptive coping. The coping domain is not directly related to psychological distress, but a significant difference is obtained from the comparison between respondents who have adaptive and maladaptive coping. Neglect of fulfilling the psychological needs of patients with cancer indicates the need for appropriate psychological interventions so as to improve the overall process of illness and recovery. |
| 18 | Evaluation of the effect of caring program based on Roy adaptation | Design: Clinical Trial pre-post test design with control group. | In this study, no significant difference was observed in the number of chemotherapy courses in the groups before intervention according to chi-square test (P = 0.667). |</p>
<table>
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<tr>
<th>Model in physiology and self-concept dimensions on fatigue of elderly cancer patients undergoing chemotherapy</th>
<th>Female, were divided into treatment and control groups. Instrument: Kuesioner Multidimensional Fatigue Inventory (MFI-20), Interview and observation. Analysis: Chi-square, paired t-test, Mann-Whitney test, Wilcoxon test, analysis of variance and Kruskal-Wallis. Mean score of fatigue according to the paired T-Test was 60.63 ± 5.92 and 58.84 ± 6.28, respectively, in intervention and control groups before the intervention and it was 50.43 ± 7.42 and 58.46 ± 5.68, respectively, in intervention and control groups after the intervention (p-value &lt;0.001).</th>
<th>Science Direct</th>
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<tbody>
<tr>
<td>Evaluating the Effect of a Video Education Curriculum for First Time Breast Cancer Patients: a Prospective RCT Feasibility Study</td>
<td>Design: Randomized Controlled Trial. Sample: 28 cancer patients were divided into treatment and control groups. Instrument: Kuesioner Analysis: Mann Whitney. This pilot study revealed that patients who were given video education experienced greater improvement in some of these areas, with the largest increases seen in patients who received personalized videos that were specific to their tumor (based on tumor receptor status), but statistical tests showed no difference with the control group. The results of this study indicate the potential of providing personalized educational videos to breast cancer patients at the beginning of diagnosis, especially to provide complex explanations of tumor types.</td>
<td>Science Direct</td>
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<td>The effect of the preoperational psychoeducation program for Taiwanese breast cancer patients: A three-month follow-up study</td>
<td>Design: Quasy experiment. Sample: 137 adult women diagnosed with breast cancer. Instrument: Distress Thermometer (DT), Skala The Preoperational CancerWorry Scale (PSCWS), The Cancer Behavior Inventory-BriefVersion (CBI-B) Analysis: ANOVA. The results of this study indicate that psychoeducational programs help patients relieve distress, calm worries and increase self-efficacy before surgery.</td>
<td>Science Direct</td>
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<td>Baseline audiological profiling of South African females with cervical cancer: an important attribute for assessing cisplatin-associated ototoxicity</td>
<td>Design: Descriptive study. Sample: women diagnosed with cervical cancer, totaling 82 participants. Instrument: Appropriate management, audiological assessments, popular antineoplastic agent. Analysis: All statistical analyses were conducted using SAS 9.4 (Johannesburg, SA). Most of the respondents were 50 years old, ethnically African, were at a stage above or equal to IIB, and were HIV positive. The majority complained of decreased hearing, especially in the left ear and experienced tinnitus. Most chemotherapy is ototoxic. Appropriate management of these patients is very important in order to reduce the side effects of hearing loss and improve the individual's quality of life, as well as to facilitate the right decision making regarding the initiation of cisplatin chemotherapy.</td>
<td>Science Direct</td>
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<tr>
<td>Impact of Different Sociodemographic Factors on Mental Health Status of Female Cancer Patients Receiving Chemotherapy for Recurrent Disease</td>
<td>Cross sectional. Sample 40 participants with breast and ovarian cancer who underwent a second or more chemotherapy. Mean and standard deviation and Levene's F values were calculated. If Levene's F value was</td>
<td>Science Direct</td>
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<tr>
<td>Page</td>
<td>Study Title</td>
<td>Design</td>
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<td>23</td>
<td>Body Changes After Cancer: Female Cancer Patients’ Perceived Social Support and Their Perspective on Care (Melissant et al., 2019)</td>
<td>Design: Descriptive study</td>
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<td>24</td>
<td>Prevalence of Lifestyle Behaviors and Associations with Health-Related Quality of Life Among Older Female Cancer Survivors (Krok-Schoen et al., 2020)</td>
<td>Design: Descriptive analysis, correlation, and stepwise linear regression.</td>
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<td>25</td>
<td>Relationship Between Spirituality, Meaning in Life, Psychological Distress, Wish for Hastened Death, and Their Influence on Quality of Life in Palliative Care Patients</td>
<td>IBM SPSS Statistics version 25.0 was used.</td>
</tr>
<tr>
<td>26</td>
<td>Pilot Pragmatic Randomized Trial Of mHealth Mindfulness-Based Intervention for Advanced Cancer Patients And Their Caregiver</td>
<td>Design: Exploratory, cross-sectional study. Using German, French and Italian.</td>
</tr>
<tr>
<td>27</td>
<td>Short- and Long-Term Impact of Adapted Physical Activity and Diet Counseling During Adjuvant Breast Cancer Therapy: the “APAD1” Rendomized Controlled Trial</td>
<td>Design: Randomized controlled trial. Sample: women diagnosed with early breast cancer totaled 143 participants. Instrument: Completed baseline assessment, The APAD experimental arm, The UC control arm</td>
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</table>
In conducting a journal review, it can be done by using literature review techniques, including determining compare, contrast, critique, synthesize, summarize.

**Similarity:** Of the thirty journals that have been analyzed, there are some similarities regarding Android-based Education on Self-Care Ability in Improving the Quality of Life of Gynecological Cancer Patients With Chemotherapy, namely similarities seen from the data collection methods used in the study. According to research conducted by Cheville, et al., Carayol et al., Kubo et al., Galiano-Castillo et al., Kinjo et al., Ozeri et al., Sulakvelidze et al, and Kneis et al. the methods used are data collection methods such as conducting interviews, observations, questionnaires and experiments. This is in line with research conducted by Nguyen et al., Bouya et al., Bernard et al., Mulhaeriah et al., Krok-Schoen et al., Melissant et al., Rubinsak et al., Mukherjee et al., Paken et al., Hung et al., Huang et al., Kim et al., Osann et al., Milanli et al., Manne et al, Ladesvita et al., Oktaviani & Purwaningsih, Hajalimohammadi et al., Pourfallahi et al., Ciria-Suarez et al., Shahid et al. The method of data collection also uses the method of observation, interviews, questionnaires and experiments.

**Inequality:** Of the thirty journals that have been analyzed, there are differences between one and the other, because they look at the results of research on the journals used. According to research conducted by Kubo et al., Nguyen et al., Kinjo et al., Krok-Schoen et al., Huang et al., Osann et al., Ladesvita et al., Pourfallahi et al., Kneis et al., Shahid et al. that the causes of the problems that occur in this study are (1). Lack of renewal of educational methods that are easier and more convenient to access and efficient, (2). The decrease in the patient's self-care ability, (3). Lack of information delivery to patients and families about daily self-care due to illness and the therapy they are undergoing. This contradicts the research conducted by Galiano-Castillo et al., Bouya et al., Mulhaeriah et al., Mukherjee

### IV. DISCUSSION

<table>
<thead>
<tr>
<th>Cancer A Randomized Clinical Trial</th>
<th>Records (EHRs), Brochure, Brief Pain Inventory, EQ-5D-3L Analysis: the AM-PAC-CAT,</th>
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<tr>
<td><strong>29</strong> Application of the Oral Assessment Guide (OAG) in Cancer Patients With Chemotherapy (Ladesvita et al., 2020)</td>
<td>Design: Comparative analysis compared conventional assessment with OAG assessment as Evidence Based Nursing (EBN). Samples: The number of patients is 71 people. Instrument: Oral Assessment Guide (OAG). OAG is an instrument for assessing oral mucositis with observation methods in eight categories, namely the ability to swallow, the condition of the lips, tongue, teeth, mucous membranes, gingiva, saliva levels, and bad breath. Results: Based on the results of conventional studies, from 71 chemotherapy patients, 14 people experienced mucositis. The OAG study found 32 people had mucositis. The results of the calculation of the sensitivity of the instrument, the sensitivity value of the OAG assessment technique shows the figure of 45.07%, while the sensitivity of the conventional assessment is 19.7%. Conclusion: The sensitivity of the OAG mucositis assessment technique in pre-chemotherapeutic patients is higher than the assessment technique used in the current ward. The OAG instrument is suitable for use in the treatment room because most of the methods are observation and the assessment time is not more than 1 minute. Google Scholar</td>
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<tr>
<td><strong>30</strong> Adjuvant Chemotherapy for Low Clinical Risk Breast Cancer Defined by Modified Version of Adjuvant Online: A Propensity Score Matched SEER Analysis (Huang et al., 2021)</td>
<td>Design: Retrospective Study Sample: 48,857 breast cancer patients aged Patient data were retrieved from the SEER 18 database using SEER Stat, version 8.3.5. Instrument: SEER 18 Database Analysis: Pearson's 2 test, Kaplan-Meier analysis and Multivariable Cox regression This study shows that chemotherapy does not have a beneficial effect on breast cancer patients with HR-positive, HER2-negative, and axillary node-negative breast cancer who are categorized as low risk patients by the Adjuvant application! On line. This is because chemotherapy has a toxic effect on patients with low risk criteria. Google Scholar</td>
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et al, Cheville et al, Carayol et al, Kubo et al 2020, Bouya et al, Bernard et al, Mulhaeriah et al., Melissant et al, Rubinsak et al, Paken et al, Hung et al, Ozeriet al, Sulakvelidze et al, Kim et al, Milanti et al, Manne et al, Oktaviani & Purwaningsih, Hajalimohammadi et al, that the causes of problems that occur in This study shows that there is an influence on, (1). The quality of information on the ability of self-care in improving the quality of life, (2). The quality of service in providing the necessary information or training about the application so that positive health behavior changes occur. (3). System quality has a significant effect on user satisfaction

**View:** From the analysis of several journals, it was found that

**Utilization of Android-based applications in providing health education**

*The Mhealth* application is used by nurses in Australia as a medium to improve oral chemotherapy compliance. Interventions through mHealth are reminders to take regular daily medications, assessment of drug side effects and evidence-based self-care advice delivered in real time and serving questions from patients. Interview results from users said *mhealth* helped in establishing medication routines, increasing awareness of self-care and making decisions based on advice from nurses through mhealth. This application is proven to improve therapy adherence and patient side effect management capabilities during home care (Pereira-Salgado et al., 2017; (Faidah and wildani., 2021).

*The Oncology Family App* is an application developed in Australia to support families who care for cancer patients with various features such as patient information and disease management plans, blood test results, 24-hour service telephone numbers and google maps to hospitals. As many as 68% of parents who use the application express enthusiasm and satisfaction with the application in providing information.

**Utilization of android-based applications in reporting and symptoms**

The *TOGETHER Care* application developed by (Oakley-Girvan et al 2021; Faidah and wildani 2021) is used for symptom identification in cancer survivors and provides reminder features, medication modules, diet guidance, and self-care for cancer sufferers who are treated at home. This application makes it easier for caregivers to record data regarding symptoms or complaints of cancer sufferers and reporting to health workers. This research supports the results of the literature study presented by the researcher that the Android-based application, one of which is mHealth, is useful in reporting and symptom management in oncology services.

Penelitian (Kunin 2016; (Faidah and wildani, 2021)) using a randomized controlled pilot trial design proves that web-based applications can increase knowledge about cancer and its therapy in adolescent and young adult patients. Android-based applications, one of which is Mhealth, has proven to be effective in providing health education, especially for the adolescent age group, most of whom use gadgets and are able to understand instructions from the application.

**Utilization of android-based applications in providing psychological social support**

Physical and social psychological empowerment of cancer patients is a core principle of patient-centred care. Technological advances in the form of mhealth and therapeutic videos are able to facilitate empowerment interventions by developing motivation and enthusiasm so as to reduce stress and fear, improve coping skills and self-management of symptoms related to illness and therapy. One of the mhealth applications is Re Mission 2 which promotes patient empowerment, increased self-efficacy, encourages positive emotions and motivation for children and adolescents and cancer parents to comply with treatment therapy. (Govender et al., 2015; (Faidah and Wildani, 2021).

MHealth is very likely to be applied in Indonesia, especially in supporting oncology services. Almost all children, teenagers and parents have smartphones so that Android-based applications are easily accessible anywhere and anytime. For nurses, the application can be used as a method of assessing cancer patients, providing nursing interventions such as monitoring chemotherapy side effects, symptom management, health education, and providing psychological social support. It is hoped that through this literature review, it can generate motivation and the role of nurses in technology development, especially Android-based applications as well as in the application of mhealth applications that are already available as an effort to improve the quality of oncology services in the cancer treatment process. (Mehdizadeh et al., 2019; Faidah and Wildani, 2021)

Several studies analyzed prove that Android-based applications with a variety of features can increase knowledge and skills, facilitate symptom reporting, provide psychological social support through interaction with peer groups, reduce stress and depression. The application makes it easy to provide supportive care and palliative care for cancer patients. Android-based applications are a solution to support services in the oncology area, especially gynecological cancer because it has been proven effective and provides benefits for patients with cancer and gynecological cancer.

**Comparison:** The results of research conducted by Kubo et al 2019, Nguyen et al, Kinjo et al, Krok-Schoen et al, Huang et al, Osann et al, Ladessvita et al, Pourfallahi et al, Kneis et al, Shahid et al. that the causes of problems in educational applications from three aspects, namely, the Application System. Patients and medical personnel (human resources), Meanwhile, according to Galiano-Castillo et al, Bouya et al, Mulhaeriah et al, Mukherjee et al, Cheville et al, Carayol et al, Kubo et al 2020, Bouya et al, Bernard et al, Mulhaeriah et al, Melissant et al, Rubinsak et al, Paken et al, Hung et al, Ozeriet al, Sulakvelidze et al, Kim et al, Milanti et al, Manne et al, Oktaviani & Purwaningsih, Hajalimohammadi et al, that the causes of problems in educational applications can be seen from two aspects, namely in terms of human resources, aspects of the implementation process. From these two opinions it is said that the causes of problems in android-based educational applications on self-care abilities include: aspects of the application system, patients, human resources and aspects of the implementation process so that it will affect the self-care of gynecological cancer patients in improving their quality of life.

**Summary:** The development of information and communication technology and its supporting facilities has now been widely felt by the wider community to reach the health sector. Android-based applications have been developed for certain purposes that can improve the quality of health. Patients undergoing chemotherapy therapy should be monitored remotely through an android-based
application where patients can report clinical parameters, quality of life, and symptoms experienced to health care providers. Education that is carried out correctly and clearly can encourage patients to comply with the instructions given through the application. The maximum benefit of the application for users needs support from service providers in providing the necessary information or training about the application so that positive health behavior changes occur such as conducting early examinations.

Gynecological cancer patients who receive chemotherapy have a tendency to feel anxious and a decrease in the patient's self-care ability. Limitations of self-care occur due to the lack of information delivery to patients and families about daily self-care due to illness and the therapy they are undergoing. This is due to lack of knowledge. The presence of an android-based application that provides simulations for cancer patients to be able to see or experience virtually how to properly self-care.

Things that need attention from a health application include application design, content, interface and functionality. The use of textual related images can reduce reading difficulties and facilitate communication. The need to create visual representations and illustrate applications, figures, photos and videos obtained in the real care environment of patients undergoing chemotherapy is included to complement the textual content and facilitate understanding for users, especially for those with low levels of education. (Cruz et al., 2021; Pramiasti Dodik Hana., 2019).

A more effective mobile health app has at least seven essential elements of patient empowerment including education, self-monitoring, feedback, customized information, self-management training, personalized exercise program, and communication with other providers or survivors. (Starmer et al., 2018; Pramiasti Dodik Hana., 2019). Educational content can be woven into the app in the form of links to quality information, information about the importance of exercise during therapy, and strategies for managing medication side effects. Education can be embedded in the form of videos that are given regularly about visualizing the patient's treatment expectations for quality of life or hope for healing.

Health education or health promotion is an asset in health care and can provide individuals or groups with relevant information to prevent disease or improve its consequences. Health literacy is an individual's ability to meet the complex health demands of modern society. Self-efficacy can also be seen as a belief in a person's ability to perform well in a life domain that may be associated with an increase in health behaviors or a decrease in disease burden. Health education using Android-based applications is an innovative model used to improve health literacy and improve health-related behaviors, including self-efficacy and positive behavior change. Cancer patients can benefit from health applications to improve health literacy, promote healthy lifestyle behavior changes, such as self-efficacy and self-management, reduce the need for nursing care, and improve quality of life after surgery or therapy. (Lee et al., 2021; Pramiasti Dodik Hana., 2019).

V. CONCLUSION

From the research results of thirty journals that have been analyzed, the conclusion from this literature review study is that the application of Android-based application technology media has an effect on increasing knowledge about health in self-care. On average, respondents stated that they enjoy getting information through technology because it is more motivating and makes it easier to get information. Analysis of the results of several studies found that physical, psychological and behavioral therapy can be recommended to improve the quality of life in gynecologic cancer patients.

Health education and interventions through android-based applications can have a positive impact on improving the quality of health, both direct impacts on physical health and indirect psychological and social impacts as well as increasing health literacy. Interventions using android-based applications are relatively cheaper in terms of cost. Applications can also protect personal privacy, realize individual interventions, provide better and more accurate ways of conducting interventions and implementation.

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AUTHORS

First Author – Nursalam Nursalam, Faculty of Nursing Universitas Airlangga Surabaya Indonesia and nursalam@fkp.unair.ac.id,
Second Author – Awatiful Azza, Doctoral Student Faculty of Nursing Universitas Airlangga Surabaya Indonesia, Universitas Muhammadiyah Jember and awatiful.azza-2020@fkp.unair.ac.id,
Third Author – Chanif, Doctoral Student Faculty of Nursing Universitas Airlangga Surabaya Indonesia, Universitas Muhammadiyah Semarang, and chanif-2020@fkp.unair.ac.id.
Four Author – Erna Dwi Wahyu, Doctoral Student Faculty of Nursing Universitas Airlangga Surabaya Indonesia, Faculty of Nursing Universitas Airlangga Surabaya Indonesia and erna-d-w@fkp.unair.ac.id.
Five Author – Machmudah, Doctoral Student Faculty of Nursing Universitas Airlangga Surabaya Indonesia, Universitas Muhammadiyah Semarang, and machmudah-2020@fkp.unair.ac.id.
Six Author – Nurus Safaah, Doctoral Student Faculty of Nursing Universitas Airlangga Surabaya Indonesia, Institut Ilmu Kesehatan Nahdlatul Ulama Tuban and nurus.safaah-2020@fkp.unair.ac.id.
Seven Author – Sri Utami, Doctoral Student Faculty of Nursing Universitas Airlangga Surabaya Indonesia, Universitas Riau Pekanbaru and sri.utami-2020@fkp.unair.ac.id.
Eight Author – Tiyas Kusumaningrum, Doctoral Student Faculty of Nursing Universitas Airlangga Surabaya Indonesia, Faculty of Nursing Universitas Airlangga Surabaya Indonesia and tiyas-k@fkp.unair.ac.id.
Nine Author – Wiwit Dwi Nurbadriyah, Doctoral Student Faculty of Nursing Universitas Airlangga Surabaya Indonesia, STIKes Kepanjen Malang Indonesia and wiwit.dwi.nurbadriyah-2020@fkp.unair.ac.id,

Correspondence Author – Wiwit Dwi Nurbadriyah, wiwit.dwi.nurbadriyah-2020@fkp.unair.ac.id, Doctoral Student Faculty of Nursing Universitas Airlangga Surabaya Indonesia, STIKes Kepanjen Malang Indonesia, +6281331118957
The “Verstehen” and the Meaning of Meaning: for a Sociology between the Cognitive Sciences

Author Francesco Paolo Pinello
University of Enna “Kore”, Italy
Sciences of Man and Society

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Abstract: the topics I deal with concern the science of symbolism (on which I think it is useful to return to in terms of cognitive science), which studying the influences of language on thought (the meaning of meaning), and the question the issue of the hermeneutic circle (language/symbols; thought/mind/brain; mental, physical, chemical, biological, social, computer/telematic references) initially developed, in sociology (Verstehen), but in a very reductionist way, by Max Weber. Language (gestures/symbols), thought (brain-mind) and references (mental, physical, chemical, biological, social, computer/telematic) – see the «Ogden and Richards Triangle» – constitute three distinguishable and different levels. Is it possible to apply Marr’s «Three Level Model» to the «Ogden and Richards Triangle», triangle designed as a tool to formulate definitions for “automatic thinking machines”, king into consideration the way the mind and self of human beings are structured and function biologically and socially? Is it to this question that I try to give a sociological answer, but in terms of cognitive sciences (or, if you prefer, cognitive science), proposing a new triangular model (the «Simulation Triangle»). In the next article (also in this Journal) I will address the issue of the «Mead Triangle», studying it and juxtaposing it with the «Ogden and Richards Triangle» and Marr’s «Three Level Model». The «Mead Triangle» is a conceptual representation (George Hebert Mead did not produce a graph of it) of the logical structure of the meaning of the social act. The «Ogden and Richards Triangle», on the other hand, is instead a graphical representation, by the authors, of the meaning of meaning. These are fundamental issues that are not always, indeed almost never, at least in Italy, taken into consideration, more or less seriously and with knowledge, by those who do sociology and, in particular, social science methodology.

Index Terms – Verstehen, Science of symbolism, Hermeneutic circle, Ogden and Richards Triangle, Marr’s three-level model, Simulation Triangle.

I. INTRODUCTION

Before starting, I would like to point out that the translations from Italian of the citations of the authors taken into consideration were done by me. The themes I address concern the issue of the hermeneutic circle (language/symbols - thought/mind/brain - mental, physical, chemical, biological, social, computer/telematic references) initially introduced, in sociology (Verstehen, Verstehende Soziologie, Sociology of the understanding of individual action with a meaning), but in a very reductionist way, by Max Weber (see Pinello, 2022; Pinello, 2021; Pinello, 2019), an author who introduced also the concept and notion of social action, distinguishing rational actions (rational action with respect to goal and rational action with respect to value) from emotional-affective and traditional actions (affective action and traditional action). Idealtypes of social action to which the idealtypes of authority are to be applied: idealtype of charismatic power, idealtype of traditional power, idealtype of legal power. The idealtype, in this way, becomes an abstract scheme, today we can even call it metaphysical (hence the recourse to the triangles mentioned in this article and the cognitive sciences), for historical understanding, i.e. for the scientific systematisation of empirical data.

As idealtypes, in addition to social action and authority, one can contrast Verstehen with Erklären, understand with explain. The Erklären is of nineteenth-century positivist vintage and is based on the biunivocal search for cause-effect connections. Verstehen, on the other hand, researches social dynamics as multi-causal and concausal processes. Not the nomoi in objects but the idios, starting with the subjects. Weber, because of his idealtypes, can be considered the initiator of constructivism in the social sciences (see Berger and Luckmann, 2019), as opposed to the 19th century positivism of Comte, Durkheim and Pareto. Verstehen, understood in the manner of Weber, does not only consist in researching why, for example, a ideal-typical group of ideal-typical individuals, exercising an idealtype of authority, pursues certain goals by means of certain rational actions, believes in certain values by trying to realise them through certain rational actions, is made up of subjects bound together by certain affections and traditions and, therefore, of
ideal-subjects who act accordingly (for cultural anthropology see Miceli, 2005). Indeed, it also implies an ethics of the social scientist (idealtype of scientist or social ideal-scientist). The social scientist (social ideal-scientist) must observe and understand in an avulatative manner (Wertfreiheit, “freedom from values”). Avulativeness is a (metaphysical) ought-to-be and not a being, because the social scientist attaches himself (attachment; see Pinello, 2022), as a secure basis, to their own value-driven assumptions, his own value-oriented knowledge, his own value-oriented skills and abilities, his own value-oriented lifestyle (cf. Berzano, 2017) and his own previous research, seeking confirmation of all this during his explorations of reality (on the problem of avulatativity, bias and cognitive heuristics, see Pinello, 2021). And values are not values in the abstract, but one’s own personal values, relative to the human being under consideration. On the human being and the genealogy of morality, law and science, see Pinello (2021). Not to mention the opportunities-limitations and orientations imposed on him by the “scientific research factory” and the need to obtain funding and return results (those expected at the funding stage) as quickly as possible. It thus happens that a considerable part of the scientific results obtained today not reproducible (the reproducibility crisis). As we shall see for Ogden and Richards, who make an important contribution to symbolic interactionism, unlike Weber it is instead a question of studying the meaning of meaning, taking into account and problematising not only ideas (the concepts, notions, mental schemas, idealtypes), but also the brain-mind and reality (the references). I now offer some insights, taken from Ogden and Richards (1966), on the hermeneutic circle, language and verbal social action (on social action, the social act, social interaction, attachment and the secure base, see Pinello, 2022),

If we consider other activities, such as eating or cycling, [they] are similar to language in that they are subject to a variable degree of control [see Pinello, 2019] […] Besides symbolising a reference, words [and actions] are also signs of emotions, attitudes, moods, sentiments, interests or mental states in which the references occur. They thus constitute signs, in that they are united with these attitudes and interests in certain contexts [the symbolic and signic situations], more or less wide or restricted. Thus, in uttering a phrase or hearing it [or performing or observing an action], we give rise to, or respectively are faced with, at least two sign situations. One, by means of symbols, interprets the reference and thus the referent; the other, by means of verbal signs, interprets the attitude, mood, interest, goal, desire, and so on, of the speaker [or agent], and from there goes back to the situation, circumstances, and conditions under which the sentence was uttered [and the action performed] […] [Example:] Suppose […] that the speaker, in addition to reporting, takes a certain attitude towards the audience, e.g. a friendly attitude (Ogden and Richards, 1966, p. 242, 246 and 255; see Pinello, 2019).

As far as Verstehen is concerned, its original Weberian definition can be extended to encompass, in the terms of the science of symbolism by Ogden and Richards, meaning as practical consequences, meaning as theoretical consequences, the meaning of a verbal or non-verbal action, «what the speaker», in terms of meaning, «intends the listener to hear and do» and «what the speaker intends the listener to take as reference». One thinks, for example, of the cases of lying, fake news, faith news, disinformation, misinformation, and, in the opposite sense, of the case of the batter who, «in a baseball game, repels a ball well [by correctly interpreting] the “meaning” of the pitcher’s action, ignoring some of the [false or misinforming] signals shown to him» (Ogden and Richards, 1966, p. 219). But such an extension is still not enough. On meaning as practical consequences and as theoretical consequences, Ogden and Richards write:

«Is the meaning [intention] of a phrase what is in the mind of the speaker at the moment the phrase is spoken or is it what is in the mind of the listener at the moment the phrase is heard? Neither […] It is certainly not what is in the mind of the listener, for he may completely misunderstand the speaker’s intention, but neither is it what is in the mind of the speaker, for he may intentionally obscure in his enunciate the thoughts that are in his brain, and evidently he could not do this if the meaning of his sentence were exactly what he had in his head […] the following formulation [does] the case: The meaning of a sentence is what the speaker intends to be understood by the listener» [Gardiner, 1922, p. 361]. Here “to be understood” is an abbreviation. It stands for: (a) to be referred to + (b) to find correspondence in + (c) to be received with regard to the referent + (d) to be received with regard to the speaker + (e) to assume that the speaker is referring to + (f) that the speaker is wishing, etc. etc. These complications are cited to show how vague, for the most part, the terms commonly judged satisfactory are. A word such as «comprehend» [Verstehen], unless it undergoes special treatment [which is not the one Weber has put in place], is far too vague to be used except under certain conditions or at levels of speech where no real understanding of the subject matter [in the sense of reference and, I would add, of cerebro-mental processes] is possible […] the expression of the speaker’s intention [as we shall see] is one of the five normal functions of language […] as with the other functions, its importance varies immensely from person to person and from occasion to occasion. Grasping the multiplicity of the normal functions of language is of vital interest in seriously addressing the problem of meaning (Ogden and Richards, 1966, p. 217-218).

It is implicit that, in order to approach Weber, one must be clear about the distinction between “meaning as an act of will” (goal, value, etc.) and biological-teleological meaning, for which biology (which Weber excludes from his field of research), teleology, i.e. location within a system, that is also biological (cerebro-mental-body-environmental), and relations (not only social ones but also the electro-chemical ones of the connectome, in the singular and plural or interactionism at the connectomes level) count. To extend the approach beyond Weber, it is necessary to distinguish between symbols and signs or sign-sensations. Signs are «the non-verbal sensations and images that accompany references». On them «little reliance can be placed». Symbols are important precisely because signs «can be relied upon little». What exactly is being judged when making the most common judgements, such as «I am thinking», «this is a chair», «this is good»? When one attempts to make secondary judgements on these primary judgements, «one is very likely to make mistakes […] for the obvious reason that verification is so difficult […] In abstract thought […] it is not the references that determine the symbols, but it is the links and interconnections between the symbols that determine the reference» (Ogden and Richards, 1966, pp. 226-227). And this is also the problem with the Weberian idealtype.
For George H. Mead, which I will discuss in the next article (again in this Journal and in the context of these issues), the logical structure of meaning of social act (and here we move from social action to social act, see Pinello, 2022, and Pinello, 2019)

is to be found in the threefold relationship of the gesture to the response and to the result of a given social act. The response, on the part of the second organism, represents the interpretation and reveals the meaning of that gesture insofar as it is indicative of the result of the social act initiated by it and in which both organisms are thus involved. The threefold or triadic relationship between the gesture, the adaptive response, and the result of the social act initiated by the gesture is the basis of meaning (Mead, 2018, p. 127).

In the sense that it is the elementary, everyday, generally automatic linguistic social act. Mead’s social act further expands the Verstehen notion from the theoretical positions of Weber and Ogden and Richards. Starting from this definition of Mead, I propose, in this introduction, the graph of “Mead’s Triangle” - figure no. 2 - (or “Mead’s Meaning Base Triangle”), which I reconstructed and drew from the Italian translation (Mead, 2018, p. 37) of the book published posthumously in Chicago in 1934 (University of Chicago Press), edited by Mead’s student Charles William Morris, with the title «Mind, Self and Society. From the Standpoint of a Social Behaviorist», a graph that I explain in the next article (also in this Journal). I also provide the graph of the “Ogden and Richards Triangle” - figure no. 1 - (or “Ogden and Richards Semantic Triangle” or “Ogden and Richards Triangle of Reference”), proposed by the authors in the book published in London in 1923 (Routledge & Kegan Paul Ltd), with the title «A Study of the Influence of Language upon Thought and of Sciences of Symbolism», a graph I derived from the Italian translation of the 1966 work and which I explain in the second paragraph. Incidentally, I say that Ogden and Richards’ (1966) book, for its physical-material references, is comparable in some respects to Wittgenstein’s Tractatus (1984) and that, even further upstream, it can be traced back, as a critique of metaphysics, it is traceable to Kant’s notions of phenomenon, noumenon, distinction between what is knowable and what is not knowable and what is residual, a priori forms of sensibility and intellect (Kant, 1983). In the third paragraph I also deal with the “Three Levels of Explanation of Complex Information Processing Systems” - figure no. 3 - model proposed by David C. Marr (1982; Tabossi, 1998).

Alberto Marradi (2007, p. 27-46), a rare case among Italian social science methodologists, also dealt with the problem of knowledge, i.e. the relationship between reality, thought and language (the relationship between reality and thought; the relationship between reality and language; the relationship between thought and language; data matrices and reality). Marradi taking into consideration both the symbol, thought, and reality external to thought – I say this using the “Ogden and Richards triangle” –, writes:

The fundamental problem of all kinds of knowledge - of scientific as well as ordinary knowledge - consists in the fact that our thought is not, nor can it in any way produce, a photographic copy of the reality it wants to know, and in the fact that language is not an exact reproduction of thought. Consequently, all our knowledge of reality can only be uncertain, fallible, revisable. Only a few scientists and philosophers have thematised this mismatch between reality, thought and language (Marradi, 2007, p. 27) [...] all attempts to give scientific knowledge a foundation of absolute certainty [...] have foundered against the observation, inevitable in gnoseology [epistemology], that there can be no rigid joints [connection joint] between the sphere of referents (reality), the sphere of thought and the sphere of language (Marradi, 2007, p. 24; see also Marradi, 1994).

It should not be assumed that the theories of all authors can be represented, as in Marradi’s case, using the “Ogden and Richards Triangle” in its entirety. For many authors (Frege, Quine, first-Wittgenstein – for whom only the references of the physical and material world and logical propositions are to be taken into account – neo-Kantians, behaviourists – for whom the human mind is a “black box” –, extensional semiotics, some cognitivists etc.), in fact, the direct passage from the objects of external reality (physical referents) to symbols can be taken into account, to the exclusion of the human mind, thought, the brain. This is, as we shall see, the side of basic of the “Ogden and Richards Triangle” and not the Triangle in its entirety. Quine observes that, in the early stages of infants’ education, language and the world are known simultaneously and jointly (see Quine, 1969, p. 919-920). The conception of sociology of Weber (see Pinello, 2019 and Pinello 2021), Parsons (see Pinello, 2022, i.e. the previous article published in this Journal) and many other sociologists, despite the reference to empirical experience, directly connects symbols (words and social actions) with ideas (the left-hand side of the «Ogden and Richards triangle»), deliberately ignoring biology, the brainmind, heredity and, in other words, the human being in its real existence and consistency (see Pinello, 2021). As I have already written in the conclusions of my article «The Social Act, Social Action and Social Interactions: A Secure Basis for Social Bonding»:

I agree with the historian of mathematics Morris Kline (1985) that mathematics has played and continues to play, like physics, a fundamental and foundational mediating function between human beings and nature and, consequently, between the world “inside” human beings (the internal environments) and the world “outside” (the external environments). Mathematics and physics, in fact, form an exceptionally strong bridge (as Kline writes) between us and the outside world. This bridge, however, although exceptionally strong, is as if it were without a foundation on dry land, because it is «not yet firmly anchored either to reality or to the human mind» (Kline, 1985, p. 362; see Pinello, 2022).

Hence the need to address the issue of the «grounding on dry land» of the products of reflection and abstraction and their anchoring both to the human mind (cerebro-mental and electro-chemical processes, connectome) and to physical, chemical, biological, social, computer/telematic reality (see Pinello, 2022), on the premise that the junction between referents and linguistic terms is not rigid, but neither is it entirely arbitrary (see Marradi, 2007, p. 34; Saussure, 1974;
Tabossi, 2002). First of all, one must consider how the correspondence between reality, thought and language, at a non-reflective, everyday, automatic level, is self-evident, obvious, immediate. This is a serious indication that biases and heuristics are at work. That is why my research interest is also cognitive biases and heuristics (see Pinello, 2021). From here (i.e. from the starting point that there can be no rigid joints between the sphere of referents - reality -, the sphere of thought and the sphere of language, but the joints is not entirely arbitrary either), on a reflexive level, the problems of representation, interpretation, understanding, explanation and simulation (analogue, digital, robotics) of human behaviour (see Datteri, 2012). The issue is clearly much more complicated than how Weber initially thought and explained it (Verstehen). Marradi, declaring his opposition to Bachelard’s so-called coupure épistemologique, i.e. the need to clearly separate scientific language from ordinary language, states that he prefers Schutz’s thesis according to which as far as it is possible for them, social scientists must use ordinary linguistic terms (natural-historical languages), illustrating them in order to make them comprehensible to their objects. Objects which, unlike the physical sciences, are also subjects (see Marradi, 2007, footnote 1 on p. 11). So: the objects of the social sciences are also subjects (as is a subject who studies them and researches and experiments on these objects/subjects, with them and for them); our thought is not a photographic copy of the reality it wants to understand and explain; language, which wants to communicate this understanding, is not an exact reproduction and representation of thought. This is a relevant issue for social science methodology. On the role of imagination, biases, heuristics, cognitive fallacies, value judgements and so-called avallutativity, see Pinello «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)» (Pinello, 2021) [The Human Being. The woman-man and the social profiles of human spirituality (Questions on the social sciences, for a genealogy of morality, law and science)]. As a criticism of Bachelard’s theses, one can add Marcello Pera’s “paradox of method”: «science is characterised by its method, but a precise characterisation of method destroys science» (Marradi, 2007, p. 16).

Let us now see, in successive order, how Marradi addresses the question of 1) the relationship between reality and thought, 2) the relationship between reality and language, 3) the relationship between thought and language.

1) The relationship between reality (physical and social) and thought (thought and concepts, which, I would add, from my point of view, must be understood not as already linguistic mental objects but as electro-chemical cerebro-mental objects that have not yet taken linguistic form): there is no rigid junction between aspects of reality and the concepts that represent those aspects, already in linguistic form. That is, there is no biunivocal correspondence between them. A and B are in bi-univocal correspondence (rigid junction) when A corresponds only to B and B corresponds only to A. There is no bi-univocal correspondence because the same aspect of reality (the same object) can be conceptualised in linguistic form, by different persons in multiple different ways (see Marradi, 2007, p. 28), and because it can be conceptualised in multiple different ways by the same person, in different environments and in different conditioned and conditioning situations. However, it cannot be deduced from this that referents (especially, from my point of view, in the prelinguistic phase) are totally independent of conceptualisations (see Marradi, 2007, p. 29). It is clear that senses, perceptions, apperceptions and conceptualisations are involved here and, I would add, the connectome. The term “referent” means anything to which the subject thinks at [a] given moment: not only physical objects, but events, other persons and their characteristics, actions and thoughts; not only objects that exist or have existed, but also those that are only imagined (Marradi, 2007, footnote no. 5 on p. 29). Marradi, like Mead, also considers experience, and thus the physical (chemical etc.) and social act. For concepts to be formed in the mind of a human being, it is necessary for him to memorise the experiences, physical (chemical etc.) and social, related to them. And he must have them in the first person and not de relato. From this, however, it cannot be deduced that experience determines the mind’s conceptualisation processes, i.e. how the mind conceptualises (see Marradi, 2007, p. 29; also Pinello, 2022), pre-linguistically and linguistically.

2) The relationship between reality and language: with regard to non-reflective, everyday activities, the correspondence between things and the words that designate them is natural and automatic (see Marradi, 2007, p. 30). Problems begin to arise, and hence the various hypotheses and theories, with reflexive activities and abstraction (see Kline cited above). Against extensional semiotics it can be argued that the relationship between sign/symbol (language) and referent (reality) is mediated by thought (better to specify, in my opinion: electro-chemical cerebro-mental objects). As in the «Ogden and Richards triangle», this relationship is not direct. The linguistic term, without the mediation of thought, of the mind, cannot have meaning (see Eco, 1973, p. 107). The sign/symbol and referent relationship, mediated by thought, concerns a concept in the sense that it concerns a cognitive container in which thousands of experiences are contained. This cognitive container is not closed, but is always open to new experiences (see Sapir, 1969, p. 13; Marradi, 2007, p. 34).

3) The relationship between thought and language: each linguistic term has several meanings, i.e. it designates, in a non-univocal manner, one or more concepts. Each of these concepts has an intension and an extension (see Marradi, footnote 7 on p. 49). I reiterate that, in my opinion, it must be made clear that, when we refer to concepts and thought, we are talking about the electro-chemical connectome, i.e. networked electro-chemical cerebro-mental objects. From my point of view, one must distinguish a pre-linguistic phase from a linguistic phase, which can be automatic or conscious. Meaning (which, from my point of view, is formed both in the pre-linguistic phase and in the linguistic phase, automatic or conscious), I would add, is expressed by language (it is not always
expressed by spoken and written natural-historical language, but is produced by the mind/thought (electro-chemical connectome), which has referents (the relationship between reality – physical, chemical etc. and social - and thought). The mind/thought is the nervous system, central and peripheral, that interacts with the internal and external environment. The external environment can be physical, chemical etc. and social, while the internal environment depends on attachments and secure bases (see Pinello, 2022). Paraphrasing Louis Hjelmslev (1968), we can say that meaning is the association (from my point of view, pre-linguistic and linguistic, automatic and conscious) of an expression with a content (not always conscious and rational; it follows that human beings are not always conscious and rational about the meaning of what they do). Disagreeing with the approach to the question proposed here by Marradi, but net of the clarifications that (from my point of view) I have added, some authors use, sometimes very reflexively, the words “concept” (content) and “linguistic term” (expression) indifferently, as if they were the same thing (see Marradi, 2007, p. 35). Furthermore, as in the case of the two-way correspondence (identity thesis) between words (expressions) and things, they theorise a two-way correspondence between words (expressions) and thoughts (contents). Thoughts and words, as well as things and words, however, are not the same thing, they are rather different, though related, things, in a way that is not bi-univocal, but also not entirely arbitrary. See Patrizia Tabossi (2002), who takes a cognitive psychology approach, and in particular psycholinguistics, as well as neurolinguistics, i.e. cognitive science. Tabossi’s thesis (which I quote because I do not share Ogden and Richards’ conception of language-as-a-tool-to extend our sensory organs, on a par with the telescope, the microscope, the microphone, etc. or an “amplifier of emotions”, see Ogden and Richards, 1966, p. 123) on spoken and written historic-natural languages, with my addition at the end of one clarifications by Derek L. Phillips (1981) and one by Marradi (2007), which I supplement and clarify, is that:

The human species has several biologically determined capacities: motor, perceptual, memory and attention capacities. Among the cognitive capacities of the human species there is also language, which consists precisely in the faculty that each person has of acquiring in childhood, and then using, the language or languages to which he or she is exposed. We do not know how this faculty developed [...] We do know, however, that modern man has a linguistic capacity that is biologically determined and is common to all members of the species, while the various languages are socially and historically determined products of this faculty (Tabossi, 2002, p. 12) [i.e. they are not only historical and social products, but also natural, biological: historical-natural languages]. There is no a priori guarantee that two people educated in the same linguistic community [...] will use the same word with the same meaning under all circumstances (Phillips, 1981, p. 174). [Linguistic] terms constitute [...] anchors, [secure] bases from which to start to conceptualise [to explore (see Pinello, 2022)] the flow of experience – external as well as interior [...] this is essentially the reason for the proliferation of meanings (Marradi, 2007, p. 40). [Concepts are open containers of experiences and experience flows are conceptualised on the basis of cognitive biases and heuristics, see Pinello (2021)]. Explicit in language, thought becomes objectified (Marradi, 2007, p. 39). This does not mean, however, that language is a necessary condition of reasoning [i.e. of activated electro-chemical cerebro-mental connections] [...] As decades of ethnological research have shown, it is by no means taken for granted that animal reasoning is so simple [...] in the many situations that – even in everyday life – require very quick decisions, man [is] capable of very complex reasoning without having the time to encode it in signs (Marradi, 2007, p. 41).

The latter is a very important point, which can be supplemented by drawing cues from Daniel Kahneman (2019), as well as from Mead (2018). Unlike natural-historical language, in which on one side of the joint (joining joint) is the mind (with all the problems of understanding the mind that this entails), the two joints (linguistic signs/symbols and cerebro-mental meanings) of artificial languages (primarily mathematics, logic, geometry and rational mechanics: use of univocal terms) are both reasonably rigid. As far as natural-historical scientific languages are concerned, it is generally thought, especially in academic communities, that their joints are less rigid than those of artificial languages and more rigid than those of ordinary natural-historical languages. This is actually not the case, because polyvocality is greater in natural-historical scientific languages than in ordinary natural-historical languages (see Marradi, p. 38).

Let us now look at the «Semantic Triangle» of Ogden and Richards (figure no. 1): the simplest case of symbolisation (basis of the Triangle):

This is the simplest and most fundamental way of defining. If we are asked what the colour “orange” refers to, we can take an orange object and say: “*orange* is a symbol that represents “this”»). The relation we use here to define is [...] the one that forms the basis of our triangle. It is [...] an attributed relation, reducible to a relation between symbol and act of reference and to a relation between act of reference and referent. The starting point is the word “orange”, the path of identification is this relation. The referent required is “this”. What we are doing on this occasion is directly denoting. But, it will be said, this only tells us that “orange” is applicable in one case; what we want to know is how it is applicable in general; we want the definition to extend to cover all the referents for which “orange” is a suitable symbol. This generalisation can be carried out in the same way for all types of definition through the use of similarity relations. We can say «*Orange* applies to this thing and to all other things that are similar to it in colour». In practice, the discrimination of one similarity relation from others generally requires the use of parallel examples, of analogies, of the simplest kind [...] In any discussion or interpretation of symbols, we need a means of identifying the referents. The answer to the question of what a word or symbol refers to consists in substituting these with a symbol or symbols that can be more easily understood. This substitution is the definition. It involves choosing known referents as starting points, and identifying the definendum through its links with these. (Ogden and Richards, 1966, p. 142-143 and 272).

«Semantic Triangle» by Ogden and Richards (figure no. 1): being the object of a state of mind (right-hand side of the Triangle):

The right side of our triangle, make reference, is an example of this; such are wishing, wanting feeling, etc. Thus “pitiful things” can be defined as those we feel pity towards, and “good things” are those we approve of (Ogden and Richards, 1966, p. 145).
An example of the left side of the triangle (symbolising) could be mathematics, if one states that mathematical symbols have no physical, mental or social reference. It is in this sense that it is stated that mathematics is not a science, but a tool used by science.

- Base (triangle) = words - things (referents);
- right side (triangle) = ideas - things (referents);
- left side (triangle) = ideas - words (symbols).

«Meaning Base Triangle» of Mead: «Mead’s Triangle» (figure no. 2): I will argue about this triangle in my next article (also in this Journal).


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<th>Computational theory</th>
<th>Representation and process</th>
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<td>What is the goal of the computation, why is it appropriate, and what is the logic of the strategy with which it has been formulated?</td>
<td>How can this computational theory be realised? In particular, what is the representation for input and output and what is the process for transformation?</td>
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II. THE «OGDEN AND RICHARDS OF MEANING OF MEANING TRIANGLE»

A theory of thought [and action] that discards mystical relations [and metaphysical; there is also a mystical logic] between the knower and the known and treats knowledge as a causal fact [in Weberian manner] open to common scientific enquiry is a theory that exempts a strong attraction on good-sense researchers […] Underlying all communication, and equally fundamental to any explanation of the scientific method, are the rules or conventions of symbolism [science of symbolism] […] A symbol […] symbolises an [social] act of reference; that is, among its causes [together with the speaker’s (or agent’s) desire to record and communicate, and together with the attitudes assumed by the speaker (and agent) towards the hearers (or observers)] there are [social] acts of reference. Thus, when uttered [or acted], a symbol becomes, being caused in this way, the sign of an [social] act of reference [to a referent] for the listener [or observer]. But this act [of reference to a referent], except when difficulties of understanding arise [as in the case of scientific research, or mystical logic, or metaphysics, etc.], is of little interest in itself [because it is part of the everyday, of immediacy, of spontaneity, of automaticity], and usually the symbol is taken as the sign of that in whose place it stands, that is, of that to which the reference it symbolises refers [the word chair is the object chair, the word horse is the object horse, etc.]. When this interpretation achieves its goal, it follows that the listener [or observer] makes a reference similar [chair, horse etc.], in all relevant respects, to that made by the speaker [or agent]. It is this that gives symbols their particularity as signs. Thus a speech transaction or communication can be defined as a use of symbols, such that acts of reference occur in the listener [or observer] that are similar in all aspects of relief to those that are symbolised by them in the speaker [or agent]. From this point of view, it is evident that for communication theory the problem consists in the delimitation and analysis of psychological contexts, an inductive problem that takes exactly the same form as the problems of the other sciences. However, due to the difficulty of observing psychological [mental] events and the superficial nature of [observable mental] uniformities, the methods used to check whether communication has or has not taken place are indirect. Since we do not have the possibility of observing [mental] references directly, we must study them by means of signs, or by means of the accompanying sensations, or by means of symbols. Sensations are clearly insufficient, whereas symbols provide a much more valid indication. But symbols also mislead and some method of control must be sought; hence the importance of the definition […] A symbol is correct when it causes a [physical, chemical etc., mental, social] reference similar to what it symbolises in any reliable user agent. Thus, for
any given group of symbol users, something will be determined with a certain stability that can be called proper meaning or good use (Ogden and Richards, 1966, p. 270-271 and 229-230).

Today the situation is different, compared to the time when Ogden and Richards were writing. There are, for example, neuromaging techniques and electronic profiling and identification techniques on the web. In the “Summary” of Ogden and Richards’ book “The Meaning of Meaning” (Ogden and Richards, 1966, p. 5-10), to which the structure of Marradi’s argumentative approach referred to in the previous paragraph can be traced, we read that a better understanding of language, in general, produces sociological and scientific consequences. I consider Ogden and Richards two pioneers of cognitive science, when computers had not yet been invented and at a time when cognitive science was already beginning to take shape: linguistics, literary criticism, neurology, psychology, biology and philosophy (of the mind). On the birth of cognitive science, see Tabossi (1998, p. 17-20). The two authors are the founders of a new science: the science of symbolism, or of representation and processes of representation, i.e. the study of the influence of language on thought, which takes into account not only words and thoughts (words symbolise thoughts) but also things and which poses the problem of what happens practically in discussions (the meaning of meaning). Symbolism is not only concerned with the role of language in the everyday lives of human beings, but also with the role played by all kinds of signs and symbols and, in particular, the influence of all kinds of signs and symbols on thought.

Symbolism as a science is an essential prerequisite for all other sciences. Together with the areas of grammar and logic that it does not make superfluous, this science covers what has hitherto been called metaphysics, integrating the work of scientists in every branch of their research. Every critical interpretation of symbols requires an understanding of sign situations [...]. A new science, the science of symbolism [which I consider to be of great importance for cognitive science and sociology, if conducted within cognitive science], is about to be born, and with it a new educational technique will be born [...]. It [symbolism] carries out a special investigation into the ways in which symbols help or hinder us in thinking about things» (Ogden and Richards, 1966, p. 275, 264 and 35) and is aware of the fact that every symbolic apparatus is exposed to imperfection and incompleteness.

Science of symbolism has as its main points: 1) language is a system of signs; 2) the analysis of interpretation must be done in causal terms; 3) the functions of language can be divided into two groups: the symbolic and the emotional; 4) the dissection and clarification of “meaning”; 5) the examination of “verbal problems” (see Ogden and Richards, 1966, p. 15-20). The desire to bring interpretation, as referred to in point 2), back into causal patterns (interpretation understood as a purely causal process) can be better understood if one points out that Ogden and Richards intend to distance themselves from esoteric doctrines of meaning, such as the dialectical devices of medieval theologians. These are doctrines that are closely related to religions. Instead, the two authors openly want to address those who regard interpretation as a purely causal process and believe that when one interprets the meaning of something it can only be explained in causal terms (while at the same time admitting an entirely different meaning of meaning, whereby the “meaning” of a poem or a religion would be the feeling or attitude they evoke (Ogden and Richards, 1966, p. 201).

As referred to in point 3), for the two authors, it is from the confusion between the two functions of language that the controversies between vitalism and mechanism, between materialism and idealism, between religion and science arise. The science of meaning (or semantics) starts from the problem of correspondence between word and fact (thoughts, words and things).

F. de Saussure [...] begins by asking, «What is the integral and concrete object of linguistics?» [...] the discourse (le langage), while being sufficiently concrete, is not integral insofar as it consists of a series of events. Sounds imply the movements of speech and at the same time, as instruments of thought, they imply ideas. Ideas [...] have a social aspect and an individual aspect, and at every moment language contains within itself both an established system and an evolution. «Thus, whichever way we approach the problem, we never find the integral object of linguistics». De Saussure does not pause at this point to ask what he is looking for [...] instead [as Weber does with social action, authority and the individual] [...] he invents a suitable object sla langue, language as opposed to discourse. ‘What is langue? [...] it is only a determinate part of discourse (le langage) [...] It is both a social product of the faculty of speech, and a set of necessary conventions adopted by the social body to make possible the exercise of this faculty by individuals [...] The langue is also the sum total of the verbal images accumulated in all individuals, a treasure trove deposited by the practice of speaking in the members of a given community; a grammatical system, virtually existing in each brain, or more precisely in the brains of a body of individuals; in fact, the langue is not complete in any of them, its existence is perfect only in the mass» [...] Unfortunately, this theory of signs, neglecting entirely the things for which signs exist [the referents], was cut off from all contact with scientific methods of verification from the outset [...] «All discourse» says [ethnologist] Boas, «is intended to serve the communication of ideas». Ideas, however, are only very indirectly accessible to outside observers, and we therefore need a theory that connects words to things through the ideas they symbolise, if any. We need, that is to say, separate analyses of the relations between words and ideas and between ideas and things [...] The analysis of the communication process has a psychological aspect, and today psychology has reached such a level that this aspect could be successfully addressed. Until this had been achieved, a science of symbolism remained necessarily latent [...] Words [...] do not signify anything in themselves [...] Only when the thinker makes use of words [thought or reference] do they [symbol] take the place of something [reference], i.e., in a certain sense, they possess a «meaning» [see figure no. 1] [...] But in addition to this referential use, predominant for any reflexive, intellectual use of language, words fulfil other emotional [non-symbolic] functions. However, this can be better examined when the scheme of rigorous expression and intellectual communication has been set up [sign theory] [...] But for the analysis of the senses of «meaning» [...] it is preferable to start from the relations between thoughts, words and things [see figure no. 1], as they are posed in the case of reflexive discourse uncomplicated by sentimental, diplomatic or other interferences [other functions of language] (Ogden and Richards, 1966, p. 32-36). If we restrict the object of the search to «ideas» and words, i.e., to the left side of our triangle [see figure no. 1], and omit any frank recognition of the world outside ourselves and, from my point of view, leave out human beings, taken as such and not as ideal types, see Pinello (2021)), we inevitably introduce confusing elements into such topics as perceptual knowledge, verification and meaning itself (Ogden and Richards, 1966, p. 45).
This is the description/explanation of the «Ogden and Richards Triangle» (concerns affirmations):

This can be illustrated simply by means of a diagram, in which the three factors that come into play every time a statement is made or occurs are placed on the corners of the triangle, while the relations between them are represented by the sides [...] the base of the triangle is composed quite differently from each of the other sides [...] Causal relations exist between a thought and a symbol [continued].

On this point (causal relations, an interpretation of thought in purely causal terms, without introducing unique relations discovered ad hoc, Ogden e Richards, 1966, p. 77), see Alberto Marradi’s criticism in the previous paragraph, with the exception of mathematical, scientific and musical notations. Bear in mind, however, that Ogden and Richards write that they use causal language for convenience of exposition, being well aware that the more complex treatment avoids «any mention of causes, effects and dependencies» by dealing exclusively with «observable correlations» and «contextual uniformities between events». Moreover, they use the notion of context (physical and psychological as well as of intention towards the reference and of particular and general conviction), or field of forces, which they define, adding that the «rubbing [of a match] in America and a flame in China do not constitute a similar context», Ogden and Richards, 1966, p. 78; 83. Hence the importance of experience to establish which relationships occur or may occur, in terms of probability.

When we speak, the symbolism we employ is determined partly by the reference and partly by social and psychological factors: the goal for which we make the reference, the intended effects of our symbols on other people, and our own attitude. When we hear what is said, the symbols cause us to perform an act of reference and at the same time to assume an attitude that will be, depending on the circumstances, more or less similar to the act and attitude of the speaker. There is also a relationship between the thought and the referent: more or less direct (as when we think of or pay attention to a coloured surface), or indirect (as when we «think of» or «refer to» Napoleon), in which case there can be a very long chain of logical situations between the act and its referent [...] Between the symbol and the referent there is no important relationship, except the indirect one consisting in the fact that someone uses it instead of a referent. Symbol and referent, that is, are not directly connected (and when, for grammatical reasons, we assume such a relation, it will only be an attributed relation, and not a real one) but only indirectly along the other two sides of the triangle. It may seem pointless to insist that there is no direct connection between saying «dogs», the word, and certain objects common in our streets, and that the only connection is that of using the word when we refer to the animal [on this point, see Patrizia Tabossi’s critique, 2002, p. 18-22] (Ogden and Richards, 1966, p. 36-38). An exceptional case is when the symbol used is more or less directly similar to the referent in whose place it is used, as can happen for example when it is an onomatopoeic word or an image, or a gesture, or a drawing [or language of the “primitives” or classical Greece]. In this case the triangle is completed: the base is provided [...] Imitative and non-imitative languages are completely different in principle. «Being in the place of» and «representing» are different relations. However, it is sometimes convenient to express oneself as if there were some direct relationship between symbol and referent (Ogden and Richards, 1966, footnote no. 6 on p. 49-50). Whenever we «perceive» what we call «a chair», we interpret a certain set of data (changes in sensory objects) and treat them as signs of a referent. Similarly, even before the interpretation of a word, the almost automatic interpretation of a group of successive sounds or letters as a word occurs. In addition to the external world, we can also explore [...] the sign situations implicit in mental events, and the developments or processes of interpretation themselves. We need neither limit ourselves to arbitrary generalisations drawn from introspection [...] nor deny the existence of images and other «mental» happenings in the manner of behaviourists [...] Advanced behaviourism will have much to say (Ogden and Richards, 1996, p. 46-47).

Ogden and Richards, starting from the assumption that the “systematisation of symbols” corresponds to the “organisation of human thought” (I would add a reference to the problems relating to the connectome and epigenetics), consider the theory according to which mathematical symbols become “thinking machines” and the theory according to which, on the other hand, mathematics is not a “thinking machine” but a set of instructions for the use of the “human mental machine” (Ogden and Richards, 1966, p. 116). «Definitions [insofar as they express the meaning of symbols] are of great importance in the construction of scientific deductive systems: those automatic thinking machines for which logic and mathematics constitute, as it were, the rules or instructions» (Ogden and Richards, 1966, p. 147). But it is also important to ask the question of the meaning of definitions or, better still, the meaning of the meaning of definitions and the meaning of the meaning of mathematics and logic. The science of symbolism in fact also implies a theory of the definition, or interpretation of sign situations, both complex (e.g. «being a benevolent uncle to») and simple (e.g. «being an uncle», «being benevolent»). It deals with genres, species, differences, types, classifications, lists, connotations, denotations, intensive/comotative definitions, extensive definitions, symbolic metaphors, emotional metaphors, associations, abstraction, intuition, of examples/experiences, of descriptions, of the problem of grammatical (dictionaries can be used to search for the referents, of which words are symbols, and the meanings of words) and logical perimeters of language, of the problem of whether we “define things or words” (do we define «the horse» or the word «horse»? problem of real or symbolic definitions, of references, of definitendum and definiens), etc. All these issues depend on the search for the meaning of meaning (i.e. «how to manipulate symbols correctly, eliminating residual imperfections»; on residues see Pinello, 2022) and sign theory. «It is not always new words that are needed, but a means of verifying them as symbols, a means of quickly discovering why they were used on a given occasion, i.e. what they referred to» (Ogden and Richards, 1966, p. 44).

Logic and grammar, according to the science of symbolism, must study the form and structure of complex references and the form and structure of their symbols. Grammar can be regarded as «the natural history of symbolic systems». But, and this is the crux of the matter, it is not possible to proceed to a normative, logical and grammatical examination of words without simultaneously proceeding to the normative examination of thought and the examination of references. I would add of the connectome and the electro-chemical cerebro-mental processes. Ogden and Richards
propose canons of symbolism: 1) the canon of univocity (“A is A”, i.e. every symbol has a referent); 2) the canon of definition, in cases of non-univocity in cases (there are traps more dangerous than ambiguity) but in the presence of the same connotation (different symbols having the same reference); 3) the canon of extension (e.g. classes and universals: they do not concern ontology but symbolic fiction, i.e. the meaning of meaning), in the case of uncertain symbols that can be clarified by extension (analysis and rationalisation: extension makes it possible to distinguish uncertain from false assertions); 4) the canon of actuality and experience (“cigarette lit now”); 5) the canon of compatibility: «concerns the construction of complex symbols from simple or less complex symbols» (Ogden and Richards, 1966, p. 129). These are the Aristotelian laws of identity, contradiction and the excluded third; 6) the canon of individuality: «All possible referents together form an order, such that each referent has a unique location (see the canon of compatibility) only in this order» (Ogden and Richards, 1966, p. 130).

Here is an example of the third canon (the canon of extension): «Hamlet was mad» is an enunciation that can be extended into «Hamlet was mad on stage»; in the reverse case we speak of contraction. There are also the pseudo-extensions, or “symbolic superfetations”, however, which further confuse rather than clarify uncertainties (see Ogden and Richards, 1966, p. 114-135). Previously, the researchers of the influence of language on thought (linguistic theory) had been philosophers, philologists and ethnologists. The latter, generally having a psychological background, dealt with “ideas” considered as “expressed” by words and not also with the grammars of the “primitive” peoples observed and their environment. Regarding the fourth cannon (the canon of actuality and experience): «A symbol refers to what it actually refers to in its actual use; it does not necessarily refer to what it should refer to according to the best usage, or to what is understood by an interpreter, or to what the one who used it intended to refer to» (Ogden and Richards, 1966, p. 127).

For Ogden and Richards, these six canons are the fundamental axioms of the correct use of the words of reasoning and form part of a system that enables «the transformations and substitutions of symbols by which scientific language strives to reflect and record its distinctions and conclusions: operations to which [...] primitive man attributed something magical» (Ogden and Richards, 1966, p. 131-132). With regard to the canon of univocity, the two authors write that in aesthetics, politics, psychology, sociology, etc., «the stage of systematic symbolisation» has not been reached, by means of fixed and unalterable definitions, because «the most systematised sciences are those that deal with the simplest aspects of nature» while those that deal with difficult subjects are still at the stage where they are debating which symbolisation to adopt (see Ogden and Richards, 1966, p. 148).

In this regard, I connect to Talcott Parsons’ attempt to formulate a general theory of social action, building on the theories of Vilfredo Pareto, Émile Durkheim and Max Weber and addressing the issue of residuals (see Pinello, 2022). Parsons seems to have followed Ogden’s and Richards’ advice,

one must first of all avoid the hidden and covert conflict between rival systems [...] In discussions in which “faith”, “beautiful”, “freedom”, “good”, “conviction”, “energy”, “justice”, “state” recur again and again, many terms are used without precise reference [...] the curious instinctive tendency to believe that a word possesses a true and exact use [...] has its roots in magic [...] it is the instinctive attitude towards words as natural receptacles of power [...] In practice [...] words are used for their persuasive and emotional effects almost as much as for their strictly symbolic value [...] The recognition that many of the most common topics of debate are steeped in words [...] symbolically empty but emotionally effective is preparatory to the extension of the scientific method to such matters [...] For those who stand before symbols without thinking [in everyday life, acting in an immediate and direct, automatic way], it is often difficult to believe that convenient words such as “beauty”, “meaning” or “truth” are in fact not single words at all, but series of superficially indistinguishable and however profoundly differentiated symbols [...] At the beginning of a serious examination of these topics we should therefore provide ourselves with as complete a list as possible of the different uses of the main words» (Ogden and Richards, 1966, p. 148-150 and 155-156; see Pinello, 2022, especially Parsons’ General Theory of Social Action, and Pinello 2021).

Also in the «Summary», we read that language (verbal and gestural) is the vehicle not only of ideas (verbal language), but also of elementary emotions (emotions) and imagination. Imagination implies the problem of generalisation, universalisation, abstraction and intuition. These problems concern the formation of Weberian idealtypes. I, starting from a critique of Max Weber, argued that social actions are language, with reference to the «Ogden and Richards Triangle» and cognitive science (see Pinello, 2019). Imagery can be dangerous and analyses based on imagination can be flawed. On imagination and gossip theory see Harari (2019) and Pinello (2021). Connected to the topic of imagination is the question of intuition. Ogden and Richards contrast intuition with analysis, arguing that both Bergson and the analysts are right and wrong at the same time. They are right because the former affirms the importance of the emotional function of language, the analysts the symbolic importance. Bergson and the analysts, however, err at the same time, because they do not «see clearly that language must have [together] these two functions. It is like arguing whether the mouth is for talking or for eating» (Ogden and Richards, 1966, p. 260). There is also the problem of slow thinking and fast thinking (see Kahneman, 2019, and Pinello, 2020a). The two founders of the science of symbolism, in addition to identifying the canons I mentioned earlier, as we shall see, indicate five functions of language, which can also be used to address the issue of slow thoughts and fast thoughts.

The Intuition has to do also with instinctive interpretations (see Kahneman, 2019, and Pinello, 2021). The relationship between the words of language and things (referents) is indirect, because it takes place through interpretation; through a thinking that has to do with perception, because the changes in our sensory organs are the initial signs that we interpret and because direct learning is an event that takes place in the nerves.
The perceptual processes provoked in a subject by the action of external objects upon him have been correctly called “perceptions” and so have the objects themselves, out of understandable confusion [...] [The] “utraquistic fallacy” [consists in confusing the referent: is “perception” what one perceives or the fact of perceiving it or the emotion of perceiving it?] Is “knowledge” what one knows or the fact of knowing it or the emotion of knowing it? Other processes, more or less abstract references obviously provoked, have similarly been called “conceptions” (Ogden and Richards, 1966, p. 124). The term concept (conception or references more or less abstract) is very equivocal and lends itself to the creation of various entities, including through instinctive interpretations. An interpretation can be erroneous, also because of misinterpretations and lies.

In examining conscious and critical processes of interpretation [e.g., induction theory], we must realise that [these] activities [...] are based on “intuitive” interpretations [...] Indeed, the very functioning of a differential equation – this process of maximally rational interpretation – will fail unless many “instinctive” interpretations, to which no mathematical [or methodological] treatment is currently applicable, are successfully implemented (Ogden and Richards, 1966, p. 98).

It is in this sense that for creative, or instinctive interpretations, there is no method (see Pinello, 2021). On statistical intuition and “instinctive” interpretation see Daniel Kahneman (2019). The problem addressed by Kahneman and Amos Tversky, albeit in different terms, is also posed by Ogden and Richards: «mental processes are not determined in a purely psychological way, but also, for example, by blood pressure [...] whether an interpretation is true or false does not depend solely on psychological contexts, unless one is talking about psychology» (Ogden and Richards, 1966, p. 99).

But the science of symbolism, as Ogden and Richards conceive it, cannot proceed from intuition, “instinctive” (or intuitive, or automatic) interpretation and introspection, although it must seriously consider this aspect of the matter as well. In order to formulate a theory of interpretation one has to start from the observation of others (on this point see Mead’s Triangle, figure no. 2, which I will discuss in the next article in this Journal), the method of introspection being uncertain and a solipsistic explanation of communication being impossible. Sign theory must be developed from the observation of other human beings and can only accept the evidence provided by introspection when there are valid criteria for evaluating it. «There are [...] good reasons why what goes on in us remains partly hidden from us» (Ogden and Richards, 1966, p. 45). There are considerable differences between speakers with regard to symbolisation processes. The recognition of sounds as words is not necessarily a conscious operation. Ogden and Richards’ perspective involves several problems: how and to what extent do the emotional functions of language interfere with referential functions? How and up to what threshold can we reach references directly? How do we deal with the orgy of verb-mania and the orgy of graph-mania? (see Ogden and Richards, 1966, p. 65; 69). The two authors also use the term logomachy (see Ogden and Richards, 1966, p. 189).

There is also another problem: religions, which carry considerable weight in terms of faith news, together with fake news. Religions (churches) «have deliberately exploited the confusion of [symbolic and emotional] functions and depend on them to such an extent that they present unquestionably pathological developments» (Ogden and Richards, 1966, p. 182). It is therefore necessary to take into account the «infantile processes» from which attachments and secure foundations arise (see Bowlby, in Pinello 2022). Only through the analysis of sign-situations (which can also be implicit) and symbolic situations is it possible to escape from the influences of the conception of the name-soul, secret names, verbal superstition (word-related superstitions, which still today, as a millenarian social legacy [and, in my view, biological], vitiate the most attentive thought processes and whose meaning of meaning must be analysed, which, like a continuum, has come down to us), verbal magic, verbal medicine (e.g., of the ancient Egyptian and the texts of the Pyramids), onomancy, incantations, the alleged Parmenidean, Platonic and Neo-Platonic world of being, the mysticism of the logicians, metaphysics.

The technique of the modern logician tends to conceal the verbal foundations of his structure, whereas in Greek philosophy these foundations are clearly revealed. Ancient writers are imbued with the relics of primitive word magic (Ogden and Richards, 1966, p. 58).

It is the question of the “magic words”, the “enchanted world”, the “disenanchted world” of Durkheim (1963) and Weber (2004) the scientific, non-scientific and ascientific theories – including pre-scientific speculation – and the problem of residuals and the general structure theory of social action of Talcott Parsons (1987; see Pinello, 2022). It is also the problem of the re-enchanted world (see Pinello, 2022a), of logical re-enchantment, or logical mysticism, and of metaphysical sociology. Parsons’ book on the general structure of social action, about which I argued in an article in this Journal (see Pinello, 2022), can be seen as a response to Ogden and Richards’ search for scientific meaning:

Most civilised persons are completely unaware of how these residues survive in them, and even less aware of how their behaviour is shaped by the invisible hand of the past [...] It may be that in the future the modern logician will be considered the true mystic, once the rational basis of the world he believes in has been scientifically examined [...] thanks to contributions [of some researchers], a science of symbolism [science that is also a theory of thought] has become possible, but it is necessary to be constantly aware of the particular forms in which the power of words can make itself felt in modern times [...] In logic, as we have seen, [words, with their power] lead to the creation of non-existent entities, universals, properties and so on (Ogden and Richards, 1966, p. 53; 64-65; 68-69; see Pinello, 2022a).
The tendency to build a world, instead of explaining and understanding the world, in the economic field is an expression of the most exaggerated neo-liberalism. Human beings act, mentally and socially, between cognitive constraints and institutional constraints (see Pinello, 2021). Among institutional constraints, language (actually, one should also consider economics, finance, religions and churches) is the most important. The concept of “institutional constraint” can be derived from Durkheim’s notion of social fact. These are modes of acting and feeling external to the individual, yet endowed with a power of coercion, by virtue of which power they impose themselves on the individual. With or without his consent. For Ogden and Richard, the language has five functions (five categories: contextual theory of interpretation), which we shall now see and which must be taken into account when studying symbols/signs. The symbolic function (affirmative use: recording, arranging, organising and communicating references, analysing) and the emotional function (expressing or arousing sentiments, attitudes, moods, intentions, intuition, etc.) are the two most important functions. It is likely that the emotional function (I would add, phylogenetically and ontogenetically) is more primitive than the symbolic one. There are trade-offs between these two functions. In fact, the phrase form is the result of a compromise between symbolisation and emotional factors. From my point of view, biological, genetic, epigenetic, environmental, computer and telematic factors must also be taken into account. The contexts required for the use of proper nouns are simpler than those of descriptive phrases. Grammar, which performs a normative task, is the natural history of symbolic systems. The theory of meaning (the semantics) depends on the theory of signs (the semiology or semiotics) and context is also important and, therefore, must be investigated in detail (contextual reference theory). However, one must not make the mistake of reducing the science of symbolism to semantics and semiotics and general linguistics. A discussion of the composition of references is a discussion of the reciprocal relations between contexts […] All true or false beliefs ‘here in a moment there will be something green’ are theoretically analysable as compounds whose components are simple references, definite or indefinite, linked by the relations that give the reference its “logical form” (Ogden e Richards, 1966, p. 92; 95). One could also cite Wittgenstein’s ‘Tractatus logicophilosophicus’ (Wittgenstein, 1984), an author known to Ogden and Richards, pointing out that it only considers external physical and material references. The central problem of language is meaning (semantics).

In a certain sense […] the question to be answered is, in short: «What happens when we judge, or believe, or think something; what kind of entity does this something consist of and how does it relate to the mental event represented by our judging, believing, thinking?». This question is traditionally and unsatisfactorily addressed by introspection and logical judgement analysis […] Logic […] can be considered the science of systematising symbols» (Ogden and Richards, 1966, p. 75 and p. 114; see also Tabossi, 2002; Kahneman, 2019).

Let us now look at the five functions of language (five categories: contextual theory of interpretation). The five functions of language are: I) The symbolisation of the reference; II) The expression of the attitude towards the listener; III) The expression of the attitude towards the referent; IV) The elicitation of the intended effects; V) The stabilisation of the reference.

[…] whenever we want to deal with things that are not immediately present, that is, things that are not found in very simple contexts close to our present experience, we need particular supports and points of reference (of secure bases, see Pinello (2022)) and the same is true for all our more complicated and refined references; therefore, in all these cases the strictly symbolic function of words easily becomes more important than any other […] the same distinction and diversity of functions exist in non-verbal languages. When we look at a painting or when we read a poem, we can assume one or two attitudes. We can accept the painting or poem as stimuli, letting their qualities of colour and form act emotionally on us. Or, with a different attitude, we can interpret shapes and colours (the words). The first of these attitudes is not necessarily preliminary to the second. To assume it would be to have misunderstood the distinction» (Ogden and Richards, 1966, p. 249, 254-255 and 258).

The study of the functions of language is important (e.g. poetic, aesthetic, religious evocative aspects, etc.) to distinguish non-scientific and ascientific discourses from scientific symbolic affirmations (see Pinello, 2022). Ogden and Richards, in addition to the six “canons of symbolism” and the five “Functions of language”, identify eight “defining paths”, three orders of meaning ideas to approach the definition of meaning (the meaning of meaning) and sixteen definitions of beauty, each of which has its own field of referents (as far as symbolic function is concerned) and emotional uses (as far as the emotional function is concerned). «The inability to distinguish between emotional and symbolic uses is a source of much confusion in discussion and research» (Ogden and Richards, 1966, p. 273). One effect of the classification of meaning into three orders of ideas of meaning (linguistically generated phantasms, occasional and eccentric uses, sign and symbolic situations) is the replacement, by extension, of the term “meaning” with the terms “intention”, “value”, “referent”, “emotion”, sometimes used as synonyms.

To address the question of meaning of meaning, Ogden and Richards start with a classification consisting of sixteen main definitions, which they question and problematise. The definitions cover the following topics: 1) meaning as an intrinsic property of words; 2) language as a non-analysable relation; 3) the dictionary and the examination of its meaning; 4) connotation as a logical artefact; 5) denotation as a hypostatised connotation; 6) meaning as a projected activity; 7) metaphor and meaning as intention; 8) affective-volitional aspects and meaning as location in a system 9) meaning interpreted from the point of view of practical consequences; 10) the pragmatists, i.e. meaning as that which is implied; 11) meaning as emotional coincidences; 12) the doctrine of natural signs; 13) meaning as psychological context; the need to check the validity of introspection; the non-definitive value of immediate conviction; why we must rely on symbols in abstract thought; meaning as referent; definition of contexts. 14) meaning as what the speaker should refer to; 15 and 16) good use and complications in the field of meaning due to symbolic situations.

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But too many interesting advances have occurred in the sciences, thanks to the repudiation of current symbols and the effort to replace them with more accurate expressions, for any naïve theory that “meaning” is only “meaning” to be acceptable today [...] [This is the] central problem of knowing or “meaning” [...] Each decisive step forward in physics came at the expense of some generally accepted metaphysical explanation, and condensed into a convenient, synthetic, universally applied symbol [...] The coarser forms of verbal confusion have long been identified; but less attention has been paid to the more subtle and more frequent forms [...] The root of all trouble [over meaning of meaning] can be traced to the superstition [magical, religious] that words are somehow parts of things or always imply things corresponding to them [on this point, however, see Tabossi, 2002, p. 18-22]. [As a rule, when we listen to anything, we spontaneously jump to an immediate conclusion, namely that the speaker is referring [reference] to what we would be referring to if we were speaking those words ourselves [...] the vagueness existing in the conversation is continuously revealed (Ogden and Richards, 1966, p. 38-41).

Ogden and Richards, referring to the war and quoting Thucydides, also denounce the very current problem of disinformation (see, Pinello 2020a): “The meaning of words no longer had the same relationship to things, but was changed by men as seemed best to them” (Ogden and Richards, 1966, p. 43). The authors, however, state that in their book they dealt exclusively with bona fide communication (i.e. the use of symbols as such and not also with malicious intent and deception), except only with the issue of the derivative use of meaning, which originated from deception. Both intellectual and social forms of life are influenced by changes in our attitudes towards words and the way we use them.

III. THE «THREE LEVELS OF EXPLANATION OF COMPLEX INFORMATION PROCESSING SYSTEMS MODEL» BY MARR

Language (gestures/symbols), thought (brain-mind) and references (physical, chemical etc., social and mental) – see the «Ogden and Richards Triangle», figure no. 1 – constitute three distinguishable and different levels. This raises the question of whether it is possible to apply Marr’s «Three-level Model» to the «Ogden and Richards Triangle». See figures 3 and 1: «Thought or Reference» and «Referent» («Computational Theory», «Symbol» («Representation and Process»). The difference between the «Ogden and Richards Triangle» and the «Marr Model» is that in the former, the hardware (Thought or Referent, see figure no. 1) is always and in any case the human being (human-thought) whereas in the latter («Realisation in hardware», see figure no. 3) it can be either the human being or the computer. In fact, Marr’s objective is to simulate in a computer what the brain/mind of a human being does (see Datteri, 2012, and the addition of the animal/human body simulated by a robot). But there are many problems and they mainly concern the meaning of meaning. Does what “something” means depend on “who” means it? Does it depend on intuition, because it is not fully present to the mind at a precise moment? What role does meaning play below the threshold of consciousness? Is personal meaning a trap? And the collective one? Can the problem of the meaning of linguistic symbols be reduced to the problem of the meaning of images, i.e. representations? Must images, or representations, or words that aim to become general and universal (such as “entity”) be cleansed of “mnemonic causality” (with respect to physical, material references, and with respect to human beings), of mnemonic effects relative to meaning? Should real meaning be overridden by verbal meaning? Does meaning depend on consequences? In short, what is the significance of meaning? Ogden and Richards write that there is the «dogma of the absolute singularity of the relationship between the mind and its objects», i.e. when we human beings think about something, with this something (or sometimes with something else) we have a relationship of an absolutely unique kind. The thinking of human beings is an event not comparable to anything else. The problem is the conscious «concept» (or «universal» or «property») of «liveness» or «being alive» that applies to human beings and not to computers: «from the awareness of a feeling of yellow “I can go directly to the knowledge of the enunciate: ‘I have a feeling of yellow”» (Ogden and Richards, 1966, p. 76; see also De Palma e Paret, 2015, Pinello, 2022), «I am self-aware that I have a sensation of yellow». This is certainly true, but it does not solve the problem of the meaning of meaning, indeed it complicates it considerably. It is in fact the problem of consciousness. The approach proposed by Ogden and Richards is certainly useful and full of consequences, which is why it should be taken into consideration, together with the theory of mind, self and society proposed by Mead, which I will discuss in my next article (also in this Journal).

I now quote Tabossi’s summary of the problem underlying Marr’s three-level model (see figure no. 3).

Suppose, for example, we investigate how intelligent systems interact with their environment by attempting to specify: a) the characteristics of the environment [e.g., the group]; b) the information [e.g., goals, values, affects, traditions] that guides the system [individual agent] in its interactions [social actions] with it; c) the way in which the system [individual agent] is structured [the ideotype] so that it can participate in those interactions. Such an articulation [traceable to Weber’s *Verstehen*] would seem natural enough: were it not that its apparent reasonableness does not seem to be matched by real practicability, since the three points interact in such a way that any solution to one of them depends on the solution given to one of the others and vice versa. [...] Taking these difficulties into account, how has intelligent systems science attempted to solve the intricate problems associated with the study of its complex object? [...] Suppose [now] we want to study how a cash register works, when paying a bill in a shop [...] for computational theory [...] it would make no difference if there were a cashier instead of a cash register. What it must specify instead is what the cash register or the cashier does when they pay a bill, and since what they do are in fact sums, it follows that the first thing to be specified is a theory of arithmetic, within which properties of addition such as the commutative or associative property can be explained. However, this does not exhaust the task of computational theory, which must also clarify why a recorder or a cashier does addition. In this case, the reason, which is rather simple, could be that addition better than other calculations allows us to grasp some of the properties that a bill [to pay in a shop] intuitively should have [...] If computational theory allows us to understand what a certain cognitive function consists of and why it is performed, it says nothing about how that function can be realised [...] The clarification of this aspect of cognitive systems concerns the third of the explanatory levels proposed by Marr: that of representations...
and processes. [...] If [...] the activities of intelligent systems are conceived, as cognitive science does, as information processing, i.e. the acquisition, memorisation and transformation of knowledge, it follows that explaining how those activities are carried out corresponds to asking how the various operations – processes – manipulate information [...] Of course, the way in which the former can be specified is not independent of how the latter are characterised: “five plus three” and “5 + 3” are two ways of conveying the same information, but it is highly improbable that the linguistic form allows the sum to be calculated by a process involving the placing of addends in columns, as can be done using numerical representation (p. 22-26).

There remains the big problem of realisation in hardware, which is also the problem of simulation (see Datteri, 2012, with the addition of the animal/human body, simulated by a robot), for which I am working on a monographic essay.

According to a tradition certainly influential in neuroscience, but also in psychology, the explanation of cognitive activities such as seeing or speaking must ultimately lie in the way the brain functions. Cognitive science does not, of course, deny the importance of discovering the mechanisms that form the material basis of cognitive activities in living systems, and indeed regards the identification of those mechanisms as one of its goals. This is, following Marr, the level of explanation called realisation in hardware, in which the way in which a structure can give rise to a cognitive capacity is investigated, and if the same activity can be performed by physically different systems, then the explanations required at this level will concern the functioning of each of the structures in which that capacity is realised [...] but precisely because physically different structures can produce the same functions, the understanding of complex systems cannot be exhausted only in the explanation of their material structure: « [...] If one hopes to achieve a full understanding of a complicated system such as a nervous system [...] then one must be prepared to contemplate different kinds of explanation at different levels of description that are linked, at least in principle, into a cohesive whole» (Tabossi, 1998, p. 23-24).

V. CONCLUSION

It is not only possible, but also useful to apply the Marr’s «Three Level Model» to «Ogden and Richards Triangle», in order to overcome the Weberian Verstehen, which has now become metaphysical. Today Marr’s model is stressed by the search for a model in machines (computers and robots), of animal and human cognitive capacities, that is ever more adherent to and corresponds to the reality of the brain, mind and body of animals and humans, as well as the reality of how animals and humans interact with each other, in an environment. A reality investigated in its meaning and in meaning of its meaning («Ogden and Richards Triangle») and not using metaphysical Weberian idealtypes. Simulation processes (see Datteri, 2012), however, can become increasingly adherent to reality to the extent that become increasingly adherent to reality the explanations provided by neuroscience and, in general, by cognitive science, including the new sociology, i.e. a sociology capable of making its own contribution to cognitive science. Indeed, an attempt is being made to artificially reproduce the human connectome and its functioning, as well as the interaction between human connectomes, with each other, in the environment inside the human body and with the environment outside (physical, chemical etc., mental and social) the human body. «But the symptomatology of behaviour in relation to language is a complicated matter, and little confidence can be placed in observations that cannot be verified by a thorough knowledge of the general behaviour of the subject» (Ogden and Richards, 1966, p. 241). A contribution of knowledge in this direction is already coming from Big Data, Artificial Intelligence (Machine Learning) and electronic profiling and identification techniques on the web. In relation to this new context (new since Marr theorised his three-level model), I propose the «Triangle of Simulation» in machine (computers and robots). This model assumes a realisation in the machine, of animal and human cognitive capacities, increasingly corresponding to animal and human reality. For the notions of hybridisation and replacement, see Pinello (2020).

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Analysis of Temperature and Rainfall Trend in South 24 Parganas District of West Bengal (1988-2017)

Chandra Shekhar Sarkar¹, Aritra Chakraborty²

¹Research Scholar, Department of Geography, Presidency University, Kolkata, India
²Assistant Professor, Dept. of Geography, Presidency University, Kolkata, India

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Abstract: This study investigated the change in the trend of temperature and rainfall in South 24 Parganas District of West Bengal. Therefore, daily temperature, total annual and monsoon rainfall data were collected from the Indian Meteorological Department (IMD), Kolkata for the period from 1988 to 2017 (30 years). Time series analysis method was used to identify the changing trend in temperature and rainfall. The study revealed that in the last 30 years (1988-2017), the average annual, average maximum annual and average minimum annual temperature were 27°C, 34.6°C and 18.8°C respectively. On the other hand, the average total annual and average monsoon rainfall were 172.7 cm. and 129.4 cm. from 1988 to 2017. The study highlighted a significant changing trend in temperature as well as rainfall. The study identified an increasing trend in average annual and average maximum annual temperature, while a slightly declining trend in average minimum annual temperature from 1988 to 2017 (30 years). The results of the study also revealed an increasing trend in the total annual and monsoon rainfall over a period of 30 years (1988-2017).

Keywords: Climate change, Trend analysis, Temperature, Rainfall

1. Introduction

Climate change is a serious concern resulting in variation of the temperature and rainfall pattern.¹ In the 21st century, worldwide climate change has taken place as a dire threatened to all life in the near future. The Inter-Governmental Panel on Climate Change (IPCC) defines climate change as a change in the climatic condition that can be identified by changes in the variability of its properties and that continues for a long period, decades or longer.² ³ The IPCC report (2019) states that the global mean surface temperature for the decade 2006-2015 was nearly 0.87°C higher than the average over the period of 1850-1900 and probable anthropogenic global warming is now increasing at 0.2°C per decade due to greenhouse gas emission.⁴ The World Metrological Organization (WMO) report (2020) describes that 2020 as one of the warmest year as per record and 2011-2020 as the warmest decade. The average global temperature is 1.2°C higher in 2020 than the pre-industrial level.⁷ However, the changing pattern of temperature and rainfall are not similar around the world there is regional variability. Rainfall and temperature are the two most important factors in the fields of climate science.⁶ Rainfall is a key factor in the flood as well as drought assessment and temperature play a vital role in evaporation, transpiration, evapotranspiration and water demand.⁶

The statistical and trend analysis of temperature and rainfall is a very important aspect of climate change.⁷ Several studies were carried out by a few Indian researchers to study the trend and temporal as well as spatial variability of both temperature and rainfall. Kumar et al. (2010) analyzed long-term rainfall trends in India by using climatic data of 135 years for 30 subdivisions. Results of the study highlighted that the significant changes in annual rainfall trend.⁸ Subash et al. (2011) investigated the historical trend of rainfall in five meteorological subdivisions of Central Northeast India by applying the Mann–Kendall non-parametric test.⁹ Further, Jagadish et al. (2012) attempted to detect the trends of monthly, seasonal and annual rainfall over the Orissa State from 1871 to 2006. The study revealed that the insignificant
decreasing trend in both monsoon and annual rainfall, while the increasing trend in post-monsoon rainfall over the state.⁷ Deshmukh, and Lunge (2013) also did a study on temperature and rainfall trends in Buldana District of Vidarbha in India using 30 years data during the period from 1975 to 2005.⁹ Goyal (2014) analyzed the 100 years rainfall trend (1901-2000) in Assam based on Mann-Kendell and Sen’s slope estimator test.¹⁰ Mondal et al. (2014) made an important study on temporal and spatial analysis of rainfall and temperature trend in India based on the Mann-Kendall (MK) test and Sen’s slope.¹ Meshram et al. (2017) also attempted a study on the spatial and temporal variability of rainfall in Chhattisgarh by using 102 years data (1901–2002) for 16 stations.¹² Shukla et al. (2017) analysed 105 years of temperature trend (1901-2005) in the Madhya Pradesh state of India using the Mann-Kendall, Sen’s slope method and Pettitt’s test.¹³ Mandloi et al. (2019) conducted a study on change in rainfall pattern in Anand of middle Gujarat by using climatic data from 1958 to 2017. The study revealed that rainy days has decreased by 0.017 mm per year in the last sixty years.¹⁴ Deoli and Rana (2019) examined the seasonal trend of rainfall and temperature in Udaipur District of Rajasthan by using 39 years daily rainfall data from 1975 to 2013.¹⁷ Several Important research work on a statistical analysis of temperature and rainfall were also carried out by a few foreign researchers like Philandras et al. (2011)¹⁶, Laseter et al. (2012)¹⁷, Akinsanola and Ogunjobi (2014)¹⁸, Khattak and Ali (2015)¹⁹, Lacerda et al. (2015)²⁰, Kruger and Nxumalo (2017)²¹, Bhuyan et al. (2018)²², Byakatonda et al. (2018)²³, Cattani et al. (2018)²⁴ and Abaje and Oladipo (2019)²⁴.

There are two objectives of the study. (1) To identify the change in trend of the average annual, average maximum annual and average minimum annual temperature from 1988 to 2017 in South 24 Parganas of West Bengal. (2) To detect the change in trend of the total annual and monsoon rainfall from 1988 to 2017 in South 24 Parganas of West Bengal.

2. Methodology

2.1 Study Area

South 24 Parganas District of West Bengal is an integral part of lower Gangetic delta. The District is bounded by Kolkata in the north, North 24 Parganas District in the northeast, Howrah District in the north-west, Hooghly river in the west, Bangladesh in the south-east and Bay of Bengal in the south. The latitudinal extension of the District is from 21° 29’ 00” N to 22° 33’ 45” N and the longitudinal extension is from 88° 03’ 45”E to 89° 04’ 50”E. It is the largest District by area in West Bengal, the total area of the District is 9960 square kilometers. There is total 5 subdivisions, 29 blocks, 7 municipalities, 310 gram-panchayats, 1994 inhabited villages in the District. South 24 Parganas is the second-highest populated District after North 24 Parganas in West Bengal. The total population of the District is 8161961, population density is 819 and the total male and female population are 51.14% and 48.86% respectively as per the 2011 census. The average annual rainfall of South 24 Parganas is nearly 140 centimeters and around 75% rainfall is received during the monsoon season. The annual maximum temperature is approximately 40°C and the minimum is around 10°C.

Figure 1. Location map of the study area
2.2 Data Collection
South 24 Parganas District is represented by the climatic data of Diamond Harbour weather station, which is the one of the main weather station of the District. In the study, daily temperature, total annual and monsoon (June-September) rainfall data of 30 years (1988-2017) were collected from the Indian Meteorological Department (IMD), Kolkata. The annual average, maximum and minimum temperature has been calculated based on daily data.

2.3 Data Analysis
Time series analysis of temperature and rainfall have been done by using Microsoft excel and the thematic maps were prepared by using ArcMap version 10.3 software.

3. Results and Discussions
3.1 Trend Analysis of the Average Annual Temperature in South 24 Parganas District from 1988 to 2017
Figure 2 and Table 1 represents the average annual temperature trend in the period from 1988 to 2017 in South 24 Parganas District of West Bengal. The maximum average annual temperature in the 30 years period (1988-2017) was recorded as 27.9°C in the year 2016 and minimum average annual temperature 26.3°C was recorded in the year 1992 (table-1). The average annual temperature has been calculated as 27°C. The years showing less than the average annual temperature were 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2003 and 2011 (table-1). On the other hand, the years showing more than the average annual temperature were 2002, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2012, 2014, 2015, 2016 and 2017 (table-1). Although, the linear regression trend line (Figure 2) represents the overall increasing trend of the average annual temperature in the period from 1988 to 2017 of South 24 Parganas District.

![Figure 2. Showing the average annual temperature trend of South 24 Parganas District (1988 to 2017).](image)

3.2 Trend Analysis of the Average Maximum Annual Temperature in South 24 Parganas District from 1988 to 2017
Figure 3 and Table 1 shows the average maximum annual temperature trend in the period from 1988 to 2017 of South 24 Parganas District. The highest average maximum annual temperature in the last 30 years period (1988-2017) was recorded as in the year 2016 (36.5°C) followed by the year 2015 (35.9°C), 2014 (35.9°C), 2009 (35.8°C) and 2002 (35.7°C). Whereas, the lowest average maximum annual temperature was recorded in the year 2000 (32.4°C). The average maximum temperature has been calculated as 34.6°C. The years showing less than the average maximum annual temperature were 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2003 and 2008 (table-1). Conversely, the years showing more than average maximum annual temperature were 1988, 1989, 2002, 2004, 2005, 2006, 2007, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016 to 2017 (table-1). While the linear regression trend line (Figure 3) represents the overall increasing trend of average maximum annual temperature in the period from 1988 to 2017 of South 24 Parganas District.
3.3 Trend Analysis of the Average Minimum Annual Temperature in South 24 Parganas District from 1988 to 2017

Figure 4 and Table 1 illustrates the average minimum annual temperature trend in the period from 1988 to 2017 of South 24 Parganas District. The highest average minimum annual temperature in the 30 years period (1988-2017) was recorded as 19.9°C in the year 1999, followed by the year 2016 (19.8°C), 2010 (19.7°C) and 1998 (19.7°C). On the other hand, the lowest average minimum annual temperature was recorded as 17.5°C in 2011. The average minimum annual temperature has been calculated as 18.8°C. The years showing less than average minimum annual temperature were 1990, 1993, 1996, 1997, 2004, 2005, 2007, 2008, 2009, 2011, 2012, 2013 and 2014 (table-1). Contrary, the years showing more than average minimum annual temperature were 1989, 1991, 1994, 1998, 1999, 2000, 2001, 2002, 2003, 2006, 2010, 2016 and 2017 (table-1). Though, the linear regression trend line (Figure 4) represents the overall slightly decreasing trend of average minimum annual temperature in the period from 1988 to 2017 of South 24 Parganas Districts.

Table 1. The average, maximum and minimum annual temperature of South 24 Parganas District from 1988 to 2017

<table>
<thead>
<tr>
<th>Year</th>
<th>Average annual temperature in °C</th>
<th>Maximum annual temperature in °C</th>
<th>Minimum annual temperature in °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>26.9</td>
<td>34.8</td>
<td>18.8</td>
</tr>
<tr>
<td>1989</td>
<td>26.7</td>
<td>34.7</td>
<td>19.0</td>
</tr>
<tr>
<td>1990</td>
<td>26.6</td>
<td>34.1</td>
<td>18.4</td>
</tr>
<tr>
<td>1991</td>
<td>26.8</td>
<td>34.2</td>
<td>19.4</td>
</tr>
<tr>
<td>1992</td>
<td>26.3</td>
<td>33.4</td>
<td>18.5</td>
</tr>
<tr>
<td>1993</td>
<td>26.3</td>
<td>33.8</td>
<td>18.2</td>
</tr>
<tr>
<td>1994</td>
<td>26.7</td>
<td>34.3</td>
<td>19.0</td>
</tr>
<tr>
<td>1995</td>
<td>26.9</td>
<td>33.3</td>
<td>19.1</td>
</tr>
<tr>
<td>1996</td>
<td>26.7</td>
<td>34.2</td>
<td>18.5</td>
</tr>
<tr>
<td>1997</td>
<td>26.5</td>
<td>33.8</td>
<td>18.5</td>
</tr>
</tbody>
</table>
3.4 Trend Analysis of the Annual Total Rainfall in South 24 Parganas District from 1988 to 2017

![Figure 5. Showing the total annual rainfall trend in South 24 Parganas District from 1988 to 2017](image)

Figure 5 and Table 2 represents the annual total rainfall trend in the period from 1988 to 2017 of South 24 Parganas District. The maximum total rainfall in the 30 years period (1988-2017) was recorded as 243 cm in the year 2013 and the minimum total rainfall of 130 cm was recorded in the year 1996. The average annual total rainfall of the study area was calculated as 172.7 cm. Figure 5 also shows the irregular pattern of annual total rainfall. The years showing less than the average annual total rainfall were 1988, 1989, 1991, 1992, 1994, 1996, 1997, 2000, 2001, 2008, 2009, 2010, 2012 and 2014. Especially in the year 1992, 1996, 2001 and 2010, the annual rainfall dropped to less than 140 cm. The years showing more than the average annual total rainfall were 1990, 1993, 1995, 1998, 1999, 2002, 2003, 2004, 2005, 2006, 2007, 2011, 2013, 2015, 2016 and 2017. Moreover, the higher amount of annual total rainfall was found in the year 1995 (217 cm), 2002 (229 cm), 2004 (203 cm), 2005 (213 cm) and 2013 (243 cm). Although, the linear regression trend line (Figure 5) represents the increasing trend of the annual total rainfall in the period from 1988 to 2017 of South 24 Parganas District.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Rainfall (cm)</th>
<th>Average Rainfall (cm)</th>
<th>Year</th>
<th>Total Rainfall (cm)</th>
<th>Average Rainfall (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>26.8</td>
<td>32.9</td>
<td>2002</td>
<td>27.3</td>
<td>35.7</td>
</tr>
<tr>
<td>1999</td>
<td>26.9</td>
<td>32.7</td>
<td>2003</td>
<td>27.0</td>
<td>34.5</td>
</tr>
<tr>
<td>2000</td>
<td>26.4</td>
<td>32.4</td>
<td>2004</td>
<td>27.0</td>
<td>34.8</td>
</tr>
<tr>
<td>2001</td>
<td>26.8</td>
<td>33.9</td>
<td>2005</td>
<td>27.2</td>
<td>35.2</td>
</tr>
<tr>
<td>2002</td>
<td>27.3</td>
<td>35.7</td>
<td>2006</td>
<td>27.5</td>
<td>35.3</td>
</tr>
<tr>
<td>2003</td>
<td>27.0</td>
<td>34.5</td>
<td>2007</td>
<td>27.1</td>
<td>35.3</td>
</tr>
<tr>
<td>2004</td>
<td>27.0</td>
<td>34.8</td>
<td>2008</td>
<td>27.2</td>
<td>34.5</td>
</tr>
<tr>
<td>2005</td>
<td>27.2</td>
<td>35.2</td>
<td>2009</td>
<td>27.7</td>
<td>35.8</td>
</tr>
<tr>
<td>2006</td>
<td>27.5</td>
<td>35.3</td>
<td>2010</td>
<td>27.7</td>
<td>35.3</td>
</tr>
<tr>
<td>2007</td>
<td>27.1</td>
<td>35.3</td>
<td>2011</td>
<td>26.9</td>
<td>35.0</td>
</tr>
<tr>
<td>2008</td>
<td>27.2</td>
<td>34.5</td>
<td>2012</td>
<td>27.1</td>
<td>35.5</td>
</tr>
<tr>
<td>2009</td>
<td>27.7</td>
<td>35.8</td>
<td>2013</td>
<td>26.9</td>
<td>34.9</td>
</tr>
<tr>
<td>2010</td>
<td>27.7</td>
<td>35.3</td>
<td>2014</td>
<td>27.3</td>
<td>35.9</td>
</tr>
<tr>
<td>2011</td>
<td>27.7</td>
<td>35.3</td>
<td>2015</td>
<td>27.6</td>
<td>35.9</td>
</tr>
<tr>
<td>2012</td>
<td>27.1</td>
<td>35.5</td>
<td>2016</td>
<td>27.9</td>
<td>36.5</td>
</tr>
<tr>
<td>2013</td>
<td>26.9</td>
<td>34.9</td>
<td>2017</td>
<td>27.5</td>
<td>35.0</td>
</tr>
<tr>
<td>Average</td>
<td>27</td>
<td>34.6</td>
<td>Average</td>
<td>27</td>
<td>34.6</td>
</tr>
</tbody>
</table>

Source: Indian Meteorological Department (IMD), Kolkata
3.5 Trend Analysis of the Monsoon Rainfall (June - September) in South 24 Parganas District from 1988 to 2017

Figure 6 and Table 2 shows the monsoon rainfall trend in the period from 1988 to 2017 of South 24 Parganas District. The maximum monsoon rainfall in the 30 years period (1988-2017) was recorded 202 cm in the year 2007 and minimum rainfall was 80 cm recorded in the year 1997. The average monsoon rainfall of the study area was calculated as 129.4 cm (table-2). Figure 6 also presents the irregular distribution pattern of monsoon rainfall. Here, it was seen that in some years the monsoon rainfall was increased and some years the rainfall was decreased. Especially, in the year 1997 and 2000, the monsoon rainfall was dropped to less than 90 cm. Moreover, in the year 1992, 1994, 1996, 2001, 2009 and 2014, the monsoon rainfall was between 90 to 110 cm. In addition, in the year 1988, 1989, 1990, 1991, 1998,2003,2005, 2008, 2010, 2012 and 2017 the monsoon rainfall was normal (110 to 130 cm). On the contrary, in the year 1995, 2004 and 2016, the monsoon rainfall was high; it was between 130 to 150 cm. Moderately high monsoon rainfall (150 to 170 cm) was observed in 1993,1999, 2006 2011 and 2015. More than 170 cm monsoon rainfall was in the year 2002, 2007 and 2015. But overall, the linear regression trend line (Figure 6) represents the increasing trend of the monsoon rainfall in the period from 1988 to 2017 of the South 24 Parganas District.

![Figure 6. Showing the monsoon rainfall trend of South 24 Parganas District from 1988 to 2017](image)

**Table 2. The total annual and monsoon rainfall of South 24 Parganas District from 1988 to 2017**

<table>
<thead>
<tr>
<th>Year</th>
<th>Monsoon rainfall in cm. (June-September)</th>
<th>Annual rainfall in cm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>115</td>
<td>145</td>
</tr>
<tr>
<td>1989</td>
<td>121.5</td>
<td>148</td>
</tr>
<tr>
<td>1990</td>
<td>125</td>
<td>197</td>
</tr>
<tr>
<td>1991</td>
<td>126.8</td>
<td>150</td>
</tr>
<tr>
<td>1992</td>
<td>102.5</td>
<td>131</td>
</tr>
<tr>
<td>1993</td>
<td>153.4</td>
<td>201</td>
</tr>
<tr>
<td>1994</td>
<td>107.6</td>
<td>152.2</td>
</tr>
<tr>
<td>1995</td>
<td>148.7</td>
<td>217</td>
</tr>
<tr>
<td>1996</td>
<td>100.7</td>
<td>130</td>
</tr>
<tr>
<td>1997</td>
<td>80</td>
<td>131</td>
</tr>
<tr>
<td>1998</td>
<td>124.2</td>
<td>198</td>
</tr>
<tr>
<td>1999</td>
<td>159.1</td>
<td>188</td>
</tr>
<tr>
<td>2000</td>
<td>90.6</td>
<td>143</td>
</tr>
<tr>
<td>2001</td>
<td>93.3</td>
<td>127</td>
</tr>
<tr>
<td>2002</td>
<td>185.3</td>
<td>229</td>
</tr>
<tr>
<td>2003</td>
<td>111</td>
<td>176</td>
</tr>
<tr>
<td>2004</td>
<td>145.2</td>
<td>203</td>
</tr>
<tr>
<td>2005</td>
<td>116</td>
<td>212</td>
</tr>
</tbody>
</table>

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www.ijsrp.org
## Conclusion

The study analysed the trend in annual mean, maximum and minimum temperature and rainfall on annual total and monsoon season from 1988 to 2017 of South 24 Parganas District in West Bengal. The study showed a very significant change in temperature as well as rainfall. The annual average and maximum temperature, both were found an increasing trend, but there was a declining trend in the annual minimum temperature. On the other hand, both the 30 years (1988-2017) monsoon rainfall and annual total rainfall were found an increasing trend. This change in temperature and rainfall will negatively affect natural resources, agriculture, fishing, livestock rearing, other economic activities and human health. The local people of South 24 Parganas District need to take adequate measures to cope with this climatic condition. It is hoped that the study will help the policymaker to make proper strategies to climate change and adaptation.

## Acknowledgement

It is a great pleasure to thank the Indian Meteorological Department, Kolkata for providing temperature and rainfall data.

## References


Abstrak - This study aims to determine whether the Digitization of the SAKPOLE Application has an effect on motor vehicle tax revenues in the Central Java Samsat in 2019 with effectiveness as a control variable. The method used in this research is a quantitative method. The population used in this study was UPPD in the Samsat area of Central Java in 2019. Based on the saturated sample method, the number of samples used in this study were 37 UPPD in the Samsat area of Central Java. The results of this study indicate that the digitalization of the Sakpole application has an effect on motor vehicle tax revenues with a significant value of 0.026 < 0.05. In addition, the effectiveness used as a control variable in this study also affects motor vehicle tax revenues with a significance value of 0.001 < 0.005.

Index Terms - Digitalization of Sakpole application, motor vehicle tax revenue, effectiveness, Samsat area of Central Java

1. INTRODUCTION

Tax is a duty from community to state based on the act, which is coercive and issued debt. The result would be used for National development (Siahaan, 2004). A State demands great fundraising to maintain the implementation of development needs (Winerungan, 2013). Governments are committed to taking reliance away from overseas assistance and turning to national's capability through improved national revenue from the tax. Organizing regional autonomy is one of the community roles through regional tax and retribution (Cristina, 2012 in Susilawati, 2013). By authorizing the regional government system hoped to improve equitable development in the entire state of Indonesia so that the national development could run adequately and strive to create a fair and prosperous community (Dharma, 2014).

An automobile vehicle tax or PKB is a tax that is a debt on automobile ownership (Suryarini, 2012). The more community is, the more national and regional revenue from the tax. In this research, the number of people who used automobiles in the Semarang Region has yet to improve the regional revenue when it is not supported by factors that influence the obedience to pay taxes.

Digitalization nowadays would give many positive advantages. Technology and information development caused people's willing in rapid, correct, efficient, and transparent public service. General service based on the law of the republic Indonesia article 1 No.25/2009, as a constituent of essential responsibility each civil servant to carry out activities that fulfill the service needs to rely on law and regulation to every people In such administration, service stuff that provided by a general manager. The state institution that has general service responsibility in the payment of vehicle tax obligations is named SAMSAT (One-stop Administration Services Office) In the payment of vehicle tax obligations, especially Samsat Semarang, a long queue takes much time. The velocity of Samsat Semarang in the vehicle tax payment service caused taxpayers often to use scalper due to the long queue. The problem arises when the scalper is often set at very much prices to deal with the tax payment queue and offer information to the taxpayer that the payment process in samsat is complicated. Furthermore, this situation makes Semarang City Samsat's name a terrible image caused of its inefficient public service. The correlation between satisfaction and service is exceptionally close. If the consumer provides the service is equal to consumer's needs satisfactory. The consumer would respond positively to the service provider that is beneficial to them. The institution has an excellent image—answering community demands on public service, directorate of central Java's traffic unit police region (POLDA), BPPD JATENG, and PT. Jasa Raharja (Insurance company) of Central Java, as the board team cooperated with Central Java Regional Development Bank, created online vehicle tax system apps, namely SAKPOLE (Online Vehicle Tax Payment Administration). SAKPOLE was developed under NAWA CITTA (Nine Mission) of Mr. President Joko Widodo, where the state is present to provide the best public service and information technology-based to support transparency and provide more satisfactory public service for the community. Using SAKPOLE APPS, the community can fulfill their obligations to pay ongoing cash programs, traffic accident cash programs, and vehicle taxes.

Notwithstanding, the community Cooperates with the fundraising for traffic accident victims. The expectations of SAKPOLE implementation in Central Java, the taxpayers could feel the facility in vehicle tax payment, time-efficient, and satisfied with the service.
provided by samsat office so that the community could settle vehicle obligation simple and on time. Electronic service in e-commerce is the consumer's review from the internet. Furthermore, the public service in line with information technology is beneficial to ease activities such as vehicle tax payments. The researcher would research "The influence of SAKPOLE Apps digitalization (ONLINE vehicle Tax service administration.)" 

2. RESEARCH METHODOLOGY

Research designs
This research was designed using qualitative methods by testing hypotheses. Qualitative research is research that emphasizes theory testing through variables measurement. This research aimed to determine if the SAKPOLE Apps digitalization influenced automobile tax revenue on Central Java Samsat in 2019 with a control variable effectiveness. This research used secondary data from the Central Java Samsat report in 2019. The population used in this research was UPPD, located in the Central Java samsat area in 2019. Based on the Saturation sampling, the sample used by this researcher was 37 UPPD located on the Central Java Samsat.

Population, Sample, and Sampling techniques
The population in this research was UPPD, located in Central Java Samsat in 2019. The sampling technique in this research used saturation sampling of 37 UPPD located on the Central Java Samsat.

The Research Variable and Measurement
There are three kinds of variables conducted in this research: dependent, independent, and control variables.
1. Dependent variable (lagged) used in this research was automobile revenue performance. The automobile tax uses monthly total automobile proxy revenue.
2. Independent variable used in this research was the sakpole apps digitalization. The digitalization users use monthly total automobiles proxy digitalization revenue.
3. Variable control used in this research was Effectivity. In the effectivity measurement realization, automobiles revenue used was divided by target and then multiple by 100%

3. RESULTS AND DISCUSSION

The result of Multiple Linear Regression Analysis
As in the analysis result data that obtained by SPSS 26 program meant to discover whether or not the influence of SAKPOLE APPS digitalization toward automobiles tax revenue with the effectivity as the control variable. The result of the first model multiple linear regression can be seen in the table below:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Regression coefficient</th>
<th>Tcount</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-122.271.622</td>
<td>-2.330</td>
<td>0.026</td>
</tr>
<tr>
<td>SAKPOLE APPS Digitalization</td>
<td>23.537</td>
<td>3.548</td>
<td>0.001</td>
</tr>
<tr>
<td>Effectivity</td>
<td>1.228</td>
<td>2.284</td>
<td>0.029</td>
</tr>
<tr>
<td>R²= 0.374</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R² = 0.337</td>
<td></td>
<td>Fcount=10.151</td>
<td>Sig = 0.000</td>
</tr>
</tbody>
</table>

Source: Data processing result, 2022

The model of this research was:

PKB = -122.271.622 + 23.537 DIG + 1.228 EFK + ε

To interpret the analysis result can be delivered below:
1. The Constant value was -122.271.622, which showed that if the SAKPOLE APPS digitalization variable and the effectivity assumed constant or equal to zero, the automobile tax revenue was -122.271.622 billion.
2. The regression coefficient variable of SAKPOLE APPS Digitalization valued positively was 23.537. This result showed that if the SAKPOLE APPS digitalization were enhanced to 1, the automobile tax revenue would improve to 23.537 billion, and vice versa.
3. The Regression Coefficient effectivity Variable is valued positively at 1.228. This result showed that if the effectivity was valued positive to 1, the automobile tax revenue would increase to 1.228 billion; and vice versa.

The Research Result Discussion

The Influence of SAKPOLE APPS Digitalization on Automobiles Revenue Performance
Based on the t-test conducted, the obtained value t count>table tax planning was 3.548 > 2.02619, and the significant value was 0.001 < 5%, so H1 acceptance meant that SAKPOLE APPS digitalization indeed influenced automobiles tax revenue. The Sakpole Apps are the information apps that rely on tax payment and Android-based online STNK (Vehicle Registration Certificate) approval. Sakpole Apps
stands for Online

Tax Administration System. The app is available in the Play store for Android-based smartphones. From the test conducted before, this app can influence the automobile tax revenue by providing facilities to the community, especially for Central Java citizens to pay taxes, get approval, and automobile information by using smartphones as the media. So that the community no need to queue on handling taxes. This research was reliable to the research conducted by Djumain (2021), Ramadanty (2020), and Usmani (2020) that the sakpole apps digitalization usage can increase the Automobiles tax revenue.

The Influence of Effectivity on the Automobiles Tax Revenue
Based on the second hypothesis test obtained t-test value $t_{count} > $t_{table}$, the effectivity value was 2.284 > 2.02619, and the significant value was 0.029 > 5%. so the H2 was approved, which meant that the effectiveness influenced automobile tax revenue. Effectivity is a condition that describes the achieved target level. Simply the effectivity is the correlation between outcome and output. The effectivity also meant the resource utilization and facility in a certain predefined amount. Goods on service activities performed. The effectivity shows the achievement in which the target was achieved or not. If the result is nearly close to the target, the effectivity is high. It can be concluded that the effectivity relies on the implementation of all primary duties, the fruition of on-time and active participation from members, and also the correlation between goals and result obtained, and shows the degree of conformity between the goals and result achieved. It is effective when the activity process reaches the goals and final policy. The tax that is collected effectively would optimize the receive to increase the Automobiles tax revenue. This research is reliable to the previous research conducted by Hebimisa et al. 1 (2017) said that the automobile tax revenue influenced its effectiveness.

4. CONCLUSION
This research aimed to discover whether the SAKPOLE APPS Digitalization influenced automobile tax revenue on Central Java Samsat 2019, with the effectivity as the control variable. It which can be concluded that:
1. value was 0.001 < 5%, so that H1 approved meant SAKPOLE APPS Digitalization influence toward automobiles tax revenue.
2. $t_{count}$ value of Effectivity variable was 2.284 > 2.02619 and the significant value was 0.029 > 5%, so that H2 approved meant the Effectivity influence toward automobiles tax revenue.

The Research Limitations
Below is considered to be the research limitation in which:
1. This research focused on the SAKPOLE APPS Digitalization toward the automobile tax revenue only by using the control variables; otherwise, many other variables can be used to control stringent factors on the influence of automobile tax revenue.
2. The researcher only used UPPD, located in Central Java Samsat in 2019, to be the sample.

Suggestions
Below are considered to be suggestions given by the researcher:
1. The subsequent research adds other variables besides this research variable.
2. The following research will use other Samsat by using other applications that would increase the quality of research to get a better generalization level.

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Ermanis, Yunaldi ., Adriyanti .A. & Nadia F.L. 2021. PENGARUH INSENTIF PAJAK PANDEMI COVID-19, DIGITALISASI ADMINISTRASI PERPAJAKAN DAN OMNIBUS LAW PERPAJAKAN TERHADAP PENERIMAAN PAJAK (Studi Kasus di KPP Pratama Pekanbaru Tampan Tahun 2020-
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AUTHORS

First Author – Aulia Chairunnisa, Muhammadiyah of Surakarta University, b200180160@student.ums.ac.id
Second Author – Zulfikar Zulfikar, Muhammadiyah of Surakarta University, zulfikar@ums.ac.id
Correspondence Author – Zulfikar, Muhammadiyah of Surakarta University, zulfikar@ums.ac.id
Behaviors and Sexual Patterns leading to HIV risk among young transgender women in Coastal Kenya; a qualitative Study.

Melanie Abongo

Department of Research, Kenyatta National Hospital, Nairobi, Kenya.

DOI: 10.29322/IJSRP.12.09.2022.p12906
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Abstract- Background:
Transgender women are globally ranked as a high-risk population for their high HIV prevalence compared to other key population and 49 times higher than cisgender populations. Studies have cited many conditions and situations that contribute to these high HIV risks including stigmatization and discrimination and occlusion to access to universal health care. This study however aims to access the behavioral and sexual tendencies of the transgender women that predispose them to HIV risk. This paper informs on the sexual and behavioral risk factors predisposing the transgender women to a high HIV prevalence.

Methods: The study enrolled 200 transgender women aged between 18-24 years. An interviewer administered questionnaire was used to capture the sociodemographic, behavioral and sexual characteristics of the young transgender women.

Results: There are five main behavioral characteristics and sexual tendencies that render the young transgender women vulnerable and at risk of HIV: preference of physical hotspot as recreational site, early initiation into sex work, engaging in sex under the influence of drugs, multiple partners, and condom less and/or non-lubricant anal sex.

Conclusion: Generally, the behaviors and sexual characteristics of the young transgender women do not only render them vulnerable but also promote other factors that may predispose them to HIV and other STIs. Programs aimed at key population should focus more on behavioral patterns and motivational skills aimed at reforming the attitudes and knowledge on HIV and other STIs.

I. INTRODUCTION

Transgender is an evolving terminology that comprises all forms of non-gender conforming characteristics. Originally this term referred to those who sought medical intervention to change their gender; lately this refers to a range of possibilities such as transvestitism and trans-sexualism. Transgender women are biological male individuals who self-identify as women and prefer to be referred as such. This sub-population was termed as a key population as a result of their high prevalence to HIV. Globally, the HIV prevalence among transgender persons is 27%.

Transgender women have 49 times the risk of HIV infections compared to the general population1. Sex work is more prevalent among transgender women due to social and economic marginalization. Transgender people face social and legal exclusion and have high risks of gender-based violence in addition, stigma and Transphobia also create barriers to access to HIV testing and treatment. This reveals an overwhelming need to bridge the gap of unmet needs for effective HIV prevention strategies. Contextual differences arising from transphobia-related stigma can limit opportunities and access to resources in a number of critical life domains e.g., employment and health care. This leaves the transgender women vulnerable and with limited life choices therefore resulting to sex work as a means of survival thus heightening their risks for HIV. In order to understand the specific needs of the transgender women, there is need to understand their behaviors, and lifestyle.

Up to recently Kenya has been defining key population to only include female sex workers, men who have sex with men and people who inject drugs (PWID). The global health research has since asserted the high prevalence of HIV among transgender women at 13 times more than the general population therefore including the transgender women as key population2. The behavior and lifestyle of the transgender women renders them prone to HIV acquisition. This is promoted by the personal and community constraints that have rendered them even more vulnerable. Towards affirmation of their gender, the transgender women prefer receptive anal sex, mostly of which if done for commercial purposes will be done among multiple partners, without condom and without lubrication. Dependence on sex work promotes drug and substance abuse besides predisposing them to violence, all these behavioral factors lead to increased HIV susceptibility among the transgender women.

An analysis of the literature available globally, regionally and in Kenya illustrate that transgender is a new concept that lacks comprehensive research, in fact it is until recently that the transgender women were recognized by global health as part of key population2. It is on this backdrop that the Kenya National Aids and STI Control Programme (NASCOP) is currently developing transgender specific guidelines for HIV and STI programming of the transgender population. Previously, programs
recognized key population to be female sex workers, male sex workers, men who have sex with men and People who inject drugs. Transgender women were shelled into men who have sex with men, gay and bisexuals and their health care needs assumed to be similar, this is however not satisfactory since being a transgender woman encompasses more than the sexual orientation and the preferred sexual partner. This assumption has further been challenged, a study done in Kenya shows a higher risk of HIV acquisition among transgender women compared to men who have sex with men at 20% and 5% respectively\(^1\).

Historically in Africa, cultures across the continent have recognized the presence of transgender population and many societies have accepted them\(^2\). However this has been modernized with all kinds of non-conforming individuals introducing same-sex societally non-acceptable behavior thereby leading to criminalization and victimization of transgender persons in most African countries. The non-conforming tendencies of the individuals to their gender has aroused violence and victimization, therefore epidemiological research aimed at identifying their needs has failed because this is perceived as potentiation of exposure to greater levels of risk\(^3\). Transgender women in Africa have been categorized in most studies as men who have sex with men, and in extension transgender men to be women who have sex with women. This may be biased and focused on the behavioral characteristics and may not describe the insight of the transgender people as they may not be linked to these social or sexual networks, or are “stealth”, as many do not express their gender identity in their daily lives\[^3\]. Lack of medical health care and considerations has been cited as the most common barrier to SRH among the transgender women population. This has been attributed to general factors just like other minority key population; however lack of more specific transgender expertise is a single most vulnerable inhibiting factor. Even though transgender is an evolving subgroup of the population with no precise medical curricula, there is no requisite knowledge on their health needs. Real and/or perceived stigma has led to social discrimination with the transgender women bearing the burden of disproportionate HIV prevalence of 20% globally. The most relevant explanation to the high prevalence of HIV among the transgender women is their preference for receptive anal sex; this can be understood as an affirmation of their female gender. This in turn places them at a greater risk of HIV contraction.

While there has been tremendous progress in access to HIV/STI services to key populations (KP) in Kenya, which has resulted in a significant decline in the number of new infections among KP, this progress is limited to female sex workers, men who have sex with men (MSM) and people who inject drugs (PWID). Transgender populations remain marginalized by most KP programs. In some programs, Transgender persons are categorized as MSM which drives the stigma even further. A major reason for this is the lack of understanding of SRH needs and the best service delivery models for Transgender persons. Consequentially in Kenya, lack of data has led to lack of funding aimed towards transgender specific HIV programs; although other (Lesbian Gay Bisexual Transgender and Queer) LGBTQ funded programs somewhat provide insight to their plight, they do not specifically provide custom made preferences for the transgender women. Most studies focusing on transgender women have behaviorally defined them as men who have sex with men (MSM).

Lack of attention to the transgender women has broadened the bridge and included diversity of other identities that HIV prevalence and risk could significantly differ between. A recent respondent driven sampling study in Nairobi Kenya revealed the prevalence of HIV among Transgender women is at 39.3%, a higher burden compared to the general population or MSM and bisexual which is at 24.6%\(^6\). Up to recently Kenya has been defining key population to only include female sex workers, men who have sex with men and people who inject drugs (PWID). The global health research has since asserted the high prevalence of HIV among transgender women at 13 times more than the general population therefore including the transgender women as key population\(^2\).

### Study Design

This was a cross-sectional study. We performed interviews using open ended questionnaires this process was necessitated by the paucity to avoid re-engaging participants after the first contact. The questionnaire was translated into Swahili for those participants who preferred Swahili.

### Setting

The research assistants who doubled up as peer educators phone-called the young transgender women and enquired where they were comfortable to meet up. 5-10 peers agreed to meet in one place at a particular time then the RA would meet them there. This could be in the drop in center (safe space) or in the hotspots where they hang out. The RA informed them about the study in a group and respond to their queries, before holding the interviews privately. Usually a peer educator has only up to 30 peers, so in order to attain the sample size, snowballing method of referral was done until the desired sample size of 200 young transgender women were reached. Screening of the participants preceded the consenting process and enrollment of participants into the study. The screening process entailed the participants voluntarily confirming their gender conformity as transgender women, and explaining what the term meant to them as having a different sexual orientation to that assigned at birth, and also confirming their age as below 24 years old before being enrolled into the study.

### Data Collection and Tools

A structured open ended questionnaire was developed, key areas that were captured included: a) sociodemographic characteristics which included age, residence, level of education, occupation, and marital status. b)Behavioral and sexual characteristics included preferred hotspot, age of transgender identification, owning a cell phone, and preferred online hotspots, drug use and abuse, health services access and delivery, identification as a sex worker, age begun sex work, position during sex, and frequency of use of condoms and lubricants, HIV status and frequency of HIV testing. Data was cleaned in analyzed using STATA.

### Ethical considerations

The study received ethical clearance from KEMRI SERU.
III. RESULTS

Sociodemographic Factors
The TGW women enrolled into the study were aged between 18-24 years of age; 18 to 21 years were 21% and the older TGW of 22 to 24 years were 80%. In this cohort, 8% had not completed primary schools, 30% of them had not completed secondary schools only 8% confirmed being in tertiary colleges, 54% of the TGW had finished secondary school but not enrolled to any tertiary institutions. Transition into TGW for most of the participants was between 15 and 20 years of age (80%). The marital statuses were; 73% single, 17% married and 11% neither single nor married. The recreational points for the young transgender women population in this study varied from online platforms to physical joints, with most of them preferring to hang out in physical hotspots 73% as opposed to online dating sites at 27%. This is presented in table1.

<table>
<thead>
<tr>
<th>Sociodemographic characteristics</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-20</td>
<td>24</td>
<td>12%</td>
</tr>
<tr>
<td>21-24</td>
<td>176</td>
<td>88%</td>
</tr>
<tr>
<td><strong>Level of education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>none</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>primary</td>
<td>41</td>
<td>21%</td>
</tr>
<tr>
<td>secondary</td>
<td>99</td>
<td>50%</td>
</tr>
<tr>
<td>Post-secondary</td>
<td>59</td>
<td>30%</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>single</td>
<td>146</td>
<td>73%</td>
</tr>
<tr>
<td>not single</td>
<td>54</td>
<td>27%</td>
</tr>
<tr>
<td><strong>Transition age to transgender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>below 16 years</td>
<td>52</td>
<td>26%</td>
</tr>
<tr>
<td>above 16 years</td>
<td>148</td>
<td>74%</td>
</tr>
<tr>
<td><strong>Preferred Recreation point</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>online dating sites</td>
<td>54</td>
<td>27%</td>
</tr>
<tr>
<td>physical hotspot</td>
<td>146</td>
<td>73%</td>
</tr>
</tbody>
</table>

Behavioral and Sexual Characteristics
Over half of the young transgender women were sex workers (54%), and others spread across doing business, employment, and being students. Most were introduced to sex work after 16 years (59%) at the age when they are able to individually discern good from bad. And most of the TG participants confirmed to be recipients of anal sex (bottom) 54% and had sex under the influence of drugs (42%). 60% of the participants had 2-5sexual partners, and up to 50% accepted to always using condoms during sex. While most of the transgender women were always using lubricants during sex, the most widely used lubricants were oils including coconut oil, Vaseline, cooking oils and body lotions to lubricate during anal sex. Half of the participants in the study accepted to be using only water to douche (wash their anus) however 29% used other harmful products including bleach, herbs, lemon and soap to wash their anus while a whole 22% do not douche at all or did not prefer to disclose how they do it. The healthcare providers were the source of condoms and lubricants of most of the young transgender women enrolled in this study, 28% received their supplies from the CHV and peer educators. A majority of the participants had HIV tests within the last 3months.

<table>
<thead>
<tr>
<th>Behavioral and sexual characteristics</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sex workers</td>
<td>105</td>
<td>52.5%</td>
</tr>
<tr>
<td>Non sex workers</td>
<td>95</td>
<td>47.5%</td>
</tr>
<tr>
<td><strong>Age begun sex work</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Count</td>
<td>Percentage</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>below 16 years</td>
<td>44</td>
<td>41%</td>
</tr>
<tr>
<td>above 16 years</td>
<td>63</td>
<td>59%</td>
</tr>
<tr>
<td>Daily average sex acts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>less than 3</td>
<td>109</td>
<td>55%</td>
</tr>
<tr>
<td>more than 3</td>
<td>92</td>
<td>46%</td>
</tr>
<tr>
<td>Sex Position</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bottom</td>
<td>107</td>
<td>54%</td>
</tr>
<tr>
<td>Equal times bottom as top</td>
<td>47</td>
<td>24%</td>
</tr>
<tr>
<td>top</td>
<td>46</td>
<td>23%</td>
</tr>
<tr>
<td>Use of drugs during sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>always</td>
<td>84</td>
<td>42%</td>
</tr>
<tr>
<td>sometimes</td>
<td>76</td>
<td>38%</td>
</tr>
<tr>
<td>never</td>
<td>38</td>
<td>19%</td>
</tr>
<tr>
<td>Sexual Partner Count</td>
<td></td>
<td></td>
</tr>
<tr>
<td>less than 2 partners</td>
<td>51</td>
<td>26%</td>
</tr>
<tr>
<td>2-5 partners</td>
<td>117</td>
<td>59%</td>
</tr>
<tr>
<td>more than 5 partners</td>
<td>32</td>
<td>16%</td>
</tr>
<tr>
<td>Frequency of condom use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>always</td>
<td>97</td>
<td>49%</td>
</tr>
<tr>
<td>sometimes</td>
<td>92</td>
<td>46%</td>
</tr>
<tr>
<td>never</td>
<td>11</td>
<td>6%</td>
</tr>
<tr>
<td>Frequency of lubricant use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>always</td>
<td>106</td>
<td>53%</td>
</tr>
<tr>
<td>sometimes</td>
<td>80</td>
<td>40%</td>
</tr>
<tr>
<td>never</td>
<td>14</td>
<td>7%</td>
</tr>
<tr>
<td>Type of lubricant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oils(coconut oils, Vaseline, cooking oils, body lotions)</td>
<td>116</td>
<td>41%</td>
</tr>
<tr>
<td>water</td>
<td>88</td>
<td>31%</td>
</tr>
<tr>
<td>water based gels</td>
<td>78</td>
<td>27%</td>
</tr>
<tr>
<td>saliva</td>
<td>3</td>
<td>1%</td>
</tr>
<tr>
<td>Anal washing-Douching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water only</td>
<td>99</td>
<td>50%</td>
</tr>
<tr>
<td>others(soap, bleach, herbs, lemon)</td>
<td>57</td>
<td>29%</td>
</tr>
<tr>
<td>Do not wash</td>
<td>44</td>
<td>22%</td>
</tr>
<tr>
<td>Source of Condoms and lubricants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHV/PE</td>
<td>55</td>
<td>28%</td>
</tr>
<tr>
<td>Health provider</td>
<td>105</td>
<td>53%</td>
</tr>
<tr>
<td>Chemists</td>
<td>38</td>
<td>19%</td>
</tr>
<tr>
<td>HIV tests in the last 3 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>170</td>
<td>85%</td>
</tr>
<tr>
<td>no</td>
<td>30</td>
<td>15%</td>
</tr>
<tr>
<td>HIV status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>181</td>
<td>91%</td>
</tr>
<tr>
<td>positive</td>
<td>17</td>
<td>9%</td>
</tr>
</tbody>
</table>
IV. DISCUSSION

The young transgender women described in this study are those aged between 16 and 24 years. The young transgender women population was of essence in this study in order to understand the background of the transgender women before they become fully camouflaged; we intended to understand their sexual patterns and behavior before they can fully mature into adulthood. Ages between 18 and 20 years were only 20% while the majority, 80%, were 21 years and above; however much this outcome is entirely reliant on the sampling process(snowballing), the TGW below 20 years are still young adults who are on the verge of understanding themselves. They have not fully come to terms with the idea of being a transgender or they have mixed feelings about the whole idea, might have just been initiated into the system or they do not completely understand the meaning of being a transgender. Most of the indecisiveness arise from the fact that most transgender women acquire the gender conforming traits in their puberty and this is emphasized as they proceed into adulthood. As confirmed in other studies, education, and knowledge geared towards behavior change could be more practical if exercised during puberty as the TGW transition into adulthood. The first contact for health care is the pediatricians who ought to be aware of the gender affirming questions or concerns from these individuals who may be seeking for hormones or gender blocking recommendations, even though most of these health care personnel’s are not aware of the guidelines related gender affirming medical care (GAMC). The Endocrine Society do not recommend use of puberty blocking prior to initiation of puberty, instead the health care providers are advised to affirm and recommend acceptance of the patients gender prior to any procedures or introduction to any hormonal therapies. The African child however is constrained by financial capabilities leaving them vulnerable and eager to experiment any possible way to counter the effects they are experiencing in their bodies. They therefore left with cheap accessible hormonal therapies containing progestin and GnRH agonists to achieve pubertal suppression.

While most of the young transgender women had attained or dropped off secondary school level of education, this might not be a significant contribution but it determines the literacy levels, and level of understanding of simple health recommendations. Kenya’s learning system does not discriminate based on the gender conforming patterns neither does it recognize transgender nor others genders other than cisgender. This therefore might have contributed to the rise of sexual assaults and same sex behaviors in the secondary schools, which might imitate transgender behavior although it is different. Transition into being a fully aware self-proclaimed transgender requires understanding of oneself, the risks and the mitigations these individuals have to have in place in order to service in a community that is not ready to accept them. While most of the young transgender women accepted that they transitioned into being transgender after 16 years, to mean they were fully aware of their decisions, it is until they are 18 years, when they are considered independent adults capable of making mature decisions. This however does not affect their decisions to engage in sexual behaviors that could predispose them HIV risk and also be victims of psychological distress and suicide arising from seclusion, discriminations, and depressions. This contributes primarily as to why these young populations is ideal for studies targeting behavior change among transgender women.

The definitions of sex work differ depending on the localities. Sex work in this study was defined as exchange of sex for money directly or sex in exchange of other favors, goods and services; most commonly is drugs, friendship, and employment. Several studies have cited that the TGW enter into sex work mainly because of stigma and discrimination. Sex work is the only credible money generating source of income among the transgender women in Coastal Kenya, with most of the participants in this study accepting to be sex workers for lack of anything better to do. Like other studies across Sub-Saharan Africa, the transgender women like other key population are more predisposed to sex work as the only source of livelihood as a result of sociocultural and economic factors. For the young TGW source of livelihood is a big challenge, even though non-employment among the youth is a concern in Kenya, the condition gets worse for the transgender youths who have sociocultural non-gender conforming issues affecting their acceptance into the community leaving them with sex work and dealing drugs as the only option. In coastal Kenya, sex work is rampant, as young as 12 year olds sell sex work for survival, in this study, most of the TGW sex workers were introduced to sex work after 16 years of age, which responds to other studies done in the region which confirms that most of the sex workers are introduced into the trade around the age of 14, 15, 16 and 17 years.

Other studies have cited that younger sex workers earn more from sex work, have more clients, and are treated better compared to older sex workers; in this study, the daily average sex acts reported by the young transgender sex workers (TGSW) was 3 acts per day, with most of them reporting 2-5 sex partners. Other studies done in Harare and among Ugandan sex workers shows an average of 10-15 clients per day, which depicts that the transgender women with an average of 3 clients per day have a higher client count per day compared to other sex workers. According to Nairobi prostitutes study, the average number of clients per week still remains at 9-16 clients per week depending on the locality of the sex work whether rural or town center based.

The most used and abused drug by sex workers is alcohol, with most studies associating use of drugs to violence and poor negotiation during sex; however these drugs were not only limited to alcohol, they included weed, miraa, muguka, cocaine and tobacco. According to a recent study among transgender women in Guatemala, TGSW are three times more likely to abuse drugs compared to non sex workers. While under the influence of
drugs, there is a higher risk of being forced into sex, non-use of condoms and/or lubricants and physical violence, all these factors are associated with risk of HIV and other STIs. Other studies have associated inconsistent condom use with use of hard drugs, forced sex and physical violence among the transgender; other studies related lack use of condoms to knowledge deficit and stigma, while others associated it with discrimination of the transgender women. However in a controlled environment where the transgender women have safe spaces, peer educators who are easily accessible and drop in centers to which they can access any health service they need, only 46% of young transgender women consistently used condoms during anal sex. Condom and lubricant use among the transgender women is very essential, not only for the prevention of STIs but also to avoid cracking and tearing of the thin anal membrane. Knowledge levels have been cited to adversely affect the use of condoms and lubricants, according to a Chinese study, not knowledge but lack of motivation and unstrengthen behavioral skills mostly led to low use of condoms among the transgender women. Even though this theory does not satisfactorily provide an explanation why the young TG do not consistently use condoms and lubricants, other studies analyzing low use of condoms among this group tend to gravitate on the attitudes of the TG and the general health perception they have on HIV preventive measures. Most of the YTGW in this study were more comfortable receiving their health supplies including condoms and lubricants from health care providers as opposed to the peer educators, in contrast of what is expected of key population including the female sex workers, male sex workers, and men who have sex with men. The young transgender women have not come to terms with themselves and definitely not with the peers in their circle, therefore have not developed rapport with each other, which explains why they prefer the key health care providers i.e. the doctors and nurses they interact with at the clinic, drop in center and safe spaces. Other studies on the preferences of health service access, depicted transgender showing closer relations and more preference to the peer educators and community mobilisers as opposed to the key health care providers. The HIV prevalence among transgender women is four times other key population and even higher among transgender women sex workers. The HIV prevalence among the young TGW in this study was however lower(9%) compared to other studies, this finding however is not conclusive as it is self-reported, this means it could be higher upon testing. The behaviors and sexual tendencies of the transgender women expose them to vulnerabilities therefore heightening the HIV prevalence. More studies have suggested activities geared towards promotion of use of PREP and PEP to control the contraction and spread of HIV among this population. Additionally most recent recommendations have suggested a quarterly testing for the TGSW and 6 monthly testing for TGW, this has been embraced by the young TGW in this study. 85% had done a HIV test within the last 3 months. This trend is however unique to young transgender women, the naivety and cowardly nature that comes with sexual contact may be creating fear that drives them to HIV self-awareness.

V. CONCLUSION

There are other studies that have determined the general predisposing factors of transgender women to high HIV prevalence, this study focused on the young transgender women of ages between 16-24 years. Generally, the behaviors and sexual characteristics of the young transgender women do not only render them vulnerable but also promote factors that may predispose them to HIV and other STIs. Programs aimed at key population should focus more on behavioral patterns and motivational skills aimed at reforming the attitudes and knowledge on HIV and other STIs.

REFERENCES


AUTHORS

First Author – Melanie Abongo, Department of Research, Kenyatta National Hospital, Nairobi, Kenya.
An Evolving Era of Aesthetic Gynaecology

Dr. Deepa Aggarwal (DGO)
Sr. Ops and Gynae Consultant Om Medical Center, Faridabad

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Abstract- In the past few years, aesthetic gynecology has been gaining popularity worldwide due to its numerous health and beauty advantages.
Aesthetic gynecology consists of procedures that improve the appearance of the vaginal and vulva regions, as well as vaginal reconstructions to improve or restore sexual functions. 1. The goal of this lecture is to explain this new subspecialty that is rapidly growing and discuss the many techniques and procedures as well as the indications for its implementation, possible consequences for harm, and benefits from these methods.

Index Terms- Aesthetic, labiaplasty, vaginoplasty, clitoral hoodectomy

I. INTRODUCTION
Aesthetic gynecology has been one of the fastest-growing branches of women's health, with increasing demand and interest. It involves a range of procedures to alter the appearance or function associated with congenital anomalies or female genital changes. There is growing anxiety about their appearances; more women are looking for more information and adopting the latest medical techniques to achieve the ideal appearance, be it internal or intimate. The field of aesthetic gynecology goes beyond beautification, but it is a significant factor to be concerned with women's reproductive health and how they function. How we feel about our bodies directly impacts our emotional well-being. It is commonly observed that people who are comfortable with their bodies feel happier and more confident.

There are a variety of gynecological procedures that are non-surgical and surgical to improve the external genital tract's health and improve the health of women. 3] The indications, as well as the long-term benefits and risks of the treatments, will be discussed in this talk.

II. SURGICAL AND NON-SURGICAL TREATMENTS:

The various treatments include:

- Labiaplasty
- Vaginoplasty
- Hymenoplasty
- Clitoral hoodectomy
- Labia majora augmentation
- O-spot
• G-spot amplification etc. Surgical solutions involve the use of –
  ➢ The number of emerging energy-based instruments (EBD) for vaginal procedures employ thermal or ablative forces to contour the vagina’s exterior or to reinforce the vaginal walls that are aging. [4]
  ➢ Lasers.
  ➢ RF (radiofrequency devices)
  ➢ HIFU (high-intensity focused ultrasound).
  ➢ LED (light emitting diodes).
  ➢ High-intensity focused electromagnetic field.

The most advanced minimally-invasive treatment that uses the FDA-accepted Co2 laser for treating typical feminine problems is "FEMILIFT."

Problems that are usually addressed by surgical interventions:

1. Stress urinary incontinence (SUI).
2. Vaginal tightening.
3. Post menopause indications.
4. Post-delivery rehabilitation.
5. Vaginal dryness.
6. Recurring infections.

Non-surgical solutions involve the use of:

• PRP (platelet-rich plasma).

• Plasma gel.

• Hyaluronic acid fillers. They are used to treat:
  1. Improve the appearance of the vulva pigmented. [5]
  2. Treatment of vulvovaginal atrophy and kraurosis.
  3. Vulva with sclerotrophic lichen.
  4. Augmentation of the labia minora and majora.
  5. Intimate contouring as well as G-spot amplification.
  6. Treatment of dyspareunia after episiotomy and perineotomy during labor.
  7. Contouring of the clitoral.
  8. Female orgasm activation and sexuality of females.
III. WHY DO WOMEN SEEK AESTHETIC GYNECOLOGY:

The main reasons are Congenital adrenal hyperplasia.

Other causes are the vagina becoming looser and larger and the desire to improve sexual function and discomfort while wearing clothing or engaging in exercises that increase sexual satisfaction for both. Psychological reasons include the need to lessen the stigma of shame, low self-esteem, and fear of how external genitalia appear.

However, the most troubling aspects are that there is no proof of long-term safety or effectiveness is not sufficient in terms of quantity and quality. [8,9,10]

Gynecologists must be properly trained to recognize women who suffer from sexual dysfunction, and psychotic disorders such as anxiety, depression, and body dysmorphic disorders.

Additionally, there is a deficiency of standard nomenclature, and there could be complications associated with vaginal procedures, such as bleeding, pain, infection, scarring adhesions, altered sensation dyspareunia, and the need to undergo an operation that is re-operated. [11,12]

IV. CONCLUSION:

Aesthetic gynecology significantly impacts the sexual quality of women's life. The benefits and importance of aesthetic gynecology procedures are greater than concerns about the long-term safety and dangers. However, further research is needed to establish the standard nomenclature and protocols.

REFERENCES


AUTHORS

First Author – Dr. Deepa Aggarwal (DGO), Sr. Ops and Gynae Consultant Om Medical Center, Faridabad
Dynamics Of Monogenean Gill Parasites Of Synodontis rebeli (Siluriformes, Mochokidae) From River Sanaga Reveals Unusual Switching Status

Jonathan Armel Mbondo 1, Etienne Didier Bassock Bayiha 2, Bahanak Dieu Ne Dort 3, Nack Jacques 4,5, Kingsley Etchu 6, Charles Félix Bilong Bilong 2

1 Institute of Agricultural Research for Development (IRAD), Experimental Research Station in Marine Ecosystems, PO Box 219, Kribi, Cameroon
2 Laboratory of Parasitology and Ecology, University of Yaoundé I, PO Box 812, Yaoundé, Cameroon
3 Institute of Agricultural Research for Development (IRAD), Station of Batoke, BO box 77 Limbe, Cameroon
4 University of Douala, Laboratory of Parasitology and Ecology, PO Box 24157, Douala, Cameroon
5 Institute of Fisheries and Aquatic Sciences of Yabassi (ISH), University of Douala, Cameroon
6 Institute of Agricultural Research for Development (IRAD), Yaoundé, PO Box 2123, Yaoundé

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Abstract- The present survey on population’s dynamics of gill monogeneans aimed to contribute in minimizing catastrophic losses in potential fish ponds. Monogeneans were dislodged from the gill filaments, with the aid of a dissecting needle and mounted between slide and cover slip in a drop of water. Water temperature and the levels of others environmental parameters appear as an important factor associated with the variation in monogenean infections; it might explain changes in the status of Synodontella sp.

Index Terms- Monogenean, dynamics, Synodontis rebeli, switching status, River Sanaga, Cameroon, Catfish

I. INTRODUCTION

Members of the catfish family Mochokidae are amongst the most important teleosts suitable for aquaculture with species of the genus Synodontis Cuvier, 1817 of great commercial value and larger ones are important food fishes in many parts of Africa [1]. In the Sanaga River basin, individuals of Synodontis rebeli Holly, 1926 are highly consumed by local populations, and potential candidates for aquaculture [2]. Ectoparasites such as monogeneans may cause localized hyperplasia, disturbance of osmoregulation and mortality of their hosts [3], [4]. Secondary infections in hosts due to viruses, bacteria and fungi are also observed [5]. In addition, environmental pollution of the aquatic ecosystem may either increase or decrease the worm (parasite) burden in aquatic organisms such as fish [6], [7]. Fish parasite diseases reduce the amount of food available to people [8] and remain a constraint for a successful fish farming [9]. Thus, fishery development programs also depend on the intensification of parasitological researches so that improved fish yield can be achieved from healthy fish stocks [10]. It is known that, parasites usually affect the marketability of fish and raise economic losses in aquaculture industry [11], [12]. The present study aimed at assessing the population dynamics of gill monogeneans of Synodontis rebeli in view to contribute to minimizing catastrophic losses which could be observed in potential fish ponds.

II. MATERIALS AND METHODS

A. STUDY AREA

This study was conducted in the Sanaga downstream, at Edéa (3°48'00''N; 10°7’60’’E) in Cameroon (Central Africa). This locality is subject to an oceanic variant of the equatorial climate of the Guinean type, characterized by two seasons: the dry season (from December to February with less than 50 mm rainfall) and the rainy season (from March to November) with the monthly average temperature of 25.5°C and the annual average humidity of 28.4 mb [13].

B. HOST FISH SAMPLING AND PARASITOLOGICAL EXAMINATION

A total of 257 specimens of Synodontis rebeli, at least 30 fish per campaign, were bought from fish landing site bimonthly immediately after fishing by nets from January 2018 to March 2019 and constituted the overall sample. After capture, fish were immediately fixed and kept in 10% formalin then transferred to the laboratory. In the laboratory, specimens standard length [SL =
horizontal distance from front tip of snout to base (articulation) of caudal fin [14] was measured to the nearest millimeter (mm) using a Carbon fiber Caliper. Fish were sexed (as male, female or undetermined) then gills were dissected. Monogeneans were dislodged from the gill filaments, with the aid of a dissecting needle, and mounted between slide and cover slip in a drop of water. They were identified to species level by the morphological characters of sclerotized parts of the haptor as well as of the copulatory organs after Mbondo et al. [2], using a Leica DM2500 microscope equipped with a Leica DFC425 camera. They were then counted.

C. TERMINOLOGY

The terms prevalence (Pr), intensity (I), mean intensity (MI) and abundance (A) are defined after Bush et al. [15]. Based on the prevalence, parasite species were termed common (Pr > 50%), intermediate (10% < Pr ≤ 50%) and rare (Pr ≤ 10%) after Valtonen et al. [16]. The mean intensity (even the intensity) is categorized very low (MI ≤ 10), low (10 < MI ≤ 50), average (50 < MI ≤ 100) and high (MI > 100) after Bilong Bilong & Njiné [17].

D. DATA ANALYSIS

The Chi-square (χ²) test made it possible to compare prevalence. The Kruskal-Wallis (K) test allowed comparing several (more than 2) mean values, while Mann-Whitney test was used for pairwise comparisons. The Sperman′s coefficient “r,” permitted to investigate the potential relationship between the parasite load of a given species and the host standard length. These analyses were performed using STATISTICA 6.0 software and Quantitative Parasitology 3.0. All values of P < 5% were considered significant.

III. RESULTS

A. DISTRIBUTION AND STATUS OF SYNODONTELLA SPP.

A total of 3683 Monogeneans (Synodontella malanoptera Dossou & Euzet, 1993, S. sanagaensis Mbondo, Nack & Pariselle, 2017 and Synodontella sp. (undescribed species)) were collected from the gills of the 257 specimens of Synodontis rebeli. Among these fish, 237 specimens harbored at least one parasite species (overall infection rate of 92.2% ± 0.02) and the mean intensity was 15.54 monogeneans per individual host. The three monogenean taxa aggregated in the host population (s²/Im > 1). Out of the 257 Synodontis rebeli examined, 220 were parasitized by S. malanoptera (prevalence: 85.6% ± 0.02), 214 by S. sanagaensis (prevalence: 83.3% ± 0.02), and 55 by Synodontella sp. (prevalence: 21.4% ± 0.02). Therefore, based on the overall sample, S. malanoptera and S. sanagaensis were common species while Synodontella sp. was rare or satellite. The mean intensities of the three above parasite species varied from very low to low (Table I).

Table I: epidemiological indexes and status of Synodontella spp.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>S. malanoptera</th>
<th>S. sanagaensis</th>
<th>Synodontella sp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosts examined</td>
<td>257</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infected</td>
<td>220</td>
<td>214</td>
<td>55</td>
</tr>
<tr>
<td>Pr (% ± S.E)</td>
<td>85.6 ± 0.02</td>
<td>83.3 ± 0.02</td>
<td>21.4 ± 0.02</td>
</tr>
<tr>
<td>MI ± S.E</td>
<td>7.6 ± 0.92</td>
<td>6.65 ± 0.54</td>
<td>10.67 ± 3.8</td>
</tr>
<tr>
<td>Overall Status</td>
<td>Common</td>
<td>Satellite</td>
<td></td>
</tr>
</tbody>
</table>

S.E: Standard Error

A total of 119 males and 113 females Synodontis rebeli were examined (sex ratio females to males = 0.9). The sex of the other 25 fish specimens was undetermined. The overall infestation rate was 90.75% ± 0.02 in males and 92.92% ± 0.02 in females respectively and did not vary between host sexes (P = 0.16).

B. RELATIONSHIP BETWEEN STANDARD LENGTH AND DEGREE OF INFECTION

Generally, the number of monogenean individuals increased with the size (Standard length) of host. The equation of regression line obtained (Fig. 1) is ln (A + 1) = 2.28 ln (LS + 1) – 1.78.

Figure 1: regression line of parasite load (ln A+1) as a function of host length (ln SL+1).

The prevalence as well as the mean intensity of Synodontella sp. were similar (P = 0.31 and P = 0.78 respectively) between host size classes. However, fish of the class size [148-163] were often relatively more parasitized (MI = 23.7 ± 15.6). For the other monogeneans species, difference of prevalence amongst host size classes was significant for S. malanoptera (P = 0.0001) and for S. sanagaensis (P = 0.004). For these two monogeneans species, the pairwise comparisons for prevalences and mean intensities revealed that fish of SL <118 mm were less infected while those of SL > 148 mm precisely of the size classes [148-163] and > 178 mm were always more infected (Table II).

Table II: prevalence and mean intensity in relation to host size

<table>
<thead>
<tr>
<th>Size classes</th>
<th>S. malanoptera</th>
<th>S. sanagaensis</th>
<th>Synodontella sp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 118</td>
<td>64 ± 0.07a</td>
<td>4.81 ± 0.8b</td>
<td>96 ± 0.07c</td>
</tr>
<tr>
<td>[118-133]</td>
<td>84 ± 0.05ab</td>
<td>6.5 ± 0.6b</td>
<td>82 ± 0.05bc</td>
</tr>
<tr>
<td>[113-148]</td>
<td>87 ± 0.14</td>
<td>6.67 ± 1.35a</td>
<td>77 ± 0.05ab</td>
</tr>
<tr>
<td>[148-163]</td>
<td>98 ± 0.05</td>
<td>11.25 ± 3.22a</td>
<td>94 ± 0.05ab</td>
</tr>
<tr>
<td>[163-178]</td>
<td>92 ± 0.05</td>
<td>5.37 ± 0.28ab</td>
<td>92 ± 0.05ab</td>
</tr>
<tr>
<td>&gt; 178</td>
<td>87 ± 0.06a</td>
<td>9.52 ± 1.17a</td>
<td>12 ± 0.07a</td>
</tr>
</tbody>
</table>

Stat: Statistics; S.E: Standard Error. ab: different letters in the same column indicate significant statistical differences.

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C. SEASONAL VARIATION OF EPIDEMIOLOGICAL INDEXES OF SYNODONTILLA SPP.

The seasonal variations of the prevalence only differed for *S. sanagaensis* (P = 0.007) while those of the mean intensity were not significant (P = 0.21). The prevalence did not vary during the different seasons for *S. melanoptera* and Synodontilla sp., while their mean intensities fluctuated (P = 0.001 and P = 0.0001 respectively) and were always higher during the rainy season (Table III).

Table III: prevalence (%) and mean intensity in relation to the different seasons for Synodontilla sp.

<table>
<thead>
<tr>
<th>Seasons</th>
<th>S. melanoptera</th>
<th>S. sanagaensis</th>
<th>Synodontilla sp.</th>
</tr>
</thead>
<tbody>
<tr>
<td> </td>
<td>Pr (%)±SE</td>
<td>MIA±SE</td>
<td>Pr (%)±SE</td>
</tr>
<tr>
<td>DS2018</td>
<td>93.5±0.04</td>
<td>7.5±0.97</td>
<td>93.5±0.03</td>
</tr>
<tr>
<td>RS2018</td>
<td>83.3±0.03</td>
<td>10.3±1.72</td>
<td>76.51±0.03</td>
</tr>
<tr>
<td>RS2019</td>
<td>82.5±0.04</td>
<td>4.01±0.4</td>
<td>87.3±0.04</td>
</tr>
<tr>
<td>Stat.</td>
<td>χ²=4.06</td>
<td>P=0.05</td>
<td>χ²=3.1</td>
</tr>
</tbody>
</table>

Stat: Statistics; SE: Standard Error; DS2018: Dry season 2018; RS2018: Rainy season 2018; DS2019: Dry season 2019; ab: different letters in the same column indicate significant statistical differences.

D. PARASITISM IN SYNODONTIS REBELI AS A FUNCTION OF FISHING CAMPAIGN

The overall mean parasite load of infected *Synodontis rebeli* increased sharply during the rainy season, in September 2018 (K=56.11, P = 0.0001). At the species level it was the case in September 2018 for *S. melanoptera* and *S. sanagaensis*, and in September 2018 and November 2018 for Synodontilla sp. The prevalence also increased in September 2018 so that the status of Synodontilla sp. reversed from satellite in July 2018 to common. In November 2018 it changed again to satellite (Table IV). Concerning the mean intensity, it varied significantly between campaigns and was very low to low for all parasite species.

Table IV: Epidemiological indexes of Synodontilla spp. during the fishing campaigns

<table>
<thead>
<tr>
<th>Fishing campaign</th>
<th>S. melanoptera</th>
<th>S. sanagaensis</th>
<th>Synodontilla sp.</th>
</tr>
</thead>
<tbody>
<tr>
<td> </td>
<td>Pr (%)±SE</td>
<td>MIA±SE</td>
<td>Pr (%)±SE</td>
</tr>
<tr>
<td>Jan 2018</td>
<td>93.7±0.04</td>
<td>6.3±0.85</td>
<td>93.7±0.04</td>
</tr>
<tr>
<td>Mar 2018</td>
<td>93.3±0.04</td>
<td>5.1±0.6</td>
<td>93.3±0.04</td>
</tr>
<tr>
<td>May 2018</td>
<td>70.9±0.08</td>
<td>8.3±3.6</td>
<td>64.5±0.08</td>
</tr>
<tr>
<td>Jul 2018</td>
<td>81.8±0.06</td>
<td>5.3±0.9</td>
<td>63.6±0.08</td>
</tr>
<tr>
<td>Sep 2018</td>
<td>100±0.0</td>
<td>18±4.9</td>
<td>94.2±0</td>
</tr>
<tr>
<td>Nov 2018</td>
<td>78.7±0.07</td>
<td>6.7±1.3</td>
<td>84.8±0.06</td>
</tr>
<tr>
<td>Jan 2019</td>
<td>83.4±0.07</td>
<td>4.9±0.7</td>
<td>93.3±0.04</td>
</tr>
<tr>
<td>Mar 2019</td>
<td>81.8±0.07</td>
<td>3.1±0.5</td>
<td>81.8±0.05</td>
</tr>
</tbody>
</table>

Stat: Statistics; SE: Standard Error; ab: different letters in the same column indicate significant statistical differences.

The distribution of Synodontilla sp. revealed that these monogenean species aggregate among *S. rebeli* individuals. Similar observations have been made by several authors around the world [16, 9, 18]. This model of parasite distribution among their hosts was proposed as a general feature of metazoan parasites and possibly the only universal law in parasite ecology [19, 20]. According to Combes [21], aggregated distribution may indicate heterogeneity in the relationship between the hosts even parasite populations. It also increases the probability for the parasite to meet its host in the one hand and its chance of surviving in the latter in the other hand; it may vary from one host to another. The overall prevalence of *S. melanoptera* and that of *S. sanagaensis* were above 50% during all campaigns while that of Synodontella sp. was below 25%. Synodontella melanoptera and *S. sanagaensis* where therefore common species while Synodontella sp. was rare or satellite [16]. The infestation of Synodontis rebeli (prevalence and the mean intensity) was similar for both males and females specimens. It is known that, Synodontis spp. live at the bottom of rivers, near shores and banks; these habitats offer them food security, protect them from predation and are favorable to their reproduction [22]. Therefore, Synodontis spp. being distributed irrespective of the host sex, it was not surprising that males and females individuals were equally parasitized because equally exposed and probably susceptible to oncomiracidia. The overall parasite load increased with the size of the host. This result is linked to the fact that, as they grow fish offer larger bodies and gills surfaces potentially colonizable by the parasites [23, 9]; it is also due to the strong water current passing through the gills of larger hosts, thus creating convenient conditions for parasites settlement [24]. The mean intensities of Synodontilla spp. increased significantly during the rainy season; therefore, fish suffered more from these parasitic agents during this period. In a pound, Bilong Bilong & Njiné [17] found that the rise in water temperature up to 25 °C or 26 °C in the long dry season was responsible for the morality of the adult monogeneans, and justifying the low parasite loads and limited the recruitment of infective stages. In addition, temperature is generally considered the most important factor associated with seasonal variation in monogenean infections [25]. In the downstream of Sanaga River, Nzpieuleu Tchapgnouo et al. [26] stated that, temperatures generally decrease during the rainy season (from September to November), increase during the dry season (from December to January), and can reaching up to 30 °C. On the other hand, the physicochemical characteristics of the water in lower Sanaga fluctuate with the seasons. During the rainy season, water in the Sanaga downstream attains the highest values of solid particle levels, conductivity, depth, salinity, dissolved oxygen, sodium, nitrate, phosphate, and is characterized by low levels of transparency, temperature, pH, magnesium, ammonium and calcium. All these observations show poor quality of water in Sanaga River downstream during this period [27]. According to El-Naggar et al. [28] poor quality of water likely creates a stressful circumstance that weakens the immune system and alters the defense tactics of aquatic organisms, leading to poor fish health. Stressed fish become susceptible to a variety of health problems such as helminth invasions. This situation might also explain the findings in this study. Infection rate and parasite load increased during the rainy season. Moreover, a numerical dominance of Synodontella sp. was observed in September and November (rainy season). This parasite species seems to better withstand the water conditions during this period; this result obtained in a natural environment gives rise to some fear for the breeding of *S. rebeli*. In the fish farming, Synodontella sp. could provoke epizootics in *S. rebeli* during rainy season. Such fish mortality may be reinforced by secondary infections favored by lesions caused by parasite hooks/anchors and the spoiling action of these ectoparasites [17]. The variation of the status of Synodontella sp.

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as a function of the host capture period poses the problem of monogeneans response to environmental conditions which remains to specify. This observation demonstrates that the status of a parasite depends on the period of sampling. Therefore, its meaning should not only be searched on the overall host sampling basis, as it is currently found in literature [18].

V. CONCLUSION

The present study provides additional information to the ecology of monogeneans in general and of Synodontella spp. in particular, in order to avoid catastrophic losses due to parasite epizootic outbreaks in the case of intensive fish farming. These findings reinforce our previous work [29] recommending quarantining native large fish specimens captured in the nature and used as sires in ponds and/or captures during the dry season when parasitic loads are low.

DISCLOSURE OF CONFLICT OF INTEREST

The authors declare no conflict of interest.

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REFERENCES


AUTHORS

First Author – Jonathan Armel Mbondo, Institute of Agricultural Research for Development (IRAD), Experimental Research Station in Marine Ecosystems, PO Box 219, Kribi, Cameroon

Second Author – Etienne Didier Bassock Bayiha, Laboratory of Parasitology and Ecology, University of Yaoundé I, PO Box 812, Yaoundé, Cameroon

Third Author – Bahanak Dieu Ne Dort, Institute of Agricultural Research for Development (IRAD), Station of Batoke, BO box 77 Limbe, Cameroon

Fourth Author – Nack Jacques, Institute of Fisheries and Aquatic Sciences of Yabassi (ISH), University of Douala, Cameroon

Fifth Author – Kingsley Etchu, Institute of Agricultural Research for Development (IRAD), Yaoundé, PO Box 2123, Yaoundé

Sixth Author – Charles Félix Bilong Bilong, Laboratory of Parasitology and Ecology, University of Yaoundé I, PO Box 812, Yaoundé, Cameroon

Corresponding Author – Jonathan Armel Mbondo, Institute of Agricultural Research for Development (IRAD), Experimental Research Station in Marine Ecosystems, PO Box 219, Kribi, Cameroon, jonathan.mbond@yaho.com, 00237656930098.
The Effect Of Health Consciousness, Perceived Behavioral Control And Attitude On Purchase Intention: A Study Of Makeup Artist Consumer Behavior During The Covid-19 Pandemic

Aisyah Fadila Sulthani¹, Yulia Hendri Yeni², and Syafiriza³

¹Master of Management Program, Faculty of Economics and Business, Universitas Andalas, Indonesia
²Department of Management, Faculty of Economics and Business, Universitas Andalas, Indonesia

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Abstract- This study aims to analyze the effect of health consciousness, perceived behavioural control, and attitude on purchase intention: a study of makeup artists' consumer behaviour during the covid-19 pandemic. The type of research used in this research is explanatory research, with the research method being an explanatory survey that emphasizes quantitative methods. The sample is 160 consumers who intend to use the services of a makeup artist during the Covid-19 pandemic in Payakumbuh City. Sampling technique Convenience sampling. The data analysis method used Structural Equation Modeling - Partial Least Square (SEM-PLS). The results showed that health consciousness had a significant effect on consumer attitudes, health consciousness had no significant effect on consumer purchase intentions, perceived behavioural control had a significant effect on consumer attitudes, perceived behavioural control had a significant effect on consumer purchase intentions, the attitude had a significant effect on consumer purchase intentions mediated by attitude, perceived behavioural control has a significant effect on consumer purchase intentions mediated by attitude. The implication that can be applied is that a makeup artist should pay more attention to health Consciousness, consumer attitudes, and consumer purchase intentions in using makeup artist services during the COVID-19 pandemic, in addition to the use of makeup artist services during the COVID-19 pandemic can still be implemented. By implementing health protocols, consumers can also exercise control in choosing the makeup artist services offered for demonstrations, or other purposes (Education, Makeup, Engineering, & Surabaya, 2021). Makeup has become part of the routine life of modern society, especially for women. The use of makeup has developed into a necessity to beauty oneself, show identity and personality, and keep up with fashion developments, especially in the entertainment world where professional makeup artists gather.

Every woman's desire to beautify themselves using makeup is very diverse, but not all of them can do it alone to produce perfect results. Therefore we need a service that serves this, namely makeup artist services, to change the woman's appearance in attending certain events.

Payakumbuh City is one of West Sumatra Province, offering makeup artist services. The character and nature of women who generally like makeup have caused the makeup artist service business and the face & body painting business in Payakumbuh to thrive. Therefore, it is not difficult to find and find the best makeup artist in the Payakumbuh area for consumers who need makeup services from professionals in the beauty sector (Muakediri.com, 2021).

However, along with the Covid-19 Pandemic in Payakumbuh City, makeup artist service providers began to be affected by these conditions. The Payakumbuh City Government has allowed a wedding reception during the new normal period of the COVID-19 pandemic. This crowd permit is given on the condition that the permit is administered in stages and complies with the health protocols that have been established (Hendra, 2020). A wedding reception is an event that requires the services of a makeup artist. As a result of this regulation, all events that need makeup services from professionals in the beauty sector (Muakediri.com, 2021).

I. INTRODUCTION

Makeup Artist (MUA) is an art of makeup performed by people who work as makeup for various purposes such as parties, weddings, photoshoots, graduation ceremonies, and other purposes (Education, Makeup, Engineering, & Surabaya, 2021). Makeup has become part of the routine life of modern society, especially for women. The use of makeup has developed into a necessity to beauty oneself, show identity and personality, and keep up with fashion developments, especially in the entertainment world where professional makeup artists gather.

Every woman's desire to beautify themselves using makeup is very diverse, but not all of them can do it alone to produce perfect results. Therefore we need a service that serves this, namely makeup artist services, to change the woman's appearance in attending certain events.

Payakumbuh City is one of West Sumatra Province, offering makeup artist services. The character and nature of women who generally like makeup have caused the makeup artist service business and the face & body painting business in Payakumbuh to thrive. Therefore, it is not difficult to find and find the best makeup artist in the Payakumbuh area for consumers who need makeup services from professionals in the beauty sector (Muakediri.com, 2021).
and customers at risk of infection. Not to mention the makeup that is used in groups and has the potential to carry germs (CNN.Indonesia, 2020)

Makeup artist jobs that require being close to clients, of course, make them have to prepare extra protection so they don't get infected or transmit the virus. Makeup artists must understand the risks of their work. Health protocols that must be used to maintain the safety and comfort of clients and makeup artist service providers while working are Wearing a Mask, Wearing a Face Shield, Not touching the face of service users before washing hands, also paying attention to the makeup tools used so that the virus does not stick to any of the tools. makeup, then it is exposed to the next client (Febriani, 2020)

Based on a survey in early August 2021 on five users of makeup artist services, it can be concluded that the makeup artist service providers in doing makeup use a new and clean sponge. Still, there are also powder sponges that have been used several times, while brushes have been used several times. Furthermore, in its implementation, some obey the health protocols by wearing masks and washing hands, and some do not use the health protocols. This is a health concern from service providers to consumers as service buyers. In addition, the main sources of information for customer about Makeup Artist (MUA) is a recommendation from a friend. because they provide packages (clothes, makeup, henna packages and also email). Beside recommendation of friends, they also get information from social media that the service provider maintains cleanliness and tidiness in the provision of services.

From a preliminary survey in August 2021 on two makeup artist service providers in Payakumbuh City, information was obtained that the pandemic has made the makeup artist service providers clean a lot and change many makeup methods for the sake of cleanliness and safety of customers and service providers. This is a form of health care for makeup artists to provide services by applying more hygienic makeup. Makeup artist work is included in high-risk work against Covid-19 transmission, where makeup artist service providers must have direct contact with customers. Then also have to touch the face, including the eyes, lips, and nose. Customers also definitely cannot wear masks when they are dressed. This condition puts makeup artist service providers and customers at risk of infection, making service providers care more about the health of their customers and their health.

In terms of health care, to overcome the spread of COVID-19, service providers, when leaving for makeup, will only bring the required makeup equipment. Makeup artist service providers also use strict health protocols such as wearing masks and face shields and maintaining personal hygiene and the makeup equipment used. Cosmetics and makeup tools used are cleaned first using a guaranteed cleanser. Then before starting to do makeup, the service provider washes his hands first, and those who will be doing makeup are asked to clean their face and wash their hands first.

The application of makeup to consumers who use health protocols is shown to prospective service users by displaying photos of makeup artist services, videos or recordings of the process of doing makeup, and testimonials from the use of these makeup services. This aims to influence the purchase intention of users of makeup artist services. Purchase Intention can be used to test the implementation of new distribution channels and assist in determining whether the concept is worth developing further and deciding which geographic markets and consumer segments to target through these channels. To predict consumer behaviour, it is necessary to know attitudes, judgments, and internal factors which ultimately lead to purchase intention (Peña-García et al., 2020).

According to Patumtaewapibal & Boonyasiriwat (2020), Health Consciousness is awareness of the health of individuals who care about each other's health. Health awareness was formed by self-health awareness, individual responsibility, and health motivation. Previous studies found that health awareness can lead individual to engage in health behaviour. Research in environmental behaviour revealed that consumer with high health conscious tend to have a high interest to purchase safe product. Kaur & Bhatia (2018) revealed that health awareness raises the interest to buy a health product. However, certain behaviours with little known health impact tend to have an insignificant relationship with health awareness. Thus, health awareness must predict an individual's intention to decide to live a healthy life (Patumtaewapibal & Boonyasiriwat, 2020).

Perceived Behavior Control (PBC) is also proposed to impact behaviour directly. Following the theoretical framework of the Theory of Planned Behavior (TPB), individuals will be successful in performing certain behaviours if they have sufficient control over internal and external factors that influence the success of behavioural goals. Having a positive attitude towards healthy living is one of the relevant predictors of awareness of healthy living (Gabbidini & Greitemeyer, 2019).

Attitude describes the results of a person's evaluation of an entity (object or action), whether the person likes it or doesn't like it. Attitude toward behaviour refers to how a person evaluates or values the behaviour. Attitude serves as a determinant of behavioural intentions. Attitude influences purchase intention (Kusumaningsih et al., 2019).

According to Gabbidini & Greitemeyer (2019), attitudes are woven into the fabric of everyday life. They are psychological tendencies that evaluate certain entities with liking or disliking. People react instantly and automatically to everything they encounter, but attitudes can be changed by providing new information. Thus, attitude is used as one of the determinants of consumer desire in buying Makeup Artist services in this study.

**Hypothesis**

H1: It is assumed that Health Consciousness affects consumers' Attitudes.

H2: It is assumed that Health Consciousness affects consumer purchase intention.

H3: It is assumed that Perceived Behavioral Control affects consumer attitudes.

H4: It is assumed that Perceived Behavioral Control affects consumers' Purchase Intention.

H5: It is assumed that Attitude affects consumer Purchase Intention.

H6: It is assumed that Health Consciousness affects consumer Purchase Intention mediated by Attitude.

H7: It is assumed that Perceived Behavioral Control affects consumers' Purchase Intention mediated by Attitude.
II. RESEARCH METHODS

This type of research is explanatory research. In contrast, the research method is an explanatory survey that puts forward quantitative methods (Sekaran & Bougie, 2016). The population is consumers who intend to use the services of a makeup artist during the Covid-19 Pandemic in Payakumbuh City. According to Hair et al. (2010), a study is considered representative of the number of samples used is as much as the number of indicators multiplied by 5-10 or at least 100 (one hundred) samples or respondents. In this study, the number of indicators is 16, so 16 x 10 = 160. The researchers distributed 160 questionnaires to consumers who intend to use the services of a makeup artist during the Covid-19 pandemic in Payakumbuh City. The sampling technique is convenience sampling. The data collection technique is a questionnaire distributed online using a google form. Measurement of the questionnaire using a Likert scale. Analysis of the research data using Structural Equation Modeling - Partial Least Square (SEM-PLS).

III. DATA ANALYSIS AND DISCUSSION

Respondents Characteristics
In general, the consumers intention to use the services of a makeup artist in the period of Covid-19 decreased. During the Covid-19 pandemic, as many as 91 respondents (56.9%), of did not use the services of a makeup artist. While the rest, as many as 69 respondents (43.1%) use the services of a makeup artist. All respondents are women (100%), have an age range of <28 years as many as 133 people (83.1%), have the latest education generally as Bachelor (S1 / D4) as many as 114 people (38.1%), and generally have incomes ranging fromRp. 2,000,001 - Rp. 4,000,000 as many as 96 people (60%).

Data Examination

Measurement Model (Outer Model)

Convergent Validity

Individual indicators are declared valid when their correlation value is 0.70 and above. However, a moderate correlation value from 0.50 to 0.60 is still can be accepted (Ghozali, 2014). This study used a correlation value (outer loading) of 0.50. The following are the results of the convergent validity test using outer loading:

Table 1. Outer Loading Result

<table>
<thead>
<tr>
<th>HC</th>
<th>AT</th>
<th>PBC</th>
<th>PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT.1</td>
<td>0.802</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT.2</td>
<td>0.806</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT.3</td>
<td>0.818</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT.4</td>
<td>0.853</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT.5</td>
<td>0.865</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT.6</td>
<td>0.857</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HC.1</td>
<td>0.791</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes : HC = Health consciousness, AT = attitude, PBC = perceived behavioral control, PI = purchase intention
Source : Output SmartPLS (2022)

Discriminant Validity

The assessment for Discriminant Validity uses a cross loading construct (Ghozali, 2014). The following is an illustration that shows the results of Discriminant Validity:

Table 2. Cross Loading Results

<table>
<thead>
<tr>
<th>HC</th>
<th>AT</th>
<th>PBC</th>
<th>PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT.1</td>
<td>0.347</td>
<td>0.802</td>
<td>0.485</td>
</tr>
<tr>
<td>AT.2</td>
<td>0.317</td>
<td>0.806</td>
<td>0.461</td>
</tr>
<tr>
<td>AT.3</td>
<td>0.244</td>
<td>0.818</td>
<td>0.443</td>
</tr>
<tr>
<td>AT.4</td>
<td>0.330</td>
<td>0.853</td>
<td>0.407</td>
</tr>
<tr>
<td>AT.5</td>
<td>0.361</td>
<td>0.865</td>
<td>0.457</td>
</tr>
<tr>
<td>AT.6</td>
<td>0.342</td>
<td>0.857</td>
<td>0.429</td>
</tr>
<tr>
<td>HC.1</td>
<td>0.791</td>
<td>0.286</td>
<td>0.370</td>
</tr>
<tr>
<td>HC.2</td>
<td>0.912</td>
<td>0.371</td>
<td>0.369</td>
</tr>
<tr>
<td>HC.3</td>
<td>0.840</td>
<td>0.327</td>
<td>0.366</td>
</tr>
<tr>
<td>PBC.1</td>
<td>0.386</td>
<td>0.467</td>
<td>0.893</td>
</tr>
<tr>
<td>PBC.2</td>
<td>0.353</td>
<td>0.540</td>
<td>0.901</td>
</tr>
<tr>
<td>PBC.3</td>
<td>0.349</td>
<td>0.269</td>
<td>0.660</td>
</tr>
<tr>
<td>PI.1</td>
<td>0.263</td>
<td>0.663</td>
<td>0.665</td>
</tr>
<tr>
<td>PI.2</td>
<td>0.284</td>
<td>0.666</td>
<td>0.590</td>
</tr>
<tr>
<td>PI.3</td>
<td>0.300</td>
<td>0.610</td>
<td>0.585</td>
</tr>
<tr>
<td>PI.4</td>
<td>0.241</td>
<td>0.613</td>
<td>0.547</td>
</tr>
</tbody>
</table>

Notes : HC = Health consciousness, AT = attitude, PBC = perceived behavioral control, PI = purchase intention
Source : Output SmartPLS (2022)

According to Ghozali (2014), a moderat correlation value from 0.50 to 0.60 can be accepted in the research development stage. This study used a correlation value (outer loading) of 0.50 and above. Based on table 4.12, all research items have fulfilled these criteria. Therefore, all the items questionnaire in this research are valid.
values with other constructs, so it can be concluded that all latent constructs have good discriminant validity because they can predict other block indicators.

However, another method that can be used to assess Discriminant Validity is by comparing the Square Root Of the AVE value for each variable with the relationship between variables and other variables in the model. The AVE value must be greater than 0.50 (Ghozali, 2014). The following table of AVE results can be seen below:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Average Variance Extracted (AVE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Consciousness</td>
<td>0.721</td>
</tr>
<tr>
<td>Attitude</td>
<td>0.695</td>
</tr>
<tr>
<td>Perceived Behavioral Control</td>
<td>0.682</td>
</tr>
<tr>
<td>Purchase Intention</td>
<td>0.878</td>
</tr>
</tbody>
</table>

Source: Output SmartPLS (2022)

Table 3

Table 4. Validity Test Results of AVE Root Discriminant

<table>
<thead>
<tr>
<th>Variable</th>
<th>Health Consciousness</th>
<th>attitude</th>
<th>perceived behavioural control</th>
<th>purchase intention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Consciousness</td>
<td>0.849</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude</td>
<td>0.390</td>
<td>0.834</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Behavioral Control</td>
<td>0.431</td>
<td>0.537</td>
<td>0.826</td>
<td></td>
</tr>
<tr>
<td>Purchase Intention</td>
<td>0.291</td>
<td>0.683</td>
<td>0.640</td>
<td>0.937</td>
</tr>
</tbody>
</table>

Source: Output SmartPLS (2022)

From table 4, it is known that the AVE root value is higher than the correlation value between other constructs. So, it can be said that each construct has high validity.

Reliability Test

The measurement of construct reliability can use two assessments in composite reliability and Cronbach’s alpha from the indicator block that measures the construct. Furthermore, to state a reliable construct can be seen from the value of composite reliability and Cronbach’s alpha above 0.70 (Ghozali, 2014).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cronbach’s Alpha</th>
<th>Composite Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Consciousness</td>
<td>0.806</td>
<td>0.885</td>
</tr>
<tr>
<td>Attitude</td>
<td>0.912</td>
<td>0.932</td>
</tr>
<tr>
<td>Perceived Behavioral Control</td>
<td>0.768</td>
<td>0.863</td>
</tr>
<tr>
<td>Purchase Intention</td>
<td>0.953</td>
<td>0.966</td>
</tr>
</tbody>
</table>

Source: Output SmartPLS (2022)

Table 5

From Table 5 above, it is shown that the value of Cronbach's Alpha and Composite Reliability for all variables is more significant than 0.70, which indicates that all variables are declared reliable.

Structural Model (Inner Model)

R Square Rating

The value of R-squares is used to assess the independent latent variable’s ability to explain whether the latent dependent variable can explain the substantive one. Here is the R-Square on the construct:

<table>
<thead>
<tr>
<th>Variable</th>
<th>R Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude</td>
<td>0.319</td>
</tr>
<tr>
<td>Purchase Intention</td>
<td>0.576</td>
</tr>
</tbody>
</table>

Source: Output SmartPLS (2022)

Table 6

From Table 6, it can be inferred that the acquisition of the R-Square value for the attitude variable is 0.319. This value indicates that 31.9% of the Attitude variable can be explained by the Health Consciousness and Perceived Behavioral Control variables. In comparison, the remaining 68.1% is influenced by other factors not described in this study.
The purchase intention variable has an R-Square value of 0.576. This value indicates that 57.6% of the purchase intention variable can be explained by the variables of health consciousness, perceived behavioural control and attitude. In comparison, the remaining 42.4% is influenced by other variables not presented in this study.

Hypothesis Test (t-Statistic)
In the hypothesis/significance test, the original sample value shows a positive (+) or negative (-) correlation. A hypothesis is accepted if the t count > t table with a confidence level of 95% or a significance level of 5%, where if t arithmetic has a significance less than 0.05, it means that it has a significant effect. The t value in this study was obtained by looking at the value (df = n - k), where n is the number of respondents, k is the number of research variables, and df is the degree of freedom. So, we get the result (df = 160 – 4 = 156). So the value of the T-table is 1.975, with the value of is 5% or 0.5.

Direct Effect Analysis
The hypothesis/significance test can be seen from the results of the path coefficient output (Mean, std-dv, and T-value) for a direct effect, with the results of testing the hypothesis in the following table:

### Table 7. Path Coefficient Results

|   | Original Sample (O) | Sample Mean (M) | Standard Deviation (STDEV) | T Statistics (|O/STDEV|) | P Values |
|---|---------------------|-----------------|--------------------------|--------------------------|----------|
| H1 Health consciousness -> attitude | 0.194 | 0.190 | 0.084 | 2.305 | 0.022 |
| H2 Health consciousness -> purchase intention | -0.077 | -0.073 | 0.067 | 1.149 | 0.251 |
| H3 perceived behavioral control -> attitude | 0.454 | 0.461 | 0.086 | 5.305 | 0.000 |
| H4 perceived behavioral control -> purchase intention | 0.407 | 0.411 | 0.082 | 4.986 | 0.000 |
| H5 attitude -> purchase intention | 0.495 | 0.487 | 0.079 | 6.264 | 0.000 |

Source: Output SmartPLS (2022)

Indirect Effect Analysis
The hypothesis/significance test can be seen from the total indirect effect output (Mean, std-dv, and T-value) for the indirect effect. Where for the results of testing the hypothesis are in the following table:

### Table 8. Indirect Effect

|   | Original Sample (O) | Sample Mean (M) | Standard Deviation (STDEV) | T Statistics (|O/STDEV|) | P Values |
|---|---------------------|-----------------|--------------------------|--------------------------|----------|
| H6 Health consciousness -> attitude -> purchase intention | 0.096 | 0.093 | 0.045 | 2.121 | 0.034 |
| H7 perceived behavioral control -> attitude -> purchase intention | 0.224 | 0.223 | 0.048 | 4.719 | 0.000 |

Source: Output SmartPLS (2022)

IV. DISCUSSION

Effect of Health Consciousness on Attitude
Based on data analysis hypothesis 1, Health Consciousness has a significant effect on consumer attitudes towards makeup artist services in the period of covid-19 outbreak in Payakumbuh City with a positive direction, so hypothesis 1 is accepted. This shows that the more Health Consciousness increases, the more consumers' attitudes in using the services of a makeup artist during the COVID-19 pandemic in Payakumbuh City will increase.

This indicates that in using the services of a makeup artist during the covid-19 pandemic, consumers consider Health Consciousness by choosing a makeup artist service carefully to ensure health. Consumers also feel like people who are aware of health pay attention to the health protocols used by the provider. Makeup artist services during the covid-19 pandemic and think about health reasons because makeup artist services are one of the professions vulnerable to the spread of the Covid-19 virus. After all, they apply makeup in the face and mouth area to have physical contact close enough to the client. It is vital to remain obedient to procedures and always maintain hygiene tools and cosmetics so that all of these things affect consumer attitudes.
in using the services of a makeup artist during the covid-19 pandemic.
Values embraced by consumers are factors that influence consumer attitudes in buying products. Consumers with different value systems will show different behaviour towards products (Kim & Chung, 2011). Someone aware of health will try to involve himself in healthy behaviour (Hong, 2009).
The results of this study are supported by research that finds Health Consciousness affects Attitude (Hoque, Nurul Alam, & Nahid, 2018). Likewise, research conducted by (Nagaraj, 2021) says that there is a significant influence between Health Consciousness and Attitude.

The Effect of Health Consciousness on Purchase Intention
Based on the results of data analysis hypothesis 2, Health Consciousness has no significant effect on consumer purchase intentions in using makeup artist services in the period of covid-19 outbreak in Payakumbuh City, so hypothesis 2 is rejected. This indicates that to increase consumer purchase intentions in using the services of a makeup artist during the COVID-19 pandemic, Health Consciousness does not contribute.
The cause of Health Consciousness not impacting consumers' purchase intentions in using the services of a makeup artist during the covid-19 pandemic is because consumers will use the services of a makeup artist in accordance with the needs of the required event. Then based on the dominant education level, undergraduate means that they understand health, but they have no intention of using makeup artists during this pandemic. In addition, makeup artist service providers are indeed required to offer their services using health protocols as a requirement to continue to be active during the COVID-19 pandemic. This means that the respondents who were sampled in this study, both those who had used the services of a makeup artist and those who had never used the services of a makeup artist at all during the Covid-19 pandemic, had the same thoughts in matters relating to Health Consciousness in choosing makeup artist services, so it doesn't affect Purchase Intention.
Consumers aware of the importance of health will become more concerned about the nutrients contained in the products they consume; therefore, health factors will be an essential criterion when they buy products (Magnusson et al., 2003). The health concern is the main factor for consumers to choose healthy products for their daily consumption (Chen, 2009).
This study obtained the same results as (Hoque et al., 2018) that health awareness does not affect Purchase Intention. This contrasts Nagaraj's (2021) study, which found that health awareness affected consumers' purchase intentions. Likewise, the research results (X. Wang et al., 2019) states that Health Consciousness affects buying intention. This research findings are also different from the previous studies, which states that consumer health awareness is positively associated with consumer intentions to buy products (Iqbal et al., 2021) and is also supported by research (Hsu et al., 2016).

The Effect of Perceived Behavioral Control on Attitude
Based on the results of data analysis hypothesis 3, Perceived Behavioral Control has a significant effect on consumer attitudes in using makeup artist services during the COVID-19 pandemic in Payakumbuh City in a positive direction, so hypothesis 3 is accepted. This shows that the higher the Perceived Behavioral Control, the higher the consumer's attitude in using the services of a makeup artist during the COVID-19 pandemic in Payakumbuh City.
This indicates that in using the services of a makeup artist during the COVID-19 pandemic, the sampled consumers in this study considered their abilities in Perceived Behavioral Control. Where consumers decide the selection of makeup artist services according to the needs of the event they need so that the decision to use or not to use the services of a makeup artist depends on them according to the conditions required so that this affects consumer attitudes in using makeup artists during the covid-19 pandemic.
In the theory of planned behaviour (TPB) Ajzen ignore the effect perceived behavioral control as an important predictor of attitudes. However, attitudes can act as mediating variable from perceived behavioral control when influencing purchase intentions. Thus, in their research framework developed by (Yu et al., 2005), which explain the behavioural intention of Taiwanese tourists in Kinmen, attitude acts as an mediating variable. This study found that attitude is an mediating variable in the relationship between perceived behavioural control on consumer intentions. Therefore, it can be concluded that perceived behavioural control has a positive influence on attitudes.
The results of this study are in line with the results of Tsai's research (2010), proving the impact of Perceived Behavioral Control on attitudes with canonical correlation analysis. It can be concluded that Perceived Behavioral Control has significant influence on attitudes. A similar study also found that Yu et al. (2005) conducted a study on the consumer intention to download MP3s, showing that the Perceived Behavioral Control of customer to download MP3s had significant influence to their attitudes.

The Effect of Perceived Behavioral Control on Purchase Intention
Based on the results of data analysis hypothesis 4, Perceived Behavioral Control has a significant effect on consumer purchase intentions in using makeup artist services during the COVID-19 pandemic in Payakumbuh City in a positive direction, so hypothesis 4 is accepted. This shows that the higher the Perceived Behavioral Control, the higher the Purchase Intention of consumers in using the services of a makeup artist during the COVID-19 pandemic in Payakumbuh City.
This indicates that consumers who intend to use the services of a makeup artist during the Covid-19 Pandemic in Payakumbuh City are seen from people who have used the services of a makeup artist, and people who have never used the services of a makeup artist at all during the Covid-19 pandemic can do this. Perceived Behavioral Control to decide whether to use the services provided by the makeup artist service provider. When a consumer needs a makeup artist service provider and wants the services provided, the consumer can pay for the makeup artist service instead of other makeup services. In addition, consumers have no difficulty spending funds to use the services of a makeup artist. Where in general, the decision to use or not to use the services of a makeup artist depends on the personal self of the consumer, so all of these things affect the intention of consumers to use the services of a makeup artist in the period of covid-19 outbreak in Payakumbuh City.
The greater the control owned by the consumer, the higher the buying interest. In this case, when consumers believe that they have more time and financial assets, their perception of control also increases. The higher control of these consumers increases their interest in buying products (Kim & Chung, 2011).

The findings of this research corroborated previous studies that found that perceived Behavioral Control has significant effect on purchase intention (Carolyn & Pusparini, 2013). Perceived Behavioral Control affects purchase intention (Kim & Chung, 2011), Perceived Behavioral Control is an important predictor of Consumer Buying Intention (Byon et al., 2014); (Christine et al., 2020); (Rehman et al., 2019); (Hasan & Suciarto, 2020);(Huang & Ge, 2019).

**The Effect of Attitude on Purchase Intention**

Based on the results of data analysis hypothesis 5. Attitude significantly affects consumer purchase intentions in using makeup artist services during the covid-19 pandemic in Payakumbuh City in a positive direction, so hypothesis 5 is accepted. This shows that the higher the attitude, the higher the Purchase Intention of consumers in using the services of a makeup artist during the Covid-19 pandemic in Payakumbuh City.

Attitude toward a behaviour is defined as refers to a individual evaluation of liking or disliking to apply certain behaviour. A person is more probably to perform a particular behaviour if they have a positive attitude in performing that behaviour (Kim & Chung, 2011). This feeling arises from an individual's evaluation of the belief in the results obtained from a particular behaviour. So, if someone has a positive attitude to buy a product, an interest will arise to buy (Carolyn & Pusparini, 2013).

Consumers in using the services of a makeup artist in the period of the covid-19 outbreak in Payakumbuh City argue that using the services of a makeup artist is a good idea, interesting, important, useful, wise, and profitable so that it affects Purchase Intention. Applying makeup with a different appearance requires special skills that everyone does not possess. Consumers prefer to entrust a makeup artist service provider to attend certain events requiring different makeup. In addition, because not everyone can apply makeup like makeup artist service providers, it is advantageous for those who need services to apply makeup to overcome their problems in applying makeup.

The results of this study corroborated the research findings of Carolyn & Pusparini (2013), who found attitudes to buy organic personal care products positively influence purchase intention (Purchase Intention). Likewise, Kim & Chung (2011) found attitudes to buying products influence purchase intentions. The same thing was also found by Al-Swidi et al. (2014) Attitude has a significant influence on purchase intention.

The results of this study are also inline with the research findings of Christine et al. (2020), which also found that attitudes affect purchase intention. Furthermore, Rehman et al. (2019) also found that Attitude affected Consumer Purchase Intention. Hsu et al. (2016) found that attitudes towards organic food positively affect purchase intention. According to (Bashir, 2019), finding Consumer Attitude influences Consumer Purchase Intention. Likewise, according to (Shah et al., 2020); (Hasan & Suciarto, 2020) (Huang & Ge, 2019) also found, Attitude affected Purchase Intention.

**The Effect of Health Consciousness on Purchase Intention mediated by Attitude**

Based on the results of data analysis hypothesis 6, Health awareness has a significant influence on customer purchase intentions in using makeup artist services during the covid-19 pandemic in Payakumbuh City, mediated by Attitude in a positive direction, so hypothesis 6 is accepted. This shows that the increasing Health Consciousness, the higher the Purchase Intention of consumers in using the services of a makeup artist during the covid-19 pandemic in Payakumbuh City, which is mediated by Attitude in a positive direction.

Consumers' attitude in using the services of a makeup artist in the period the covid-19 outbreak in terms of using the services of a makeup artist is a good idea. Consumers highly consider interesting, important, useful, wise and profitable things in using the services of a makeup artist during the covid pandemic. Where consumer attitude mediates the influence of Health Awareness on customer buying intention. This is because consumers consider Health Consciousness by choosing makeup artist services carefully to ensure health. Consumers also feel like people who are aware of health so that they pay attention to the health protocols used by makeup artist service providers during the covid-19 pandemic and think about For things related to health, the reason is that makeup artist services are one of the professions that are vulnerable to the spread of the Covid-19 virus because they apply makeup in the face and mouth area, so they have close physical contact with clients. Maintain hygiene tools and cosmetics so that all of these things affect consumers' attitude in using the services of a makeup artist in the period of covid-19 outbreak in Payakumbuh City. Furthermore, it impacts consumers' purchase intentions in using the services of a makeup artist during the covid-19 pandemic.

Values embraced by consumers are factors that influence consumer attitudes in buying products. Consumers with different value systems will show different behaviour towards products (Kim & Chung, 2011). Someone aware of health will try to involve himself in healthy behaviour (Hong, 2009). Furthermore, attitude toward behaviour refers to individual evaluation of liking or disliking to run the behaviour. An individual is more probably to perform a particular action if they have a positive predisposition in performing that action (Kim & Chung, 2011). This feeling arises from an individual's evaluation of the belief in the results obtained from a particular behaviour. So, if someone has a positive attitude to buy a product, an interest will arise to buy (Carolyn & Pusparini, 2013).

The results of this study are not in line with the results of research (Michaelidou and Hassan, 2010) that attitudes do not fully mediate the effect of health awareness on purchase intention.

**The Effect of Perceived Behavioral Control on Purchase Intentions Mediated by Attitude**

Based on the results of data analysis hypothesis 7, Perceived Behavioral Control has a significant effect on consumer purchase intentions in using makeup artist services during the covid-19 pandemic in Payakumbuh City, mediated by Attitude in a positive direction, so hypothesis 7 is accepted. This shows that the higher the Perceived Behavioral Control, the higher the Purchase Intention of consumers in using the services of a makeup artist.
during the COVID-19 pandemic in Payakumbuh City, which is mediated by Attitude in a positive direction.
This indicates that in using the services of a makeup artist during the COVID-19 pandemic, the sampled consumers in this study considered their abilities in Perceived Behavioral Control. Where consumers decide the selection of makeup artist services according to the needs of the event they need so that the decision to purchase or not to purchase the services of a makeup artist depends on them according to the conditions required so that this affects the attitude of consumers in using makeup artists in the period of covid-19 outbreaks.
Then, consumers' attitude in using the services of a makeup artist in the period of COVID-19 outbreaks, which is seen from using the services of a makeup artist, is a good idea, interesting, important, useful, wise and profitable also has an impact on Purchase Intention. Applying makeup with a different appearance requires special skills that everyone does not own, so to attend certain events requiring different makeup, consumers prefer to entrust a makeup artist service provider.

The greater the control owned by the consumer, the higher the buying interest. In this case, when consumers believe that they have sufficient financial ability and time their perception of control also increases. The higher control of the consumer increases their interest in buying the product (Kim & Chung, 2011).

V. CONCLUSION AND SUGGESTION

From the research conducted, several conclusions can be drawn that can be explained that Health Consciousness has a significant effect on consumer Attitude, Health Awareness has no significant influence on customer Purchase Intentions, Perceived Behavioral Control has a significant influence on consumer attitudes, Perceived Behavioral Control has a significant influence on customer buying intentions, Attitude has a significant influence on customer buying Intention, Health Consciousness significant link to customer buying intention mediated by Attitude, Perceived Behavioral Control significant link to customer buying intention mediated by Attitude.

From the research results obtained, the implications that makeup artist service providers can use to increase Purchase Intention in consumers' use of their services. A makeup artist should pay more attention to Health Consciousness, Consumer Attitude and Consumer Purchase Intention in using the services of a makeup artist during the COVID-19 pandemic.

Researchers hope that this research can be developed so that the use of makeup artist services during the covid-19 pandemic can still be carried out by applying health protocols, as well as consumers can also exercise control in choosing the makeup artist services offered, this is because, in general, respondents who fill out questionnaires have never used the services of a makeup artist during the covid-19 pandemic. This causes consumers to be unable to determine how true Health Consciousness and Perceived Behavioral Control are that they can sing, which have an impact on attitude and purchase intention in using the services of a makeup artist during the COVID-19 pandemic.


AUTHORS

First Author – Aisyah Fadila Sulthani, Master of Management Program, Faculty of Economics and Business, Universitas Andalas, Indonesia, aisyahfadilasulthani@gmail.com

Second Author – Yulia Hendri Yeni, Department of Management, Faculty of Economics and Business, Universitas Andalas, Indonesia, yuliahendriyeni@eb.unand.ac.id

Third Author – Syafirzal, Department of Management, Faculty of Economics and Business, Universitas Andalas, Indonesia, yafrizal@eb.unand.ac.id
How Active Teaching and Learning Improve Students’ Teamwork Skills?

Abdul Talib Hashim & Asmawati bte Mohamad Ali
Faculty of Human Development
Sultan Idris Education University, Malaysia

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Abstract- This study examined the used of the Active Teaching and Learning Activity Module (MaPdPA) in improving teamwork skills in the form six curriculum. This study used a combination of design and development studies. A quasi-experimental design was also used to observe or evaluate the effect of the Active Teaching and Learning Activity module (MaPdPA) in improving teamwork skills. The total number of study samples for treatment groups and control groups students was 120 students consisting of 38 male students and 82 female students. The instrument of this study consisted a set of pre and post test questions using a 5-point Likert scale to assess the level of mastery of soft skills of students assessed by teachers. Quantitative data for this study were analyzed using descriptive and inferential using MANCOVA test. The results of the MANCOVA test analysis found that there was a significant main effect of the type of treatment using MaPdPA on the level of mastery of teamwork skills of students. Through the post-test analysis for the level of mastery of the elements of teamwork skills showed that there was a significant difference in the test mean for both groups of PA and PSA students. The PA student group turned out to have a better level of mastery in teamwork skills with a better post-test mean value than the PSA student group. The used of MaPdPA is not only an innovation of BBM for the use of teachers but also able to narrow the gap in learning effects to increase the level of mastery of soft skills of students. As a result, active learning provides benefits in improving the skills of teachers and students as well as boosting self-achievement and institutional performance.

Index Terms: Active Teaching and Learning Activity module, teamwork skills, self-achievement

I. INTRODUCTION

There are various issues and challenges nowadays that need to be addressed by various parties, especially among school leavers or pre-graduates such as marketability in meeting the needs of the current industry as well as the need to equip themselves with soft skills. Instructors and employers stated that students are weak in the elements of soft skills, namely leadership skills, critical thinking and oral communication skills, especially in English. Accordingly, educators are advised to give more attention and emphasis to the types of learning activities that can improve students’ soft skills (Che Norlia, 2015).

A key issue that is often discussed from the perspective of employers in industry and career contexts is that most local graduates have deficiencies in mastering soft skills (Jumali et al., 2013; Sharifah Nadiyah, Hanipah & Faaizah, 2014). Employers also demand that graduates should have good soft skills overcoming academic achievement as an important criterion in the selection of new employees (Sharifah Nadiyah, Hanipah & Faaizah, 2014) while the findings of overseas studies by Wahl et al., (2012) also clearly stated about soft skills gaps in education. There is a gap that exists between academic education and requirements by most current industries. In fact, the issue of soft skills among Form Six Pre-U graduates was also studied by local researchers. Soft skills are the most important and very significant factor in measuring the marketability and employability of graduates. Thus, graduates need to strengthen soft skills to address the issue of marketability and employability of graduates (Rozita & Langkan, 2018).

The average document analysis of the examination syllabus for the new Higher Examination Certificate Assessment System (2012/2013) provided by the Malaysian Examinations Council (MPM) applies aspects of soft skills in the curriculum of this system. The objective of preparing coursework or project work is to assess the candidate’s ability in three main skills namely cognitive skills, manipulative skills and soft skills (SP 900 General Studies). Higher Examination Certificate School-Based Assessment (SBA) candidates are also assessed based on their ability to apply cognitive skills and also mastering soft skills (SP 922 Communicative Malay Literature). Therefore, there is a need for the assessment of learning outcomes or the determination of the achievement of objectives to assess the ability, application and level of mastery of ICT soft skills of students.
The objective of the Higher Examination Certificate history project is to develop soft skills while the objectives of the Geography syllabus are divided into four domains, namely the cognitive, psycho-motor, affective and social domains (SP 942 Geography). The social domain includes elements of soft skills such as students being able to improve their oral and written communication skills effectively, teamwork skills, leadership and group skills as well as improving cross-cultural skills. The final title of the learning outcomes in section C: Geographical External Studies for the presentation of the report which allocates eight hours of teaching time refers to the mastery of ICT soft skills. Even candidates are allowed to perform it in groups.

Document analysis as well as the findings of literature review in and outside the country explain about some specific problems for ICT students' soft skills to be studied in more depth. The learning outcomes of the application or integration of ICT soft skills in the form six curriculum for each Higher Examination Certificate subject have been outlined by the Malaysian Examinations Council (MPM) from the 2012/2013 intake session. However, specific studies on the application of learning to the development of students' level of mastery of soft skills in the curriculum of this system implemented at the local level are very limited.

II. LITERATURE REVIEW
A study carried out by Maznah Abdullah, Azlin Norhaini and Norlena Salamuddin (2022) has categorized soft skills into two main parts namely basic skills and interpersonal communication skills. Basic skills are reading, writing, counting, problem solving, information technology skills and thinking systems skills. Through extensive past literature review as well as studies on the development and construction of validation of soft skills measurement such as performance measurement by Kantrowitz (2005) found that there are 107 elements in soft skills while western researchers agree to conduct analysis on the qualitative group by reducing it to 10 groups with a multi-dimensional scale to the following: (1) Self-management skills; (2) Communication or persuasion skills; (3) Performance management skills; (4) Interpersonal skills; (5) Leadership or organizational skills; as well as (6) Political or cultural skills. The classification of these 10 groups is more systematic when compared to the list of 107 elements of soft skills.

Alshare, Lane and Miller (2011) had studied the perceptions of students and faculty who offers soft skills in curriculum information systems in the United States. Through the researcher's report, it was found that in general, students are more satisfied with the faculty that has coverage on soft skills. In addition, most of the researchers’ findings have also emphasized on the need for soft skills to be applied in the curriculum further facilitating its acquisition for the use of students. Meanwhile, the results of a study by Aworanti (2012) showed that graduate competence in the workplace requires the acquisition of soft skills that they integrate into current academic and technical courses is an effective method to develop soft skills among community members.

Willcoxson, Wynder and Laing (2010) had examined the overall approach to the development of soft and professional skills in accounting programs at the university level. This study focused on the responsibilities of staff in the formation of long-term strategies on the development of soft and professional skills of students to always be relevant and coherent with the programs offered. The teaching staff will develop a teaching course framework to ensure coherence between soft skills and teaching objectives as well as activity evaluation. The researcher used the information available in the course framework to be analyzed in order to provide data on the tendency of soft skills applied by the teaching staff to the students. The findings of the study indicated that the objective, teaching activities and methods required change because they could not achieve the goal by applying the soft skills themselves. Therefore, this study had increased the awareness of teaching staff to conduct a more effective course design to improve soft skills among students. Thus, the researcher used the Active Learning module to test its effect on the level of mastery of the elements of soft skills of students.

III. RESEARCH METHODOLOGY
This study used a combination of design and development research. Development research in Teaching and Learning is a process that covers all activities involving needs analysis, determination of content to be mastered, educational goals created, Teaching and Learning materials designed to achieve objectives, implementation and evaluation of the effectiveness of Teaching and Learning programs or materials (Richie & Klien, 2007). However, this article focused on the suitability and usability evaluation phase using a quasi-experimental design. Quasi-experimental design was also used to see or evaluate the ‘effect’ of a program, activity, method etc. In the case of a study sample can’t be randomly selected to see a comparison of two or more data sets (Chua Yan Piaw, 2006).

The total sample of study subjects for the Treatment Group (KR) was 60 students consisted of 18 males and 42 females for KR while the total sample for the Control Group (KK) was also 60 students consisting of 26 males and 44 females for KK. The total number of study samples for KR and KK for both groups of students was a total of 120 students consisting of 38 male students and 82 female students.

The instrument of this study consisted of a set of pre and post test questions using a 5-point Likert scale to assess the level of soft skills mastery of the students which aided by the teachers. Achievement tests or mastery level detection were used to measure an individual’s skills in a particular field or subject (Noraini, 2010).
Quantitative data for this study were analyzed using descriptive and inferential statistics aimed at analyzing statistical data using MANCOVA test through IBM Statistical Package for Social Sciences (SPSS) version 20. Before statistical analysis was conducted, the data had to be cleaned first through data loss analysis as suggested by Tabachnik and Fidell (2007).

IV. FINDINGS

The effect of the development of students' soft skills between the group using MaPdPA and the group following PSA can be seen through data analysis and study findings calculated by summing the cumulative mean of the post-test that measures the level of communication. Table 1 shows the mean for both groups of PA (KR) students with PSA (KK) pre and post tests for the level of mastery of communication skills. The PA group of students appeared to have a better level of mastery of teamwork skills post-test mean value compared to the PSA group of students (PreMPA = 3.35, PreMPSA = 3.36) compared to (PostMPA = 4.04, PostMPSA = 3.67).

Table 1: Mean Level of Mastery of Teamwork Skills of PA Students with PSA

<table>
<thead>
<tr>
<th></th>
<th>Active Pem (PA)</th>
<th>Existing Pem</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min Pra KR</td>
<td>Min Pasca KR</td>
</tr>
<tr>
<td></td>
<td>3.35</td>
<td>4.04</td>
</tr>
</tbody>
</table>

The results of the MANCOVA test analysis found that there was a significant main effect of the type of treatment using MaPdPA on the level of mastery of teamwork skills of students. Through the post-test analysis for the level of mastery of the elements of teamwork skills showed that there was a significant difference in the test mean for both groups of PA and PSA students. MANCOVA test results refer to Table 2.

Table 2: MANCOVA Test Analysis of Mastery Level of Student Teamwork Skills Elements between KR and KK

<table>
<thead>
<tr>
<th></th>
<th>F</th>
<th>dk</th>
<th>Error dk</th>
<th>Sig.</th>
<th>Partial and square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wilks' Lambda</td>
<td>0.569</td>
<td>1,041</td>
<td>8</td>
<td>0.000</td>
<td>0.431</td>
</tr>
</tbody>
</table>

Next, univariate analysis was done to identify which soft skills between the treatment group using MaPdPA and the group following PSA. For communication skills (F (1,117) = 6.654, p = 0.011) was significant at the significance level of p <.05. The findings of the univariate analysis are as shown in Table 3 below:

Table 3: Univariate Analysis Identifying Significant Levels of Mastery of Students' Teamwork Skills between KR and KK

<table>
<thead>
<tr>
<th></th>
<th>Mean Squared</th>
<th>dk</th>
<th>Sum of Squares</th>
<th>F</th>
<th>Sig.</th>
<th>Partial and square</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.222</td>
<td>1</td>
<td>0.222</td>
<td>2,021</td>
<td>0.158</td>
<td>0.017</td>
</tr>
</tbody>
</table>

Discussion of Study Findings

The level of mastery of the teamwork element was studied by the National Association of Colleges and Employers (2011) which showed that employers place teamwork skills among the important skills i.e. 3rd position. In fact Lee (2003) and Virgona and Waterhouse (2004) found that the elements of communication skills and teamwork are the most important essences given attention in soft skills by employers. However, the findings of this study were found to be contradict with the study by Liza Lytha and Abdullah...
which showed that there is a significant relationship between dominant soft skills with the level of mastery of soft skills among high technical stream students.

This study found that there was no significant relationship between the development of teamwork elements while the findings of previous studies by Chang Peng, Fauziah Ahmad and Faridah Ibrahim (2011) found that communal relationships have a positive relationship with ICT soft skills namely communication, critical skills and problem solving, skills teamwork, continuous learning and information management, and entrepreneurial skills.

The use of MaPdPA in active learning has an impact on the level of mastery of the elements of teamwork skills, especially for KR students. The level of mastery of soft skills for KR students who follows PA was found to increase in the post-test compared to KK students who follow PSA. Limiting the duration of PA treatment to seven weeks may not be sufficient to significantly increase the level of mastery of soft skills on the elements of teamwork.

There are several considerations that can be discussed further as a result of the implementation of the study such as the level of mastery of soft skills of students, the level of mastery of each of the elements of teamwork. In addition, the implications of the study using active learning is relevant to be implemented today in addition to the improvement of the assessment system and continuous evaluation should also be highlighted as one of the alternatives of Teaching and Learning sessions in line with the implementation of PAK21. For example, studies on the effectiveness of the new Higher Examination Certificate assessment system are only discussed for accounting subjects only (Noor Lela, Rohaila & Rosmini, 2017). Therefore, the study of form six curriculum needs to be intensified in terms of quantity and quality.

V. CONCLUSION

The implementation of active learning in the Teaching and Learning sessions of the form six curriculum has a different impact on the level of mastery of teamwork skills among students compared to the existing Teaching and Learning sessions in schools. The implementation of active learning is able to increase the level of mastery of teamwork skills in the treatment group when compared in contrast to the control group who only mastered it at a lower level. Therefore, KK students who follow PSA are recommended to be given the opportunity to follow PA so that the assessment and evaluation of the level of mastery of their soft skills ICT can be improved. As such, it can be concluded that the use of MaPdPA is not only an innovation of BBM for the use of teachers but also able to narrow the gap in learning effects to increase the level of mastery of soft skills of students. As a result, active learning provides benefits in improving the skills of teachers and students as well as boosting self-achievement and institutional performance.

Overall, the findings of the study can drive the improvement of wave 2 system (2017) in improving the quality of education such as the integration of HOTS in PAK21, strengthening bilingual competence among students, elevating Bahasa Malaysia and Strengthening English (MBMIB) and strengthening teacher quality. In addition, the development of ICT can further strengthen unity through education, especially for soft development through co-curriculum (Annual Report 2017 Malaysia Education Development Plan 2013-2025 by the Education Implementation and Performance Unit (PADU), KPM).

REFERENCES


AUTHORS

First Author – Abdul Talib Hashim, Assoc. Prof. Dr, Faculty of Human Development, Sultan Idris Education University, abdul.talib@fpm.upsi.edu.my

Second Author – Asmawati bte Mohamad Ali, Research Scholar, Faculty of Human Development, Sultan Idris Education University, drtalib.upsi@gmail.com

Correspondence Author – Abdul Talib Hashim, Assoc. Prof. Dr, Faculty of Human Development, Sultan Idris Education University, drtalib.upsi@gmail.com
Clinical Profile & Management Of Acute Pulmonary Embolism In A Tertiary Care Centre At South Tamilnadu In This Covid Era

Prof. Dr. J M Ravichandran Edwin¹, Prof Dr. A S Arul², Dr. M S Selvakumaran³, Dr. E. Thirulogachandar⁴, Dr. Benitta Mary V⁵

¹. Professor & Head of the Department, Department of Cardiology, Tirunelveli Medical College Hospital, Tirunelveli
². Assistant Professor, Department of Cardiology, Tirunelveli Medical College Hospital, Tirunelveli
³. Assistant Professor, Department of Cardiology, Tirunelveli Medical College Hospital, Tirunelveli
⁴. Assistant Professor, Department of Cardiology, Tirunelveli Medical College Hospital, Tirunelveli
⁵. Postgraduate DM Cardiology, Department of Cardiology, Tirunelveli Medical College Hospital, Tirunelveli

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I. INTRODUCTION

Venous thromboembolism presenting as Pulmonary embolism or DVT is globally the third most frequent acute cardiovascular syndrome next to MI & stroke¹. Annual incidence of pulmonary embolism ranges from 39-115/ 1,00,000 population²³. About 10% of pulmonary embolism is fatal during the first hour⁴. The mortality rate is 3-8%, increasing to about 30% in untreated patients.

II. OBJECTIVE

To study risk factors including covid status, clinical profile, ECG & echocardiographic features in patients with acute pulmonary embolism, to assess the severity of pulmonary embolism, classify them according to disease severity & management of acute Pulmonary Embolism patients with anticoagulation and/or advanced therapy in addition to anticoagulation, its outcome & prognostic significance.

III. METHODS OF DATA COLLECTION

It is a prospective observational study conducted in the department of Cardiology, Tirunelveli Medical College hospital from April 2021 - March 2022 for 1 year.

INCLUSION CRITERIA: All patients diagnosed with acute pulmonary embolism by CTPA or direct evidence of thrombus in an Echocardiogram were included in the study. Pre-existing cardiac or pulmonary disease & CTEPH were excluded. Risk factor assessment was done including the covid status, D dimer, Troponin T, ECG, Echocardiogram & CTPA. The patients were followed up 2 days after thrombolysis/anticoagulation, 1 week & after 3 months.

RESULTS: Among 28 pulmonary embolism patients, 7 patients had a prior covid infection. Of which CTPA showed the central distribution of thrombus in 6 patients (85.7%), and peripheral distribution in 1 patient (14.3%). High risk category found in 4 patients (57.1%), intermediate high risk in 1 patient (14.3%) & intermediate low risk in 2 patients (28.6%). 5 patients (71.4%) had pulmonary embolism without evidence of DVT. Among 7 patients, 3 received thrombolytic therapy (42.86%), rest were treated with heparin. 6 patients (85.7%) had resolution & 1 patient (14.3%) showed persistent pulmonary hypertension on follow-up.

Conclusion: Post covid patients had a higher thrombus burden when compared to noncovid patients and had better clinical outcomes with appropriate management.

Index Terms- Pulmonary embolism, Post covid patients
Patients who were eligible for advanced therapy were lysed using a Streptokinase bolus of 2.5 lakh units over 30 mins followed by an infusion of 1 lakh units/hour for 24hrs. The rest of the patients were anticoagulated with unfractioned heparin 80U/kg IV bolus followed by an 18U/kg/hr infusion. The patients were clinically & echocardiographically followed up 2 days after advanced therapy or anticoagulation, 1 week later, and after 3 months. The outcome & prognostic significance of our management is assessed.

IV. RESULTS

Among 28 pulmonary embolism patients, 7 patients had a prior covid infection. Of which CTPA showed the central distribution of thrombus in 6 patients (85.7%), and peripheral distribution in 1 patient (14.3%). High risk category found in 4 patients (57.1%), intermediate high risk in 1 patient (14.3%) & intermediate low risk in 2 patients (28.6%). 5 patients (71.4%) had pulmonary embolism without evidence of DVT. Among 7 patients, 3 received thrombolytic therapy (42.86%), rest were treated with heparin. 6 patients (85.7%) had resolution & 1 patient (14.3%) showed persistent pulmonary hypertension on follow-up.

V. DISCUSSION

Pulmonary Embolism is often unrecognized & under-diagnosed. A high index of suspicion is necessary because clinical signs & symptoms of pulmonary embolism are nonspecific. Further, routine laboratory tests are nonspecific & not helpful in diagnosis. Therefore, patients suspected to have pulmonary embolism because of unexplained dyspnea, tachypnea, chest pain, or the presence of risk factors must undergo diagnostic tests until the diagnosis is confirmed or an alternative diagnosis is made. With the advent of CT pulmonary angiogram (CTPA), there is increased recognition of pulmonary embolism in India. Despite diagnostic advances, delays in pulmonary embolism diagnosis are not uncommon. When definitive diagnostic tests are not available, empiric treatment should be initiated immediately. Early diagnosis & aggressive therapy improves the outcome in pulmonary embolism patients.

Despite rapid advances in diagnosis & management, it is still underreported in India. Most of the reports are limited to short case series. No such studies are performed in South Tamil Nadu so far. Venous thromboembolism is one of the major cardiovascular hazards noted in more than >20% of critically ill covid patients. When surveillance venous ultrasonography was performed, the frequency of VTE was as high as 69%. Autopsy studies had shown nearly 88% had widespread thromboembolic disease. Small arteries (<1mm) had fibrin thrombi in 87%.

Dysregulated immune response, hypoxia & direct triggers by SARS-CoV-2 contribute to the thrombotic milieu due to acute pressure overload is the primary cause of death in severe pulmonary embolism.

VI. LIMITATION

Asymptomatic patients and patients with nonspecific signs & symptoms were not included in the study.

VII. CONCLUSION

Early diagnosis & aggressive therapy improves outcome in pulmonary embolism patients. Post covid patients had a higher thrombus burden when compared to noncovid patients and had better clinical outcomes both in terms of mortality and morbidity with appropriate management.

REFERENCES


AUTHORS

First Author – Prof. Dr. M Ravichandran Edwin, Professor & Head of the Department, Department of Cardiology, Tirunelveli medical college hospital, Tirunelveli

Second Author – Prof Dr. A S Arul, Professor, Department of Cardiology, Tirunelveli medical college hospital, Tirunelveli

Third Author – Dr.M S Selvakumaran, Assistant Professor, Department of Cardiology, Tirunelveli medical college hospital, Tirunelveli

Fourth Author – Dr.E. Thirulogachandar, Assistant Professor, Department of Cardiology, Tirunelveli medical college hospital, Tirunelveli

Fifth Author – Dr. Benitta Mary V, Postgraduate DM Cardiology, Department of Cardiology, Tirunelveli medical college hospital, Tirunelveli

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<table>
<thead>
<tr>
<th></th>
<th>NONCOVID PTE (n 21)</th>
<th>COVID PTE (n 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms - dyspnoea</strong></td>
<td>18 (85.7%)</td>
<td>7 (100%)</td>
</tr>
<tr>
<td>cough</td>
<td>6 (23.8%)</td>
<td>2 (28.6%)</td>
</tr>
<tr>
<td>chest pain</td>
<td>4 (19%)</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td>syncope</td>
<td>2 (9.5%)</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td><strong>Signs - Tachypnoea</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tachycardia</td>
<td>19 (90.5%)</td>
<td>6 (85.7%)</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>4 (19%)</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td>Fever</td>
<td>2 (9.5%)</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td>SpO2 ≤ 90%</td>
<td>9 (42.9%)</td>
<td>3 (42.8%)</td>
</tr>
<tr>
<td><strong>Venous doppler evidence of DVT</strong></td>
<td>16 (76.2%)</td>
<td>2 (28.6%)</td>
</tr>
<tr>
<td><strong>ECG - Sinus tachycardia</strong></td>
<td>19 (90.5%)</td>
<td>6 (85.7%)</td>
</tr>
<tr>
<td>RV strain</td>
<td>19 (90.5%)</td>
<td>6 (85.7%)</td>
</tr>
<tr>
<td>P pumonale</td>
<td>2 (9.5%)</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td>RAD</td>
<td>5 (23.8%)</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td>ICRBBB</td>
<td>5 (23.8%)</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td>S1Q3T3</td>
<td>7 (33.3%)</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td>SVT</td>
<td>0 (0%)</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td><strong>Echo - RA/RV dilatation</strong></td>
<td>19 (90.5%)</td>
<td>7 (100%)</td>
</tr>
<tr>
<td>Flat IVS</td>
<td>18 (85.7%)</td>
<td>6 (85.7%)</td>
</tr>
<tr>
<td>60/60 sign</td>
<td>18 (85.7%)</td>
<td>6 (85.7%)</td>
</tr>
<tr>
<td>McConnell sign</td>
<td>14 (66.7%)</td>
<td>4 (57.1%)</td>
</tr>
<tr>
<td>PHT</td>
<td>18 (85.7%)</td>
<td>7 (100%)</td>
</tr>
<tr>
<td>Direct evidence of thrombus</td>
<td>7 (33.3%)</td>
<td>2 (28.6%)</td>
</tr>
<tr>
<td>RV Dysfunction</td>
<td>15 (71.4%)</td>
<td>6 (85.7%)</td>
</tr>
<tr>
<td><strong>Positive tro T</strong></td>
<td>5 (23.8%)</td>
<td>4 (57.1%)</td>
</tr>
<tr>
<td><strong>PESI - Class I</strong></td>
<td>6 (28.6%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Class II</td>
<td>4 (19%)</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td>Class III</td>
<td>6 (28.6%)</td>
<td>4 (42.8%)</td>
</tr>
<tr>
<td>Class IV</td>
<td>3 (14.3%)</td>
<td>2 (28.6%)</td>
</tr>
<tr>
<td>Class V</td>
<td>3 (14.3%)</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td><strong>CTPA Central thrombus</strong></td>
<td>14 (66.7%)</td>
<td>6 (85.7%)</td>
</tr>
<tr>
<td>Peripher thrombus</td>
<td>7 (33.3%)</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td><strong>High risk</strong></td>
<td>2 (9.5%)</td>
<td>4 (57.1%)</td>
</tr>
<tr>
<td>Intermediate high</td>
<td>9 (42.9%)</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td>Intermediate low</td>
<td>7 (33.3%)</td>
<td>2 (28.6%)</td>
</tr>
<tr>
<td>Low risk</td>
<td>3 (14.3%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td><strong>Nasal O2</strong></td>
<td>9 (42.9%)</td>
<td>5 (71.4%)</td>
</tr>
<tr>
<td>Inotropics</td>
<td>2 (9.5%)</td>
<td>3 (42.8%)</td>
</tr>
<tr>
<td>Anticoagulant alone</td>
<td>11 (52.4%)</td>
<td>4 (57.14%)</td>
</tr>
<tr>
<td>Thrombolyis &amp; anticoagulation</td>
<td>10 (47.6%)</td>
<td>3 (42.86%)</td>
</tr>
<tr>
<td><strong>Follow up 1 week Normal</strong></td>
<td>19 (90.9%)</td>
<td>7 (100%)</td>
</tr>
<tr>
<td>Discharged</td>
<td>2 (9.1%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td><strong>Follow up 3 months Normal</strong></td>
<td>13 (61.9%)</td>
<td>6 (85.7%)</td>
</tr>
<tr>
<td>RA RV Dilatation</td>
<td>8 (38%)</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td>PHT</td>
<td>8 (38%)</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td>RV dysfunction</td>
<td>3 (14.3%)</td>
<td>1 (14.3%)</td>
</tr>
<tr>
<td>CTEPH</td>
<td>8 (38%)</td>
<td>1 (14.3%)</td>
</tr>
</tbody>
</table>
Table 1: Baseline characteristics of pulmonary embolism patients

FIG 1: ECG features of pulmonary embolism patients

FIG 2: Echocardiographic manifestations in pulmonary embolism patients

FIG 3: Thrombus burden in pulmonary embolism patients
FIG 4: Classification of pulmonary embolism according to the severity in covid patients

FIG 5: Follow up ECHO after 3 months
Rehabilitation of the Lost Urban Spaces below the Elevated Movement Axes within the City


* Professor at Department of architecture, design, and urban planning, Faculty of Engineering, Suez Canal University, Ismailia, Egypt
** professor at Department of Architecture and Urban Planning, Faculty of Engineering, Suez Canal University, Ismailia, Egypt
** Demonstrator at Department of Architecture and Urban Planning, Faculty of Engineering, Suez Canal University, Ismailia, Egypt.

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Abstract- In recent years, many elevated roads have been implemented in the Egyptian city, especially in the capital, because of the demand for transportation and solving traffic problems. This is shown by the informal use of the lost spaces below elevated roads, so these lost spaces are considered a possibility to transform into urban spaces that serve the surrounding urbanization. Those huge structures caused many problems in urbanization, such as cutting the urban fabric, wasting distinctive lands, and created lost urban spaces.

This research aims to focus on the urban lost spaces under elevated roads, and the optimal use of those spaces, then proposing principles and guidelines to be followed whenever designing these spaces.

A literature review on the urban lost spaces and how it can transform into urban spaces, secondly, a study on the elevated roads, their importance and impact on the surrounding urbanization, then an analytical study of several international and local examples is conducted, followed by a comparison study to reach the best use for those spaces and concluding guidelines that are taken into consideration when designing those spaces or rehabilitating them.

Index Terms- Urban lost spaces – urban spaces – public spaces – elevated roads - Elevated Movement Axes

I. INTRODUCTION

The rapid growth in the population has led to congestion of cities, so the Country adopted the concept of establishing new cities and reducing traffic problems. Despite these solutions, there was pressure on the road networks, in the 21st century the country tended to construct overpasses and dig tunnels to solve the traffic problems.

Nowadays, the elevated roads become one of characters of the Egyptian city, as they are huge structures that cut the urban and social fabric and occupy large urban areas, which leads to depriving the surrounding community of those spaces, it can be said that the elevated roads weren’t consciously built to integrate with the urbanization surrounding. (Tawfiq, 2018)

On other hand, Cairo suffers from lack of open public spaces and a high building density. This lack can be compensated by using the spaces under the elevated roads as urban public spaces for the surrounding community, but the country has planned to transform these spaces into private and commercial spaces aiming for a financial profit or as car park lots.

Figure 1 The current situation in Egypt below the elevated road Saft El Laban and Tharwat. source: researcher

Figure 2 The current situation in Egypt below the elevated road El-Etahdy in Masr El-Gadida. source: researcher
II. URBAN LOST SPACES

The lost spaces are defined as lands neglected or left among the urban spaces in the communities, also to these spaces can be incomplete or lack in use and seen as undesirable, neglected and leave a void in the urban fabric. Also, Roger Trancik mention in Finding Lost Space book that voids disturb the surrounding urban fabric. (Trancik, 1986)

While these spaces are seen as undesirable urban spaces, they have various potentials and opportunities that serve the communities around them. (Narayanan, 2012)

A. VALUE OF URBAN LOST SPACES

Regardless of the negative effects of lost spaces on the city, it can be as a vital resource that provides great value to the community to improve the quality of life. These values are divided into environmental, social, economic, cultural and visual values. (Tobias, 2018)

Figure 3 Value of Urban Lost Spaces. Source: Researcher
B. **CLASSIFICATION OF LOST URBAN SPACES**

Many planners and architects discussed different types of lost spaces that appeared in the urban fabric and some of them can be summarized as follows: *(Sameeh, Gabr, & Aly, 2019)*

![Figure 4](https://www.achdaily.com)  ![source: www.achdaily.com](https://www.achdaily.com)  ![source: www.achdaily.com](https://www.achdaily.com)

**Figure 4** classification of urban lost spaces. **Source:** researcher

The space under the elevated roads is chosen because of its large spread in Egypt, also because of its negative effects on the urban fabric.

C. **EXISTING GUIDELINES FOR SUCCESSFUL PUBLIC SPACE**

Carolyn Francis and Clare Cooper Marcus conducted research on urban public space and developed Guidelines that can achieve a successful urban public space, their list of strategies for its creation is often used by designers, planners, and academics *(Biesecker, 2015)*, the guidelines were also developed by Project for Public Spaces (PPS), which has discussed the place making since 1975.

The main principles of these guidelines can be summarized as follows:

![Figure 5](https://www.pps.org/article/grplacefeat)  ![source: https://www.pps.org/article/grplacefeat](https://www.pps.org/article/grplacefeat)

**Figure 5** element of project for public space. **Source:** https://www.pps.org/article/grplacefeat

![Figure 6](https://www.pps.org/article/grplacefeat)  ![source: researcher](https://www.pps.org/article/grplacefeat)

**Figure 6** Existing Guidelines for Successful Public Space. **Source:** researcher
III. ELEVATED ROADS

Because of the continuous increase in population density, the demand for increasing transportation increased, which led to neglecting other dimensions when constructing elevated roads, as the design and planning of roads became limited to some officials who aim to solve traffic problems only.

“The planning and design of roads, like other modes of transport, tends to become the preserve of blinkered specialists infatuated with the dream of maximizing the transport mode for which they assume responsibility” (Turner, 1998)

Regardless the importance of the elevated roads in connecting the cities together, they lead to cutting the fabric below them and affect the urbanization around, so many countries went to solve the problem resulting from the construction of the elevated roads.

A. THE IMPACT OF ELEVATED ROADS

In the 1960s, Jane and several urban planners realized the negative impacts of elevated highways in cities. In (The Death and Life of Great American), the book discusses these various impacts on the environment and society,

The impacts of the elevated roads divided to environment, economic, aesthetic, social impacts, and can be illustrated in fig7

<table>
<thead>
<tr>
<th>SOCIAL IMPACTS</th>
<th>AESTHETIC IMPACTS</th>
<th>ECONOMIC IMPACTS</th>
<th>ENVIRONMENT IMPACTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social communication</td>
<td>Separation of districts</td>
<td>decrease property values.</td>
<td>the noise</td>
</tr>
<tr>
<td>Impact on pedestrians</td>
<td>Build a massive barrier</td>
<td>Urbanization and rapid mobility</td>
<td>High temperature</td>
</tr>
<tr>
<td>Safety</td>
<td>Impact on the historical</td>
<td>high maintenance cost</td>
<td>low air quality</td>
</tr>
<tr>
<td>Community connection</td>
<td>characteristics of</td>
<td>Wasting distinctive lands</td>
<td>Effect on lighting</td>
</tr>
<tr>
<td>Reducing the quality</td>
<td>urbanism</td>
<td>Defined lifespan</td>
<td>rainwater drainage</td>
</tr>
<tr>
<td>of life</td>
<td>Create a landmark in the</td>
<td>Impact and changes in local</td>
<td></td>
</tr>
<tr>
<td>Lost spaces</td>
<td>district</td>
<td>economic activities</td>
<td></td>
</tr>
</tbody>
</table>

Figure 7 The Impact of Elevated Roads. Source: researcher

B. COMPONENTS OF LOST SPACES UNDER THE ELEVATED ROADS

It is necessary to know the components of urban spaces below the elevated roads to understand the relationship between them and the elements of urban open spaces, as it is the main component influencing the activity and pedestrians within the space. (Al-Qanati, 2015)

C. POTENTIALS OF VOIDS UNDER ELEVATED ROADS

Spaces beneath elevated roads are considered a double-edged because they have many negative impacts, whether they are environmental, social or others, but they contain many potentials that can be used, most of these spaces are transformed into lost spaces containing crimes like drugs and garbage, due to lack of management.

The potentials can be summarized as follows:

- Unused spaces that can be used within the city.

This potential is important in congested cities where open and entertainment spaces are rare (Kamvasinou, 2011), for example in Paris, the Viaduct

Figure 8 Components of lost Spaces Under Elevated Roads. Source: researcher

Figure 9 Viaduct des Arts in paris Source: https://en.parisinfo.com/shopping-paris/73812/Le-Viaduc-des-Arts
des Arts, down the Avenue Daumesnil, and its use as art shops.

- **Huge structure**

  These spaces located under huge structure, whether concrete or metal, that protect them from natural factors such as sunlight and rain (Su, 2005). Also (Under Elevated Structure) indicated that "protection from sunlight and rain is a necessary component for users." (Bauer, Drake, Fletcher, Travieso, & Woodward, 2015). The structure of the elevated road provides shade and protection from rain, as shown in **Fig10**

- **Distinguished location**

  Most of elevated roads are generally located in a distinct and vital location, as they are located in the main axes of movement in the centers of cities and vital places and are distinguished gathering points. Therefore, the spaces under elevated roads must take more importance than elevated roads themselves because they affect the urban fabric at the ground level. (Jones, 2002)

  Akkerman and Cornfeld mentioned “Because they occupy an important space in the city and in mind of users, but may be invisible to planners and designers the same.” (Kamvasinou, 2011)

**IV. INTERNATIONAL EXAMPLE**

International examples were chosen to conclude guidelines to be used when designing or rehabilitating the spaces under the elevated roads, the projects were chosen using the following criteria: were implemented to know the extent of their success and impact on the urbanization around, in communities similar to Egypt economically, socially and environmentally, being in urbanization due to their large impact on the urbanization around them.

![Figure 10: Shadow tracking beneath elevated roads](image)

![Figure 11: International Examples](image)

**Source:** researcher
A. UNDERPASS PARK

The underpass is one of the largest parks under elevated roads and the first of its kind in Toronto. It was developed and transformed from an unsafe and dark place into a livable garden, the garden transformed the unused and abandoned space into services for the neighborhood and into a pedestrian path. The project area is about 2.5 acres designed by Philips Farevagg Smallenberg (PFS Studio), The project is located under the east side of the Richmond/Adelaide Elevated Road which crosses the Don River.

It is surrounded by residential, commercial areas and open greenspaces such as Lawren Harris Park and Corktown Common Garden. It is also surrounded by trees.

In the beginning, the residents and officials were afraid of the existence of a huge structure that divides the neighborhood and creates intermittent and abandoned spaces, also leads to isolating the residents of their services and the rest of the neighborhood. Therefore, the main aim was to revive the space beneath the elevated road as parts of the neighborhood. Each community organization or group working on this development wanted it to reflect the neighborhood's identity, its residents and its history instead of feeling artificial. The development includes a traditional community-led plan that aims to have the void under the upper road suggest to users that it is a social and innovative gathering place and also that is gives a sense of welcome and dynamic in environment.

Although the park is a permanent design, it includes a number of flexible spaces that allow the community to gather and festivals (Hamelin, 2016), the activities in the space divided into: skate area – Basketball – kids area - community gathering area – semi shaded siting area

Underpass Park has received the American Society of Landscape Architect’s prestigious Award of Excellence (ASLA), the highest honor given in the public design. (Awards, 2016)

B. A8ERNA

In the early seventies, the new A8 elevated road was built with the aim of crossing a river in Koog aan de Zaan, which is located on the Zaan River, it has led to the separation of the city in two parts. It is considered a blind spot for more than 30 years, The project is surrounded by residential, commercial and open green areas, from the north by the State Hall, from the south by a church, and the Zaan River from the east and the Provincialeweg axis from the west, for many years the space was neglected and used as a car parking. Due to the dense construction on the banks of River, the river was closed as an outlet for the users and this was compensated by the part of the river within the project and the work of a mooring for boats, As for the graffiti exhibition, its purpose...
was to create a space for drawing to reduce scribble on the walls (Singhal, 2011). Project A8erna was awarded (The European Prize for Urban Public Space) in 2006.

The project consists of three parts in addition to developing two urban areas around it as shown in fig15:

![Figure 15 activities in space. Source: researcher (Singhal, 2011)](image)

V. EGYPT

To solve the problem of overpopulation and traffic jams, urban planners and decision makers have seen that the overpasses and bridges that extend above the center of Cairo are the easiest way to solve the problem and connect between the regions (Elbih, 2020). In the Arab Republic of Egypt, there are 2,267 bridges and overpasses, including elevated railways, pedestrian bridges and overpasses, according to the report of the Central Agency for Public Mobilization and Statistics (CAPMAS) in 2015, while the recent report in 2019 showed that 1,762 of them are bridges and overhead roads for cars. And Cairo only contains 94 bridges and overpasses, as these statistics reflect the size and development of the road network inside Egypt (CAPMAS, 2015).

The highway network was developed as a tool to reach new cities, and decision makers ignored the old cities and neglected surface transportation in order to improve access to them. (Dessouky, 2016)

In the following, the current trends in Egypt will be divided into spaces designed as shops and parking lots, spaces transformed into bus stops and some informal uses, spaces that were used as landscapes that are not used, and finally informal spaces filled with crime, garbage and informal use.

**Table 1** trends in Egypt beneath elevated roads. **Source:** researcher

<table>
<thead>
<tr>
<th>A. The Space Beneath the Elevated Road Intersection Mustafa AlNahhas with Abbas ELAkkad</th>
<th>B. The Space Beneath the Elevated Road Juhayna Square</th>
<th>C. The Space Beneath the axis of Saft al-Laban</th>
<th>D. The Space Beneath the Elevated Road Ahmed Elzomor (Elasher stop)</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Image A]</td>
<td>![Image B]</td>
<td>![Image C]</td>
<td>![Image D]</td>
</tr>
<tr>
<td>The uses in the space were divided into commercial kiosks of various use and design, and parking lots.</td>
<td>The uses in the space were sitting area, green spaces and pedestrian paths.</td>
<td>The uses in the space were informal uses like parking, street vendors and café.</td>
<td>The uses in the space were divided into bus stop, street vendors and parking.</td>
</tr>
</tbody>
</table>

It was concluded from this that the current situation in Egypt has deteriorated and it is important to reconsider the plan used to rehabilitate these spaces and benefit from them as public spaces for the Egyptian society.
VI. GUIDELINES FOR DESIGNING SPACES UNDER ELEVATED ROADS

After completing the theoretical part and analyzing the global examples, the most important points to be taken into consideration were concluded:

Table 2: a comparative study between international and local example with deduced guidelines. Source: researcher

<table>
<thead>
<tr>
<th>Components Of Space Under Elevated Roads</th>
<th>International example</th>
<th>Local example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevating Roads Body</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Pedestrian Paths</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Seats</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Public Art</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Waste Bins</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Signs</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Ads</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Barrier</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Lighting</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Accessibility</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Borders And Transitions</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Entrances</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Natural Elements (Softscape)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Uses</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

VII. CONCLUSION

The continuous population increase leads to more elevated roads and thus an increase in the lost urban spaces that can be converted into urban public spaces which improve the quality of life, as these spaces have huge potentials to improve the city and provide a stronger urban fabric, and the rehabilitation of these spaces can reduce the negative effects of the elevated roads. The guidelines can be summarized as follows:
<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>GUIDELINES</th>
</tr>
</thead>
</table>
| Floorings | • Floor’s finishing is chosen according to the activities in the space, and it is preferable to have an interlock with colors to attract the attention of users to the space.  
• Children’s play areas preferably with materials that protect them from shocks, such as rubber or grass. |
| Columns   | • The location of the columns in the space determines the locations of the activities where in the edges the activity is in the middle and vice versa in the case of the columns in the middle, so the activities are exposed to the movement of vehicles differently.  
• Finishing materials can be concrete, painted, or clad. |
| Elevated Road Body | • According to the structural system of the elevated road, in the steel systems, a noise insulator is made. |
| Furniture | • Establishing a clear path for the movement of pedestrians and calves and separating them from the path of vehicles, as well as pedestrian paths preferably separated in terms of use according to the age group.  
• Seating close to movement paths and in gathering areas, preferably flexible for use in more than one purpose.  
• Providing barriers separating the space from the surrounding roads to reduce accidents, transparent to give a sense of welcome and safety from blind spots.  
• The lighting elements must be distributed in the space equally and sufficiently to illuminate the space to avoid criminal acts, and lighting units on pedestrian paths, the boundaries of the space, the ceiling of the space and the places of activities, considering that they are designed in an attractive form.  
• It is preferable that the space contain Public Art works to attract users to the public space.  
• Garbage bins are evenly distributed in the void to avoid the vacuum being unclean.  
• Signs help to understand the space forms faster.  
• Private sector advertisements can provide funding for space through space management and maintenance. |
| Accessibility | • Accessibility by clearing the space from the outside and preparing the road to the space by making bumps or traffic lights or determining the speed of vehicles around the space.  
• If the speed of vehicles around the void is high, pedestrian bridges can be made to cross the road or tunnels. |
| Borders And Transitions | • Transitions in the space are observed by seeing the vehicles around the space.  
• The boundaries of the space must be defined to prevent encroachment on the space and the boundaries of the roads surrounding it. |
| Entrances | • Entrances must be clear from surrounding urban space  
• Allow all categories of society to use the space under the elevated road.  
• Entrances can be definite by signs, lighting, and plants. |
| Natural Elements (Softscape) | • Natural elements are placed on the edges of the space due to their need for sunlight and at the same time to reduce pollution and noise around the space, so it is preferable to use types that help in this.  
• Using natural elements that are suitable for use, grass can be used in children's play areas.  
• The use of natural elements suitable for the site, it is preferable to use trees and plants that can withstand the site conditions from pollution and reduce noise to space.  
• Pots of plants should not obstruct the view into and out of the site. |
| Uses | • Activities in the space must be suitable to the surrounding uses and meet their needs.  
• Flexible activities, so the space can be used in more than one use, which helps to operate the space throughout the year and throughout the day, which reduces the transformation of the space into a lost space again.  
• It is necessary to provide services for the space such as toilets, shops and security rooms. Providing enough parking spaces for space users.  
• The activities in the space are determined by the size of the space.  
• If the space below the upper road is part of a larger space, the program must link the space with the rest of the space. |
<table>
<thead>
<tr>
<th>Provisional Areas and Public Art, Taking into Account That the Recreational Activity Is Suitable for the Size of the Space.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separate Activities That Need a Quietness and Sports and Leisure Activities as Well as Separate Them From Surrounding Traffic.</td>
</tr>
<tr>
<td>Providing Commercial Elements and Integrating Them With Activities in the Public Space to Increase the Users of the Space and the Sustainability of the Space Through the Contribution of the Financial Consideration to the Maintenance Process.</td>
</tr>
<tr>
<td>Providing Flexible Spaces That Can Be Used in More than One Activity.</td>
</tr>
</tbody>
</table>

**Identity**

| Create Visual Landmark That Can Be Seen From a Distance. |
| Using the Elevated Road Body in the Design, Which Can Be Used in Drawing Graffiti, Colors or Lights. |
| The Use of Suitable Materials in Finishing Floors, Ceilings and Columns, and the Difference in Materials Can Help Visual Observation of the Spaces. |

**Management and Operation**

<table>
<thead>
<tr>
<th>Community Participation in The Design Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Community Must Participate in the Selection of Activities and Uses Within the Space to Meet Their Needs, and This Is Done Through Questionnaires, Forms or Meetings.</td>
</tr>
</tbody>
</table>

**Funding**

<table>
<thead>
<tr>
<th>Funding Can Be Divided Into:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Local Sector Can Collect Donations For the Space.</td>
</tr>
<tr>
<td>The Private Sector Can Participate in the Space in Exchange for Advertisements in the Space, Considering the Space Remain a Public Space.</td>
</tr>
<tr>
<td>The Public Sector Finances the Space As a Public Space That Serves the Community.</td>
</tr>
</tbody>
</table>

**Supervision**

| Supervising the Space From the Public Sector or Local Community. |
| Provide Security Elements for the Space. |
| There Must Be a Management That Manages the Process of Space, Cleaning and Safety. |

**Maintenance**

| Maintaining the Space Periodically Contributes to the Maintenance of the Space and Not Turning It Into a Lost Space Again. |
| A Plan Must Be Drawn Up for the Maintenance of the Space, As It Can Be From the Space Due to Shops or Donations From the Surrounding Community. |

---

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   architects/
   under the Chicago Brown Line. Massachusetts Institute of Technology,
   FREEWAYS: APPLICATION TO THE WEST END ‘S DALLAS.

AUTHORS

First Author – Mohamed Hassan Atwa Eldek, Professor at Department of architecture, design, and urban planning, Suez 
Canal University, Ismailia, Egypt
Second Author – Ahmed Mohamed Saleh Khedr, Professor at Department of architecture, design, and urban planning, Suez 
Canal University, Ismailia, Egypt.
Third Author – Doaa Mohamed Ali Abdelaziz, Demonstrator in Architecture Department, Suez Canal University, Ismailia, 
Egypt.

Correspondence Author – Doaa Mohamed Ali Abdelaziz, baumanee@gmail.com, doaa.mohamed@eng.suez.edu.eg
Relationship Among Public, Private Costs and Transition of Junior Secondary Students In Federal Capital Territory: Implications For Human Capital Development In Nigeria

Mathew Sunday Dada, PhD¹
Department of educational Management
Faculty of Education
University of Abuja, Nigeria
Suday.dada@uniabuja.edu.ng

Lami Ofie, Ph.D²
Department of Foundations of Education
Federal College of Education
Kano, Kano State, Nigeria

EJAH, Michael Omache
Federal Capital Territory College of education
Zuba, FCT-Abuja, Nigeria

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Abstract: This study investigated relationship among public, private costs and transition of Junior Secondary Schools (JSS) students in Federal Capital Territory (FCT) Abuja and its implications on human capital development in Nigeria. Two research questions and two hypotheses guided the study. The study was anchored on the equalization theory of Cubberley, 1905. The study employed Ex-Post-Facto and a Descriptive Survey research design. The population of the study was 47,576 year three students in 182 public JSS. A sample size of 18 (10 percent) Schools participated in the study. Three instruments were used for data collection; Enrolment and Budgetary Allocation Inventory Proforma (EBAIP), School Sample Receipt (SSR) and Students’ Sundry Expenditure inventory (SSEI). The findings revealed that though, the policy provides for free JSS, private costs contribute 24.15 percent of the total of JSS in the FCT from 2015 - 2020 was 24.15. FCT recorded only 73.78 percent transition rate with 26.22 percent drop-out. The private cost contribution was found to be statistically significant. The finding of the study also showed an inverse relationship between private cost and students’ transition to Senior secondary schools. The study recommended that Federal Capital Territory Administration should initiate interventions in the form of scholarship and bursary awards to provide supports to parent of the indigent students to stay and complete SSS education. Federal Capital Territory Education Secretariate should carry out advocacy and sensitization to the international development partners on the need to extend educational support to the SSS level in the bit to reduce Out-Of-School Children (OOSC).

Key Words: Public Cost, Private Costs, Transition, Junior Secondary Students, Federal Capital Territory & Human Capital Development.

Introduction
Investment into education has attracted attention of scholars in the field of economics of education. Alfred Marshal in 1890 commented that there were few practical problems with direct interest to economists. Practically, economics of education is interested on issues which border on expenditures in education. Miller in 1966 was concern on studying how expenditures should be divided between state and households. West, in 1964 also addressed the issue of public or private finance of education and the economic consequences of
Expenditures on education. In addition, scholars such as T. W. Schultz, 1961 and G. S. Becker, 1964 developed the popular Human Capital Theory which provided justification that people spend on education for future productivity. The general idea is that education should not only be social service but also as an investment. Therefore, public and private spending on education is encouraged where there are perceived superior positive effects of the efforts made (Undie, J.A 2007, Țaran-Moroșan, Sava and Diaconescu, 2010).

The launching of Universal Basic Education in 1999 in Nigeria was a commitment to the achievement of the ‘Education For All’, an international initiative which was designed to provide quality basic education for all children, youths and adults who never had access to education. This was designed to achieved the millennium development goal two which was aimed at achievement of universal primary education by 2015. By the provision, the junior secondary School (JSS) constituted a major component of the nine-year free and compulsory education. Following this development, the expectation was that access to JSS component could increase, now that government took the initiative of bearing the costs, hear in refer to as public cost. The substitution of the burden of private cost in the provision of JSS was a fertile ground for the improvement into the enrolment of JSS.

The provision of education in Nigeria is in the concurrent list, it is both public and private sector driven. In this wise, the national policy on education recognises that provision of education is capital intensive and requires financial provision from all tiers of government for successful implementation of educational programmes. Hence, the provision of education is a joint responsibility of Federal, State, Local governments and private sectors. In this connection, government welcomes and encourages participation of local communities, individuals and organizations (FGN, 2013).

The Universal Basic Education Act 2004, made provision of the financing arrangements for the implementation of the Universal Basic Education (UBE) programme. Accordingly, the programme is financed from;

i. Federal Government block grant of not less than 2percent of its Consolidated Revenue Fund;

ii. funds or contributions in form of Federal guaranteed credits; and

iii. local and international donor grants;

iv. For any State including Federal Capital territory (FCT) to qualify for the Federal Government block grant would have to contribute not less than 50 percent of the total cost of projects as its commitment in the execution of the project. (Federal Government constitute the public cost for providing for UBE that comes from the federal government block grant and the 50 percent contributions for the implementation of the expenditure for basic education programme (FRN, 2004:6).)

Conceptually, cost is the monetary expression of the value of resources required to develop and/or implement an intervention or produce specific goods or services, regardless of how these resources are financed. Cost is different from price, which is the monetary value exchanged in a market transaction for one unit of a good or service (Walls, 2021).

Educational costs in general include both the actual expenses and the opportunity costs incurred by the person who makes the investment in education. In other words, it is the income which public or individuals’ give-up during the life devoted to education. The total cost of education of a person comprise both the costs supported by the individual and the social costs paid by the society for him. In other words, it includes all the amounts paid for an individual to become educated, regardless of the person or persons who pay these costs. (Țaran-Moroșan, Sava and Diaconescu, 2010). This lays credence to the assertion that no level of education can totally be free to any of the stakeholders. While governments on one hand intervenes in the provision of a particular level education by incurring expenses and opportunity costs, individuals on one hand bear significant amount of costs either in the form of actual expenditure on education or give-up earnings in the course of acquiring education.
Dada and Ofie (2018) saw cost in education to represent the real resources devolved to education, this could be in cash, material and sacrifices that are surrendered or made to produce an educated person at a given level of education. The cost of education could be incurred by the stakeholders; State, organizations and private individuals. Agabi, (Dada and Ofie, 2018) maintained that cost of education is the amount of money paid for a student in the course of acquiring education. It is the price that an individual or a group of people have to pay to acquire education or to provide education for another person or group of persons. Therefore, in this case, cost represents the costs incurred by the Federal, State, Non-Governmental Organizations (NGOs) and individuals in the provision of JSS in the FCT. Cost in education is majorly categorized into public otherwise called institutional costs and private costs.

Public cost of education entails the cost borne by government on the basis of taxes, loans and other public revenues on the account of providing education. Public costs of education could be in the form of recurrent, otherwise called the overhead cost and capital costs. The later component of educational cost represents annual ongoing expenses of the education sector. It is also referred to as Operational cost. This cost component captures staff salaries, which takes the largest chunk of the overhead costs. The recurrent costs also include the cost for textbooks, Teachers’ manuals, educational supplies such as Chalk/White Boards, School records, Stationery, teacher training, capacity building monitoring and evaluation costs. Capital costs components include the costs for the provisions of infrastructure in the school system and other educational facilities; the type of cost incapsulates cost for equipment such as school furniture, computers, constructions such as roads, toilets, boreholes. Operationally, special projects & programmes that appears to recurrent in nature could be captured under capital cost especially when they are hug to be accounted as recurrent cost (Unpublished UNICEF training Manual, 2020).

Private cost of education is concerned with the cost borne by individual in families, it represents costs which the individuals and the families must bear in return for the education received. These costs are incurred in the payments of tuition and examination fees and other such fees; institutional supplies; manuals and books; transport; uniforms; foregone earnings and sundry expenditures. To this end, it can be observed that the cost of providing JSS education ultimately is not totally free of the private costs as parents, individuals grapple with the payments of the hidden costs of education.

Costs associated with schooling are frequently cited as a barrier to school enrolment and a cause for dropout in Nigeria, especially costs for education which are directly or indirectly related to students’ households. The study of 2010 Nigeria Education Data Survey (NEDS) found that around 60% of households were still paying PTA levies and buying uniforms. Household costs are private costs associated with purchase of books and supplies and other hidden cost such transports to and from school. These have to a large extend increased costs of education to the learners (UBEC 2012; Humphreys and Crawford, 2015). This implies that though, theoretically UBE is free for all, the reality on the ground is that households still bore some costs. This situation is more worrisome when parents have to shoulder the entire cost without public interventions as in the case of Senior Secondary School (SSS). Biwott (2013) established that cost variables borne by parents potentially effect students’ transition and are linked to be the third most common cause for non-enrolment affecting about a quarter of children, one third of dropouts nationally, non-completion and transition of students in secondary school level. Transition as in this study is described as the gradual process of moving from JSS to SSS (Jindal-Snape, Symonds, Hannah and Barlow, 2021).

Worthy to note is that in the past two decades, Nigerian educational system has undergone major structural, policy changes and innervations geared towards enhancing free and compulsory basic education for the first nine years of schooling. The impact of the policy direction was noticeable in the rise of enrolment into public JSS in the four-year. The period recorded visible overall improvement in transition rates nationally across the zones. An improvement in transition rates of 43 & 54 percent were recorded in 2007 and 2010.
respectively (Humphreys and Crawfurd, 2015). This is an indication that all thing being equal, government intervention could improve school participation.

However, despite the interventions to maintain the gains recorded at the JSS level of education, out-of-school children (OOSC) still persists. OOSC includes children within the ages 6-17 who have never attended school, as well as those who were once in school but dropped out at some point for some reasons (Federal Republic of Nigeria 2021). In 2010, NEDS estimated that there are about 11.8 million children aged 5–16 in Nigeria that had never attended school. In addition to one million who dropped out of school two or more years previously (Humphreys and Crawfurd, 2015). The challenge is more serious at SSS as the gross enrolment ratio in upper secondary school in Nigeria dropped over the past years. In 2018, only 38.7 percent of population in upper secondary education age was enrolled. Statistics has also shown that of the twelve million children aged 6-17 out of school in 2018/19, 3.8 million were in the senior secondary reference age group 15-17 years (Federal Republic of Nigeria 2021). Available data at the Federal Ministry of Education (FME) 2019 indicate that from 2011 and 2016 the enrolment JSS enrolment figures stood 5.8 and 6.9 million student while the enrolment figures at the SSS level remained between 4.2 and 5.8 million students, from the analysis the deficit of enrolment figures between JSS and SSS ranged between 15-30 percent annually. Implying that the 15 -30 percent students that were not accounted for at the SSS level swelled up the OOSC in Nigeria. In addition, the Nigeria Living Standards Survey in 2018/19 established that the adjusted net attendance rates in Junior Secondary School was 94.3 while that of Senior Secondary school was 81.8 percent (Federal Republic of Nigeria, 2021). This indicates that at the national level there is a gap in the JSS students’ transition to SSS. Although, there appears to be limited studies in the FCT that establish a relationship between private, public cost and transition rates from JSS to SSS, the situation may not be different from what obtains at the national level. The concern of the study is that aside other factors restraining students transition to SSS, private cost of education could have significant limitations for students transition in the FCT, Abuja. Therefore, the relationship among public, private costs and transitions of JSS to SSS is the concern of the study.

The study is anchored on equalization theory, proposed by Cubberley in 1905. According to the model, state support educational provision to equalizing educational opportunities as well as ensuring fairness…. The duty of the state is to secure for all as high a minimum of good education as possible, but not to reduce all to this minimum, to equalize the advantages to all as nearly as it can be done with the resources at hand or place a premium those local effort which will enable communities to rise above the legal minimum as far as possible, and to encourage communities to extend educational energies to view and desirable undertakings (Undie, 2007). Where the state extends its financial supports beyond JSS, this could positively influence transition of students to SSS thereby reducing OOSC and increasing the build-up of stock human resources for the economy.

Research Questions

The following research questions were raised for the study:

1. What is the percentage of annual private costs contributions to the total costs of Public Senior Secondary Schools in the Federal Capital Territory from 2015 -2020?
2. What is the transition rate of students from Public Junior Secondary Schools to Public Senior Secondary School in the Federal Capital Territory from 2015 – 2020?

Hypotheses

H0: Private costs do not significantly contribute to the total costs of public Junior Secondary Schools in the Federal Capital Territory from 2015 -2020.
H0: There is no significant relationship between private costs and transition rate in Public Junior Secondary Schools in the Federal Capital Territory from 2015-2020.

Research Design

The study employed two research designs; Ex-Post-Facto and a descriptive survey research design. The former was to allow for the harvest of existed secondary data of public costs, the approved budget of FCT- Universal Basic Education Board (UBEB) and students’ enrolment from FCT, Department of Policy Planning Research and Statistics (DPPRS). The later design is suitable because it substantially complies with the basic principles of the design which allows for collection of data from sampled respondents (students) considered to be representative the larger population.

The population of the study consisted 47,576 students of year three from 182 Public JSS in the FCT. A total of 18 (10 percent) Junior Secondary Schools in the FCT participated in the study, the sampled schools were first stratified by area councils and randomly selected for the study. Nwana (Adukwu, 2001) suggested that in population of few thousand 10 percent sample size was adequate for in social science research. The researchers referred to sampling standards of Krejcie and Morgan, 1970 and selected 181 respondents proportionally from the schools as sample for the study.

Three instruments were developed for data collection; Enrolment and Budgetary Allocation Inventory Proforma (EBAIP), a School Fees Sample Receipt (SFSR) and Students’ Sundry Expenditure Inventory (SSEI). EBAIP collected students’ enrolment and the budgetary allocations (public cost) from the FCT-UBE and DPPRS for the period of the study, 2014 to 2020. SFSR was used to harvest tuition and non-tuition fees where applicable; it indicated the official amount students pay per term, representing part of private costs of JSS. The thirdly instrument, SSEI contained 17 items of costs drivers designed to collect data on unreceipted hidden students’ sundry costs borne by households of JSS students, the data was supplied on daily, weekly and termly basis.

The instrument for the collection of public costs and the school receipt were not subjected to validity and reliability tests; they are both audited and certified official documents. SSEI was only validated through peer review with colleagues in the department to ensure that hidden cost variables were adequately captured. This instrument did not require reliability test as the data involve were purely financial figures used by students. Applications were made to the relevant offices in the FCT to obtain secondary data on budget and students’ enrolment. To collect primary data, the researchers obtained permission from the school authorities to distribute SSEI, respondents were guided on how to supply data on the students’ sundry costs while in school. Simple percentage was employed to answer research questions of the study with results presented in graph and histography. ANOVA was used to test the hypotheses of the study. Private costs for the sampled students was calculated by summing up all the cost driver variables as follows:

\[ PC_{n1} = \left\{ \left( \sum X_1, X_2, X_3, X_4, X_5 \ldots \ldots \ldots X_n \right) \right\} \frac{n}{N} \]

where \( PC_{n1} \) = Private Costs of base line year,
\( X_1 \ldots X_n \) = cost driver variables for individual student.
\( n \) = Number of sampled students
\( N \) = Number students enrolled in the years under consideration.

Results and Discussion

Research Question One

What is the percentage of annual private costs contributions to the total costs of Public Senior Secondary Schools in the Federal Capital Territory from 2015-2020?

Table 1: Private Costs Contributions to the Total costs of Public Junior Secondary Schools in the FCT

This publication is licensed under Creative Commons Attribution CC BY.
Table 1 and figure 1 present public and private costs of JSS in the FCT. The analysis revealed that though, JSS is said to be free in the FCT and elsewhere in the nation, private costs contribute 24.15 percent of the total costs of JSS in the FCT from 2015 - 2020. Details of the analysis showed trend of private cost of JSS which fell between 20.03 percent and 27.99 percent. The highest total private cost of 27.99 percent was recorded in 2014/2015 session. A gradual down turn in the annual private cost was noticed in the period of the study; in 2015/2016 private cost was 25.20 percent, subsequently dropped to 24.64 percent, 23.83 percent, 23.18 percent and 20.03 percent in 2016/2017, 2017/2018, 2018/2019 and 2019/2020 respectively.

Research Question Two:

What is the percentage of annual private costs contributions to the total costs of Public Senior Secondary Schools in the Federal Capital Territory from 2015 - 2020?

Table 2: Transition Rate from Public JSS students to Public SS One in the FCT

<table>
<thead>
<tr>
<th>Year</th>
<th>Completion of JSS</th>
<th>Enrolment in SSSI</th>
<th>Transition Rate (%)</th>
<th>Drop-Out (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015/2016</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2016/2017</td>
<td></td>
<td></td>
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<tr>
<td>2017/2018</td>
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<tr>
<td>2018/2019</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019/2020</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2 presents results of the analysis of transition rates of JSS students which and graphically represented in figure 2. The result of the analysis revealed that FCT recorded only 73.78 percent transition rate with 26.22 percent drop-out. Details of the analysis revealed that the highest transition rate of 82.02 percent was recorded in 2016/2017 leaving behind only 17.98 percent. In 2014/2015 and 2019/2020, 77.93 percent and 77.01 percent of students transited to SSSI with 22.07 percent and 22.99 percent respectively dropping out of the link. In 2015/2016, 2017/2018 and 2018/2019, the transition rates were between 67.93 percent and 69.81 percent leaving between 30.19 percent and 32.07 percent out of the system.

**Figure 2: Transition Rate from Public JSS students to Public SS One in the FCT**

Table 2 presents results of the analysis of transition rates of JSS students which and graphically represented in figure 2. The result of the analysis revealed that FCT recorded only 73.78 percent transition rate with 26.22 percent drop-out. Details of the analysis revealed that the highest transition rate of 82.02 percent was recorded in 2016/2017 leaving behind only 17.98 percent. In 2014/2015 and 2019/2020, 77.93 percent and 77.01 percent of students transited to SSSI with 22.07 percent and 22.99 percent respectively dropping out of the link. In 2015/2016, 2017/2018 and 2018/2019, the transition rates were between 67.93 percent and 69.81 percent leaving between 30.19 percent and 32.07 percent out of the system.

**Hypothesis**

**H0**: Private costs do not significantly contribute to the total costs of public Junior Secondary Schools in the Federal Capital Territory from 2015 -2020.

**Table 3**: Analysis of Variance of Contribution Private Cost to Total Cost of JSS in FCT

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>R</th>
<th>r²</th>
<th>Sig@0.05</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Costs</td>
<td>6</td>
<td>16457282279.70</td>
<td>3157674367.29</td>
<td>0.947</td>
<td>0.898</td>
<td>0.002</td>
<td>Significant</td>
</tr>
<tr>
<td>Private Costs</td>
<td>6</td>
<td>3905244356.3533</td>
<td>344339136.35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: FCT, DPPRS and FCT-UBEB
Result on Table three showed that Private costs do significantly contribute to the total costs of public Junior Secondary Schools in the Federal Capital Territory (p=0.002, which is less than 0.05 level of significance). As a result, the hypothesis was rejected. In other words, there was a very strong positive correlation (0.947) which shows that there exists a very strong positive influence of private cost on the total cost of public secondary school in the Federal Capital Territory. The $r^2$ value of 0.898 shows that only 89.8 percent of the variance in total costs of public Junior Secondary Schools in the Federal Capital Territory can be explained on the basis of influence of private costs variations.

**HO$_2$:** There is no significant relationship between private costs and transition rate in Public Junior Secondary Schools in the Federal Capital Territory from 2015 - 2020.

Table 4: Analysis of Variance of Private Cost and Transition of JSS Student to SSS in FCT

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>R</th>
<th>$r^2$</th>
<th>Sig@0.05</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transition Rate</td>
<td>6</td>
<td>73.78</td>
<td>5.99</td>
<td>-0.363</td>
<td>0.132</td>
<td>0.240</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Private Costs</td>
<td>6</td>
<td>3905244356.35</td>
<td>344339136.35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Result on Table four showed that Private costs do not positively significantly influence the transition rates of Public Junior Secondary Schools to public Senior Secondary School in the Federal Capital Territory (p= -0.395, which is greater than 0.05 level of significance). As a result, the hypothesis which state that there is no significant relationship between private costs and transition rate in Public Junior Secondary Schools in the Federal Capital Territory was accepted. In other words, there is a weak negative correlation (-0.363), the weak negative influence implies that as private cost and transition rates of public Junior Secondary Schools to public Senior Secondary School in the Federal Capital Territory are inversely related; an increase in private cost would result in decrease of transition rates. The $r^2$ value of 0.132 shows that only 13.2 percent of the variance in transition rates of Public Junior Secondary Schools to public Senior Secondary School in the Federal Capital Territory can be explained on the basis of influence of Private costs variations.

**Discussion**

The provision of JSS education in the FCT just like elsewhere in the nation, is a component of the free and compulsory Universal Basic Education programme, a federal government intervention programme aimed at providing uninterrupted and equal access to basic quality education to children within the borders of the nation. The national policy on education is unequivocal that the 9-year duration of basic included the three years of Junior Secondary Education “shall be free and compulsory” (FRN, 2013). The philosophy behind was to aggressively pursuit drastic reduction of the OOSC in Nigeria towards achieving the EFA of the MDGs and consequently SDG. Therefore, it is implied that the cost burden of the students’ transiting from JSS to SSS was squarely on the shoulder of parents. This situation could potentially cut transition rate especially in the present economic situation where parents are grappling with the impact of inflation and unemployment in addition to forgone earnings on the account of the pursuit for education. Though, the policy provides for free JSS education, the study found out that the parents and guidance still pay different kinds of fees and levies; among others include PTA levies (Local and National), examination fee, utility fee, health fee, clubs and society fee, files and badges fee, identity cards fee, sport and games fee, computer and library fees. This is in addition to the endless hidden costs; for instance, cost of uniform, textbooks exercise books, transports, school bags and feeding that are borne by parents; the sum of such could affect students transition thereby increasing the already high number of OOSC. Federal Republic of Nigeria (2021) Education Sector Analysis, also admitted that households have been paying towards their children’s education. Even in public schools, where government’s full contribution is
expected in accordance with education policy, the study estimated that households spend an average of NGN16,900 towards their children’s schooling. Mutege (Mwikya, Cheloti, & Mulwa, 2019) saw these costs associated with secondary education as one of the factors affecting demand for secondary education Tharaka District.

The finding of the study showed that the average percent of transition of JSS to SSS in FCT Public Secondary Schools between 20014 and 2020 stood at 73.78 percent leaving 26.22 percent dropping out of the system. This means that the 26.22 percent who never transited to SSS increased the number of the OOSC. Similarly, according to the UNESCO Institute of statistics (UIS) 2017, worldwide 85 percent of children in the last grade of primary school go on to attend secondary school. Only two regions have transition rates below this global average. Eastern and Southern Africa (67.1 percent) and west and Central Africa (52.4 percent). The study noticed that transition rates are highest in the industrialized countries (98.2 percent) and in Eastern Europe. FRN (2021) estimated that 22 percent of the children and adolescents are out of school due to cost pressures. Lewin (Mwikya, Cheloti, Mulwa, 2019) attributed this phenomenon to payment of tuition fees which constitute large chunk of household payments to education and described it as the greatest challenge in secondary education in Sub-Saharan Africa that inhibits access and transition rate in secondary education particularly among poor families.

This finding was further confirmed by the negative correlation (-0.363) between private cost and transition to SSS education. The negative relationship implies that as private cost JSS education increases the transition rates to public Senior Secondary School in the Federal Capital Territory decreases; the inversely relationship presuppose that as parents continue to pay fees this reduces the possibility of the students moving to SSS, where they would be paying high fees that will increase in private cost would result in decrease of transition rates. This finding is validated the finding of Areba, Ayodo & Chemwei (2016) that a strong positive linear correlation exist between the two variables of completion and hidden costs in secondary education in Kenya which implied that as one variable increased so did the other decreases. Mwikya, Cheloti & Mulwa, (2019) in a related study in Kenya found that cost of education, significantly influence the transition rate from primary school to secondary schools in Machakos Sub-County. The study concluded that cost of education had the greatest influence on the transition rates from primary to secondary schools in Machakosm, Kenya. Hence as the hidden costs increased the total number of students who failed to complete the four years of secondary school education also increased. Thus, they concluded that hidden cost is a key barrier to transition to secondary schools.

Conclusion and Recommendations

Conclusively, this research finds out that private costs contribute to the total cost of JSS education and that there was an inverse relationship between private costs and students’ transition. When students are moved from the street to enrol into basic education as result of the federal government intervention and cannot stay to complete senior secondary education. It could therefore, be deduced that without specific interventions in SSS education level, the menace of dropout syndrome of students who complete JSS education will continue unabated especially in the present economic circumstance where parents are saddled with multiple financial tasks. Wastages in the educational sector and increase in the number of OOSC is inevitable. A situation such as this when students do not transit to and complete SSS education, the implication is that the build-up of the stock of well-trained human capital for the economy becomes eminent.

From the conclusion the flowing recommendations are made:

1. That, the Federal Capital Territory Administration initiate interventions in the form of scholarship and bursary awards should be resuscitated to provide supports to parents of the indigent students to transit and complete SSS education.
2. That, the Federal Capital Territory Education Secretariatate should carry out advocacy and sensitization to Development Partners on the need to extend educational supports to the SSS level in the bid to reduce OOSC.

3. That, the Principals of public secondary schools should mobilize SBMC to initiate Private Cost Reduction Strategy (PCRS) by raising funds from community-based associations in form grants to support schools in provide uniforms, instructional materials as financial supports to poor families.

References


Effects of Information and Communication Technology Online Platforms on Sustaining Teaching and Learning in Tertiary Institutions during Covid-19 Lockdown in Nigeria

Amina Lawal*, Dr. Musa Ahmed Zayyad**

*Department of Computer Science, Federal College of Education Katsina State, Nigeria
**Department of Information Technology & Systems, Kampala International University Uganda

Abstract- The COVID-19 pandemic lockdown in 2019 affected the social services of countries worldwide. Schools were shutdown, which poses a threat to teaching and learning. On March 19, 2020, the Federal Ministry of Education approved the closure of all learning institutions. This abrupt closure led to significant disruptions in the education system in Nigeria, which affected access to quality education generally. However, this propelled schools to adopt measures of teaching and learning using ICT tools in form of online learning, where students are taught while they are at home. The aim of the study is to analyze the effect of ICT tools on sustaining teaching and learning during the COVID-19 lockdown. The study particularly investigated the challenges in adopting online learning as well as students’ satisfaction in learning through online learning. The study uses survey method to administer questionnaires to students in order to determine the level of their satisfaction or otherwise of learning through online systems. The numbers of students that filled and returned the questionnaire were 95. The study identified that significant activities which support learning continued during the COVID-19 pandemic. The students of Al-Qalam University Katsina were taught using Zoom and Loom application. However, despite the advantages of online learning, the study identified some challenges in adopting and utilizing the technology. This includes lack of technical infrastructures, poor organizational policies, poor internet service, and lack of access to electricity, among others. The study concluded that online learning cannot completely replace traditional classroom activities; rather it can at best serve as a complement in the event of any disaster that may cause the closure of schools, such as the COVID-19 pandemic. The study recommended that both the Federal government, states and local government should adopt and maintain ICT infrastructures to sustain teaching and learning during any disaster such as the COVID-19 pandemic.

Keywords: Education, ICT, learning, online, teaching.

I. INTRODUCTION

As part of the consequences of COVID-19 pandemic, countries worldwide experiences lockdown in 2020, which in turn led to the closure of schools at all levels of primary, secondary, and tertiary institutions [1]. When the World Health Organization (WHO) came to the resolute conclusion of stopping the spread of this viral pandemic, they suggested a series of safety measures such as hand washing with soap and running water for at least 20 seconds, wearing of face masks, social distancing, and sit-at-home or lockdown orders [2]. According to UNESCO, national school closure has been executed on more than half of the world’s student populace, in a bid to stop the spread of the pandemic (UNESCO, 2020). Despite sit-at-home/lockdown ordinances, learning should be a continuous process. The emergence of the COVID-19 pandemic has made some countries, including Nigeria to consider a web-based learning approach. Online learning is no more to be thought of as in future tense; it is here already, and thankfully, as an answer to teaching problems. Although, a few Nigerian schools, especially private schools came up with the idea of online learning during the global lockdown [3]. Technological growth has brought about major changes in how things are done in all sectors, including learning and schooling methods. The transition of this growth has been somewhat smooth due to easy access to technological devices (internet access, mobile devices, etc.) for teachers and students. According to [4], the majority of students see online learning as groundbreaking for education; others on the other hand have major concerns about the discrepancy associated with its credibility. The Nigeria University Commission (NUC) has vehemently pushed back against online degrees, and in most places of employment, certificates from such programs are frowned upon. As stated by Jones and Blankenship, the traditional face-to-face method of learning is able to provide immediate feedback on students’ performance unlike web-based learning [5].

The global spread of the COVID-19 pandemic has led to the closure of educational institutions all over the world. This brings to fore the readiness of educational institutions to deal with a crisis that requires the help of advanced technology including hardware and software to enable effective online learning. Such closure of schools has accelerated the development of the online learning environments so that learning would not be disrupted. Many institutions have become interested in how to best deliver course content online, engage learners and conduct assessments. Hence, COVID-19 while being a hazard to humanity, has evolved institutions to invest in online learning [6].

Online learning systems are web-based software for distributing, tracking, and managing courses over the Internet [7]. It involves the implementation of advancements in technology to direct, design and deliver the learning content, and to facilitate two-way communication between students and teachers. They contain features such as whiteboards, chat rooms, polls, quizzes, discussion forums and surveys that allow teachers and students to communicate online and share course content side by side. These can offer productive
and convenient ways to achieve learning goals. In Nigeria, the institutions are using video conferencing applications, which include Zoom, Loom, Skype for business, Webex and Webinar etc. [8]. As part of the COVID-19 safety measures, learning activities in Nigerian tertiary institutes were placed on a compulsory lockdown. Some institutions were still involved in teaching students, some examining the students, and others awaiting results approval. While students never expected the pandemic to last this long, tertiary institutions have however been locked for months in Nigeria. This had prompted students to seek alternate sources of learning, especially e-learning, amongst other activities. Thus, this study aims to determine the e-learning attitude of tertiary students during the COVID-19 pandemic in Nigeria [9]. As a result of the COVID-19 halt in school activities, many researchers have taken it upon themselves to carry out findings especially on the effect the closure is having on learners and teachers. Most of these findings are focused on either student’s perception of the learning process, courses that can be taught online or grades of students, etc. In all, these findings have either been forecasted for during and after of COVID-19, be it long or short term bases. Pandemics, wars, or natural disasters are not the only cause of change in the educational system as the world globally is evolving, thus focused on learning methods should be based on a safer environment [10]. This study takes its root based on these findings and also focused on the students’ online learning perspective, its feasibility, learning pattern, and assessments of Nigerian students during this COVID-19 pandemic.

A. Objectives of the Study

The objectives of the study are to:
1) Investigate the impact of Information and Communication Technology in education.
2) Identify the challenges and the different categories of ICT tools applicable to education.
3) Evaluate the uses and application of ICT in teaching and learning.
4) Investigate the extent of ICT usage as a tool for teaching and learning in schools.

B. Research Questions

The following research questions guided the study:
1) What is the impact of information and communication technology in education?
2) What are the challenges and different categories of ICT tools applicable to education?
3) What are the uses and application of ICT in teaching and learning?
4) What is the extent of ICT usage as a tool for teaching and learning in schools?

II. THEORETICAL FRAMEWORK

This study adopted the modified version of Delone & McLean information system success model, which has gained significant attention from researchers in the field of information systems. In 1992, this model was initially developed by DeLone and McLean to measure the dependent construct of IS success [11] was primarily based on following three aspects: study on communications, Taxonomy of measuring information output and research work on information system during that period. There are three levels of communication:

- First Level: Technical (accuracy of information system)
- Second level: Semantic (success of right information conveyed to the right receiver)
- Third level: Effectiveness (influence of information on the receiver).

The information success model has discussed the six dimensions, such as information quality, system quality, system use, user satisfaction, and organizational impact. After one decade, the author modified the original model by adding service quality dimension and in the end replaced the individual impact and organizational impact with the net benefits. Figure 1 showed the theoretical framework adopted by this study.

![Figure 1: Modified version of D&M model as theoretical framework for the study](http://dx.doi.org/10.29322/IJSRP.12.09.2022.p12914)

The model was designed to measure three basic variables that would determine the level of success for adopting the online teaching and learning activities during the COVID-19 pandemic lockdown. These three variables included students’ attitude towards online learning, students’ satisfaction to online learning, and students’ intention or motivation to use the online learning.
III. METHODOLOGY
The methodology adopted for the purpose of the study is the descriptive research. Descriptive research involves the systematic collection of data about a given population or area of interest such as individuals, students, teachers and institutions [12]. The design is used for the following reasons;
1) To collect evidence concerning an existing situation
2) To identify current practices
3) To identify standards and norms which to compare and evaluate present conditions.

A. Population and Sampling of the Study
This study used the survey method to determine the effects of ICT online platforms on sustaining teaching and learning in schools during COVID-19 pandemic lockdown in Nigeria. Students of Al-Qalam University Katsina were the target population and the sample for the study were the 400 level Computer Science students who were randomly selected. A self-administered questionnaire was administered to 95 students who were asked to fill it based on the knowledge and experiences of using ICT online platforms for teaching and learning during the COVID-19 lockdown.

B. Data Collection and Analysis
The data was collected using a questionnaire that was administered physically as hardcopy to the respondents. After gathering the data in its raw form from the respondents, the data was then classified and tabulated after ascertaining its completeness and consistency. This is followed by analysis and interpretation of results as can be seen in subsequent chapters. In analyzing the data, a simple statistical analysis was done based on frequency and percentage. The statistical analysis produced clear results and interpretation of the relative frequencies of the raw scores.

IV. RESULTS AND ANALYSIS
This section shows the results and analysis of the demographic results as well as the survey questions and responses of the respondents.

A. Demographic Results
The Table below shows the results of the demographic information of the respondents, which shows their gender distribution.

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>65</td>
<td>68.4</td>
</tr>
<tr>
<td>Female</td>
<td>30</td>
<td>31.6</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>100</td>
</tr>
</tbody>
</table>

From Table 1 above, it can be seen that 68.4% of the respondents are males while 31.6% are females. This is an expected result, because in most developing countries such as Nigeria, the rate of school enrolment is higher in the male than in the female.

B. Survey Results
The following were the questions that appeared in the measuring instrument, which is the questionnaire. The respondents were enjoined to answer the questions to the best of their ability, and in the event where they are not sure of the answer, then an option for ‘neutral’ was provided to cater for such issue. The number of questions in the questionnaire are fourteen (14), and the last item was provided in form of recommendations where the respondents were expected to express their opinions on how best to improve the deployment of ICT facilities in education.

i. Which ICT device did you use to participate in the online teaching and learning?
This question was asked in order to find out the different types of ICT devices used in the online teaching and learning, and which one is mostly used by the students. This is because there is no way a student or teacher can participate in the online teaching and learning without having a device such as computer, smartphone, tablet, etc.

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desktop computer</td>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td>Laptop computer</td>
<td>5</td>
<td>5.3</td>
</tr>
<tr>
<td>Smartphone</td>
<td>79</td>
<td>83.2</td>
</tr>
<tr>
<td>Tablet</td>
<td>9</td>
<td>9.4</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2 gives a depiction of the different types of devices that are owned by the respondents, and which they used in participating in the online learning. It can be seen that 83.2% of the respondents uses Smartphones, and only 9.4% use Tablet, while 5.3% uses laptop.
computer, and only 2.1% of the respondents’ uses desktop computer. The domination of the use of Smartphones by the respondents may not be unconnected with its mobility and ease of use feature, in which it can be used anywhere and anytime.

This result corresponds with the findings of [13], who studied the use and effect of smartphones in students’ learning activities, where he identified that Smartphone usage ensures flexible course delivery, makes it possible for learners to access online learning platforms easily, access course resources and interact digitally.

ii. Have you use any online application platforms before the COVID-19 lockdown?
The respondents were asked this question to determine whether they have been using the online application platforms for study or for any other purposes.

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>6</td>
<td>6.3</td>
</tr>
<tr>
<td>No</td>
<td>89</td>
<td>93.7</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>100</td>
</tr>
</tbody>
</table>

As seen in Table 3, the number of respondents who had been participating in online learning before the COVID-19 lockdown was a mere 6.3%, while 93.7% of the respondents said they had not been doing online learning before the lockdown. This shows that before the COVID-19 lockdown, online learning is not common in this part of the world. Therefore, the COVID-19 lockdown has made the online application learning more popular.

This result was supported by the findings of [14], in their study on advantages, limitations and recommendations for online learning during COVID-19 pandemic era. They stated that online learning became more popular during the COVID-19 lockdown era due to its advantages, which include the active involvement of students, that is being student-centered learning and it is easily manageable.

iii. Do you know about online application packages for teaching and learning?
The respondents’ were asked this question in order to ascertain their level of familiarity with online application platforms for teaching and learning. The result is shown in Table 4.

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>33</td>
<td>34.7</td>
</tr>
<tr>
<td>No</td>
<td>62</td>
<td>65.3</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>100</td>
</tr>
</tbody>
</table>

From Table 4 above, it can be seen that 34.7% of the respondents were aware of online learning applications for teaching and learning, while 65.3% of the respondents were not aware of them.

iv. Which of the online application package was used in teaching you during the lockdown?
The respondents were asked the type of online application packages that were used in teaching them during the COVID-19 pandemic lockdown. This question will particularly help teachers and other relevant stakeholders in schools to know the popular online application used in teaching and learning.

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zoom</td>
<td>85</td>
<td>89.5</td>
</tr>
<tr>
<td>Loom</td>
<td>7</td>
<td>7.4</td>
</tr>
<tr>
<td>Webinaria</td>
<td>3</td>
<td>3.1</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>100</td>
</tr>
</tbody>
</table>

From Table 5 above, it can be seen that 89.5% of the respondents were taught with Zoom application, while 7.4% were taught with Loom application, and then only 3.1% were taught with Webinaria. This result indicates that Zoom application is more popular than the rest of the online application packages. This result corresponds with the findings of [15] in his study on higher education institutions and the use of online instruction and online tools and resources during the COVID-19 outbreak. His findings suggested that Zoom application was the most adopted and preferred tool among the 58 of the 64 universities that were surveyed in the United States.

v. What is your perception and acceptance of the online application packages?
The respondents were asked about their perception and acceptance of the online applications to continue teaching and learning during the COVID-19 pandemic lockdown.
Table 6: Perception and acceptance of the online applications

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>3</td>
<td>3.2</td>
</tr>
<tr>
<td>Agree</td>
<td>12</td>
<td>12.6</td>
</tr>
<tr>
<td>Neutral</td>
<td>22</td>
<td>23.2</td>
</tr>
<tr>
<td>Disagree</td>
<td>30</td>
<td>31.6</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>28</td>
<td>29.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>95</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

The respondents were asked about their perception and acceptance of the online applications to sustain teaching and learning, also if they had gained knowledge from online courses. The result shown in Table 6 shows that 15% of the respondents’ agree with the perception and acceptance of the online applications to sustain teaching and learning during lockdown, and 23% remain neutral, while 61% did not agree with the notion of sustaining online teaching and learning.

vi. Students’ opinion about replacing classroom teaching with online learning

The respondents were asked their opinion about whether online teaching and learning can eventually replace the traditional classroom teaching and learning method.

Table 7: Replacing classroom teaching with online learning

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>4</td>
<td>4.2</td>
</tr>
<tr>
<td>Agree</td>
<td>7</td>
<td>7.4</td>
</tr>
<tr>
<td>Neutral</td>
<td>15</td>
<td>15.8</td>
</tr>
<tr>
<td>Disagree</td>
<td>29</td>
<td>30.5</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>40</td>
<td>42.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>95</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 7 gives a distribution of the respondents’ opinions on whether they think online teaching and learning can eventually replace the traditional classroom teaching and learning. The result shows that 72.6% of the respondents believed that online teaching and learning cannot replace the traditional face-to-face classroom teaching, while only 11.6% of the respondents agreed that online teaching and learning can eventually replace the classroom teaching and learning, and finally 15.8% of the respondents decided to remain neutral.

vii. Online application platforms are easy and simple to use

The respondents were asked about the simplicity and ease of use of the online learning application platforms.

Table 8: Ease and simplicity of online application platforms

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>19</td>
<td>20.0</td>
</tr>
<tr>
<td>Agree</td>
<td>55</td>
<td>57.9</td>
</tr>
<tr>
<td>Neutral</td>
<td>4</td>
<td>4.2</td>
</tr>
<tr>
<td>Disagree</td>
<td>10</td>
<td>10.5</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>7</td>
<td>7.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>95</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

The results in Table 8 shows that majority of the respondents (totaling 77.9%) accepted that online application platforms are easy and simple to use, while only 17.9% were not in support of this view, and the remaining 4.2% decided to remain neutral.

viii. Online learning applications are suitable to use for both theory and practical

The respondents were asked about the suitability or otherwise of online learning platforms for both theory and practical.

Table 9: Suitability of online learning applications

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>12</td>
<td>12.6</td>
</tr>
<tr>
<td>Agree</td>
<td>23</td>
<td>24.2</td>
</tr>
<tr>
<td>Neutral</td>
<td>5</td>
<td>5.3</td>
</tr>
<tr>
<td>Disagree</td>
<td>15</td>
<td>15.8</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>40</td>
<td>42.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>95</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Table 9 shows a cross-section of respondents’ opinion on online learning being suitable for all types of courses, which is both theory and practical. The result shows that 36.8% agreed that online learning applications are suitable for all course types, while 57.9% did not agree with this view, and then 5.3% of the respondents decided to remain neutral.

ix. Time requirement and commitment for online learning
The respondents were asked about the time requirement and commitment for online learning.

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>51</td>
<td>53.6</td>
</tr>
<tr>
<td>Agree</td>
<td>34</td>
<td>35.8</td>
</tr>
<tr>
<td>Neutral</td>
<td>6</td>
<td>6.3</td>
</tr>
<tr>
<td>Disagree</td>
<td>3</td>
<td>3.2</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 10 shows the distribution of students’ opinions on time and commitment as requirements to online learning. A larger percentage of the respondents, 89.4% are in support of the view that online learning requires time and commitment, while 4.3% of the respondents did not agree.

x. Which of the following online learning processes have you enjoyed before?
The respondents were asked whether they have enjoyed any online learning processes.

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer tutorial</td>
<td>15</td>
<td>15.8</td>
</tr>
<tr>
<td>Video conferencing</td>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td>None of above</td>
<td>78</td>
<td>82.1</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 11 shows that only 17.9% of the respondents enjoyed the use of computer tutorials or video conferencing before the COVID-19 era, while majority of the respondents, 82.1% indicated that they have never participated in any form of computer tutorial or video conferencing. This result indicates that the COVID-19 pandemic has brought significant changes in the field of education, particularly with regards to online learning activities.

xi. Online learning allows for better interaction between students and teachers
The respondents were asked about their relationship with the teachers during the online learning processes.

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>19</td>
<td>20.0</td>
</tr>
<tr>
<td>Agree</td>
<td>27</td>
<td>28.4</td>
</tr>
<tr>
<td>Neutral</td>
<td>3</td>
<td>3.2</td>
</tr>
<tr>
<td>Disagree</td>
<td>26</td>
<td>27.4</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>20</td>
<td>21.0</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>100</td>
</tr>
</tbody>
</table>

It was noted in Table 12 that the respondents have an equal view on whether online learning allows for better interaction between students and teachers. The result shows that 48.4% of the respondents are of the opinion that online learning allows for better interaction between teachers and students, while another 48.4% were against this opinion. The remaining 3.2% decided to remain neutral.

xii. Online learning is more interesting than the traditional classroom teaching
The respondents were asked their opinion about whether online learning is more interesting than the traditional classroom teaching and learning.

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>13</td>
<td>13.7</td>
</tr>
<tr>
<td>Agree</td>
<td>11</td>
<td>11.6</td>
</tr>
</tbody>
</table>
Table 13 shows the opinion of all respondents on whether online learning is more interesting than normal classroom teaching and learning. The results show that only 25.3% of the respondents accepted that online learning is more interesting than classroom teaching, while majority of the respondents, 70.5% objected to this view, and the remaining 4.2% decided to remain neutral.

This result corresponds with the result of [16] in their study on comparative study of online education and traditional offline education during COVID-19; the findings revealed that it is impossible for online teaching and learning to fully replace the traditional classroom teaching and learning, but it can play a bit part in complementing it, and generally help in improving the teaching effect significantly.

xiii. Ease of doing online learning
The respondents were asked about their opinion on using online applications to learn at their own pace.

Table 14: Ease of doing online learning

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>23</td>
<td>24.2</td>
</tr>
<tr>
<td>Agree</td>
<td>52</td>
<td>54.7</td>
</tr>
<tr>
<td>Neutral</td>
<td>4</td>
<td>4.2</td>
</tr>
<tr>
<td>Disagree</td>
<td>10</td>
<td>10.5</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>6</td>
<td>6.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>95</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

The results in Table 14 shows that the majority of the respondents, 78.9% agreed that online learning can enable learners to learn at their own pace, because the lectures can be recorded and this can enable the learners to watch the recorded lecture over and over. However, 16.9% of the respondents did not agree with this view, and only 4.2% of the remaining respondents decided to remain neutral.

xiv. Introduction of online learning to Nigerian tertiary institutions
The respondents were asked their opinion about whether online learning should be imposed on schools as a teaching method even without any pandemic or school closure.

Table 15: Introduction of online learning in schools

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td>Agree</td>
<td>9</td>
<td>9.5</td>
</tr>
<tr>
<td>Neutral</td>
<td>7</td>
<td>7.4</td>
</tr>
<tr>
<td>Disagree</td>
<td>59</td>
<td>62.1</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>18</td>
<td>18.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>95</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

As shown in Table 15, majority of the respondents, 81% objected to this view that the online learning should be imposed on schools, rather they believe that the schools should be allowed to make their decision on whether to adopt the online learning or not. Only 11.6% agreed with this opinion, and the remaining 7.4% decided to remain neutral.

xv. Suggest ways on how the usage of ICT can be improved in education
Finally, the respondents were given the chance to make some recommendations on how ICT can be improved in education. Some of the suggestions made by the respondents include:

a. ICT facilities should be made cheaper and available in schools.

b. Those staff with the knowledge of ICT should help enlighten those who are ignorant of it through seminars, workshops, etc.

c. The achievements of ICT in education as seen in other developed countries should not be downplayed by the government.

d. Institutions should adapt to the use of learning with ICT facilities and not considering them as immature tools.

e. Government should take into account the importance of academic autonomy and avoid micromanaging change.

f. Patronizing the use and application of ICT should be made more attractive.
V. CONCLUSION

In conclusion, this study was able to highlight the impact of online technology platforms that were used for sustaining teaching and learning during the COVID-19 pandemic lockdown, which causes schools and the country in general to close all activities. This study determined that Nigerian tertiary students have devices capable of accessing online teaching and learning. The beneficial features of online learning are the ability of schools to continue providing students with teaching and learning even in the event of any disaster that may cause the closure of schools. Videos containing lectures can be recorded and sent to students at their homes, which can enable them to learn at their own pace, and the simplicity of the learning materials.

However, the students that participated in the study did not believe that online learning can completely replace traditional classroom activities; rather it can at best serve as a complement in the event of any disaster that may cause the closure of schools. The students support the introduction of online learning platforms to the teaching methods adopted by their tertiary institutions, which enable them to continue learning during the COVID-19 pandemic lockdown.

VI. RECOMMENDATIONS

Based on the study conducted, the following recommendations were proposed, they include:

1) Since the application of ICT in education has brought significant changes in teaching and learning, the school management, education authorities, and the government should make more funds available to sustain ICT infrastructures.

2) Internet access service is one of the key requirement for conducting online teaching and learning, therefore, the bandwidth and power supply issues should be tackled with renewed vigor.

3) ICT literacy should be a compulsory aspect of teacher preparation programme. This means teachers should be given the opportunity to become ICT literate within a specific timeframe.

4) Online learning requires competency and skills in order to manipulate the relevant devices and make the best use of such technologies. Therefore, it is recommended that the staff involved in the online teaching should of necessity be trained and retrained.

5) Federal, State and Local Government authorities should ensure the provision of ICT facilities in every school as well as maintaining them.

6) Every teacher should view ICT literacy as an indispensable aspect of self/professional development and endeavor to achieve that without waiting for any directive to that effect.

7) Those staff with the knowledge of ICT should help enlighten those who are ignorant of it through seminars, workshops etc.

References


AUTHORS

First Author – Amina Lawal, M.Sc. Management Information Systems, Federal College of Education Katsina State Nigeria, meenalawal@yahoo.com

Second Author – Musa Ahmed Zayyad, PhD Management Information Systems, zayyad.musa@kiu.ac.ug; zayyad19@yahoo.com; +256708548985; +2348063440008

Correspondence Author – Dr. Musa Ahmed Zayyad, zayyad.musa@kiu.ac.ug, +256708548985
Influence Of Management Risk On Performance Of Manufacturing Firms In Kenya

James Mutinda Kithuka  
Jomo Kenyatta University of Agriculture and Technology (JKUAT)

Dr. Wario Guyo, PhD.  
JKUAT, KENYA

Dr. David Kiarie, PhD.  
JKUAT, KENYA

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ABSTRACT

The aim of this paper was to assess the influence of management risk on performance of manufacturing firms in Kenya. Management risk is one of the risks encountered during logistics outsourcing. It is aligned with the administrative differences between the outsourced company and the manufacturing firm, which could affect the effectiveness of the cooperation towards enhanced performance. The study also sought to address the moderating effect of information flow on the relationship between management risk and performance of manufacturing firms. The study was informed by core competency theory. Both descriptive and explanatory research designs were adopted. The unit of observation was the supply chain administrators of manufacturing firms in Kenya. Stratified sampling was conducted on all the one thousand one hundred and twenty three manufacturing firms registered by KAM, simple random sampling was carried out on the strata to identify a sample size of 295 firms. The study relied on primary data which was collected through semi-structured questionnaires that were administered to administrators charged with the management of supply chain within the selected firms. Data analysis was done using descriptive statistics namely percentages, mean and standard deviation through the help of SPSS. The findings revealed that management risk significantly influenced the performance of manufacturing firms in Kenya. The findings further revealed that information flow had a positive but insignificant moderating effect on the relationship between management risk and performance of manufacturing firms in Kenya. The study concluded management risk is essential in the performance of manufacturing firms in Kenya.

Keywords: Management risk, Logistics Outsourcing, Information Flow, Firm Performance, Manufacturing Firms

1.0 INTRODUCTION

1.1 Background of the Study

In the current 21st century, most business are enhancing the efficiency and effectiveness of their supply chain through outsourcing logistics. This process has seen most of the leading companies across the globe achieve their short-term and long-term goals through focusing on their core business. Outsourcing is being preferred in most firms because of the extensive structural changes that have caused dwindling budgets, shrinking in house workforce and organizational restructuring. The alternative to transfer all or part of a company’s business function to an external unit plays an ever more important role in the strategic configuration of organizations (Sanchez, 2015). Companies have been pressed to look neutrally and critically at business processes due to competition pressures. Firms have been outsourcing manufacturing operations, business services and even entire business lines for a period now (Akbari, 2015).
Many companies are applying outsourcing as a strategic option to advance their competitive situation and targeting business objectives through minimized costs, maximized revenues and profits. However, outsourcing logistics has its risks. One of these risks is the management risk. This is a type of risk that results from the difference between management methods and the culture of the company used by the provider and client (Aguezzoul, 2014).

In the cooperation between the industrial or circulation enterprise and logistics provider, the variance of their management methods and enterprise culture possibly cause the administrative risk of logistics services outsourcing. If the outsourcing enterprise cannot appropriately deal with their cultural encounters, fully gauge logistics provider, effectively manage logistics provider with the result that logistics outsourcing fails to be accomplished (Yang & Zhao, 2015).

In the operation procedure of logistics outsourcing, there exist all categories of complications. Case in point, if the service provider adjusts the outline of logistics service, which may influence all the staff and even be boycotted by them, the normal production and operation may also be influenced. In addition, the logistics outsourcing may affect the interests of some employees hence reducing their loyalty and morale (Joto & Odock, 2019). The 3PL may probably lack know how of the company's core business and may have margins as their focal point and optimization of the contractual terms. The company may face incompatible culture and ethos from the commissioning company and consequently experience sinking standards in terms of services and products. This could affect customer service due to reduced concentration on their requirements.

In logistics outsourcing structure, each party may be pushing a divergent objectives so there exist commercial variations between business and the partnerships are being replicated from different perspectives. Other conflicting factors are management approaches and levels of bureaucracy within the firms. For the partnership to succeed, consideration of these factors is crucial to ensure feasibility of the collaborative endeavor (Vagadia, 2012). Many entities who may be considering outsourcing logistics function are more concerned of inability to control running of their business. Good example of these uncertainties is the lack of control over the universal management of the sector or function that has been outsourced. This may manifest itself as a loss of direct control over the transport of the products and could potentially disturb the customer's experience (Ansari et al., 2010).

Organizational performance consists of three specific areas of firm outcomes: financial performance (profits, return on property, earnings on investment); performance of products in the market (sales, market share); and shareholder return (total shareholder return, economic value added) (Monday et al., 2015). Performance measurement refers to the process of measuring the action’s efficiency and effectiveness. Performance measurement is the transference of the complex reality of performance in organized symbols that can be related and relayed under the same circumstances.

Many Manufacturing firms in Kenya have relocated or restructured their operations opting to serve the local market through importing from low-cost manufacturing areas such as Egypt, South Africa and India therefore resulting in job losses (Nyabiage & Kapchanga, 2014). This is an indication that many manufacturing firms in Kenya are experiencing performance challenges with many reporting profit warnings due to challenges in the operating environment (RoK, 2018). Statistics from World Bank show that manufacturers operate in Kenya registered stagnation and declining profits for the last five years due to a turbulent operating environment (World Bank, 2019).

The manufacturing sector in Kenya has been growing at a rate lower than the economy, which dipped to 4.9% in 2017. This indicate a reducing contribution of manufacturing sector to GDP over time hence it can be argued that the country is going through premature deindustrialization in a context where manufacturing and industry are still moderately under-developed. Manufacturing is the industry
with the highest demands regarding logistics services and consequently it is judged as the most appropriate industry for comparisons within the logistics context (Gotzamani et al., 2010).

The Kenyan manufacturing industry continues to grow from strength to strength in spite of challenges in economic status of the country. The manufacturing industry in Kenya brings about 14 percent to the country’s Production (GDP) and offer over 2 million jobs (KAM, 2016). According to Awino (2011) the sector is essential and contributes significantly to the country’s economic advancement. In the vision 2030, the industry is among the top economic pillars and positioned to move the nation to a middle level income country by the year 2030.

According to data from KAM (2019), there was over 1123 registered multi-sector manufacturing firms in Kenya. These companies produce different products and vary in size which is determined by the number of staff they employ. Through export of their products, the industry has the capacity to generate foreign exchange earnings which will enhance the country’s economy and create job opportunities. The country's share of manufacturing exports to the international market is projected to be about 0.02 percent which is favorable compared with its immediate East Africa neighbors (Kenya Institute for Public Policy Research and Analysis, 2013). Manufacturing sector grew by 4.8 percent in 2013 in comparison to a revised growth of 3.2 per cent in 2012 and was projected to uphold that growth path through 2014 (KNBS, 2014). PwCIL (2010) and Okoth (2012) show Kenya’s expanded manufacturing subsector has a challenging past in terms of its performance, unstructured strategy and use of obsolete technology.

1.2 Statement of the Problem

While some companies in the country’s manufacturing sector have opted for outsourcing their logistics services, their performance has continued to deteriorate and thus several manufacturing companies are in a dilemma on whether to perform in-house logistics services or to outsource the services from logistics providers (Joto et al., 2019). In the year 2000 manufacturing sector was the second largest sub sector of the economy after agriculture but in 2018, it was in the fourth place behind agricultural segment, distribution and small scale trade, transport and communication (World Bank, 2019). Unfortunately for Kenya, the share of the manufacturing sector to gross domestic product (GDP) has been on a declining trend from 11.8% in 2011 to 8.4% in 2017 and contracting by 3.9 % in 2020 (KNBS Quarterly Gross Domestic Product Report, 2020). There had been a decrease in expansion of manufacturing sector from 3.6% in 2015 to 3.5% in 2016 (KNBS, 2016). The performance of the sector in Kenya has not been stable, it decreased by 0.4% in 2015 from 3.2% in 2014, contributing a reduction of more than $62 billion; 10.3% on GDP.

The sector had a lower growth of 3.6% in the first quarter of 2016 compared to 4.1% growth in the first quarter of 2015. In the third quarter of 2017 the sector’s growth rate was 1.9% compared with 3.3% in the same quarter in 2015 (KNBS, 2017). According to KAM, manufacturing priority agenda (2019), the weak performance has been attributed to high production and logistics costs, influx of counterfeits, drought incidences and volatility in international oil prices.

Previous empirical evidence has shown a significant relationship between outsourcing risks and firm performance, and one of the major risks identified is management risk. Tsai (2012) and Gąsowska (2017) found that minimizing the management risk in logistics outsourcing influenced the effectiveness of logistics thus enhancing firm performance. The studies have however focused on different contexts and with varied methodologies were used. This study therefore sought to fill the existing gaps by assessing the influence of management risk on the performance of manufacturing companies in Kenya.
1.3 Study Objectives

The specific objectives of this study are:

1. To assess the influence of management risk on performance of manufacturing firms in Kenya
2. To examine the moderating effect of information flow on the influence of management risk and performance of manufacturing firms in Kenya

1.4 Research Hypotheses

The researcher tested the following research hypotheses:

\[ H_{A1}: \text{There is a significant influence of management risk on performance of manufacturing firms in Kenya} \]

\[ H_{A2}: \text{There is a significant moderating effect of information flow on influence of management risk and performance of manufacturing firms in Kenya} \]

2.0 LITERATURE REVIEW

2.1 Theoretical Framework

This study was anchored on core competency theory. The theory was pointed out by Simchi-Levi et al. (2004). The theory is based on make or buy decision which propose that firm's activities should either be performed in house or by outsourced external service providers. Outsourcing of non-core activities should be offered to best appropriate service providers who are experts in that field. Core Competencies are bundles of skills and competencies that firms built over period of time. They are not ordinary skills that can be acquired by any business organization anywhere in the market, easily (Edgar & Lockwood, 2012). The opinion of traditional approaches to strategy which state that outsourcing aspects of the core business is risky is supported by many practitioners and academics. Companies may lose their competencies and become hollow (Prahalad & Hamel, 1990). Vendors’ knowledge on the outsourced activity is an important factor that influences success of the arrangement (Lavina & Ross, 2003). Core competency theory was consequently constructive in measuring the impact of management risks on performance of manufacturing firms in Kenya.
2.2 Conceptual Framework

![Conceptual Framework Diagram]

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Moderating Variable</th>
<th>Dependent Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Management Risk</strong></td>
<td></td>
<td><strong>Performance of manufacturing firms</strong></td>
</tr>
<tr>
<td>• Cultural conflict</td>
<td></td>
<td>• Profits</td>
</tr>
<tr>
<td>• Loss of control</td>
<td></td>
<td>• Market share</td>
</tr>
<tr>
<td>• Overreliance on single supplier</td>
<td></td>
<td>• Customer satisfaction</td>
</tr>
<tr>
<td><strong>Information flow</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Poor communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Latent information asymmetry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Incompatibility</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1: Conceptual Framework

2.3 Empirical Review

Kamanga and Ismail (2016) studied effects of outsourcing on organization performance in manufacturing sector in Kenya: a case of Del Monte Kenya limited. Results showed that Cost, quality, technology adaption and organization performance had a significant strong positive relationship. There was an insignificant positive weak relationship between risks and organization performance. Based on the study findings, the researchers recommended that: Organizations should not outsource an activity fully until they have confirmed beyond doubt that the service provider is capable of handling the activity, Organization should engage the service provider on the quality standards which are expected before entering into the contract, Organizations should select the service provider on the basis of consistent technical and managerial capabilities, Service providers should only handle particular risks which even if they occurred would not affect the entire organization performance.

Bosire (2011) investigated on the consequences of logistics outsourcing on delivery time and customer service among supermarkets in Nairobi. Results came out that outsourcing these services in supermarkets has a direct effect on the lead times of product delivery and that amongst those chains that have outsourced procurement of products from the suppliers; lead time to deliver the same products to their warehouses has immensely condensed. Onyebueke et al., (2019) investigated various challenges of logistics outsourcing that can lead to failure or ineffectiveness when not properly managed, which included: Poor maintenance culture and poor service condition of the Staff of logistics providers, Late payment of invoices by logistics consumers, poor communication management, hidden charges and pricing issues, poor or inadequate documentation, Use of unskilled personnel, change in management or difference in Policy/Modus Operandi (mode of operation), company’s secret been at risk and delay. The research was informed by the existence of positive relationship between these challenges and performance of Oil and Gas companies hence the need to investigate how to overcome these challenges in this sector.

Wanjiru and Nyamwange, (2017) explored on challenges of import logistics outsourcing by manufacturing firms in Nairobi county. The outcome showed that of the essence, outsourcing motives were satisfying in expounding the decision by manufacturing entities to
The factors of outsourcing are essential in deciding to outsource import logistics. The range of challenges the importers come across when importing services also determined the verdict to outsource in the firms. Mulama et al., (2012) on their study on effect of Logistics Outsourcing Practices on the Performance of Large Manufacturing Firms in Nairobi found that the companies were involved in transportation services, warehouse management and material handling controlling.

3.0 RESEARCH METHODOLOGY

3.1 Research Design
The study utilized jointly descriptive and explanatory research designs which allow for both observational data and formulation of a problem for more accurate investigations (Bordens & Abbott, 2014). Both provide the collection of relevant evidence with minimal expenditure of effort, time and funds; the resolve of the research transpires to be an accurate descriptive of condition and investigation of the affiliation between variables.

3.2 Target Population
The study population was all the manufacturing firms in Kenya and the target population was all the manufacturing companies listed by Kenya Association of Manufacturers (KAM). According to (KAM, 2019) there are 1,123 manufacturing firms registered in KAM directory 2019.

3.3 Sampling
To achieve optimum sample, this study followed the formula proposed by Saunder et al., (2016) since it is simple to use, scientific and can be used in cases of large populations. Thus, to calculate the sample size from 1,123 companies in Kenya, the study specified a 5% margin of error as shown in equation below:

\[ n = \frac{p \times q \times Z^2}{e^2} \]

Where;

- **n** – Minimum sample size required
- **p** - No. of target population that conforms to the characteristic of the sample required
- **q** - No. of target population that don’t conform to the characteristic of the sample required
- **e** – Margin of error (0.05)

**Z** = the value corresponding to the confidence level required (1.96 for 95% level of confidence)

Using the above formula, a study sample of 295 companies was derived.

3.4 Data Collection
The study used questionnaires with closed and open questions to collect data from 295 manufacturing businesses.

3.5 Data Analysis and Presentation
Both quantitative and qualitative techniques were adopted in the analysis of the collected data. The data was scrutinized and cleaned for any errors and coded in SPSS version 24. Using the coded data, the researcher generated tables, graphs and pie-charts which were
used in presenting the results of the study. Qualitative data was checked through and compared based on the relevancy and presented in form of explanations. Regression analysis was carried out to test for the relationship between the independent variables and the dependent variable. The following regression model was adopted:

\[ Y = \beta_0 + \beta_1 X_1 + \epsilon \]

### 4.0 RESEARCH FINDINGS

#### 4.1 Response Rate of the Study

The study was carried out using 295 respondents who were surveyed using a structured questionnaire. Out of the 295 surveyed respondents, 233 returned dully filled questionnaires for analysis. This represented a response rate of 78.9%. This was considered adequate for the study.

#### 4.2 Management Risks

The fourth objective of the study was to establish the effect of management risks on the performance of manufacturing firms in Kenya. The main aspects used to assess management risk included cultural conflicts, loss of control and overreliance of a single supplier. A Likert’s scale was used whereby the respondents were asked to indicate their levels of agreement or disagreement with specific statements on contractual risks. The findings are as shown in Table 1. The findings concur with those by Mukaddes et al. (2010) who established that one of the main bottlenecks that affect the effectiveness of outsourcing is the risks of managing the internal values of both the outsourced party and the outsourcing party. This in turn affects the ability of the organizations to gain full benefits of outsourcing thus not getting value for the investment in outsourcing. The results are in line with those by Sodhi et al. (2015) who established that through continued focus on management risks in the supply chain, there is high likelihood of solving any managerial differences between the outsourced suppliers and the organization thus promoting a smooth flow of activities for better performance.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>There have been cases of conflicts between employees and outsourced parties</td>
<td>3.73</td>
<td>0.96</td>
</tr>
<tr>
<td>There are conflicting cultures between our organization and some of the contracted suppliers</td>
<td>3.24</td>
<td>1.13</td>
</tr>
<tr>
<td>The hierarchy of decision-making between our company and the contracted suppliers has affected the flow of business</td>
<td>3.28</td>
<td>1.15</td>
</tr>
<tr>
<td>Alignment of strategies, goals, objectives and aims has been poor between our company and the outsourced parties</td>
<td>3.88</td>
<td>0.91</td>
</tr>
<tr>
<td>There have been instances of employees being reluctant in accepting changes in the logistics processes</td>
<td>3.15</td>
<td>1.10</td>
</tr>
<tr>
<td>There have been instances of poor power and responsibilities sharing between our company and the outsourced parties</td>
<td>2.82</td>
<td>1.14</td>
</tr>
<tr>
<td>Our company has experienced lack of organizational boundaries with the outsourced parties</td>
<td>2.71</td>
<td>1.16</td>
</tr>
<tr>
<td>There are policies and procedures that are not clear to the outsourced parties</td>
<td>2.94</td>
<td>1.16</td>
</tr>
<tr>
<td>There have been incidences of lack of evaluation and monitoring of outsourced parties</td>
<td>3.08</td>
<td>1.11</td>
</tr>
<tr>
<td>We have had instances where a supplier did not deliver and we ran out of options</td>
<td>3.97</td>
<td>0.89</td>
</tr>
<tr>
<td>There have been failures in delivery schedules due to suppliers being unable to deliver failures</td>
<td>2.87</td>
<td>1.22</td>
</tr>
<tr>
<td>The outsourced partners have previously withdrawn of services hence paralysing the operations of the company</td>
<td>2.68</td>
<td>1.37</td>
</tr>
</tbody>
</table>
4.3 Information Flow

The study sought to assess the moderating effect of information flow on the relationship between management risk and performance of manufacturing firms in Kenya. Information flow determines the ability of an organization to effectively communicate both internally and externally, thus affecting the effectiveness of the process and relationships within and outside the organization. In this study, information flow was assessed through three key aspects which were; poor communication, latent information symmetry and incompatibility of the information. The findings are as shown in Table 2. The findings compare with those by Yousefi, and Alibabaei (2015) who found out that through effective communication and information sharing, the operations flow more efficiently thus leading to better organizational performance. The findings compare with those by Mukaddes et al. (2010) who established that as a result of poor information flow between the outsourced firms and the outsourcing entities, it became difficult to coordinate activities effectively for mutual benefit. Liu et al. (2015) also indicated that the information sharing within and out of the organization was essential in steering the effectiveness of operations thus enhancing customer satisfaction and continued performance.

Table 2: Descriptive Results on Information Flow

<table>
<thead>
<tr>
<th>Statements</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Our company has not adopted the latest information technology to aid communication in and out of the company</td>
<td>3.23</td>
<td>1.07</td>
</tr>
<tr>
<td>The hierarchy of communication in our organization is only based on top-bottom approach</td>
<td>3.79</td>
<td>1.01</td>
</tr>
<tr>
<td>Giving feedback to the customers has not been effectively upheld in our company</td>
<td>2.56</td>
<td>1.32</td>
</tr>
<tr>
<td>The employees do not give and receive feedback to the management timely and efficiently</td>
<td>2.58</td>
<td>1.33</td>
</tr>
<tr>
<td>There are no effective approaches and strategies to ensure the internal information of the organization is not leaked</td>
<td>2.11</td>
<td>1.56</td>
</tr>
<tr>
<td>There are is unequal sharing of information among the employees in our organization</td>
<td>3.36</td>
<td>1.34</td>
</tr>
<tr>
<td>Staff members are held responsible in cases of leakage or misuse of internal organizational information</td>
<td>3.45</td>
<td>1.32</td>
</tr>
<tr>
<td>For any information shared the recipients are informed on the level of confidentiality on such information</td>
<td>3.42</td>
<td>1.36</td>
</tr>
<tr>
<td>There is no clarity in the information shared in our organization</td>
<td>3.54</td>
<td>1.21</td>
</tr>
<tr>
<td>The management has not been committed towards ensuring consistency in information sharing in and out of the firm</td>
<td>3.34</td>
<td>1.33</td>
</tr>
<tr>
<td>The communication procedures in our company are not flexible</td>
<td>3.41</td>
<td>1.41</td>
</tr>
<tr>
<td>There have been cases of inaccurate information being shared in our organization</td>
<td>3.81</td>
<td>0.98</td>
</tr>
</tbody>
</table>

4.4 Performance of Manufacturing Firms

The study sought to unveil the performance of manufacturing firms in Kenya. The findings are as shown in Table 3. As the findings portray, the respondents disagreed that their respective companies had recorded an increase in the quality of services as shown by a mean of 2.31 and a standard deviation of 1.48. The respondents also disagreed that there had been a decrease in number of customer complaints in their respective organizations over the recent past as shown by a mean of 2.33 and standard deviation 1.52. The respondents disagreed that the sales revenues had increased in their respective organizations and that the profit margin of the firms had been growing annually over the years as shown by a mean do 2.71 and a standard deviation of 1.73. The findings imply that the performance of the manufacturing firms has not been as impressive which is an indication of a distressed industry.

Table 3: Descriptive Results on Performance

<table>
<thead>
<tr>
<th>Statements</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The company has recorded an increase in quality of services in the recent past</td>
<td>2.31</td>
<td>1.48</td>
</tr>
<tr>
<td>There has been a decrease in number of customer complaints in our organization over the recent past</td>
<td>2.33</td>
<td>1.52</td>
</tr>
</tbody>
</table>
Our company has seen a surge in the customers loyalty over the recent past  

The market share for the company has been on the increase in the past two years  

The sales revenues have been on increase in the recent past  

The profit margin of the firm has been growing annually over the past five years  

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Profits Margin</th>
<th>Average Sales Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>518</td>
<td>2,716</td>
</tr>
<tr>
<td>2019</td>
<td>922</td>
<td>4,085</td>
</tr>
<tr>
<td>2018</td>
<td>895</td>
<td>3,698</td>
</tr>
<tr>
<td>2017</td>
<td>644</td>
<td>2,931</td>
</tr>
<tr>
<td>2016</td>
<td>781</td>
<td>3,490</td>
</tr>
</tbody>
</table>

The findings as shown in Figure 2 revealed that the performance trend of the manufacturing industry has been unstable with declines in revenues recorded the year 2016 and 2017 (from Kshs3,490million to Kshs2,932million) and from Kshs.4,085million in the year 2019 to Kshs.2,716million in the year 2020. The same trend was observed in the average profit margins where decline in the average profits was seen 2016 and 2017 and between 2019 and 2020. While this trend could be attributed to other aspects outside the logistics outsourcing risks, there could also be a high likelihood of lack of effective logistic processes to have affected the performance (Li-jun, 2012; Shanker, Sharma, & Barve, 2021; Elock, Müller, & Djuatio, 2019).

![Figure 2: Performance of Manufacturing Firms](image)

### 4.5 Inferential Analysis

#### 4.5.1 Correlation Analysis

Pearson's correlation was carried out to establish the relationship between the management risk and performance of manufacturing firms in Kenya. The correlation between management risks and performance of manufacturing firms had a Pearson correlation coefficient of -0.665 at significance level of 0.000<0.05. This implies that the correlation between management risk and performance of manufacturing firms is strong and negatively significant.

### Table 4: Correlation Results for Management Risks
Performance of Manufacturing Firms & Management Risk

<table>
<thead>
<tr>
<th></th>
<th>Performance of Manufacturing Firms</th>
<th>Management Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>233</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pearson Correlation</td>
<td>-.665**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>233</td>
<td>233</td>
</tr>
</tbody>
</table>

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

4.5.2 Hypothesis Testing

H1a: There is a significant influence of management risk on performance of manufacturing firms in Kenya

The study sought to test the alternative hypothesis which was that there is a significant relationship between management risk and performance of manufacturing firms in Kenya. The model summary results are as shown in Table 5. As the results portray, the R² for the model was 0.443. This implies that management risks influences up to 44.3% of the variation in performance of manufacturing firms in Kenya.

Table 5: Model Summary for Management Risk

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.665a</td>
<td>.443</td>
<td>.440</td>
<td>.59209</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Management Risk

The ANOVA results for the model are as shown in Table 6. As the results portray, the F-statistic for the model was 183.620 at a significance level of 0.000<0.05. This implies that the model is statistically significant and can predict the relationship between management risk and performance of manufacturing firms in Kenya.

Table 6: ANOVA Results for Management Risk

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>64.373</td>
<td>1</td>
<td>64.373</td>
<td>183.620</td>
<td>.000b</td>
</tr>
<tr>
<td>Residual</td>
<td>80.983</td>
<td>231</td>
<td>.351</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>145.355</td>
<td>232</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: Performance of Manufacturing Firms

b. Predictors: (Constant), Management Risk

The regression coefficients for the model are as shown in Table 7. As the results portray, the Beta coefficient for management risk is -0.621 which implies that a unit change in management risk influences the decline in the performance of the manufacturing firms in Kenya by 0.621 units. The P-value for the variable was 0.000<0.05, an indication that the relationship between management risk and performance of manufacturing firms in Kenya is significant. The fourth alternative hypothesis that there is a positive significant
influence of management risk on performance of manufacturing firms in Kenya is therefore not accepted, and a conclusion drawn that with increase in management risk, there will be a significant decline in the performance of manufacturing firms in Kenya.

### Table 8: Regression Coefficients for Management Risk

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
<td>5.008</td>
<td>.138</td>
<td>36.416</td>
<td>.000</td>
</tr>
<tr>
<td>Management Risk</td>
<td>-.621</td>
<td>.046</td>
<td>-.665</td>
<td>-13.551</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Performance of Manufacturing Firms

### Hₐ₂: There is a significant moderating effect of information flow on influence of management risks and performance of manufacturing firms in Kenya

The study set to test the hypothesis which was that there is information flow has a significant moderating effect on the relationship between management risks and performance of manufacturing firms in Kenya. The regression coefficients are as shown in Table 9. As the results portray, the interaction effect between management risk and information flow had a Beta coefficient of 0.042 at a significant level of 0.032<0.05. This is an indication that while information flow has a positive and significant moderating effect on the relationship between management risk and performance of the manufacturing firms. It implies that as a result of information flow, the negative impact of management risk on performance of the manufacturing firms in Kenya is reduced, and the firms record a marginal increase in performance.

### Table 9: Regression Coefficients for the Moderating Effect of Information Flow

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>1.888</td>
<td>.249</td>
<td>7.570</td>
<td>.000</td>
</tr>
<tr>
<td>Management Risk*Information Flow</td>
<td>.042</td>
<td>.019</td>
<td>.142</td>
<td>2.163</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Performance of Manufacturing Firms

### CONCLUSIONS AND RECOMMENDATIONS

The study sought to establish the influence of management risk on the performance of manufacturing firms in Kenya. The findings from the study revealed that there were conflicts between the employees of the manufacturing firms and the outsourced companies in most of the surveyed firms as well as conflicting cultures between the two parties. The decision making between the two parties was also a major issue that affected the flow of operations as well as poor alignment of strategic goals and objectives between the
outsourced companies and the manufacturing firms. These risks as described by Ansari et al. (2010) compromise the ability of an organization to fully focus on the main goals and objectives, thus losing the competitiveness to the closer competitors.

The study concluded that management risk was among the integral risks associated with logistics outsourcing that significantly influenced the performance of the manufacturing companies. Through the cultural conflicts whereby the outsourced companies had internal cultures that conflicted with those of the manufacturing companies, the ability to mutually work together was affected, thus undermining the goals and objectives of the manufacturing firms. It was further concluded that the loss of control was major management risk that faced the manufacturing as a result of failure to guide their boundaries against the interference of the outsourced logistics service providers. Further, through overreliance of a single supplier, the companies in given failed to deliver the expectations of the customers, thus affecting the performance of the manufacturing entities negatively.

The management risks are prone to a logistics outsourcing company. The culture of the outsourced company in most cases is different from the outsourcing entity and so is to the interest and prospects of the employees. Therefore, the management risks should be assessed and managed effectively by the manufacturing companies for a better flow of operations with the outsourced company. There should be a framework for ensuring the cultures of the manufacturing companies and the outsourced logistics service providers integrate. The conflicts between the employees from the two companies are also a subject of concern in the entire process of logistics outsourcing. It is essential for the conflicts to be managed and solved with full commitment of the management of the two organizations for a continued cooperation.

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Procurement Methods in Public Procurement and their effect on Sustainable Performance of State Corporations in Kenya

Catherine Njoki Gatari¹, Dr Ismail Noor Shale², Dr Anthony Osoro³
Jomo Kenyatta University of Agriculture and Technology (JKUAT)

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ABSTRACT

The purpose of this study was to assess the effect of procurement methods on sustainable performance of state corporations in Kenya. The study was anchored on tendering theory and employed descriptive research design. This study focused on positivist Philosophy. The target population of this study included all 187 registered state corporations in Kenya. The study was a census survey of all the 187 state corporations. The sampling frame comprised of heads of finance and heads of procurement function in all 187 state Corporations in Kenya. The heads of finance and the heads of procurement function were purposively selected forming 374 respondents. The research questionnaire was used to collect primary data which was the main data for the study. Descriptive statistics and inferential statistics was used supported by SPSS version 26 to facilitate data analysis and presentation. Descriptive statistics was used to summarize and present features of a data set collected which was presented in form of means, modes and standard deviations. Inferential statistics was done using Pearson Correlation Coefficient and regression model. Then inferential statistics through a regression model was used to test the research hypotheses. The study established that procurement methods had a significantly influence on the performance of state corporations in Kenya. The study concluded that the procurement methods had a significant influence on the sustainable performance of state corporations in Kenya and recommended that the management of the state corporations ought to embrace the appropriate procurement methods as a way of enhancing sustainable performance of the corporations.

Key words: Public procurement regulation, procurement methods, public procurement regulatory bodies, Sustainable performance, state corporations

1.0 Background of the Study

According to Munyao and Moronge (2019), procurement is a critical component in the functioning of any state as it is used for acquiring of assets and services in such a way to meet a specific need. Public Procurement has certainly become gradually more significant factor in economic and business circles worldwide as it has a key responsibility in triumphant management of public resources and most countries have made an attempt to incorporate it into a more strategic view of government hard work (Grandia & Meehan, 2019). Public procurement of supplies, works and services, is valued to account for 20-25% of GDP in developing countries, and up to 60% or more of aggregate state expenditure and it is therefore an area that needs attention in the face of increasing noncompliance (Hussein & Makori, 2018). Procurement managers and stakeholders in the Public Service serve institutions created and governed by a complex array of statutes, regulations, policies, and directives. They operate in an environment of increasingly intense scrutiny and accelerated changes driven by environmental regulations, technology, program reviews, and public and political expectations for service improvements (Mbatt & Osoro, 2020).

Rono and Moronge (2019), observe that millions of dollars get wasted due to inefficient and ineffective procurement structures, policies and procedures as well as failure to impose sanctions for violation of procurement rules thus resulting in poor service delivery. The level of compliance to procurement regulations can therefore determine whether a government meets its goals and objectives or not as well as affect many internal and external stakeholders. According to Agaba, and Shipman (2018), the last decade of the twentieth century has witnessed the start of the global evolution in the public procurement. Marendi and Awino (2016), assert that challenges in public procurement go beyond procurement regulations to include procurement process, methods, organizational structure and work force. Public Procurement often constitutes the largest domestic market in developing countries. Depending on

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www.ijsrp.org
how it is managed, public procurement can thus contribute to the economic development of these countries (Muange & Chirchir, 2018).

Indeed, public procurement is the principal means through which governments meet developmental needs such as the provision of physical infrastructure and the supply of essential medicines (Corsten, 2020). Again, many governments use Public Procurement to support the development of domestic industries, overcome regional economic imbalances, and support minority or disadvantaged communities (Ivar, Paula & Erik, 2020). After decades of chaotic Public Procurement systems, a greater part of developing countries, Kenya included, are now reforming the authorized, organizational and institutional frameworks for public procurement (Chalton, 2018). According to Ondigi and Muturi (2019), law involves obligatory system of conduct predestined to enforce justice and lay down duty and resulting mostly from formal enactment by a ruler. The PP law evidently covers the complete scope of PP, all steps of the acquiring process, procurement methods and ethical behavior (Hunja, 2020).

Kumar, Patel and Singh (2020), stated that an excellent PP law is based on the values of openness, fairness, accountability, transparency, professionalism and integrity. To ensure increased achievement of sustainable performance procurement procedures are aimed to enhance competition between bidders for contracts. Chekol and Tehulu (2020), indicated proof from a number of sources that noncompetitive procurement processes can surge costs by 30% and above, and affirms that competitive procurement processes are the best to achieve value for money. According to Okong’o and Muturi (2017), study indicated that there were only 50% of states corporations that submitted mandatory reports on compliance with public procurement regulation guidelines in relation to use of appropriate procurement methods and procedures when acquiring goods and services in 2015/2016 financial. The Compliance Rating scale that was applied indicated that below 50% to be non-compliant, 51-80% average compliant, 81-99% above average compliant and 100% fully compliant. And only 45% of states corporations that submitted mandatory reports had complied with public procurement regulation guidelines (Mutangili, 2019).

1.2 Statement of the Problem

In recent years there has been growing global pressure on all public entities to improve sustainable performance (Mugo & Odari, 2018). Bilala and Odari (2021), indicated that there has been little reporting on sustainable performance by public procuring entities compared to those in private entities. This raises concerns as to the degree to which public entities are following appropriate procurement methods to achieve sustainable performance. According to King’oo and Mulí (2019), the state corporations in Kenya have been reporting poor performance in relation to social, environmental and economic measures of performance with losses of about Ksh. 121 billion which is equal to 17% of the state budget annually. Jepchirchir and Noor (2019), in their study noted that most public procuring entities are not environmental conscious when implementing procurement methods guidelines which as a result has led to increased resources usage, inefficient utilization of resources and increased waste production in their operations activities.

According to Mutangili (2019), in 2019 32% of states corporations in Kenya experienced material shortages and 46% of these entities were still not fully adhering to guidelines in relation to procurement methods and procedures stipulated in the public procurement and assets disposal regulation resulting to high costs of procurements, lack of competitiveness, transparency and accountability in procurement process (Ondigi & Muturi, 2019). In spite of underpinning and backing from national governments and procurement institutions to formulate procurement guidelines and policies, several studies indicate diverse success in the attainment of sustainable performance in states corporations in Kenya (Kariuki & Aduda 2019). While previous studies elsewhere have linked public procurement with sustainable performance, there remains limited evidence on a local perspective. This study therefore, sought to assess the effect of procurement methods on sustainable the performance of state corporations in Kenya.

1.3 Objective of the Study

To assess the effect of procurement methods on sustainable performance of state corporations in Kenya

1.4 Research Hypothesis

H₀: There is no significant effect of procurement methods on sustainable performance of state corporations in Kenya.

2.0 Literature Review

The supporting theory in this study include Tendering Theory. According to Runeson and Skitmore (1999), this theory explains that when selecting a method of obtaining goods, services, works and consultancy services there is needs for a proper development of a specification (Buuri, 2020). The focus in this theory is that desired bidders are awarded the contract based on procuring entity achievement of competitiveness, transparency and value for money (Simeon, 2018). Chelimo and Makori (2018), stated that when using a certain method of procurement in the tendering process, the goal should be to maximize revenue that is expected from a single tender where each tenderer submits one closed tender simultaneously. Tendering theory argues that that there should be minimization of transaction costs which is the price that market participants are required to pay (Njoki & Kimiti, 2019). This is to help meet an agreement, come up with policies to establish the agreement, and ensure proper delivery system as part of this agreement in the procurement process (Kalatya, 2019).
Tendering theory clarifies reasons why different organizations are required to select the most appropriate method of procurement in order to improve effectiveness and efficiency which lead to the organization performance (Njoki & Kimiti, 2019). Procurement process costs in states organizations are related to organization and administration of public, competitions, payment of independent experts, legal expertise of contracts, public tender reestablishing, costs coming up due the delay in the execution of public contracts, and complaint (Duraku, 2020). Consequently, procurement staffs are required to control these costs well when choosing the best method of procurement and awarding tender to the most competent supplier so as to ensure improving the overall organizational performance (Muli, Bwisa & Kihoro, 2016). The theory indicates that choosing the most appropriate method of procurement can help an organization achieve value for money, reduce procurement cost, acquire quality goods and services and also ensure fairness in the procurement process. This theory prompts the research hypothesis:

$H_0$: There is no significant effect of procurement methods on sustainable performance of state corporations in Kenya.

2.1 Conceptual Framework

Conceptual framework is a brief description of the occurrence in a study that is graphical representation of the significant variables of the research (Sekaran, 2020). Independent variables influence the dependent variables, while a dependent variable is a standard that can be forecasted. Independent variable in this research was Procurement methods. Sustainable performance of state corporations was the dependent variable. A range of aspects in every variable was examined on a likert scale. The level to which procurement methods affect sustainable performance of state corporations was documented.

![Conceptual Framework](image)

**Independent Variables**
- Open Tender
- Restricted Tendering
- Direct Procurement

**Dependent Variable**
- Environmental Measures
- Economic Measures
- Social Measures

2.2 Review of Empirical Literature

According to Gatobu (2020), procurement methods are the procedures that public procuring entities use to procure acquire products, consultancies and works. These methods can be competitive or non-competitive. There is preference of using competitive procurement methods in supplier selection and evaluation because that they tend to promote transparency, economy and efficiency (Wachiuri, Waiganjo, Noor & Odhiambo, 2018). Procurement encompasses the whole process of acquiring goods, works or services. It begins when an agency has identified a need and decides on its procurement requirement (Mogikoyo, Magutu & Dolo, 2019). There are different procurement methods that can be used in public procurement each with different condition for use.

Open tendering as per PPAD; Regulation 2020 involves invitation of prospective suppliers to compete for an advertised contract where the lowest tenderer in terms of price was accepted. However, the lowest bidder should be deemed competent to carry out the contract (Chelimo & Makori, 2018). Restricted tendering is mostly used when the value and the conditions are not justifiable to the open tendering where by bids are obtained directly without floating the tender to the public (Buuiri, 2020). Here the procuring entity uses its database of pre-qualified providers who are directly invited to tender. Direct procurement is used where circumstances do not allow for competitive bidding. It is used for small quantities in case where time may not allow for competitive bidding (Gatobu, 2020). Njoki and Kimiti (2019), states that Direct Procurement method is only applicable on ground of urgency or emergency when life and property are threatened and other methods are not practical.

3.0 Research Methodology

The research design applied in this research was descriptive research design. Descriptive study design helped realize the objectives of the study given that it explains the distinctiveness of a particular individual, or of a group and at the same time makes adequate provision for protection against bias and maximizes reliability (Kothari, 2019). The study used a census which comprised of each head of finance and the head of procurement function in all 187 states corporations in Kenya which formed 374 respondents. The study used a census to obtain the units of analysis and Purposive Sampling to identify the units of observation. This study used a questionnaire as the main research tool to collect primary data. The questionnaire used in this study involved both structured and semi structured questions to help the respondents express their own opinion on the area of study. Secondary data was obtained from, published journals of the organization, library and studies done by other researchers.

Quantitative data collected in this research was analyzed using descriptive and inferential statistics. Descriptive statistics using the mean, median and standard deviation and, inferential statistics that involved correlation and regression analysis were applied to
analyze quantitative data. This was made possible through the use of Statistical Package for Social Sciences (SPSS) version 26 since it has capability to analyze data with ease and accuracy (Kothari, 2019). The analyzed data was then presented using tables, percentages, pie charts, histograms and graphs. The results of the study were tested at significance level of 5% (Ngechu, 2019). Pearson product moment Coefficient correlation was used to show the strength of the connection between the variables used in the research. Correlation analysis was used to check the association between independent variables and dependent variable. A correlation matrix was established to give summary of the correlation analysis results (Orodho, 2018).

The hypothesis was tested in order to ascertain the effect of procurement methods on the sustainable performance of state corporations. The correlation coefficients (R) and the coefficient of determination (R²) were used. ANOVA test showing the F-calculated against the F-Critical of 1.96 and the p-value against the standard p-value of 0.05 was also used. Moreover, the regression coefficients for the variables as well as the p-values and the scatter plot diagram were utilized to reveal the relationship between the variables. The criteria to reject or fail to reject the null hypotheses was that, if the P-value is greater than 0.05, the study fails to reject the null but if P-value is less than 0.05, the null hypothesis is rejected (Kothari, 2019).

4.0 Research Findings and Discussions

The study used census which comprised of each head of finance and the head of procurement function in all 187 states corporations in Kenya which formed 374 respondents. 10% of the target population was used to carry out the pilot test which resulted to 37 respondents picked from 19 state corporations. The 19 corporations used for pilot study were excluded from the main study. The main study focused on 337 respondents after deducting 37 respondents who had participated in the pilot study. The study respondents were surveyed using a structured and semi-structured questionnaire. A response rate of 90.2% (304 respondents) was achieved and the data used for analysis. The non-response rate was 9.8%. This therefore makes the study appropriate to make conclusions and recommendations since according to Cohen et al., (2018) a response rate of 30-60% in a study is adequate for making conclusions and recommendations. The response rate is as shown in table 1.

Table 1: Response Rate

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sampled Population</td>
<td>337</td>
<td>100%</td>
</tr>
<tr>
<td>Responses</td>
<td>304</td>
<td>90.2%</td>
</tr>
<tr>
<td>Non-Responses</td>
<td>33</td>
<td>9.8%</td>
</tr>
</tbody>
</table>

4.1 Descriptive Statistics on Procurement Methods

The descriptive results in Table 2 was to assess the relationship between procurement methods and sustainable performance of state corporations in Kenya. The findings the respondents were asked to indicate their level of agreement on specific statements drawn from the three key sub-constructs of procurement methods. A five-points Likert’s scale was used where 1 was strongly disagree, 2 was disagree, 3 was neutral, 4 was agree and 5 was strongly agree. Table 2 summarizes the findings.

Table 2: Descriptive Statistics on Procurement Methods

<table>
<thead>
<tr>
<th>Statement</th>
<th>N</th>
<th>SD</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>All open tender procurements are advertised in the dedicated Government</td>
<td>304</td>
<td>8(2.6)</td>
<td>21(6.9)</td>
<td>18(5.9)</td>
</tr>
<tr>
<td>tenders' portals / our website</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All open tenders have clear technical specifications that follow</td>
<td>304</td>
<td>3(1.0)</td>
<td>9(3)</td>
<td>23(7.6)</td>
</tr>
<tr>
<td>objective qualifications criteria</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our organization strictly follow all laid down procedures in Provision</td>
<td>304</td>
<td>8(2.6)</td>
<td>2(7.9)</td>
<td>61(20.1)</td>
</tr>
<tr>
<td>of open tender documents.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restricted tender is frequently used in cases where the works</td>
<td>304</td>
<td>15(4.9)</td>
<td>21(6.9)</td>
<td>37(12.2)</td>
</tr>
<tr>
<td>are specialized in nature</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is a database of pre-qualified providers who are invited to tender</td>
<td>304</td>
<td>82(26.9)</td>
<td>88(28.8)</td>
<td>33(10.9)</td>
</tr>
<tr>
<td>in restricted tendering process</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The tender committee frequently meet to agree on the use of restricted</td>
<td>304</td>
<td>99(32.6)</td>
<td>71(23.3)</td>
<td>8(2.6)</td>
</tr>
<tr>
<td>tendering</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The study sought to know the extent to which the respondents agreed on the given statement relating to open tender a construct of methods of procurement on sustainable performance of state corporations. The findings revealed that 84.5% of the respondent agreed that all open tenders were advertised in the dedicated government websites and portals for every interested and qualifying member of the public to apply with the mean and standard deviation of 4.09 and 0.96 respectively. On the statement “All open tender procurements have clear technical specifications that follow objective qualifications criteria” cumulatively, 3% disagreed while 88.5% agreed with the statement. The findings had the mean and the standard deviation of 4.17 and 0.77 respectively. Result indicated that most of the respondents at 69.4% agreed with the statement that “Our organization strictly follow all laid down procedures in Provision of open tender documents.”. The findings had the mean and the standard deviation of 3.80 and 0.97 respectively. These findings are in tandem with the findings of Wachiuri et al. (2018), who argued that one of the main causes of ineffectiveness in the tendering process between businesses and the government is misuse of restricted tendering and carrying out such processes of tendering without involvement of all key stakeholders.

The study sought to know the extent to which the respondents agreed on the given statement relating to restricted tendering a construct of methods of procurement on sustainable performance of state corporations. Result in table 2 indicated that most of the respondents at 76.0% agreed while 11.8% disagreed that ‘Restricted tender is always used in cases where the works are specialized in nature”, The findings had the mean and the standard deviation of 3.89 and 1.06 respectively. On the statement “There is a database of pre-qualified providers who are invited to tender in restricted tendering process” cumulatively, 55.7% disagreed while 23.6% agreed with the statement. The findings had the mean and the standard deviation of 3.51 and 1.20 respectively. Result in table 2 indicated that, most of the respondents at 55.9% disagreed with the statement while 41.5% agreed with the statement that “The tender committee always meet to consent to the use of restricted tendering”. The findings had the mean and the standard deviation of 4.28 and 0.87 respectively. The findings are in line with those by Mogikoyo et al. (2019), who established that the procurement methods applied by most of the state agencies are not effectively in line with what is articulated under the PPAD regulation and this could affect the efficiency and goodwill of the entire process towards promoting the sustainable performance of these agencies.

The study sought to know the extent to which the respondents agreed on the given statement relating to direct procurement a construct of methods of procurement on sustainable performance of state corporations. Result in table 2 indicated that most of the respondents at 75.0% agreed while 12.5% disagreed with the statement that “Direct procurement is used strictly where circumstances do not allow for competitive tendering”. The findings had the mean and the standard deviation of 3.91 and 1.04 respectively. On the statement “Direct procurement is strictly used where the total cost is within the threshold set in the regulation” as indicated in table 2, cumulatively, 70.8% agreed while 15.5% disagreed with the statement. The findings had the mean and the standard deviation of 3.91 and 1.04 respectively. Result in table 2 indicated that most of the respondents at 38.8% disagreed with the statement while 35.9% agreed with the statement that “There are streamlined processes in place to manage direct procurement requirements to ensure its effectiveness”. The findings had the mean and the standard deviation of 2.98 and 1.29 respectively. The findings echo the findings of Iregi and Kipkorir (2019), who observed that procurement methods were essential in determining how effective the entire procurement process was towards promoting firm’s sustainable performance.

### 4.2 Sustainable Performance of State Corporations in Kenya

The study sought to assess the sustainable performance of State Corporations in relation to the compliance with the public procurement regulation guidelines. The sustainable performance in this case was assessed using environmental, economic and social performance indicators. The respondents were asked to indicate the percentage increase/decrease on specific aspects of sustainable performance for the period between 2016 and 2020. The findings are as shown in Table 3.

<table>
<thead>
<tr>
<th>Measurement Aspects</th>
<th>Below 5%</th>
<th>5 - 10%</th>
<th>11 - 15%</th>
<th>16 - 20%</th>
<th>Above 20%</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
</table>

Table 3: Descriptive Statistics on the Sustainable Performance of State Corporations

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The percentage increase the efficient use of resources for the last 3-5years

<table>
<thead>
<tr>
<th>Mean</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>137</td>
<td>1.30</td>
<td>100</td>
</tr>
<tr>
<td>81</td>
<td>1.30</td>
<td>100</td>
</tr>
<tr>
<td>63</td>
<td>1.30</td>
<td>100</td>
</tr>
<tr>
<td>16</td>
<td>1.30</td>
<td>100</td>
</tr>
<tr>
<td>7</td>
<td>1.30</td>
<td>100</td>
</tr>
</tbody>
</table>

The percentage decrease in organizational expenditure for the last 3-5years

<table>
<thead>
<tr>
<th>Mean</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.07</td>
<td>0.75</td>
<td>100</td>
</tr>
<tr>
<td>1.93</td>
<td>0.75</td>
<td>100</td>
</tr>
</tbody>
</table>

The percentage increase in social initiatives participations for the last 3-5years

<table>
<thead>
<tr>
<th>Mean</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>51.0%</td>
<td>6.0%</td>
<td>100</td>
</tr>
<tr>
<td>30.3%</td>
<td>6.0%</td>
<td>100</td>
</tr>
<tr>
<td>10.2%</td>
<td>6.0%</td>
<td>100</td>
</tr>
<tr>
<td>5.3%</td>
<td>6.0%</td>
<td>100</td>
</tr>
<tr>
<td>3%</td>
<td>6.0%</td>
<td>100</td>
</tr>
</tbody>
</table>

The percentage increase in the use of renewable resources for the last 3-5years

<table>
<thead>
<tr>
<th>Mean</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>32.6%</td>
<td>3.0%</td>
<td>100</td>
</tr>
<tr>
<td>9.2%</td>
<td>3.0%</td>
<td>100</td>
</tr>
<tr>
<td>17.1%</td>
<td>3.0%</td>
<td>100</td>
</tr>
<tr>
<td>26.0%</td>
<td>3.0%</td>
<td>100</td>
</tr>
<tr>
<td>15.1%</td>
<td>3.0%</td>
<td>100</td>
</tr>
</tbody>
</table>

The percentage decrease in procurement opportunities for the last 3-5years

<table>
<thead>
<tr>
<th>Mean</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.03</td>
<td>1.30</td>
<td>100</td>
</tr>
</tbody>
</table>

The model summary results on Table 4.18 reveal a correlation of satisfaction of stakeholders was below 10% in most of the surveyed states. The findings are in tandem with the findings of Ongeri and Osoro (2020), who found out that procurement activities and procedures have a correlation to the improvement of business’ economic, social and environmental performance which is seen through sustainable performance.

As the results portray, on the percentage increase in efficient use of resources for the previous 3 to 5 years, most of the respondents indicated that their respective organizations had below 5% increase. This is as shown by a mean of 1.93 and a standard deviation of 1.03. The respondents also indicated that their respective organizations had less than 5% decline in reduction of waste rate for the same period (Mean= 1.79) and the use of renewable sources was also achieved by less than 5%. This is an indication that the environmental factors had seen minimal increment among the state corporations. The findings are in tandem with the findings of Mbati and Osoro (2020) who found out that procurement activities and procedures have a correlation to the improvement of business’ economic, social and environmental performance.

On the economic measures of sustainable performance, the majority of the respondents stated that their respective organizations less than 5% decrease in organizational expenditure for a period of between 3 and 5 years (Mean = 1.67; standard deviation= 0.75) and that the organizations recorded a less than 5% increase in procurement budget for the same period (Mean= 1.93; standard deviation = 1.13). The findings further revealed that most of the surveyed corporations had a less than 5% increase in technological investment for a period of between 3 and 5 years. The findings imply that the economic factors are also not effectively achieved in most of the surveyed state corporations. The findings are in line with the findings of Kariuki and Aduda (2019), who indicated that achievement of an organizational goal is considered in form of achieving economic performance measures of cost reduction, reduction in lead time, customer satisfaction, quality improvement and compliance to policies, laws and regulations.

On the social measures, the study established that the satisfaction of stakeholders was below 10% in most of the surveyed state corporations (Mean = 2.69; standard deviation= 1.23) while the increase in the participation in social initiatives was below 10% in most of the state corporations (Mean = 2.48; standard deviation= 1.26). The percentage increase in the equal access to procurement opportunities for the period between 3 and 5 years was below 5% (Mean = 2.07; standard deviation= 1.26). The findings imply that the state corporations still have a below average satisfaction, quality improvement and compliance to policies, laws and regulations.

4.3 Test of Hypothesis

\( H_0: \) There is no significant effect of procurement methods on sustainable performance of state corporations in Kenya.

The study sought to find out the effect of procurement methods on sustainable performance of state corporations. A regression model of the form; \( Y = \beta_0 + \beta_1X_1 \) was used to determine the relationship. The model summary results on Table 4.18 reveal a correlation coefficient \( R \) value of 0.660 and a coefficient of determination \( R^2 \) value of 0.436 an indication that a unit change in procurement methods could explain up to 43.6% increase in sustainable performance of the state corporations in Kenya.

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Table 4: Model Summary (Procurement Methods)

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.660 a</td>
<td>.436</td>
<td>.434</td>
<td>.54926</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Procurement Methods  
b. Dependent Variable: Sustainable Performance of State Corporations

The ANOVA results on Table 5 revealed that the F calculated was 233.303 and the P-value was 0.000 an indication that procurement methods significantly predicts the sustainable performance of state corporations in Kenya. This also implies that model is significant. These results support the findings of Mose, Ombui, and Iravo (2018) that procurement methods selected when procuring goods and services helps an organization achieve sustainable performance.

Table 5: Analysis of Variance (ANOVA)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>70.383</td>
<td>1</td>
<td>70.383</td>
<td>233.056</td>
<td>.000 b</td>
</tr>
<tr>
<td>Residual</td>
<td>91.108</td>
<td>302</td>
<td>.302</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>161.492</td>
<td>303</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: Sustainable Performance of State Corporations  
b. Predictors: (Constant), Procurement Methods

The findings from the regression coefficients as shown in Table 6 revealed that at the coefficient of determination, 73.4% of the firm performance could be explained by a unit change in procurement methods as evidenced by the Beta coefficient of 0.734. With these results the null hypothesis that procurement methods have no influence on firm’s sustainable performance was rejected. The model so derived was: \( Y = 0.732 + 0.734X \). The findings also reveal that the P-value for procurement methods is 0.000 which is less than the standard p-value of 0.05 thus the null hypothesis was rejected and adopted alternative hypothesis that procurement methods positively and significantly influence sustainable performance of state corporations in Kenya at 0.000 significance level. These findings are in line with the findings of Munyao and Moronge (2018) that procurement practices affect performance of an organization.

Table 6: Regression Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
<td>.732</td>
<td>.182</td>
<td>.660</td>
<td>4.025</td>
</tr>
<tr>
<td>Procurement</td>
<td>.734</td>
<td>.048</td>
<td></td>
<td>15.274</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Sustainable Performance of State Corporations

The study sought to prove the effect of procurement methods on sustainable performance of the state corporations in Kenya using the scatter plot diagram as herein shown on Figure 2. The findings revealed that the scatter plots had a positive gradient an indication that procurement methods positively influenced the sustainable performance of state corporations in Kenya.
A Histogram was used to show the distribution of the standardized residuals in the model. As the results in Figure 3 portray, the standardized residual is normally distributed as evidenced by the curve that is bell-shaped and the symmetric nature of the histogram. This is an implication that the regression model significantly predicts the effect of procurement methods on sustainable performance of state corporations in Kenya. These results tally with those of Giathi, Abayo & Muhoho (2021), that procurement management methods and processes positively influence the performance of public entities in Kenya.

Figure 3: A Histogram on Procurement Methods

5.0 Conclusion

The study concluded that the procurement methods had a significant influence on the sustainable performance of state corporations in Kenya. Through a well-defined tendering process under the open and restricted tenders, the credibility and effectiveness of the entire process is enhanced thus enabling efficiency in the tendering process. The study concluded that while open tendering was efficient in most of the state corporations, this was not the case when it comes to direct procurement and restricted tendering. The study concluded that some of the measures that were taken to streamline the restricted tendering and direct procurement were not effective towards promoting the sustainable performance of the corporations.

6.0 Recommendations of the Study

The management of the state corporations ought to embrace the appropriate procurement methods as a way of enhancing sustainable performance of the corporations. Upholding effectiveness ways of handling open tenders and restricted tenders would shape the openness and efficiency in the procurement process of the corporations which is essential to their sustainable performance. The enforcing agencies also should be keen in ensuring that the procurement methods utilized by the state corporations match the ones provided for under the PPAD Regulation. Then there is need to ensure that all relevant stakeholders are involved when planning for acquiring goods, services, works and consultancy services and ensure that when using a competitive procurement method an objective qualifications criterion is applied so at award tender to the most competent bidder. The management should also develop relevant policies in order to ensure accountability, competitiveness, transparency, integrity and value for money is achieved in a procurement process.

REFERENCES


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**AUTHORS**
**First Author**- Catherine Njoki Gatari: Student, Jomo Kenyatta University of Agriculture and Technology, Nairobi Kenya.
**Second Author**- Dr Ismail Noor Shale, PhD: Senior Lecturer, Jomo Kenyatta University of Agriculture and Technology, Nairobi Kenya.
**Third Author**- Dr Anthony Osoro, PhD: Lecturer, Jomo Kenyatta University of Agriculture and Technology, Nairobi Kenya
Influence of Green Packaging on Performance of Building and Construction Manufacturing Firms in Kenya

Peter Kiama Gikonyo
PhD Candidate;
Jomo Kenyatta University of Agriculture and Technology,
Nairobi, Kenya

Prof. Patrick Karanja Ngugi, PhD
Jomo Kenyatta University of Agriculture and Technology,
Nairobi, Kenya

Dr. Samson Nyang’au Paul, PhD
Jomo Kenyatta University of Agriculture and Technology,
Nairobi, Kenya

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Abstract

The aim of this paper is to establish the influence of green packaging as one of the components of green logistics on the performance of building and construction companies in Kenya. This comes as the call for embrace sustainable development goals across all sectors is on the rise, and most companies stepping in to embrace sustainable practices as a way of minimizing costs, ensuring customer satisfaction, and conserving the environment. The paper has been anchored on the institutional theory. Through cross-sectional research design, the study surveyed 270 respondents drawn from the 54 building and construction manufacturing firms in Kenya. Primary data was collected using a questionnaire. Qualitative data was analyzed through content analysis whereas quantitative data was analyzed through descriptive statistics (mean, standard deviation, frequency and percentages) and inferential statistics (ANOVA, P-value, t-test). The results revealed that green packaging had a significant influence on the performance of the building and construction manufacturing firms in Kenya. The study concluded that through embrace of green packaging, performance of the manufacturing firms was obtained. It is recommended that the management of the building and construction manufacturing firms embraces green packaging for better cost-saving, enhancing customer satisfaction, conserving natural resources and strengthening their competitive edge.

Keywords: Green Logistics, Green Packaging, Building and Construction Manufacturing Firms

1.0 Background of the Study

As the global suppliers of manufactured products, manufacturing enterprises are implementing sustainable solutions such as green logistics management (GLM) for the movement of the goods both to manufacturing industries and customers (Wolf, 2014). The focus is on profitable growth without inflicting environmental damages through pollution to other countries through managing the logistics cycle of their merchandises spanning sourcing, channel deliveries, general distribution and disposal of the waste and default products (Hsueh, 2015). Such a solution are able to key green logistics initiatives enable to improve business performance, while preserving the local environment, as well as the global environment image on the environmental preservation. Many manufacturing companies across the globe are encountering international pressure to maximise on green transport and reduce their environmental consequences the circular economy, which promotes conservation of resources, reflects organizational responsibility towards achieving the green logistics goal (Tseng & Hung, 2014).

According to Hazen and Hanna (2011) green packaging refers to any change made by a product manufacturer or service provider to lessen the environmental-impact of the materials or processes involved in packaging the products and services while their deployment to the end-user. Implementing methods for green packaging include practices such as the use of biodegradable or recycled material, reducing the amount of material used for packing a product or using refillable or reusable packaging containers (Hsueh, 2015).
According to Osmani and Zhang (2014) states that Biodegradable refers to the ability of materials to break down and return to nature. In order for packaging products or materials to qualify as biodegradable, they must completely break down and decompose into natural elements within a short time after disposal typically a year or less. Carter & Easton (2011) the ability to biodegrade within landfills helps to reduce the buildup of waste, contributing to a safer, cleaner and healthier environment. Materials that are biodegradable include corrugated cardboard and even some plastics

Packaging Reduction is structure that doesn't utilize a lot of bundling material. Grasp effortlessness alongside innovativeness to concoct an alluring and moderate structure (Pietro, Huge-Brodin, Isaksson & Sweeney, 2012). Insignificant bundling helps in decreasing material use, prompting diminished item cost. During transportation even devour less vitality to fabricate both the material and bundling and less fuel is utilized to transport things. Reusable containers and boxes are a shipping container with strength suitable to withstand shipment, storage, and handling (Ballot & Fontane, 2010). Shipping containers range from large reusable steel boxes used for intermodal shipments to the ubiquitous corrugated boxes which are designed to be moved from one mode of transport to another without unloading and reloading.

The Kenya Association of Manufacturers (2019) classifies companies that deal with the manufacture and production of building and construction materials under building and construction manufacturing companies. The companies deal with products such as cement manufacturing, manufacture of steel and iron, manufacture of paints and assembling of building materials among other products.

1.2 Statement of the Problem

Despite the merit surrounding the building and construction manufacturing firms in Kenya, the firms have continually recorded a surge decline in performance over the past five years (KAM, 2017). According to KAM report (2017), most of the manufacturing companies in building and construction sector recorded over 15% decline in their annual turnover while the sector lost over 2.8% of its market share between 2013 and 2017. According to the Competition Authority of Kenya (CAK) (2018), building and construction manufacturing companies in Kenya have been facing tough times in the market a matter that has seen most of the companies retrench to save their operational costs. This is despite the continued growth of urban centres and demand for housing and related infrastructure in the country. According to KAM (2020), in the period between 2015 and 2019, close to 45% of the building and construction manufacturing firms had recorded over 26% increase in their annual operational costs, with costs related to supply chain and logistics practices taking up to 48% of these costs. The available evidence therefore shows that despite the surge in high-rise buildings and other mega construction projects in the country, the construction and building manufacturing companies have been poorly performing in the recent past.

Green logistics through green packaging has been considered as a major approach in promoting sustainability of the supply chain management through which organizational performance is enhanced as well as meeting the environment conditions of the modern day World (UNEP, 2018). Empirical studies have revealed mixed results on the relationship between green packaging as an aspect of green logistics and firm performance. Vermeulen (2015) and Qureshi, Rasli and Zaman (2016) found that green packaging is an aspect of green logistics that has a significant influence on the firm performance through cost-saving and enhancing efficiency and effectiveness. Based on the available literature, it is evident that green packaging would be essential in enhancing firm performance. However, there is scant evidence in the Kenyan manufacturing sector, especially in the building and construction manufacturing firms. To this effect, the study sought to establish the influence of green packaging on the performance of building and construction manufacturing companies in Kenya.

1.3 Objectives of the Study

i. To determine the effect of green packaging on performance of building and construction manufacturing firms in Kenya

1.4 Research Hypotheses

1. $H_{A1}$: Green packaging has a significant effect on the performance of building and construction manufacturing firms in Kenya

2.0 Theoretical Review

This research paper was informed by the institutional theory. The theory emphasizes the role of social and cultural pressures subjected to organizations that influence management practices. DiMaggio (2008) argues that managerial decisions are strongly influenced by three institutional mechanisms namely; coercive, mimetic and normative isomorphism - that creates and diffuses a common set of values, norms and rules to produce similar practices and structures across organizations that share a common organizational field.

Delmas and Toffel (2014) proposed an institutional perspective to analyze the drivers of green packaging and also came up with how distinct levels of coercive pressures are exerted upon different industries which may lead to different environmental strategies. Firms tend to adopt green logistics management practices in response to institutional pressure. They can be based on; natural methodologies of conformance that attention on consenting to guidelines and embracing standard industry practice, or to

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lessen ecological effect of tasks past administrative necessities (Sharma, 2010). This includes areas such as recycling and refurbishment, returns policy and remanufacturing.

Management can also include green packaging as a performance indicator in green logistics management (Nelson & Winter, 2012). Firms can create relationships with regulators and signal a proactive environmental stance by participating in government sponsored voluntary programs (Delmas & Toffel, 2014). Construction companies can also work with their customers and suppliers to improve their green packaging through better green logistics management (Nelson & Winter, 2012). For the construction firm to achieve the best in enhancing green packaging, it ought to collaborate with suppliers and regulators hence the essence of institutional theory. The theory, therefore informed the study on green packing as an aspect of green logistics.

2.1 Conceptual Framework

![Conceptual Framework](image)

### Independent Variables
- Green Packaging
  - Biodegradable Packaging
  - Packaging Reduction
  - Reusable Containers & Boxes

### Dependent Variable
- Performance of Building & Construction Manufacturing Firms
  - Lead Time
  - Customer Satisfaction
  - Quality

2.2 Review of Empirical Literature

Chen and Delmas (2011) while analyzing the factors influencing the adoption of green practices within the logistics industry investigated green practices including the adoption of fuel efficient vehicles, electricity management systems and solar energy systems. The scholars analysed and surveyed three hundred and twenty two (322) logistics firms in China’s Shanghai and Shenzhen areas. The study also explored the roles of organizational factors such as the firms’ size and the quality of their human-resources systems, for example. The business context, pressure from customers or the government and uncertainty in the business setting and technological factors were found to be among the key aspects influencing the adoption of green logistics (Chen & Delmas, 2011). Technological factors, such as the relative benefits of new technologies and innovations, how well suited they are to a firm’s needs and how easy they are to understand and use, are a relatively new focus for research. Queueing models provide closed form results and approximations for certain congested service systems, although under assumptions that may differ substantially from actual operating conditions.

The studies further established that analysis of routing and assignment heuristics in idealized systems yields insight into asymptotic and worst-case performance, which may not be of direct relevance to actual operating conditions. Such conditions can be represented effectively in a computer simulation modelling framework, which provides the requisite flexibility of strategy representation and complex process emulation for the evaluation of dynamic green distribution systems. Carrier operations in response to demands for service can be examined over periods of varying duration, providing a test-bed for the design and performance evaluation of real-time operational strategies consisting of load acceptance, assignment, routing, and scheduling techniques. In addition to mean performance, evaluation through simulation readily can yield results regarding performance variability, reliability, robustness under stochastic events, and other measures.

3.0 Methodology

3.1 Research Design

The study used a cross-sectional research design. This design incorporates collection and analysis of cross-sectional data which according to Kothari (2014); enables intensive collection of in-depth data for the purpose of responding to the research questions. The cross-sectional research design will therefore be adopted to enable the use of a linear and multiple regression model to assess the relationship between green packaging and performance building and construction manufacturing firms in Kenya.
3.2 Target Population and Sampling

The target population for the study comprised of the building and construction manufacturing firms registered under the Kenyan Association of Manufacturers. As of December 2020, there were 54 building and construction manufacturing firms registered under KAM. The firms deal with manufacture of building and construction materials and accessories including cement, glassware, steel and iron materials, precast and ready-mix concrete, and quarry construction and building materials.

The sampling frame was the 54 building and construction manufacturing firms in Kenya, as enlisted by the Kenya Association of Manufacturers. The unit of observation was the employees from the 54 building and construction manufacturing firms companies. According to KAM, the firms have employed over 6,000 employees. However, there are 900 senior management and administrative staff in the sector. These were the target population for the study from which the target population was obtained.

The study used a census to identify the units of analysis. This is where all the 54 building and construction manufacturing companies were included in the study. A purposive sampling was used to identify the units of observation, where the heads of 5 key departments involved the logistics processes and related activities were purposively selected. This implies that in every firm, 5 respondents were drawn, making the sample size to be 270 respondents which is 30% of the target population (900).

3.3 Data Collection and Analysis

This study used primary data which was collected using a structured questionnaire. The questionnaire was deemed appropriate due to its ability to collect a wide range of data and cover a high number of respondents within a reasonable period of time. The questionnaire was administered both manually (physically) and through online means.

Descriptive statistics such as frequency distributions and percentages were used to summarize basic features of the data in the study. Inferential statistics were used in computation of: the confidence levels to be applied; Normality test, test for heteroscedasticity, correlation matrix; and the multiple regression process for testing of the hypothesis (Saunders & Thornhill, 2009). The Statistical Package for Social Sciences (SPSS) version 26.0 was used to perform the analysis of quantitative data. A regression model was developed to present the relationship between the variables.

The multiple regression model was:

\[ Y = \alpha + \beta_1 X_1 + \varepsilon \]

Where:
- \( Y \) = Performance of Building and construction manufacturing firms
- \( \alpha \) = the Constant
- \( \beta_1 \) = the coefficient of the independent variable
- \( X_1 \) = Green packaging
- \( \varepsilon \) is the error term established from heteroscedasticity test;

4.0 Research Findings

4.1 Response Rate

Out of the sample size of 270 respondents, the study obtained a response rate of 84.4% where 228 dully filled questionnaires were returned for analysis. This was considered adequate for the study, since it was above the recommended response arte of 60% (Kothari, 2014) and Creswell, 2016).

4.2 Descriptive Results on the Influence of Green Packaging on Firm Performance

The study sought to establish the influence of green packaging on the performance of construction companies in Kenya. The main sub-variables for the green packaging were: biodegradable packaging, reduction of the packaging materials and use of reusable containers and boxes in packaging. The respondents were asked to indicate their level of agreement or disagreement with specific statements drawn from these aspects. A 5-points Likert’s scale was used. The findings are as summarized in Table 1. The findings portray that green packaging has not been effectively upheld among most of the building and construction manufacturing firms, and this could affect the performance of the companies.

Table 1: Descriptive Statistics on Green Packaging

This publication is licensed under Creative Commons Attribution CC BY.
The organization applies packaging made of recyclable materials enhancing quality of goods
2.58 1.28
The organization packaging materials are bio-degradable
2.59 1.34
The organization uses minimum transportation packaging materials to preserve the natural resources which has reduced the cost of transportation
3.39 1.20
Post-consumer recycled polyethylene bags made from recycled waste are used in our firm
2.84 1.51
The organisation uses renewable resource based packaging materials
2.58 1.43
The organization uses minimum possible packaging materials to save on costs
3.03 1.46
The materials used in packaging help to preserve the natural state of the products
2.66 1.47
The resources used in packaging enhances the delivery of goods in their original state
2.77 1.46
The company has enhanced packaging optimization by packaging reduction, while retaining product protection
2.67 1.41
Our organisation uses packaging with additives added in order to make the packaging degradable
2.53 1.36
Use of eco-friendly packaging material - without sacrificing appearance and quality is embraced in our organization
3.21 1.26

4.3 Descriptive Results on Firm Performance

The study sought to find out the opinions of the respondents regarding the performance of their respective building and construction manufacturing firms. They were asked to indicate their level of agreement or disagreement on specific statements on organizational performance based on a 5-points Likert’s scale. The findings are as summarized in Table 2. The results imply that the performance of the construction companies has not been effective, thus raising the need for green logistics to boast their cost saving, enhancement of quality and meeting customer satisfaction.

Table 2: Descriptive Statistics on Firm Performance

<table>
<thead>
<tr>
<th>Statements</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Our company has drastically reduced the rate of customer returns over the past five years</td>
<td>2.68</td>
<td>1.00</td>
</tr>
<tr>
<td>The cost of operations in our firm has reduced for the past five years</td>
<td>2.50</td>
<td>1.23</td>
</tr>
<tr>
<td>Our company has seen an increase in the sales revenue for the past five years</td>
<td>2.89</td>
<td>1.07</td>
</tr>
<tr>
<td>There are fewer customer complaints with regard to our products over the past five years</td>
<td>3.18</td>
<td>1.10</td>
</tr>
</tbody>
</table>

4.4 Inferential Analysis Results

4.4.1 Correlation Analysis

Correlation analysis was carried out to establish the relationship between green packaging and the performance of building and construction firms in Kenya. The results as shown in Table 3 revealed that the Pearson Correlation (r) on the relationship between green packaging and firm performance was 0.667, at a significant level of 0.000<0.05. The findings imply that green packaging has a significant and strong correlation with the performance of building and construction manufacturing firms in Kenya.

Table 3: Correlation Results between Green Packaging and Performance

<table>
<thead>
<tr>
<th>Firm Performance</th>
<th>Pearson Correlation</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm Performance</td>
<td>.667**</td>
<td>.000</td>
</tr>
</tbody>
</table>
4.4.2 Regression Analysis

The study adopted alternative hypotheses, which were tested using regression model.

**H1:** *Green packaging has a significant effect on the performance of building and construction manufacturing firms in Kenya*

The study sought to establish the influence of green packaging on the performance of building and construction manufacturing firms in Kenya. The model summary as shown in Table 4 revealed that the $R^2$ for the model was 0.444. This implies that as a result of green packaging, the variation of performance of building and construction manufacturing firms will be 44.4%. This is an indication that green packaging has a strong influence on the performance of building and construction manufacturing firms in Kenya.

The ANOVA test results for the model revealed that the $F$-statistic for the model was 180.641 at a significant level of 0.000<0.05. This implies that the model is significant in predicting the effect of green packaging and firm performance. It also shows that there is a possibility of a significant relationship between the variables.

The regression coefficients for the model on the relationship between green packaging and firm performance revealed that the Beta coefficient for green packaging is 0.620. This implies that a unit change in green packaging would influence the performance of the building and construction firms by 0.62 units. The significant level for the variable is 0.000<0.05. This implies that there is a significant

<table>
<thead>
<tr>
<th>Table 4: Regression Analysis Results on the Influence of Green Packaging on Firm Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model Summary</strong></td>
</tr>
<tr>
<td>Model</td>
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<tr>
<td>1</td>
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<tr>
<td>a. Predictors: (Constant), Green Packaging</td>
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<table>
<thead>
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<th><strong>ANOVA Test</strong></th>
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<tbody>
<tr>
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<td>Regression</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>
| a. Dependent Variable: Firm Performance  
| b. Predictors: (Constant), Green Packaging |

<table>
<thead>
<tr>
<th><strong>Regression Coefficients</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>(Constant)</td>
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<tr>
<td>1</td>
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<tr>
<td>a. Dependent Variable: Firm Performance</td>
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</table>

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4.5 Discussion of the Findings

The study sought to assess the effect of green packaging on the performance of building and construction manufacturing firms in Kenya. The descriptive results of the study revealed that most of the manufacturing firms surveyed did not apply packaging made of recyclable materials, despite this being a major way of enhancing the quality of goods. Most of the organizations also did not embrace packaging materials that were biodegradable. The findings further revealed that the surveyed firms used minimum transportation packaging materials which is a way of preserving the natural resources and reduce the cost of transportation. The firms however did not embrace use of post-consumer polyethylene materials to package their goods and also embrace of renewable resources in packaging was minimal. The respondents further disagreed that their respective firms used packaging materials that helped to preserve the natural state of the products and the materials used in packaging enhanced the delivery of goods in their original state. Most of the companies did not enhance packaging optimization through reduction of packaging and retaining product protection, and this could mean that increased costs and lack of proper protection in the products was high. The respondents further noted that their respective firms did not actively use eco-friendly packaging materials, an indication that the building and construction manufacturing firms could be actively contributing to environmental pollution through unsustainable packaging practices thus not benefiting from reduced costs and enhanced customer satisfaction. The results from the regression model on the other hand revealed that green packaging had a significant and positive effect on the performance of building and construction manufacturing firms in Kenya. This was both when regressed alone through univariate regression analysis and when regressed with other variables on green logistics through multivariate regression model.

5.1 Conclusions of the Study

The study concluded that green packaging as one of the aspects of green logistics play a significant role in promoting the performance of building and construction manufacturing firms in Kenya. The use of biodegradable packaging materials and reducing the materials used in packaging are essential way through which the manufacturing firms can embrace green sustainable logistics practices. These practices despite saving on operation costs, they also enhance the satisfaction of customers and enhance the public image of the companies. The study concludes that the use of green packaging through promotion of reusable containers in packaging enhances recycling among the customers thus promoting a greener environment. Moreover many customers would prefer products from a company that packages its products with reusable packages, which is to the advantage of the manufacturing entity.

5.2 Recommendations of the Study

Packaging is one of the crucial processes in the logistics practices of the manufacturing firms, particularly those in the building and construction sub-sector. It is recommended that the management of the building and construction manufacturing firms steps up to ensure that the packaging of their products is done in a more sustainable manner such that conserves the environment. Through use of biodegradable materials to package, and ensuring the packages used are reusable, the customers are attracted to such products and this would mean enhanced performance of the firms. The management should require that those in charge of packaging minimize the materials used in packaging while ensuring that the quality of the products is not compromised. This ensures that as the company is upholding green logistics practices, the costs of packaging are minimized as well.

Embrace of green logistics through green packaging is one of the sustainable business practices among the organizations in the country that remains a blueprint for the government as one of the sustainable development goals. The government therefore ought to incorporate policing and governance framework that provide guidance to the manufacturing firms on how to embrace green logistics as one of the sustainable practices. The government through key arms such as the parliament should come up with policies that highlight the key green logistics practices to be adopted by the building and construction manufacturing firms.

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Smart parking guidance: A step towards sustainable cities

Sana Ben Hassine*, Rafaa Mraihi**, Elyes Kooli***

* Higher Institute of Finance and Taxation of Sousse, Sousse 4000, Tunisia
** Higher School of Business of Tunis, Manouba 2010, Tunisia
*** Higher Institute for Technological Studies of Ksar Hellal, Ksar Hellal 5070, Tunisia

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Abstract- Generally, dense urban areas suffer from local parking shortages; a limited supply coupled with a diffuse demand in both space and time. According to this plan, additional vehicles will be searching for available parking spaces, particularly during peak hours. Searching for parking disrupts the economic, environmental, and social sustainability of the city. The purpose of the paper is to optimize parking management, by guiding drivers who request a vacant space. Multi-agent systems can be used as an appropriate modeling approach for the development of such a smart parking guidance system. In order to verify and validate the model, simulations were performed in Tunis city-center. The numerical results show that smart parking guidance systems can manage parking areas more efficiently. It can reduce energy consumption and carbon dioxide emissions, increase revenues for parking managers and satisfy drivers' requirements.

Index Terms - parking guidance, utility maximization, parking search, sustainability

I. INTRODUCTION

It is increasingly difficult to find a vacant parking space within the urban area as most of the transportation infrastructure is over-exploited and under-sized [1]. The mismatch between parking supply and demand [2], caused by a multiplicity of vehicles, the rarity of urban areas, and the under-evaluation of parking pricing, increased the time spent searching for a vacant parking space. A study showed that during peak hours in almost all large cities, traffic generated by vehicles looking for vacant parking spaces can account for up to 30% of the total traffic flow [3].

The conductors do not perceive parking problems, until they are engrossed in the parking search process [4]. However, finding a vacant parking space, who is responsive to our needs, can never be guaranteed due to the lack of accurate information about the spaces, and other conductors. As a result, we exert a lot of effort, but without being effective. Furthermore, even if we simply want to make the best decision, based on the available information, the quantity and diversity of this information (variable message panels, time of day, personal experiences) suggest that the optimal treatment is too complex for our cognitive capabilities [5].

The new technologies of information and communication have been used to solve or mitigate this problem, namely the parking guidance systems. These last systems have been in place since the 1970's [6]. The information they provide facilitates drivers' decision-making processes, enabling them to locate vacant parking spaces around their preferred destinations and to choose where to park [7]. A parking guidance system is most relevant where there is high parking demand [8]. As a result of Southampton's inquiries, the time spent in parking search decreased from 2.2 minutes to 1.1 minutes, courtesy of the guidance system. Dijkschoorn illustrates how the system guides non-habitual drivers (e.g., visitors) toward a vacant parking space, while preventing habitual drivers from viewing already congested parking lots [9]. Thompson et al. developed a behavioral parking model to predict the effect of variable message signs and provide the most effective information for free parking [10]. On the other hand, Shi et al proposed a real time parking guidance system [11]. Conductors can be dynamically regrouped and affect different parking spaces according to their preferences, which prevents the saturation of certain parking spaces.

Liu et al developed a parking guidance system based on the web and a geographic information system (GIS) to let drivers receive information via the internet and mobile phones [12]. At the end of the trip, the conductor can refer to a route map, displayed on his mobile phone, to see which parking spaces are available or who will be released near the destination. Mobilis, Smartphone, Streetline, and Smartgrains are some applications that make it possible for all users to share information about parking in urban areas. The
service is provided in real-time. A few studies have attempted to improve parking guidance's reliability. For example, Caliskan et al. aim to improve the availability of free parking [13]. They developed a system for surveying and preserving parking occupancy. The vacant parking spaces were predicted using a Markov model based on the arrival and departure parking times. The utility of the model was demonstrated by simulation tests.

Chou et al. utilized an agent-based parking guidance system. Parking can be suggested by drivers based on their proximity to their destination, the parking cost and the capacity as part of the developed system [14]. Although, Seong-Eun et al. presented a conceptual architecture for a parking guidance system based on a wireless sensor network [15]. Through the Internet, users can verify the availability of parking spaces. According to Caicedo [16], real-time parking information could improve circulation by 10%. In addition, Giuffre et al. developed a conceptual architecture that provides intelligent management solutions for public parking lots [17].

Model for this study consists of five modules: parking controller, communication module, user interface module, management interface, and function module. This system allows conductors to reserve vacant parking spaces in real-time by using a network of sensors.

Napoli et al. examined the issue of allocating parking spaces based on a negotiation process that creates an agreement between parking providers and parking demanders [18]. The model considered the needs of conductors in terms of parking locations and costs, and the requirements of managers in terms of parking availability and distance to the center of town. They propose a system of information and guidance parking that provides auxiliary users with information about the city's plans and regulations, as well as an estimate of displacement time. An algorithm for intelligent parking guidance was proposed by Shin and Jun [19]. The algorithm allows drivers to identify vacant spaces based on parking occupancy in real time. Simulation tests were conducted. Empirical results show better utilization of spatial resources in cities, a minimization in energy consumption and carbon emissions, and a reduction of congestion caused by parking search traffic. Ben Hassine et al. proposed a network of intelligent agents that could help drivers to find parking spaces, in real time [20]. The results of this study generated by the platform MATSim transport simulation, demonstrate that their approach optimizes parking lot occupancy. Therefore, Shin et al. proposed a predictive control approach based on a neuronal network [21]. The proposed method improves parking guidance's performance via dynamic selection of the best parking spaces. To evaluate of the approach, a simulation test, and a comparison with a traditional model are necessary.

The purpose of this paper is to develop a smart parking system in order to optimize parking management in Tunis city center. Then, we propose a parking guidance system based on real-time parking information to satisfy the needs of conductors and parking managers. The paper is organized as follows. In Section 2, we describe the architecture of the system, the performance measures of smart parking guidance, and the utility function that evaluates the effective parking and selects the best available parking in a dynamic environment. The numerical results and analysis are described in section 3. Conclusions are given in section 4.

II. IMPLEMENTATION ET SIMULATION

Our model simulates the driver's itinerary from his current location to the chosen parking lot, the walking distance, and also the parking cost. Several factors, including walking time, time spent looking for vacant parking spaces, and the parking price and duration, are taken into consideration in the algorithm proposed.

Two environments have been created for studying the effect of guidance on our smart parking system. The first noticed (unguided environment) represents the current parking situation in Tunis city center: an environment without guidance. The second notice (guided environment) described an environment with guidance. A comparison of the two environments has been conducted. To facilitate the simulation process, the underlying hypotheses are considered. Suppose:

- Hypothesis relating to transportation mode: The vehicle is the only dynamic component of our road network.
- Hypothesis about displacement of individuals: this research concerns parking related to individuals’ displacement. Parking related to dealer transportation is not covered.
- Hypothesis of parking managers: An organization is responsible for managing all the parking and controlling the parking locations, fees and spaces.
- Hypothesis of the perfect information: Conductors have access to real-time information regarding parking such as the price, occupation, etc.
- Hypothesis of homogenous time value: we suppose that the value of time is the same for all users.

A. Parking guidance system

A smart parking guidance system combines parking demand (destination, duration of activities, and other parameters) with local parking supply (limited parking duration, parking fee, availability of spaces), and treats parking in interaction with the road flow (conditions and traffic state). Our system allocates and reserves a vacant parking space for a driver according to their needs. It allows them to search for available spaces at anytime and anywhere and get valuable information, such as parking names, prices, locations, and costs around their destinations. Furthermore, to look for the optimal path so as to reach the destination quickly, avoid congestion, and ensure parking reservations. Parking decisions vary according to the users. In fact, the driver chooses a parking based on his budget constraints and the level of convenience (parking security, walking time, price). Our smart parking system provides real-time information to the user (Figure 1).
The parking guidance system will be based on the paradigm of multi-agent systems. A network of cognitive agents is proposed to better assist drivers and parking managers. Adaptability, coordination, communication, and collaboration, allows agents to perform automated searches for vacant spaces, negotiate parking prices, and reserve parking spaces. As a result, intelligent agents select the appropriate parking based on a driver's requirements.

The system consists of autonomous computing units that interact with the environment (infrastructure, parking). It represented the dynamic use of parking resources. Hierarchy is the basic structure of our system. It is through this hierarchical organization that messages can be routed. Different agents from a hierarchical level to another. They are divided into three types based on their characteristics: driver agent, parking agent, and central agent (Figure 2).
The parking agents keep all types of information pertaining to their parking lots: type of lot (public or private), location, capacity total, vacant and occupied spots, limited parking duration, rotation rates, etc. Parking agents can predict parking demand in order to better manage the situation. They provide a visual display of historical statistics for periods, for zones or parking lots, and emits a warning when demand is abnormal.

Parking agents are installed in each parking space. In general, they are responsible for tracking parking occupancy at each interval of time. These agents are placed on parking meters signed to on-street parking, as are those in Tunis city center. Alternatively, they can be placed in automatic barriers at off-street parking entrances. The agents will be notified whenever a vehicle arrives or departs from a parking space. They also anticipate the availability of parking spaces, which were used for a limited period of time. Once a reservation is confirmed, the parking agent indicates the occupied new space. Once the parking duration is determined, the parking agent automatically marks the space as available.

The agent central is a server that stores information about parking occupancy and prices for the zone it manages. It provides a general view of all the parking in the area. It provides direct interaction with parking agents through a central supervision entity. It is responsible for acquiring and managing various types of information in real-time. This information is provided by parking agents. For each new contract, it compiles a list of parking with available spaces, around the destination requested by the driver agent. After evaluating the different propositions, it attributes the contract to the winning parking agent, in accordance with the driver agent.

### B. Utility Function

In order to simplify the simulation, let's assume displacement generally consists of two steps: First, from the origin point o to the parking j, and second from the parking j to the destination d, for only one activity k. The MATSim utility is defined as follows:

\[
U = U_{\text{travel},t} + U_{\text{parking},t} \\
U_j^t = U_{j,\text{travel},t} + U_{j,\text{cruise},t} + U_{j,\text{park},t} + U_{j,\text{walk}} \\
U_{j,\text{travel},t} = \beta_{\text{t, drive}} \cdot \text{t}_{\text{drive}, j} + \beta_{\text{g, drive}} \cdot \text{l}_{\text{oj}} \\
U_{j,\text{cruise},t} = \beta_{\text{cruise}} \cdot \text{t}_{\text{cruise}, j} \\
U_{j,\text{park},t} = \beta_{\mu} \cdot \text{s} \cdot \text{P}_j \\
U_{j,\text{walk}} = \beta_{\text{walk}} \cdot \text{t}_{\text{walk}, j} \\
U_j^t = \beta_{\text{t, drive}} \cdot \text{t}_{\text{drive}, j} + \beta_{\text{cruise}} \cdot \text{t}_{\text{cruise}, j} + \beta_{\text{walk}} \cdot \text{t}_{\text{walk}, j} + \beta_{\text{g}} \cdot \text{l}_{\text{oj}} + \beta_{\mu} \cdot \text{s} \cdot \text{P}_j
\]  

(1)
With

\[ \beta_{\text{driv}} \]: Marginal utility of travel time
\[ \beta_{\text{walk}} \]: Marginal utility of walking time
\[ \beta_{\text{driv}} \]: Marginal utility of travel distance
\[ \beta_{\mu} \]: Monetary marginal utility
\[ \beta_{\text{cruis}} \]: Marginal utility of cruising time for vacant parking space
\[ P_j \]: price of parking j (TND / h)
\[ s \]: parking stay duration (h)
\[ t_{\text{driv}}^{o,j} \]: driving travel time from the origin o to parking j
\[ t_{\text{walk}}^{j} \]: time spent walking from parking to final destination (h)
\[ t_{\text{cruis}}^{t} \]: cruising time for parking at time period t (h)
\[ l_{o,j} \]: distance to travel from the origin o to a parking j

III. NUMERICAL RESULTS AND ANALYSIS

As a driver, smart parking guidance should be less costly in terms of money, walking distance, time spent searching for vacant parking spaces, and stress reduction. On the other hand, as parking managers, smart parking guidance should allow optimal usage of parking spaces and maximize turnover. To verify and validate the initial hypotheses, simulations were conducted in a real-world environment, in order to test the impact of smart parking guidance on drivers' and managers' expectations.

Tunis city center is taken as a sample to illustrate the approach. We chose the Tunis city center due to its relevancy linked to the weight of parking supply and demand. The selected zone covers an area of 10 km². The road network is represented by a diagram of 1361 directed links and 584 nodes. The data set included 346 on-street parking locations with a total capacity of 4,250 places. For off-street parking, there are 24 lots with a total capacity of 4,800 parking spots. The spatial data were edited and processed using QGIS (Quantum Geographic Information System).

![Figure 3. Study area](image)

The simulation concerns a limited time period, typically the morning peak. It is a discrete event simulation with intervals of five minutes. It examines the effects of each environment on: traffic conditions, parking occupancy levels, parking managers turnovers, walking time, travel distance, social well-being, and environmental costs. The simulation reroutes up to 20000 vehicles per day (randomly generated).
A. Traffic conditions

Through simulations, it was shown that parking search traffic is reduced. The road congestion is then mitigated.

A.1. Number of vehicles in circulation

To examine the results of the simulation in both environments, the status of traffic road is compared.

Figure 4 shows the number of vehicles in circulation during simulation day. On the morning debut, the curves have a similar allure. In fact, when parking demand is feasible, all drivers can find an available space that corresponds to their preferences, so there is no additional travel distance. As time progresses, the appearance of courses changes. As a result, parking search traffic is created (unguided environment). Vehicles that are looking for a parking space slow down the movement of other drivers. They generate circulation on the main roads and adjacent streets. The problem is a non-negligible part of traffic flow specifically during peak hours. This is clearly demonstrated in figure 4.

In the comparison of environment (guided) to (unguided), the number of vehicles in circulation is reduced by 15.51%. These vehicles were looking for vacant parking spaces. The result was as expected. According to a Shoup (2006) study, 30% of the traffic flow can be attributed to parking search traffic. As conclusion, traffic on (guided environment) is proportionally more fluid than traffic on (unguided environment).

A.2. Road congestion status

Figure 5 shows the evolution of road congestion on the day of the simulation.

There are 11918 vehicles for unguided environment and 1421 vehicles for guided environment. Road congestion is then reduced by 11.92%. The reduction can be explained by the suppression of parking search traffic through vehicle guidance. The result proves that traffic is fluid.
A.3. Number of vehicles at destination

Figure 6 represents the number of vehicles that reached their destination.

The number of vehicles arriving at destinations is higher in guided environment than in unguided environment. This suggests that if conductors are guided to available parking spaces, the number of vehicles in circulation will decrease. Parking guidance reduces travel distances for drivers looking for available parking spaces and increases the number of vehicles arriving at their destination. Thus, traffic becomes more fluid. Furthermore, the vehicles on the unguided environment arrive at their destinations at 7:00 p.m. The guided vehicles on the guided environment arrive at their destinations at 16h. Thus, parking guidance systems can reduce three hours of road circulation.

B. Parking occupancy

For the unguided environment, the conductor cannot collect information about parking space availability. Thus, he is interested in finding the closest parking spaces to his destination. For the guided environment, the conductor is informed and guided to an available parking space. It optimizes the use of parking spaces.

Figure 7 illustrates the number of occupied parking spaces at different times of the day. It shows a comparison between parking occupancy in the two environments unguided and guided. The guided environment affects vehicles looking for parking spaces. Therefore, the parking occupancy rates are optimized to 28.38% (Figure 7.a). A comparison of figures 7.b and 7.c shows that guided environment is more efficient than unguided environment. The guided environment increases the occupancy rates for both on-street and off-street parking. These results also confirm the effectiveness of the parking guidance system.
C. Parking managers’ turnover

At this level, we study the impact of guidance on parking managers’ turnover.

![Figure 8. Parking managers’ turnovers](image)

Figure 8 illustrates the total turnover of parking spaces in each of the two environments (unguided and guided). Turnovers, especially during peak hours, is very high. It is due to the fact that the parking lots are close to being fully occupied. At the end of a simulation day, turnover is 33741 TND for guided environment, compared to 23857 TND for unguided environment. The turnover increased by 29.29%. Therefore, parking managers should apply the parking guidance system.

D. Travel distance

The travel distance is defined as the total distance traveled by a vehicle.

![Figure 9. Travel distance](image)

Figure 9 illustrates a significant reduction in travel distances. Travel distance is 3650km for unguided environment and 3200km for guided environment. Then, 450 kilometers are reduced. The results support the idea that parking guidance systems reduce traffic congestion.

E. Walking time

The figure 10 illustrates the walking time from the parking j to the final destination d.
Figure 10. Walking time

The guided environment increases drivers' walking time compared to unguided environment. For guided environment, walking time is estimated at 13 minutes, while for unguided environment walking time is 12.14 minutes. An increase in walking time is related to the spatial dispersion of drivers in parking lots. The parking guidance system involves a sensible increase in walking time.

F. Social well-being

Social well-being is calculated as the sum of all the conductors' utility.

Figure 11. Social well-being

Figure 11 illustrates the social well-being change. It's lower for unguided environment than guided environment. The decrease is attributed to a reduction in parking search traffic, and travel distances. Even though walking time increased when guided environment was applied, smart parking guidance provided the lowest travel costs to drivers. The average social well-being of conductors is 25 for unguided environment and 103 for guided environment (iteration N° 10). As a conclusion, the guidance to available parking spaces maximizes the user's utility.

G. Environmental Cost

This section evaluates firstly the average saving of energy consumption and secondly the average carbon dioxide emissions.

G.1. Average saving of energy consumption

The transport sector in Tunisia is ranked second in energy consumption. It accounted for 34% of total energy consumption (The National Agency for Energy Conservation, 2010). The road transport sector represents 82% of the sector's consumption, followed by air, maritime, and railway transportation. A decrease in travel distance is accompanied by a decrease in energy consumption. Depending on the travel distance, the average saving of energy consumption can be calculated as follows:
\[ \text{ASEC} = \text{NV} \times \text{AFC} \times \text{TD} \times \text{APF} \]

Where:
- ASEC: Average Saving of Energy Consumption,
- NV: number of vehicles,
- AFC: average fuel consumption per 100 km (7 liters/100 km = 7%),
- TD: travel distance,
- APF: average price of fuel.

The table 1 shows the main differences between the two environments in terms of travel distance (total), and corresponding average saving of energy consumption. Guided environment is guaranteed to be more efficient than unguided environment. The average saving of energy consumption for the two environments is as follows:

\[
\text{ASEC} = 20000 \times 7\% \times 3650 \times 1820 = 46.501 \times 10^8 \text{ (unguided environment)} \\
\text{ASEC} = 20000 \times 7\% \times 3200 \times 1820 = 40.768 \times 10^8 \text{ (guided environment)}
\]

Reduction of travel distance (guided environment), including a reduction of \(5.733 \times 10^8\) in average saving of energy consumption, equivalent to a reduction of approximately 12.32%.

<table>
<thead>
<tr>
<th>Environment</th>
<th>unguided</th>
<th>guided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel distance</td>
<td>3650 km</td>
<td>3200 km</td>
</tr>
<tr>
<td>Average saving of energy consumption</td>
<td>46.501*10^8</td>
<td>40.768*10^8</td>
</tr>
</tbody>
</table>

**G.2. Average carbon dioxide emissions**

Carbon dioxide (CO2) emissions represents one of the most detrimental effects of transportation on the environment. The official reports state that Tunisia's emissions of carbon dioxide have continued to rise (National Institute of Statistics, 2015). In Tunisia, 66% of cars are gasoline, 34% are diesel (The National Agency for Energy Conservation, 2010). In average, a vehicle consumes 7 liters per 100 kilometers. Knowing that one liter of diesel emits 2640g of CO2, diesel vehicle emits 184.8g of CO2 per kilometer \((7 \times 2640 / 100)\), on average. In parallel one liter of gasoline emits 2392g of CO2, while a gasoline vehicle emits 167.44g of CO2/km \((7 \times 2392 / 100)\). Hence, we can calculate the average carbon dioxide emissions (ACDE), at period \(t\), by using the equation below:

\[
\text{ACDE} = \text{ACDE}_{\text{gasoline}} + \text{ACDE}_{\text{diesel}} \\
\text{ACDE} = [(\text{NV}_{\text{gasoline}} \times \text{TD}_{\text{veh}} \times 167.44) + (\text{NV}_{\text{diesel}} \times \text{TD}_{\text{veh}} \times 184.8)] \\
\text{ACDE} = [(\text{NV} \times 66\%) \times (\text{TD} \div \text{NV}) \times 167.44] + [(\text{NV} \times 34\%) \times (\text{TD} \div \text{NV}) \times 184.8]
\]

Where
- ACDE: average carbon dioxide emissions
- ACDE_{\text{gasoline}}: average carbon dioxide emissions for gasoline vehicle
- ACDE_{\text{diesel}}: average carbon dioxide emissions for diesel vehicle
- NV: number of vehicles
- DP: travel distance
- NV_{\text{gasoline}}: number of gasoline vehicle
- DP_{\text{veh}}: average travel distance
- NV_{\text{diesel}}: number of diesel vehicle

<table>
<thead>
<tr>
<th>Environment</th>
<th>unguided</th>
<th>guided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel distance</td>
<td>3650 km</td>
<td>3200 km</td>
</tr>
<tr>
<td>average carbon dioxide emissions (g de CO2)</td>
<td>63.2699*10^6</td>
<td>55.4695*10^6</td>
</tr>
</tbody>
</table>
A diminution of the travel distance would reduce the quantity of CO2 emitted during the simulation. According to guided environment, the total quantity of carbon dioxide (CO2) has reduced by 12.32%.

IV. CONCLUSION

At present, Tunisia does not have a well-developed parking management system, and innovation is in its embryonic stages. Developing a smart parking system could lead to interesting practical results. In this paper, we propose a smart parking guidance system that can respond in real-time to the diverse requirements of drivers and parking managers. Multi-agent approach is used in this system.

Simulations were conducted on the road network of Tunis city-center. The numerical results illustrate the improvements that the parking guidance system is expected to bring, compared to a unguided driving environment. In addition, results were analyzed both from the perspective of the operator (parking manager) and from the perspective of the conductor (parking service consumer).

It is crucial to compare the simulation sorts for the two environments (unguided and guided). The smart parking guidance system mitigates traffic congestion by 15.51%, minimizes travel distance by 12.3%, reduces energy consumption and carbon dioxide emissions by 12.33%, increases revenue for parking managers by 29.29%, improves walking time by 5.32, and improves social well-being by 75.72.

In the following studies, an intelligent system based on dynamic parking pricing is an option that is worth exploring. If we have reliable sources for predicting parking occupancy, we could apply dynamic parking pricing to verify the parking demand for each parking facility, as well as the total travel demand in the road network. The dynamic price can be readjusted according to parking occupancy and demands.

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AUTHORS

First Author – Sana Ben Hassine, assistant professor, Higher Institute of Finance and Taxation of Sousse, Tunisia, sana.benhassine@ymail.com
Second Author – Rafaa Mraihi, professor, Higher School of Business of Tunis, Tunisia, rafa.mraihi@gmail.com
Third Author – Elyes Kooli, associated professor, Higher Institute for Technological Studies of Ksar Hellal, Tunisia, elyes.kooli@ksarhelal.r-iset.tn

Correspondence Author – Sana Ben Hassine, sana.benhassine@ymail.com, 00216 54 74 54 54.
Radiographic Evaluation of Ankle Syndesmosis using Anterior Tibiofibular Ratio (ATFR) and Anteroposterior Tibiofibular Ratio (APTF): A Pilot Study

Jeremy D. Iturriaga, MD, DPAFP, DPBO*, Lucille P. Detoyato, MD, FPOA*

* Western Visayas Medical Center
Department of Orthopaedics
Iloilo City, Philippines

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Abstract

Objectives: To determine the ankle syndesmosis radiographically using Anterior Tibiofibular Ratio (ATFR) and Anteroposterior Tibiofibular Ratio (APTF) of selected tertiary government hospital employees.

Methods: Four observers namely two consultants and two residents, were employed randomly using a simple randomization, from a pool of six consultants and thirteen residents in order to measure the ATFR and APTF ratio of the lateral ankle radiographs. Forty lateral ankle radiographs were initially assessed in a specific order. Another assessment was done three weeks after the first observation by the same observers but with rearranged order of the previously assessed radiographs. Single blinding was applied to observers.

Results: There were twenty subjects included in this study with a total of 40 lateral ankle radiographs, which was based on the inclusion and exclusion criteria. ATFR mean is 0.41 and the APTF ratio mean is 0.90. Paired t-test results showed no significant difference when comparing the right and left ankle among different observers for both ATFR and APTF ratio. Likewise, the t-test comparing sexes showed no significant difference for all observers on both ATFR and APTF ratio.

Conclusion: This study was able to determine the Anterior TibioFibular Ratio and AnteroPosterior TibioFibular ratio of Filipino subjects. Furthermore, ATFR and APTF ratio are both reliable and reproducible tools in the measurement of the ankle syndesmosis.

Index Terms- ATFR, APTF ratio, Ankle syndesmosis, Radiograph

I. INTRODUCTION

The integrity of the ankle mortise relies on the relationship of the distal tibia and fibula around the ankle, where the syndesmotic ligament complex is found and works to resist rotational, translational as well as axial force. Injuries to the ankle can have an associated disruption to the ankle syndesmosis, although injury to the syndesmosis alone may occur.

In the study of Vucivekic et. al in 1980, syndesmosis injuries arise in approximately 10% of all patients with ankle fractures although some report showed even up to 13 per cent of syndesmotic injuries found in ankle fractures. Still other authors suppose that the incidence may even be as high as 40% in athletes, and syndesmotic disruption can even occur in such a simple ankle sprain.

As stated by Heckman in 2015, the relationship between the tibia and fibula centers on the syndesmosis where the fibula lies in the incisura of the lateral aspect of the tibia. There are important ligaments that stabilize the syndesmosis and these are the anterior-inferior tibiofibular ligament (AITFL), the posterior-inferior tibiofibular ligament (PITFL), and the interosseous ligament which is confluent with the interosseous membrane above.

In an article published by Ramsey and company in 1976, where cadaveric investigation was assessed and it showed that disruption and widening of the ankle syndesmosis results in shifting of the talus laterally. A 1 mm of lateral talar shift reduces the contact area of the

talus to the tibial plafond by as much as 42%. Thus, it is considered important to accurately reduce syndesmotic disruption to prevent poor functional outcome.

In 1989, a journal published by Harper et, al. described the radiographic relationships of the distal tibiofibular syndesmosis which was considered to be the normal values. These includes the following: first, the tibiofibular clear space (TFCS) on the AP and mortise view which is less than 6 mm; next, the tibiofibular overlap (TFO) on the AP view of more than 6 mm or 42% of the fibular width, and (3) tibiofibular overlap on the mortise view of more than 1 mm.

Aside from radiography, there are other clinical diagnostic tests used to diagnose syndesmotic injuries including CT scan, even MRI and Arthroscopy but these tests are considered costly economic wise especially in our setting.

In 2013, Grenier et. al, published a study of a new radiographic measurement using lateral view of ankle in normal adults: the anteroposterior tibiofibular ratio (APTF) to determine the reliability of standard lateral ankle radiograph in diagnosing syndesmotic integrity. In the same year, Croft et. al, also made a study of the lateral ankle using anterior tibiofibular ratio (ATFR) that will add to the current diagnostic tools that delineate the ankle syndesmosis.

The purpose of this study will be to validate the ATFR and the APTF ratio on a normal lateral ankle radiograph among Filipinos that would increase the reliability of standard radiography in diagnosing syndesmotic integrity and to aid in intraoperative decision making on fixation of the syndesmosis.

**Objectives**

**General Objective:**
To determine the ankle syndesmosis radiographically using Anterior Tibiofibular Ratio (ATFR) and Anteroposterior Tibiofibular Ratio (APTF) of selected WVMC employees at Western Visayas Medical Center (WVMC).

**Specific Objectives:**
1. To determine the ATFR of selected WVMC employees.
2. To determine the APTF ratio of selected WVMC employees.
3. To determine if there is a significant difference of ATFR and APTF ratio of the left and right ankle among selected WVMC employees among selected observers

**II. DATA COLLECTION**

This study was designed to determine the Anterior Tibiofibular Ratio and Anteroposterior Tibiofibular ratio among selected WVMC employees using lateral radiography of the ankle. This research is a Prospective Cross-Sectional, Correlational study which was conducted at Western Visayas Medical Center from December 2020 until January 2021.

The study population were Western Visayas Medical Center employees who had no prior history of injury to the ankle. A simple randomization using a randomization platform was utilized from an internet website “randomizer.org” from a pool of 1075 employees. Subjects signed an informed consent form approved by the ethics committee of our institution. For subjects who refused to give consent, randomization with replacement was employed. All subjects wore lead protection during the radiological imaging procedure.

**Inclusion Criteria**
Radiographs included in this study met all of the following criteria:
1) patient is aged 21 years old or older.
2) patient had no documented ankle joint disease or condition.
3) a true lateral ankle view showing superimposition of the talar domes are visible
4) senior radiologic technicians will be assigned to take the X-ray

**Exclusion Criteria**
Radiographs excluded in this study were those who have any of the following:
1) Poorly taken radiograph including blurry films or with artifacts,
2) Patient who underwent prior ankle surgery,
3) Patient who had history of trauma to the ankle,
4) Pregnant subjects

**Withdrawal Criteria**
A. Withdrawal of the Subject by Principal Investigator
1) Principal investigator may remove or withdraw a subject at any time in his discretion in circumstances wherein the safety of subject is compromised or the subject is non-compliant.

B. Voluntary Withdrawal by the Subject
1) Subject who wishes to withdraw from the study at any given time for which he or she has previously gave consent.

Sample Size
A total of twenty subjects were included in this study, which produced 40 lateral ankle radiographs as recommended by Harrison et al., (2001) in conducting a validation or reliability study of a new radiological method, particularly in line-drawing radiographic procedures. Harrison et al., (2001) recommended the following:
1. At least three observers should be used. This will create three pairs for an analysis of interobserver reliability.
2. Between 30 to 60 radiographs should be used. This provides enough comparisons of measurements to provide meaningful results.
3. All observers should measure all radiographs at least twice with a time delay. This will provide at least three sets of intraobserver data.
4. ICCs for both interobserver and intraobserver reliability should be provided; any additional tests are welcome.

Description of the Study Procedure
Four observers, two (2) Orthopaedic consultants and two (2) Orthopaedic residents, were employed randomly using a simple randomization platform from an internet website “randomizer.org”, from a pool of six (6) consultants and thirteen residents measured the ATFR and APTF ratio of the lateral ankle radiographs. Forty lateral ankle radiographs were initially assessed by the observers in a specific order. Another assessment was made three weeks after the first observation by the same observers but with rearranged order of the previously selected and assessed radiographs. Single blinding was applied to observers. The radiographs were evaluated with the use of Picture Archiving and Communication System (PACS).

Statistical Tool
Data was analyzed using SPSS version 25. 95% confidence interval will be used. A paired t test was used to compare the right and left measures and the correlation was assessed by a Pearson test.

| Table 1. Level of acceptability as clinical measure by Portney and Watkins (2000) |
|-----------------------------|-----------------|-----------------|
| 0.99           | Excellent      | Clinical Measures |
| 0.96           |                 |                 |
| 0.90           |                 |                 |
| 0.89           |                 | Good            |
| 0.80           |                 |                 |
| 0.75           |                 | Poor to moderate |
| 0.50-74        | Good            |                 |

III. RESULTS AND DISCUSSION

Results
There were twenty subjects included in this study with a total of 40 lateral ankle radiographs, which was based on the inclusion and exclusion criteria. 12 subjects were males. The mean age of the subjects was 34.3 (22 – 51) years old. ATFR mean is 0.41 (sd 0.06651) with a range of 0.26-0.68 (Table 3). For the APTF ratio, the mean is 0.90 (sd 0.077) with a range of 0.75-1.20 (Table 3.).

The paired t-test comparing the right and left ankle was not significantly different among observers, (right ATFR for observers A and B is 0.123 and 0.931 for observers C and D). Same is true with the APTF ratio which revealed a not statistically significant difference for all observers (right APTF ratio for observers A and B is 0.259 while 0.325 for observers C and D (Table 8). The t-test comparing sexes showed no significant difference for all observers on both ATFR and APTF (Table 9).ow it is the time to articulate the research work with ideas gathered in above steps by adopting any of below suitable approaches:

<table>
<thead>
<tr>
<th>Table 2. Clinical and Demographic Characteristics of Subjects</th>
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<tbody>
<tr>
<td>Sidedness</td>
</tr>
<tr>
<td>Right</td>
</tr>
</tbody>
</table>
Sex

<table>
<thead>
<tr>
<th></th>
<th>Left</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Mean Age</td>
<td>(34.3) 22-51</td>
<td></td>
</tr>
</tbody>
</table>

### Table 3. Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>ATFR</th>
<th>APTF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.41</td>
<td>0.90</td>
</tr>
<tr>
<td>SD</td>
<td>0.06651</td>
<td>0.077</td>
</tr>
<tr>
<td>Range</td>
<td>0.26-0.68</td>
<td>0.75-1.20</td>
</tr>
</tbody>
</table>

### Table 4. Paired t-Test for Sidedness

<table>
<thead>
<tr>
<th></th>
<th>APTF</th>
<th>ATFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observer A and B</td>
<td>0.259</td>
<td>0.123</td>
</tr>
<tr>
<td>Observer C and D</td>
<td>0.325</td>
<td>0.931</td>
</tr>
</tbody>
</table>

### Table 5. Paired t-Test for Sex

<table>
<thead>
<tr>
<th></th>
<th>APTF</th>
<th>ATFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observer A and B</td>
<td>0.214</td>
<td>0.051</td>
</tr>
<tr>
<td>Observer C and D</td>
<td>0.449</td>
<td>0.914</td>
</tr>
</tbody>
</table>

**Discussion**

It has been known that an injury to the ankle syndesmosis leads to incongruency of the mortise and can give rise to ankle instability, pain and arthritis. Hence, judicious restoration of ankle syndesmosis is a must in order to prevent long term complications.

Several textbooks and other literatures recommend radiographic measurements in evaluating the syndesmosis on AP and mortise view of the ankle. Nonetheless, Beumer in 2004 believed that these parameters were not optimal to assess ankle syndesmosis. To reliably evaluate the syndesmosis, CT scan and MRI are indeed better option as well as considered to be superior to plain radiograph. On the contrary, intraoperative CT scan evaluation is not generally available to some surgeons. In this regard, Grenier et. al, in 2013 and Croft and colleagues in 2015, established new radiographic parameters; the AnteroPosterior TibioFibular ratio (APTF) and Anterior TibioFibular Ratio (ATFR) respectively to establish newer criteria for evaluation of syndesmosis.

Anatomic variations due to race can contribute to differences in radiographic measurements. On this account, the author evaluated lateral view of forty ankle radiographs using the APTF and ATFR by Grenier et. al, and Croft et. al, respectively. The APTF ratio is a ratio based on the line made from anterior physeal scar of the distal tibia to the anterior fibular cortex that bisects the physeal scar, and carrying on of that line to the posterior cortex of the distal tibia. Whereas the ATFR describes the ratio of the anterior tibiofibular interval to the tibial width which was described earlier.

In 2013, Grenier et. al, described a new radiographic measurement of ankle syndesmosis utilizing the true lateral view radiograph of the ankle that can be used in the intraoperative evaluation of syndesmos: the AnteroPosterior Tibiofibular Ratio (APTF). The APTF ratio was 0.94 + 0.13 with a range of 0.63 – 1.31. They concluded that this ratio is a new reliable method for radiographically measuring the distal tibiofibular joint anatomy. This study showed APTF ratio of 0.90 + 0.08 with a range of 0.75 – 1.2.

Meanwhile, Croft and colleagues in 2015, also evaluated lateral ankle radiographs utilizing 4 measurements namely tibial width (TW), fibular width (FW), anterior tibiofibular interval (ATFI) and posterior tibiofibular interval (PTFI). By using these measurements, four ratios: PTFI:TW, ATFI:TW, PTFI: (PTFI + FW) and ATFI: (ATFI + FW) were utilized to describe the tibia and fibula relationship were evaluated. Of the 4 ratios, the authors found out that the ATFR (ATFI:TW) ratio has better Intraclass correlation coefficient. They found that the ATFR is equal to 39% + 9% of the tibia should be anterior to the anterior fibular cortex. On that account, they recommended the ATFR as a measure in conjunction with other parameters for evaluation of syndesmotic disruptions. This study
noted that ATFR of 0.41 + 0.07 with a range of 0.26 – 0.68 or 41% + 7% of the tibia is anterior to the anterior fibular cortex when measured 1 cm above the center of tibial plafond.

IV. CONCLUSION AND RECOMMENDATION

In conclusion, APTF and ATFR are both radiographic measurements on the lateral ankle that will add to other imaging and diagnostic studies for evaluation of ankle syndesmosis. In addition, these ratios can further assess the intra-operative reduction of ankle syndesmosis. There was no significant difference of both ratios when it comes to sidedness of the ankle. In addition, both of these ratios are quick and simple to perform and reliable measures as well. Reliability study such as the ICC or Intraclass correlation coefficient should also be included on further studies, as it is one of the descriptive statistics that allows testing the reliability of the study among groups of data.

Further evaluation of these ratios should be conducted to pediatric age population, as well as larger population should be determined since this is a pilot study conducted only in this center.

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REFERENCES

AUTHORS

First Author – Jeremy D. Iturriaga, MD, DPAFP, DPBO, Western Visayas Medical Center Department of Orthopaedics, dr.jeremyiturriaga@gmail.com

Second Author – Lucille P. Detoyato, MD, FPOA, Western Visayas Medical Center Department of Orthopedics, lucilmd@gmail.com
Parenting Problems and Coping Styles during the COVID - 19 Pandemic

Sana Siddiq¹, K. B. Kumar²

¹Scholar, Sweekaar Academy of Rehabilitation Sciences, Telanagana
² Professor and Head, Department of Clinical Psychology, Institute of Mental Health, Sweekaar Academy of Rehabilitation Sciences, Telanagana

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Abstract- A worldwide Coronavirus Disease 2019 (COVID-19) pandemic resulted in a decreased social interaction level, negative emotions, and an increased level of anxiety and stress. Their usual routine was disrupted, their usual routine was radically reduced, and their daily lives were greatly affected. Pandemic-related economic crises have caused widespread unemployment and poverty throughout the world, as well as the loss of jobs and sending back home of migrant workers. Consequently, many people were unable to provide for their families as a result of these losses, including those employed in non-essential industries such as hotels and restaurants, leisure and hospitality, manufacturing, real estate, travel and transportation, and warehousing. Because of deep-rooted gender expectations, mothers are burdened more than fathers by the pandemic due to crippling fears that their families or themselves will become infected. For parents to help their children, reducing stress is essential to their coping strategies. The study aimed to assess the quality of life of parents and determine whether low quality of life is influenced by the difficulties experienced during the Covid-19 Pandemic and/or related to the problems of the children, and whether resilient coping moderates these causal pathways. The sample for this study consisted of 160 parents with a child between the ages of 4 and 10 selected on the basis of a rule of thumb that called for 20 subjects per variable who lived in Hyderabad, Telangana. The results indicate that the relationship between Parental difficulty, Externalizing problems of children, and Quality of Life was significantly negative. Parental quality of life did not correlate significantly with internalizing problems of children. There is no significant correlation between Resilient Coping and Quality of Life, Parental Difficulty, or Resilient Coping and Parental Difficulty. The association between Quality of Life and Parental Difficulty was not moderated by Resilient Coping.

Index Terms- Parenting, COVID-19, Coping Styles, Behaviour Problems, and Quality of Life

I. INTRODUCTION

A Public Health Emergency of International Concern was declared by the World Health Organization on 30th January, 2020, following the outbreak of several cases of COVID-19 infections in China (Burki, 2020). After this, the Indian government on 24th March, 2020, ordered a nationwide lockdown as a measure of safety and prevention, causing people to lose their jobs. Except for those selling necessary goods and hospitals, all businesses were closed by the government (Narayan & Saha, 2020). Those employed in non-essential businesses, such as hotels, restaurants, leisure and hospitality services, manufacturing, real estate, travel and transportation, warehouses, and information and communication technology companies, faced the risk of unemployment and significant loss of income (Dua et al., 2020). Schools, colleges, and daycares were closed during the lockdown, and for children, a sudden switch to home-based learning occurred, as teachers and peers were suddenly removed. Individuals now have to play the role of worker, parent, and teacher all at once due to working from home and closure of daycares and schools (Spinelli et al., 2020).

Psychological stress occurs when an individual's resources are exhausted or exceeded by the environment and endangered the individual (Lazarus and Folkman, 1984). Physiological and psychological problems can result from chronic or long-term stress (Ader & Cohen, 1993). On the other hand, while chronic stress affects people's health, short-term stress has a benefit, since it's one of nature's fundamental survival mechanisms. An individual is able to make the most of short-term stress by coordinating their various organ systems together (Dhabar, 2018). People have benefited from globalization and development in terms of standard of living, added comfort, and improved quality of life (Kumar et al., 2021). However, this has also resulted in highly competitive work environments, excessive workloads and ever-increasing job responsibilities, causing stress (Prasad et al., 2020). In recent decades, work and family responsibilities have become increasingly common (Kumar et al., 2021).

Human behavior increasingly relies on self-concepts as concise measures and critical factors of personality. A person's sense of self encompasses their attitude, judgment, and values regarding their behavior, abilities, and qualities. In a study, the Self-concept questionnaires were used to examine individual perceptions of self and the conceptual and perceptual aspects of those perceptions. As a result, the client demonstrated a positive self-concept across a wide range of behavioral patterns on the test (Ram Kumar, Sailaja &
Jagruth, 2022). In addition to personality characteristics, one must also know their skills and abilities, their occupations, and their physical abilities. An individual's psychological or physical range of ability is pushed beyond their capabilities as a result of occupational stress (Clegg, 2001). It is stressful for employees when they lack the resources to meet their demands (Prasad et al., 2020). The effects of long-term stress include distraction, loss of focus, fatigue, and short temper, which negatively affect personal and social relationships. In addition to psychological problems such as insomnia, anxiety, mood disorders, and ulcers, occupational stress can precipitate physical conditions as well (Jamison et al., 2004). Employees across all sectors are experiencing work-life balance strains in the ongoing pandemic, and this strain is likely to interfere with their personal and home lives (Jamison et al., 2004). It was necessary to make significant adjustments in the workplace such as temporary unemployment, remote work, and excessive and exhausting work for healthcare and janitorial employees, which adversely affected their work-life balance, caused burnout, and negatively affected their personal and social life (Rigotti et al., 2020). In the last decade, remote working has become more common in most occupations, except in essential services like healthcare and janitorial facilities. In order to work from home effectively, individuals with limited experience had to learn new methods, one that required different web applications to be used and practiced. Before even offering adequate training to their employees, corporate leaders decided that working from home would become a permanent solution until things settle down (Hayes et al., 2020). It has been found by Rigotti et al (2020) that healthcare workers are at significant risk of psychological problems because they fear infection and putting themselves, their families, and others at risk of contracting the disease. A study by an Iranian researcher found that nurses were especially susceptible to stress and burnout caused by the pandemic when dealing with patients with COVID-19 (Shoja et al., 2020).

Pandemic-related economic crisis has caused widespread unemployment and poverty around the world (Thakur & Jain, 2020). In addition, Gopalan & Misra (2020) report that migrant workers losing their jobs and being sent back home have been similarly affected by the ongoing pandemic. As a result of these losses, many individuals were unable to provide for their families, such as those employed in non-essential businesses such as hotels and restaurants, leisure and hospitality services, manufacturing, real estate, travel and transportation, warehousing, and other non-essential businesses (Dua et al., 2020). It is likely that these individuals will develop anxiety, mood disorders, self-harm, and suicidality (Thakur & Jain, 2020). An individual who lacks social interactions can suffer from chronic loneliness and boredom due to a lack of social interactions (Hwang et al., 2020; Banerjee & Rai, 2020). Globally, billions of people are quarantined in their own homes due to the ongoing pandemic, where universal lockdown was declared to curb the spread of infection, causing mass panic and anxiety (Banerjee & Rai, 2020). There are also numerous factors that contribute to stress in individuals, including emotional distance, absence of colleagues, lack of routine interaction and advice from peers, family distractions, etc (Marsh et al., 2007; Kaushik & Guleria, 2020). According to Marshall et al. (2007), workplace isolation is a two-dimensional construct that represents individuals' perceptions of isolation at work from co-workers and co-workers' support networks. It is discriminatory to regard COVID-positive individuals as negligent and careless, and to hold them accountable for their status. After recovering, they are prohibited from entering residential areas since they are stereotyped as active spreaders of the virus. (Bhanot et al., 2020). Race, religion, and social status are also known to stigmatize people - North Eastern Indians, Muslims, people from low socioeconomic status, and rural dwellers are accused of spreading the virus actively, resulting in significant psychological distress for them (Haokip et al., 2021).

Individuals now have to play three roles at once as a result of working from home and closing daycares and schools. This causes role overload (Spinelli et al., 2020). Role overload can occur when an individual fails to manage multiple roles effectively without having the resources to pull this off (Golparvar et al., 2012). There is a greater burden on mothers due to deep-rooted gender expectations than on fathers. It is common for women from low socioeconomic status to be expected to do household chores, care for elderly individuals, and care for children without support from their spouses (Fan et al., 2019). The pandemic leaves parents with crippling fears of their families or themselves getting infected (Spinelli et al., 2020). For those with preexisting health conditions, the Coronavirus disease caused by SARS-CoV-2 can have a significant impact on mortality (Rigotti et al., 2020). As a result of being quarantined away from their children and rest of the family, parents suffering from SARS-CoV-2 experienced massive distress (Wamsley et al., 2020). SARS-CoV-2 infected individuals who lose a relative or friend suddenly are experiencing subjective distress because no one is allowed to look at the corpse or grieve according to cultural or religious customs. Moreover, they are not allowed to share or receive in person support from family members going through the same situations (Aguiar et al., 2020). In the midst of the lockdown, food shortages have resulted in a marked increase in food prices, putting a strain on individuals' ability to support their families (Kansiime et al., 2021). The COVID-19 crisis has had a rapid impact on food insecurity. Increasing financial hardships for parents of children eligible for free school meals are associated with food insecurity (Loopstra, 2020).

The problem-focused coping strategy includes active coping, planning and seeking social support, whereas the emotional coping strategy involves seeking emotional support, avoidance, denial, positive reappraisal, isolation, venting, ruminating, wishful thinking, self-blame, positive self talk and exercise are two strategies individuals can use to cope with major stresses (Cooper & Quick, 2017). Parents' coping strategies are how they manage stress, and reducing stress is essential for them to help their children (Solem et al., 2011). The study of Solem et al (2011) found that seeking social support is a very effective coping strategy for parents, since it may aid in reducing the effects of stress. Parents' coping strategies are influenced by their resources and perceptions in the face of the ongoing pandemic. For example, parents whose point of view is positive and whose health is good may see the pandemic from a positive light, resulting in less stress and a better coping and resilience. (Wu & Xu, 2020). Accordingly, discovering new ways to partake in and cherish life during traumatic events can reduce symptoms of post-traumatic stress and increase psychological wellbeing (Dekel et al., 2020).

The COVID -19 lockdown, the first of its kind, has not been adequately researched with regard to parents' and children's mental health. A review concluded that the several research indicated that children with ASD are often reported problem in executive function
in order to have poor working memory capacity, difficulties in switching attention between tasks, and inhibition response problems, which can seriously affect their school performance and everyday functioning (Jagruth et al., 2021). It is the purpose of this study to determine if resilient coping style has a positive effect on parents' quality of life, as well as whether lockdown has negative effects on the behavior of children and the difficulties faced by parents. A study concluded that the Transdisciplinary approach can reduce difficulties in children with Sensory processing disorder particularly in social interactions and improve their behaviour and the sensory pattern which helps to be independent and for a better quality of life of persons’ with SPD (Ram Kumar, et al, 2021). The main purpose of this study was to examine parents' difficulty with parenting, children's behavioral/emotional symptoms and their resilience in dealing with difficult situations

II. METHODS

Aim
The Aim of the study was to assess the quality of life of parents and determine whether low quality of life is influenced by the difficulties experienced during the Covid-19 Pandemic and/or related to the problems of the children, and whether resilient coping moderates these causal pathways.

Objectives
a) To determine the quality of life of parents with at least one child between the ages of 4 and 10 years.
b) To assess the difficulties parents are experiencing as a result of the Covid-19 pandemic.
c) To assess the children's behavioral and emotional symptoms during the pandemic period, as perceived by their parents.
d) To assess the degree of resilient coping of parents.
e) To assess the correlation between resilient coping style and the daily hassles experienced during the pandemic.

Hypotheses
a) There would be a significant difference in the quality of life of parents having at least one child aged between 4 and 10 years.
b) There would be a significant difference in difficulties parents are experiencing as a result of the Covid-19 pandemic.
c) There would be a significant difference in children's behavioral and emotional symptoms during the pandemic period, as perceived by their parents.
d) There would be a significant difference in degree of resilient coping of parents.
e) There would be a significant correlation between resilient coping style and the daily hassles experienced during the pandemic.

Sample
In this study, 160 participants were selected for the study based on a rule of thumb, which called for 20 subjects per variable who were residents of Hyderabad city, Telangana State. Parents with at least one child between the ages of 4 and 10 were eligible; participants were recruited without regard to their age, literacy, occupation, or income. Among the female participants, the number was significantly higher (N = 124) than among the male participants (N = 36).

Parents of those who have at least one child between 4 and 10 years old of either sex and living with family (spouse and child) for at least the last six months. Those parents having a good understanding of English or Hindi as well as the ability to read and write were included in the study. This study excluded parents with a history of mental disorders, including substance abuse disorders, who had been diagnosed with Covid-19 infection in the past year and quarantined, as well as parents who reported severe marital conflict and/or considered legal separation. Participants were given consent forms with details about the study, including its title, purpose, investigator and guide, and consent was obtained from those who were willing to participate in it. It was assured to them that their information would be kept confidential and that they could withdraw from the study at any time.

In the research design, the survey design was adapted using convenience sampling for a cross-sectional assessment of the general population at a particular point in time. The data was collected between 13 December 2020 to 25 April 2021.

Tools:
The Strengths and Difficulties questionnaire is used to screen children for psychosocial problems. It measures both problem behaviors and competencies through 25 items equally divided into five scales measuring (1) emotional symptoms, (2) conduct problems, (3) hyperactivity-inattention, (4) peer problems and (5) prosocial behavior. The SDQ scores can be categorised as normal (0-13), borderline (14-16), and abnormal (17-40). The scale of the total problem had a Cronbach's alpha of 0.77 and test-retest reliability correlation of 0.77.

Individuals' judgements of the impact COVID-19 has had on their quality of life are measured by the COVID-19 - Impact on Quality of Life scale. The scale consists of six negatively worded items, each of which discusses quality of life as it relates to subjective health. Each item asks participants to rate how much they agree with a statement from 'Completely disagree' (scored as 1) to 'Completely agree' (scored as 5). A Cronbach's alpha coefficient of .885 was obtained for the non-clinical sample and .856 for the clinical sample, indicating internal consistency of the scale.

Brief Resilient Coping Scale (BRCS) is designed to measure whether individuals believe they can cope with adverse situations (Sinelcraire and Wallston, 2004). There are four main themes addressed in this questionnaire: creativity, optimism, a dynamic approach to problem solving, and a commitment to emerge victorious in spite of stressful circumstances. The scale consists of 4 positively worded items and individuals are asked to indicate the extent to which each item/statement describes them on a 5 point likert scale ranging from 'Doesn't describe me at all' (scored as 1) to 'Describes me very well' (scored as 5). There are three levels of resilient coping on this scale:
low resilient coping (4 - 13), medium resilient coping (14-16) and high resilient coping (17-20). The Cronbach's alpha coefficient of the BRCS was .78, which indicates internal consistency.

**Procedure**

A total of 160 parents were recruited using the Convenience Sampling method from Hyderabad city of Telangana State based on their accessibility and cooperativeness. In this study, participants were explained the purpose and aim of the study and consent were sought from them with the assurance that confidentiality would be maintained. In the beginning, the researcher sought the help of friends so that he could introduce himself to potential participants by phone. Following that, the researcher visited their homes at their preferred times and dates while keeping in mind the COVID 19 pandemic safety precautions (wearing a mask, keeping six feet away). Furthermore, teachers in local schools who met the selection criteria were also contacted, and parent-teacher meetings were held in several schools to find respondents. Prior to proceeding, permission was sought from school management. Participants who agreed to participate were provided with a Research consent form, a Socio-Demographic questionnaire, the Parent Report Measures for Children and Adolescents SDQ (P) 04-10, the Quarantine Parent Risk Index, the COVID -19 - Impact on Quality of Life scale, as well as the Brief Resilient Coping Scale.

**Statistical Analyses**

In order to analyze the socio-demographic characteristics of the sample, descriptive statistics such as Mean, SD, and percentage were used. In order to determine the normal distribution of data, skewness and kurtosis were calculated, and Pearson's correlation was used to examine the relationship between the variables. A linear regression model was used to analyze the predictor variables' role in predicting the criterion and to determine whether there exists a moderation between the variables by doing an independent samples t test.

**III. RESULTS**

A primary objective of this study was to evaluate the quality of life of parents and determine if perceived difficulties and burden during the COVID -19 pandemic are related to their children's problems, and whether resilient coping moderates these causal pathways. A descriptive statistic, such as Mean and Standard Deviation, was calculated for the sociodemographic data.

![Figure 1: Gender of the participants](image-url)
Figure 2: Education of the participants

Figure 3: Employment of the participants

Figure 4: Family Type of participants
The socio-demographic data displayed in Figures 1 to 5 indicate that most participants were between 30-40 years old, with a substantially higher percentage of females than males. Nearly 60% of the participants were working individuals and lived in nuclear families, with most being graduates or postgraduates. The income of all participants ranged between Rs. 30,000 and Rs. 1 lakh, with about 77% of them having a family income of that level.

**Table 1: Mean, SD values of specific measures employed of participants**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Measure</th>
<th>Mean(±)SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>SDQ Externalizing</td>
<td>7.34 (±) 3.35</td>
</tr>
<tr>
<td></td>
<td>Internalizing</td>
<td>4.93 (±) 3.14</td>
</tr>
<tr>
<td>2.</td>
<td>Parental Difficulty</td>
<td>41.77 (±) 15.52</td>
</tr>
<tr>
<td>3.</td>
<td>Quality of Life</td>
<td>2.56 (±) 0.86</td>
</tr>
<tr>
<td>4.</td>
<td>Resilient Coping</td>
<td>14.98 (±) 2.94</td>
</tr>
<tr>
<td>5.</td>
<td>Perceived Burden</td>
<td>0.24 (±) 0.61</td>
</tr>
</tbody>
</table>

The table 1 presents the Mean and SD values of the specific measures that participants took. The results of the Strengths and Difficulties questionnaire show that the Mean (±) SD values for externalizing and internalizing are 7.34 (±) 3.35 and 4.93 (±) 3.14 respectively, on the Strengths and Difficulties questionnaire. The Mean (±) SD values of parental difficulty, Quality of life, Resilient coping and Perceived burden are 41.77 (±) 15.52, 2.56 (±) 0.86, 14.98 (±) 2.94 and 0.24 (±) 0.61 respectively.

**Table 2: Gives correlation between quality of life and other variables**

<table>
<thead>
<tr>
<th>Variables</th>
<th>QOL r</th>
<th>Significance (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental Difficulty</td>
<td>0.491</td>
<td>0.000</td>
</tr>
<tr>
<td>Externalizing</td>
<td>0.164</td>
<td>0.038</td>
</tr>
<tr>
<td>Internalizing</td>
<td>0.120</td>
<td>0.131</td>
</tr>
<tr>
<td>Perceived Burden</td>
<td>0.070</td>
<td>0.382</td>
</tr>
<tr>
<td>Resilient Coping</td>
<td>-0.079</td>
<td>0.162</td>
</tr>
</tbody>
</table>

The Pearson's correlation between QoL and Parental Difficulty is shown in Table 2. According to the study, parental difficulty and quality of life are significantly correlated. Pearson's correlations are also shown in this table between QoL and Internalizing and QoL and Externalizing. According to Table 2, there was a significant correlation between QoL and Externalizing, but not between QoL and Internalizing. Thus, externalizing problems compromise the quality of life of parents; internalizing problems do not compromise the quality of life of children.
Table 3: Gives correlation between resilient coping and other variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Resilient Coping</th>
<th>Significance (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental Difficulty</td>
<td>0.015</td>
<td>0.851</td>
</tr>
<tr>
<td>Quality of life</td>
<td>-0.129</td>
<td>0.104</td>
</tr>
</tbody>
</table>

In this table, Pearson's correlations are also shown between Resilient Coping and parental difficulty and Resilient Coping and quality of life. The results of Table 3 showed that Parental Difficulty was associated with QoL by 23%, whereas Resilient Coping was not associated with QoL of parents.

Table 4: Summary of Regression Models of QoL and Parental difficulty

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of est</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.491</td>
<td>0.241</td>
<td>0.231</td>
<td>0.75909</td>
<td>50.301</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Predictors: (Constant), Parental Difficulty
Dependant Variable: QoL

Table 5: Summary of Regression Models of QoL and Resilient Coping.

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of est.</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.129</td>
<td>0.017</td>
<td>0.010</td>
<td>0.86429</td>
<td>2.680</td>
<td>0.104</td>
</tr>
</tbody>
</table>

Predictors: (Constant), Resilient Coping
Dependant Variable: QoL

Using regression analysis, it was found that Perceived Burden did not have any influence on Quality of Life (Table 6).
### Table 6 Summary of Regression Models of QoL and Perceived Burden.

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of est.</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.070</td>
<td>0.005</td>
<td>-0.001</td>
<td>0.86948</td>
<td>0.767</td>
<td>0.382</td>
</tr>
</tbody>
</table>

Predictors: (Constant), Perceived Burden  
Dependant Variable: QoL

### Table 7 Summary of Regression Models of QoL and Predictor variables  
(Parental Difficulty x Resilient Coping)

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of est.</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.079</td>
<td>0.006</td>
<td>0.000</td>
<td>0.86890</td>
<td>0.980</td>
<td>0.324</td>
</tr>
</tbody>
</table>

Predictors: (Constant), Parental Difficulty x Resilient Coping  
Dependent Variable: QoL

A regression analysis was conducted between Parental Difficulty x Resilient Coping; and Quality of Life. No moderation effect is observed as a result of not being able to predict the dependent variable (QoL) based on the two independent variables (Parental Difficulty x Resilient Coping).

### IV. DISCUSSION

The purpose of this study was to assess the quality of life of parents and determine whether low quality of life is influenced by perceived parental difficulties and perceived burden during the COVID-19 pandemic and/or if resilience moderates these causal pathways.

The results of the current study confirm that parental difficulty and quality of life are significantly negatively correlated. The current study found that as Parental Difficulty increased, Quality of Life decreased. Additionally, a regression analysis revealed that Parental Difficulty is a 23% predictor of Quality of Life. In the Model Summary, Beta was observed to be 0.491, reflecting a significant
relationship between these two variables of 23% (R2 = 0.231). There is an association between increased parental difficulty and poorer quality of life. According to previous studies, the following findings are in agreement with the current findings:

In addition to perceived difficulties of parents, remote working, salary reductions, monetary losses, and the risk of unemployment have been associated with considerable stress by parents (Spinelli et al., 2020; Pfefferbaum et al., 2020). Parents experienced routine issues with scheduling, homeschooling challenges, marital conflicts, etc. on a regular basis during the pandemic (Wu & Xu, 2020) and parents were found insurmountable amounts of stress due to balancing family life and work (Spinelli et al., 2020).

The QoL of parents, i.e. their fulfillment of goals and realization of their abilities and lifestyle, is unmet during the pandemic (Pfefferbaum and al., 2020). The study found a significant negative correlation between externalizing problems of children and parents' quality of life as perceived externalizing problems increase, parents' quality of life decreases. The results of this study did not suggest a significant correlation between internalizing problems of children and quality of life of their parents. This might be because children with internalizing problems have more rigid self-regulation, and direct their negative emotions toward themselves instead of others like their parents and family members (Joussemet et al., 2018). Thus, internalizing problems in children may have a less significant impact on parents than externalizing problems. In contrast, Spinelli et al. (2000) found that the perceived burden of parents significantly impacts children's externalizing and internalizing problems.

The present study found no significant correlation between Resilient Coping and QoL, as well as the relationship between Resilient Coping and Parental Difficulty. As a result, Resilient Coping did not moderate the relationship between QoL and Parental difficulties. Furthermore, perception of burden does not predict the quality of life, thus there is no association between perceived burden and quality of life.

This present study's findings are inconsistent with those of other studies. Adapting to stressful circumstances and daily difficulties is considered a method of reducing physical, emotional, and psychological distress (Snyder, 1999; Cooper & Quick, 2017)).

V. CONCLUSION

A significant negative correlation was found between Parental difficulty and Quality of Life, indicating that Quality of Life decreases when Parental difficulty increases. There is also a significant negative correlation between Externalizing problems of children and the Quality of Life of parents, indicating that as Externalizing problems increase, the Quality of Life decreases. There was no significant correlation between internalizing problems of children and the quality of life of parents.

A positive association between Parental difficulty and Quality of life was found. Resilient Coping does not have a significant correlation with Quality of Life, nor with Parental Difficulty, nor with Resilient Coping. As a result, Resilient Coping did not moderate the association between Quality of Life and Parental Difficulty.

The COVID-19 pandemic lockdown is a particularly stressful experience for parents who must manage both their work and family lives. By analyzing how parents perceive their difficulties and burden, as well as how they affect their quality of life, it will be able to understand how they perceive their difficulties and burden. In light of the novel COVID-19 pandemic, strategies may be developed for helping parents alter their negative perceptions and cope better, thereby improving their quality of life.

Limitations

- This study sample does not represent the entire parent population due to the restrictions imposed by the ongoing pandemic.
- In the current study, male participants were underrepresented, and female participants were considerably more numerous than male participants.
- The responses could have been biased since 70% of the participants filled out all measures at home with family members present.
- A few items of one of the scales are not applicable to Indian contexts since it was validated from a different cultural setting.

Suggestions for future

- In light of the novel COVID-19 pandemic, strategies may be developed to assist parents in altering their negative perceptions and coping better.
- Researchers could replicate the present study using newer, more valid, reliable measures and questionnaires that are more applicable to Indians in the COVID-19 context.
- It is possible to replicate this study on a larger scale with a more representative population, since it was limited mainly to females and constrained by pandemic regulations.

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AUTHORS

First Author – Sana Siddiq, Scholar, Sweekaar Academy of Rehabilitation Sciences, Telangana
Second Author – K. B. Kumar, Professor and Head, Department of Clinical Psychology, Institute of Mental Health, Sweekaar Academy of Rehabilitation Sciences, Telangana

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Safety Studies of *Acmella Caulirhiza And Spermacoce Princeae* Used By Postpartum Mothers In Nyamira County, Kenya

1Jesper Nyaboke Onyango*2Dr. Jared Misonge Onyancha, 3 Dr. Jackson Odhiambo Onyuka **, 4 Prof. John Memba Ochora, PhD. 5Patrick Ogembo Getonto

1 Medical Laboratory Department, Mount Kenya University
2 Pharmacognosy Department, Mount Kenya University
3 Medical Laboratory Department, Mount Kenya University
4 Botany Department, Jomo Kenyatta University of Agriculture and Technology
5 Department of Community Health Nursing, Mount Kenya University

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Abstract: Introduction: Puerperal sepsis is the major cause of (31%) maternal mortality. Appropriate care could prevent majority of these deaths. Exogenous and endogenous organisms are the causatives agents. Traditional medicine have been used in treating postpartum sepsis for example *Acmella caulirhiza* used to treat a child’s mouth sores and *Spermacoce princeae* used to accelerate healing of umbilical cord and to clean the system after birth.

Objective: The main objective of the present study was to determine safety of *A. caulirhiza* and *S. princeae* used by postpartum mothers in Nyamira County, Kenya.
Methodology: The study area was Nyamira County where the two plant specimens were collected. Plant materials were identified at East Africa Herbarium. Plant specimens were transported to Mount Kenya University Pharmacognosy laboratory where processing was done. Brine shrimp toxicity testing methods were employed to determine safety of the two crude plant extracts. Data was stored in Excel spread sheet in a personal computer protected with a password. Toxicity results were analyzed using the graph pad prism version 5 to estimate IC50 values. Data was presented using, tables and photographs.

Results: Brine shrimp lethality test of the two plants indicated that the plants were non-toxic.

Conclusion and recommendation: The two plants may be considered safe for use in treating puerperal sepsis though commercially available drugs are recommended as they are highly effective. The two plants may be considered safe for medicinal use and can be a potential source of complementary and modern medicine. Further studies are recommended on genotoxicity of this plant extracts on *S. aureus* and *E. coli* genes.

Index Terms- Traditional medicine, brine shrimp and safety.

I. INTRODUCTION

Puerperal sepsis is a commonly pregnancy-related state which could lead to obstetric shock or death (Shagufta *et al.*, 2015). Puerperal infection has been the leading cause of maternal morbidity and mortality globally World Health Organization (2012) and it continues to be a significant public health problem worldwide, posing a major threat to women (Shagufta *et al.*, 2015). Puerperal sepsis arises in a woman, amid the onset of labour to 42 days postpartum (Seale *et al.*, 2009).

Medicinal plants play important role during birth and postpartum in several rural areas of the world (Vichith *et al.*, 2011). Traditional medicine, being the total knowledge, abilities and practices grounded on ideas, beliefs and capabilities, native to diverse cultures used to preserve health, identify, treat and prevent physical and psychological illnesses (WHO, 2008). Nowadays, isolation and characterization of biologically active compounds from medicinal plants continues and drug discovery techniques have been applied to the standardization of herbal medicines, to elucidate analytical marker compounds (Marcy and Douglas, 2005).

Medicinal plants used to manage postpartum complications include the following: *Hydrocotyle manii* and *Centella asiatica* plant species which belongs to Apiaceae family. The two plants are both used to manage abdominal pains after birth (Jeruto *et al.*, 2015).

*Acmella caulirhiza* is a flowering herbal plant, which belongs to Compositae/Asteraceae family (Berhane *et al.*, 2014). Locally it is known as Ekenunyuntamonwa (Ekegusii) and Ajuok-olwa Salamatwe (Dholuo) (Kokwaro, 2009). It is an annual or perennial herb which is used by different communities in Kenya and the rest of Africa countries to treat various medical conditions. Example in Kenya, its flowers
and leaves are used to treat venereal diseases, decayed teeth, gingivitis or wounds in the mouth, toothache and sore throat (Jeruto et al., 2015; Kipruto et al., 2013). It is used to relief painful sores of the mouth, gums and throat, as well as stomach ache (Kokwaro 2009). The Zulu people of South Africa use *A. caulirhiza* as a local analgesic for toothache and to ease sensitivity of gums during dental extractions (Crouch et al., 2005).

*Spermacoce princeae*

*Spermacoce princeae* is flowering herbal plant which belongs to the family Rubiaceae (Augustin et al., 2015). Locally it is known as Omoutkiebo (Ekegusii), Gakungathe (kikuyu), Murkugwet (kipsigis) and Nyamwoch (Dholuo) (Kokwaro, 2009). At maturity, *Spermacoce princeae* produces white flower. Rubiaceae family grows in tropical, subtropical, temperate regions and consist more than 100 000 species divided into 600 classes. *Spermacoce princeae* is used in the Kenya to treat bacterial infections (Jeruto et al., 2011). Water extracts of leaves and roots are used to treat Chronic asthma, cancer, wounds, eye problems, mastitis in cows, venereal diseases, skin diseases, pneumonia, typhoid, caterpillar bites and diarrhea (Jeruto et al., 2011). The water macerate of leaves and stem is used in treating female infertility in Baham, Cameroon (Telefo et al., 2011). Leaves warmed gently are crushed, diversified using red oil and salt then orally taken in treatment of kidney diseases (Focho et al., 2009). Leaves and roots are used to treat venereal diseases (Jeruto et al., 2015). In Uganda this herb is used to quicken delivery (Jane et al., 2011). For the purpose of enlightening the consumers on possible toxicological risks associated with consumption in treatment of some bacterial and fungi infections, safety of these plants were assessed using brine shrimp.

**II. MATERIAL AND METHODS**

**Study Area**

The study site was North Mugirango and West Mugirango constituencies of Nyamira County. The study points in West Mugirango constituency were; Sironya (0° 33’14.8536 S and 34° 58’ 2.4996 E), Bonyunyu (0° 31’36.2532 S and 34° 53’20.4108 E) and miruka (0° 29’13.902 S and 34° 53’20.3208 E) whereas the study point in North Mugirango constituency was; Magong’a (0° 28’ 46.7724 S and 34° 57’6.4836 E) in Nyamira County. In this County, local inhabitants regularly use medicinal plants for personal and domestic animal health. Local inhabitants in this County, follow traditional beliefs and customs. Further, most inhabitants living in this area have a tendency of harvesting the medicinal plants from undisturbed vegetation. This is due to the fact that many plant species grow in the study region (Omwenga et al., 2015). Postnatal mothers use *Acmella caulirhiza* and *Spermacoce princeae* to treat child sores and to clean reproductive system respectively in women after birth. Nyamira County is one of highly populated area with approximately 912.5 Km² with a population of 598,252 and a population density of 656 persons per Km² according to (KNBS, 2009).

**Plant materials collection**

*Acmella caulirhiza* and *Spermacoce princeae* medicinal plant specimen were collected from West Mugirango and North mugirango constituencies in Nyamira County with acceptable bio-conservation methods (WHO, 2003a). Harvesting was done in a dry weather morning after the dew had evaporated (Prajapati et al., 2010). The two specimens were carried separately in gunny bags and transported to Pharmacognosy Laboratory of Mount Kenya University within 72 hours of collection (WHO, 2003a).
### Plate 3.2 Two medicinal plant materials collected

(A) *Acmella caulirhiza*  
(B) *Spermacoce princeae*

#### Processing of plant materials

Processing was done within 72 hours after collection. Herbarium preparations were established and the voucher specimens were processed in duplicate. They were mounted on herbarium sheets, pressed to flatten, to dry and were labeled. Voucher specimen (Number JN001 and JN002) were identified at East African Herbarium in the National Museums of Kenya on basis of morphological characteristics and compared with the voucher specimens recorded in East Africa Herbarium. Voucher specimen (Number JN001 and JN002) were deposited at Mount Kenya University Botanical Herbarium Laboratory in the school of Pharmacy. The collected materials were washed thoroughly with tap water and then air dried under a shade at room temperature for one week. When dried, the plant materials (*A. caulirhiza* and *S. princeae*) were ground into course powder using a porcelain mortar and pestle (Hena, *et al.*, 2010). The course powder materials were labeled and stored in brown paper bags under a dry condition, away from light at room temperature till the time of extraction and phytochemical screening (Prajapati *et al.*, 2010).

#### Plant extraction using organic solvents

Using a top loading Weighing Electronic Balance (Models TP-B 2000), 50 grams of the Kenyan *Acmella caulirhiza* and 50 grams *Spermacoce princeae* each powder was weighed separately and transferred into separate conical flasks, labeled with the constituency of collection, plant species and date. Then 500mls of 100% Ethyl Acetate (Loba Chemie Company Lot#L157601502) was added to cover each plant materials and covered with a stopper, then macerated in the solvent at room temperature for 48 hours with intermittent agitation. Using a funnel and Whatman filter paper No. 1 the crude extracts from each of the plant materials were strained separately into glass reagent bottles then covered with stoppers. The process was repeated with 500mls of 100% Ethanol Analar Normapur (VWR Prolabo Company Batch 12D250511) and Methanol (Loba Chemie Company Lot #B193331604). The filtrates were labeled and concentrated in a rotary evaporator at 40 degree Celsius for Ethyl acetate, 60 degree Celsius for Ethanol and Methanol respectively. Using analytical balance, empty beakers were weighed, the extracts from the distillation flask were transferred into them, labeled appropriately and the solvents were evaporated in an Oven set at appropriate temperature. Quantity of each crude plant extract paste was calculated by the formula: Plant crude residue = (weight of beaker + extract) - (weight of empty beaker). The extracted paste of each plant species examined was kept in beakers covered in a refrigerator a waiting for bioactivity assay (Afolayan *et al.*, 20008).

#### Aqueous extraction of crude plant material

Aqueous extracts of *Acmella caulirhiza* and *Spermacoce princeae* was made from crude plant material according to Bibi *et al.*, (2012) by weighing 20 grams of *Acmella caulirhiza* and 20 grams of *Spermacoce princeae*. They were boiled separately in 400mls distilled water in beakers of 400ml capacity on Hot Plate set at 100° C for 5 minutes. The extracts were cooled, using a funnel and Whatman filter paper (No. 1) they were filtered and freeze dried according to Pikal *et al.*, (2010), to extract dry powders from the aqueous solutions of the two plants. Freeze-drying was done in the following steps; freezing, primary drying and secondary drying. Primary drying involves; evacuating the system, increasing shelf temperature resulting to product temperature 2–3° C below collapse temperature. Secondary drying involves; removing unfrozen water from the solute phase by desorption through raising temperatures. The dry and lyophilized extracts were weighed and stored in a freezer for bioactivity testing (Bibi *et al.*, 2012).
Brine Shrimp Lethality Assay using Artemia salina larvae

Artificial sea water was prepared by dissolving 33gms of sera sea salt (USA GB) in 1 liter of distilled water. Brine shrimps were hatched in a round-shaped plastic container which contained a divider in between the chambers (dark small chamber and light larger chamber) with several holes. Prepared sea water (200ml) was poured into both chambers of the container and 5grams of Artemia salina eggs (Original Great Salt Lake USA) were introduced into the dark small chamber. It was covered and a light source provided, aerated well and incubated for 48 hours at room temperature (22-29 degrees Celsius). Active larvae (nauplii) were hatched. The free hatched larvae were attracted by light source and migrated from small hatching compartment into the illuminated larger hatching chamber through a divider in between and were collected and used for Brine Shrimp Lethality assay.

Evaluation of toxicity of Acmella caulirhiza and Spermacoce princeae in Artemia salina larvae was performed according to Sharma et al., (2013). Samples were prepared by dissolving 0.1 g of each (methanol, ethyl acetate, ethanol and aqueous) crude extract in 9ml of distilled water in different test tubes and serial diluted to make the concentration range of 10 µg/ml, 100 µg/ml, 1000 µg/ml then tested by adding 10 brine shrimp larvae. Positive control containing 10 brine shrimp larvae and 10 ml artificial sea water was set. Also a negative control containing 10 brine shrimp larvae and 10 ml dimethyl Sulphoxide was set (Naidu et al., 2014). Experiments were done in triplicate and toxicity was evaluated by inspecting and counting survived larvae after 24 hours using a magnifying glass. Abbott’s formula Somayeh et al., (2015), was used to calculate percentage lethality as shown; Percentage lethality = [(Test − Control)/Control] × 100. IC50 values were estimated using a Graph pad Prism version 5 (Misonge et al., 2015).

Data Analysis and Presentation
Data was stored in Excel spread sheet in a personal computer protected with a password. Also a flash disk secured with a password was used as a backup. The toxicity results were analyzed using the Graph pad Prism version 5 to estimate IC50 values. Data was presented using photograph and tables.

Ethical Considerations
Ethical clearance was obtained from Mount Kenya University E.R.C and NACOSTI before commencement of the study. Toxicity testing was in M.K.U Pharmacognosy laboratory.

III. FINDINGS

Evaluation of Toxicity Levels of the Crude Plant Extracts Using Brine Shrimp
Brine shrimp toxicity is a method of testing bioactive chemicals in natural plant extracts and it is based on the killing ability of test compounds on a zoological organism- brine shrimp (Artemia salina). Table 4.3a, LC50 values of ethyl acetate and ethanol crude plant extract of Acmella caulirhiza had low toxic effects on brine shrimp larvae while methanol and aqueous crude plant extract of the same plant indicated it had no toxic effects on brine shrimp larvae. The classification of toxicity levels was done according to Misonge et al., (2015) methods.

Plate 2a: a Container used to hatch Artemia salina nauplii
Plate 2b: a hatched *Artemia salina* nauplius
Table 4.3a: Percentage Mortality of brine shrimp *Artemia salina* nauplius Treated with *Acmella caulirhiza* Crude Plant Extracts and their IC50

<table>
<thead>
<tr>
<th>Solvent extracts of Dimethyl Sulphoxide</th>
<th>1000 µg/ml</th>
<th>100 µg/ml</th>
<th>10 µg/ml</th>
<th>Sea salt=0 µg/ml</th>
<th>IC50 values µg/ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethyl acetate</td>
<td>100%</td>
<td>50%</td>
<td>30%</td>
<td>20%</td>
<td>0%</td>
</tr>
<tr>
<td>Ethanol extract</td>
<td>100%</td>
<td>50%</td>
<td>30%</td>
<td>30%</td>
<td>0%</td>
</tr>
<tr>
<td>Methanol extract</td>
<td>100%</td>
<td>30%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Aqueous extract</td>
<td>100%</td>
<td>20%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Brine shrimp (*Artemia salina*) were used to assess toxicity of *Spermacoce princeae* crude plant extracts. Table 4.3b, LC50 values of ethyl acetate crude plant extract of *Spermacoce princeae* had low toxic effects on brine shrimp larvae while ethanol, methanol and aqueous crude plant extract of the same plant indicated it had no toxic effects on brine shrimp larvae.

Table 4.3b: Percentage Mortality of Brine Shrimp *Artemia salina* nauplius Treated with *Spermacoce princeae* Crude Plant Extracts and their IC50

<table>
<thead>
<tr>
<th>Solvent Extracts of Dimethyl Sulphoxide</th>
<th>1000 µg/ml</th>
<th>100 µg/ml</th>
<th>10 µg/ml</th>
<th>Sea salt=0 µg/ml</th>
<th>IC50 values µg/ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethyl acetate</td>
<td>100%</td>
<td>50%</td>
<td>30%</td>
<td>20%</td>
<td>0%</td>
</tr>
<tr>
<td>Ethanol extract</td>
<td>100%</td>
<td>40%</td>
<td>40%</td>
<td>30%</td>
<td>0%</td>
</tr>
<tr>
<td>Methanol extract</td>
<td>100%</td>
<td>30%</td>
<td>30%</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>Aqueous extract</td>
<td>100%</td>
<td>30%</td>
<td>20%</td>
<td>10%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Table 4.3c: Classification of Toxicity

<table>
<thead>
<tr>
<th>Classification</th>
<th>Extremely toxic</th>
<th>Very toxic</th>
<th>Highly toxic</th>
<th>Moderately toxic</th>
<th>Lowly toxic</th>
<th>Particularly non-toxic</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC Values 50</td>
<td>≤1 µg/ml</td>
<td>1-100 µg/ml</td>
<td>100-200 µg/ml</td>
<td>200-500 µg/ml</td>
<td>500-1000 µg/ml</td>
<td>≥1000 µg/ml</td>
</tr>
<tr>
<td>Extract</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Ethanol in <em>A. caulirhiza</em>. EthylAqueous and methanol in the two plants.</td>
</tr>
</tbody>
</table>

IV. DISCUSSION

Medicinal plants usage is increasingly popular among the Gusii community of Nyamira County. Many medicinal plants grow around the homestead and have been used naturally for many years by traditional healers to control common health problems. Antimicrobial drug discovery from natural medicinal plants are expected to be effective against multi drug resistant microorganisms (Gemechu et al., 2015).

Evaluation of Toxicity Levels of the Crude Plant Extracts Using Brine Shrimp

Brine Shrimp Lethality Assay is the most suitable method for monitoring biological activities of several plant species. This technique is suitable for preliminary assessment of toxicity levels of crude plant extracts. It is based on the killing ability of the test compounds on a zoological organism-brine shrimp (*Artemia salina*). Lethal dose 50 values of methanol and aqueous extracts of *A. caulirhiza* indicated that
the plant is non-toxic while those of ethyl acetate and ethanol extracts indicated low toxic effects on brine shrimp. On the other hand IC50 values of aqueous, methanol and ethanol extracts of *S. princeae* indicated the plant was non-toxic while ethyl acetate extract showed low toxic effects on brine shrimp. These results concur with those of Augustin *et al.*, (2015), in which he reported that aqueous extract was non-toxic in mice and rats. Therefore the two plants are considered safe.

**Conclusion**

Brine shrimp toxicity testing confirmed that, the two plants can be considered safe for use as medicine. Brine shrimp toxicity study lays a foundation for ethnobotanical and pharmacological investigations for new drug discovery.

**Recommendation**

*A. caulinirhiza* and *S. princeae* plants may be used in treating puerperal sepsis as they can be considered safe. The two plants may be considered safe for medicinal use and can be a potent source of complementary and modern medicine. Further studies are recommended on genotoxicity of this plant extracts on *S. aureus* and *E. coli* genes.

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AUTHORS

First Author – Jespher Nyaboke Onyango, BSc, Mount Kenya University and email address Rebecca.nyaboke059@gmail.com.

Second Author – Jared Misonge Onyancha, MSc, Kenyatta University and email address onyancha.jared@mku.ac.ke

Third Author - Dr. Jackson Odhiambo Onyuka, Phd. Mount Kenya University, and email address jonyuka@mku.ac.ke

Fourth Author – Prof. John Memb Ochora, PhD. Jomo Kenyatta University of Agriculture and Technology, and email address jochora@jkuat.ac.ke

Fifty Author – Patrick Ogembo Getonto, BSc, Mount Kenya University and email address ppgetonto059@gmail.com

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The Influence of Tax Audit, Administration Sanction, Taxpayers’ Understanding, and Tax Amnesty on the Taxpayers’ Compliance in KPP Pratama Batam Utara

Dr. Dian Wahyudin, S. Sos. M. Si¹, Burhan, S.E., M.A²

¹Lecture Institut Ilmu Sosial dan Manajemen STIAMI, Jakarta
²Graduate Institut Ilmu Sosial dan Manajemen STIAMI, Jakarta

e-mail: zahidah181011@gmail.com /telp:+6281284955928
²e-mail: burhanchen456@gmail.com /telp:+6285270104208

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ABSTRACT

Abstract: The legal basis for Tax Collection in Indonesia is the 1945 Constitution Article 23A. Not all individual taxpayers registered in KPP Pratama Batam Utara fulfill their obligations to pay the tax, which means very low tax compliance. The Directorate-General of Tax has the authority to assess the taxpayers’ compliance to meet the tax obligations. The tax sanction is a (preventive) tax instrument for taxpayers to keep them from violating tax values. Understanding the tax regulations affects taxpayers’ compliance with their tax obligations. Tax amnesty helps restructure development through tax. This research aims to partially and simultaneously study the influence of tax audit, administration sanction, regulation understanding, and tax amnesty on taxpayers’ compliance as registered in KPP Pratama Batam Utara. The data in the research was collected using a quantitative approach through questionnaires circulated using Google Form and with the Slovin formula and obtained a total of 98 samples. This research results showed that: 1) tax audit positively and significantly affects the Taxpayers’ Compliance by 0.5%, 2) Administration Sanction positively and significantly affects Taxpayers’ Compliance by 29.8%, 3) tax regulation understanding positively and significantly affects Taxpayers’ Compliance by 25%, 4) as for tax amnesty does not affect the Taxpayers’ Compliance, and 5) tax audit, administration sanction, regulation understanding, and tax amnesty simultaneously affect 46.4 percent of Taxpayers’ Compliance.

Index Term: audit, sanction, understanding, amnesty, compliance

I. Introduction

National development activities require large financing, one way to get funds is by maximizing income in the form of taxes. Taxes are people’s contributions to the state treasury based on the law (which can be enforced) without receiving reciprocal services (counter achievements) which can be directly shown and which are used to pay general expenses (Soemitro, 2011). Taxpayer compliance is very necessary for carrying out obligations in terms of paying taxes so that state financing for national development activities can be realized, and thus the government’s obligation to prosper and prosper and overcome social problems can be carried out. Taxpayer compliance describes a situation where taxpayers can carry out all their obligations and fulfill their rights and relation to taxation (Gunadi, 2013). In recent years, the Government has always failed to achieve its tax revenue target. The Minister of Finance, Sri Mulyani revealed that the main cause of not achieving the tax revenue target was the low compliance of taxpayers in fulfilling their tax obligations.
To determine the level of taxpayer compliance in the self-assessment system regime, a tax audit is an important factor that cannot be missed. In a system where taxpayers are given the full trust to calculate, calculate, deposit, and report their taxes, tax audits are an important instrument to determine whether or not the fulfillment of tax obligations is true or whether a taxpayer is obedient in fulfilling one of his obligations as a citizen.

In addition, based on previous research, some factors can affect taxpayer compliance in paying their tax obligations, namely the provision of Sanctions in the form of Tax Administration Sanctions that are required for taxes for those who do not make payments. Administrative sanctions are the payment of losses to the government, which can be in the form of interest, increases, and fines. Administrative sanctions are given to tax administration violations that do not lead to tax crimes (Tamar, 2019).

In addition to the two factors that have been explained, the taxpayer's understanding of tax regulations is also a dominant factor in its effect on taxpayer compliance. A good and correct understanding of tax regulations must be given to the public, and also tax regulations must have clear tax rates to determine the amount of tax that must be paid. Knowledge of taxation has an important role to grow taxpayer compliance.

In addition to these three important factors, the Government, in this case, the Directorate General of Taxes, seeks to improve taxpayer compliance and pursue tax revenue targets by establishing a tax amnesty policy known as tax amnesty. Tax amnesty or the Voluntary Disclosure Program is a government policy that provides for the elimination of taxes owed by paying a certain amount of ransom.

The phenomenon that occurs in the KPP Pratama Batam Utara is one of the reasons researchers conduct research at the KPP. At first, there was only one KPP Batam, namely KPP Batam. However, in 2016 the division of these KPPs was carried out to become KPP Pratama Batam Utara and KPP Pratama Batam Selatan. Researchers are more interested in conducting a research locus at KPP Pratama Batam Utara because taxpayers at KPP Pratama Batam Utara are more stable than at KPP Pratama Batam Selatan. With a more stable number of taxpayers, it means that the taxpayer population of KPP Pratama Batam Utara is higher than KPP Pratama Batam Selatan, with a larger population it is easier for researchers to determine the research sample and later the influence of independent and independent variables from the research results can be generalized.

II. Methodology

In this study, the research method used is quantitative research because this research uses data collection methods by distributing questionnaires (Sugiyono, 2018). After the data is collected, it will be processed using the SPSS for Windows program (Ghozali, 2016). The population, in this case, is an individual taxpayer who is required to register an annual tax return in 2020, amounting to 67,390 people at the KPP Pratama Batam Utara. The non-probability sampling technique used is purposive sampling, and the research sampling technique uses the Slovin formula so that the total sample in this study is 97.81 rounded up to 98 respondents.

III. Discussions and Results

Table 1. shows the results of classical assumption testing, in this study classical testing was carried out in three ways. Starting from the normality test, continued with the multicollinearity test, the heteroscedasticity test, and finally the autocorrelation test. Where the test results show that the data is normally distributed because the test results are 0.104 > 0.05. The multicollinearity test showed that there was no multicollinearity as indicated by the tolerance value for each independent variable greater than 0.10 and the VIF value less than 10. The test results also showed a RES2 significance value above 0.05, meaning that it was free from heteroscedasticity.

<table>
<thead>
<tr>
<th>Variabel</th>
<th>Normalitas</th>
<th>Multikolinearitas</th>
<th>Heteroskedastisitas</th>
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<tr>
<td>Hasil Pengujian Asumsi Klasik</td>
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<tr>
<td>Tabel 1.</td>
<td>Hasil Pengujian Asumsi Klasik</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Tolerance | VIF
--- | --- | ---
Pemeriksaan Pajak (X₁) | 0.722 | 1.386 | 0.068
Sanksi Administrasi (X₂) | 0.467 | 2.141 | 0.073
Pemahaman Peraturan (X₃) | 0.465 | 2.149 | 0.593
Pengampunan Pajak (X₄) | 0.577 | 1.734 | 0.385

Sumber: data diolah, 2022

From table 2, below, it can be seen from the results of the regression analysis that the coefficient for the moral obligation variable is 0.567, for the service quality variable is 0.072, for the tax sanction variable is 0.536 with a constant of 0.475.

Based on the multiple linear regression equation in Table 2, the regression line equation is obtained which provides information that: Y = 7.895 + 0.005X₁ + 0.298X₂ + 0.250X₃ + 0.006X₄ indicates that if the value of the tax audit variable (X₁), administrative sanctions (X₂), regulatory understanding (X₃), and tax amnesty (X₄) is zero, then the value of Taxpayer Compliance (Y) is 7.895. X₁ = 0.005 means that if the value of tax audit (X₁) increases by 0.005 then Taxpayer Compliance (Y) increases by 0.5 percent. X₂ = 0.298 means that if the value of administrative sanctions (X₂) increases by 0.298 then Taxpayer Compliance (Y) increases by 29.8 percent. X₃ = 0.250 means that if the value of regulatory understanding (X₃) increases by 0.250 then Taxpayer Compliance (Y) increases by 25 percent. X₄ = 0.006 means that if the value of tax amnesty (X₄) increases by 0.006 then Taxpayer Compliance (Y) increases by 0.6 percent. From the above equation, it can be explained that the pattern of influence of the tax audit variable (X₁), administrative sanctions (X₂), regulatory understanding (X₃), and tax amnesty (X₄) on the Taxpayer Compliance variable (Y) is positive. The positive regression coefficient indicates a unidirectional effect, where if the tax audit (X₁), administrative sanctions (X₂), regulatory understanding (X₃), and tax amnesty (X₄) increase, it will be followed by an increase in Taxpayer Compliance (Y).

The coefficient of determination has a function to explain the extent of the ability of the independent variables, namely tax audit (X₁), administrative sanctions (X₂), regulatory understanding (X₃), and tax amnesty (X₄) on the dependent variable (taxpayer compliance). The results of statistical processing assisted by the SPSS 22 program show that the independent variable can explain the dependent variable by 46.4 percent, while the remaining 53.6 percent is explained by other variables that are not included in this model (not studied).

Based on the test results, the count value is 0.119 with a significance of 0.045 < = 0.05. This means that the tax audit has a positive and significant impact on taxpayer compliance at the KPP Pratama Batam Utara. In addition, based on Table 2, the partial effect of the tax audit on taxpayer compliance is 0.5 percent. The results of this study are in line with research conducted by Windasari and Ernandi (2020); and Prayoga et al. (2021) which previously provided empirical evidence that the audit affected taxpayer compliance. This is different from the research conducted by Nugrahanto and Nasution (2019) which states that there is no significant difference between audited and unexamined taxpayers regarding taxpayer compliance. Implement the provisions of tax laws and regulations. This activity is carried out as a form of monitoring the implementation of the self-assessment system to test taxpayer compliance in fulfilling tax obligations that adhere to the Taxation Law. In this study, based on the results of the questionnaire given to taxpayers, taxpayers agree with the statement that tax audits can improve taxpayer compliance. The more efficient the tax audit carried out by the tax officer, the higher the taxpayer's compliance in paying off his tax debt at KPP Pratama Batam Utara.
Based on the results of the tests carried out, the count value was 3.063 with a significant value of 0.003 $\leq$ 0.05. This shows that this study can provide empirical evidence of administrative sanctions having a positive and significant effect on taxpayer compliance at KPP Pratama Batam Utara. In addition, based on Table 2, the partial effect of administrative sanctions on taxpayer compliance is 29.8 percent. In line with the research conducted by Siamena et al. (2017); Siregar (2017); and Bankruptcy et al. (2020) which in his research found that the existence of administrative sanctions given to taxpayers made taxpayers more obedient to the existing tax rules and should thus increase taxpayer compliance in paying off their tax debts. However, different results were presented by Situmorang and Maksum (2019) in their research which found that tax administration sanctions had no effect on individual taxpayer compliance, and this study was located at KPP Pratama Medan Polonia. Administrative sanctions are penalties given to taxpayers for violating the law in the form of payments for losses to the state and sanctions that can be imposed in the form of fines, interest, and tax increases. The existence of this sanction makes taxpayers understand the consequences if they do not fulfill their tax obligations. This administrative sanction can be used as a reference that the provisions of tax laws and regulations will be complied with and this sanction can be used as a tool so that taxpayers do not violate tax norms.

Based on the data analysis that has been done, the count results are 2,768 with a significance value of 0.007 $\leq$ 0.05. This means that this study proves that the understanding of tax regulations has a positive and significant effect on taxpayer compliance at KPP Pratama Batam Utara. In addition, based on Table 2, the partial effect given by the taxpayer's understanding of tax regulations on taxpayer compliance is 25 percent. Supported by research conducted by Prajogo and Widuri (2013); Mostofa et al. (2016); and Khodijah et al. (2021) which also shows the results that the more taxpayers understand the applicable tax rules, the more taxpayer compliance will be in paying off their tax debts. Saragih (2014) in his research found different results, namely providing evidence that at KPP Pratama Medan Kota taxpayers who better understand tax regulations do not affect taxpayer compliance compared to taxpayers who better understand regulations. Taxpayers' understanding of tax regulations is a process where taxpayers know about taxation and apply this knowledge to pay taxes. In this understanding, taxpayers are required to understand and understand the provisions that apply to taxpayers. The higher the taxpayer's understanding of the tax rules, the higher the taxpayer's desire to pay taxes voluntarily which of course affects taxpayer compliance in fulfilling the tax obligations he bears.

Based on the data analysis that has been done, the count results are 0.069 with a significance value of 0.945 $\leq$ 0.05. This means that this study proves that the existence of amnesty for tax debts is not able to affect taxpayer compliance at KPP Pratama Batam Utara. Sari and Fidiana (2017) and Anggarini et al. (2019) also found similar results that the existence of a tax amnesty policy will increase the voluntary willingness of taxpayers to pay off their tax debts, which means increasing taxpayer compliance. Research conducted by Kusumaningrum and Aeni (2017) and Arifin (2018) found different results. In both studies, empirical evidence was found that the existence of a tax amnesty policy or tax amnesty did not affect taxpayer compliance in paying off their tax obligations. Tax amnesty is the provision of tax facilities in the form of exemption within a certain period from the imposition, examination, investigation, and prosecution of assets or income that were previously not or have not been fully taxed, based on an acknowledgment of guilt from the Taxpayer by disclosing assets and paying a ransom. Should there be a government policy to provide forgiveness for the amount of tax debt borne by taxpayers will increase taxpayer compliance to pay off their tax debts. However, in this study, tax amnesty was not able to affect taxpayer compliance at KPP Pratama Batam Utara. Based on the results of respondents' answers conducted by WP KPP Pratama Batam Utara, WP is aware of the tax amnesty, but WP does not feel that the implementation of the tax amnesty will affect taxpayer compliance in paying off their tax debts.

Looking at the results of data analysis, the Fcount value is 14,875 with a significance value of 0.000 $\leq$ 0.05. These results show empirical evidence that tax audits (X1), administrative sanctions (X2), regulatory understanding (X3), and tax amnesty (X4) have a positive and significant effect on taxpayer compliance at KPP Pratama Batam Utara. In addition, based on Table 2, the simultaneous effect shown by tax audits (X1), administrative sanctions (X2), regulatory understanding (X3), and tax amnesty (X4) on taxpayer compliance is 46.4 percent. Tax audit is the authority given to the DGT to conduct audits to test compliance with the fulfillment of taxpayers' tax obligations. In addition, the existence of administrative sanctions is used as a tool to monitor taxpayers not violating the tax norms that apply at that time. Understanding of tax regulations by taxpayers will also affect taxpayer compliance in fulfilling tax obligations. Lastly, there is a tax amnesty which is the government's way of accelerating economic growth and restructuring through the transfer of assets, which will have an impact on increasing domestic liquidity, improving the rupiah exchange rate, lowering interest rates, and increasing investment, encouraging tax reform towards a more equitable taxation system and the expansion of a more valid.
comprehensive and integrated tax database has an impact on the compliance of the taxpayers of KPP Pratama Batam Utara in fulfilling their tax obligations.

IV. Conclusions

Based on the research results, several conclusions can be conveyed in this study. (1) The results of the H1 test provide empirical evidence that the tax audit (X1) has a positive and significant effect of 0.5 percent on KPP Pratama Batam Utara; (2) The results of the H2 test are empirical evidence that partially sanctioned taxes give (X2) a positive and significant effect of 29.8 percent on Mandatory Compliance (Y) at KPP Pratama Batam Utara. (3) The results of the H3 test provide empirical evidence that regulatory understanding (X3) has a positive and significant effect of 25 percent on taxpayer compliance (Y) at KPP Pratama Batam Utara. (4) The results of the H4 test provide empirical evidence that tax amnesty (X4) has no effect on Taxpayer Compliance (Y) at KPP Pratama Batam Utara. (5) The results of the H5 test provide empirical evidence that tax audits (X1), administrative sanctions (X2), regulatory understanding (X3), and tax amnesty (X4) have a positive and significant simultaneous 46.4 percent effect on Taxpayer Compliance (Y) at KPP Pratama Batam Utara.

Some suggestions that can be submitted by researchers based on the conclusions that have been presented are as follows for the tax authorities to provide an understanding of tax audits that may be carried out on taxpayers who are late in submitting their SPT. The government should conduct more detailed socialization regarding the reasons for being given a fine of 50 percent for underpaid taxes if the SPT is filled out incorrectly. The government re-socializes the regulations regarding sanctions that will be borne by taxpayers if the taxpayer experiences delays in paying taxes which leads to the imposition of tax bills. The government should provide a further understanding of the tax amnesty program so that taxpayers know more about the benefits of the tax amnesty policy. The government gives appreciation taxpayers who deposit their taxes on time so that the desire of taxpayers arises to deposit their taxes voluntarily without any coercion.

References


An Investigation Of Agricultural Training Competencies Needed In Vocational Colleges In North Rift Region, Kenya

*Tarus J¹, Ouma P¹ and Waswa P²

Department of Science Education, School of Education, University of Eldoret, P.o.Box 1125, Eldoret.

*Corresponding author’s email address: jepkuruitarus@gmail.com

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ABSTRACT

The agricultural industry globally is frustrated by chronic mismatch between competencies and work, often leading to economic downturn and youth unemployment. The objective of the study was to assess the extent to which the capacity of trainers influences the quality of teaching of Agriculture in selected TVET colleges. The research method used was descriptive. A total of 384 students in TVET institutions studying agriculture were selected from a population frame of 5 TVET colleges using simple random sampling. 16 teaching staff (principals & lecturers) and 14 human resource personnel were purposively selected. Structured questionnaires and interview schedules were employed in collecting the research data from students and human resource personnel. Focus Group Discussions and Key Informants interviews were used to collect data from lecturers and principals respectively. Cronbach Alpha was used to determine the reliability of the questionnaires and a reliability co-efficient of 0.7 was adopted. Hypothesis testing was done by use of chi square at 95% confidence level. The study found that there was a statistically significant relationship between the capacity of the trainers and the quality of training of agriculture in TVET colleges. This study therefore concluded that agricultural training should be matched with the competencies required by the agricultural organizations. It was therefore recommended that for quality training to be achieved there was need to retrain TVET trainers on the competencies they lacked.

Key words: competency, mismatch, curriculum, infrastructure, market needs, training

INTRODUCTION

Training on hands-on competencies has been part of human history from medieval times. Historically, Vocational and Technical Education has been known as ‘‘Education for work.’’ TVET is a key to economic prosperity in developed countries while in developing countries it is seen as a key to economic self-sufficiency (Zirkle, 2017). Students have been training for specific vocations for thousands of years (Maeko & Makgato, 2014). Women learned domestic competencies from their mothers, and young men trained for specific trades under skilled professionals (Brush, 2016). Technical and Vocational Education and Training (TVET) programs and institutions have played a consistent role in agricultural development and economic growth in developing countries over the past 50 years (Jonnes,
2012). Regardless of its true origin, some believe that vocational education began in 626 BC with the Neo-Babylonian Empire and its knack for apprenticeship-run education (Brush, 2016). Notably, vocational education development began in United States (US) in the early 20th century before the great depression. According to American Radio works, on paper, the creation of Vocational Education programs solved major problems like overcrowded classrooms and demand for a skilled workforce. Vocational Education today is a well-developed schooling system which balances class time and work experience. It increases inclusivity, innovation and prosperity (Jonnes, 2018).

The Sub-Saharan Africa region accounts for more than 950 million people, approximately 13% of the global population. By 2050, this share is projected to increase to almost 22% or 2.1 billion. (OECD & FAO, 2016). Agriculture is a graying sector in Africa given that the average age of farmers is about 60 years, despite the fact that 60 per cent of Africa’s population is under 24 years of age. According to Walker & Hofstetter, (2016) ATVET plays a consistent if limited role in approaches to Agricultural development and economic growth over the past 50 years. Formal Agricultural Technical and Vocational Education and Training (ATVET) in many Sub-Saharan African countries were often based on colonial systems where few individuals in the university and colleges benefited (Walker & Hofstetter, 2016). Consensus to provide ATVET in different educational approaches such as formal, non-formal and informal has been put in place, to reach the diverse target groups and to make a wide skill set encompassing technical, soft, entrepreneurial and analytical competencies provision more innovative and up-to-date (FAO, 2014). A major challenge in TVET training in Sub-Saharan Africa is posed by quality in teaching which is characterized by a significant lack of practical relevance and responsiveness to labour market needs, insufficient infrastructure and equipment and extremely low throughputs (Eicker, Haseloff & Lennartz, 2017). Training opportunities for young people in Sub-Saharan Africa and the training offered does not match the needs of the private sector and local administration i.e. they focus much on production competencies than practical competencies. According to Kirui & Kozicka, (2014). A major rising concern in many developing countries is linking of private sector and the education institutions. In Kenya, the government set the target of achieving newly industrialized status by the year 2020 (Obwoge, Mwangi & Nyongesa, 2013). Technical education is necessary if Kenya is to industrialize by the year 2030. Relevant competencies have to be given in Technical Training Institutions. Competency Based Training (CBT) can be used to ensure that the teachers have the necessary competencies to achieve this philosophy (GoK, 2017). This study therefore aimed to investigate how teaching and learning of Agriculture influence the competencies of the learner in TVET colleges.

Problem Statement
Developed and developing countries are confronted by most of the problems that could limit the capacity of expansion in education to stimulate growth and development. Some of these problems are underemployment, low absorption capacity, shortage of professionalism, regional imbalances, and brain drain. (Brown & Slater, 2018). In spite of the various policy formulations in TVET colleges, there is persistence of many problems in the field which require more focused, responsive, functional and qualitative education system (Friedhelm, Gesine & Bernd, 2017). A proper TVET curriculum formulation and implementation would increase employability and marketability of TVET graduates (Kenya News Agency, 2019). Kenya’s vision 2030 document noted that there was a mismatch between training and the competencies desired in the industry (Ngure, 2013). Ligami, 2018, observed that TVET institutions in Kenya are still too theoretical and are not providing the real competencies needed by the agricultural sector. The mismatch of the training in TVET colleges is in the context of increasingly commercial and technical 21st century agricultural system which demands for retraining of Agricultural Technical and Vocational Education and Training (ATVET) graduates immediately after employment (Kirui & Marta, 2018). Hence, there was need for critical analysis of agricultural training against competencies needed by agricultural organizations among selected technical and vocational colleges.
Purpose of the study

Capacity of trainers influences the quality of training in agriculture. The study investigated the existing relationship between indicators of quality training in TVET colleges against competencies needed in the industry.

Main Objective of the study

The main objective of the research was to assess the extent to which the capacity of trainers influences the quality of teaching of Agriculture in selected TVET colleges;

Objectives

i. To assess the extent to which experience of the trainers in the industry influences the quality of teaching of agriculture in TVET colleges
ii. To assess the extent to which competencies required in training ATVET colleges influences the quality of teaching of agriculture in TVET colleges
iii. To assess the extent to which competencies lacked by trainers teaching agriculture in ATVET colleges influences the quality of teaching of agriculture in TVET colleges

Research Hypotheses

H01: There is no significance difference on the extent to which capacity of trainers influences the quality of teaching of Agriculture in selected TVET colleges;

Justification of the research

Research has shown that there are many contributions of TVET on nation’s economy (Bappah & Medugu, 2013; Bhurtel, 2015). Currently Kenya is offering financial support to students joining TVET colleges as well as equipping TVET colleges in terms of infrastructure and trainees’ employment. Thus, the findings will hopefully improve the employability of the TVET graduates and establish the pitfalls in ATVET training; increase meaningful academic learning and facilitates, social and emotional growth and decrease negative behaviour as well as increase time on task. This study came at an opportune time to look into the status of teaching and learning of Agriculture, the capacity of trainers.

METHODOLOGY

The study was undertaken in the North Rift Region, Kenya. The region was created after a split in the larger former Rift Valley province which currently houses; North Rift, South and Central Rift regions. North Rift region was composed of Nakuru, Baringo, UasinGishu, Trans Nzoia Counties
This research adopted descriptive research design. This design was suitable for this study since the researcher described how variables influence quality training in production of middle level workforce (Aggarwal & Ranganathan, 2019).

Target population for the study included trained technical teaching staff, students of the technical institutions and 14 human resource personnel of the agricultural organizations in North rift region. A total of 16 trained technical and teaching staff; 6 principals, 10 lectures and 384 students were drawn from the technical institutions that were purposively sampled.

The population comprised of student trainees in TVET institutions in the North Rift Region pursuing agriculture related courses at certificate and Diploma levels in government institutions. Sample respondents for study was purposively drawn from 5 different institutions, one from each County. The institution to be sampled were randomly selected from the list of 10 TVET institutions. Out of the targeted 5 TVET institutions a proportionate number of 25% of the trainees were identified using a table of random numbers, a sample size of 384 trainees from the total population was used in the survey. Yamane’s formula method was used to determine the sample size due to the large population sizes (Yamane, 1967; Cochran, 1977)

Split-half reliability was used to calculate the correlation between the two sets of responses. The items were considered reliable since they yielded a reliability coefficient of 0.7, which was the value respectable and desirable (Rosaroso, 2015).
Data Analysis

The study took both quantitative and qualitative analysis. Inferential statistics such as the cross tabulation and use of Chi-square were adopted in order to test the hypothesis stated on the study. Chi-square was used for the test of significance of association and to reflect the strength of the relationship: the greater the chi-square statistic, the stronger the significance (De-Vaus, 2002). On the other hand, qualitative data from the key informants’ and FGDs notes were reviewed through content analysis based on particular themes to ensure that relevant information was recorded. The field notes that were collected using unstructured interviews from the key informants and the FGDs were reorganized schematically using word tables. Qualitative data from the FGDs and key informants were used to triangulate the quantitative components in the study where necessary.

RESULTS

The study sought to find out the extent to which the capacity of trainers influences the quality of teaching of Agriculture in selected TVET colleges.

4.1 To assess the extent to which the capacity of trainers influences the quality of teaching of Agriculture in selected TVET colleges;

The researcher sought to determine the experience required in agricultural colleges by comparing the experience of the trainers in the industry, trainers’ level of education, equipment handling and quality of their graduates. The trainers had adequate experience in the industry, the trainers are very inadequate in equipment handling, the trainers said quality of their graduates was not adequate. According to Huang, (2019), his findings revealed that well-designed and prepared training activities in a training program will result in job training satisfaction, which influences employees work-related attitudes such as job satisfaction. That would further affect their intentions of turnover and job performance. These findings concurred with the findings of Wisshak & Hochholdinger (2019). Their findings indicated that subject-matter knowledge and communication techniques are considered vital for trainers, alongside content specific instructional knowledge such as specific training methods. Trainers are expected to provide clarity and structure, build relationship with trainees and create a constructive learning environment. The findings therefore revealed that experience of the trainers was very paramount in ATVET training institution so as to pass the competences to the learners.

4.2 Competencies required in training ATVET

The researcher sought to determine competencies on course syllabus coverage: Learning hours for competency acquisition and development, time allocated for practical lessons, qualified trainers and time allocated for coverage of the course. Table 4.3 shows that when student respondents were asked their expectations towards requirement in training ATVET colleges, 50.0% of the respondents mentioned that trainers were very adequately qualified, 43.5% of the respondents said trainers were adequately qualified, 3.1% of the respondents highlighted that trainers were very inadequately qualified and 3.4% of the respondents commented that trainers were not adequately qualified.
Table 4.2 Competencies required in training ATVET

<table>
<thead>
<tr>
<th>Competencies</th>
<th>Very adequate</th>
<th>Adequate</th>
<th>Very Inadequate</th>
<th>Not adequate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours for competency</td>
<td>153 (47.2%)</td>
<td>147 (45.4%)</td>
<td>11 (3.4%)</td>
<td>13 (4.0%)</td>
</tr>
<tr>
<td>Acquisition</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time allocated for practical</td>
<td>123 (38.0%)</td>
<td>121 (37.3%)</td>
<td>42 (13.0%)</td>
<td>37 (11.4%)</td>
</tr>
<tr>
<td>Lessons</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qualified Trainers</td>
<td>162 (50.0%)</td>
<td>141 (43.5%)</td>
<td>10 (3.1%)</td>
<td>11 (3.4%)</td>
</tr>
<tr>
<td>Time allocated for course coverage</td>
<td>124 (38.3%)</td>
<td>148 (45.7%)</td>
<td>25 (7.7%)</td>
<td>27 (8.3%)</td>
</tr>
</tbody>
</table>

The respondents’ point of view revealed that trainers were moderately qualified. This concurred with the study by Wilson, (2021), where he found out that most trainers were unable to use the new equipment that had been acquired by TVETs thus re-skilling exercise was inevitable in order to improve teaching standards and quality training in TVET colleges.

On learning hours for competency development 47.2% of the respondents said learning hours for competency acquisition and development were very adequate, 45.4% of the respondents mentioned that learning hours for competency acquisition and development was adequate, 3.4% of the respondents noted that learning hours for competency acquisition and development was very inadequate and 4.0% of the respondents highlighted that learning hours for competency acquisition and development was not adequate. The study of Ogunniyi & Nwalo, (2016). Recommended that more time should be allocated to practical courses so as to encourage the trainers to develop interest in practical. It was clear that learning hours for competency acquisition and development in this study was below 50.0% in adequacy hence could affect competencies acquired by the learners.

On the time allocated for coverage of the course 38.3% of the respondents said the time allocated for coverage of the course was very adequate, 45.7% of the respondents admitted that time allocated for coverage of the course was adequate, 7.7% of the respondents said time allocated for coverage of the course was very inadequate and 8.3% of the respondents admitted that time allocated for coverage of the course was not adequate. The study of Said, Friesen & Al-Ezzah (2014). Recommended that more time should be allocated on practical activities and more emphasis to be put on assessment of practical activities. Generally, the expectation of the respondents towards requirements in training ATVET courses was 50.0% or below 50.0% which is worrying in competencies which should be acquired by the trainees.

4.3 Influence of teaching and learning of agricultural related courses on competencies of learners

The study sought to understand the influence of teaching and learning agricultural related courses in TVET colleges. Teaching and learning agriculture in TVET colleges influenced the competencies of the learners positively according to the findings of the trainers in...
TVET colleges. The trainers’ respondents said teaching and learning of agriculture instill competencies, make the learners self-reliant and capable of solving farming problems, enhance socially and economically rewarding jobs, make learners acquire competencies through practical conducted. The study of Okoye & Isaac (2015) concluded that TVET mode of delivery was to provide the kind of workers needed in the industry and also to prepare individuals for self-employment. This study is in agreement with the study of Affero, Hassan, Bakar & Hussin (2018). There outcome revealed that the competencies developed in TVET learners produced graduates who are capable to meet the requirement of industries and professional bodies.

4.4 How to improve agriculture training in ATVET colleges to ensure learners are getting the right competencies

The study sought to know how to improve agriculture training in ATVET colleges. The trainers’ respondents believed that adoption of competency based curriculum and increasing number of practical hours and reducing lecture hours, addressing emerging issues in agriculture, providing students with materials to initiate and implement projects, competent lecturers and increasing number of academic trips to expose students would improve agriculture training in TVET colleges. According to Adelabu (2021). His study revealed that trainers should be upgraded especially on hands-on practical activities in order to prepare the students to meet the companies’ requirements. Ismail, Razali, Aabu & Habriza (2018), acknowledges that for quality training to be attained, trainers should develop personal traits and professionalism, teaching and learning and training and technical and innovation were the main components for quality training to be attained. The results revealed that for quality competencies to be attained by the trainers, quality competencies of the trainers were very critical.

4.5 Competencies lacked by trainers teaching agriculture in ATVET colleges

This study sought to find out whether there were competencies lacked by TVET trainers. The trainers said they lacked the following competencies in teaching ATVET colleges: Curriculum development competency, competency on modern technology e.g. Tissue culture, hydroponics, Green house farming and smart agriculture, competency to handle farm machinery and farm tools, soft skills, competencies to handle physically challenged persons and leadership competencies. Similar research conducted by other studies concurred with this study. Research conducted by Abdurrahman (2021), found out that trainers were facing the following challenges in attaining capacity building in TVET programs: Inadequate funding, poor research attitude, poor training of TVET instructors, poor supervision of teachers, inadequate facilities and poor assessment of TVET students’ competency. The study of Kraak & Parterson (2016) found out that to secure TVET programs, adequate quality was vital; the quality in TVET colleges depends so much on competency and commitment of the TVET trainers.
Table 4.3: Relationship between Qualified Trainers and Quality Teaching

The table below shows the inferential statistics of the findings. Chi square was used to test the relationship of the hypothesis at 95% confidence level. \(H_0\) There is no significance difference on the extent to which capacity of trainers influence the quality of teaching of Agriculture in selected TVET colleges in the North-Rift region yielded the results on the table below.

<table>
<thead>
<tr>
<th>Qualified Trainers</th>
<th>Value</th>
<th>df</th>
<th>Approx. Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning hours for competency</td>
<td>85.776</td>
<td>9</td>
<td>.000</td>
</tr>
<tr>
<td>Acquisition and development</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time allocated for practical lessons</td>
<td>118.220</td>
<td>12</td>
<td>.000</td>
</tr>
<tr>
<td>Time allocated for coverage of the</td>
<td>46.683</td>
<td>9</td>
<td>.000</td>
</tr>
<tr>
<td>Course</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moral integrity</td>
<td>34.886</td>
<td>12</td>
<td>.000</td>
</tr>
<tr>
<td>Preparedness in terms of competencies acquired during training</td>
<td>56.262</td>
<td>9</td>
<td>.000</td>
</tr>
<tr>
<td>Expectations of the students to job market</td>
<td>56.039</td>
<td>9</td>
<td>.000</td>
</tr>
<tr>
<td>Relevance of the course to employment</td>
<td>30.798</td>
<td>12</td>
<td>.000</td>
</tr>
</tbody>
</table>

On the basis of chi square tests, it was clear that there was a statistically significant relationship between the capacity of the trainers and the quality of training of agriculture in TVET colleges. The \(H_0\) There is no significant difference on the extent to which capacity of trainers influence the quality of teaching of Agriculture in selected TVET colleges was therefore rejected. Therefore, the researcher suggested that for quality training to be achieved there was need to retraining TVET trainers on the competencies they lacked since those competencies could not be passed to the trainees.

CONCLUSION

The findings revealed that teaching and learning agriculture in TVET colleges influenced competencies of the learners positively, make the learners self-reliant and capable of solving farming problems, enhance socially and economically rewarding jobs. In contrary, the findings revealed that trainers lacked the following competencies: curriculum development, modern technology e.g. tissue culture, hydroponics, green house farming and smart agriculture, how to handle farm machinery, farm tools and farm equipment, soft skills, how to handle physically challenged persons and leadership skills. Based on the findings presented the study as shown that agriculture training has been found to have mismatch training in competencies needed in agricultural organizations. This study therefore concluded that agriculture training should be matched with the competencies required by the agricultural industry.

Recommendation

i. TVETA and other stake holders should provide in-service training for the TVET trainers. This is because the competencies lacked by the trainers will not be passed to the trainees.
ii. TVET curriculum should be reviewed to fit the changing needs
iii. TVETs should incorporate emerging technologies on their teaching and learning
iv. Farm tools and equipment in TVETs should be modern
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Influence of different weed control strategies on growth, yield attributing characters, yield and quality parameters of Lentil (*Lens culinaris Medik.*)

Ritika Kumari¹, Sunil Prakash²*, Harsh Vardhan Vimal¹, Ashutosh Subhash Mane¹

¹ Research Scholar, School of Agriculture, Uttaranchal University, Dehradun 248007, Uttarakhand, India.
² Assistant Professor, School of Agriculture, Uttaranchal University, Dehradun 248007, Uttarakhand, India.

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**Abstract**- A field experiment was conducted at the Crop Research Centre, School of Agriculture, Uttaranchal University, Dehradun, Uttarakhand to observe ‘The efficiency of different weed management practices in Lentil’ during the Rabi season of 2021-22. The experimental design used for the purpose was Randomised Block Design with 3 replications and 8 treatments. The treatments were as Control, 2 hand-weeding, Atrazine (Pre-emergence) @1kg a.i./ha, Atrazine (PE) + 1 hand-weeding, Pendimethalin (post-emergence) @ 1 kg a.i./ha, Pendimethalin (PE) + 1 hand-weeding, Isoproturon (PoE) @ 1 kg a.i./ha and Isoproturon (PoE) + 1hand-weeding. Out of all the treatments mentioned T6 which was Pendimethalin + one hand-weeding was found to be better in terms of growth as well as yield attributing characters such as plant height, number of branches, number of pods per plant, number of seeds per pod, seed yield per plant, grain yield, straw yield and biological yield however in terms of quality parameters such as dry matter accumulation in plants, seed index as well as protein content, the treatment T2 was observed to be superior than any other treatment. The least yield and product quality was found in T1 which is Control or Weedy Check.

**Index Terms**- Isoproturon, Pendimethaline, Control, Hand weeding, Yield

I. INTRODUCTION

Lentil (*Lens culinaris Medik.*) has been reported as one among the most primitive seasonal food/pulse crop which are being cultivated as a very crucial food source for more than 8,000 years (Dhuppar et al., 2012). About 25% protein, 0.7% fat, 2.1% mineral, 0.7% fiber, and 60% of lentil’s calories come from carbohydrates. It is also abundant in niacin, riboflavin, thymine, ascorbic acid, calcium, iron, phosphorus, potassium, zinc, and magnesium.

In India, lentil was grown for over 1.35 Million ha while production was 1.18 million tons (FAO, 2020). In India, the major producing states are Uttar Pradesh with 0.45 Million tonns, Madhya Pradesh with 0.32 Million ton, West Bengal with 0.16 Million tonns, and Bihar with 0.12 Million tonns on about 11.15 thousand tonnes are produce in Uttarakhand. (Directorate of Economics and Statistics, 2020).

Weeds in lentils are a serious threat to productivity, reducing production by 70%. (Singh and Singh, 1985). Due to its tiny and thin canopy, the lentil is not highly competitive against weeds. The dominant weeds found in lentil crops are and *Chenopodium album* (6%), *Capsella bursa pastoris* (57.4%) and *Phalaris minor* (27.8 %). Other prevalent weeds involve (8.8 %), *Anagalis arvensis, Fumaria parviflora, Spergula arvensis,* and *Vicia sativa* (Bhattarai et al., 2018).

II. MATERIALS AND METHODS:

A field experiment had been conducted during the Rabi season of 2021-22 at the Crop Research Centre of Uttaranchal University, Premnagar, Dehradun, Uttarakhnad (30.33° N Latitude and 77.95° E Longitude). The maximum and minimum temperatures of the place is 27.65°C and 13.8°C respectively. The soil of the experimental site contained sand 53.40 %, silt 25.40% and clay 21.30%. The soil texture was Sandy loam having pH almost neutral which is 7.4 and organic carbon 0.83%. The available Nitrogen 297.8 kg/ha, available P 13.8 kg/ha and available K
was 237.5 kg/ha. The experimental design selected for this purpose was randomised block design using 3 replications and 8 treatments. The treatments applied were T1 as Control, T2 as Two hand-weeding, T3 as Atrazine @ 1kg a.i. per hectare (PE), T4 as Atrazine (PE)+ 1 hand-weeding, T5 as Pendimethalin @ 1kg a.i. per hectare (PoE), T6 as Pendimethalin (PE) + 1 hand-weeding, T7 as Isoproturon @ 1 kg a.i. per hectare (PoE) and T8 as Isoproturon (PoE)+ 1 hand-weeding.

The sowing had been done on 26th November, gap filling at 17th December and the harvesting had been done on 13th of April. Seed rate was 40 kg/ha and the recommended dose of fertilizer that is 20 kg/ha of N, 40 kh/ha of P and 20 kg/ha of S. The application of pre-emergence herbicide was done on 25th November. The post-emergence herbicide application was done at 45 days and 2 hand-weeding was performed at 30 and 60 DAS respectively. In treatments of herbicide + 1 hand-weeding was done at 45 DAS. The crop variety used was VL-Masoor 103.

### III. RESULTS AND DISCUSSION:

Table: 4.14 Effect of various weed control methods on the height of plants at different stages of growth

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Height of plants in (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30</td>
</tr>
<tr>
<td>T1 (CONTROL)</td>
<td>4.90</td>
</tr>
<tr>
<td>T2 (2 Hand weeding)</td>
<td>6.50</td>
</tr>
<tr>
<td>T3 (Atrazine (PE), ATRATEX 50% WP @ 1kg a.i. per hectare)</td>
<td>5.76</td>
</tr>
<tr>
<td>T4 (Atrazine (PE) + 1 Hand weeding)</td>
<td>5.81</td>
</tr>
<tr>
<td>T5 (Pendimethalin PoE, PENDANT 30% EC @ 1kg a.i. per hectare)</td>
<td>5.86</td>
</tr>
<tr>
<td>T6 (Pendimethalin (PE) + 1 hand weeding)</td>
<td>6.23</td>
</tr>
<tr>
<td>T7 (Isoproturon (PoE) SHIVRON 75% WP @ 1kg a.i. per hectare)</td>
<td>6.40</td>
</tr>
<tr>
<td>T8 (Isoproturon (PoE) + 1 Hand weeding)</td>
<td>6.30</td>
</tr>
<tr>
<td>SEm±</td>
<td>0.09</td>
</tr>
<tr>
<td>CD (P≥0.05%)</td>
<td>0.53</td>
</tr>
</tbody>
</table>

The plant height had been observed at 30, 60, and 90 days after sowing. At 30 DAS, the plant height in all the treatments was almost equal, still, the tallest plants were found in T2 (Two hand-weeding), followed by T7 (Isoproturon @ 1kg a.i./ha) and T8 (Isoproturon + One hand-weeding) as Isoproturon was not applied in the plots till then. T7 is statistically at par with T2 and T6 (Pendimethalin + One hand-weeding) is statistically at par to T8. The shortest height of plants had been observed in T1 which is Control. At 60 DAS, the maximum heights were attained by treatments of Pendimethalin+ One hand-weeding (T6), two hand-weeding (T2), Atrazine + One hand-weeding (T4). T4 is statistically at par to T2. The minimum heights were observed in T8 which is Isoproturon + One hand-weeding, T7 which is Isoproturon @ 1kg a.i./ha as well as Control (T1). Isoproturon initially affects the growth of the plants, as a result of which the plants show stunting after application of this chemical. At 90 DAS, the plant height was observed again and the tallest plants were found in T2 (2 hand-weeding), T6 (Pendimethalin + One hand-weeding) is at par to T2, T3 (Atrazine @ 1kg a.i per hectare) and T5 (Pendimethalin @ 1 kg a.i per hectare) are statistically at par to T4 (Atrazine + 1 hand-weeding). Lowest plant height was observed in Control.

Table: 4.15 Effect of various weed control methods on number of branches at various stages of growth

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Number of branches day after sowing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30</td>
</tr>
<tr>
<td>T1 (CONTROL)</td>
<td>2.06</td>
</tr>
<tr>
<td>T2 (2 Hand weeding)</td>
<td>2.80</td>
</tr>
<tr>
<td>T3 (Atrazine (PE), ATRATEX 50% WP @ 1kg a.i. per hectare)</td>
<td>2.53</td>
</tr>
<tr>
<td>T4 (Atrazine (PE) + 1 Hand weeding)</td>
<td>2.50</td>
</tr>
<tr>
<td>T5 (Pendimethalin PoE, PENDANT 30% EC @ 1kg a.i. per hectare)</td>
<td>2.73</td>
</tr>
<tr>
<td>T6 (Pendimethalin (PE) + 1 hand weeding)</td>
<td>2.93</td>
</tr>
<tr>
<td>T7 (Isoproturon (PoE) SHIVRON 75% WP @ 1kg a.i. per hectare)</td>
<td>2.26</td>
</tr>
</tbody>
</table>

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The branches number was observed at 30, 60 as well as 90 days from the sowing. At 30 DAS, the highest branching had been observed in T6 which is Pendimethalin + One hand-weeding followed by T2 which is Two hand- weeding. T2 is also observed to be significantly at par to T6 and the lowest branching is observed in T1 which was Control. At 60 DAS, the observation of branches number had been taken and the highest branching was found again in T6 (Pendimethalin + One hand-weeding) and T2 which is Two hand-weeding was observed to be at par statistically to the T6. The lowest branching had been found in T1 which is Control. At 90 DAS, the number of branches is observed to be highest in T6, T2 as well as T4 was observed to be statistically at par with T6. Number of branches is some important criteria as in legumes like lentil and chickpea, more the number of branches more is the number of flowers followed by number of pods.

Coming to the plant attributes of growth, the height of plants and branches number were observed. The observation of height was taken at 30, 60, as well as 90 DAS as the plant height, shows a minimal or negligible increase after attaining the reproductive stage. The number of branches was observed at an interval of 30, 60, and 90 DAS. The period of vegetative growth gets extended when the climatic conditions are not favourable. In the parameters of vegetative growth (plant height, number of branches) the treatment T6 which is (Pendimethalin + One hand weeding) depicted the best results followed subsequently by T2 which is Two hand-weeding and T4 (Atrazine One hand-weeding). Herbicides application along with cultural practices enhanced the height of the plant as well as primary branches of plant, resulting into the increment of the plants’ lateral growth (Erskine et al., 2009).

### Table: 4.16 Effect of various weed control methods on accumulation of dry matter at different stages of growth

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Dry matter accumulation (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30</td>
</tr>
<tr>
<td>T1 (CONTROL)</td>
<td>0.85</td>
</tr>
<tr>
<td>T2 (2 Hand weeding)</td>
<td>0.96</td>
</tr>
<tr>
<td>T3 (Atrazine (PE), ATRATEX 50% WP @ 1kg a.i. per hectare)</td>
<td>0.78</td>
</tr>
<tr>
<td>T4 (Atrazine (PE) + 1 Hand weeding)</td>
<td>0.90</td>
</tr>
<tr>
<td>T5 (Pendimethalin PoE, PENDANT 30% EC @ 1kg a.i. per hectare)</td>
<td>0.81</td>
</tr>
<tr>
<td>T6 (Pendimethalin (PE) + 1 hand weeding)</td>
<td>0.99</td>
</tr>
<tr>
<td>T7 (Isoproturon (PoE) SHIVRON 75% WP @ 1kg a.i. per hectare)</td>
<td>0.85</td>
</tr>
<tr>
<td>T8 (Isoproturon (PoE) + 1 Hand weeding)</td>
<td>0.89</td>
</tr>
<tr>
<td>SEm±</td>
<td>0.02</td>
</tr>
<tr>
<td>CD (P≥0.05%)</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Plant dry matter accumulation is observed at 30, 60 and 90 DAS. It was observed highest in T2 which is a complete cultural practice-based treatment. In this treatment, the product obtained is free from any type of herbicide or chemical. Hence the dry matter accumulation was highest. Other treatments in which herbicides are used are affected by the side effects of the chemicals and hence the dry matter obtained was slightly low. Imtiaz et al. 2020 confirmed the fact that lentil due to its physiological characters is more sensitive to chemicals than any other cereal or legume crops.

### Table: 4.18 Effect of various weed management practices on yield attributes of lentils

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Number of pods per plant</th>
<th>Number of seeds per pod</th>
<th>Seed yield per plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 (CONTROL)</td>
<td>15.60</td>
<td>1.30</td>
<td>27.83</td>
</tr>
<tr>
<td>T2 (2 Hand weeding)</td>
<td>29.00</td>
<td>2.12</td>
<td>41.80</td>
</tr>
<tr>
<td>T3 (Atrazine (PE), ATRATEX 50% WP @ 1kg a.i. per hectare)</td>
<td>21.66</td>
<td>1.94</td>
<td>31.56</td>
</tr>
<tr>
<td>T4 (Atrazine (PE) + 1 Hand weeding)</td>
<td>27.66</td>
<td>1.94</td>
<td>32.56</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Treatments</th>
<th>Grain yield (kg/ha)</th>
<th>Straw yield (kg/ha)</th>
<th>Biological yield (kg/ha)</th>
<th>Harvest index (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 (CONTROL)</td>
<td>284.69</td>
<td>1033.95</td>
<td>1318.64</td>
<td>21.50</td>
</tr>
<tr>
<td>T2 (2 Hand weeding)</td>
<td>439.88</td>
<td>1110.66</td>
<td>1550.55</td>
<td>21.87</td>
</tr>
<tr>
<td>T3 (Atrazine (PE), ATRATEX 50% WP @ 1kg a.i. per hectare)</td>
<td>292.98</td>
<td>1048.33</td>
<td>1340.31</td>
<td>21.78</td>
</tr>
<tr>
<td>T4 (Atrazine (PE) + 1 Hand weeding)</td>
<td>314.24</td>
<td>1127.06</td>
<td>1441.31</td>
<td>21.79</td>
</tr>
<tr>
<td>T5 (Pendimethalin PoE, PENDANT 30% EC @ 1kg a.i. per hectare)</td>
<td>309.77</td>
<td>1123.90</td>
<td>1433.67</td>
<td>21.60</td>
</tr>
<tr>
<td>T6 (Pendimethalin (PE) + 1 hand weeding)</td>
<td>443.49</td>
<td>1265.60</td>
<td>1709.09</td>
<td>25.94</td>
</tr>
<tr>
<td>T7 (Isoproturon (PoE) SHIVRON 75% WP @ 1kg a.i. per hectare)</td>
<td>292.25</td>
<td>1042.40</td>
<td>1323.88</td>
<td>21.67</td>
</tr>
<tr>
<td>T8 (Isoproturon (PoE) + 1 Hand weeding)</td>
<td>292.33</td>
<td>1042.82</td>
<td>1330.54</td>
<td>21.72</td>
</tr>
<tr>
<td>SEm ±</td>
<td>18.67</td>
<td>22.73</td>
<td>-</td>
<td>0.02</td>
</tr>
<tr>
<td>CD (P ≥0.05%)</td>
<td>7.55</td>
<td>8.35</td>
<td>-</td>
<td>0.29</td>
</tr>
</tbody>
</table>

Table: 4.19 Effect of various weed control methods on yield of grain, yield of straw, total biological yield and harvest index
The study of reproductive parameters included the grain yield, pods per plant, harvest index and biological yield. All of the treatments’ application created an impact over biological yield and grain yield remarkably over the control. The highest average biological yield and grain yield had been found in Pendimethalin + One hand weeding (T6) as well as two hand weeding (T2). This was confirmed by Gupta and Rao, 2013 that better the weed control better would be the yield contributing attributes like number of flowers, seed yield per plant, seed per pod, number of pods per plant, total biological yield, grain yield as well as straw yield.

Table: 4.20 Effect of various weed control methods on weight of 100 seeds.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Weight of 100 seeds (gm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 (CONTROL)</td>
<td>1.60</td>
</tr>
<tr>
<td>T2 (2 Hand weeding)</td>
<td>3.40</td>
</tr>
<tr>
<td>T3 (Atrazine (PE), ATRATEX 50% WP @ 1kg a.i. per hectare)</td>
<td>2.01</td>
</tr>
<tr>
<td>T4 (Atrazine (PE) + 1 Hand weeding)</td>
<td>2.35</td>
</tr>
<tr>
<td>T5 (Pendimethalin PoE, PENDANT 30% EC @ 1kg a.i. per hectare)</td>
<td>2.20</td>
</tr>
<tr>
<td>T6 (Pendimethalin (PE) + 1 hand weeding)</td>
<td>2.50</td>
</tr>
<tr>
<td>T7 (Isoproturon (PoE) SHIVRON 75% WP @ 1kg a.i. per hectare)</td>
<td>1.90</td>
</tr>
<tr>
<td>T8 (Isoproturon (PoE) + 1 Hand weeding)</td>
<td>2.30</td>
</tr>
<tr>
<td>SEM ±</td>
<td>0.02</td>
</tr>
<tr>
<td>CD (P ≥0.05%)</td>
<td>0.24</td>
</tr>
</tbody>
</table>

The 100 seeds weight had been computed from each plot of the field to check the seed quality. The quality of the seeds obtained from the plot in which hand weeding was applied was the best. The weight of 100 seeds (seed index) was highest in the plot of Two hand-weeding. Herbicides may be effective in controlling the weed density/population better but it also has an adverse effect on the quality of the produce. The product quality degrades as residues from herbicides/chemicals are present in it. Cereal crops are usually more tolerant to chemicals than those of legume crops. Lentil is very sensitive toward herbicide phytotoxicity as confirmed by Imtiaz et al. 2020 and Leoci and Ruberti 2020.

Table: 4.21 Effect of various weed management practices on protein content of the produce

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Protein Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 (CONTROL)</td>
<td>23.32</td>
</tr>
<tr>
<td>T2 (2 Hand weeding)</td>
<td>25.02</td>
</tr>
<tr>
<td>T3 (Atrazine (PE), ATRATEX 50% WP @ 1kg a.i. per hectare)</td>
<td>24.01</td>
</tr>
<tr>
<td>T4 (Atrazine (PE) + 1 Hand weeding)</td>
<td>24.51</td>
</tr>
<tr>
<td>T5 (Pendimethalin PoE, PENDANT 30% EC @ 1kg a.i. per hectare)</td>
<td>24.06</td>
</tr>
<tr>
<td>T6 (Pendimethalin (PE) + 1 hand weeding)</td>
<td>24.98</td>
</tr>
<tr>
<td>T7 (Isoproturon (PoE) SHIVRON 75% WP @ 1kg a.i. per hectare)</td>
<td>23.91</td>
</tr>
<tr>
<td>T8 (Isoproturon (PoE) + 1 Hand weeding)</td>
<td>24.48</td>
</tr>
<tr>
<td>SEM ±</td>
<td>0.09</td>
</tr>
<tr>
<td>CD (P ≥0.05%)</td>
<td>0.27</td>
</tr>
</tbody>
</table>

Herbicides have a tendency to degrade the nutritional quality of the grains, mainly the content of protein because of the chemical composition which prevents accumulation of Nitrogen in it. There are differences in the protein content of different treatments. The T2 and T6 which are two hand-weeding and Pendimethalin + One hand- weeding have shown highest protein content whereas the lowest protein content was found in Control which is T1. The other treatments which were using chemicals solely were also observed to have comparatively lower protein content as confirmed by Kumar and Nandan, 2014.
IV. CONCLUSION:

The outcome of the observation depicts that in terms of vegetative growth, yield and other yield attributing characters, the combination of suitable herbicide and cultural practice which is Pendimethalin + one hand weeding (T6) is best suited. The outcomes from the treatment of Two hand weeding (T2) was also observed to be at par statistically to T6. However, in terms of attributes depicting the quality of the produce such as dry matter accumulation, seed index (weight of 100 seeds) as well as Protein content of the produce the treatment of Two hand weeding (T2) was observed to be the superior. Pendimethalin + one hand weeding was observed to be the second best in terms of quality as herbicides have a tendency to hamper the quality of the produce. The most suitable weed control practices observed in the experiment were Pendimethalin + one hand weeding (T6) as well as Two hand weeding (T2).

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AUTHORS

First Author – Ritika Kumari, Research Scholar, School of Agriculture, Uttaranchal University, Dehradun 248007, Uttarakhand, India.
Second Author – Sunil Prakash, Assistant Professor, School of Agriculture, Uttaranchal University, Dehradun 248007, Uttarakhand, India.
Third Author – Harsh Vardhan Vimal, Research Scholar, School of Agriculture, Uttaranchal University, Dehradun 248007, Uttarakhand, India.
Fourth Author – Ashutosh Subhash Mane, Research Scholar, School of Agriculture, Uttaranchal University, Dehradun 248007, Uttarakhand, India.
The Relationship Between Immunohistochemical Expression Of Vitamin D Receptor (VDR) With Tumor-Associated Stromal Cells (TASCs) And Histopathological Grading In Prostate Adenocarcinoma

Zuhri Madriah*, T. Ibnu Alferally*, Jessy Chrestella*

Department of Anatomical Pathology, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia.

*Corresponding Author

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Abstract: In few studies, the exposure of ultraviolet and vitamin D serum levels has been linked to prostate cancer. To date, there are controversy about research results and still no studies linking VDR directly with TASCs in prostate cancer.

Objective: To assess the relationship between immunohistochemical expression of VDR with TASCs and histopathological grading in prostate adenocarcinoma.

Materials and Methods: This analytic study with cross sectional approach used 35 samples from paraffin blocks from patients histopathologically diagnosed as prostate adenocarcinoma. Grading of these samples were assessed and Masson’s trichrome histochemistry (for TASCs) and VDR immunohistochemical staining were performed. All results were analyzed using Chi Square or Pearson chi square.

Results and Discussion: There was statistically significant relationship between immunohistochemical expression of VDR with histopathological grading and grade group, with moderate strength value (r=0.381) and p value <0.05. But, no statistically significant relationship between immunohistochemical expression of VDR and TASCs in prostate adenocarcinoma.

Conclusion: Further studies are needed to compare vitamin D blood levels with immunohistochemical expression of VDR in prostate tissue. Also, further researchers are needed to relate TGFβ with TASCs and immunohistochemical expression of VDR in prostate adenocarcinoma. In these samples, it is also necessary to further investigate the VDR SNP gene.

Keywords: vitamin D, VDR, prostate adenocarcinoma, TASCs

I. INTRODUCTION

Prostate adenocarcinoma is an invasive carcinoma consisting of neoplastic prostate epithelial cells with differentiation and secretion arranged in various histomorphological patterns. In this carcinoma, basal cells are generally not found.1 Prostate adenocarcinoma is one of leading causes of death in men. Each year 1.6 million men are diagnosed as prostate adenocarcinoma and 366,000 men die because of this tumor around the world.2 In North Sumatra in 2016, prostate cancer ranked in 4th after lung, cervical, and breast cancer with 42 cases.3 In Medan in 2014 based on health center recapitulation, there were 99 prostate cancer patients ranking in 2nd after breast cancer (499 cases).4

Prostate gland consists of epithelial and stroma compartment separated by basal membrane5,6. Cells in these two compartments maintain an active two-way communication through paracrine mechanism whereby ligands and receptors are shared between these two compartments. This mutual communication is balanced and important for maintaining tissue homeostasis.5 Stromal of prostate gland is composed of fibroblasts, smooth muscle cells, and extracellular matrix (ECM) rich in collagen fibers lying between the glands. The existence of repeated and continuous epithelial injuries throughout the aging process and at the same time androgen hormone also needed to regulate the prostate gland, cause biological change of the prostate which is from reproductive function to chronic wound repair function. The biologic condition of this wound repair is the key in driving the development of different prostate diseases, all of which are found in both TASC and inflammation.6

TASCs are referred as new stromal environment that occur as a result of the response to carcinoma.7 These TASCs are described as microenvironment located adjacent to the epithelium that are able to coordinate several activities (wound repair, changes in homeostasis and interactions with neoplastic complexes).5,7 Tumor microenvironment include mesenchymal/stromal stem cells, endothelial cells, fibroblasts, myofibroblasts, immune cells, and neural crest cells, all of which secrete factors such as chemokines, cytokines, ECM, and matrix-degrading enzymes.5,8-10 Prostatic TASCs promote prostate cancer progression by supporting tumor cell proliferation, inducing fibroblastic phenotype, changing the shape of ECM, and increasing the likelihood of metastasis.5

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www.ijsrp.org
Because prostate cancer-associated TASCs consist of cancer-associated fibroblasts cells (CAF) that occur concomitantly with reduced or complete loss of smooth muscle cells, these changes can be easily seen using simple histochemical methods such as Mallory or Masson’s trichrome staining. These CAFs are most often regulated through transforming growth factor (TGFβ) signaling pathway. The presence of TGFβ upregulation supports the formation of TASCs, induces epithelial-to-mesenchymal transition (EMT), and induces VDR expression in WPMY-1 human prostate stromal cell line. This VDR mediates the action of vitamin D hormone and can affect prostate tissue. Vitamin D has been known as a hormone to have a lower risk of several types of cancer, including prostate cancer.

On the other hand, this TGF-β can increase the upregulation of CYP24A1 (functions to metabolize 1,25D3 into an inactive form which will then be excreted in the urine) induced by 1,25D3. The increased expression of CYP24A1 in the tumor microenvironment can increase the metabolism of 1,25D3 thereby reducing its availability. Therefore, the high expression of TGFβ in tumors and stroma may have negative impact on 1,25D3 therapy. This is also confirmed by the study of Ding et al, who found that the anti-tumor effect of 1,25D3 was due to TGF-β inhibition mediated by the interaction between ligand-bound VDR and the transcription factor Smad3 which was activated by TGF-β. The differences in these study results coupled with the absence of studies linking VDR directly with TASCs in prostate cancer cause researchers to be interested in looking at the relationship of VDR immunohistochemical expression with TASCs and histopathological grading of prostate adenocarcinoma.

II. MATERIAL AND METHODS

Sample selection

This analytic research with cross sectional approach was done in General Hospital H. Adam Malik Medan/ Department of Anatomical Pathology, Medical Faculty USU. This study was conducted from December 2021 until March 2022, after receiving approval from Health Research Ethics Committee, Medical Faculty Universitas Sumatera Utara Medan.

Study samples were gathered from paraffin blocks from patients diagnosed as prostate adenocarcinoma cases in General Hospital H. Adam Malik Medan/ Department of Anatomical Pathology, Medical Faculty USU fulfilling inclusion and exclusion criteria. Samples were gathered by using consecutive sampling. Inclusion criteria in this study were paraffin blocks from TURP, prostatectomy and core biopsy specimens that has been histopathologically diagnosed as prostate adenocarcinoma, are adequate after stained with hematoxylin-eosin. Meanwhile, exclusion criteria were paraffin blocks with core biopsy specimens <10, and paraffin blocks/ slides that are not fulfilling standard (damaged, etc.). VDR expression was determined as dependent variable and histopathological grading and TASCs were determined as independent variables. Each sample was stained with HE, Masson’s trichrome histochemistry and VDR polyclonal antibody immunohistochemistry (Bioassay technology laboratory, dilution 1:100-1:300).

To evaluate histopathological grading in this study, the researchers use two versions, which are based on Gleason score and grade group. According to Gleason score, histopathological grading are categorized into well differentiated (Gleason score ≤ 6), moderately differentiated (Gleason score 7), and poorly differentiated (Gleason score 8 – 10). On the other hand, based on grade group, histopathological grading are categorized into: Grade group 1 (Gleason score ≤6), Grade group 2 (Gleason score 3+4), Grade group 3 (Gleason score 4+3), Grade group 4 (Gleason score 4+4=8, 3+5=8, 5+3=8), and Grade group 5 (Gleason score 9–10).

TASCs assessed using Masson’s trichrome staining were categorized into 4 groups. If no blue color was found in the stroma around malignant prostate gland, it was determined as (-). If found 1-15% blue color in the stroma around malignant prostate gland, it was assessed as (+). If there was 15-50% blue color in the stroma around malignant prostate gland, it was assessed as (++). When found >50% blue color in the stroma around the prostate gland, it was assessed as (+++). Then, VDR expression was interpreted by adding the area scores with the intensity scores. Total area was done as follows: score 0 (if no positive stained nuclei and cytoplasm), score 1 (<10% of positive stained nuclei and cytoplasm), score 2 (10-50% of positive stained cells), and score 3 (>50% of positive stained cells). Meanwhile, intensity was scored as follows: 0 (none), 1 (weak, light brown), 2 (moderate), and 3 (strong, dark brown). After that, the total score of VDR expression was categorized as weak (if total score ≤2), moderate (if total score 3-4), and strong (total score 5-6).

Data analysis

Data collected in this research were processed by using statistical software and analyzed using Chi Square Test or Pearson Chi Square Test.

III. RESULTS

In this study, 35 samples with prostate adenocarcinoma diagnosis in Department of Anatomical Pathology, Faculty of Medicine, Universitas Sumatera Utara and Anatomical Pathology Unit, General Hospital Haji Adam Malik Medan were obtained. In this study, analysis about relationship about VDR immunohistochemical expression with TASCs and grading histopathology was done. Pearson chi square test analysis found statistically significant relationship between VDR immunohistochemical expression with grading histopathology and grade group, with moderate strength value (r=0.381) and p value <0.05. But, no statistically significant relationship between immunohistochemical expression of VDR and TASCs in prostate adenocarcinoma (p>0.05) (Table 1).
IV. DISCUSSION

The role of vitamin D has been widely studied in various diseases and type of cancer. Vitamin D has been proposed to have anti-cancer abilities, especially through its nuclear receptor activity or VDR. This VDR expression can be overexpressed or underexpressed in various cancer. As previously mentioned, TASCs are determined as microenvironment located adjacent to the epithelium that is able to coordinate several activities such as wound repair, homeostatic changes and interactions with neoplastic complexes. These TASCs promote prostate cancer progression by supporting tumor cell proliferation, inducing a fibroblastic phenotype, changing the shape of the ECM, and increasing the likelihood of metastasis. In cancer, it is known that carcinoma cells have the capacity to induce normal fibroblasts into a reactive myofibroblast phenotype. To examine these cells in TASCs associated with prostate cancer, this study used Masson’s trichrome staining. In this study, it was found that from 35 samples, there were about 54.3% samples had >50% of the stroma around the prostate gland stained blue (group ++), 22.9% samples had ≤15% stroma stained blue (group +), and 22.9% samples had >15-<50% stroma stained blue (group ++). The results of this study was in line with Hilbertina and Mulyani who found that all carcinoma specimens had TASCs> 15%. The higher the degree of histopathology, the higher the percentage of TASCs and this relationship is strong and statistically significant.

Then, in this study, the relationship between VDR immunohistochemical expression and TASCs in prostate adenocarcinoma.
adenocarcinoma was determined. By using Pearson chi square, no statistically significant relationship between VDR immunohistochemical expression and TASCs in prostate adenocarcinoma was found (p>0.05). So far, there are still no published studies examining the relationship between VDR expression and TASCs in prostate adenocarcinoma. Therefore, it cannot be compared with other studies.

According to the literature, it is known that carcinoma cells have the capacity to induce normal fibroblasts into a reactive myofibroblast phenotype (CAF). These CAFs are most often regulated through TGFβ signaling pathway. TGFβ upregulation supports angiogenesis and the formation of TASCs through matrix production (fibronectin, elastin, type I collagen) and release of factors responsible for extracellular remodelling (metalloproteinases and their inhibitors). Moreover, TGFβ activation induces EMT and VDR expression in the human WPMY-1 prostate stromal cell line. Increased levels of IL-6 secretion from CAFs are thought to be a mechanism for the development of prostate cancer that is not dependent on androgen hormones through the PI3K-AKT, STAT3 and MAPK/ERK pathways. Activated stromal cells react with each other. Based on this study’s results, it can be concluded that there appears to be no direct association between VDR and the onset of TASCs. Based on the theory, it seems that TGFβ is the one that causes TASCs and induces VDR expression. Therefore, it is necessary to further investigate whether this TGFβ is indeed directly and separately causes TASCs and induces VDR expression. So, it can be concluded that TGFβ does not directly affect the occurrence of TASCs.

In addition, based on grading, this study found a statistically significant relationship between VDR immunohistochemical expression with both histopathological grading and group grade, with moderate strength value (r=0.381; p value <0.05). There is controversy from several previous studies’ results. The results of this study was in line with Hendrickson et al. They found that men with high expression of VDR protein tumour had better clinical characteristics, including lower Gleason scores. They also found that VDR expression was highest in tumour with Gleason 3+3 and decreased with Gleason scores (p<0.001). Currently, molecular biology has developed very rapidly. The VDR gene is found on chromosome 12q13.11 and is polymorphic with at least 618 variants found. There have been several previous studies regarding single nucleotide polymorphisms (SNPs) in the VDR gene. As in the study of Jingwi et al, it was found that there was an association between SNP VDR and Gleason scores in prostate adenocarcinoma, which was the relationship between BsmI genotypes and rs2239185 with high Gleason scores. Because in this study, there was VDR expression in all histopathological grading. This led researchers to think that there may be certain VDR SNPs that tend to have higher or lower levels. Therefore, it is necessary to conduct further research on VDR SNPs in this sample group. However, in contrast to Ginting et al, they found no difference between VDR expression and prostate adenocarcinoma grade groups. In addition, it was also found that in all groups, moderate VDR expression was higher than strong expression.

Increased expression of VDR in colorectal cancer is associated with better tumour differentiation, absence of lymph node involvement and better prognosis. In the study of Erida et al, it appeared that there is a strong correlation between VDR immunoexpression and the degree of differentiation in colorectal adenocarcinoma. It was found that VDR correlated with the low grade group so that targeted therapy with vitamin D or its active form, calcitriol, could be given to the low grade group. An increased number of VDRs in tumour tissue responds to calcitriol therapy as the active form of the vitamin D metabolite. Aminah et al and Kure et al also found that VDR expression was less common in high grade tumours than in low grade colorectal adenocarcinomas. They also found an association between VDR immunoexpression and the degree of differentiation in colorectal adenocarcinoma. A recent study of VDR protein expression in 841 prostate cancer patients found that patients with high VDR expression had decreased Gleason score and stagnant tumour stages; it significantly reduces the risk of a lethal malignancy of prostate cancer.

The results of this study and several previous studies proved the same thing. VDR expression began to increase at the beginning of carcinogenesis or increase in the human colonic and prostate mucosa during early tumour development, but the level became low in poorly differentiated. This proved that VDR has the effect of restraining the growth of tumour cells. The results of this study have proven the role of VDR in the development of the pathogenesis of prostate adenocarcinoma so that vitamin D and its synthetic analogues can be used as adjuvant therapy in prostate cancer patients with positive VDR expression. If there is downregulation of the VDR, it will cause unresponsiveness and resistance not only to 1.25(OH)2D3 analog therapy but also the antitumoral effects of endogenous 1.25(OH)2D3. In this study, a polyclonal antibody VDR was used, where the VDR here specifically encoded the hormone receptor for vitamin D3. Therefore, the treatment given for this VDR is cholecalciferol-D3.

During this study, there was difficulty experienced by researchers. First of all, in determining the grading, some of the samples were from core biopsy, so it is difficult for the researchers to obtain good enough tumour specimens. It is feared that it does not represent the Gleason score and VDR expression. Second, in assessing VDR expression, the intensity of the brown color that appeared was not too different.

There were limitations encountered in this research. First, the researchers only evaluate the amount of VDR in tissues and not in blood samples. Therefore, it can’t describe the actual vitamin D levels in the samples.

V. CONCLUSION

In this study, some conclusion could be emphasized. There was statistically significant relationship between immunohistochemical expression of VDR with histopathological grading and grade group, with moderate strength value (r=0.381) and p value <0.05. But, no statistically significant relationship between immunohistochemical expression of VDR and TASCs in prostate adenocarcinoma.

VI. COMPETING INTERESTS

The author has no financial interests relevant to the product or company described in this article.
VI. ACKNOWLEDGMENT

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VII. ETHICAL APPROVAL

Health Research Ethical Committee, Universitas Sumatera Utara, Medan, Indonesia approved this study.

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AUTHORS

First author- dr. Zuhri Madriah, Resident of the Department of Anatomical Pathology, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia, email ID: zuhrimardiah@gmail.com

Second Author- Dr. dr. T. Ibnu Alferally, M.Ked (PA) Sp.PA, D.Bioeth. Department of Anatomical Pathology, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia. The third author- Dr. dr. Delyuzar, M.Ked (PA), Sp.PA (K), Department of Anatomical Pathology, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia.

Correspondence Author- dr. Jessy Chrestella, M.Ked (PA) Sp.PA (K) Department of Anatomical Pathology, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia, email ID:jes_ch@msn.com
The effect of high concentration of Lonchocarpus Laxiflorus leaf extract on turbidity removal in high turbid water

Abdulaziz Khalil*, Mustapha Umar Babayo**, Sulaiman Sulaiman Kabir***

* Civil Engineering, Bayero University, Kano
** Civil Engineering, Nile University of Nigeria, Abuja
*** Civil Engineering, Bayero University, Kano

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Abstract- Natural coagulants can potentially compliment or replace synthetic chemicals used for turbidity removal from raw water. This paper evaluated the turbidity removal efficiency of Lonchocarpus laxiflorus leaf extracts on raw water. The turbidity removal efficiency was evaluated at 0.5, 1.0 and 1.5% w/v stock solutions of Lonchocarpus laxiflorus leaf extract, using jar test. Results obtained revealed that 1.5% w/v Lonchocarpus laxiflorus leaf extract optimally removed turbidity from the synthetic raw water at about 300 mg/L coagulant dose, corresponding to a turbidity removal efficiency of about 98.5% in high turbid synthetic raw waters. This study demonstrated the potentials in using Lonchocarpus laxiflorus leaf extract for turbidity removal from raw water.

Index Terms- Turbidity, Wastewater, Lonchocarpus laxiflorus, Coagulation, and flocculation.

I. INTRODUCTION

Water is one of the most vital natural resources for all life on Earth. The availability and quality of water always have played an important part in determining not only where people can live, but also their quality of life. Industrial water use is valuable resource to the nations industries for such purposes as processing, cleaning, transportation, dilution, and cooling, in manufacturing facilities. Major water-using industries include steel, chemical, paper, and petroleum refining. Industries often reuse the water over and over for more than one purpose. Domestic wastewater is the water that has been used by a community and which contains all the materials added to the water during its use. It is thus composed of human body wastes (faeces and urine) together with the water used for flushing toilets, and sullage, which is the wastewater resulting from personal washing, laundry, food preparation and the cleaning of kitchen utensils [1]. Fresh wastewater is a grey turbid liquid that has an earthy but inoffensive odour. It contains large floating and suspended solids (such as faeces, rags, plastic containers, maize cobs), smaller suspended solids (such as partially disintegrated faeces, paper, vegetable peel) and very small solids in colloidal (i.e. non-settleable) suspension, as well as pollutants in true solution. It is objectionable in appearance and hazardous in content, mainly because of the number of disease-causing (‘pathogenic’) organisms it contains. In warm climates, wastewater can soon lose its content of dissolved oxygen and so become ‘stale’ or ‘septic’. Septic wastewater has an offensive odour, usually of hydrogen sulphide [2].

Turbidity removal is one of the important steps in water treatment process and generally is achieved by coagulation – flocculation – sedimentation process. Common coagulants like alum and iron salts have been widely used in conventional water treatment processes. Recent studies have pointed out many serious drawbacks of using these coagulants. Production of large sludge volume, Alzheimer’s disease, reduction in pH and low efficiency of coagulation in low temperature water are some of the problems faced with these coagulants. Also because of high cost and low availability, their use is difficult in many developing countries. Many researchers have worked on natural coagulants produced and extracted from plants, animals and microorganisms [3].

Research work by [4] indicated that Lonchocarpus laxiflorus leaves has significant flocculation abilities and have the potential of replacing conventional flocculants for water treatment, due to their efficiency, biodegradability and low sludge production. The cost of this coagulant is less expensive compared to the conventional coagulant (alum) for water purification. It is relatively available in most rural communities where treated water is a scarce resource. In this regard, this research will be conducted to evaluate the effectiveness of Lonchocarpus laxiflorus leaves extract on turbidity removal in domestic wastewater.

The history of the use of natural coagulants is long. Natural organic polymers have been used for more than 2000 years in India, Africa, and China as effective coagulants and coagulant aids at high water turbidities. They may be manufactured from plant seeds, leaves, and roots. These natural organic polymers are
interesting because, comparative to the use of synthetic organic polymers containing acrylamide monomers, there is no human health danger and the cost of these natural coagulants would be less expensive than the conventional chemicals alike since it is locally available in most rural communities of Bangladesh. A number of effective coagulants from plant origin have been identified which include; Nirmali, Okra, red bean, sugar and red maize, Moringa oleifera, Cactus latifera, Lonchocarpus laxiflorus and seed powder of Prosopis juliflora. Natural coagulants have bright future and are concerned by many researchers because of their abundant source, low price, environment friendly, multifunction, and biodegradable nature in water purification [5].

II. RESEARCH METHODOLOGY

A. Methods

i. Sample collection
The matured leaves of Lonchocarpus Laxiflorus leaves and Kaolin were obtained from Rimi market, Kano municipal, Kano State.

ii. Preparation of the sample
The plant was washed thoroughly under running water to remove dust and any adhering particle and then rinse with distilled water. The sample was air dried for two weeks and dry leaves were grounded using mortar and pestle and were sieved through 150um BS sieve, in order to achieve proper solubility of the active ingredient in the pods. The powdered leaves were stored in a plastic container for use in the experiment.

iii. Preparation of Synthetic Water Sample
To prepare 400NTU synthetic water:
6g of kaolin was dissolved in 500ml of tap water in a beaker, and was mixed for about 10 minutes. The sample was allowed to dissolve for 24hours. After 24hours, 2500ml of tap water was diluted in a bucket and was mixed. The initial turbidity was measured as 393NTU.

iv. Preparation of coagulants
Different concentration of Lonchocarpus laxiflorus leaf were prepared by dissolving 0.5g, 1.0g and 1.5g of powdered Lonchocarpus Laxiflorus leaf weighed on a triple beam balance into 100ml of distilled water, each contained in a conical flask to obtain 0.5%, 1.0% and 1.5% respectively. After that, the solution was shaken properly for about 1 minute to extract and activate the coagulant and antimicrobial proteins in the pod powder.

v. Coagulation Test
Samples of domestic wastewaters were treated by coagulation-flocculation and sedimentation, using Lonchocarpus laxiflorus coagulant as a primary coagulant. The quality of the treated wastewater was analyzed and compared to that of the wastewater treated with alum. Experiments were conducted at various dosages of the coagulant, using jar-test equipment. Parameters of quality of the wastewaters were measured before and after the treatment to evaluate the removal efficiency on the major pollutants of concern in wastewater treatment, such as suspended solids.

Conventional jar test [6] was carried out to investigate the treatment performance of the coagulant. The jar test carried out for this research was performed using flocculator (Model: PEF, Serial No. PEF003/11, Spain), which consist of six propellers. Under each propeller, a 500ml capacity beaker was placed containing 250ml of domestic wastewater with same turbidity level. Different dosages of the coagulants were added to five of the beakers with the last beaker kept as reference beaker without adding any dose. The varying dosages are 1ml, 2ml, 3ml, 4ml, and 5ml. The flocculator was then turned ON and left to run for about 30 minutes until the contents in the beakers were completely mixed. After 5 minutes of rapid agitation at 125 rpm, the mixing speed was then lowered to 20 rpm for 25 minutes in order to form flocs. The flocculator was then stopped by turning it off and allowed the sample to stand at near quiescent condition for 1 hour. The sample of the supernatant was collected from each beaker after 1 hour, and its residual turbidity was measured. The optimum dosage of coagulant is the beaker with the lowest turbidity value. In order to obtain a reliable result, the experiments were conducted in duplicate.

Fig. 1. Jar test apparatus

vi. Determination of optimum pH
There are other factors that affect coagulation and flocculation, and also affect the performance of the coagulant; one of these factors is pH. To determine the effect of pH on Lonchocarpus laxiflorus leaf performance. The 500ml capacity beakers were filled with synthetic raw water with identical turbidity up to the 250ml mark. Using hydrochloric acid (HCl) or sodium hydroxide (NaOH) solutions, the pH value of the raw water in each of the six beakers were adjusted to the range of drinking water pH specified by WHO which are 6.5, 7.0, 7.5, 8.0, and 8.5. The last beaker served as control beaker. The optimum dose for each coagulant obtained during the determination of the optimum dosage was used. The Jar test similar to that of the determination of optimum dose was performed. The beaker that gave the least
residual turbidity after measuring the turbidity of the supernatant gave the value of the optimum pH for the coagulation process. Similarly for reliable results, all the experiments were performed in duplicate.

B. Determination of Turbidity

The standard solution of 100 NTU was used to calibrate the instrument; the detection range selected for the adjustment was 1000 NTU.

Distilled water first added to the sample cell up to the vertical mark and was wiped gently using cotton wool. The sample cell was then inserted in to the turbidity meter and the dial cap placed. Using the set zero knobs, the reading on the turbidity meter was adjusted to zero.

The distilled water was then discarded and a standard solution of 100 NTU was added to the sample cell up to the vertical mark and wiped gently with soft cotton wool. The sample cell was inserted into the turbidity meter and covered with the cap. The stable reading on the turbidity meter was then observed. If the reading was not 100 NTU, using the calibration knob, the reading was adjusted to 100 NTU. The procedure was repeated until the distilled water and the standard solutions gave zero and 100 NTU respectively. The instrument was then ready for used.

ii. Testing of water sample

The water to be measured was added to the sample cell up to the vertical mark, cylindrical glass was wiped gently with cotton wool and it was inserted into the turbidity meter, the turbidity meter cap was placed and reading was observed and recorded as the turbidity of the water sample. The efficiency of turbidity removal of the Lonchocarpus laxiflorus leaf extract was calculated in percentage which forms the effectiveness of varying doses of the Lonchocarpus laxiflorus leaf extract using the relationship below:

\[ \text{Turbidity removal efficiency} = \left( \frac{C_i - C_f}{C_i} \right) \times 100\% \]

Where \( C_i \) and \( C_f \) are the initial and final turbidity of the raw water respectively.

C. Determination of pH

i. Testing of water sample

The electrode of the pH meter was first rinsed with distilled water, it was immersed carefully up to the maximum level in the beaker containing the water sample to be tested, and the reading on the pH meter was observed and recorded. The electrode was then removed from the sample and rinsed with distilled water. The electrode was wiped and cleaned to dryness using a soft cotton wool. The procedure was followed for all the remaining samples, and all the pH values were determined.

III. RESULTS AND DISCUSSIONS

The jar test experiment conducted shows the result of coagulation of Lonchocarpus laxiflorus leaf using 0.5% w/v, 1% w/v and 1.5% w/v stock solutions. The initial turbidity of the raw water was determined, the turbidity removal efficiencies of the different forms of coagulants were obtained using equation 1.0 from chapter three and the optimum dosage of each coagulant was determined. The dosage corresponding to the highest turbidity removal efficiency or lowest residual turbidity can be said to be optimum.

A. Maximum Dosage of the Coagulant

i. Maximum Dose of Lonchocarpus laxiflorus leaf extract with concentration (0.5% w/v).

Using different doses of 0.5% concentration of the Lonchocarpus laxiflorus leaf extract, the turbid water of 393NTU was treated. Fig. 2 represents the turbidity removal efficiencies obtained when 20, 40, 60, 80 and 100mg/l doses were added. At maximum dose of 100mg/l, the turbidity removal efficiency was found to be 97.8%. The result is in line with the research findings of [7] who reported 70.21% efficiency with initial turbidity of 47NTU.

\[ \text{Turbidity removal efficiency} = \left( \frac{C_i - C_f}{C_i} \right) \times 100\% \]

Fig. 2. Turbidity Removal Efficiency versus Dose for 0.5% concentration of Lonchocarpus laxiflorus leaf extract.

ii. Maximum Dose of Lonchocarpus laxiflorus leaf extract with concentration (1.0% w/v).

Fig. 3 below explain the results obtained when 393NTU was treated with 0.5% concentration of the Lonchocarpus laxiflorus leaf extract. It can be observed that by increasing the concentration of the stock solution to 1.0% w/v the maximum dose was found to be 160mg/l which yields the highest turbidity removal efficiency of 98.4%. This shows that increasing the concentration of the stock solution, increases the turbidity removal efficiency.
iii. Maximum Dose of L. laxiflorus leaf extract with concentration (1.5% w/v)

After the jar test experiment was carried out with 1.5% concentration of L. laxiflorus leaf extract, the results were presented in the fig. 4 below. The result revealed that, when different range of dosages of L. laxiflorus leaf extract were added to the raw water with initial turbidity of 393NTU, the turbidity removal efficiency was found to be 98.5% at an maximum dosage of 300mg/l. This shows that increasing the concentration of the stock solution, increases the turbidity removal efficiency.

### B. Maximum pH of Lonchocarpus laxiflorus leaf extract

#### i. Maximum pH of Lonchocarpus laxiflorus leaf extracts (0.5% w/v)

The fig. 5 below represents the turbidity removal efficiency of 0.5% concentration of Lonchocarpus laxiflorus leaf extract when used to treat the raw water with initial turbidity of 393NTU. With different initial pH values, it was observed that, the Lonchocarpus laxiflorus leaf extract (0.5% w/v) has higher turbidity removal efficiency of 98.7% at pH value of 6.5. Therefore, the result agreed with the findings of [7], who recorded about 72.3% at pH value of 6.5 by treating 47NTU low turbid water with the same type of coagulant.

#### ii. Maximum pH of Lonchocarpus laxiflorus leaf extracts (1.0% w/v)

The result obtained when the maximum dose of 1.0% concentration were used to treat the raw water with high turbidity of 393NTU with the pH value adjusted within the range of 6.5, 7.0, 7.5, 8.0, 8.5 as specified by the WHO, the highest turbidity removal efficiency of 97.7% was obtained at pH value of 7.5 as illustrated in the fig. 5 below.

### iii. Maximum pH of Lonchocarpus laxiflorus leaf extracts (1.5% w/v)

The results illustrated in the fig 7 below, represent the optimum pH at which the highest turbidity removal efficiency was obtained when the maximum dose of Lonchocarpus laxiflorus leaf extract was used to treat the high turbid water of 393NTU. The highest turbidity removal efficiency of 98.2% was recorded at 6.5 pH value and presented in the fig. 7 below.
From the results obtained of the analysis using *Lonchocarpus laxiflorus* leaf extract as a coagulant to treat raw water of high turbidity. It has been realized through the findings that *Lonchocarpus laxiflorus* leaf extract has not polluted the raw water but, instead gave it a much better clarity and it is available locally, therefore, the use of this substance should be upheld as a substitute of chemical coagulants. Furthermore, the residual turbidity values of 0.5%, 1.0% and 1.5% concentrations of *Lonchocarpus laxiflorus* leaf extract do not meet the WHO recommended value of drinking water quality. Therefore there is need for further filtration of the water sample.

In rural areas of the developing countries where conventional treatment is economically non-viable, *Lonchocarpus laxiflorus* leaf is recommended for use in treating water. Government should utilize the *Lonchocarpus laxiflorus* leaf extract in treating wastewaters which would drastically reduce the cost of conventional treatment.

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AUTHORS

First Author – Abdulaziz Khalil, Bachelor degree, Bayero University, Kano and abdulazizkhalil4118@gmail.com.
Second Author – Mustapha Umar Babayo, Bachelor degree, Nile University of Nigeria, Abuja.

Third Author – Sulaiman Sulaiman Kabir, Bachelor degree, Bayero University, Kano.

Correspondence Author – Author name, email address, alternate email address (if any), contact number.
The potential use of *moringa oleifera* pod extract in softening hard water

Abdulaziz Khalil¹, Mustapha Umar Babayo**, Mansur Isah Ismail***

¹ Civil Engineering, Bayero University, Kano
** Civil Engineering, Nile University of Nigeria, Abuja
***Civil Engineering, Bayero University, Kano

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**Abstract**- Natural substances that is locally, readily available and often considered as waste was potentially found to be good in water treatment. This paper investigated the hardness removal efficiency of *Moringa oleifera* pod extract for softening high hard water. The turbidity removal efficiency was investigated with 3% (w/v) and 6% (w/v) stock solution concentrations of *Moringa oleifera* pod, using jar test. Results obtained revealed that 540mg/L dose of the two stock solution concentrations gave the highest turbidity removal efficiency of 48% and 57% respectively. This study demonstrated the potential of using *Moringa oleifera* pod for softening high hard water.


I. INTRODUCTION

Water is an important component of human life and is needed in every activity in human life. Surface and ground water are the main source of water that we use for many purposes in domestic, agricultural, industrial and recreational purposes. Human activities increase due to increase in modern technologies, pollution and population, which result to contamination of human food chain and water sources. Water contamination by these microorganisms is inevitable. About billion people across Asia, Africa, and Latin America are estimated to rely on untreated surface water sources for their daily water needs. Of these, some two million are thought to die from diseases caught from contaminated water every year, with the majority of these deaths occurring among children under five years of age [1].

In some communities where surface water is difficult to access, groundwater is used for day to day life activities. The groundwater used is usually hard water that contains salts of calcium and magnesium principally as bicarbonates, chlorides, and sulfates. Ferrous iron may also be present; oxidized to the ferric form, it appears as a reddish brown stain on washed fabrics and enameled surfaces. Water hardness that is caused by calcium bicarbonate is known as temporary, because boiling converts the bicarbonate to the insoluble carbonate; hardness from the other salts is called permanent. Calcium and magnesium ions in hard water react with the higher fatty acids of soap to form an insoluble gelatinous curd, thereby causing a waste of the soap and scale formation in hot water pumps, boilers and pipes. Hardness is expressed in terms of CaCO₃ and is divided into temporary and permanent hardness [2].

Softening is the removal of ions which cause hardness in water. Hardness is caused mainly by calcium and magnesium ions, or at times, by iron, manganese, strontium, and aluminum ions. Hardness causes excessive soap consumption and scale formation in hot water pumps, boilers and pipes. Public water supplies should not exceed 300 to 500mg/l of hardness; although, aesthetically, a hardness greater than 150mg/l is unacceptable. Because the cost of chemicals for softening is high, local materials are being considered as substitutes. *Moringa oleifera* seed extract has been identified as a potential softening agent [3].

*Moringa oleifera* is a tropical plant which belongs to the family Moringaceae. The plant is one of the most widely cultivated species of the genus *Moringa*. *Moringa oleifera* is a fast growing evergreen, deciduous plant found in the tropical and sub-tropical countries of Asia and Africa. It is highly valued and provided with incredible nutritious components. In Northern Nigeria, the fresh leaves are used as a vegetable, roots for medicinal purposes and branches for demarcation of property boundaries and fencing. The dry seed is known to be a natural coagulant and coagulant aid as well as bacterial reduction agent. The softening property of *Moringa oleifera* which was accidentally discovered in that study is the only one documented to date. The present study was therefore carried out to explore further the potential of this multipurpose tropical plant as a new method for use in the softening of hard groundwater [4].

II. RESEARCH METHODOLOGY

A. Methods

i. Sample collection

The fresh matured *Moringa oleifera* pods were obtained from Mr. Musa’s farm at Garko local government area, Kano state. The pods were allowed to naturally dry under shade. The dried
pods were ground into powder using mortar and pestle, the powder was sieved through 150μm BS test sieve to obtain a fine powder. The sample was stored in an enclosed plastic container prior to use.

ii. Preparation of the sample
   A. Preparation of Moringa oleifera stock solution of 3.0% (W/V)
   3.0g of the fine powder of pod was added to a beaker containing 100ml of tap water to give a solution with approximate concentration of 30000mg/L. The solution was stirred using a magnetic stirrer for ten minutes to promote the extraction of the active components of Moringa oleifera, the resulting suspension was filtered through a filter paper.

   B. Preparation Moringa oleifera stock solution of 6.0% (W/V)
   6.0g of the fine powder of pod was added to a beaker containing 100ml of distilled water to give a solution with approximate concentration of 60000mg/L. The solution was stirred using a magnetic stirrer for ten minutes to promote the extraction of the active components of Moringa oleifera, the resulting suspension was filtered through a filter paper.

iii. Preparation of Hard Water Sample
   Synthetic hard water was prepared with powdered calcium carbonate and tap water. The volume of the calcium carbonate solution to substitute the same volume out of 250ml of tap water and results hardness of about 500 CaCO₃ was determined in quick test.

iv. Quick test
   0.5g of the fine powder was weighed using weighing balance and then dissolved in 100ml of tap water to give a solution. Firstly, hardness of the tap water was tested and found to be 178 CaCO₃. At the end of many trials which were done by substituting some little quantity of the tap water with the same quantity of prepared solution of CaCO₃ in 250ml of tap water, 2.6ml was found to results in hardness of about 500 of CaCO₃.

v. Determination of temperature
   Thermometer was set in a vertical position and the lower end of it was carefully clean with cotton wool. The sample to be tested was shaken and poured in a clean beaker; the mercury end of the thermometer was inserted and holds firmly while observing the rise in mercury level until it become stable. The mercury level was recorded as the temperature of the sample and then the thermometer was removed from the sample and cleans with cotton wool. The procedure was followed for all the samples and all the temperature values were determined both before and after the Jar test.

vi. Determination of pH of the samples
   The electrode of the pH meter was first rinsed with distilled water, and then carefully placed up to the maximum immersion level in the beaker containing the water sample to be tested, the stable reading on the pH meter was observed and recorded. The electrode was then removed from the sample and rinsed with distilled water. Using a soft cotton wool, the electrode was wiped and cleaned to dryness. The procedure was followed for all the samples and all the pH values were determined both before and after the Jar test.

vii. Conventional jar test
   Investigations of treatment performance were undertaken using the conventional jar test [5]. The jar test carried out for this research was carried out using a flocculator (Model: PEF, Serial No. PEF003/11, Spain) that consists of six propellers. Under each propeller, a 500ml capacity beaker was placed containing 250ml of hard water with same hardness. Different dosages of the Moringa oleifera were added to five of the beakers with the last beaker served as control beaker without adding any dose, prior to the addition of the different dosages, the same volume to be added was removed from each beaker containing hard water so as to maintain 250ml in each beaker. The varying dosages are 0.5ml, 1.5ml, 2.5ml, 3.5ml, and 4.5ml for 3.0%(W/V) stock solution and 0.25ml, 0.75ml, 1.25ml, 1.75ml, and 2.25ml for 6.0%(W/V) stock solution. The flocculator was then started, and allowed to mix the content of the beaker for about 30 minutes. After 5 minutes of rapid agitation at 125 rpm, the mixing speed was then lowered to 20 rpm for 25 minutes, this allowed the flocs to form. The flocculator was then stopped and the sample was allowed to stand at near quiescent condition for one hour. After 1h, the sample of the supernatant was collected from each beaker, and its residual hardness, turbidity, temperatures were measured as well as their pH. The dosage that gave the lowest residual hardness value was taken as the optimum dose. For the purpose of obtaining reliable results, the experiments were carried out in duplicate and the averages were taken.

viii. Determination of turbidity
   Calibration of turbidity meter (Portable Turbidity, Model: SGZ-200BS, England): The standard solution of 100 NTU was used to calibrate the instrument; the detection range selected for the adjustment was 1000 NTU. Distilled water first added to the sample cell up to the vertical mark and was wiped gently using cotton wool. The sample cell was then inserted in to the turbidity meter and the dial cap placed. Using the set zero knobs, the reading on the turbidity meter was adjusted to zero. The distilled water was then discarded and a standard solution of 100 NTU was added to the sample cell up to the vertical mark and wiped gently with soft cotton wool. The sample cell was then inserted in to the turbidity meter and covered with the cap. The stable reading on the turbidity meter was then observed. If the reading was not 100 NTU, using the calibration knob, the reading was adjusted to 100 NTU. The procedure was repeated until the distilled water and the standard solutions gave zero and 100 NTU respectively. The instrument was then ready for used.

ix. Testing of water sample
   The water to be measured was added to the sample cell up to the vertical mark, the cell was wiped gently with cotton wool and inserted in to the turbidity meter, the dial cap was placed and the stable reading observed and recorded as the turbidity of that water sample. Turbidity removal efficiency of the coagulants was calculated in percentage using the relationship below:

\[ \text{Turbidity removal efficiency} = \left( \frac{C_i - C_f}{C_i} \right) \times 100\% \]

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Where \( C_i \) and \( C_f \) are the initial and final turbidity of the raw water respectively.

x. **Determination of Hardness of the sample**

A. **Hardness test**

50ml of the supernatant was measured into the beaker, 0.5ml of 0.1N HCl was added to it and heat was applied to boil it, in order to expel CO₂, the boiled solution was allowed to cool to 50°C. 2ml of the buffer solution (pH 10) was added after which two drops of Erichrome T indicator was added. The solution was then titrated with EDTA until the colour changes from wine red to blue and the volume of EDTA was recorded. The procedure was followed for all the samples. Hardness was determined using this formula below:

\[
\text{Hardness as mg/l CaCO}_3 = \text{ml of EDTA titrant} \times 1000 \times 0.1 \times 17.8/ \text{ml of sample} \nonumber
\]

Where \( f = 1 \)

Hardness removal efficiency = \( \frac{h_i - h_f}{h_i} \times 100\% \)

Where \( h_i \) and \( h_f \) are initial and final hardness of the sample respectively.

## III. RESULTS AND DISCUSSIONS

The jar test experiments were conducted for the two stock solutions each with varied dosages. The synthetic hard water was made to have hardness of 500CaCO₃. After the tests with different dosages of the two stock solutions of the *Moringa oleifera* pod extracts, the hardness removal efficiencies were determined using equation 3. The last dose that corresponds to the lowest residual hardness represents the highest dosage and the stock solution with the highest removal efficiency represents the highest stock solution. The initial and final temperature, pH, and turbidity for all the dosages were determined.

### A. **Highest Dosage of the Stock Solutions**

i. **Stock solution 1: 3% (w/v)**

Figure 1 shows the relationship between dosages and the hardness removal efficiencies from 3% (w/v) stock solution to 3% (w/v) stock solution.

Fig. 1. Hardness removal efficiency against dose of 3% (w/v) stock solution.

Figure 1 explain the results obtained when the hard water of 500caco3 was treated with doses of 0, 60, 180, 300, 420 and 540mg/L of 3% (w/v) stock solution. The residual hardness after the test with the dosages was determined to be 0, 500, 423, 348, 328, 305 and 262caco3 respectively. The corresponding hardness removal efficiencies were 15, 31, 34, 39 and 48% respectively. The result shows that the hardness decrease with increase in dosage and the hardness removal efficiency of 48% was achieved at dose of 540mg/L which is taken as the highest dosage of 3% (w/v) stock solution.

### x. **Stock solution 2: 6% (w/v)**

Figure 2 shows the relationship between dosages and the hardness removal efficiencies from 6% (w/v) stock solution.

Fig. 2. Hardness removal efficiency against dose of 6% (w/v) stock solution

Figure 2 explain the results obtained when the hard water of 500caco3 was treated with doses of 0, 60, 180, 300, 420 and 540mg/L of 6% (w/v) stock solution. The residual hardness after the test with the dosages was determined to be 500, 405, 323, 309, 274 and 213caco3 respectively. The corresponding hardness removal efficiencies were 0, 19, 35, 38, 45 and 57% respectively. The result shows that the hardness decrease with increase in dosage and the hardness removal efficiency of 57% was achieved at dose of 540mg/L which is taken as the highest dosage of 6% (w/v) stock solution.

### B. **Highest Stock Solution**

From the results above, 48% was determined as the highest hardness removal efficiency that corresponds to the 540mg/L dose of 3% (w/v) stock solution and 57% was determined as the highest hardness removal efficiency that corresponds to the 540mg/L dose of 6% (w/v) stock solution. By comparing the highest efficiencies of the 3% (w/v) and 6% (w/v) stock solutions which were 48% and 57% respectively, it can be seen that 6% (w/v) stock solution have the greater efficiency of 57% therefore 6% (w/v) stock solution is taken as the highest stock solution.
C. pH results

i. Stock solution 1: 3% (w/v)
The average initial pH of the six set of beakers before the jar test were determined to be 7.31 which after the jar test decreases with increase in dosages. The average final pH of the six beakers were determined to 7.31, 6.93, 6.85, 6.83, 6.80 and 6.76 corresponding to 0, 60, 180, 300, 420 and 540mg/L dosages respectively.

ii. Stock solution 2: 6% (w/v)
The average initial pH of the six set of beakers before the jar test were determined to be 7.31 which after the jar test decreases with increase in dosages. The average final pH of the six beakers were determined to 7.31, 6.91, 6.84, 6.81, 6.76 and 6.74 corresponding to 0, 60, 180, 300, 420 and 540mg/L dosages respectively.

C. Relationship between pH and hardness removal efficiency

i. Stock solution 1: 3% (w/v)
Figure 3 shows the relationship between hardness removal efficiency and pH.

![Fig. 3. pH against hardness removal efficiency](image)
The figure above also indicated that hardness removal efficiency increases with the increase in pH.

ii. Stock solution 2: 6% (w/v)
Figure 4 shows the relationship between hardness removal efficiency and pH. It revealed that hardness removal efficiency increases with the increase in pH.

![Fig. 4. pH against hardness removal efficiency](image)

D. Temperature
Throughout the tests, initial and final temperature was measured. The temperature during the tests ranges from 25 to 30°C. As pH decreases with increase in temperature, so the increase in temperature might have also contributed in the decrease in pH of the water.

E. Turbidity
The initial turbidity of the sample was 4NTU which after the tests was also determined as shown in the figures below.

![Fig. 5. Residual turbidity against dose of 3%](image)

From the result shown in figure 5, turbidity was decreasing with dosages except for the last dose where the turbidity increased to 3NTU and from figure 6, turbidity was also decreasing with dosages except with the last two dosages where turbidity increased to 5NTU which is due the color of the moringa olifera pod extract as noted by[6] that since Moringa oleifera is a polyelectrolyte, It may not be effective as a primary coagulant for low/medium turbid water because such waters contain low concentration of colloidal particles, with a low rate of inter particle contact in such systems.

IV. CONCLUSION
The results for 3% (w/v) and 6% (w/v) stock solutions were obtained using various dosages and hardness removal efficiency was found to increase with increasing dosage of Moringa
Moringa oleifera pod extract, hence it was investigated to be suitable in softening hard water. Moringa oleifera pod extract could be utilized in softening hard water as it was found from the stock solutions used in this research, hardness was reduced by 48% and 57% with 3% and 6%(W/V) stock solutions respectively. Hence Moringa oleifera pod could reduce the need to spend on chemical for softening hard water. Dosage of 540mg/L both from the stock solutions was found to reduced hardness the most by 48% and 57%. Therefore, its determined to be the highest dosage within the scope of this research. The 6%(W/V) Stock solution was determined to reduced hardness the most, with its highest dosage of 57%. Hence it is found to be the highest stock solution in softening hardness. Furthermore, there is need for clarification of the treated water as the residual hardness were still at the range of higher hardness. Moringa oleifera pod is recommended for use in softening hard water especially in rural areas where hard water is mostly used for their activities. As coliforms might be present, treatment on disinfection of the treated water is needed. It is recommended that research work should be carried out on combining Moringa oleifera pod and Moringa oleifera seed in various ratios to investigate the suitability as well as the best combined ratio in softening hard water.

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AUTHORS

First Author – Abdulaziz Khalil, Bachelor degree, Bayero University, Kano and abdulazizkhalil4118@gmail.com.
Second Author – Mustapha Umar Babayo, Bachelor degree, Nile University of Nigeria, Abuja.
Third Author – Mansur Isah Ismail, Bachelor degree, Bayero University, Kano.

Correspondence Author – Abdulaziz Khalil, abdulazizkhalil4118@gmail.com, 08102712775.
Investigating the thermal and mechanical performance of compressed earth blocks

Abdulaziz Khalil*, Sani Abubakar Sani**, Abdulrauf A. Liman***

* Civil Engineering, Bayero University, Kano
** Civil Engineering, Nile University of Nigeria, Abuja
***Civil Engineering, Nile University of Nigeria, Abuja

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Abstract- Due to the rapidity with which structures are being constructed nowadays, particularly in developing nations like Nigeria, concrete blocks have become the most commonly used building material. Even though they aren't very light, concrete blocks have a high compressive strength, and the ingredients for concrete are easy to find. Some industrialized nations are shifting away from utilizing concrete blocks due to their lack of sustainability, which leads to their being environmentally unfriendly, in favor of compressed earthen blocks (CEB), which are more sustainable in terms of getting resources and more ecologically friendly. This paper investigated the thermal and mechanical performance of compressed earth blocks. The percentage of cement was investigated with 0%, 2%, 4%, and 6% cement sample. Results obtained revealed that the compressive strength was notably high at 28 days after curing, with strength of 10.30 N/mm². After 28 days of curing, a high UPV of 8622m/s and 8660m/s for 4 and 6 percent cement replacement was reported respectively.

Index Terms- Thermal, Mechanical, Compressed earth, Blocks and Cement

I. INTRODUCTION

Compressed earth bricks are one of the most frequent earthen building methods (CEBs). They're a contemporary descendent of the molded earth block, or adobe block [1]. Earth compaction improves the quality and function of the blocks while also delivering a number of environmental, social, and economic benefits [2], [3] In a cradle-to-gate investigation of various walls, a previous study indicated that using earthen building materials might result in a 50% reduction in possible environmental implications when compared to using conventional construction parts [4] Earthen constructions are prone to deterioration in harsh weather conditions [5]. If not built appropriately, earthen constructions are less durable and more prone to intense weather and rainfall than conventional structures. Over the course of a building's life cycle, this condition leads in higher maintenance and repair costs [6]. In recent years, there has been an increasing interest in tackling the mechanical and durability issues connected with clay bricks. Various stabilizing approaches were used to increase durability and compressive strength [7].

In addition, some study shows that adding lime to compressed earth blocks might improve their mechanical and hydrous properties [8]. When it comes to the thermal characteristics of earthen construction materials, their mass contributes to the structures' thermal inertia. This feature may have a positive influence on building thermal performance in specific areas. According to previous study, clay buildings in areas with hot summers and mild winters, such as the Mediterranean, can only provide a suitable internal temperature by passive means [9].

A compressed earth block (CEB), also known as a pressed earth block or a compressed soil block, is a type of construction material composed mostly of moist soil compacted under high pressure into blocks. Compressed earth blocks are made using a mechanical press from a mixture of relatively dry inorganic subsoil, non-expansive clay, and aggregate. Compressed stabilized earth block (CSEB) or stabilized earth block (SEB) refers to blocks that have been stabilized using a chemical binder such as Portland cement (SEB). Most of the time, pressures of about 21 MPa (3,000 psi) are used, and the initial volume of the soil is reduced by about half. Rammed earth differs from CEBs in that the latter employs a bigger formwork into which earth is poured and physically tamped down, rather than building blocks, to create larger shapes, such as a full wall or more at once. CEBs vary from mud bricks in that the latter are not compacted and solidify when they air dry due to chemical changes. CEB has a compression strength that is generally higher than that of mud brick. CEB has established its own set of building standards.

II. RESEARCH METHODOLOGY

A. Methods

i. Sample collection

The compressed earth, sand, clay, silt, and cement were brought from a market located in the city of Abuja, Nigeria.
ii. **Preparation of the sample**

The tested compressed earth blocks were manufactured in the city of Abuja, Nigeria, using one pail of rammed earth. In most cases, rammed earth was used to construct 50 compressed earth blocks, each measured in centimeters. Because, it is the most common block made locally or by corporaions in Nigeria, 28 cm x 25 cm x 11 cm compressed earth blocks were used in this research. Furthermore, this is the most common size in Nigerian buildings. Water harvested on-site (groundwater) is also used in the mix (10% by weight), which evaporates during the drying process. The dirt removed from the construction site is used to create the bulk of earthen building parts. A mechanical tapping machine is also used to make and compact compressed earth blocks, according to statistics. The soil was utilized in the process. They were put through tests at the Laboratory of the Department of Civil Engineering at Nile University in Abuja.

iii. **Mixing Process**

Soil, cement, and water are among the ingredients utilized in the mixing process. Cement and water were added to the soil. A total of four compressed earth block samples were created: a 0% sample, a 2% sample, a 4% sample, and a 6% sample. A total of 12 compressed earth bricks were created in each sample. Twelve samples of compressed earth blocks were made from a 0% sample, which had 1 bucket of soil for each block, water, and zero percent cement. The mixing ratio for the 2 percent sample is 1 bucket of starchy soil for each block, water, and 2 percent of 1 bag of cement; twelve samples were also created using the mechanical tapping machine. Furthermore, the mixing ratio for 4% samples included 1 bucket of soil for each block created, 4% of a bag of cement and water, and 12 samples. Finally, the mixing ratio for 6 percent samples is 6 percent of 1 bag of cement, water, and 1 bucket of starchy soil. A mechanical tapping machine was used to create 12 samples.

### Table 1. Compressed Earth Block Produced

<table>
<thead>
<tr>
<th>S/no</th>
<th>Samples</th>
<th>Number of blocks produced</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0% sample</td>
<td>12</td>
</tr>
<tr>
<td>2.</td>
<td>2% sample</td>
<td>12</td>
</tr>
<tr>
<td>3.</td>
<td>4% sample</td>
<td>12</td>
</tr>
<tr>
<td>4.</td>
<td>6% sample</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>48</td>
</tr>
</tbody>
</table>

iii. **Compressed Earth Block Produced**

Total of fifty compressed earth blocks were produced, each sample include 0%, 2%, 4% and 6% of cement ratio.

---

**B. Testing of compressed Earth Block**

i. **Ultrasonic Pulse Velocity**

The Ultrasonic Pulse Velocity (UPV) test assesses material qualities such as elasticity modulus, homogeneity, mechanical resistance, and cracking. The propagation velocity can also be calculated. The time it takes for a particular sound pulse to travel through a known area of a material is measured in UPV tests. This is based on the wave propagation hypothesis, which states that a sound pulse travels quicker in dense materials than in porous materials. So, the propagation speed can be calculated, and this test can be used in a roundabout way to find out what a specific sample is made of. There is practically no literature on the use of this test on compacted earth blocks. Nonetheless, certain investigations into rammed earth have revealed a link between the UPV and the compressive strength of earthen products. In two ways, the UPV measurement was developed (direct and indirect). The transmitter and receiver transducers were placed on opposing sides to measure UPV in the direct position. The indirect measurements were carried out by putting the transmitter on one side and the receiver on the opposite side. To avoid voids in the contact region, a suitable coupling gel was put between the transducers and the sample. For each sample, three separate readings must be recorded. Equation 1 is used to figure out the UPV. It is the ratio of the distance (L) between the emitter and receiver to the time (t) it takes for the signal to travel.

\[
\text{UPV (m/s)} = \frac{L}{t} \tag{1}
\]

ii. **Compressive Strength**

According to the British Standard, the compressive strength test was performed using a hydraulic press machine with a capacity of 3000 kN (Figure 2) and a hydraulic control system. Two transducers were employed in the test, one from the press and the other from the outside (LVSTs). The test employed displacement control with a regular load velocity of 0.5 kN/s. The experiment consisted of increasing the compressive load until it reached 40 percent to 50 percent of the failure value after the highest load peak was recorded. Six samples were examined to determine the compressive strength of CEBs.
Fig. 2. Testing of compressed earth blocks

ii. Total Water Absorption

The total water absorption of a block must be determined since it may be utilized for routine quality checks, categorization based on needed durability and structural usage, and estimation of void volume. The higher the structural performance and longevity of a block, the less water it absorbs and retains. Reducing a block’s overall water absorption capacity has long been thought to be one approach to improving its quality. Immersing a block in water until no further rise in apparent mass is noticed is the complete water absorption test. When two successive mass measurements differ by less than 0.1 percent, it is assumed that no apparent mass increase occurred. Three samples were submerged in water for 1, 2, 3, 4, and 5 hours at atmospheric pressure for the test. The surface of the specimen was cleaned with a towel after each interval to remove any adsorbed water. The samples were then weighed. Initially, the test was carried out for 24 hours, as per the norm and previous research. The CEBs, on the other hand, decomposed after 72 hours in water, making it impossible to determine their wet weight.

An equation was used to compute the proportion of water absorbed (A).

\[ A \text{ (percentage)} = \frac{\text{Wh} - \text{Ws}}{\text{Wst}} \] .................................................(1)

Where Wh represents the weight of the specimen after each immersion, and Ws represents the weight of the dry block.

III. RESULTS AND DISCUSSIONS

The findings of the cement used in this investigation are displayed in Table 2. The cement test complies with the British Standard Institution’s (BSI) (2011) guideline for block manufacturing cement. The results of the water absorption, compressive strength, and ultrasonic pulse velocity tests were obtained.

Table 2. Properties of cement

<table>
<thead>
<tr>
<th>S/No</th>
<th>Properties</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Standard Consistency</td>
<td>31 %</td>
</tr>
<tr>
<td>2.</td>
<td>Initial setting time</td>
<td>166 min</td>
</tr>
<tr>
<td>3.</td>
<td>Final setting time</td>
<td>340 min</td>
</tr>
<tr>
<td>4.</td>
<td>Specific Gravity</td>
<td>3.13</td>
</tr>
<tr>
<td>5.</td>
<td>Fineness</td>
<td>1.58</td>
</tr>
</tbody>
</table>

A. Determination of ultrasonic pulse velocity, compressive strength and water absorption

i. Ultrasonic Pulse velocity test after 7days curing

The UPV results for each sample are shown in Figure 3. Every sample was subjected to three measurements, and the values provided are the average of the data obtained for each sample. After 7 days of curing, the outcome yield a high UPV of 1922m/s with 4% cement replacement and a lower UPV of 784m/s at 2% cement replacement. As a consequence of the examination of the data, it is reasonable to deduce that sample 2 had a somewhat lower UPV, which could indicate a bigger number of voids.

ii. Ultrasonic pulse velocity test after 28 days curing

Figure 4 shows the UPV findings for each sample. Every sample was measured three times. A high UPV of 8622m/s for 4 percent cement replacement and slightly higher for 6 percent (8660m/s) after 28 days of cure was obtained. A lower UPV of 7486m/s was found with 2% cement replacement.

Fig. 3. Ultrasonic pulse velocity at 7 days curing

Fig. 4. Ultrasonic pulse velocity test after 28 days curing
iii. Water absorption after 7 days curing

The maximal water absorption values for samples 1, 2, 3, and 4 were 1.86 percent, 5.3 percent, 19.87 percent, and 7.77 percent, respectively, according to Figure 5. Water absorption ranged between 1.86 and 19.87 percent when compared to clay bricks (0–30 percent), concrete blocks (4–25 percent), and calcium silicate bricks (6–16 percent). Although this looks to be a beneficial outcome, the quick absorption and desegregation of blocks might compromise the durability. Water absorption is influenced by soil granularity and compaction pressure.

iv. Water absorption after 28 days curing

According to Figure 6, the maximum values for water absorption for samples 1, 2, 3, and 4 were 3.20 percent, 1.17 percent, 7.05 percent, and 1.64 percent, respectively. When compared to clay bricks (0–30%), concrete blocks (4–25%), or calcium silicate bricks (6–16%), it is possible to deduce that water absorption varied between 1.17 and 7.77 percent. Although this appears to be a positive result, the rapid absorption and desegregation of blocks may have a negative impact on the durability.

A. Compressive Strength

i. Compressive strength after 7 days curing

After 7 and 28 days of curing, the blocks were crushed to assess compressive strength. On the sides, a variable load was applied, and the failure load was recorded.

Fig. 5. Water absorption after 7 days curing

Fig. 7. Compressive strength after 7 days curing

The compressive strength was notably high at 7 days after curing, with strength of 10.30 N/mm². As shown in Figure 7, the control with 0% sand replacement has a compressive strength of 8.90 N/mm², with a modest rise from when the sand was partially replaced by Cement in 2% and a slight increase from 4% replacement onward.

ii. Compressive strength after 28 days curing

Water absorption maximum values for samples 1, 2, 3, and 4 were 3.20 percent, 1.17 percent, 7.05 percent, and 1.64 percent, respectively, according to Figure 8. Water absorption ranged between 1.17 and 7.77 percent as compared to clay bricks (0–30 percent), concrete blocks (4–25 percent), and calcium silicate bricks (6–16 percent). Although this looks to be a beneficial outcome, the quick absorption and desegregation of blocks might compromise the durability.

IV. CONCLUSION

The compressive strength and the water absorption were determined. The compressive strength was notably high at 28 days after curing, with strength of above 10.30 N/mm². The control, which has no cement replacing any of the sand, has a compressive strength of 9.04 N/mm². When 2 percent of the
sand is replaced by cement, the strength increases and from 4 percent replacement it increases more, to 9.65 N/mm². These indicates that increase in the cement, increases the strength of the block. In general, the compressed earth blocks have been examined as suitable for use in the building of partition walls. Furthermore, it was discovered that the compressed earth blocks had a number of environmental benefits. Taking this into account, changing the size distribution of the soil particles in the mixture before making compressed earth blocks could be a way to solve these problems (mostly in terms of thermal performance) while keeping the blocks' strong mechanical resistance.

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My deepest gratitude goes to Allah the Sustainer, the Cherisher, the most Beneficent, the most Merciful, Who grant me the will to put all that was needed to complete this project.

My sincere appreciation goes to my tutor Prof. Salisu Dan Azumi whose personality I very well admire and whose contribution has pushed me to expand the kind of efforts I have exerted to make this work as original as it can be. Thanks to him I have experienced true research and my knowledge on the subject matter has been broadened, I will never forget you Sir. I owe a deep sense of gratitude to Prof. A.Y. Abdulfatah Department of Civil Engineering Bayero University Kano, for his keen interest, tireless support and encouragement on me at every stage of my research. His prompt inspirations, timely suggestions with kindness and enthusiasm and dynamism have enabled me complete my research.

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AUTHORS

First Author – Abdulaziz Khalil, Bachelor degree, Bayero University, Kano and abdulazizkhalil4118@gmail.com.

Second Author – Sani Abubakar Sani, Bachelor degree, Nile University of Nigeria, Abuja.

Third Author – Abdulrauf A. Liman, Bachelor degree, Nile University of Nigeria, Abuja.

Correspondence Author – Abdulaziz Khalil, abdulazizkhalil4118@gmail.com, 08102712775.
A Case Report On Role Of Ayurveda In Lumbar Disc Herniation

Dr. Renu Sharma*1, Dr. Abhishek Bhushan Sharma*2, Dr. Kumar Anand*3

*1 Assistant Professor, Dept. of Kayachikitsa, Khalsa Ayurvedic Medical College, Nangal Kalan, Mansa, Punjab, India.
*2 Professor, Dept. of Kayachikitsa, Motherhood University, Roorkee, Uttarakhand, India.
*3 Professor, Dept. of Samhita, Sanskrit and Siddhant, Baba Khetanath Ayurvedic college and hospital, Patikara, Narnaul, Haryana.

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Abstract- Pain in the distribution of the lumbar or sacral roots is often due to disc protrusion. In industrialized area, 60-70% people are found with low back pain. The purpose of the study is to explore ayurvedic management to enhance the quality of life in patients suffering from low-backache due to Lumbar Disc Herniation. Katigraha is occurring mainly due to the imbalance of vata dosha hence, the treatment plan will be accordingly. Here is a case presentation of 28 years old patient with complaints of low back-pain and numbness in bilateral lower limbs with neck pain since 3 months. Her MRI report shows posterior disc bulge with disc desiccation noted at L5-S1 indenting the thecal sac. The modern medicines are used specifically analgesics for pain relief but these are not devoid of complications mainly in long term use. Surgical procedures are the last option but that is not always effective. Owing to these reasons, it is obligatory to plan treatment with good efficacy and no toxicity profile. Considering the issue, a single case study has been done with ayurvedic management accordingly. As Kati is mainly sthana of vata so Basti was planned. Miraculous results were witnessed in form of complete cure of low back pain and numbness in bilateral lower limbs by SHODHANA, SHAMANA and YOGA-ASANAS within three months of treatment.

Index Terms- Katigraha, vata dosha, Basti, Asanas

I. INTRODUCTION

Low back pain is most common rheumatic disorder accounting for 30% to 50% of rheumatic musculoskeletal complaints encountered by general practitioners. Pain in the distribution of lumbar or sacral roots is almost always due to disc protrusion. The intervertebral disc are the cushions that act as shock absorbers between each of vertebral bones in spine. Taking a glance towards the anatomy, the spine is made up of individual bones known as vertebrae. Intervertebral discs are discs of cartilage that sit between the vertebrae. Intervertebral disc consists of three major components i.e. the inner- Nucleus Pulposus, the outer- Annulus Fibrosus and the cartilaginous Endplates that anchor the disc to adjacent vertebrae. The central nucleus pulposus is a site of collagen secretion and contains numerous proteoglycans, which facilitate water retention, creating hydrostatic pressure to resist axial compression of spine. In lumbar disc herniation, nucleus pulposus may bulge or rupture through the annulus fibrosus, giving rise to pressure on nerve endings in the spinal ligaments, changes in the vertebral joints or pressure on nerve roots. Each year, herniated discs affect around 5-20 of every 1000 adults around the age group of 20-49 years. The symptoms of herniated disc mainly depend on the location of the herniation and the amount of compression on neural structures. The onset may be sudden or gradual. Alternatively, repeated episodes of low back pain may precede sciatica by months or years. Constant aching pain is felt in the lumbar region and may radiate to the buttock, thigh, calf and foot. Investigation can be done through Plain X-Ray, CT-Scan but MRI would be preferred because soft tissues can be imaged well.

II. MANAGEMENT

In 90% cases conservative treatment is given like NSAIDs, analgesic drugs, physiotherapy and early mobilization. Long term use of these drugs results in side effects. Instructions should be given for back strengthening exercises and avoid physical work likely to strain the lumbar spine. Injections of local anesthetics or corticosteroids may be useful treatment if symptoms are due to ligament injury or joint dysfunction. Surgery i.e. lumbar discectomy, endoscopic spine surgery etc. seems the last option if central disc prolapses with bilateral symptoms and signs. Research studies explains 70-80 % results in better outcome for cases with severe radicular pain but it involves financial issues. Reoccurrence with certain complications like foot drop may happen post-operatively.

III. AYURVEDIC REVIEW-

In Ayurveda both the neuromuscular disorders that are present at birth and those that are gradually degenerative are Vata disorders or Vata Vyadhi. Ayurveda offers treatment methods for these disorders through a multifaceted approach. The Vata imbalance is treated by internal medication as well as external
treatments i.e. Panchkarma therapy which strengthens the affected part and helps pacify the Dosha imbalance.

According to Ayurveda, kati i.e. lumbar-sacral region is the sthana of Vata specifically Apana Vata. Basti is the prime treatment modality for Vata Dosha. Acharya Charaka praised Basti as half treatment and said Basti Vataharaman and some called it complete treatment as it has vast field of therapeutic action.\textsuperscript{10} According to Acharya Charak taila is the best management for vata shaman because of its snigdha and guru guna.\textsuperscript{11} These Ayurvedic treatments when sustained over a longer period aim to restore the patient’s ability to move freely and lead a better quality of life.

**Case Report**-

1. **Chief complaints**- pain in low back which radiates to bilateral lower limbs.

2. **History of present illness**- A 28-year-old female patient reported to OPD of department of Kayachikitsa, Patanjali Ayurved hospital, Hardwar in April 2021. She was having low back pain radiating towards lower limbs with numbness while sleeping since 3 months and pain with stiffness in neck region. She then visited allopathic hospital where she was advised MRI scan and found posterior disc bulge with disc desiccation noted at L5-S1 indenting the thecal sac. Allopathic medicines including Pregabalin 75 mg and Brut flam-MR was prescribed but couldn’t got much relief in 20 days. For better management she was admitted to IPD ward of our hospital.

3. **History of past illness**- History of accident 6 months back.

4. **Treatment history**- Tab. Pregabalin 1 BD and Tab. Brutafam MR 1 BD since 20 days.

5. **Family history**- nothing as such.

6. **Examination**- while local examination patient was found with positive SLR Test at the angle of 45\(^\circ\) as well as tenderness was also present in left iliac region.

7. **Investigation**-

8. **Management**

1. **Nidan privarjan**- Patient was advised to avoid vata-vardhaka ahar and vihara i.e weight lifting, forward bending and heavy work during the treatment plan.

2. **Shodhan chikitsa**-

   Considering **Lumbar Disc Herniation** as katigraha following ayurvedic plan was administered.

<table>
<thead>
<tr>
<th>THERAPY</th>
<th>DRUG</th>
<th>DAYS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GREEVA BASTI</td>
<td>PRASARANI TAILA</td>
<td>7 days</td>
</tr>
<tr>
<td>KATI BASTI</td>
<td>PRASARANI TAILA</td>
<td>7 days</td>
</tr>
<tr>
<td>PATRA POTLI PIND SWEDA</td>
<td></td>
<td>7 days</td>
</tr>
<tr>
<td>ANUVASANA BASTI</td>
<td>KSHEERBALA TAILA (70 ml)</td>
<td>9 days</td>
</tr>
<tr>
<td>NIRUHA BASTI (Eranda mooadi Yapna Basti)\textsuperscript{12}</td>
<td>Madhu- 50 ml Saindav lavan- 5 gm</td>
<td>7 days</td>
</tr>
</tbody>
</table>

Both ANUVASANA AND NIRUHA BASTI was planned in such a manner from 14\textsuperscript{th} 2021 to 29\textsuperscript{th} 2021:

<table>
<thead>
<tr>
<th>Days</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basti</td>
<td>A</td>
<td>N</td>
<td>A</td>
<td>N</td>
<td>A</td>
<td>N</td>
<td>A</td>
<td>N</td>
<td>A</td>
</tr>
</tbody>
</table>

3. **Shaman Chikitsa** as follows:

   Cap. Ksheerabala\textsuperscript{13} – 2 BD after meal with lukewarm water. (For 3 months)

   **Vatakulantaka Rasa**\textsuperscript{14} – 100 mg BD (crush in the powder form) before meal with honey. (For 1 month)

4. **Advised ASANAS** as follows:\textsuperscript{16}
   a. Bhujangasana
   b. Makarasana
   c. Markatsana
   d. Dhanurasanas
   e. Vipritaukasana
   f. Setubandhasana

**Ingredients of Cap. Ksheerabala** are as follows:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Drugs</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Bala (Sida Cordifolia)</td>
<td>3.338 g</td>
</tr>
<tr>
<td>2.</td>
<td>Cow milk</td>
<td>75.700 ml</td>
</tr>
<tr>
<td>3.</td>
<td>Tila Taila (Sesamum Indicum)</td>
<td>187.500 mg</td>
</tr>
</tbody>
</table>

**Contents of Vatakulantaka Rasa**\textsuperscript{15} are as follows:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Contents</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mriganabhi- kasturi musk</td>
<td>12 gm</td>
</tr>
<tr>
<td>2.</td>
<td>Manashila</td>
<td>12 gm</td>
</tr>
<tr>
<td>3.</td>
<td>Nagakesara</td>
<td>12 gm</td>
</tr>
<tr>
<td>4.</td>
<td>Vibhitaki</td>
<td>12 gm</td>
</tr>
<tr>
<td>5.</td>
<td>Shudha Parada</td>
<td>12 gm</td>
</tr>
<tr>
<td>6.</td>
<td>Shudha Gandhaka</td>
<td>12 gm</td>
</tr>
<tr>
<td>7.</td>
<td>Jatiphal</td>
<td>12 gm</td>
</tr>
<tr>
<td>8.</td>
<td>Eka</td>
<td>12 gm</td>
</tr>
<tr>
<td>9.</td>
<td>Lavanga</td>
<td>12 gm</td>
</tr>
<tr>
<td>10.</td>
<td>Jala</td>
<td>Q.S. for bhavana and mardana</td>
</tr>
</tbody>
</table>

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5. **NIDAN PARIVARJAN**- Patient was advised to avoid *vata-vardhaka ahara and vihara i.e weight lifting, forward bending and heavy work during the treatment plan.*

**ASSESSMENT CRITERIA**

**COMPARATIVE PAIN SCALE CHART (Pain Assessment Tool)**

<table>
<thead>
<tr>
<th>Pain Free</th>
<th>Very Mild</th>
<th>Discomforting</th>
<th>Tolerable</th>
<th>Distressing</th>
<th>Very Distressing</th>
<th>Intense</th>
<th>Very Intense</th>
<th>Utterly Horrible</th>
<th>Excruciatingly Unbearable</th>
<th>Unimaginable Unbearable</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Pain</td>
<td>Minor Pain</td>
<td>Moderate Pain</td>
<td>Severe Pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Feeling perfectly normal | Interferes significantly with daily living activities. Requires lifestyle changes but patient remains independent. Patient unable to adapt pain. | Disabling; unable to perform daily living activities. Unable to engage in normal activities. Patient is disabled and unable to function independently. |

1. **PAIN ASSESSMENT**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Low back pain</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Pain in Right limb</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Pain in Left limb</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

2. **TENDERNESS ASSESSMENT**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Right Iliac Region</td>
<td>Present</td>
<td>Absent</td>
</tr>
</tbody>
</table>

3. **SLR Test**

<table>
<thead>
<tr>
<th>S.no.</th>
<th>SLR TEST</th>
<th>Before treatment</th>
<th>After treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Right leg</td>
<td>Present at 45°</td>
<td>Absent</td>
</tr>
<tr>
<td>2.</td>
<td>Left leg</td>
<td>Present at 30°</td>
<td>Absent</td>
</tr>
</tbody>
</table>

4. **MRI Report**

**Before Treatment**- Diffuse disc bulge at L5-S1 with disc herniation.

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IV. DISCUSSION

Injury or weakness leads to protrusion of disc through the outer ring. This is known as slipped, herniated or prolapsed disc. Disc herniation simply means a condition in which the outermost layer of annulus fibrosus are still intact but can bulge when the disc is under pressure. In adults basically it results due to poor posture, incorrect mechanics, hard physical labour, improper lifting, especially if accompanied by twisting or turning; excessive strain, sudden forceful trauma. Herniation of disc is very common lower back especially at the L4-L5 and L5-S1 levels. The onset is generally abrupt with severe radicular pain in the lumbosacral dermatomes in the sciatic distribution. In mild cases condition may improve with rest and conservative measures. But if presence of progressive symptoms then surgical treatment is the only option. In Ayurvedic prospective, L5-S1 is the real part where treatment of Vata specifically Apana Vata is important. Basti we choose according to the aggravated dosha which we find out after prakriti
analysis. Prasarni Taila is beneficial in all Vata vyadhi so greeva basti and kati basti was planned to relax the neck and back muscles. Swedan is a treatment modality which provides relief from Stambha (stiffness), Gaurava (heaviness) and Sheeta (coldness) in the body. Patra Pinda Potli Sweda was here planned to relax the back muscles to get rid of pain.18

**Action of Basti dravasy inside the body:**19

1. **Saïndhava:**
The presence of Na* in Basti dravya may play important role for the absorption of the drug.

2. **Madhu:**
It forms the homogeneous mixture with the Saïndhava which easily gets absorbed and assimilated by the body.

3. **Sneha:**
It reduces Vata Dushti, softens micro-channels, destroys the compact Mala, and removes the obstruction in the channels. Sneha increases the permeability of cell membrane and become helpful in elimination of Dosha and Mala.

4. **Kalka and Kwat Dravya:**
These are the main constituents of Basti Dravya and are vatanulomaka in property. They serve the function of Utkleshana of Dosha, Dushya and Srotasa so their main is Samprapti Vighatana of Roga.

**Shamanu Oushadhi:**

a. The main contents of **Ksheer Balã Capsule** are *Bala* (*Sida cordifolia*), *Ksheera* (*cow’s milk*), and *Thila Taila* (*Sesamum indicum*) which are antioxidant in their properties. The synergistic action of all components might thus may potentiated its neuroprotective effect. Research studies suggests its nervine and analgesic effect along with strengthening property. Reduced pain and inflammation helps to improve mobility in patients.

b. **Vatakulantaka Rasa** is an ayurvedic preparation used to balance Vata Dosha.

**Asana:**
They are practiced in order to achieve physical stability and steadiness.20

a. **Makarasana:** (Crocodile pose) As per *Gheranda Samhita* it expands the chest and lungs. This asana is very effective for people suffering from slipped disc, sciatica and certain types of lower back pain. It encourages the vertebral column to resume its normal shape and relieves compression of the spinal nerves.

b. **Bhujangasana:** (Cobra pose) It helps to remove backache and keep the spine supple and healthy. It improves the circulation in the back region and tones the nerves so that better communication between the brain and body results.

c. **Dhanurasana:** (Bow pose) It helps to correct hunching in the upper back and prescribed especially for the treatment of spinal disorders. The spinal column is realigned and the ligaments, muscles and the nerves are activated, removing stiffness.

d. **Viprut Naukasana:** (Reverse Boat pose) It helps to tone and strengthen the back muscles by stimulating the nerves, particularly in the lower back, while simultaneously giving a diagonal stretch to the body.

e. **Markasana:** (Monkey pose) It is spinal twist yoga pose which helps in curing slip disc, spondylitis and sciatica. It also stretches the hip muscles and relaxes the body completely.

f. **Setubandhasana:** (Bridge pose) It strengthens the back muscles by relieving the tired back instantaneously. It gives a good stretch to the chest, neck and spine.

**V. CONCLUSION**

This is a single case study and promising result has observed. For further establishment of ayurvedic management in patients of Lumbar Disc Herniation a pilot study or clinical trial can be planned.

**VI. DECLARATION OF PATIENT CONSENT**

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

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AUTHORS

First Author – Dr. Renu Sharma, Assistant Professor, Dept. of Kayachikitsa, Khalsa Ayurvedic Medical College, Nangal Kalan, Mansa, Punjab, India.
Second Author – Dr. Abhishek Bhushan Sharma, Professor, Dept. of Kayachikitsa, Motherhood University, Roorkee, Uttrakhand, India.
Third Author – Dr. Kumar Anand, Professor, Dept. of Samhita, Sanskrit and Siddhant, Baba Khetanath Ayurvedic college and hospital, Patikara, Narnaul, Haryana.

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A Study on Work Motivation and Job Satisfaction among Female Nurses of Ranchi Town in Jharkhand

Vandana Sahu Jaiswal*, Dr. Renu Dewan**

*Ph.D. Research Scholar, University Department of Psychology, Ranchi University, Ranchi
**Former Head and Associate Professor University Department of Psychology, Ranchi University, Ranchi.

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I. INTRODUCTION

1.1. The concept of work motivation

Work motivation is a set of energetic forces that originate both within as well as beyond an individual’s being, to initiate work-related behavior, and to determine its form, direction, intensity, and duration. Understanding what motivates an organization's employees is central to the study of I-O psychology. It is the force that drives an employee to perform well in their job. Work motivation is highly influenced by the external and internal socio-psychological environment of an individual in working place (Agarwal, 1988).

1.2. The concept of job satisfaction

Job satisfaction is a general attitude of employee towards their job. It is amount of pleasure contentment associated with job. When employees attitude towards his job is positive it results in job satisfaction and when it is negative it results in job dissatisfaction. Feldman & Arnold, (1983) defines job satisfactions the amount of overall positive effect or feelings that individuals have towards their job’. Thus, when the individual feels fair treatment, justice, and regard in the organization he feels satisfied with his full potential for the benefit of organization, job satisfaction is a positive attitude or emotional response towards one’s job which results when the individual gets that what he wants from his job.

Review of literature

Khalatbari et al. (2018) conducted a study on job satisfaction, work motivation and burn-out. The results found that burn-out has positive correlation with job stress, work motivation and job satisfaction. Deshinger (2018) studied that job performance was affected by stress including productivity, job satisfaction/morale, absenteeism, decision making abilities, accuracy, creativity, attention to personal appearance, organizational skills, courtesy cooperation, initiative, reliability, alertness, perseverance and tiredness. Lili et al. (2017) investigated job stress and work motivation and their effects on job satisfaction among community health workers. The findings indicated considerable room for improvement in job satisfaction among community health workers. Healthcare managers and policy makers should take both work stress and motivation into consideration, as two sub-scales of work stress and one sub-scale of work motivation were negatively influenced by job satisfaction, and two sub-scales of work motivation were positively influenced by job satisfaction. This perception believes that stress is essentially a feeling that leads to dysfunctionity for an organization and its employees (Gupta & Beehr, 1979). Warren and Kaplan (2019) found that negative affect from job stress is indirectly related to an employee’s performance. Golshan et. al., (2019) conducted a study to measure the effect of occupational stress on job satisfaction. They used 80 usable questionnaires which were gathered from academic employees in private institutions of higher learning in Kuching City, Malaysia. Result of this investigation shows that physiological stress level expanded job satisfaction, and psychological stress level had not diminished job satisfaction. The examination additionally shows that occupational stress goes about as a fractional determinant of job satisfaction in the stress models of the organizational area. Fida et. al., (2017) directed an exploration which analyzed the connection between job stress and job satisfaction among the employees of colleges in Lahore, Pakistan. Results revealed that employees profoundly happy with their jobs (13.5%) or who were exceptionally stressed on their jobs were not many (2.5%); the majority of the employees were anyway moderately fulfilled on every factor utilized in questionnaire to survey the level of job stress and job satisfaction.
II. OBJECTIVES

- To find out the impact of religion, marital status and age on work motivation.
- To find out the impact of religion, marital status and age on job satisfaction.

III. HYPOTHESES:

- There may be significant main and interaction effect of religion, marital status and age on work motivation.
- There may be significant main and interaction effect of religion, marital status and age on job satisfaction.

IV. SAMPLE:

The research consisted of 160 female nurses selected by using stratified random sampling technique. In total, there were 8 sample sub-groups based on 2x2x2 factorial design and for each sub-group, 20 cases were selected randomly. The stratification was based on two groups of religion (tribal Christian & non-Christian), marital status (married & un-married) and age (younger, 25-35 yrs. & older, 40-50 yrs).

The sample for the study was selected in two stages; in first stage, a Personal Data Questionnaire (PDQ) was applied on tribal Christian & non-Christian female nurses, working in different government hospitals located in Ranchi town such as RIMS (Ranchi Institute of Medical Sciences) and Sadar. After collection of personal information from the female nurses, the sample was divided into two broad groups of tribal Christian and non-Christian. Then each one was further sub-divided into two sub-groups of marital status (married & un-married) and age (younger, 25-35 yrs & older, 40-50 yrs.).

V. RESEARCH DESIGN:

The research design is given below in table 1:

<table>
<thead>
<tr>
<th>Groups</th>
<th>Tribal Christian</th>
<th>Non-Christian</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Married</td>
<td>Un-Married</td>
<td>Married</td>
</tr>
<tr>
<td>Younger (25-35 yrs.)</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Older (40-50 yrs.)</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>

VI. TOOLS USED:

The following tools were used for data collection:

i. **Personal Data Questionnaire (PDQ):**
   A Personal Data Questionnaire (PDQ) prepared by the researcher was applied on selected sample to obtain information about their name, age, position, marital status, religion, ethnicity, educational level, parental income, occupation and educational qualification, working period and registration date in nursing job etc.

ii. **Work Motivation Questionnaire (WMQ):**
   Work Motivation Questionnaire (WMQ) developed by Agarwal (1990) was used to measure the work motivation level of the sample. It consists of 26 Likert type items with 5 alternatives. It is used to measure the work motivation of employees of any industry or organization. This questionnaire consists of 6 dimensions namely- dependence, organizational orientation, work group relations, psychological work incentives, material incentives and job situation. All the items of Work Motivation Questionnaire are Likert type based on a five point scale, since the items were Likert type, summed scoring is done by assigning 5 for most positive response and 1 for extreme negative response. So, in this way score 5, 4, 3, 2, 1 were assigned to each item; alternative a, b, c, d, e can also be assigned respectively.

iii. **Job Satisfaction Scale (JSS):**
   The Job Satisfaction Scale was developed by Singh and Sharma, (1986/2009 Revised). It was used to measure the level of job satisfaction of the nurses. This scale includes dimensions with a total of 30 items in which 24 were positive and remaining 6 were negative statements. The present scale is a test useful to find the Job satisfaction of any
category of employees. This scale was motivated from the works of Hoppock (1935) to Muthaya (1984) and framed on almost all known factors of job satisfaction such as work values and job rewards also. The levels of job satisfaction were measured in two types of areas: - Job intrinsic (factors lying in the job itself) & Job extrinsic (factors lying outside the job). Responses to these items are made on 5-point Likert Scale format form 4,3,2,1,0. For totaling of the scores, reverse scoring is done from 0,1,2,3,4 for item numbers for 4,13,20,21,27,28. It has lowest score of 47 or below which indicates extremely dissatisfied and the high score of 74 or above indicates extremely satisfied. Respondents have to give their responses on five-point scale from strongly agree to strongly disagree. The reliability of the scale with test-retest method was found to be 0.98 while the test is also found to have concurrent validity of 0.74 and Correlation Coefficient of 0.78. Cronbach alpha technique was used for assessing the reliability.

VII. ANALYSIS & RESULTS

The analysis and results were presented under the following sections:

Section-A

Analysis of Variance (ANOVA) showing the main as well as interaction effects of religion, marital status and age on work motivation of female nurses:

Table 2. Impact of religion, marital status and age on work motivation of female nurses

<table>
<thead>
<tr>
<th>Sources of Variance</th>
<th>Sum of Squares</th>
<th>Degree of Freedom</th>
<th>Mean Square</th>
<th>F ratio</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Religion</td>
<td>72.90</td>
<td>1</td>
<td>72.90</td>
<td>0.70</td>
<td>0.40NS</td>
</tr>
<tr>
<td>B. Marital Status</td>
<td>640.00</td>
<td>1</td>
<td>640.00</td>
<td>6.21</td>
<td>0.05*</td>
</tr>
<tr>
<td>C. Age</td>
<td>348.10</td>
<td>1</td>
<td>348.10</td>
<td>3.38</td>
<td>0.06NS</td>
</tr>
<tr>
<td>2-Way interaction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AXB (Religion x Marital status)</td>
<td>6325.22</td>
<td>1</td>
<td>6325.22</td>
<td>61.36</td>
<td>0.00</td>
</tr>
<tr>
<td>AXC (Religion x Age)</td>
<td>7209.22</td>
<td>1</td>
<td>7209.22</td>
<td>69.94</td>
<td>0.00</td>
</tr>
<tr>
<td>BXC (Marital status x Age)</td>
<td>1177.22</td>
<td>1</td>
<td>1177.22</td>
<td>11.42</td>
<td>0.00</td>
</tr>
<tr>
<td>3 Way Interaction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AXBXC</td>
<td>1040.40</td>
<td>1</td>
<td>1040.40</td>
<td>10.09</td>
<td>0.01</td>
</tr>
<tr>
<td>Corrected Model</td>
<td>16813.08</td>
<td>7</td>
<td>2401.86</td>
<td>23.30</td>
<td>0.00</td>
</tr>
<tr>
<td>Error</td>
<td>15666.70</td>
<td>152</td>
<td>103.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1035152.00</td>
<td>160</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>32479.78</td>
<td>159</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant at 0.05/NS: -Not Significant
Main Effects
The F-value of religion is 0.70, which is found not significant. Which indicates that Christian and non-Christian sample did not differ significantly on work motivation.

The F-value of marital status has been found 6.22, which is found statistically significant at 0.05 level. It indicates that married and un-married sample differed significantly on work motivation.

The F-value of age is 3.03, which is statistically in-significant. So age had no effect on work motivation of the sample.

Interaction Effects:
The F-value for the religion and marital status (AXB) is found 0.31, which was not statistically significant. So, religion and marital status did not effect on work motivation of the sample.

The F-Value for religion and age (AXC) is found 0.13, which is not found statistically significant on work motivation of the sample

The F-Value for marital status and age (BXC) was 2.70, which is statistically in-significant. Thus, marital status and age had no effect on work motivation.

The F- Value of religion, marital status and age (AXBXC) was found 10.09, which is found statistically significant at 0.01 level. It indicates that religion, marital status and age had joint effect on work motivation of the sample of nurses.

Conclusions:
The following conclusions were drawn from the above discussion:

- Religion and age did not produce significant main effect on work motivation where as marital status produced significant main effect on work motivation.
- Religion & Marital Status, Religion & Age and Marital Status & Age did not produce significant joint effect on work motivation.
- Religion, marital status and age produced it’s significant three-way interaction effect on work motivation.

Table 3. Comparison between married and un-married sample groups on work motivation:

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Mean diff.</th>
<th>df</th>
<th>t Value</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>80</td>
<td>81.26</td>
<td>14.65</td>
<td>4.10</td>
<td>158</td>
<td>1.98</td>
<td>P&lt;.05</td>
</tr>
<tr>
<td>Un-married</td>
<td>80</td>
<td>77.16</td>
<td>13.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure – 1
Graph represents the mean scores of married and un-married sample on work motivation
It was evident from table number 3 and figure - 1 that the mean scores of married nurses exhibited 81.56 and un-married nurses exhibited 77.01. The difference between the mean scores of both groups on work motivation was 4.10. SD of married & un-married nurses on work motivation was 14.65 and 13.72 respectively. The obtained t- ratio for both groups was 1.98, which is statistically significant at 0.05 levels. Hence, the hypothesis “There may be significant difference between married and un-married female sample on work motivation” has been accepted. Result reveals that married female sample had more work motivation than un-married same sample.

**Conclusion:** Married female nurses had more work motivation than un-married female nurses.

**Section-B:**
Analysis of Variance (ANOVA) showing the impact of religion, marital status and age on job satisfaction of female sample:

<table>
<thead>
<tr>
<th>Sources of Variance</th>
<th>Sum of Squares</th>
<th>Degree of Freedom</th>
<th>Mean Square</th>
<th>F ratio</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Religion</td>
<td>589.44</td>
<td>1</td>
<td>589.44</td>
<td>8.50</td>
<td>0.01**</td>
</tr>
<tr>
<td>B. Marital Status</td>
<td>350.76</td>
<td>1</td>
<td>350.76</td>
<td>5.05</td>
<td>0.05*</td>
</tr>
<tr>
<td>C. Age</td>
<td>2.78</td>
<td>1</td>
<td>2.78</td>
<td>0.04</td>
<td>0.84NS</td>
</tr>
<tr>
<td><strong>2-Way interaction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AXB</td>
<td>21.68</td>
<td>1</td>
<td>21.68</td>
<td>0.31</td>
<td>0.57</td>
</tr>
<tr>
<td>AXC</td>
<td>9.56</td>
<td>1</td>
<td>9.56</td>
<td>0.13</td>
<td>0.71</td>
</tr>
<tr>
<td>BXC</td>
<td>186.84</td>
<td>1</td>
<td>186.84</td>
<td>2.70</td>
<td>0.10</td>
</tr>
<tr>
<td><strong>3-Way Interaction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AXBXC</td>
<td>472.31</td>
<td>1</td>
<td>472.31</td>
<td>6.81</td>
<td>0.01</td>
</tr>
<tr>
<td>Corrected Model</td>
<td>1633.38</td>
<td>7</td>
<td>233.4</td>
<td>3.36</td>
<td>0.00</td>
</tr>
<tr>
<td>Error</td>
<td>10540.14</td>
<td>152</td>
<td>69.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Corrected Total</strong></td>
<td>12173.51</td>
<td>159</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Main Effects:**

Above Table- 4 shows that obtained F-value for religion was 8.50, which was found statistically significant at 0.01 level, it indicates that religion produced significant main effect on job satisfaction.

The F-value for marital status was found 5.05 , which is statistically significant at 0.01 level. It indicates that marital status produces its significant main effect on job satisfaction.

The obtained F-value for age was 0.04, which is found statistically not significant, it indicates that age did not produce significant main effect on job satisfaction.

**Interaction Effect:**
The F value of Religion & Marital Status (A x B) for interaction effect was found 0.31, which is found statistically insignificant. It indicates that religion & marital status did not produce significant joint effect on job satisfaction.
The F value of Religion & Age (AxC) for interaction effect was 0.13 which was statistically insignificant. So, we can say that religion & age did not produce its significant joint effect on job satisfaction.

The F value of Marital Status & Age (BxC) was 2.70, which was found statistically in-significant. It indicates that marital status and age did not produce significant joint effect on job satisfaction.

The F value for three-way interaction effect of religion, marital status and age (AXBXC) was found 6.81, which is found statistically significant at 0.01 level. It indicates that religion, marital status and age produced its significant three-way joint interaction effect on job satisfaction.

**Conclusion:**

The following conclusions were drawn from the above discussion:

- Religion and Marital status produced its significant main effect on job satisfaction whereas, Age didn’t produce its significant main effect on job satisfaction.
- Religion and marital, marital status and Age & religion and age didn’t produce its significant joint effect on job satisfaction.
- Religion, marital status and age produced it’s significant three-way interaction effect on job satisfaction.

**Table -5. Comparison between Tribal Christian & Non-Christian female nurses on Job Satisfaction:**

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Mean difference</th>
<th>df</th>
<th>t Value</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tribal Christian Nurses</td>
<td>80</td>
<td>83.88</td>
<td>9.01</td>
<td>3.84</td>
<td>158</td>
<td>2.83</td>
<td>0.01**</td>
</tr>
<tr>
<td>Non-Christian Nurses</td>
<td>80</td>
<td>80.04</td>
<td>8.08</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure – 2.**

Graph showing mean differences between tribal Christian and non-Christian nurses on job satisfaction.
It was evident from table 5 and figure 2 that the mean scores of tribal Christian nurses was found 83.88 and that of non-Christian nurses was 80.04. The difference between the mean scores of both groups on job satisfaction was 3.84. SD of tribal Christian & non-Christian nurses on job satisfaction was 9.01 and 8.08 respectively. The obtained t-ratio for both groups was 2.83, which was statistically significant at 0.01 level. Hence the hypothesis “There may be significant differences between tribal Christian & non-Christian nurses on job satisfaction” was accepted. It reveals that tribal Christian had more job satisfaction than non-Christian nurses.

**Conclusion:** Tribal Christian nurses sample had more job satisfaction than non-Christian sample.

**Table – 6.**

Comparison between mean scores of married and un-married female nurses on job satisfaction.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Mean diff</th>
<th>df</th>
<th>t Value</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married Nurses</td>
<td>80</td>
<td>83.43</td>
<td>8.38</td>
<td>2.96</td>
<td>158</td>
<td>2.16</td>
<td>0.05*</td>
</tr>
<tr>
<td>Unmarried Nurses</td>
<td>80</td>
<td>80.47</td>
<td>8.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure – 3.**

Graph showing mean difference between married and un-married female nurses on job satisfaction:
It was evident from above table - 6 and figure - 3 that the mean scores of married nurses exhibited 83.43 and un-married nurses exhibited 80.47. The difference between the mean scores of both groups on job satisfaction was 2.96. SD of married & un-married nurses on job satisfaction was 8.38 and 8.90 respectively. The obtained t-ratio for both groups was 2.16, which was found statistically significant at 0.05 levels. Hence the hypothesis “there may be significant differences between married and un-married female nurses on job satisfaction” was accepted.

**Conclusion:** Married female nurses had more job satisfaction than un-married female nurses.

**REFERENCES**


**AUTHORS**

First Author – Vandana Sahu Jaiswal, Ph.D. Research Scholar, University Department of Psychology. Ranchi University, Ranchi

Second Author – Dr. Renu Dewan, Former Head and Associate Professor University Department of Psychology, Ranchi University, Ranchi. email: modernity2010@gmail.com
Impact of motivation on employees

Ibrahim Mare

phd candidate

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Paper Publication Date: 15th September 2022

Abstract - The connection between the employee and the manager is the most important in creating motivation, and the manager is responsible for increasing employee motivation level. Motivating employees is not easy, but it is necessary if they want to progress and be satisfied with their work. Motivation is what makes people work harder, be more productive and, after all, stay in the organization in which they work. With all that in mind, it must be mentioned that there is no single strategy that will magically motivate employees and keep their motivation at a high level. Every employee is unique, has unique attitudes and ideas, and if all employees are to be successfully motivated, managers will need to implement strategies to encourage each employee individually.

Index Terms - connection, reward, stimulation, acknowledgement.

I. INTRODUCTION

The best way to motivate employees when it comes to paying attention to an individual is to commend the job done properly. Not only will that individual feel valued, but other employees in the organization will start to do the same. However, paying attention to each individual is not limited to praise. If someone works below their capabilities, in that case they need to be better informed, help to overcome obstacles and do a better job. Paying attention to each employee individually is very important - although teamwork is also important for the company's success and although grouping employees contributes to creating a sense of community and building a team mentality, nothing is better for motivating employees than when managers pay attention to each individual. This is especially true for large companies where employees may feel unimportant and isolated from other employees. That is why it is important to set aside time to talk to each employee separately, because it means a lot to them and makes them feel valuable.

II. THE MOTIVATION PROCESS IS CHANGEABLE

Motivating employees for advancement - When their job is always reduced to the same action or when the job is at one point, it starts to suffocate employees. The same job, the same position, without any indication or chance of advancement can demotivate even the most ambitious. However, if management offers them the opportunity to advance, employees will be motivated to work harder and be more productive. However, promotion does not always mean a raise and a new position. Improvement can also be in the form of trainings and courses. On the other hand, it is also necessary to motivate employees by offering them the opportunity to develop their skills and improve their knowledge.

Get to know your employees and take an interest in their lives - It's not enough for executives to be interested in their business progress. It is important to motivate employees by showing them and proving that they are encouraged to enjoy their private life as well. Showing interest in their careers - It's just amazing how much energy an employee gets when he feels that his superior really cares about how his career is progressing.

Respect for their private life - It's important that the manager respects this balance between business and private life. It is necessary to understand if they have family obligations, scheduled medical examinations and so on. If the manager shows that he has understanding, they will appreciate it more and in turn will be more productive at work. Small gestures can make a big difference.

Supporting new ideas is a great motivation for employees - When they come up with a new idea or solution that they believe is good for the project, it is important that they are supported. It is a sign that they care about the success of the company and the project. If the idea is good, adopt it. This will be a great motivation for all other employees in the organization. By supporting the employee's idea, he is given the opportunity to show himself and that will motivate him for further work. Whether his proposal succeeds or not. Motivating each employee by acknowledging their work - After all, each person contributes. Recognition of their individual work motivates and inspires employees to strive to succeed in their work, regardless of their role in the project.

It is necessary to find a way to break the monotony. Organize competitions or have another employee meet every week. These are some of the easiest ways to start a team.

In no matter how many employees there are, it is important to try to mark everyone's personal achievement. It doesn't have to be a business achievement like five years of working in an organization, it can be someone's engagement or birthday.

Socializing as an additional motivation for employees - Most try to keep their private and business lives separate. And that is smart in most cases. Not everyone can be a friend in private. But that doesn't mean they shouldn't talk about things that aren't business-related. A friendly relationship with employees strengthens the bond between everyone and encourages teamwork. The job then looks less mechanical and everything seems like a
natural consequence of teamwork. It is necessary to listen to their problems.

If he lets the employees know that they are trusted and trusted, they will do everything to justify that trust. Trust motivates employees.

It is necessary to motivate employees with positive energy.

Managers must be enthusiastic and let that enthusiasm infect employees and serve as motivation.

Set clear goals and share feedback - Employees will be more motivated to work if they know exactly what is expected of them. Clearly explain the company's goals and vision, and inspire and motivate employees to put them into action. Then reward them when they achieve that goal. Give them a free afternoon or throw a party.

Some additional ways of motivation

An additional motivation for employees is the fact that everyone will have some of it if they work hard. In addition to setting clear and feasible goals, it is important to motivate your employees by providing feedback. Just as success is to be commended, it is also necessary to draw attention to mistakes and failures. By no means by punishing, but by reaching a common solution for overcoming obstacles and managing crises in the future.

The bigger picture to motivate all employees - It is important that everyone sees the bigger picture. This is important because then they will realize that what they are doing contributes to meeting the ultimate goal. And that serves as a great force for motivating every employee. When they are given tasks and responsibilities within the project, it is important that they understand how their share fits into the bigger picture.

To be open to new approaches – the age of the internet is constantly changing our lives. We cannot all keep up with all the changes. Therefore, instead of avoiding, adopt new techniques, methods and approaches.

Employee motivation also depends on the business environment - Employee motivation depends to a large extent on the business environment. Use the company's culture to motivate your employees. However, there must be no negativity if you want the success of projects and companies. A positive work environment depends solely on the superior.

Give them a reason to come to work - Coming to work five days a week with the attitude to exceed everyone's expectations requires a level of loyalty that can only be achieved with high motivation to work.

Techniques for employee motivation

There are other techniques and methods of employee motivation, some of which are as follows: 1) "adequate job design, 2) employee participation, 3) goal management, 4) flexible working hours and 5) other competencies and motivation strategies."

Business design

"The pronounced division of business activities and specialization in work can lead to negative consequences that result in the emergence of employee monotony. This phenomenon has served as a basis for developing various motivation strategies through the design of work performed by the individual. Some of the best-known strategies are: job rotation strategy - this strategy includes activities aimed at changing highly specialized jobs from time to time according to a pre-established plan.

Job Expansion Strategy - This strategy includes job expansion where a specific individual is assigned multiple similar, interrelated jobs. Enrichment strategy - this strategy includes activities in which the worker is given more freedom in deciding how to work. This strategy gives the employee a sense of personal responsibility for the task, encourages interaction among employees, obtaining better feedback, etc.

Employee participation

This strategy includes employee participation in decision making. The feature of this strategy is that the participation of employees can be organized in two ways, namely: Participation in problem solving - this activity is applied to small groups working in teams. Characteristically, all team members are involved in identifying problems. Participation in goal-based management is a method by which leaders and employees participate together in setting goals, then creating plans for achieving goals, monitoring and evaluating goals, analyzing achieved goals, and taking any corrective action. This strategy aims to make employees as motivated as possible to realize the plans and goals they have created."

"Empowerment - Empowerment is one of the latest strategies for intangible employee motivation. It is a process of sharing power with others through the decentralization of structure, roles and responsibilities and through the delegation of work inherent in authority." The main goal of this strategy is for employees to create a greater personal sense of responsibility, by being aware of the fact that they have been given admiration, which results in further motivating them to invest more effort and effort in achieving organizational goals. This strategy is especially applied to younger and more educated staff, to give their maximum through the activities of this strategy.

Flexible working hours

Flexible working hours are such a schedule during the day where employees are given the opportunity to vary their working hours within certain limits. "Also, they are left with the possibility of overtime working hours, on the basis of which, after a certain number of collected, they can ask for a day off. Flexible working hours have two positive effects, both for the employees and for the organization itself. The positive effects for employees are reflected in the form of more free time, more job satisfaction, and even some kind of responsibility because they organize their work schedule themselves. The positive effects for the organization itself are reflected in a reduced absenteeism rate, greater commitment of employees, greater commitment to the organization, and thus improved performance and better results. On the other hand, the disadvantage of flexible working hours is that it is not applicable to all jobs.

Additional motivational techniques

In addition to the listed activities of the strategy towards employees, there are other tools used to motivate employees:

• Recognition of success - is one of the key factors of motivation. In practice, it occurs in material form, but it
is equally important when it comes to acknowledging success in the form of praise and gratitude.

- **Rewards** - this type of motivation is most often found in practice after certain business successes (conquering new markets, increasing income, etc.) or after certain years of service. They are usually given in cash, gifts, oral or written acknowledgments. In practice, there are two types of rewards: standard rewards (bonuses, salary supplements) and situational rewards. "Their forms differ according to hierarchical levels. At lower levels these are e.g. free day, paid vacation, etc., and at higher levels it is a luxury company car, a better office, etc.

- **Praise and rebuke** - these tools of motivation are a strong work impulse because they affect a person’s need to affirm their own identity in front of themselves and others. Punishments and reprimands are in practice associated with the person who carried them out, and not with the act that led to it, so instead of being a regulator of behavior, in practice they often disrupt interpersonal relationships. Reprimands and punishments can damage the reputation of individuals or groups in their work environment.

- **Interpersonal relations** - they show the situation in the entire socio-economic life. "Forms of interpersonal relations in the organization that have the greatest motivational, ie. demotivating effect are: Competitions - individuals are prone to various forms of competition because of prizes, awards, prestige, but also because of the feeling of their own satisfaction and success in something; Cooperation - is a form of collective behavior in which there is a coordinated effort of all members of the group or collective, with the aim of achieving mutually shared goals.

- **Feedback** - comes to the fore in cases of work performance of an individual or group. "The lack of such information, when the employee does not know whether he did his job well and whether he did what is expected of him, can have a negative impact on his work performance. The existence of feedback encourages desired behaviors, enables professional development, contributes to the establishment of open relationships and trust in the organization and shows employees that their work is monitored and appreciated."

- **Self-motivation** - each individual or group should play an active role in raising their own motivation. "It leads to career advancement and development, achieving personal ambitions and professional goals. For self-motivation, it is important that employees acquaint their managers with what they would like to achieve, that is, open and two-way communication between employees and their managers is very important."

- **Harmonization of relations** - is such an activity of motivation that results in the removal of status differences between employees of different functions in the organization. "The ultimate goal of harmonization is the elimination of all differences based on the status of workers. Hence the term "single status", which means that all employees of an organization have the same status and can be reduced to the same structure.

### The importance of leaders in motivating employees

Increasing motivation and performance is a challenge for managers who are constantly looking for new tools to stimulate their teams, accurately identify and eliminate recurring challenges, and help employees solve their problems with empathy. Much of a leader’s responsibility is to provide structure, guidelines, and regulations. However, many studies in the workplace point to the fact that the most important measure of a healthy work environment is not a strong external framework of work processes, but the ability of team leaders to encourage internal motivation in members.

From the aspect of organization, the motivation of employees is extremely important, and as managers are aware that people are not divided into motivated and unmotivated, the essence is that they are motivated by different things. Using the theory of motivation, the following 3 ways have been identified that influence employees to be more motivated, engaged and productive.

### Employee connectivity

Employees in an organization often cannot see how their efforts contribute to broader strategies. "One study shows that only 47% of employees can establish a connection between their daily duties and the company’s success. That is why successful team leaders let employees know that they appreciate their work and initiatives because the organization benefits from their engagement. In addition, they communicate that it is important to them that employees are satisfied, not just productive. No significant contribution comes without personal sacrifices for the one who does it. Whether they are sacrificing time with family, taking mental effort to learn something new, or taking visible risks for the project, let people know that you understand the price it took to achieve a particular achievement. "If executives acknowledge the challenges they face confronted, makes gratitude credible and employees more confident to remain honest when faced with difficulties.

### Inspirational model

"Given the fact that a leader inspires more with his actions than with his words, there are three ways in which employees are encouraged to work more efficiently: 1) Continuous consistency and commitment to work; 2) Focus on tasks and 3) Encourage the team.

### Encouraging creativity

Supervision does not mean controlling every step of an employee. This means ensuring that all organizational activities are carried out at the highest level. Give employees the freedom to find unique ways to solve problems. Challenge them to think outside the box. The best way to do this is to give people a chance to experiment while solving problems that really matter. Involving employees in decisions in which their contribution is valuable, creates a sense of satisfaction and additional motivation among employees.

Giving employees some autonomy in the way they do business will have a strong impact on their motivation. In today’s business world, the job of a great leader is to collaboratively set the goals of the individual and the team, but also to allow the team or individuals to determine how they will achieve those goals. All..."
it takes is trust. But if the leader starts to trust his team, he will be able to give them more autonomy. Or better yet, he will give them autonomy first and then see how much he trusts them.

**Designing work tasks**

In addition to the above, there are other categories when motivating employees, namely: “Designing work tasks and work is a very complex task of management and already in that phase different motivational potential is built into the work itself. Motivation to perform comprehensive, meaningful and challenging tasks that provide autonomy, special contribution and constant information on the quality of performance will be higher than with narrow, routine tasks that do not leave room for their investigators to express themselves further. The goals to be achieved and the control standards must be clear and precise, but also challenging in order to guide work behavior. The way in which goals are set (from above "autocratically or in cooperation and together with employees, participatory) significantly determines motivation.

**Encouraging quality task execution**

Such as the organization of work and the means used, resources that include knowledge and information are needed, not just material and objective resources such as raw materials and the like. The lack of the necessary objective assumptions about work behavior and performance can significantly reduce work motivation. It is achieved through the introduction of various motivational factors in the work environment. A very important task of managers is to monitor the needs and preferences in terms of the reward they want to receive for their work and what is important to them. In order to really work on increasing motivation, they must know and analyze what employees want, because people's needs and motives are a dynamic category. ”

“Work efficiency management is an idea developed to coordinate goals, training, evaluation and compensation - all for the purpose of achieving effectiveness. The work efficiency cycle includes three key aspects of effective work that as such can be used as steps towards achieving employee performance:

- Work planning - Work efficiency planning includes a unified view of the expected performance of managers and employees, which is reflected in the traditional job description, key responsibilities, work standards, specific goals and core competencies.
- Support in achieving results - the role of managers is to enable the achievement of set goals to their associates. They must count on unforeseen obstacles related to them, on situations that will require re-examination of the results, as well as on the exchange of internal, no matter how sensitive, information.
- Continuous review of the results achieved includes a joint insight into how the other side is progressing and what can be done to help each other. ”

“The essence of work efficiency management is the idea that the employee's efforts should be directed towards achieving goals. On the one hand, the manager should evaluate the employee based on what his results are if the specific standards set for him are taken into account. On the other hand, the manager needs to make sure that the goals and standards set for him are in line with the broader corporate goals. ”

**III. Conclusion**

“Getting the best out of the workforce has always been the most important task of management, including the period that preceded the development of scientific management methods. Psychologists dealt with motivation and leadership, biotechnologists separated and reconstructed every aspect of the physical work environment, industrial relations experts studied power relations and rewards, while sociologists discussed organizational design and its social structure, and operational experts sought ways to plan process improvements. When we talk about the factors that affect the effectiveness of employees, we must separate those who have understood what it is that they value highly in their lives from those who are not. ”

**Authors**

First Author – Ibrahim Mare Phd candidate
Attitudes towards mathematics: A look at attitude to mathematics inquiry and enjoyment of mathematics lessons among Ghanaian students

Stephen Rowland Baidoo, ORCID ID:0000-0003-4847-7572*, Francis Kwaku Assan**, Josephine Celestine Baidoo***

* School of Education, University of Tasmania, Australia  
** Department of Mathematics, Akrokerri College of Education, Akrokerri - Ashanti, Ghana  
*** Department of Mathematics and ICT, Holy Child High School, Cape Coast, Ghana

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Abstract- Literature is clear about how individuals’ capacity to solve real-world problem could be enhanced through mathematics learning. It is also suggested that advances in mathematics and sciences could be promoted by one’s knowledge and skills in mathematics. Yet attitudes of students toward mathematics learning can affect and influence their mathematics results, which in turn can limit their access to taking advantage of opportunities offered by mathematics and sciences. Different dimensions of attitude to mathematics are known but there is the need to determine and nurture, early in students, those dimensions likely to groom them into inventiveness and problem-solving for development. Inspired by the country’s aim at looking to produce students who would become citizens capable of solving societal problems, we used quantitative investigation to explore two of such dimensions: attitudes to mathematics inquiry and enjoyment of mathematics lessons. The sample involved 134 first-year senior high school students in Ghana. Data was collected through attitude survey. Overall, ANOVA differences were found at programme and gender levels regarding students’ attitude to mathematics inquiry and how they enjoyed their mathematics lessons. Females were highly mathematically inquisitive than were their male counterparts, which is a good signal for investment in their mathematics education. Findings also revealed a strong and positive correlation between students’ attitude to mathematics inquiry and their enjoyment of mathematics lessons. Conclusion and recommendations are offered based on the findings.

Index Terms- Attitude, attitude to mathematics inquiry, enjoyment, mathematics lessons, senior high school students

I. INTRODUCTION

Attitude, though intangible but observable construct, is an “individual’s disposition to respond favourably or unfavourably to an object, person, or any other discriminable aspect of the individual’s world” (Ajzen, 1989, p. 241). Mizra and Hussain (2018) referred to attitudes as “a state of mind and its tendency to respond to a certain situation or a person” (p. 11). Relating the issues of attitude to a popular Ghanaian adage, it might be possible to use the following catchphrase to depict it: ‘attitude – like a person’s character, or a pregnancy – cannot be hidden or suppressed forever. It will certainly show up!’ This depiction signifies how critical attitude is to one’s life, particularly as it can model individual’s behaviour (Narayan, 2015). If this sense of attitude as being capable of modelling behaviour and that like a pregnancy – cannot be hidden – can be adopted, then it is significant for teachers to detect early and teach the attitudes and behaviours that maximise student’s benefits – to enhance their “learning and success in later life” (Goss & Sonnemann, 2017, p. 7).

Narayan (2015) opined that students’ attitude towards mathematics is a major influence on and determine their performance in the discipline. Several studies – for example, Cetin et al. (2005) – that have explored students’ attitude to and performance in mathematics, have noted that a relationship exists between one’s attitude to mathematics and mathematics performance. Authors, such as Anthony and Walshaw (2007) and Kele and Sharma (2014), have underscored the importance of attitudes in students’ mathematics learning. Literature has shown that the process of mathematics learning does not entirely depend on one’s thinking and reasoning alone. The aspect of learner’s attitudes is also critical. For instance, attitudes entail cognitive (involving individual’s thinking and belief about mathematics), affective (concerning general feelings and emotions expressed towards learning of mathematics) and behavioural (as regarding propensity to act in a certain manner towards learning mathematics) responses that are demonstrated by individuals towards an object or environment as results of one’s feeling and interest (Han & Carpenter, 2014).

In line with the notion of Han and Carpenter (2014), Sanchal and Sharma (2017) noted that as the proportion of learners who likes mathematics increases, there is a corresponding increase in learners’ enjoyment in mathematics lessons. This observation corroborates the findings of Zan and Di Martino (2007) that learners who find pleasure in learning mathematics lessons always enjoy same and are positively disposed towards the subject.
It is asserted that through mathematics learning, learners enhance their capacity to solve real world problems (Dewi & Kusumah, 2014) and that the advances in mathematics and sciences can be enhanced by one’s mathematics knowledge and mathematical skills (Narayan, 2015). These asserted views suggest that mathematics lesson enjoyment and mathematics inquisitiveness are very consequential to developing problem-solving skills that can be useful in life. For instance, within the framework of developing effective, competent, and reflective citizens that can solve not only personal but confronting societal issues, Ghana’s curriculum developers believe that learners should acquire positive outlook in life and attitude including values and psychological set of skills for participation in issues of national importance.

Spurred largely by this requirement, the Ghanaian mathematics curriculum among other things seeks to develop attitudes and values through several pathways, including willingness to change one’s opinion in the presence of plausible evidence; being reflective, necessitating acquisition of habit of critical reviews of ways and manners in which things are done; willingness to gather and use data for investigation, whiles at the same time, showing respect for data that others collect (National Council for Curriculum and Assessment (NaCCA), 2019). This attitude can come about and become fully developed in students as they develop their mathematics inquiry base and enjoy what they do in mathematics lessons. Taken together, whether a student would become interested or otherwise in any activity, including the learning of mathematics to develop critical skills and to solve future societal problems, is a function of one’s attitude towards the object that relates it. Therefore, to produce students so that they can become problem-solving citizens and major players in a technological world, the key lies in early determination and characterisation of students’ attitude towards mathematics learning and nurturing same in them towards the envisioned goal, in their schooling. This key necessitated the impetus to develop this study to explore the attitude to mathematics inquiry and enjoyment of mathematics lessons among different academic programme students who were in their first year at senior high school in Ghana.

Attitude to mathematics

The place of attitude in the teaching and learning of mathematics is recognised despite its multiple definitions. Earlier, some authors have attempted some definitions, for example, specified that attitude to mathematics is liking and disliking of mathematics. For Hart (1989), it is favourable and unfavourable disposition towards mathematics. Attitude is described to be cognitive, affective, and behavioural (Han & Carpenter, 2014; Maio & Haddock, 2010; Petty et al., 2003). Attitude, considered in the light of many definitions, indicates a lack of single defined meaning (Mullis et al., 2016). However, McLeod's (1992) definition indicates that “positive or negative feelings of moderate intensity and reasonable stability” constitute attitude which is different from all other facets of affect in mathematics.

Attitude can be considered multi-dimensional. For example, Fennema and Sherman (1976) considered nine dimensions of attitude in their study. These are success in mathematics, male domain, mother/father, teacher attitudes, mathematics anxiety, motivation, and usefulness. It is asserted that affect variables (eg attitude) affect one’s effort exerted to learn mathematics and has excessive impact on selection of mathematics above secondary school level (Fennema & Sherman, 1976).

Wilkins and Ma (2003) clarified that people’s disposition relating attitude towards mathematics is as vital for informed decision-making, regarding their willingness to use knowledge in everyday life, as content knowledge. Subsequently, Dede (2012) maintained that attitude (particularly, affect) influences students’ use of mathematics as far as their future is concerned and how they learn mathematics in contexts. Two of such attitude dimensions include mathematics lessons enjoyment and mathematics inquiry (Chow, 2011), which are variables of interest in this study and are described next.

Attitude to mathematics inquiry

The coming together of “problem solving, communication, representation, connections and reasoning with content-based objectives” (as promoted by National Research Council (NRC) 1996 , p. 105) determine the approaches to effective inquiry in mathematics (Tyminski et al., 2013, p. 328). Mathematics inquiry involves developing people’s understanding by investigating. This can be achieved by questions they ask, suitable methods they use, data they get to collect, and to formulate, communicate, and argue logically (NRC, 1996). In these approaches, learners are expected to be presented with opportunities so they can explore mathematics concepts being learnt prior to receiving any of formal explanations (Tyminski et al., 2013).

Inquiry mathematics attitude actively engages learners in their learning processes, affording them the “opportunity for both individual ownership and more collaboration with peers” and help learners enjoy their lessons more, which in turn, develop in them “more confidence in their abilities” (Riegle-Crumb et al., 2019, p. 3).

Tyminski et al. (2013, p. 326) argued that students are expected to be taught to “view mathematics as a coherent, sense-making ende[avour] and to use key mathematical processes” as a vehicle to learn the content of mathematics. This might endear students to mathematics learning as they may see mathematics lessons more practical and sensible venture, rather than as an abstract and teacher-dominated activity. This trend of mathematics teaching and learning was first promoted by the National Council of Teachers of Mathematics (NCTM, 1980). NCTM keeps stressing this in the standard documents, for example, of NCTM (2000) and Common Core State Standards Initiative (2010) as intimated by Tyminski et al. (p. 326). This continued emphasis suggests issues of concern with regard to the teaching and learning of mathematics lessons. This suggestion is given some credence by McGregor (2016), who mentioned that concerns about declining secondary school student interest and learning of mathematics lessons have been on the rise.

According to McGregor (2016, p. iii), this is a worldwide phenomenon, most experienced by students “in the senior years of high school and at university”. To Explore how the beliefs and attitude of students can be influenced and re-shaped by inquiry-based mathematics lesson learning, the author discovered that secondary school students who have developed mathematics inquiry attitude were able to use several ways to solve, defend
alternative ways they chose, and were willing to seek more understanding of the problems they faced (McGregor, 2016). Students were reported to have taken intelligent risks and offered suggestions. Findings also showed that the students increasingly acquired mathematics inquiry attitude as they repeatedly engaged in ill-structured problems in their mathematics lessons.

**Enjoyment of mathematics lessons**

As a positive activating emotion – capable of affecting the possibility of students engagement or re-engagement in studying enjoyable content (Pekrun, 2006), ‘enjoyment’ has become one of the most commonly studied emotions in the classroom (Schukajlow, 2015), and especially within mathematics classrooms (e.g., Kupari & Nissinen, 2013; Firmender et al., 2017; Hidi, 2000). Enjoyment of mathematics lessons is viewed as the degree to which learners enjoy learning mathematics (Kupari & Nissinen, 2013). In mathematics lessons, enjoyment is enabled in varied ways. One of them is the comfortability and interactions among members of the classroom community (Firmender et al., 2017; Hidi, 2000). The chief aim is “mak[ing] students feel stress-free while [learning mathematics lessons and] writing their solution” Kaur and Prendergast (2021).

Literature attests to learners’ enjoyment of mathematics lessons. In Bangrak, a study was conducted by Kumar and González (2021) to explore the attitudes of students to enjoying mathematics lessons (and self-confidence) after they have been exposed to a short writing intervention. Data, from their study, reported significant increase in the enjoyment of mathematics lessons mean scores of students. In another study, Mazana et al. (2019) investigated students’ attitude to mathematics learning with Tanzanian students and the findings illustrated that the participating students highly enjoyed learning lessons in mathematics and that children in the primary school did enjoy learning mathematics lessons than their older counterparts. One-way ANOVA test confirmed a statistically significant study level (primary, secondary, and college) differences for enjoyment of mathematics lessons.

These findings suggest that students of all kinds enjoy lessons in mathematics differently and at different levels. Those who may find lessons enjoyable would perhaps endeavour to prevail and succeed whilst it might be possible for those on the other side of the spectrum to concede defeat and discontinue making any personal efforts. Enjoyment of mathematics lessons can also be increased to boosts students’ confidence to learn mathematics (Capraro & Capraro, 2006; Haack, 2011).

The foregone literature review has identified the centrality of attitude in mathematics learning. Particularly, the review has indicated how students with mathematics inquiry attitude used different ways to solve, defend alternative ways used in their solutions to tasks, and how willing they sought to more understand the problems they encountered (McGregor, 2016). Students have also been found to enjoy mathematics lessons and that significant differences exist among study levels. However, not much is known about the constructs among Ghanaian high school students in their first years, and the association among the constructs as far as programme study level is concerned. It would therefore be interesting to see how the construct of mathematics lessons enjoyment and attitude to mathematics inquiry are experienced by same level students and among student in different programmes. This became the focus of research study upon which this manuscript is written.

**II. RESEARCH QUESTIONS**

1. What is the level of high school students’ attitude towards mathematics as measured by TOMRA (Test of Mathematics-Related Attitude)?
2. Do the high school students studying different programmes have similar (or dissimilar) attitude to mathematics inquiry as measured by TOMRA?
3. Do the high school students studying different programmes express similar (or dissimilar) enjoyment of mathematics lessons as measured by TOMRA?
4. Is there a reasonable relationship between the attitude to mathematics inquiry and enjoyment of mathematics lessons as measured by TOMRA?

**III. MATERIALS AND METHODS**

**Participants**

In this study, a quantitative research design method was used. The study was conducted in Asare Bediako Memorial Senior High School, located in the Adansi North district in the Ashanti region of Ghana. A total of 134 first-year students participated in a self-reported survey. Of this sample, 46.3% was males and females constituted 53.7%. Before the survey was administered to the students, research permission was sought from the school administration. Student recruitment was made voluntary and those who expressed interest were allowed to participate in the study.

**Instrument**

The survey was developed by Chow (2011). It is a Test of Mathematics-Related Attitude (TOMRA), a revised form of a Test of Science-Related Attitudes (TORSRA) by Fraser (1981). The TOMRA instrument contains two subscales of 10 items each. A half of the items for each sub-scale was negatively worded. The items were Likert type and were rated as: strongly agree – 5; agree – 4; not sure – 3; disagree – 2; and strongly disagree – 1. All negative statements were reversed scored. Chow reported, in his study, the Cronbach’s alpha values for pre- and post-TOMRA subscales: Attitude to mathematics inquiry (AMI) (pre-test: $\alpha = 0.64$, post test: $\alpha = 0.76$) and Enjoyment of mathematics lessons (EML) (pre-test: $\alpha = 0.93$, post test: $\alpha = 0.86$).

However, contrary to the reported values of reliability, the scores (of the sample, $n = 134$, in this study) obtained from the instrument suffered low reliability: AMI ($\alpha = .46$) and EML ($\alpha = .35$). Nimon et al. (2012) have recommended that one or a few items that negatively impact the reliability of the observed scores can be omitted to enhance reliability. This position was earlier assumed by Dillon and Bearden (2001). To progress, the correlation matrix for the data was run, and all items found uncorrelated with other items with coefficients less than 0.30 were removed. Hence, items 15 (The material covered in mathematics lesson is uninteresting); 11(Mathematics lessons are a waste of time); 3 (I dislike mathematics lessons) and 7 (Mathematics lessons bore me) were removed from AMI subscale.
Similarly, items 4 (Doing mathematics problems is not as good as finding out from teachers), 8 (I would rather agree with other people than to do mathematics problem to find out for myself), 10 (I would prefer to do my own mathematics problems than to find out information from a teacher), 12 (I would rather find out about things by asking an expert than by doing a mathematics problem), 16 (It is better to ask the teacher than to find it out by doing a mathematics problem), and 20 (It is better to tell mathematics fact than to find them out from doing a mathematics problem) were removed from the EML subscale.

Chow (2011), who amended the TOSRA scale to create TOMRA scale, adopted in this current study, derived validation for its use from Fraser (2011) and his endorsement. Since the phenomenon investigated in this study focused on SHS students’ attitude to mathematics lesson inquiry and their attitude to enjoyment of mathematics lessons and the TOMRA items purported to measure such constructs, the 10 items used can be seen as measuring what they were meant to do. In addition, due to the reduced items used in this study, the researchers collectively agreed to the use of the items after having rated the items, individually. It was further endorsed by other colleagues in the field of mathematics education who reviewed the items for face validity.

Subsequently, further analysis on the reliability was then performed. The resulting reliability for each subscale is: AMI ($\alpha = 0.84$) and EML ($\alpha = 0.60$). The Cronach’s alpha estimate of the internal consistency reliability for the entire scale was 0.84.

The new reliability values suggest the items on each subscale can be trusted to reasonably measure the same underlying construct for which they were intended, thus, internal consistency among items of each subscale is okay. Based on this, we judged that the scores are reliable to be used for further analysis. Table 1 lists the various items that made for each subscale which generated data used for the results in this study upon which this manuscript is written. The bold figures indicate their serial numbers.

Table 1 Items for the study

<table>
<thead>
<tr>
<th>Attitude to mathematics lesson inquiry</th>
<th>Mean</th>
<th>SD</th>
</tr>
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<tbody>
<tr>
<td>1. I would prefer to find out why something happens by solving a mathematics problem than by being told</td>
<td>3.66</td>
<td>1.238</td>
</tr>
<tr>
<td>2. I would prefer to do mathematics problems than read about them</td>
<td>4.31</td>
<td>1.035</td>
</tr>
<tr>
<td>3. I would rather solve a problem by doing mathematics than to be told the answer</td>
<td>3.96</td>
<td>1.241</td>
</tr>
<tr>
<td>4. I would prefer to do a mathematics problem on a topic than to read about it in a mathematics magazine</td>
<td>3.77</td>
<td>1.286</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attitude to enjoyment of mathematics lessons</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Math lessons are fun</td>
<td>4.07</td>
<td>1.119</td>
</tr>
<tr>
<td>2. Schools should have more math lessons each week</td>
<td>3.58</td>
<td>1.483</td>
</tr>
<tr>
<td>3. Mathematics is one of the most interesting school subjects</td>
<td>3.75</td>
<td>1.336</td>
</tr>
</tbody>
</table>

We categorised and maintained a mean score of 3.0 (overall score divided by number of items) as criterion for the TOMRA, AMI, and EML. Thus, any dimension of attitude with items-mean of more than 3.0 is an indication that students possess a high and positive attitude. Otherwise, students were deemed to have low and negative attitude of that particular dimension. The overall score for TOMRA ranged from 10 to 50; for AMI, 4 to 20; and for EML, 6 to 30.

IV. DATA ANALYSIS

The descriptive statistics were used to report the mean scores of students’ overall attitude and the subscales by academic programme of study and gender. Students’ attitude to mathematics inquiry as well as enjoyment of mathematics lessons were analysed to investigate academic programme-level (Home economics, Business, Science, Agricultural science, and Arts) differences and gender-level (males and females) differences. A One-way between-groups analysis of variance (ANOVA) was used. A pairwise post hoc test with Bonferroni for multiple comparisons was performed if ANOVA result confirmed a statistically significant difference. The level of significance was set at 0.05 for all. Pearson product-moment correlation analysis was conducted to investigate the relationship between attitude to mathematics inquiry and enjoyment of mathematics lessons.

V. RESULTS

High school students’ attitude towards mathematics

We present the results of high school students’ attitude towards mathematics as was assessed by TOMRA. We do this by listing the mean and standard deviation scores for the items (Table 2); the entire participants (Table 3); and further, looking at academic programme-level (Table 4) and gender-level (Table 5) across the whole scale and the factor levels of the scale.
4. I really enjoy going to mathematics lessons (13).
5. I look forward to mathematics lessons (17).
6. I would enjoy school more if there were mathematics lessons (19).

Data reveals high and positive mean scores were obtained for individual items on both subscales. Regarding the overall attitude of students towards mathematics, a high and positive level of attitude was expressed towards mathematics (M = 3.78, SD = 0.3), generally. Males (M = 37.94, SD = 8.66) appeared to have expressed higher and positive attitude as compared to their female counterparts (M = 37.71, SD = 7.79), even though both expressed a high attitude to mathematics. By programme-wise, the results showed that students of Business (M = 41.88, SD = 6.32), Science (M = 40.0, SD = 6.84), Agricultural science (M = 39.18, SD = 6.12), and Home economics (M = 39.11, SD = 6.163) – in order of magnitude of their mean scores – expressed a high level of attitude to mathematics. However, Arts students (M = 29.17, SD = 10.23) held a moderate attitude.

Again, the results of the analysis showed that students, overall, held high and positive attitude to mathematics inquiry (M = 3.93, SD = 0.29). Analysis by gender revealed that both females (M = 16.42, SD = 3.139) and males (M = 14.87, SD = 3.21) held a high attitude to mathematics inquiry, with the former leading the latter. Further, the results revealed that students of Home economics (M = 17.34, SD = 2.50), Business (M = 16.65, SD = 2.34), Science (M = 15.76, SD = 3.03), and Agricultural science (M = 15.11, SD = 2.25) (in order of magnitude of their mean scores) held a high attitude to mathematics inquiry. A moderate attitude to mathematics inquiry was, however, observed with Arts students (M = 13.33, SD = 4.60).

Regarding the overall students’ enjoyment of mathematics lessons, a high and positive level was observed among students (M = 3.69, SD = 0.29), generally. Males (M = 23.06, SD = 6.13) appeared to have enjoyed mathematics lessons more than females (M = 21.29, SD = 5.47), even though both held a high level of enjoying lessons in mathematics. By programme-wise, the data revealed that students of Business (M = 25.24, SD = 4.60), Science (M = 24.24 SD = 4.80), Agricultural science (M = 24.08, SD = 4.40), and Home economics (M = 21.76, SD = 4.30) (in order of magnitude of their mean scores) enjoyed mathematics lessons highly. Arts students (M = 15.83, SD = 6.80) moderately enjoyed mathematics lessons.

Table 3 Students’ mean ratings of attitude (n=134)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Max</th>
<th>Min</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMI</td>
<td>3.93</td>
<td>0.29</td>
<td>4.31</td>
<td>3.66</td>
<td>0.64</td>
</tr>
<tr>
<td>EML</td>
<td>3.69</td>
<td>0.29</td>
<td>4.07</td>
<td>3.21</td>
<td>0.89</td>
</tr>
<tr>
<td>TOMRA</td>
<td>3.78</td>
<td>0.30</td>
<td>4.01</td>
<td>3.21</td>
<td>1.10</td>
</tr>
</tbody>
</table>

Table 4 Students’ ratings of attitude by programme (n=134)

<table>
<thead>
<tr>
<th>H Econs</th>
<th>Business</th>
<th>Agric</th>
<th>Arts</th>
<th>Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td>17.34</td>
<td>16.65</td>
<td>15.11</td>
<td>13.33</td>
<td>4.60</td>
</tr>
</tbody>
</table>

Table 5 Students’ mean ratings of attitude by gender (n=134)

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>AMI</td>
<td>14.87</td>
<td>3.20</td>
</tr>
<tr>
<td>EML</td>
<td>23.06</td>
<td>6.13</td>
</tr>
<tr>
<td>TOMRA</td>
<td>37.94</td>
<td>8.66</td>
</tr>
</tbody>
</table>

Students’ differences in attitude to mathematics inquiry

To answer this question, one-way between-groups analysis of variance was performed to explore the differences in the mean scores for students’ ratings for mathematics inquiry (as measured by TOMRA) across their programmes of study. The results revealed a statistically significant difference at the p < .05 level in scores for the various programmes studied by the students, F (4,129) = 7.513, p = .0001.

Table 6 Students’ attitude to mathematics inquiry by academic programme

<table>
<thead>
<tr>
<th>Gender</th>
<th>n</th>
<th>Mean±SD</th>
<th>F value</th>
<th>p value</th>
<th>interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>H Econs</td>
<td>38</td>
<td>17.34±2.50</td>
<td>7.513</td>
<td>0.000</td>
<td>sig</td>
</tr>
<tr>
<td>Business</td>
<td>17</td>
<td>16.65±2.34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agric</td>
<td>38</td>
<td>15.11±2.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arts</td>
<td>21</td>
<td>13.33±4.60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science</td>
<td>17</td>
<td>15.76±3.03</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Post hoc tests for multiple comparisons, with Bonferroni, determined that Home Economics (M = 17.34, SD = 2.50) differed from Arts (M = 13.33, SD = 4.60) and Agriculture Science (M = 15.11, SD = 2.25). Business (M = 16.65, SD = 2.34) differed from Arts (M = 13.33, SD = 4.60). All others appeared to have similar attitude towards mathematics inquiry as shown:

- Home economics and Business (p = 1.0)
- Home economics and Science (p = .714)
- Business and Agriculture Science (p = .779)
- Business and Science (p = 1.0)
- Agriculture Science and Arts (p = .239)
- Science and Arts (p = .110)

When the impact of gender was investigated, the independent t-test revealed a statistically significant difference between the scores of males and females (t value = -2.814, p value = .000). The summary of results (in Table 5) indicates that the scores of attitudes to mathematics inquiry for the females is higher than their male counterparts.
Students’ differences in enjoyment of mathematics lessons

One-way between-groups analysis of variance was performed to explore the differences in the mean scores for students’ ratings for enjoyment of mathematics lessons (as measured by TOMRA) across their programmes of study. The test confirmed a statistically significant difference at the p < .05 level, existing between the five ratings (F (4,129) = 13.587, p = .0001). Post hoc test for multiple comparisons, with Bonferroni, determined that Arts (M = 15.83, SD = 6.73) differed statistically significantly (p < .05) from: Home Economics (M = 21.76, SD = 4.40); Business (M = 25.24, SD = 4.60); Agriculture science (M = 24.08, SD = 4.30); and Science (M = 24.24, SD = 4.80).

Table 8 Students’ enjoyment of mathematics lessons by academic programme

<table>
<thead>
<tr>
<th>Gender</th>
<th>n</th>
<th>Mean ± SD</th>
<th>F value</th>
<th>p value</th>
<th>interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>H Econs</td>
<td>38</td>
<td>21.76 ± 4.40</td>
<td>13.587</td>
<td>0.000</td>
<td>sig</td>
</tr>
<tr>
<td>Business</td>
<td>17</td>
<td>25.24 ± 4.60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agric</td>
<td>38</td>
<td>24.08 ± 4.40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arts</td>
<td>21</td>
<td>15.83 ± 6.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science</td>
<td>17</td>
<td>24.24 ± 4.80</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

However, students of the following academic programmes appeared to have similar attitude towards enjoyment of mathematics lessons:

- Home economics and Business (p = 0.180)
- Home economics and Science (p = 0.904)
- Home economics and Agriculture Science (p = 0.441)
- Business and Agriculture Science (p = 1.0)
- Business and Science (p = 1.0)
- Agriculture Science and Science (p = 1.0)

When the impact of gender was investigated, the independent t-test revealed a statistically significant difference between the scores of males (M = 23.06, SD = 6.13) and females (M = 21.29, SD = 5.47). Table 7 indicates that the score of enjoyment of mathematics lessons for the males is higher than their female counterparts.

Table 9 Enjoyment of mathematics lessons

<table>
<thead>
<tr>
<th>Gender</th>
<th>n</th>
<th>Mean ± SD</th>
<th>t value</th>
<th>p value</th>
<th>interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>62</td>
<td>23.06 ± 6.12</td>
<td>-2.814</td>
<td>0.006</td>
<td>sig</td>
</tr>
<tr>
<td>Female</td>
<td>72</td>
<td>21.29 ± 5.47</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Relationship between attitude to mathematics inquiry and enjoyment of mathematics lessons

To answer this question, the relationship between attitude to mathematics inquiry and enjoyment of mathematics lessons was examined with Pearson product-moment correlation coefficient. All preliminary analyses (tests of normality, linearity, and homoscedasticity) were performed, which revealed no violation of any of the assumptions. The test confirmed that there was a strong, positive correlation between attitude to mathematics inquiry and enjoyment of mathematics lessons: \( r = .584, n = 134, p < .000 \), indicating a high level of mathematics inquiry (inquisitiveness) is associated with corresponding high level of enjoyment of mathematics lessons. It is revealed that attitude to mathematics inquiry accounted for 34.1% of variance in students’ enjoyment of mathematics lessons.

VI. DISCUSSIONS

As a critical variable determining how individuals respond to objects, people, subjects, and places (Ajzen, 1989), attitude of senior high school students to mathematics is essential to be determined. Determining students attitude to mathematics is important on some counts: first, it shows if a person is interested in mathematics or not; second, it influences their mathematics performance (Hattie, 2009); third, mathematics is said to filter students into STEM programmes (Blotnicki et al., 2018; Seo et al., 2019); and lastly, for teachers to action appropriate interventions. The overarching objective can then be to direct their attitude positively for their learning.

This study is quantitative method-oriented, focussing on high school students’ attitude to mathematics inquiry and enjoyment of mathematics lessons, with reference to whether different academic programme students have similar or dissimilar attitude. Further, the study investigated the relationship between the two dimensions to attitude. The study reveals diverse results.

High school students’ attitude towards mathematics

Consistent with earlier research results (e.g., Blackwier, 2016), this study results indicate, overall, that students hold attitude towards mathematics, but then it is moderate. This study found that males expressed relatively higher level of attitude to mathematics than the females, though both expressed a high attitude to mathematics. The students of some different academic programmes showed more attitude to mathematics than did others. The findings echoed with Blackwier's study that found the attitudes of boys of all ages more positive towards mathematics than the girls. Somewhat not assessed in this current study, Balkweir found that girls in Years 11 and 12 held more negative attitude towards mathematics. Blackweir developed an online instrument to assess the attitude of Australian secondary students towards mathematics, in two suburbs in Perth. Our findings also lend support to that of Eisey and Snetzler (1998). In their meta-analysis of 96 studies (n = 30490), a key conclusion drawn illustrates that gender differences exist in attitudes of students towards mathematics but are small; and that, males are more positive in terms of their attitudes to mathematics.

Literature has been quite inconsistent with the attitudes of males and females towards mathematics learning. For example, quite contrary to the above findings, Elçi (2017) – who compared males’ attitude to mathematics with that of the females’ – found a statistically significant difference between them (using a t-test) in favour of females. Thus, statistically, females’ scores were higher than their male counterparts. Elçi’s findings supports that of Guzel (2004), that illustrates that the attitude of female students towards mathematics is rather more positive than their male counterparts. Some other studies (e.g.: Mohamed & Waheed, 2011; Olufemi & James, 2014) reveal otherwise. They claimed that attitude towards mathematics of students is not dependent on gender – connoting that male students’ attitudes to mathematics do not differ from that of the female students.
Regarding programme-level differences, our study found that students of Business, Science, Agricultural science, and Home economics (in order of magnitude in mean scores) expressed a high level of attitude to mathematics, except Arts students whose attitude was moderate. This finding is consistent with the finding of Kumar and González (2021). Their study, conducted in Bangrak–Thailand with 142 upper secondary students, confirmed differences in the programme-levels. Math-Science programme students were reported to have enjoyed a high level of mathematics lessons. However, Math-English students neither enjoyed a high nor low level of mathematics lessons. In Elçi’s (2017) study, the ANOVA results revealed a statistically significant difference in the mean scores of students’ attitudes to mathematics among the three programmes (mathematics, Science, and Turkish). A pairwise comparison with Sidak multiple adjustment, confirmed that Science and mathematics differed.

We recognise that, students do show attitude to mathematics learning; gender-level differences as well as programme-level differences exist; and that we agree with Langat (2015) that teachers should determine carefully and support student interaction and style of instruction to enable fruitful knowledge transfer within the classroom. This can reduce, if not eliminating, the tendency of students to skive off mathematics lessons.

### Differences in attitude to mathematics inquiry

The results revealed a statistically significant difference at the p < .05 level in scores for the various programmes studied by the students (F (4,129) = 7.513, p = .0001). This finding indicates that the attitude to mathematics inquiry held by the participating students, learning different programmes, was significantly different for some at least two academic programmes.

Added findings identified that the Home Economics students differed highly from Agricultural Science and Arts students in their attitude to mathematics inquiry. The students of Business studies tended to hold higher attitude to mathematics inquiry than their counterparts in Arts programme. There was evidence to suggest that the average programme-level effect is similar for the following programmes: Home economics and Business; Home economics and Science; Business and Agriculture Science; Business and Science; Agriculture Science and Arts; and Science and Arts.

The data also showed, by the independent t-test analysis, that the scores of the males and females were statistically significantly different (t value = -2.814, p value = .000), in favour of females. Thus, statistically, the scores proved that the females were somewhat highly mathematically inquisitive than their male counterparts. s to attitude. The study reveals diverse results.

### Differences in enjoyment of mathematics lessons

The results obtained revealed that students of some academic programmes enjoyed mathematics lessons differently, as indicated by their ratings. This was confirmed by ANOVA test which resulted in a statistically significant difference (F(4,129) = 13.587, p = .0001), existing between the five academic programmes. Post hoc test, with Bonferroni, determined that Arts students differed statistically significantly (p < .05) from students of: Home Economics (mean = 21.76, sd = 4.40); Business (mean = 25.24, sd = 4.603); Agriculture science (mean = 24.08, sd = 4.40); and Science (mean = 24.24, sd = 4.80). The students who studied Home economics enjoyed mathematics lessons similarly as those who studied Business (p = 0.180), Science (p = .904), and Agriculture Science (p = 0.441). Similarly, Business and Agriculture Science students also enjoyed mathematics lessons in a similar manner (p =1.0). Further, it was found that Business and Science students did not differ in their enjoyment of mathematics lessons (p =1.0) and so did the students of Agricultural Science and Science (p =1.0). The above findings, somehow, corroborate the findings of Kumar and González’s (2021) study that found that the Upper Secondary Math-Science students differed significantly from their Math-English counterparts regarding their enjoyment of mathematics lessons.

Again, the independent t-test conducted in this present study revealed a statistically significant difference between the scores of males (mean = 23.06, sd = 6.13) and females (mean = 21.29, sd = 5.47). The score of enjoyment of mathematics lessons for the males was higher than their female counterparts. This finding, however, does not support the findings of Kaur and Prendergast (2021) that the scores of the males were not statistically significantly different from that of their female counterparts in terms of enjoying mathematics lessons. In spite of their results, the authors opined that the reflections of students, such as, “I like it”,”It was enjoyable” and “I like my math class as this” (p. 10) confirmed that participants enjoyed mathematics lessons. Their work involved Indian students in a co-educational secondary school. The study explored the students’ attitudes to enjoyment of mathematics and self-confidence, after they have been exposed to a short writing intervention. The students increased in their enjoyment of mathematics lessons (initial mean score = 34.79, final mean score = 39.82).

In another Australian study with the 8th graders, Narayan (2015) reported that more boys, as compared to girls, disagree that mathematics is boring. It has been reported in another study by Langat (2015, p. 37) that, a high percent of 83 were found to have enjoyed mathematics lessons (as against 11% who never enjoyed), 77% looked forward to mathematics lessons, 16% somewhat felt mathematics was boring as against a whopping 75% who felt otherwise.

### Relationship between the attitude to mathematics inquiry and enjoyment of mathematics lessons

This study found a strong and positive correlation between attitude to mathematics inquiry and enjoyment of mathematics lessons: r = .584, n = 134, p < .0001. This indicates that a high level of mathematics inquiry is linked with corresponding high level of enjoying mathematics lessons. It is revealed that attitudes to mathematics inquiry explains 34.1% of variance in students’ enjoyment of mathematics lessons. This finding connotes that if individuals are mathematically inquisitive, they will continue to enjoy their mathematics lessons. This finding supports Putwain et al.’s. (2018) findings that explored the give-and-take relationship that exist between academic enjoyment, boredom, and achievement of English primary school students (selected from 65 classrooms within 25 schools). These authors found that a higher mathematics lesson enjoyment and lower boredom predict larger consequent achievement and vice versa.

Parallel to the finding of this study, and that of Putwain et al. (2018), Langat (2015, p. 37) asserted that a student would always
enjoy learning mathematics lessons if he/she continues to like it and would all the time expect mathematics lessons. This finding echoed Schreiber (2000) and Hannula (2002) for whom good performance is always linked with positive attitude, and that, positive attitude would predict better student mathematics performance. Other researchers, such as Ma and Kishor (1997), opined that as long as students continue to like what they learn, their learning becomes effective and would perform better. It has been hypothesised that if individuals enjoy their subjects, it could help them to understand better, motivate them to learn, and become proficient in their subjects (Nyacomba, 2017).

Summary and conclusions

This study reports on an investigation into the attitude of first year senior high school students in Ghanian context to determine their attitude to mathematics inquiry and enjoyment of mathematics lessons at academic programme levels. This was necessitated by the country’s aim at looking to produce students who will become citizens capable of solving societal problems. The adequate sample size of 134 participating students in this investigation has offered a pretty good support base for effective evaluation of students’ attitude. Descriptive analysis, one-way between group analysis of variance (ANOVA) and correlation analysis were conducted

Based on the following results obtained, we reckon that this study contributes to literature in first-year students’ attitude to mathematics learning. Generally, males expressed higher level of attitude to mathematics learning than did the females though both expressed high level of the construct; whilst some programme students have similar attitude, in terms of their mathematics inquisitiveness and mathematics lesson enjoyment, other students differ in these constructs at programme level. Data suggests female students were more mathematically inquisitive than were their male counterparts. The reverse results hold true for enjoying lessons in mathematics; that is, in favour of the males. Finally, their attitude to mathematics inquiry strongly and positively correlated their enjoying mathematics lessons. We agree, then, with Langat (2015) that teachers should determine carefully and support student interaction and style of instruction to enable fruitful knowledge transfer within the classroom. This can reduce, if not eliminating, the tendency of students to skive off mathematics lessons.

We recommend that the existence of high level of attitude to mathematics learning among the sampled first-year Ghanaian senior high school students, both at gender and programme levels, is a recipe for effective mathematical preparation of students to become problem solvers in society. Senior high school mathematics teachers need to be encouraged to use interactive inquiry-based mathematics instructions in their teaching practices to increase students’ rate of enjoying lessons in mathematics. Particularly, their female students should be engaged more to develop fully their inquisitive attitude in mathematics. This, when ensured would not only get more of our female students’ attention into male-dominated STEM (Science, technology, engineering, and mathematics) programmes and their related field of work, would also develop their aptitude to problem-solve.

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Tyminski, A. M., Haltiwanger, L., Zambak, V. S., Horton, R. &

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Influence of frequency of use of ICT on effective management of public secondary schools in Uasin-Gishu County, Kenya

Stephen Kirui, Hellen Sang, Alfred Bett & Joshua Manduku

University of Kabianga, Kericho – Kenya

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I. INTRODUCTION

BACKGROUND OF THE STUDY

The rapid growth in the global economy and technological advancement has pressurized the education institutions to use ICT not only for teaching and learning but also for managing school operations. Since ICT has become an essential part of everyday life, its integration in education is inevitable and cannot be avoided. However, it is important to note that Schools are open systems that interact with their environment, and the effective use and integration of technology is directly associated with the role of various socio-technical factors that may impact the integration of ICT in schools (Tai, Lim & Lim, 2013).

Today, all schools are already equipped with computers and connected to the internet, and 93.2% operate their own wireless network or information system (Wichova, 2020). The ICILS international comparison of computer and information literacy states that Czech schools (Fraillon, Ainley, Schulz, Friedman, and Duckworth 2018).

Globally, the use of ICT innovation in school management can be dated back to the 1960s when the computerization of schools gained momentum (Mimb & Bankole, 2016). Anderson, Potočnik and Zhou (2014) stipulated that secondary schools should embrace ICT use in school management. For example, In Malaysia, the University Science Malaysia (2009) “brought to light that successful diffusion of ICT was due to perceived administrative and technical support on the use of technology. In Spain, familiarity with computers and years of experience with ICT correlate positively with levels of institutional management (Selwood, Fung & Mahony, 2003).

In African countries, initially, the use of ICT in management of schools was low compared to other fields such as business and engineering; however, in recent times, school managers have embraced ICT in the education sector” (Mwadulo & Odoyo, 2020). Farrell and Isaacs (2007) observe that Rwanda is among few African countries to have embraced ICT policy more specially in the management of schools (Farrell & Klemperer, 2007). In South Africa many educational institutions have embraced ICT in management of their operations (Hennessy, Harrison & Wamakote, 2010).

Abstract- With the introduction of Information and Communication Technologies in schools, major changes should be observed in the way education is managed, but there is still minimal evidence on the impact of these technologies in public secondary schools in Uasin-Gishu County. The objective of the study was to analyze how ICT frequency of use influence effective management of public secondary schools in Uasin-Gishu County. The study was based Open Systems Theory and The Technology Acceptance Model (TAM). The researcher adopted the correlational and cross sectional research designs. “The population for the study was 189 with 171 respondents being selected using stratified and simple random sampling method. Primary data was collected using structured questionnaire measured on liker type interval scales of 1-5 between April 2021 and August 2021. Reliability of the research instrument was tested against Cronbach’s alpha coefficient where an overall reliability score of 0.778 was achieved while validity was gauged using panel of experts, ensuring that the indicators of each variable were within the same construct and operationalizing the instrument as per the variables. Descriptive statistics comprising means and standard deviations were used to analyze the data while hypotheses were tested using multivariate linear regression model to generate relevant statistics.” The findings indicated that ICT frequency of use and effective school management had a moderate relationship (R =0.549, β1= 0.449, R²=0.302, p<0.05) demonstrating that whenever school administrators’ frequently employ ICT facilities in their management functions there was a significant improvement on effective management of schools. On the basis of these findings, it was concluded that the Ministry of education should encourage frequent use of ICTs in school management by conducting training in the area of ICT. The study may be useful to stakeholders in the education sector in providing information on the state of ICT in public secondary schools in Kenya.

Index Terms- Public Schools, Frequency, Information and Communication Technology, School Management
Effectiveness in the use of ICT in school management can be influenced “by the frequency of use of ICT as shown in several studies. Afshari, Bakari, Luan, Afshari, Fooy and Samah (2012) indicated that frequency of use entails communicating with staff, and members of the wider school, initiating and sustaining collaborative activities with colleagues within and outside their school were the areas of greatest use, while financial matters, maintaining administrative records about students, using a program to analyze information for solving problems, and using technology to support levels of professional collaboration.”

Markauskaite (2006) did a study in Nairobi, Kenya that revealed that many school principals have low levels of competencies for effective use of ICT in school leadership. School principals not only need formal training, but also sustained and ongoing support from their colleagues to help them learn how best to integrate technology into their administrative duties (Amara, 2006). ICT administration and management applications are currently common in schools because of their capacity to facilitate administration from data storage to information management and decision-making activities (Ghavifekr, Afshari, Siraj & Serej, 2013)." In a study by Ngavana, Mutua and Koech (2018), the emphasis was on frequency of use of ICT equipment, and Singh and Muniandi (2012) looked at frequency of use of ICT applications for management. The conclusion in these studies was that frequency of ICT use can influence effective use in ICT management.

Like many other countries in the world, Kenya developed National ICT policy in 2006, giving priority to ICT. The ICTs in Education Sessional Paper one (MoE, 2010), explains that ICT can be leveraged to support and improve school management (MoE, 2010). In regard to educational institutions adoption of ICT the mandate was to improve school management. In the quest for integrating ICT in education, various policy documents spelt out the ICT policy in schools, namely; e-Government Strategy, National ICT Policy and Sessional Paper No. 1 of 2005” (MOE, 2006). ICT policy in this study was taken as a theoretical variable that the researcher used to explain a connection between Socio-Technical issues and the management of public secondary schools in Uasin-Gishu County in Kenya. A sound policy in place would ensure that the issues bedeviling the ICT usage in secondary schools in Uasing-Gishu County would be addressed adequately enabling schools to adopt technologies that are relevant to their business processes.

**Statement of the Problem**

The use of ICT in school management helps enhance effectiveness in three main areas of administration, that is, student administration, staff administration, and general administration. ICT assists in enhancing timeliness, accuracy, completeness and quality of school management. To achieve this, school administrators need to embrace the adoption of ICT for use in school management in order to register required management effectiveness. On the other hand, the government should ensure that a policy to address the socio-technical issues be in place to help address them and enable schools adopt technologies that will help them achieve their objectives. Schools’ ought to have relevant ICT hardware and software and related ICT skills for effective management of various business processes in schools. Past studies in Kenya indicate that secondary school does not involve ICTs frequently in handling their day to day operations. This has led to challenges with respect to organization of information, computation and processing of paper work, organization communication, planning, monitoring, and management of instruction. This study sought to determine how ICT frequency of use influence effective management of public Secondary Schools in Uasin-Gishu County.

**Hypothesis**

*There is no significant influence of frequency of use of ICT on effective management of public secondary schools in Uasin-Gishu County.*

**ICT use in Management of Public Secondary Schools**

Information and Communication Technology (ICT) is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software. They are often spoken of in particular context like ICT in education (Noor-ul-Amin, 2013). Information and Communication Technology in education encompasses the utilization of ICT in carrying out management functions of (Sweeney, 2012). ICT applications in the field of education are regarded as an effective facilitator to creating, accessing, storing, manipulating and transmitting or share various forms of information, such as audio, visual and word formats. This is made possible by the proactive environment presented by ICT (Kawade & Kulkarni, 2012).

In a school context, ICT applications can be utilized for various functions including enhancing the teaching-learning process and the overall school administration purposes. School administrators utilize ICT to ease their mundane administrative task areas. School administrators use ICT in the registration of students, preparing school reports, announcements and letters for meetings, as well as staff and teachers’ employment. ICT is also employed in giving in-house training or presentations to teachers. Preparation of schemes of work, teaching plans and timetables also come forth as the functions that necessitate administrators to use ICT applications. Finally, school administrators utilize ICT application in handling financial work, keeping records, collecting data, processing documents and maintaining communication across the school and with the external environment alike (Mwalongo, 2011).

ICT in education improves teaching, learning, and administrative processes to qualify students for the modern-day era (Zhao, Pugh, Sheldon, & Byers, 2012). Efforts have been made to incorporate technology into education since the late 20th Century. For instance, low cost software, such as Logo, first became available in the 1980s (Papert, 1980). According to the World Bank, [ICTs] consist of hardware, software, networks and media for collection, storage, processing, transmission, and presentation of information (including voice, data, text and images).

Plomp, Anderson, Law & Quale (2009), in his contribution in the World Communication “and Information Report 1999-2000 states, that information and communication technologies (ICT) are diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information. For the purpose of this study, ICT covers a range of
technologies, including computers, communication devices, and audio and video components (Powell & Rodseth, 2013). ICT also includes software, such as Excel Spreadsheet, Word processing, Image Creation, Data Show, Email, and Web tools; all help to improve the teaching approaches and content quality.

Osborne and Hennessy (2003) emphasize the role of the teacher; state that a significant role is played by the teacher as they create the conditions for effective ICT use. Therefore, ICT is considered a tool that creates and causes change in the practices and behaviours of both teachers and students. While some people view the use of ICT in education in negative ways (Trucano, 2008), ICT is perceived as a positive influence by many in the global education field.

ICT makes use of a combination of information and communication methods and, as a result, helps students to learn faster. The strength of ICT is that it makes use of text, images, motion and, sometimes, sound, to engage the learner and transform traditional teaching approaches (Selinger, 2010). Moreover, through networking, ICT uses information repeatedly, while also increasing the learner’s chance to participate in real world events (Baumgartner, Denz, Oberhauer, & Hoffmann, 2011). For these reasons, ICT offers great advantages for students, and teachers; it also facilitates management processes, such as meetings and training sessions (World Bank, 2008).” Nevertheless, ICT implementation in schools requires much effort for successful integration. Embedding ICT requires both behavioural and practical amendments which can be challenging for educators. While past research presented here appears to concentrate on the importance of ICT in school management,” the neglected aspect is the ICT competencies of the user and how these relates to effective school management in selected public secondary schools. Though we appreciate the fact that much effort is required on the part of school managers, little is said about their attitude and its relationship with effective school management.

Effective implementation of an innovation is dependent to a considerable degree upon the active intervention of key personnel in change agent roles; their roles are crucial because school improvement programmes require time and effort for effective change (Miles, Sax & Lieberman, 2000). Wango (2009) indicates that there is a considerable increase in knowledge and innovations which have had an impact on education. Wango (2009) elaborates that education policy makers will have to combine the knowledge of individual schools with an understanding of administrative and managerial factors and skills so as to influence the process of change.”

School administration and management can use various software applications in their work. The enormous data generated in the course of managing schools can be efficiently and effectively handled by use of spreadsheets and database applications. A case in point is the Education Management Information System (EMIS). Information can easily be collected, stored, processed, analysed, and disseminated by such a system” (Ministry of Education, 2012).

Tay et al (2013) describes and analyses the conditions that support the seamless integration of information communication technology (ICT) into school management. The researcher points out the importance of two factors: technological infrastructures and human (school managers’) beliefs and practices. However, Tay’s argument relate to primary school and thus, leaves the gap as to whether these factors can apply in the context of secondary schools.

Etudor-Eyo (2012) investigated the “use of ICT and communication effectiveness among secondary school administrators in Akwalbom State, Nigeria. The study obtained data from 396 secondary school administrators through the Administrators’ Use of ICT Questionnaire (AUIQ) and Administrators’ Communication Questionnaire (ACQ). The findings were that the extent of administrators’ use of ICT and the extent of administrators’ effectiveness in communication are high; there is a significant positive relationship between administrators’ use of ICT and administrators’ effectiveness in communication; the effectiveness of secondary school administrators in communication is significantly predicted by the use of ICT.” This study therefore provides the opportunity to transform the management practices in schools.

Frequency of Use of ICT and Effective Management of Public secondary schools

Afshari, Bakari, Luan, Afshari, Fooi & Samah (2010) studied the “extent to which Iranian secondary school principals used computers and secondly to explore the relationship between a number of variables related to the use of information and communications technology (ICT). The word processing was the most frequently utilized software among the principals and they used it to create documents and slides. The findings also revealed that that within the area of administrative uses, communicating with staff, and members of the wider school, initiating and sustaining collaborative activities with colleagues within and outside their school were the areas of greatest use, while financial matters, maintaining administrative records about students, using a program to analyze information for solving problems, using technology to support levels of professional collaboration, and using technology to engage new kinds of professional development were the least used areas. Therefore, the early assumption that the introduction of computers into schools for administrative purposes would spread to their use for instructional purposes was not supported by the data.

Kimosop and Chemwei (2016) examined the frequency of use of ICT equipment by secondary school heads and teachers in Nandi and UasinGishu counties, Kenya. The study employed a descriptive survey research design. A total of 63 schools with functional ICTs were purposively selected and, in each school, one class teacher, 2 subject teachers and 2 heads of department were selected using stratified random sampling to give a total of 315 teachers. All head teachers from each of the 63 schools were selected through purposive sampling. From the study findings, the most utilized ICTs in schools were the printer, photocopier and computer while the curriculum management activity that highly utilized the use of ICT was the preparation of and the analysis of exams. This implies that ICTs in schools were mostly used as gadgets for typing and producing exam materials. Little seems to have been done in the utilization of ICTs for curriculum delivery and the management of data that could be utilized for informing decision making.

Lipesa (2018) studied the effectiveness of ICT integration in enabling the e-leadership of public secondary schools in Busia County, Kenya. A cross-sectional survey design was adopted. Systematic random sampling technique of 14 public secondary
schools was employed, while the school leaders, including 14 principals, 42 teachers and 14 support staff were sampled using Stratified Random Sampling. Questionnaires was employed in gathering quantitative data. The study established that there was a marked difference between the ways in which support staff and teachers were integrating ICT in their administrative roles, integrating ICT in the leadership of public secondary schools was deemed to improve access to a motivating learning and teaching environment that provides a good interface between theory and practice, as well as improve efficiency.

Jumaet al., (2016) found that frequency in the use of Institutional management systems databases help to avoid the redundancy or duplication of data thereby enhancing data coordination with departments. Manual handling of huge data is very difficult and causes delayed information collection and compilation. This affects decision-making process for quality education, but with the use of ICT, well-organized and analyzed data is readily available to foster effective and quick decision-making.

Biegon (2017) examined the extent of ICT integration in school management and the perceptions of teachers on its usefulness in Westlands, Nairobi. It focused also on the level of foundation skills and training of school managers on ICT usage for management. The samples size was 114 teachers and 10 principals from the 10 schools. The study found that ICT was not extensively used in management of the schools. The study further established that secondary schools in Westlands mostly concentrated on using ICT in teaching and learning and not management. This shows that there is still a lot to be done on the integration of ICT in school management. The study concluded that ICT was not highly upheld in public secondary school management.

Mutisya (2017) studied the extent to which Information and Communication Technology has been integrated in the management of public secondary schools in Kitui County, Kenya. This study used sample size table as proposed by Krejcie and Morgan (1970) and Peter (2005) whereby 58 principals, 58 senior teachers and 266 assistant teachers from schools that have functional ICT infrastructure were selected. All 16 Sub-county Directors of Education and one County Director of Education were selected for the study. The study found that among those who used ICT, majority of the principals used ICT for managing internal exams to a great extent. On internet use the study established that; majority of principals used internet for school management less frequently. In fact, some of the principals had no active emails. It was also noted that some of the principals and senior teachers respectively had never used internet.

II. REVIEW OF RELATED LITERATURE

Theoretical Framework

This study was supported by the Open Systems Theory and The Technology Acceptance Model (TAM).

Open Systems Theory

The “theory was developed by a biologist Ludwig Von Bertalanffy in 1937 in Chicago. The theory views an organization as an integrated system of interdependent and interrelated structures and functions. In the open systems theory, the school is viewed as an open social-technical system composed of four major inter-dependent subsystems namely; structure, technology, task and people. These subsystems interact with the external environment in such a way that bringing change in one would lead to changes in all the others (Waweru, 2008).

The incorporation of ICT into the day-to-day functions of educational institutions has a marked impact on every aspect of management structure and dynamics. It means the study on ICT introduction in the schools would not have been exhaustive if the social and technical aspects were not considered in their entirety explaining the reason for the adoption of the socio-technical approach in the study based on the open systems theory as espoused by Kast and Rosenzweig (1985).

According to Owen &Valesky (2011), the organization is structured, equipped and staffed appropriately to accomplish its mission. The organization must have technological resources and people who contribute to the task achievement. The four internal organization factors; task, structure, technology and people are variables that are highly interactive, each tending to shape and mold the others. Significant change in one factor will result in some adaptation on the part of the other factors. A technological change, such as introduction of computers in a high school will require personnel with new technical skills. It may lead to change in the structure as a new department may be created. Technology is usually developed outside the school system. The school may either adapt it smoothly and easily, or it may resist technological changes (Muriko, Njoguna, &Njihia, 2015).

The Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is a theoretical model that explicates the manner in which users accept and embrace novel technology and was coined by Fred Davis in 1989. TAM postulates that actual technology usage is shaped by behavioral intent. TAM proposes that perceived usefulness of new technology determines the attitude of a user towards the innovation. On the other hand, perceived ease of use influences the users to utilize technology. Generally, TAM assumes that once perceived usefulness and perceived ease of use interact and the intention to act is developed, an individual is boundlessly able to act. However, this comes out as the major limitation of TAM since in reality individuals face constraints including time, limited ability, as well as organizational and environmental restraints (Davis, Foxall&Pallister, 2002). This brings forth the importance of perceived usefulness and perceived ease of use in integration of ICT into secondary schools.

According to Crawford (1997), Schools should encourage teachers to develop their ICT skills. It is advisable to reserve some ICT resources for staff only. The staff ICT room should be equipped with the suitable hardware, software and ICT learning resources to train staff on ICT skills. If teachers can see that what is done can be done more thoroughly and effectively using ICT, then they will spend more time developing their ICT skills. Schools should hire ICT technician to assist teachers in familiarizing with both the theory and applications of computers.

According to Daily Nation (August 31, 2012; pVII), Kenya Education Management Institute (KEMI) has been at the forefront of building the capacity of education administrators/managers on ICT integration under the Economic Stimulus Program. KEMI director Dr. WanjeruKariuki has expressed the organizations...
commitment to bridging the digital divide in the education sector. In its ICT strategy the MOE has outlined a training program for the entire MOE, its agencies and institutional managers in the area of Education Management Information System (EMIS). The teaching staff force of about 240,000 teachers will be trained in ICT literacy and integration (ROK, 2006).

### Conceptual Framework

The conceptual framework shows that Frequency of ICT use is looked at from the point of frequency of using computer applications such as word processing, spreadsheets, and presentations for school management, as well as frequency of use of ICT equipment.

![Conceptual Framework](image)

**Source:** Author, (2022)

### III. METHODOLOGY

#### Research Methodology

The study used a convergent mixed research design. A convergent mixed research design is a type of design in which qualitative and quantitative data are collected in parallel, analyzed separately, and then merged (Creswell, 2014). This design was chosen because both qualitative and quantitative data was collected, analyzed and interpreted. This design helped gain insight in generalizing a situation without utilizing the whole population. It is suitable in determining reasons or causes for the current status under study (Marshall & Rossman, 2014). The study was carried out in UasinGishu County located in Rift Valley region of Kenya 330km North West of Nairobi. The County has 166 secondary schools. The county was selected as a representative of other counties because it is believed that it will give a wider view of the problem under the study. The population of the study was 189 with a sample of 171 respondents being picked. Stratified sampling technique was used to stratify schools based on sub counties while purposive sampling method utilized to pick respondents. Data was collected using a questionnaire designed based on study objectives. Instrument validity was gauged using a panel of experts who are knowledgeable in the study area while internal consistency of was tested against Cronbach’s alpha where a reliability score of 0.778 > than 0.7 was obtained. Both descriptive and inferential statistics were used in the data analysis. Primarily, descriptive statistics encapsulated measures of distribution and central tendencies while inferential statistics constituted correlation and regression analysis that helped determine the relationship between the study constructs.

For the purpose of communicative effectiveness the study findings were presented in tables.

### IV. RESULTS

#### Discussion of Findings

**ICT frequency of Use and Effective Management of Public secondary schools**

The objective was to determine how ICT Frequency of use influence Effective Management of Public secondary schools in Uasin-Gishu County. 

**H₁:** There is no significant influence in Frequency of use of ICT on Effective Management of Public Secondary Schools in Uasin-Gishu County.

#### Table 1: Model Summary for Regression Analysis for ICT Frequency of Use and Effective Management of Public secondary schools

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. of Observations</th>
<th>Beta (t-value)</th>
<th>Standard Error</th>
<th>t-Statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>171</td>
<td>6.84 (5)</td>
<td>1.585</td>
<td>4.319</td>
<td></td>
</tr>
<tr>
<td>Frequency of Use</td>
<td>171</td>
<td>.449 (.118)</td>
<td></td>
<td>8.989</td>
<td>.000</td>
</tr>
</tbody>
</table>

*Correlation Coefficient (R) = .549, R² = .302, F = 80.796*
Durbin Watson=2.01
*p<0.05
Predictors: (Constant), Frequency of Use
Dependent Variable: School Management

The results in table 4.12 indicates the regression analysis for Frequency of use, the value for Durbin-Watson (D=2.201) is also within the established range of 1-3 indicating the absence of autocorrelation in the sample. The correlation in the relationship between Frequency of use and Effective Management of Public secondary schools was also found to be positive and significant (R = 0.549, p<0.05). This indicates a significant relationship between Frequency of use and Effective Management of Public secondary schools signifying that whenever Public secondary schools in Uasin-Gishu County ensured that there was frequent use of ICT there was a positive and significant improvement on Effective Management.

The regression results further indicated that Frequency of use significantly predicted Effective Management of Public School (β1= .449, t= 8.989; p<0.05), which means a unit increase in Frequency of use produced a 0.449 deviation in Effective Management of Public secondary schools in Uasin-Gishu County. The R squared value indicated that Frequency of use explained 30.2 percent of the variance in Effective Management of Public Secondary Schools (R² = 0.302, F= 80.796; p<0.05). This reveals that a higher proportion of disparity in Effective Management (69.8%) is explained by other aspects not captured in the second model. Therefore, the hypothesis that there is a significant relationship between Frequency of use and Effective Management of Public secondary schools in Uasin-Gishu County is therefore supported.

The results again demonstrate that Effective Management in Public Secondary Schools may not be attributable to Frequency of use only but could be explained further by the ability of the Schools in the County to integrate frequency of use, attitude, access to ICT facilities and their technical competencies to effectively achieve good management.

Afshari, et al (2010), supported the findings of the current study where they established that most school administrators frequently use ICTs in maintaining administrative records about students. Similarly, Kimosop&Chemwei (2016), Junwa (2016) and Mutisya (2017) further supports the findings of this study that frequency of ICT use in Schools can help the School administrators achieve their objectives. However, Biegon (2017) indication that School administrators rarely used ICTs for planning school activities contrasted the current results. The study outcomes however are in contrary with those ofLipesa (2018) which established that most school administrators such as school administrators and bursars had not integrated ICT in handling financial work, and where this was done it was not frequently done.

V. SUMMARY AND CONCLUSION

Summary and Conclusion

The objective sought to determine frequency of use of ICT affect the effective utilization of ICT in management of public secondary schools in Uasin-Gishu County. The study established that a minority of the school administrators’ often used ICT in their management activities. This is justified by a weak relationship between frequency of ICT use and effective management of Schools in the County. The results however indicated a positive and significant relationship between ICT frequency of use and effective school management indicating that whenever there was an increase in ICT usage there was likely to be effective management of school in Uasin-Gishu County.

Based on this the study concluded that failure to utilize ICT facilities frequently due to unavailability of the same in most schools has led to a negative impact on the achievement of effective management in Uasin-Gishu County. On the conclusion that minority of the school administrators’ utilizes ICT facilities frequently in their management functions, the Ministry of Education should consider revising policies related to monitoring the frequency of ICT by school administrators for management purposes. The policy should be crafted in such a way that school administrators are encouraged to use ICT equipment and software for school management as frequently as possible.

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AUTHORS

First Author – Stephen Kirui, University of Kabianga, Kericho – Kenya

Second Author – Hellen Sang, University of Kabianga, Kericho – Kenya

Third Author – Alfred Bett, University of Kabianga, Kericho – Kenya

Fourth Author – Joshua Manduku, University of Kabianga, Kericho – Kenya
The Influence of School Administrators Attitude on effective use of ICT in Management of Public Secondary Schools in Uasin-Gishu County in Kenya

Stephen Kirui, Joshua Manduku, Hellen Sang & Alfred Bett

University of Kabianga, Kericho –Kenya

Abstract- There “is increasing interest, attention and investment being put into the use of ICT in education worldwide. The Ministry of Education Science and Technology in Kenya has developed an Information Communication Technology (ICT) strategy which outlines how ICT will be adopted and utilized to improve access, quality and equity in the delivery of education services in Kenya. With the introduction of computer-based technology in schools, major changes should be observed in the way education is managed, but there is still minimal evidence on the impact of these technologies in public secondary schools. The general objective of the study was to analyze selected socio-technical issues influencing effective management of public secondary schools in Uasin-Gishu County. Specifically, the study sought: To Examine how school administrators’ attitude on ICT influence effective management of public secondary schools in Uasin-Gishu County, Determine how ICT frequency of use influence effective management of public secondary schools in Uasin-Gishu County, Establish how school administrators’ access to ICT facilities influence effective management of public secondary schools in Uasin-Gishu County and Investigate how school administrators’ ICT technical competencies influence effective management of public secondary schools in Uasin-Gishu County. The study was based Open Systems Theory and The Technology Acceptance Model (TAM). The researcher adopted the correlational and descriptive research design. “The population for the study was 166 public secondary schools in Uasin-Gishu County. The sample size used was 61 principals, 61 school bursas, 61 school secretaries and 6 Sub-County Directors. Stratified random sampling methods were used to select the respondents. Primary data was collected using structured questionnaire measured on liker type interval scales of 1-5 between April 2021 and August 2021. Reliability of the research instrument was tested against Cronbach’s alpha coefficient where an overall reliability score of 0.814 was achieved while validity was gauged using panel of experts, ensuring that the indicators of each variable were within the same construct and operationalizing the instrument as per the variables. Descriptive statistics comprising means and standard deviations were used to analyze the data while hypotheses were tested using multivariate linear regression model to generate relevant statistics.” The findings indicated that administrators’ attitude on ICT has a moderate relationship (R = 0.637, β1= 0.637, R²=0.405, p<0.05) with effective management of schools indicating that a positive change in administrators’ attitude leads to adequate improvement on management of schools. ICT frequency of use and effective school management were also found to have a moderate relationship (R =0.549, β1= 0.449, R²=0.302, p<0.05) demonstrating that whenever school administrators’ frequently employ ICT facilities in their management functions there was a significant improvement on effective management of schools. Based on the study findings, there was also a moderate relationship between access to ICT facilities and effective management of schools (R =0.383, β1= 0.287, R²=0.147,p<0.05) which demonstrated that those administrators’ who have access to ICT facilities tend to manage their schools better. Lastly, the study established a moderate relationship between administrator’s ICT technical competencies and effective school management (R = =0.58, β1= 0.506, R²=0.346, p<0.05). Implying that administrators’ skill set are necessary in leveraging on ICT facilities to realize success in management of schools. On the basis of these findings, it was concluded that the Ministry of education should: ensure that the administrators’ develop a favourable attitude; frequent use of ICTs in school management is encouraged; resources are allocated for the acquisition of ICT facilities and administrators given training on how to utilize ICTs their schools to enable them achieve effective management. The study may be useful to stakeholders in the education sector in providing information on the state of ICT in public secondary schools in Kenya.

Index Terms- Attitude, Information and Communications Technology, Administration, Educational Management

I. INTRODUCTION

Background of the Study

Information and Communication Technology (ICT) in educational management is used to overcome the barriers of distance and time and significantly improves the accessibility of information and knowledge (Gavua, Okyere-dankwad&Offei, 2018). Rapid growth in the global economy and technological
advancement has pressurized the education institutions to use ICT not only for teaching and learning but also for managing school operations. Since ICT has become an essential part of everyday life, its integration in education is inevitable and cannot be avoided. However, it is important to note that Schools are open systems that interact with their environment, and the effective use and integration of technology is directly associated with the role of various socio-technical factors that may impact the integration of ICT in schools (Tay, Lim & Lim, 2013).

Today, all schools are already equipped with computers and connected to the Internet, and 93.2% operate their own wireless network or information system (Wichowa, 2020). The ICILS international comparison of computer and information literacy states that Czech schools (Fraillon, Ainley, Schulz, Friedman, and Duckworth, 2018). Even though teachers are generally positive about ICT and its ability to support their administrative and management duties, the findings point to low levels of use of ICT for administration and management.

Globally, the use of ICT innovation in school management can be dated back to the 1960s when the computerization of schools gained momentum (Mimbi & Bankole, 2016). Anderson, Potočnik and Zhou (2014) stipulated that secondary schools should embrace ICT use in school management. In Malaysia, the University Science Malaysia (2009) “brought to light that successful diffusion of ICT was due to perceived administrative and technical support on the use of technology. In Spain, familiarity with computers and years of experience with ICT correlate positively with levels of institutional management (Selwood, Fung & Mahony, 2003). Palagolla and Wickramarachchi (2019) in a study in the North Central Province (NCP) of Sri Lanka documented that there was a very low use of ICT among schools in the territory due to poor ICT infrastructure, leadership support, school planning, and ICT competency. Although different actions have been taken to promote effective ICT usage among secondary schools of Sri Lanka, ICT is underutilized in secondary schools.

In African countries, initially, the use of ICT in management of schools was low compared to other fields such as business and engineering, however, in recent times, school managers have embraced ICT in the education sector” (Mwadulato & Odoyo, 2020). Farrell and Isaacs (2007) observe that Rwanda is among few African countries to have embraced ICT policy more specially in the management of schools (Farrell & Klemperer, 2007). In South Africa many educational institutions have embraced ICT in management of their operations (Hennessy, Harrison & Wamakote, 2010). Studies in Nigeria such as Jegede, Dibu-Ojerinde and Ilori (2007) and Mohammad, (2012) revealed that one of the challenges impeding the use of ICT for school management was the school administrators’ attitude towards ICT. There are isolated cases where individuals are technophobia or just develop a dislike towards ICT. This will make them not to acquire literacy skills or better still work negatively towards equipping the schools with requisite skills.

Even though the importance of using ICT in school management, studies worldwide show that to date some principals still have a negative attitude towards the utilization of ICT for school management. Examples of such studies include Takach, Ayoub and Kibbi (2018) among the Lebanese public secondary schools, Papaioannou and Charalambous (2011) among the Cyprus primary school principals’ and Bahrain, Abdul Razzak (2013) among Arab Countries. However, these studies did not explore how this negative attitude affected effective use of ICT in the management of public secondary schools which is the interest of the current study.

Principals and other school administrators need requisite technical competencies for effective school management (Polizzi, 2011). Several studies however, show that majority of school administrators’ do not have adequate technical competencies for ICT utilization in school management hence leading to negative attitude towards ICTs. For instance, studies by Obiekwe and Obadigie (2019) and Ogachi (2014) in Nigeria and Chepkonga (2015) in Kenya demonstrated that school administrators lack essential skills required “for use of ICT in school management. Like many other countries in the world, Kenya developed National ICT policy in 2006, giving priority to ICT. The ICTs in Education Sessional Paper one (MoE, 2012), explains that ICT can be leveraged to support and improve school management (MoE, 2012). In regard to educational institutions adoption of ICT the mandate was to improve school management. In the quest for integrating ICT in education, four various policy documents spelt out the ICT policy in schools, namely; e-Government Strategy, National ICT Policy and Sessional Paper No. 1 of 2005” (MoE, 2006).

ICT policy in this study was taken as a theoretical variable that the researcher used to explain a connection between Socio-Technical issues and the management of public secondary schools in Uasin-Gishu County in Kenya. A sound policy in place would ensure that the issues bedeviling the ICT usage in secondary schools in Uasin-Gishu County would be addressed adequately enabling schools to adopt technologies that are relevant to their business processes.

II. STATEMENT OF THE PROBLEM

The use of ICT in school management helps enhance effectiveness in three main areas of administration, that is, student administration, staff administration, and general administration. ICT assists in enhancing timeliness, accuracy, completeness and quality of school management. To achieve this, school administrators need to embrace the adoption of ICT for use in school management in order to register required management effectiveness. On the other hand, the government should ensure that a policy to address the socio-technical issues be in place to help address them and enable schools adopt technologies that will help them achieve their objectives. Schools’ ought to have relevant ICT hardware and software and related ICT skills for effective management of various business processes in schools. Nevertheless, past studies in Kenya indicate that secondary school principals’ lack proficiency in database, spread sheet, presentation/multimedia software, the internet and information seeking which are requisite for school management leading to negative attitude towards implementation of ICTs in their stations. When school administrators fail to embrace ICT in their work place, they will experience challenges with respect to organization of information, computation and processing of paper work, organization communication, planning, monitoring, and management of instruction. This paper examine how school
administrators’ attitude on ICT influence effective management of public secondary schools in Uasin-Gishu County.

**Hypothesis**

*There is no significant influence of school administrators' attitude towards ICT on effective management of public secondary schools in Uasin-Gishu County*

**ICT use in Management of Public Secondary Schools**

Information and Communication Technology (ICT) is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software. Information and Communication Technology in education encompasses the utilization of ICT in carrying out management functions (Sweeney, 2012). These applications in the field of education are regarded as effective facilitators to creating, accessing, storing, manipulating and transmitting or sharing various forms of information, such as audio, visual and word formats.

In a school context, ICT applications can be utilized for various functions including enhancing the teaching-learning process and the overall school administration purposes. School administrators utilize these applications to ease their mundane administrative tasks. They leverage these applications in the registration of students, preparing school reports, announcements and notices. ICT is also employed in giving in-house training preparation of schemes of work, teaching plans and timetables. Finally, schools’ administrators utilize ICT applications in handling financial work, keeping records, collecting data, processing documents and maintaining communication across the school and with the external environment alike (Mwalongo, 2011).

**School Administrators’ Attitude toward ICT and Effective Management of Public secondary schools**

Hashim, Ahmad and Abdullah, (2010) observed that in Malaysian schools “individuals’ attitudes toward ICT have been recognized as an important factor for the success of technology integration in education. Administrators who have positive attitudes toward technology are very helpful and supportive in introducing these new technologies in schools. They encourage their colleagues to have ICT training, equip the school with sufficient computers and ensure that staff has access to relevant technology.

Papaoannou and Charalambous (2011) explored the Cyprus primary school principals’ attitudes towards Information and Communication Technologies (ICT) as well as their perceptions about the factors that facilitate or inhibit ICT integration in primary schools in Cyprus. Using the formula of Krecjie and Morgan (1970) it was estimated that a sample of 180 principals would be representative for the purpose of this study. According to the findings of the research, primary school principals in Cyprus hold positive attitudes towards ICT.

In “Lebanon, Ghmarawi (2013) investigated the relationship between the leadership styles exhibited by 651 Lebanese public-school principals and their attitudes and the level of use of technology for educational purposes. The study documented that though the principals of these schools bear positive attitudes towards computers; they did not consider them as important tools for the enhancement of teaching and learning. They valued computers as tools for the facilitation of the management of information in their schools and for administrative purposes. The study also revealed the existence of positive correlation between the autocratic leadership style of school principals and their negative attitudes towards the use of ICT for educational purposes. In addition, the results of the study accentuate another positive correlation existing between principals’ attitudes towards the use of ICT for educational purposes and the level of its use by their teachers in schools.

Oluyemisi (2015) in Nigeria investigated administrators’ perspective towards using ICT for effective school management. The sample used for the study consisted of 120 administrative staff randomly selected from different Secondary Schools in Ilesa Local Government area in Osun State. The results indicated that school administrators have a positive perspective towards the use of ICT tools in effective school management by solving the problem of poor communication in schools and achieving effective planning. Ogachi (2015) studied the factors influencing principals' integration of information communication technology in administration of public secondary schools in Isinya Sub-County, Kenya. Simple random sampling was utilized to select a sample of 10 public secondary schools to participate in the study. The study established that principals’ attitude towards ICT affected effective utilization of ICT in secondary schools. The attitudes of the principals towards the use of ICT have a fundamental impact on the principals’ integration of ICT in administrative undertakings. Principals with a positive attitude towards the use of ICT will be primed to utilize ICT in their administrative endeavors since they comprehend and appreciate the benefits of employing ICT. Conversely, principals with a negative attitude towards the use of ICT, perhaps due to their previous experience with ICT, will be hesitant to integrate ICT in their administrative roles because of their pessimistic perspective towards ICT use.

Njathi, Ngaruiya and Maithya (2018) studied the relationship that existed between principals’ perception towards computer application and the actual computer use by principals in public secondary schools in Kiambu County, Kenya. The study adopted descriptive survey research design. The study sample comprised of 205 principals which translated to 67% of the target population. The study found out that principal’s attitude towards use of computers influenced the use of computers among school principals.” However, the study only focused on one type of IT, the computers and thus did not explore other forms of IT, such as phone applications, tablets and other gadgets that can be utilized in school management.

Muchiri (2014) “identifies the lack of enthusiasm towards ICT integration among principals as the main cause of low use of information and communication technology. Another factor that influences the utilization of computers in school administration is the attitude towards the use. The researcher found that individual principals’ attitudes toward computer use was an important factor for the success of technology integration in secondary schools.

Muthoni, Mbugua &Githua (2013) in their study on reactions of schools’ Headteachers toward computer use in teaching and learning in secondary schools in Tharaka-Nithi County in Kenya found out that all the head teachers who participated in the study believed that it was very important for them to learn how to use computers.” Majority of the principals agreed that computers usually saved time. The school managers
believed that they were better principals with computer technology. Majority of school principals valued the use of computers in learning. However, the researchers did not find out if this positive attitude of using computers made them more effective in their work.

III. REVIEW OF RELATED LITERATURE

Theoretical Framework

Open Systems Theory
The “theory was developed by a biologist Ludwig Von Bertalanffy in 1937 in Chicago. The theory views an organization as an integrated system of interdependent and interrelated structures and functions. In the open systems theory, the school is viewed as an open social-technical system composed of four major inter-dependent subsystems namely; structure, technology, task and people. These subsystems interact with the external environment in such a way that bringing change in one would lead to changes in all the others (Waweru, 2008).

The incorporation of ICT into the day-to-day functions of educational institutions has a marked impact on every aspect of management structure and dynamics. It means the study on ICT introduction in the schools would not have been exhaustive if the social and technical aspects were not considered in their entirety explaining the reason for the adoption of the socio-technical approach in the study based on the open systems theory as espoused by Kast and Rosenzweig (1985).

According to Owen & Valesky (2011), the organization is structured, equipped and staffed appropriately to accomplish its mission. The organization must have technological resources and people who contribute to the task achievement. The four internal organization factors; task, structure, technology and people are variables that are highly interactive, each tending to shape and mold the others. Significant change in one factor will result in some adaptation on the part of the other factors. A technological change, such as introduction of computers in a high school will require personnel with new technical skills. It may lead to change in the structure as a new department may be created. Technology is usually developed outside the school system. The school may either adapt it smoothly and easily, or it may resist technological changes (Muriko, Njuguna, & Njihia, 2015).

The Technology Acceptance Model (TAM)
The Technology Acceptance Model (TAM) is a theoretical model that explicates the manner in which users accept and embrace novel technology and was coined by Fred Davis in 1989. TAM postulates that actual technology usage is shaped by behavioral intent. TAM proposes that perceived usefulness of new technology determines the attitude of a user towards the innovation. On the other hand, perceived ease of use influences the users to utilize technology. Generally, TAM assumes that once perceived usefulness and perceived ease of use interact and the intention to act is developed, an individual is boundlessly able to act. However, this comes out as the major limitation of TAM since in reality individuals face constraints including time, limited ability, as well as organizational and environmental restraints (Davis, Foxall & Pallister, 2002). This brings forth the importance of perceived usefulness and perceived ease of use in integration of ICT into secondary schools.

The concept of perceived usefulness, as presented by TAM, will be conceived to influence not only the attitude of principals towards the use of ICT but also the ICT literacy, which they seek in order to tap on the potential benefits of ICT. On the other hand, perceived ease of use will be conceived to be demonstrated through the availability of both ICT infrastructure and the technical support thereof. By comprehending the manner in which new technology is embraced, it is easy to predict the aforementioned factors will impact the utilization of ICT in administration of schools.

Conceptual Framework of the Study
The following framework describes how the variables under study relate to each other in which Administrators’ Attitude is the independent variable and the dependent variable is School Management.

Independent Variables

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IV. METHODOLOGY

Research Methodology

The study used a convergent mixed research design. A convergent mixed research design is a type of design in which qualitative and quantitative data are collected in parallel, analyzed separately, and then merged (Creswell, 2014). This design was chosen because both qualitative and quantitative data was collected, analyzed and interpreted. This design helped gain insight in generalizing a situation without utilizing the whole population. It is suitable in determining reasons or causes for the current status under study (Marshall & Rossman, 2014). The study was carried out in Uasin Gishu County located in Rift Valley region of Kenya 330km North West of Nairobi. The County has 166 secondary schools. The county was selected as a representative of other counties because it is believed that it will give a wider view of the problem under the study. The population of the study was 189 with a sample of 171 respondents being picked. Stratified sampling technique was used to stratify schools based on sub counties while purposive sampling method utilized to pick respondents. Data was collected using a questionnaire designed based on study objectives. Instrument validity was gauged using a panel of experts who are knowledgeable in the study area while internal consistency of was tested against Cronbach’s alpha where a reliability score of 0.778 > than 0.7 was obtained. Both descriptive and inferential statistics were used in the data analysis. Primarily, descriptive statistics encapsulated measures of distribution and central tendencies while inferential statistics constituted correlation and regression analysis that helped determine the relationship between the study constructs. For the purpose of communicative effectiveness the study findings were presented in tables.

V. RESULTS

Discussion of Findings

School Administrators’ Attitude on ICT and Effective Management of Public secondary schools

The objective was to find out how School Administrators’ Attitude on ICT influence Effective Management of Public secondary schools in Uasin-Gishu County.
The results in Table 1.0 indicates the regression analysis for administrators’ attitude, the value for Durbin-Watson (D=1.226) is also within the established range of 1-3 indicating the absence of autocorrelation in the sample.

The correlation in the relationship between Administrators’ Attitude and Effective Management of Public secondary schools was positive and significant ($R = 0.637$, $p<0.05$). This means that there was a significant relationship between Administrators’ Attitude and Effective Management of Public secondary schools indicating that whenever Public secondary schools in Uasin-Gishu County invested in ensuring that there is a good administrators’ attitude towards ICT usage there was a positive and significant improvement on Effective Management of Schools. The results of the regression further indicated that Administrators’ Attitude significantly predicted Effective Management of Public School ($\beta = .637$, $t= 11.294$; $p<0.05$), which means a unit increase in Administrators’ Attitude produced a 0.637 variation in Effective Management of Public secondary schools in Uasin-Gishu County. The R squared value indicated that Administrators’ Attitude explained 40.5 percent of the variance in Effective Management of Public Secondary Schools in Uasin-Gishu County ($R^2 = 0.405$, $F = 127.546$; $p<0.05$). This demonstrates that the larger proportion of disparity in effective management (59.5%) is explained by other factors not captured in the first model. The Hypothesis that there is a significant relationship between Administrators’ Attitude and Effective Management of Public secondary schools in Uasin-Gishu County is therefore supported.

The results illustrate that Effective Management in Public Secondary Schools may not necessarily be solely attributable to Administrators’ Attitude but could be based on how Public secondary schools in the county can combined attitude, frequency of use, access to ICT facilities and their technical competencies to effectively achieve good management. The findings are consistent with those of Hashim et.al (2010), Ogadi (2015), Njathi et.al (2018), Muchiri (2014), Muthoni et.al (2013), Ghamrawi (2013), Papaioannou &Charalambous (2011) and Oluyemisi (2015), however the findings differed with those of Kavagi (2010) who found out that school administrators see the computer as another typewriter hence its use is likened to turning the boss into the school secretary.

VI. CONCLUSION AND RECOMMENDATIONS

The study sought to find out how school administrators’ attitude affects the effective utilization of ICT in management of public secondary schools in Uasin-Gishu County. Most of the school administrators believe that ICT helps them to handle management activities and that schools can be managed effectively using ICT, and this is justified by a significant and positive relationship between administrators’ attitude and effective management of schools in the County implying that whenever school administrators in the County invest in developing a positive attitude towards ICT, there was likely to be effective management of public secondary schools.

Specifically, study concluded that school administrators’ attitude toward ICT positively influenced the effective management of public secondary schools in Uasin-Gishu County. Most of the school administrators believed that ICT can contribute significantly towards effective management of the schools they manage

Recommendation

Based on the conclusion of objective one that administrators’ attitude toward ICT positively influenced effective management of public secondary schools in Uasin-Gishu County, the Ministry of Education should consider organizing arranging for mentorship programs for school administrators geared at fostering positive attitude towards ICT use for effective school management. School administrators need to be psychologically influenced so as to appreciate the benefits of ICTs in management of schools.

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AUTHORS
First Author – Stephen Kirui, University of Kabianga, Kericho – Kenya
Second Author – Joshua Manduku, University of Kabianga, Kericho – Kenya
Third Author – Hellen Sang, University of Kabianga, Kericho – Kenya
Fourth Author – Alfred Bett, University of Kabianga, Kericho – Kenya
Evaluating the Use of HOTS in the Formulation of English Teacher-Made Test

Tiara Novalia*, Suwandi**

* English Education, Post Graduate Program  
** Universitas Negeri Semarang  
Email: tnovalia11@gmail.com

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Abstract- Since implementing the 2013 curriculum, the government has focused on applying HOTS at school. Beginning in 2018, HOTS questions have been included in the national examination. However, in the national examination of 2018, 40% of the students in Indonesia struggled to answer the HOTS questions. As a result, there is a decrease of 0.93 in the students' scores in both in-state and private high schools. This study focussed on evaluating the use of HOTS in English teacher-made tests at MA NU 03 Sunan Katong Kaliwungu Kendal. From the findings, the comparison between LOTS and HOTS was 47% to 53%. The proportion of HOTS was more than it is expected as the criteria of HOTS were expected to be around 10% to 15% of the total questions. While for the level distribution, analysing was 20%, evaluating was 6%, and the highest, creating with 74%. It suggested that the teacher had already given plenty of HOTS practice to her students in the class by using the daily test. The test also fulfilled the requirement of validity, practicality, and reliability, as shown in the supporting document.

Index Terms- Cognitive domain, Bloom’s taxonomy, HOTS, English teacher-made test.

I. INTRODUCTION

The implementation of the 2013 curriculum creates the change in the approach, method, and learning assessment in Indonesia education system. The government tries to encourage the teachers, especially teachers of higher education level, to apply higher-order thinking skills in every subject at school. As a result, the government has involved HOTS questions in the national examination; as Muhajir Effendi (2018) states, beginning in 2018, HOTS questions have been included in the national examination. However, they are only 15% out of the total question. Likewise, Collins (2014) states that applying HOTS can prepare students to compete in the 21st century. However, some issues are with HOTS in Indonesia (Wuryadi as cited in Rezkikasari, 2018).

According to Wuryadi (2018), Indonesia is left behind in applying HOTS to the students compared to other countries. It is supposed to be used years before. In addition, applying HOTS skills in the 2018 national examination does not go along with the reality of the teaching and learning process in the classroom. As a result, there is a disconnection between the national examination test makers and the students' conditions in the school (Wuryadi, 2018). The test makers do not know whether the teaching and learning process has been applied in HOTS or not. Still, some questions in the national examination are in HOTS form. As a result, most students have difficulties in doing the national examination. Based on the data from Kemendikbud, as stated by Totok as cited in Nugroho (2018), in the national examination of 2018, 40% of the students in Indonesia struggled to answer the HOTS questions. As a consequence, the student's scores are dropped. Kemendikbud as cited in Nugroho (2018) states that there is a decrease of 0.93 in the students' scores, both in-state high school and private high school. Two significant factors cause it. First, the swift from paper-based to computer-based tests pushes the students to adapt to the test mode. Second, some questions in the form of HOTS make students struggle to answer the questions. Directorate of High School Development in the International Standard Preparation Guide explained that most high school teachers only tended to measure low-order thinking skills (LOTS). Teachers' questions commonly measured recall skills. In addition, teachers focused on theories, not contextual knowledge, which did not fit the 2013 curriculum's requirements.

Teachers are expected to promote HOTS elements to encourage more profound thinking activities in students. HOTS cannot be directly given to the student. However, students should develop their thinking skills if they get the assessment regularly. As a guide in the classroom, the teacher plays a big part in training HOTS to the students. Giving a good assessment is one of the best ways to train HOTS to the student. HOTS should be present in all the curriculum 2013, including the English language assessment. The assessment is not only used to recall, restate, and recite the information, but it should be more to make students analyse, synthesize, evaluate and create. The concept of the HOTS question refers to the abilities to (1) transfer one concept to another, (2) to process and apply the information, (3) to find the relevance of different information, (4) to solve the problem using information, and (5) critical thinking.
HOTS involves the transformation of information and ideas. This transformation occurs when students analyse, combine facts and opinions, and synthesize, generalize, explain, or arrive at some conclusion or interpretation. Manipulating information and ideas through these processes allows students to solve problems, understand, and discover new meanings (Tomei, 2005). One of the most well-known taxonomies in education is Bloom's. It offers a basic thinking skills model adopted by several researchers for their studies' purposes. Bloom's taxonomy focuses on six levels of thinking that students practice while learning or acquiring knowledge. They are consistent of understanding, remembering, applying, analysing, evaluating, and creating. The first three levels of taxonomy belong to lower order thinking skills. While analysing, evaluating, and creating belong to higher order thinking skills. The focus point in this study is dealing with HOTS in Revised Bloom’s Taxonomy. As the addition, this study examined the validity, practicality, and reliability of the test that used as the objects of the study according to Brown’s (2004) theory on language assessment.

Validity is the most complex criterion and important principle of an effective test. There is no final absolute measure of validity, but several different kinds of evidence may be invoked in support (Brown, 2004). There are five types of evidence below, according to Brown (2004): content validity, criterion-related evidence, construct-related evidence, consequential validity, face validity.

Practicality refers to an effective test. This means that the test is not excessively expensive. It also stays within appropriate time constraints. Moreover, it is relatively easy to administer. Last, it has a scoring/evaluation procedure that is specific and time-efficient. Thus, it can be said that without those aspects, the test might be said as impractical. Practicality is determined by the teacher's and the student's time constraints, costs, and administrative details, and to some extent, by what occurs before and after the test, Brown (2004). It means that to administer what is so-called a good test, the teacher must meet some criteria relating to the practicality of the test.

Reliability means the consistency of measurement in the test. According to Brown (2004), "A reliable test is consistent and dependable. It means that if the teacher gives the test to a student on two different occasions, the test result will still be the same. The reliability problems may occur by the following factors as follows (Brown, 2004): student-related reliability, ratter reliability, test administration reliability, test reliability.

II.  METHOD

The research was categorized as a qualitative study. Creswell (1998) stated that qualitative research involved the study in which it used and collected a variety of empirical methods. It analyzed the data based on particular theories in such a way to prove the evidence whether or not the data are compatible with those theories. Thus, the result was explained in the description.

This research aimed to explain the realization of HOTS in English teacher-made tests, so the content analysis was used as the research design. Hsieh and Shannon (2005) define content analysis as "a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns." Therefore, content analysis was chosen for some reasons; first, this study provided the readers with an explanation of the HOTS found in the test. Then, the examples of each level of HOTS were compared with the theories of revised Bloom's taxonomy. Last, the result of this study was written in description.

As the subject of the study, one of the senior high school teachers in an Islamic private school is chosen. She took part as an interviewee to provide information about her English test's practicality, reliability, and validity. Furthermore, the objects of this research were teacher-made test items for English subjects for two semesters from two academic years. Teacher-made tests are the tests that are constructed and prepared by the teacher themselves to test their students. Teachers made these kinds of tests by considering the students' abilities in the classroom. They also adjusted the material of the tests based on what students have learned in the classroom. In short, these tests might suit students because they knew what they did in the test and expected a better outcome. The objects were the school's documents of test paper that had been used for students in tenth, eleventh, and twelfth grade at MA NU 03 Sunan Katong Kaliwungu Kendal.

The reading and writing questions were selected as items to be analysed. There were two units of analysis used in this research. The first was a cognitive process in Revised Bloom's Taxonomy (Anderson et al., 2001) which contained six main categories and 19 sub-categories. The characteristics of each sub-category were used to examine the individual test item in which category the item was included. The second was the practicality, reliability, and validity of the test so that the test was appropriate to be given to the student.

The data of this research belonged to qualitative data. Qualitative data are mostly non-numerical and usually descriptive or nominal (Creswell, 2009). It means the data collected were in the form of words and sentences. In this study, the data were collected from documentation and interview. The documentation included teacher-made test items for the English subject for two semesters from two academic years of MA NU 03 Sunan Katong Kaliwungu Kendal.

In addition, interview is used as another method of data collection. We used the standardized open-ended interview to question the teachers. Patton (1990) stated that in a standardized open-ended interview, all interviewees were asked basic questions in the same order. Questions were worded in a completely open-ended format. We asked the teachers about the test's practicality, reliability, and validity here. The interview was personal, so we asked the questions directly to the interviewee. Then, the result was recorded and transcribed as the research finding. There were two kinds of instruments in this research. They were checklist forms and interview questions. Then, the checklist form was divided into four sub-forms. After preparing the instruments, we included teacher-made English subject tests. Then, we analysed the realization of HOTS, which is embedded in the test items. This large number of items was purposively selected to obtain a more accurate analysis. The steps of data collection are described below:
1) Selecting the test paper written by English teachers.
2) Grouping the test items based on the cognitive level categories; analysing, evaluating, and creating.
3) Observe the supporting documents for the test's practicality, reliability, and validity.
4) Interviewing the interviewee about the test evaluation
5) Transcribing the result of the interview reciprocal

The analysis aimed to investigate the quality of the items that agreed with the thinking skills category. We used the approach of Singh and Shaari (2019) to add the modification as they had done quite similar research. The analysis of items was categorized into three parts. First, we evaluated the items according to HOTS listed in Bloom's Taxonomy. These items were reading and writing tests. Second, we analysed the levels of HOTS in Bloom's Taxonomy. The items were then categorized into three levels; analysing, evaluating, and creating. In the next step, we categorized the sub-skills under each main skill; analysing, evaluating, and creating items. Then, we observed the supporting documents to check the test's practicality, reliability, and validity. Last, we identified the evaluation of the test based on the interview done with the teachers.

III. RESULTS AND DISCUSSIONS

A. Analysing Domain in the Test

Based on Revised Bloom’s taxonomy by Anderson (2001) that we used as a tool for analysing the test, the result was there were 241 questions belonged to LOTS and 212 to HOTS. The overall questions that we found in the question was 453 questions. The gap was only 6 %. It suggested that the teacher give plenty of HOTS exercises to the students. It is in line with the teacher's second interview (interview#2, 11062022). The teacher stated that the result was as expected because they aimed to give HOTS questions to the students. It is not surprising since the teacher has already planned the test before.

In addition, we analysed the English teacher-made test to examine the use of analysing domain in the questions. Based on the documents obtained, we found that there were 79 questions out of 453 questions belonging to the analysing domain of Bloom's revised taxonomy. Here is the result.

From the table above, it showed that the word “classify” appeared the most. The reason was in majority of the questions, the students needed to classify some kinds of text. For the second highest, analyse, appeared as the questions in which the students needed to analyse whether the options were true or false based on the text that they read.

B. Evaluating Domain in the Test

Based on the data, we found that there were 17 questions out of 453 questions belonging to evaluating domain.

From the figure, evaluating domain only appeared in as much as 4 % of the questions. It is because evaluating domain was found mostly in reading questions. In contrast, none of them was found in writing questions. Moreover, the reading questions that used evaluating domain were in the form of essays. Meanwhile, there were only three questions in the form of a multiple-choice question. Furthermore, as written in the table, some active verbs under the evaluating domain were also found.
In the end, these findings are similar to the result of the research conducted by Narwianta, Anggani, and Rukmini (2019). The study entitled “The Evaluation of Higher Order Thinking Skills in English School National Standardized Examination at State Senior High School 6 Semarang”. The results indicated that HOTS realized in the listening, reading, and writing questions. The listening was in the form of spoken and written. There is one listening question categorized into HOTS of level analysing. In reading, the questions belonging to HOTS reach eight questions that consist of 5 questions of analysing level and three questions of evaluating level.

The result shows that in reading questions, HOTS domains that appear in the test mostly analyse and evaluate. It is in line with the result that we found in the test. I found that the majority of reading questions belonged to analysing. From the three domains of HOTS, analysing tends to be the highest HOTS that appeared in the test. In addition, writing questions that appeared in the test is in creating domain. The finding of the research from Narwianta, Anggani, and Rukmini (2019) also suggests the same thing. They found that one HOTS question was the level of creating in writing questions. It is similar to the findings that I found. We discovered that writing questions were in the form of creating. While comparing HOTS in reading and writing questions, it seems that reading appears slightly more than writing questions.

In accordance to the validity, practicality, and reliability of the test. We followed Brown’s (2004) theory on language assessment. We did some checklist and checked the supporting documents to see whether they followed the rules or not. From the data in findings, it can be said that the test is valid enough. The teacher has already met the criteria suggested by Brown (2002). The teacher has stated the objective of the test clearly in the test, has set the timing appropriately, and has created the test's structure well. The tests also are established in reference to a specific purpose; the test may not be valid for different purposes. For example, the test the teacher created used to evaluate the students' knowledge about pronouns may not be valid for predicting the students' listening skills. Nevertheless, it is one of the principles of assessment. It also leads to the following principle of assessment.

Similarly, a test's validity is established in reference to specific groups. These groups are called reference groups. The test may not be valid for different groups. For example, a test designed to measure the English of twelfth-grade students will not be appropriate to be given to tenth-grade students since the test materials are not the same. The teacher is responsible for describing the reference groups used to develop the test. Furthermore, the validity of the test in this research is measured by using the content validity method. Content validity refers to the extent to which the items on a test are reasonably representative of the entire domain the test seeks to measure. Content validity in this research is assessed by using Brown's theory.

We discover the practicality of the test based on Brown's (2004) theory of practicality. From the aspects of practicality, we can say that the test was practical enough. The teacher met most of the

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Table 2 Operational Verbs Used in the Test under Evaluating

<table>
<thead>
<tr>
<th>No</th>
<th>Operational Verbs</th>
<th>Number of questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Conclude</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>Predict</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Evaluate</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Opinion</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Interpret</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Assess</td>
<td>1</td>
</tr>
</tbody>
</table>

Based on the table above, conclude appeared the most. Here, the word conclude was found in reading questions. The questions were about concluding the message of the text or song. To conclude something, the students needed to understand the text.

C. Creating Domain in the Test

The last type of higher-order thinking skill in the cognitive domain was creating. Of 453 questions, we found 116 questions that belonged to creating domain.

Figure 3 Creating Domain of English Teacher-made Test

The number was pretty high considering the other domains, such as analysing with 79 questions or evaluating with only 17 questions. The reason might be that the tests consisted of reading and writing questions, so almost half of the test was in writing. Most of the questions that belong to creating domain were in the form of essays.

Table 3 Operational Verbs Used in the Test under Creating

<table>
<thead>
<tr>
<th>No</th>
<th>Operational Verbs</th>
<th>Number of questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Create</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>Combine</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Arrange</td>
<td>6</td>
</tr>
</tbody>
</table>

HOTS questions that found majority in writing questions were creating. Perhaps, it was because the teacher wanted the students to improve more in creating or making something. However, so far, the implementation of HOTS in each test is beyond than what this study expected so far. The teacher gives students with lots of practice. Although it might be quite difficult at first, but the students can do more practice. It will benefit them in doing such a test in the future.

In accordance to the validity, practicality, and reliability of the test. We followed Brown’s (2004) theory on language assessment. We did some checklist and checked the supporting documents to see whether they followed the rules or not. From the data in findings, it can be said that the test is valid enough. The teacher has already met the criteria suggested by Brown (2002). The teacher has stated the objective of the test clearly in the test, has set the timing appropriately, and has created the test's structure well. The tests also are established in reference to a specific purpose; the test may not be valid for different purposes. For example, the test the teacher created used to evaluate the students' knowledge about pronouns may not be valid for predicting the students' listening skills. Nevertheless, it is one of the principles of assessment. It also leads to the following principle of assessment.

Similarly, a test's validity is established in reference to specific groups. These groups are called reference groups. The test may not be valid for different groups. For example, a test designed to measure the English of twelfth-grade students will not be appropriate to be given to tenth-grade students since the test materials are not the same. The teacher is responsible for describing the reference groups used to develop the test. Furthermore, the validity of the test in this research is measured by using the content validity method. Content validity refers to the extent to which the items on a test are reasonably representative of the entire domain the test seeks to measure. Content validity in this research is assessed by using Brown's theory.

We discover the practicality of the test based on Brown's (2004) theory of practicality. From the aspects of practicality, we can say that the test was practical enough. The teacher met most of the
requirements. I also delivered the result of the practicality test to the teacher. I said that there were two aspects that seemed not to be stated in the checklist. After conducting the interview, the teacher said that she thought all the students' activities needed some costs, especially when they have a test. Because the test itself is planned in school budgeting, for example, for copying the test sheets and so on, while for the method for reporting, there was a method determined in advance, for example, when it was the daily test, then the score would be combined to other scores to yield the final score which was written in students' report card.

Moreover, the test itself is well-structured. The teacher has provided the objective, the guides, the time allocation, and so on. The test is also comprised of five to ten questions so that it will be easier to score. The teacher also provides the scoring rubric. It is in line with the statement of Manuel (2022). He says that no matter how valid or reliable a test is, it has to be practical to make and to take this means that the test is economical to deliver. It means that it is not excessively expensive. The layout should be easy to follow and understand. The students should be able to follow the directions of the test. In addition, it should stay within appropriate time constraints. It means that it has to follow the time allocation. It should not waste much time than the allocation. Last, it is relatively easy to administer. Its correct evaluation procedure is specific and time-efficient.

Overall, the test is easy to administer. The teacher has set the time for each test to be given. The test also costs less. Since the test is only one page, the cost of a copy will be inexpensive. In addition, the teacher has already provided the scoring or evaluation procedure to make it easier to score the test. Indeed, we can say that the test is practical enough.

Moving to reliability, it refers to the consistency of the test. It means that if the test is given to the student in any other condition now or then, the result of the test will not change. In this research, reliability is limited to the theory of Brown (2004) on the reliability of the test, not quantitative.

The test has met 3 of 5 criteria based on Brown's checklist. The test does not meet all the requirements. However, it is still reliable because of the supporting document's evidence. The supporting documents are also available to support the data. For example, the scoring rubric is the supporting documentation to support the statement 'Is the objective of scoring procedure clear?'. It means that the test is easy to score since the scoring sheet is provided. The students also got each text copy as stated in the checklist.

While we did the data analysis, we found some tests the teacher gave the students in two different academic years. It means that the same test is given to different students repeatedly. Therefore, it can be concluded that the test managed to yield the same result, so the teacher gave the test again to the other students.

IV. CONCLUSION

There are some major conclusions that can be drawn from this study. First, the questions in the tests are mostly reading and writing, with the total questions almost similar in number. It might be better for the teacher to give students daily tests in other English skills, such as grammar or listening. On the other sides, the variation of reading and writing questions is good. The teacher provides the questions in the form of essays, fill-in, and multiple choices, so the students can practice such forms of questions. Second, the realization of HOTS in the tests is various. The teacher provides lots of HOTS questions. The number of HOTS is also similar to the number of LOTS found in the tests. It means that the teacher is doing a great job in providing the students with HOTS practices. It may help the students to solve HOTS questions in the future, for example, when they do the final examination or school examination. The students will be more prepared because they have done the same thing in their daily tests. Third, the operational verbs and the level of HOTS found in the tests are varied. The teacher uses the three levels of HOTS domains. Surprisingly, the creating level is highly used in the tests. Most of the questions are asked the students to create or to make sentences or text. It is good for the students because they are allowed to write something. It means that the teacher is aware of improving the students' writing skills. The teacher uses different kinds of operational verbs for each level. It can help the students to enrich their knowledge in dealing with HOTS questions. Unfortunately, for creating domain, the teacher mostly used the word creating as the operational verb. At the same time, other operational verbs can be used. If the others are used, the students will be exposed to more variations of the questions.

While for the test's validity, practicality, and reliability, they align with Brown's (2004) theory. The tests meet almost all the requirements of those three aspects. Although some aspects are not suited, the teacher is still trying to achieve the other aspects in terms of validity, practicality, and reliability of the tests.

Overall, the teacher's use of HOTS in the tests is done well. The teacher provides more than enough HOTS questions to students.

We also proposed some suggestions for the teacher, the students, and future researchers. First, what the teacher does in the tests is great. However, it will be more excellent if the teacher provides the tests in other English skills. In addition, the teacher can also give the students with more variety of questions. It will be great for the students to practice such a test. Second, the students can try to do the test as best as they can. It is their time to practice HOTS as their daily test before they do the HOTS test in their final examination. Third, future researchers can do a deeper analysis of a similar topic. The lack of this research is not using quantitative measurement to analyse the validity, practicality, and reliability. It will be better if a similar topic of this research is done with a mix of qualitative and quantitative methods.

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AUTHORS

First Author – Tiara Novalia, Post Graduate Student Universitas Negeri Semarang, tnovalia11@gmail.com.

Second Author – Suwandi, Universitas Negeri Semarang.

Correspondence Author – Author name, email address, alternate email address (if any), contact number.
Cloud Data Security System Using Cryptography and Steganography: A Review

AKSA Anudini¹, G. Gayamini ², and Prof. Thushara Weerawardane ²

¹Department of Computer Science, General Sir John Kotelawala Defence University, Sri Lanka
²Department of Computer Engineering, General Sir John Kotelawala Defence University, Sri Lanka

36-cs-0011@kdu.ac.lk

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Abstract— Data and information security can be considered one of the most important issues of the 21st century and it is essential to avoid data breaches, decrease the risk of data exposure, and ensure regulatory compliance. Cloud computing is a trending technology in this era. Cloud computing refers to the on-demand availability of digital resources, particularly data storage and computational power, without the user having to manage them directly. Cryptography and steganography can be defined as the most popular techniques that can be used to enhance data and information security inside the cloud. High-level security can be provided when cryptography and steganography are applied together to the cloud platform. Therefore, Hybrid cryptographic algorithms and multilayer steganographic techniques can be combined to develop a security system for efficient and secure data transmission in the cloud to provide availability, integrity, authenticity, confidentiality, and non-repudiation of the data and information. This paper analyzes the performance of cryptographic and steganographic techniques and suggests the best hybrid cryptographic algorithms and multilayer steganographic techniques that can be combined to efficient and secure data transmission in the cloud.

Keywords— cryptography, steganography, Symmetric Key Cryptography, Asymmetric Key Cryptography, Image Steganography

I. INTRODUCTION

Cryptography is a technique of transforming secret information from readable to unreadable format and vice versa. Cryptography consists of terminologies namely plain text, ciphertext, encryption, and decryption. Converting a normal message (plaintext) into a meaningless message (ciphertext) is known as encryption and converting a meaningless message (ciphertext) into its original form (plaintext) is known as decryption.

Symmetric Key Cryptography (Private Key Cryptography) uses the same cryptographic key for both the encryption of plaintext and the decryption of ciphertext. Asymmetric Key Cryptography (Public Key Cryptography) has two keys namely private key and public key. The message will be encrypted by the sender using the public key of the receiver. Then the message will be decrypted by the receiver using his or her private key.

<table>
<thead>
<tr>
<th>Symmetric Key Cryptography</th>
<th>Asymmetric Key Cryptography</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use the same key for both encryption and decryption</td>
<td>Use one key for encryption and another key for decryption</td>
</tr>
<tr>
<td>Fast encryption process</td>
<td>Slow encryption process</td>
</tr>
<tr>
<td>Provides confidentiality only</td>
<td>Provides confidentiality, non-repudiation, and authenticity</td>
</tr>
<tr>
<td>Used to transfer a large amount of data</td>
<td>Used to transfer a small amount of data</td>
</tr>
<tr>
<td>Low resource utilization</td>
<td>High resource utilization</td>
</tr>
<tr>
<td>Comparatively high security</td>
<td>Comparatively low security</td>
</tr>
</tbody>
</table>

Fig 1 shows the classification of cryptography based on the keys and encryption techniques used.

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Steganography is an information hiding technique that uses cover objects to send messages between a sender and a receiver without making any suspicion and not allowing anyone else to know whether a communication is taking place. Steganography can be classified into five types depending on the nature of the cover object namely text, video, audio,
image, and network steganography. Text steganography secures a message by hiding it in a specific letter of every word or by rearranging the text without changing its meaning. Audio Steganography makes use of the human ear to conceal information secretly. Video Steganography hides the secret message into a digital video. Network Steganography is the process of hiding information using a network protocol as a cover object, such as TCP, UDP, ICMP, IP, etc. Image Steganography hides the secret message in the cover object as an image.

![Classification of Steganography](image)

Both steganographic and cryptographic approaches are used to secure data. Steganography differs from cryptography is where cryptography scrambles a message so that it cannot be understood by unauthorized users or third parties. Steganography camouflages to hide the existence of a message, then no one can know there is a secret message hidden in a cover object. Steganography provides confidentiality and authentication only while cryptography provides confidentiality authentication, data integrity, and non-repudiation.

Section II of this paper deals with the literature review on the researches related to data and information security using steganographic or cryptographic techniques. Section III provides the discussion and section IV presents the conclusion and further works.

II. LITERATURE REVIEW

This section deals with the vast number of researches that relate to secure and efficient data in the cloud using steganographic or cryptographic techniques.

Research on performance analysis of Symmetric Cryptographic Algorithms [4] has discussed different symmetric key cryptographic algorithms namely Data Encryption Standard (DES), Triple Data Encryption Standard (3DES), Advanced Encryption Standard (AES), and Blowfish by analyzing encryption time, decryption time, avalanche effect, energy consumption, memory usage, and throughput by practical implementation using java. The results of the study reveal that the Blowfish algorithm requires less memory, high throughput, and it needs less time for the encryption and decryption of files when compared to other algorithms. Moreover, the study depicts that the blowfish algorithm is well suited for applications where memory and time usage play a significant role while the AES algorithm is ideal for applications where strength and the minimal energy consumption is crucial factor. In addition, DES is the best algorithm for applications that need security with minimal bandwidth consumption.

A study [5] was conducted to analyze the performance of asymmetric cryptographic algorithms namely Diffie-Hellman, RSA (Rivest, Shamir, Adleman), Elliptic-curve cryptography (ECC), El Gamal, and Digital Signature Algorithm (DSA) algorithms. The results of the study have concluded that each algorithm had its advantages and disadvantages. Furthermore, the experiments prove that the efficiency of RSA is lower than the ECC algorithm. In addition, El Gamal is slower in speed and DSA needs lots of time to authenticate and the verification process has complicated remainder operators. Moreover, the authentication procedure of the Diffie-Hellman algorithm is very low. Finally, the study concluded that the performance of all the algorithms varies upon the application they choose.

Research [6] proposed a method to provide high security to the cloud platform using double encryption techniques. The proposed system combined the AES symmetric cryptographic algorithm and RSA asymmetric cryptographic algorithm to increase the security and reduce the drawbacks of using those algorithms separately. The results of the study depict that the proposed methodology takes the least time for encryption runtime of the text file and decryption runtime of the text file. In addition, the proposed system provides high security with resistance against propagation errors compared with DES, Blowfish, RC5, and 3-DES algorithms.

The study [7] aimed to create a new security solution to protect the data in the cloud with a hybrid cryptosystem. The proposed system combined the Blowfish symmetric cryptographic algorithm to ensure the confidentiality of data and the RSA asymmetric cryptographic algorithm to ensure the authenticity of data. In addition, this system consists of
Secure Hash Algorithm-2 (SHA-2) to ensure data integrity. Therefore, the study has revealed that this hybrid cryptosystem provides high security for data transmission over the cloud.

A review on data security in cloud computing using steganography [8] depicts the categories of steganography with a high focus on image steganography. The paper highlights the Discrete Cosine Transform (DCT) and Least Significant Bit (LSB) and the techniques. Performance evaluation of the spatial domain and transform domain techniques of image steganography exposed the fact that spatial domain, the LSB technique is mostly used to hide data that has a high payload capacity, but it’s easily encoded and detected by attackers. In the transform domain, the DCT technique is very complicated and has a lower payload capacity compared to the LSB technique, but the DCT technique provides high security than the LSB technique. Furthermore, this research suggested that future work could combine LSB and DCT approaches to avoid the drawbacks that arise when applying these techniques individually and to provide more security to the secret message.

A study [9] analyzed the performance of Least Significant Bit (LSB), Discrete Cosine Transform (DCT), and Discrete Wavelet Transform (DWT) steganographic techniques. The performance analysis of the above-mentioned steganographic techniques was carried out by analyzing the parameters namely invisibility, robustness, Peak Signal to Noise Ratio (PSNR) and Mean Square Error (MSE). Invisibility is the similarity of the stego image, and the original image. Robustness means the ability of the secret message to remain unchanged even if the stego image was subjected to changes. MSE is the square of the error between the cover image and stego image and PSNR can be defined as the ratio of the maximum signal to noise in the stego image. As a result of the experiments, it can be concluded that the DCT algorithm is the most suitable technique compared with the DWT and the LSB steganographic techniques.

Research [10] was conducted to analyze the performance of the LSB and modified DWT algorithm for image steganography. According to the results obtained by testing five RGB image sets, the researchers concluded that the modified DWT algorithm has a higher PSNR value, high security, invisibility, and robustness compared with the LSB algorithm. Furthermore, it was concluded that the overall performance of the modified DWT algorithm is better than the LSB algorithm.

Research [3] has exposed an efficient algorithm to provide the confidentiality, integrity, and authentication of data and information using hybrid cryptographic and steganographic algorithms. In this research, hybrid cryptography has been applied using AES symmetric cryptographic algorithm and RSA asymmetric algorithm. Then the secret message has been embedded using the LSB steganographic technique.

The study [11] focused on a cloud data security model using both cryptography and steganography. Through the proposed system data will be encrypted using the RSA asymmetric cryptographic algorithm. After that, the secret data will be embedded using Discrete Wavelet Transform (DWT) technique. Then the file will be uploaded to the cloud. The results of the proposed system will be provided with augmented security to the data and that can be used anywhere without qualms.

Another research [12] presented a multilayer security system to protect and hide multimedia data using cryptographic and steganographic techniques. Here, DES symmetric cryptographic algorithm is used as the symmetric cryptographic algorithm and the LSB technique is used to embed the secret message. Furthermore, the study has revealed that steganography is a highly effective technique used for confidential communications. In addition, the researchers concluded that the combination of cryptography and steganography can be used for many other applications apart from secret communications.

III. DISCUSSION

Data security functions are used to avoid data breaches, decrease the risk of data exposure, and ensure regulatory compliance. The goal of data security in any organization is to assure the continuous safe and secure usage of private data while limiting the danger of exposure.

In recent years, people used symmetric or asymmetric cryptographic approaches to increase the efficiency and security of data transmission inside the cloud. But with the development of technology hackers easily broke the algorithms and decrypt the ciphertext. As a solution for using symmetric or asymmetric cryptographic algorithms individually, the researchers proposed systems to combine symmetric and asymmetric algorithms to enhance the security of the cloud. Therefore, the double encryption techniques using both symmetric-key algorithms and asymmetric key algorithms helps to reduce the drawbacks that arise when they are used separately. In the double encryption process, the two-time encryption and decryption process is performed using symmetric and asymmetric algorithms.

With technological advancement, cryptography was used along with steganography to give high security to the cloud. The fundamental drawback of cryptography is that anyone can understand there is a secret communication is taking place. As a result of that, hackers try to access the data by breaking the secret key. But when we use steganography, no one is aware of the ongoing secret communication. In this case, the secret message can be hidden inside audio, text, network, video, or image. The drawbacks that arise using only steganography to hide the secret message are steganography doesn’t provide non-repudiation, and authenticity, it provides only confidentiality to the data. Therefore, to provide high security to data when saving, retrieving, and transmitting in the cloud, it is best to choose the best hybrid cryptographic algorithm and multilayer steganographic algorithm.

Table II shows the comparison of mainly using symmetric key cryptographic algorithms namely AES, Blowfish, DES, and 3-DES, and RC5.
According to the previously discussed literature review and the comparison of the above-mentioned symmetric cryptographic algorithms, the best symmetric cryptographic algorithm that can be used is the Blowfish algorithm.

Table III shows the comparison of mainly using asymmetric key cryptographic algorithms namely Diffie-Hellman, RSA, ECC, El Gamal, and DSA algorithms.

According to the previously discussed literature review and the comparison of the above-mentioned asymmetric cryptographic algorithms, the best asymmetric cryptographic algorithm that can be used is the ECC algorithm.

As discussed earlier, steganography can be classified as text, video, audio, network, and image steganography. Image steganography is the most popular steganographic technique because images are widely used, and they contain a large number of bits which used to hide a secret message. The image steganography techniques can be categorized as spatial domain and transform domain techniques.[8]

A. Spatial Domain Techniques

Secret messages are hidden directly in the intensity of pixels of the cover image in this method. Therefore,
embedding and extraction processes are very simple. These techniques are classified into several methods:

1) Least Significant Bit (LSB): In this approach, the secret message is embedded by replacing the least significant bits (bit number 8) of some or all of the bytes inside a cover picture. As a result, the LSB approach usually results in a large payload.

2) Binary Pattern complexity (BPC): The image complexity is used to determine the noisy blocks in the cover picture in this technique. The binary bits of the secret message is used to replace these blocks. This approach does not affect image quality degradation.

3) Pixel Value Differencing (PVD): The PVD separates the image into a series of non-overlapping two-pixel blocks and compares their differences. Although this method has a large capacity, it is not very secure.

B. Transform Domain Techniques

These methods give a high level of security. Rather than concealing the secret information directly in the pixels, the frequency coefficients of the picture are used in this method. It is complex to hide the secret message inside a cover image in transform domain techniques than spatial domain techniques.

1) Discrete Wavelet Transformation (DWT): DWT is frequently used for signal processing, watermarking, and image compression. The DWT mathematically decomposes an image into a series of functions known as wavelets.

2) Integer Wavelet Transformation (IWT): IWT technique will efficiently produce lossless compression. If the input consists of integers, the output will also consist of integers. As it translates integer to integer in the output, the IWT cannot lose data and it strengthens the security of the transformation.

3) Discrete Cosine Transformation (DCT): DCT technique can convert the image from the spatial domain to the frequency domain and split it into three frequency regions according to low frequency (FL), middle frequency (FM), and high frequency (HF).

To choose the best image steganographic technique it is necessary to consider the main steganographic characteristics. The main steganographic techniques are discussed here.

C. Invisibility

The similarity of the stego image and its related cover image is used to determine invisibility. As the similarity increases, the invisibility improves.

D. Payload

The number of secret bits that may be hidden in the cover image is referred to as the payload (capacity) and it is commonly measured in bits per pixel (bpp).

E. Robustness

The secret message can remain unchanged even if the stego image was subjected to changes such as linear and non-linear filtering, cropping, scaling and blurring, transformation, sharpening, etc.

F. Complexity

It measures the complexity of the steganographic algorithm.

G. Peak Signal to Noise Ratio (PSNR)

PSNR can be defined as the ratio of the maximum signal to noise in the stego image. It is one of the most well-known and widely used tools for evaluating the quality of stego images.

H. Mean Square Error (MSE)

MSE is the square of the error between the cover image and the stego image. If the MSE is smaller, then the image steganography technique is more efficient.

Table IV shows the comparison of main image steganographic techniques namely LSB, DCT, and DWT.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>LSB</th>
<th>DCT</th>
<th>DWT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invisibility</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Robustness</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Payload</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Complexity</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Peak Signal to Noise Ratio (PSNR)</td>
<td>Medium</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Mean Square Error (MSE)</td>
<td>Medium</td>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>

According to the previously discussed literature review and the comparison of the above-mentioned image steganographic techniques, the best hybrid steganographic technique that can be used is the combination of LSB and DCT algorithms. LSB technique has low invisibility and robustness while DCT has high invisibility and medium robustness. MSE value of DCT is low but LSB has a medium MSE value. Therefore, the combination of DCT and LSB techniques can reduce the drawbacks of using those algorithms separately.

IV. CONCLUSION AND FUTURE WORKS

Cloud security is a subset of cybersecurity that deals with policies, procedures, and technologies for safeguarding cloud computing systems. It protects data in the cloud and other digital assets from data breaches, distributed denial of service (DDoS), hacking, malware, and other cyber threats. This paper suggested using cryptography along with steganography to provide high-level security to the confidential data inside the cloud platform. Moreover, this review paper discussed the concept of cryptography, the performance of different symmetric and asymmetric key cryptographic algorithms, the concept of steganography, and the performance of different steganographic techniques. The facts discussed above proved that the blowfish algorithm has better performance when compared with other symmetric key cryptographic algorithms (AES, DES,3-DES, and RC5 algorithms). In addition, the ECC algorithm has better performance when compared with other asymmetric key cryptographic algorithms (Diffie-
Hellman, RSA, ECC, EL Gamal, and DSA algorithms). Furthermore, it can be concluded that the combination of LSB and DCT image steganographic techniques can provide extraordinary security when hiding the file inside a cover image. Future work can be done in a way of combining the blowfish symmetric key cryptographic algorithm and ECC asymmetric cryptographic algorithm as a hybrid cryptosystem to perform double encryption to secure the data. Then LSB and DCT image steganographic techniques can be combined to create a multilayer steganographic algorithm to hide the encrypted file to provide extra security. This proposed system will provide availability, integrity, authenticity, confidentiality, and non-repudiation to the data and information.

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Treatment of the cyclic homology through topological spaces


[1] Mathematics Department, Faculty of Science, South Valley University, Qena, Egypt
[2][3] Mathematics Department, Faculty of Science, Aswan University, Aswan, Egypt
E-mail: szagloul@yahoo.com, E-mail: ala2222000@yahoo.com, E-mail: fatenragh2020@yahoo.com

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Abstract- The purpose of this paper is proving the analysis of vanishing and non-vanishing cyclic and reflexive (co)homology groups of algebras. Additionally, we present and prove some of the results and examples which related cyclic and reflexive (co)homology theory.

Index Terms- Dihedral (co)homology - Reflexive homology - Operator algebras- exact sequence.


I. INTRODUCTION

The cohomology theory is discussed as the following: Triangular Banach algebras’ second-order cohomology groups are researched in [10]. Factorization and bounded Hochschild cohomology of matrix-like Banach algebras are investigated in [14], while the group cohomology of triangular Banach algebra is addressed in [5]. In [7], projective modules in quantized homology are introduced. [6] Studies projective Hilbert modules over operator algebras. C*-algebra projective homological classification is investigated. Using aspects of quantum theory, biprojective algebras, homological dimensions, and current advances in Banach homology theory are addressed in [2]. In [8], the studies the disappearance of the third simplicial cohomology group for specific classes of C*-algebra. In [95], an approximate identity for ideals of Segal algebras on a compact group and homology theory are examined.

Murry and von Neumann published a number of articles in the 1930s and 1940s that served as the foundation for the theory of von Neumann algebras. Connes demonstrated in [1] that for any dual normal A-bimodule N, the cohomology of injective von Neumann algebra H*(A, N) disappears. The Kadison theorem [15], which states that all derivations of any von Neumann algebra A into itself are inner, is the earliest result in von Neumann algebra cohomology. It states that if the linear map d: A → A satisfies d(x, y) = xd(y) + d(x)y, then there exists a in A such that d(x) = xv − vx. According to this, H²(A, A) = 0 for all A. In [9], the main finding in Hochschild cohomology of von Neumann algebras is that for every whose type II₂, H*(A, N) vanishes. The fully bounded cohomology of von Neumann algebra disappears; Hcb (A, A) = 0, according to Sinclair and Smith’s presentation and extension of results from [9] in [11]. In [8], the norm continuous cohomology Hcb (A, A) = 0 is investigated. A few finite von Neumann algebras’ cohomology groups were explored by Christensen, Smith, and in [3]. The Hochschild and cyclic cohomology groups vanish if B is C*-algebra without a nuclear C*-algebra or bounded traces as in [2]. The cyclic and dihedral cohomology of a nuclear C*-algebra and the even dimensional dihedral cohomology of a biflat algebra do not vanish as shown in [6] and [1].

The contents of this paper are as follows. After recalling some definitions and background notations in the category of operator algebras, we study the vanishing and nonvanishing of the dihedral and reflexive cohomology groups of operator algebras. We study examples of the vanishing of the reflexive and dihedral cohomology topological algebras. Firstly, we review a few definitions and relations from [1], [3] and [4] on the category and dihedral (Reflexive) cohomology of topological algebra.

II. SIMPLICIAL OBJECT

This part, introduce notations and I some definitions of simplicial object. The main references in this material are [3], [8] and [11].

The simplicial category Δ has objects of Δ are a bounded sets [nt]: = {0, 1, ..., nt}, nt ≥ 0, and morphisms are the functions [nt] → [nt]. A contravariant functor from Δ to a category C is simplicial object (Δ → C). The simplicial objects in C form a category, with morphisms being the natural transformations of functors.
We denote a category of objects with morphisms by a natural transformations of functors in $\mathcal{C}$ by $s\mathcal{C}$. If a topology $X \in \text{Ob}(s\mathcal{C})$, we denote $X^n = X([n])$.

The category $\Delta$ is generated by two distinguished classes of morphisms $\{\delta^n_{i0}\}_{0 \leq i < n}$ and $\{\sigma^n_i\}_{0 \leq i \leq n}$, whose images under $X \in s\mathcal{C}$. The face and degeneracy maps of $X$ are $\{\delta^n_i\}_{0 \leq i < n}$ and $\{\sigma^n_i\}_{0 \leq i \leq n}$, with $X \in s\mathcal{C}$. The injection map is $\delta^n_i : [n-1] \rightarrow [n]$ and the face map is $d_i : X(\delta^n_i) : X_n \rightarrow X_{n-1}$. Similarly, the surjection $\sigma^n_i : [n+1] \rightarrow [n]$ for $n \geq 0$, in $\Delta$. The image of $\sigma^i$ under $X$ is $s_i : X(\sigma^i) : X_n \rightarrow X_{n+1}$. The relations between face and degeneracy maps are:

$$d_id_j = d_{j-1}d_i \text{ if } i < j$$
$$d_is_j = s_{j-1}d_i \text{ if } i < j$$
$$d_is_j = s_jd_{i-1} \text{ if } i > j + 1$$
$$s_is_j = s_{j+1}s_i \text{ if } i \leq j$$
$$d_is_j = \text{Id} \text{ if } i = j, j + 1.$$  

A set $s\mathcal{Set}$ define a category of the simplicial sets. The reduced simplicial set will be indicated as the entire subcategory of $s\mathcal{Set}_0$. A simplicial set $X$ is said to be pointed if it contains distinct simplices $x_0 \in X_n$, one for each degree, such that $n \geq 1$, $x_n = s_0(x_{n-1})$. A basepoint of $X$ is the sequence $(x_0, x_1, x_2, ...) \in \prod_{n \geq 0} X_n$. A canonical basepoint exists in the category of pointed simplicial sets.

Let $X \in s\mathcal{Set}$ denote the set of nondegenerate $n$-simplices of $X$, which is defined as $X^n_n := X_n \setminus \bigcup_{i=0}^{n-1} s_i(X_{n-1})$.

**Definition (1):**

For each object $A \in \mathcal{C}$, a simplicial object $A$ in $s\mathcal{C}$ can be associated, with $A_n = A$ and $d_i, s_j$, becoming the identity map of $A$ for any $n, i, j$. This results in a fully embedding $\mathcal{C} \hookrightarrow s\mathcal{C}$. The objects of $s\mathcal{C}$ that emerge in this manner are known as discrete simplicial objects.

**Definition (2):**

The topological space

$$\Delta^n := \left\{ (x_0, ..., x_n) \in \mathbb{R}^{n+1} \mid \sum_{i=0}^{n} x_i = 1, x_i \geq 0 \right\}$$

is the $n$-dimensional geometric simplex

Let $e_i$ represent the vertex of $\Delta^n$ with the $i^{th}$ one coordinate. There is a (unique) linear map $\mathbb{R}^{n+1} \rightarrow \mathbb{R}^{n+1}$ conveying $e_i$ to $e_{f(i)}$, that limits to a map of topological spaces $f^* : \Delta^n \rightarrow \Delta^n$ for each morphism $f : [m] \rightarrow [n]$ in $\Delta$. $\Delta^* := \{\Delta^n\}_{n \geq 0}$ forms a cosimplicial space, i.e. a (covariant) functor $\Delta \rightarrow \text{Top}$, where $\text{Top}$ denotes the category of topological spaces. This functor is faithful: it provides a topological realisation of the simplicial category, which was historically the original definition of $\Delta$.

**Definition (3):**

The Yoneda embedding is $Y: \Delta \hookrightarrow s\mathcal{Set}$. The standard $n$-simplex is a functor $Y$ assigns to $[n]$ a simplicial set $\Delta[n]$, which $\Delta[n]$, is writing by

$$\Delta[n]_k := \text{Hom}_{\Delta}([k], [n]) \equiv \{ (n_0, ..., n_k) \mid 0 \leq n_0 \leq \cdots \leq n_k \leq n \},$$

a map $f : [k] \rightarrow [n]$ is given with the sequence of its values $\{f(0), ..., f(k)\}$. The degeneracy and face maps in $\Delta[n]$, are getting by

$$d_i(n_0, ..., n_k) = (n_0, ..., \hat{n}_i, ..., n_k), s_j(n_0, ..., n_k) = (n_0, ..., n_j, ..., n_k).$$

The natural bijection $\text{Hom}_{s\mathcal{Set}}(\Delta[n], X) \cong X_n$ is exist for a simplicial set $X$, The $\Delta[n]$, is represent the functor: $s\mathcal{Set} \rightarrow \text{Set}$, $X \mapsto X_n$.

The functor $|-| : s\mathcal{Set} \rightarrow \text{Top}$ defiend to each simplicial set $X$, a topological space $|X|$ denoted by:

$$|X| = \bigsqcup_{n \geq 0} (X_n \times \Delta^n)/\sim.$$  

Every $X_n$ corresponding with discrete topology and given by:

$$(d_i x, p) \sim (x, d^i p) \text{ for } (x, p) \in X_n \times \Delta^{n-1}$$

$$(s_j x, p) \sim (x, s^j p) \text{ for } (x, p) \in X_{n-1} \times \Delta^n.$$  

Let $(X, *)$ be a pointed topological space. The singular complex of the topology $X$ is a simplicial set $S_n(X)$ denote by the form:

$$S_n(X) := \text{Hom}_{\text{Top}}(\Delta^n, X).$$

The Eilenberg subcomplex of $S_n(X)$ is $\overline{S}_n(X) := \{ f : \Delta^n \rightarrow X \mid f(v_i) = * \text{ for all vertices } v_i \in \Delta^n \}$. If $X$ is connected, the natural inclusion $\overline{S}_n(X) \hookrightarrow S_n(X)$ is a weak equivalence of simplicial sets.

The induce inverse equivalences of a homotopy categories is $\text{Ho}(s\mathcal{Set}_{0}) \approx \text{Ho}(\text{Top}_{0,*})$.

**III. REPRESENTATION COHOMOLOGY**

Now it is the time to articulate the research work with ideas gathered in above steps by adopting any of below suitable approaches:
We give the basic theorem of the homotopy types of simplicial groups with those of pointed connected spaces. And study the cohomology theory of the topological spaces. The important theorem in the cyclic and dihedral cohomology of algebra is given with proving in this part.

**Definition (4)**
For a topological space $X \in \text{Top}_0$, we give the derived representation scheme $\text{DRep}_G(X)$ to be $\text{DRep}_G(\Gamma X)$, such that $\Gamma X$ is a simplicial group model of $X$. The representation homology of $X$ in $G$ is denote by the form:

$$\text{HR}(X,G) := \pi_* L(\Gamma X)_G.$$  

By definition, $\text{HR}_0(X,G)$ is a graded commutative algebra, with $\text{HR}_0(X,G)$ naturally isomorphic to $[\pi_1(X)]_G = \mathsf{O}[\text{Rep}_G(\pi_1(X))]$, the coordinate ring of the representation scheme $\text{Rep}_G(\pi_1(X))$. The last isomorphism with the natural isomorphism $\pi_0(\Gamma X) \cong \pi_1(X)$.

For a simplicial set $X \in s\text{Set}_0$, a loop group $\mathbb{G}X$ provides a functorial simplicial group model for $[X]$. Since this simplicial group is semi-free as $(\text{HR}(X,G)) = \pi_*(\mathbb{G}X)_G$.

This form used to calculate the representation homology in simple cases.

**IV. THE CATEGORY OF ALGEBRAS**

We recall that $X = \{X_n\}_{n \in \mathbb{Z}}$ is a topological algebra. The $n$th-dimensional homology of $X$ is the quotient spaces $\mathcal{H}_n(X) = Z_n(X)/B_n(X)$. $Z_n(X) = \text{Ker}(d_n: X_n \to X_{n-1})$ is the $n$th-dimensional cycles and $B_n(X) = \text{Im}(d_{n+1}: X_{n+1} \to X_n)$ is the $n$th-dimensional boundaries since $B_n(X) \subset Z_n(X)$. The family $\{\mathcal{H}_n(X)\}$ is known as the homology of $X$.

The short exact sequence $0 \to B_n(X) \overset{i_n}{\to} Z_n(X) \overset{p_n}{\to} \mathcal{H}_n(X) \to 0$ is splitting since there are continuous operators $q_n: \mathcal{H}_n(X) \to Z_n(X)$ which satisfies:

$$p_n \circ q_n = 1d: \mathcal{H}_n(X) \to \mathcal{H}_n(X),$$

$$1d - q_n \circ p_n = d_{n+1} \circ q_n: Z_n(X) \to B_n(X)$$

Let $\overline{X} = \{\overline{X}_n\}$ be a dual complex of the space. The differentials $d_n: X_n \to X_{n-1}$ induce the differentials of $\overline{d}_n: \overline{X}_{n-1} \to \overline{X}_n$. If $X$ is an admissible Banach complex, then $\overline{X}$ would also be an admissible Banach complex. The homology of the dual complex $\overline{X}$ is the cohomology of $X$ defined by the form:

$$\mathcal{H}^*(X) = \{\mathcal{H}_n(X)^\vee\}, \quad \mathcal{H}^n(X) = \mathcal{H}_n(\overline{X}).$$

Let $X$ and $Y$ be two Banach complexes where the mapping is $f: X \to Y$ s.t. $f = \{f_n\}, \ f_n: X_n \to Y_{n+m}$. We then define the differentials $d(f)_n$, which maps among most of the linear spaces $\text{Hom}_m(X,Y)$ as $d: \text{Hom}_m(X,Y) \to \text{Hom}_{m-1}(X,Y)$ and define them as:

$$d(f)_n = d_{n+m} \circ f_n, \quad d(f)_{n} + (-1)^{1 \cdot \cdot \cdot 1} f_{n-1} \circ d_n: X_n \to Y_{n+m-1}$$

Clearly $d \circ d = 0$, then the family $\text{Hom}(X,Y) = \{\text{Hom}_m(X,Y)\}$ forms the complex in the category of linear spaces. The chain map of $(X,Y)$ is $f: X \to Y$ induces the following homology map:

$$\mathcal{H}_*(f) = [\mathcal{H}_*(f_n)]; \quad \mathcal{H}_*(Y), \quad \mathcal{H}_*(f): \mathcal{H}_*(X) \to \mathcal{H}_*(Y),$$

and the cohomology map:

$$\mathcal{H}^*(f) = [\mathcal{H}^*_0(f)]; \quad \mathcal{H}^*(X) \to \mathcal{H}^*(Y),$$

$$\mathcal{H}^*(f); \mathcal{H}^*(X) \to \mathcal{H}^*(Y).$$

For the two chain functions $f, g: X \to Y$, their homotopic is $f \cong g$ if there exists a homotopic map $h: X \to Y$ that satisfies that $d(h) = g - f$ or $d(h) + h_{n} \circ d_{n} = 0$ then $h \cong 0$.

If for the topological complexes $X, Y$ there are chain mappings $f: X \to Y$ and $g: Y \to X$ with $g \circ f \cong 1d_X$, $f \circ g \cong 1d_Y$, then $X \cong Y$ are said to be homotopy equivalent. If $f \cong g: X \to Y$, $f \cong g: X \to Y$ and $X \cong Y$ then $\overline{X} \cong \overline{Y}$.

The tensor product of any two topological complexes $X$ and $Y$ is given by the formula (see [6]):

$$(X \otimes Y)_n = \sum_{p+q=n} X_p \otimes Y_q.$$  

(1)

The differential is:

$$d_n(x_p \otimes y_q) = d_p(x_p) \otimes y_q + (-1)^p x_p \otimes d_q(y_q), \quad p + q = n.$$  

In the following part we introduce the cohomology theory of topological algebras. So, we explain some examples of topological algebras and we introduce some states of trivial and nontrivial cohomology theory of topological algebras.

**1. (Co)homology of topological algebra**

We begin by briefly recalling the basic definitions concerning (co)homology of algebras. For a gentler introduction see [1, 6 and 17]. Consider the algebra $B$ which is a space with associative multiplication $\pi: B \otimes B \to B$, and the $B$-construction $BB$ since:

$$(BB)_n = \begin{cases} B \otimes B, & n \geq 1 \\ 0, & n \leq 0 \end{cases}$$
The elements in \( \mathcal{B} \otimes^n \) are in the form \([a_1, \ldots, a_n]\), \( \forall a_i \in \mathcal{B} \). The differential \( d \) is defined as:

\[
d_n[a_1, \ldots, a_n] = \sum_{i=1}^{n-1} (-1)^{i+1} [a_1, \ldots, \pi(a_i \otimes a_{i+1}), \ldots, a_n]
\]

If \( \mathcal{B} \mathcal{B} \) is admissible, then \( \mathcal{B} \) is admissible. Every finite dimension of algebras are admissible. For example, for the finite dimensional of admissible topological algebra, let \( \mathcal{B} = l_1 \) be the convergent series \( \sum_{n=1}^{\infty} \mathcal{X}_n \) with multiplication:

\[
\sum_{n=1}^{\infty} \mathcal{X}_n \cdot \sum_{n=1}^{\infty} \mathcal{Y}_n = \sum_{n=2}^{\infty} \left( \sum_{k=1}^{n-1} \mathcal{X}_k \cdot \mathcal{Y}_{n-k} \right)
\]

The elements of the series are \( e_i \) which remaining zeros. The map \( s: \mathcal{B} \otimes^n \rightarrow \mathcal{B} \otimes^{n+1} \) is defined as:

\[
s(e_1 \otimes \ldots \otimes e_n) = \begin{cases} e_1 \otimes e_{i+1} \otimes \ldots \otimes e_{n}, & i_1 > 1 \\ 0, & i_1 = 1 \end{cases}
\]

Satisfying \( s \circ s \circ d = d \), meaning that \( \mathcal{B} \) is admissible algebra.

Let \( \mathcal{B} = \mathcal{B} \otimes \mathcal{B}^* \) be algebra. The elements in \( \mathcal{B} \otimes^n \) are \( a_1 \otimes \ldots \otimes a_n \) such that \( a_i \in \mathcal{B}^* \) or \( \mathcal{B}^* \). If we rewrite these elements to the form \( \mathcal{B}_1 \otimes \ldots \otimes \mathcal{B}_n \) where \( \mathcal{B}_1, \ldots, \mathcal{B}_n \) are the tensor products of \( \mathcal{B}^* \) or \( \mathcal{B} \), then we find that \( \mathcal{B}_i \in \mathcal{B} \mathcal{B}^* \) or \( \mathcal{B}_i \in \mathcal{B}^* \mathcal{B} \).

For the map \( s: \mathcal{B} \otimes^n \rightarrow \mathcal{B} \otimes^{n+1} \), we have:

\[
s(\mathcal{B}_1 \otimes \ldots \otimes \mathcal{B}_m) = s(\mathcal{B}_1) \otimes \mathcal{B}_2 \otimes \ldots \otimes \mathcal{B}_m + (-1)^{n_1}(\mathcal{B}_1 - d \circ s(\mathcal{B}_1)) \otimes s(\mathcal{B}_2) \otimes \ldots \otimes \mathcal{B}_m + \ldots
\]

\[
+ (-1)^{n_{i+1} + \ldots + n_m - 1}(\mathcal{B}_1 - d \circ s(\mathcal{B}_i)) \otimes \ldots \otimes (\mathcal{B}_m - d \circ s(\mathcal{B}_{m-1})) \otimes s(\mathcal{B}_m)
\]

Since, \( n_i \) are dimensions of \( \mathcal{B}_i \) [10].

The (co)homology of \( \mathcal{B} \) as the (co)homology of \( \mathcal{B} \)-construction \( \mathcal{B} \mathcal{B} \) over \( \mathcal{B} \) is denoted by \( \mathcal{H}_c(\mathcal{B})(\mathcal{H}^*(\mathcal{B})) \), then \( \mathcal{H}_c(\mathcal{B}) = \mathcal{H}_c(\mathcal{B})(\mathcal{H}^*(\mathcal{B})) \) [17].

Consider algebra \( \mathcal{B} \) with unity \( e \), then \( \mathcal{B} \) is contractible and complex with contracting homotopy \( \mathcal{H}: \mathcal{B} \rightarrow \mathcal{B} \) which is defined as \( \mathcal{H}_c(a_1, \ldots, a_n) = [e, a_1, \ldots, a_n] \). This means that the (co)homology of \( \mathcal{B} \) is trivial.

Let \( \mathcal{B} \) be a unity algebra where the factorization algebra \( \mathcal{B} / \mathcal{C} \). The (co)homology of \( \mathcal{B} \) is the (co)homology of \( \mathcal{B} / \mathcal{C} \).

An example of a homologically trivial Banach algebra is the algebra \( L_1(G) \) in locally compact amenable group \( G \). The algebra \( \mathcal{K}(\mathcal{H}) \) of compact operators is in separable since \( \mathcal{H} \) is Hilbert space [5].

We now go on to introduce some examples of the topology spaces which have non-trivial homology.

**Example (5):**

Consider \( \mathcal{B} = \mathcal{C} \) has trivial multiplication since \( (\mathcal{B} \mathcal{B})_n \equiv \mathcal{C} \) and the identity differential is equal to zero. From [6], the homology of \( \mathcal{C} \) for all \( n \geq 1 \) are isomorphic to \( \mathcal{C} \).

**Example (6):**

If \( \mathcal{B} = l_1 \) is the convergent series Banach algebra, then the one-dimensional homology of \( \mathcal{B} \) is isomorphic to \( \mathcal{C} \).

**Example (7):**

If \( \mathcal{B} = l_1^m = l_1/l_1^{(m)} \). By [17], the one-dimensional homology of \( \mathcal{B} \) is amorphic to \( \mathcal{C} \).

**Example (8):**

If \( \mathcal{B} = C_{\mathcal{Z}_0}^{(m)}(\mathcal{D}) \) is the polynomial algebra of the analytical functions with domain \( \mathcal{D} \subset \mathcal{C} \) that vanishes at the \( \mathcal{Z}_0 \), then we get the one-dimensional homology \( \mathcal{B} \) that is isomorphic to \( \mathcal{C}^{m+1} \).

Note that space \( Z^n(\mathcal{B}^*, B^*) \) is a closed subspace of \( C^m(\mathcal{B}, M) \) but the subspace of \( B^*(\mathcal{B}, B^*) \) is not closed see, [12].

\( C^m(\mathcal{B}, B^*) \approx C^{m+1}(\mathcal{B}, C) \), where \( C^{m+1}(\mathcal{B}, C) \) is the space of the bounded \((n + 1)\)-linear forms in \( \mathcal{B} \). The relation between \( C^n(\mathcal{B}, B^*) \) and \( C^{n+1}(\mathcal{B}, C) \) is given by:

\[
\begin{align*}
< a_0, \phi(a_1, \ldots, a_n) > &= \omega_\phi(a_0, a_1, \ldots, a_n), \quad \phi \in C^n(\mathcal{B}, B^*), \\
&= \omega_\phi \in C^{n+1}(\mathcal{B}, C), \\
<, >: B \times B^* \rightarrow C, \quad < a, f >= f(a).
\end{align*}
\]

**Theorem (9):** [13]

If \( \mathcal{B} \) is a properly infinite von Neumann algebra and \( B^* \) is the dual of \( B \), then:

\[
\mathcal{H}_c^n(B, B^*) = 0 \quad \forall n \in \mathbb{N}.
\]

**Corollary (10):**

Let \( \mathcal{B} \) be the algebra without bounded traces or nuclear algebra, and \( \mathcal{H}_c^n(B, B^*) \) is the Hochschild cohomology of \( B \) with coefficients in \( B^* \). Then:

\[
\mathcal{H}_c^n(B, B^*) = 0 \quad \forall n \in \mathbb{N}.
\]

**Theorem (11):**

The cyclic cohomology of the norm continuous algebra \( \mathcal{B} \) is vanishing since \( \mathcal{B} \) is the algebra without bounded traces.

**Proof:**

Let \( \mathcal{B} \) be the \( B^* \)-algebra without bounded traces, then \( \mathcal{H} C^0(\mathcal{B}) = 0 \). From theorem (9), for \( n \in \mathbb{N} \), we get \( \mathcal{H} C^n(B, B^*) = 0 \). From [17], if we need to get a long exact sequence, we will find that \( \mathcal{H} C^1(\mathcal{B}) = 0 \). \( \mathcal{H} C^{n-1}(\mathcal{B}) = \mathcal{H} C^{n+1}(\mathcal{B}) \). By this way we get the required result.

**Corollary (12):**

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For the nuclear algebra $B$, $\mathcal{H}C^n(B)$ are vanished if $n$ is odd. If $n$ is even, then $\mathcal{H}C^n(B)$ are isomorphic to the spaces of all bounded traces in $B$.

Proof:
Since $B$ is a nuclear $C^*$-algebra, then $\mathcal{H}^n(B) = 0$. Then we have $\mathcal{H}C^n(B) = 0$ if $n$ odd and for even groups, $\mathcal{H}C^n(B) \cong \mathcal{H}C^0(B)$ such that $\mathcal{H}C^0(B)$ is the space with bounded traces, see [6].

Now we give some results of this paper, which is a study of cases in which reflexive cohomology of algebras is vanish. We begin by recalling the cyclic cohomology of algebras and how it relates to reflexive cohomology of algebras by the long exact sequence.

2. The reflexive and dihedral cohomology of algebras
Let $B$ be an involution $C^*$-algebra over a field $\mathcal{C}$. The map $\omega \in C^{n+1}(B, \mathcal{C})$ is known to be $\alpha$-dihedral, fulfilling the following accompanying statements:

(i) $\omega(a_0, \ldots, a_{n-1}, a_n) = (-1)^n \omega(a_n, a_0, \ldots, a_{n-1})$, is a cyclic operator.

(ii) $\omega(a_0, \ldots, a_{n-1}, a_n) = (-1)^{\frac{n}{2}} \omega(a_0^*, a_n, \ldots, a_1^*)$, is a reflexive.

Define $a_i^*$ as the image of $a_i \in B$, $i = 0, 1, \ldots, n$ under the involution operator $*: B \rightarrow B$. The map $f \in C^n(B)$ is $\alpha$-cochain dihedral if it coincides with its $\alpha$-dihedral $\omega \in C^{n+1}(B, \mathcal{C})$. The space $CD^n(B)$ is made up of dihedral $n$-cochains and is invariant with map $\delta: C^{n+1}(B, \mathcal{C}) \rightarrow C^n(B, \mathcal{C})$.

**Definition (13):**
The $n$-dimensional dihedral cohomology of a $C^*$-algebra $B$ is defined by $\alpha HD^n(B)$ where

$$\alpha HD^n(B) = ZD^n(B) / B D^n(B), \quad \alpha = \pm 1,$$

$ZD^n(B)$ is the dihedral $n$-cocycles and $B D^n(B)$ is the dihedral $n$-coboundaries, which are defined by the below formula:

$$ZD^n(B) = CD^n(B) \cap Z^{n+1}(B, \mathcal{C}),$$

$$B D^n(B) = CD^n(B) \cap B^{n+1}(B, \mathcal{C}).$$

The functional $\omega \in C^{n+1}(B, \mathcal{C})$ is called $\alpha$-reflexive if it satisfies the condition (ii). We can similarly get the reflexive cohomology $\alpha HR^n(B)$, $\alpha = \pm 1$.

$$\alpha HR^n(B) = ZR^n(B) / B R^n(B), \quad \alpha = \pm 1, \quad \text{where}$$

$ZR^n(B) = CR^n(B) \cap Z^{n+1}(B, \mathcal{C})$, $BR^n(B) = CR^n(B) \cap B^{n+1}(B, \mathcal{C})$.

**Lemma (14):**
For a topological algebra $B$ where $\mathcal{X}$ is the $B$-bimodule topological algebra with $\mathbb{K} \in B^n(\mathcal{B}, \mathcal{X})$, we have

$$\sum (-1)^{\sigma} \mathbb{K}(a_{\sigma(1)}, \ldots, a_{\sigma(n)}) = 0$$

Where $\sigma, \ldots, a_n \in B$, $\sigma$ is the permutation with $n$ ordered.

**Proof:**
Let $f \in C^{n+1}(B, \mathcal{X})$ be a cochain, that is $\mathbb{K} = \delta^{n-1} f$. From [15] and [16], we can show that $\sum (-1)^{\sigma} \delta^{n-1} f(a_{\sigma(1)}, \ldots, a_{\sigma(n)}) = 0$.

For a permutation $\sigma$ and $\tau$ where

$$\sigma(i + 1) = \begin{cases} \tau(i), & i = 1, 2, \ldots, n - 1, \\ \tau(n) & i = 0 \end{cases}$$

the terms $a_{\sigma(1)} \cdot f(a_{\sigma(2)}, \ldots, a_{\sigma(n)})$ and $f(a_{\tau(1)}, \ldots, a_{\tau(n-1)}) \cdot a_{\tau(n)}$ are the approach and left-hand side of relation (7). This reality holds for the accompanying:

$$f(x_{\sigma(1)}, \ldots, x_{\sigma(k)}x_{\sigma(k+1)}, \ldots, x_{\sigma(n)}) = f(x_{\tau(1)}, \ldots, x_{\tau(k)}x_{\tau(k+1)}, \ldots, x_{\tau(n)})$$

For every $\mathbb{K} < n$. For more information, see [10] and [12].

**Theorem (15):**
For an algebra $B$, the sequence which is related to the cyclic $\mathcal{H}C^n(B)$ and dihedral $\mathcal{H}D^n(B)$ cohomology of $B$ is the long exact sequence:

$$\cdots \rightarrow \mathcal{H}D^n(B) \rightarrow \mathcal{H}C^n(B) \rightarrow \mathcal{H}D^n(B) \rightarrow \mathcal{H}D^n(B) \rightarrow \cdots$$

**Proof:**
We can get the required from the short exact sequence:

$$0 \rightarrow Tot C(B) \rightarrow Tot D(B) \rightarrow Tot D(B) \rightarrow 0.$$

**Theorem (16):**
Let $B$ be the commutative unital algebras with involution. If $B$ has a condition $\text{codim} B^n \geq n$, $n > 1$, then $\alpha HD^n(B) \neq 0$, $\alpha = \pm 1$.

**Proof:**
Since $n \leq \text{codim} B^2$, there exists a linear independent element $e_1, \ldots, e_n \in \frac{B}{B^2}$ defines the functional,

$$\phi_1 \in B^* = Hom_B(B, \mathcal{C}), 1 \leq i \leq n + 1$$

Such that:

$$\phi_i / B^2 = 0, \phi_i(e_j) = \delta_{ij} = \begin{cases} 1, & i \neq j, \\ 0, & i = j \end{cases}$$
Consider the cochain $f \in \mathcal{C}^n(B,B^*)$ as follows,

$$f(a_1, \ldots, a_n) = j_1(a_1) \ldots j_n(a_n)j_1, \quad a_1, \ldots, a_n \in B.$$ 

Clearly, $\delta f(a_1, \ldots, a_n) = 0$ hence $f \in Z^n(B,B^*)$ and from (7), it is equal $\phi_1$, therefore the cocycles do not equal the coboundaries. Thus $\mathcal{H}^n(B,B^*) = 0$.

Now consider the co-chain $f \in \mathcal{C}^n(B,B^*)$ such that:

$$f(a_1, \ldots, a_n) = j_2(a_1) \ldots j_n(a_n)j_1 + (-1)^n j_1(a_1) \ldots j_n(a_n)j_{n+1} +$$

$$+ \sum_{i=1}^{n} (-1)^i j_1(a_i) \ldots j_2(a_{i+1}) \ldots j_{n-i+1} (a_{n-i+1}) j_{n-i+2}.$$ 

An immediate count shows that the map is $f \in Z^n(D)$. Using (15) and relation (7), we get:

$$\alpha \mathcal{H}^n(D) = 0, \quad \alpha = \pm 1.$$ 

**Corollary (17):**

One of the reflexive cohomology is $\alpha \mathcal{H}^n(B) \neq 0$, $\alpha = \pm 1$.

**Example (18):**

Let $\mathcal{A}$ be a nuclear algebra, then $\alpha \mathcal{H}^n(A) \cong \alpha \mathcal{A}^{tr}$. Where $\alpha \mathcal{A}^{tr}$ is all bounded traces in $\mathcal{A}$,

$$\mathcal{A}^{tr} = \alpha \mathcal{A}^{tr}, \quad \alpha \in \mathcal{A}, \alpha = (-1)^k, k > 0.$$ 

**Theorem (19):**

Let $X = L(\mathbb{H})$ be the algebra of the bounded operators in Hilbert algebra $\mathbb{H}$. We then have the vanishing state of the reflexive cohomology in the Hilbert space as the form:

$$\alpha \mathcal{H}^n(X) = 0, \quad n \geq 0, \quad \alpha = \pm 1.$$ 

**Proof:**

Let $X$ be a $C^*$-algebra (that has no bounded traces). This means that $\mathcal{H}^0(X) = \mathcal{H}^n(X) = 0$. From [5] and [6], if we relate among the sequence:

$$\cdots \to -\mathcal{H}^D(X) \to -\mathcal{H}^{CR}(X) \to \cdots \to -\mathcal{H}^{Dn-1}(X) \to -\mathcal{H}^{Dn+1}(X) \to \cdots \tag{9}$$

This is in addition to two short exact sequences:

$$0 \to -\mathcal{H}^n(X) \to 0 \to -\mathcal{H}^n(X) \to 0.$$ 

Then we find that, $\alpha \mathcal{H}^n(X) = \alpha \mathcal{H}^n(X) = 0, \quad n \geq 0, \quad \alpha = \pm 1$. (see [9]).

**Theorem (20):**

Let $X$ be an arbitrary stable or nuclear algebra. Then $\alpha \mathcal{H}^n(X) = \alpha \mathcal{H}^n(X) = 0, \quad n \geq 0, \quad \alpha = \pm 1, \quad n$ is odd.

**Proof:**

For the nuclear $C^*$-algebra $X$, from theorem (11), we have $\mathcal{H}^n(X) = 0$ if $n$ is odd and it is isomorphic to $X^{tr}$ if $n$ is even. Using theorem (15) we have the reflexive cohomology of $X$ as vanishing for all odd groups and the dihedral cohomology is $\alpha \mathcal{H}^n(X) = \alpha X^{tr}, \quad \alpha = \pm 1$ as $n$ is even.

**Theorem (21):**

Let $P$ be the commutative unital algebra algebras with an involution and $codim P \geq n, \quad n > 1$, then $\alpha \mathcal{H}^n(P) = 0, \quad \alpha = \pm 1$.

**Proof:**

Same manner as in theorem (16) and using [13] and [15] obtain our proof.

V. CONCLUSION

We study some result regarding the vanishing cohomology theory of the topological spaces. The reflexive and dihedral cohomology groups of algebra are vanishing in some states as we proven. So, we have proved that there are instances of nontrivial (co)homology groups in the operator algebras.

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AUTHORS

First Author – S.Z. Rida, Mathematics Department, Faculty of Science, South Valley University, Qena, Egypt, E-mail: szagloul@yahoo.com
Second Author – Alaa Hassan Noreldeen, Mathematics Department, Faculty of Science, Aswan University, Aswan, Egypt, E-mail: ala2222000@yahoo.com.
Third Author – Faten. R. Karar, Mathematics Department, Faculty of Science, Aswan University, Aswan, Egypt, E-mail: fatenragab2020@yahoo.com.

Correspondence Author – Faten. R. Karar, Mathematics Department, Faculty of Science, Aswan University, Aswan, Egypt, E-mail: fatenragab2020@yahoo.com.
A Study on Financial Literacy and it’s Determinants among Millennials in Mysore City

Shyamala G
Research Scholar, DOS in Business Administration, B.N Bahadur Institute of Management Sciences, Mysuru, India,
shyamalag94@gmail.com

Dr. R. Mahesh
Professor DOS in Business Administration, B.N. Bahadur Institute of Management Sciences, University of Mysore, Mysuru, India, maheshraijgopal@yahoo.com

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Abstract

Financial literacy is the integration of individual’s knowledge, attitude, skills and planning with respect to financial activities. It directs to make effective decisions and well-being of an individual. There are many researches have been conducted globally for measuring the financial literacy and also survey on financial literacy has been conducted at country level by the governments. Most of the research have done in order to know the financial knowledge of the investors. The present study focuses on financial literacy among millennials. An attempt has been made through this study to understand the demographic and socio-economic profile of the millennials in Mysore city. And also measure the financial literacy among millennials. Findings of the study interpret that gender, age, education, occupation, income, expenditure and savings have significant impact on the level of financial literacy. This study would assist in acquiring appropriate strategies to enhance the level of financial literacy among millennials.

Keywords: Income, Savings, Expenditure, Financial Literacy, Financial Knowledge, and Millennials.

Introduction

Financial literacy is the serious challenge face by all countries world-wide. Financial literacy is the integration of individual’s knowledge, attitude, planning, and control towards financial activities. It assists to make effective decisions and well-being of an individual. In present world which has a market complicated financial instruments, the essential for financial literacy becomes inevitable. Country like India which has prominent young population, the government has to conduct various programs in order to provide financial education. So, that it helps increase the level of financial literacy. The financial literacy is more than the provision of financial advice. It is the potential to know, monitor, and efficiently use of financial sources to improve the welfare and economic society of an individual, his/ her family and his/her business. The financial literacy is defined by The Organisation for Economic Co-operation and Development (OECD) as “A combination of awareness, acquaintance, skill, attitude, and behaviour necessary to make sound financial decisions and ultimately achieve individual financial well-being”.

Financial literacy is mainly engaged with better planning of reaping regular wealth, retirement life and making preferential financial decisions. So to be financially literate becomes necessary from the primary stage of one’s career. But, due to some personal or professional quandaries they become financially illiterate. This leads them with poor financial knowledge about financial dealings, undesirable decisions etc. Therefore, they have to be improved with financial knowledge and skills which are required to make better decisions. Financial literacy influences the promotion of financial incorporation which finally results in financial soundness of any economy. The need of financial literacy in India is important because of low level of literacy and huge population which is financially excluded from the formal financial structure.

Surveys have been taken place globally for measuring the level of financial literacy and also there are many surveys have been conducted at country level by the governments and it was found that poor level of financial literacy among Individuals. This study attempt to measure the financial literacy among millennials. The research also focuses on their sources, their knowledge and skills they have in financial matters.
Need for the Study

Complicated financial Instruments, lack of awareness and low level of knowledge about financial activities make the need of financial literacy noteworthy. The level of literacy varies from person to person. Gender gap also plays a vital role is deciding the level of financial literacy. A women’s decision with respect to financial activities is often determined by her personal life experience. Emotion, money, and family are interconnected in the life of a woman. Lack of consistent information to make better decision results in low level of confidence and knowledge about financial matters.

The changes proposed in financial markets have declined the scope of governments and employers in matching the employees to plan their future financial requirements. So, the responsibility of managing and deciding their future financial requirements has increased among the millennials. Job insecurity, changeable income and easy access to use credit have a high influence on their financial behaviour. Very countable research has been done on financial literacy. In India, high young demographic and socio-economic diversities should undertake researches in this area. Around 65% of Indian population consists under the age group of 35 years. A large segment of this population belongs to the millennials. So, measurement of financial literacy among the millennials is important. This research focuses on measuring the financial literacy among millennials in Mysore city.

Review of Literature

This part of the paper deals with review of literature. Study pertaining to financial literacy of the millennials has been covered. Few important studies in the chosen topic has been covered in the following paragraphs. Each paper was reviewed individually and presented chronologically. Finally the results are discussed in order to draw meaningful conclusion that provides directions for further studies.

Vera Dewi, Erie Febrian, Nury Effendi and Mokhamad Anwar (2020) were examined a study titled that “Financial Literacy among the Millennial Generation: Relationships between knowledge skills, attitude and behaviour.” The study aimed to examine the correlation of their financial knowledge, financial attitude, and financial skills with respect to financial behaviour. Chi-square test was used to test the hypotheses. There was significant relationships were found not only between financial skills and financial behaviour but also between financial attitude and financial behaviour. It was found that respondents in the ‘fair’ category of financial attitude, financial skills and financial behaviour were 70.6%, 66.5% and 72.2% respectively.

Annamaria Lusardi (2019) conducted a study titled that “Financial literacy and the need for financial education: evidence and implications.” The study described how to measure financial literacy, level of financial literacy around the world and implications of financial literacy for financial decision making. It was found that there was lack of financial literacy even in few of the world’s most well-developed financial markets. It showed that majority if the respondents (54%) who belong to age group between 70-74 years, answered correctly all big three question followed by age group between 65-69 years answered correctly (47%), further investigated that Jap had highly financial literate women (69%) followed by USA (53%). There were 50%v of women and 34% of men were financially literate. In Switzerland, 22% of women and 12% of men were financially literate.

Joshi J. Beck and Richard O. Garris (2019) were examined a study titled that “Managing personal finance literacy in the United States: A case study.” The study investigated the perspectives and impact of the personal finance education had on participants in Western Pennsylvania. The study was exploratory in nature and direct semi-structured interview was conducted. It was found that majority of the respondents were prepared for investment for future purpose. Further, respondents demonstrated that they were more comfortable with personal finance incorporated at a young age. Millennials also realized the importance of personal finance knowledge and also revealed that a large portion of participants have foresight when it comes to their finance.

Daniel Kim and Dimitri Katsanos (2018) conducted a study titled that “Financial Literacy of Millennials; Increasing awareness, offering recommendations and providing a quick educational guide to financial literacy.” The study investigated the rates and effects of financial literacy in the Georgetown University. Data have been collected from the Georgetown students through non independent and non-random survey. It was found that only 20% of the respondents had an awareness of personal finance, 14% of the people had a high-level of financial literacy.

Germani pamarhea, Jaco Fouche, Freda Van du walt (2017) conducted a study titled that “Financial literacy of undergraduate students – A case study of a public university in South Africa.” The aim of this study was to determine undergraduate students’ financial literacy at a public university in South Africa. It was conducted a cross sectional study with sample size of 300 undergraduate students. The study revealed that there was a need of financial literacy training programmes among students. Further, found that the students’ financial knowledge was low and there was poor performance in banking and taxation, and financial planning. It was also showed that there was a significant difference among many group with the biological data.

Sudhir Chandra Das (2016) investigated a study titled that “Financial literacy among Indian millennials Generation and their reflections on financial behaviour and attitude: An explanatory Research.” The study focused to measure the level of financial literacy among Indian millennials and also understanding the reflections of financial literacy on financial behaviour and attitude. There were 210 respondents of PG students of marketing, accounting / finance and HR group (Millennials) of an institution for
national importance complying sampling adequacy chosen through proportionate stratified sampling method. The study has used various statistical tools such as means cluster technique, Man-Whitney and Multinomial logistic model. It was found that more than 60% of respondents correctly answered majority of questions. Further, revealed that maximum select indicators of financial literacy were dependent on select indicators demographic variables. High level of financial literacy was found among finance students followed by HR and marketing students. Reflections of financial literacy on financial behaviour and financial attitude were found to 0.859 and 0.897 respectively.

Sekar and Gowri (2015) conducted a study titled “A study on financial literacy and it’s determinants among Gen Y employees in Coimbatore city.” The study aimed to examine financial literacy among generation – Y employees. Convenient sampling has been used to collect the data from 200 respondents. The study revealed that highest level of financial literacy (61.4%) was found among PG students followed by undergraduate students (48.3%). Further, it was found that there was significant difference between education and financial literacy level and also between income and financial literacy level.

Objectives
1. To understand the demographic and socio-economic profile of the millennials in Mysore city.
2. To investigate the relationship between selected variables and financial literacy of millennials in Mysore city.

Research Methodology
For the purpose of the study a survey was conducted among millennials of Mysore city. Respondents were selected by using convenience sampling method. Primary data from the respondents was collected through structured questionnaire. A total of respondents constitute a sample for the study. Out of the 120 questionnaire only 106 were filled completely. Were used for the study. To measure the financial literacy level, questions regarding personal finance were asked to the respondents. The questions were asked in the view that to measure respondents’ financial knowledge, financial attitude and financial skills. Total score for each respondent is evaluated. The total for each respondent was further converted into their percentage score and financial index is developed. The following hypotheses are constructed.

Hypotheses

$H_0$: there is no association between selected variables (gender, age, education, marital status, occupation, income, expenditure and savings) and financial literacy level of millennials.

$H_1$: there is an association between selected variables (gender, age, education, marital status, occupation, income, expenditure and savings) and financial literacy level of millennials.

The hypotheses of this study has been tested by using statistical tools such as Chi-square test and ANOVA with 5% significance level.

Results and Discussions
This part of the study carries out data analysis and interpretation. The data have been collected from primary source. The stratified sampling has been used to select 106 respondents through structured questionnaire for the study. The demographic and socio-economic profile of millennials have been presented below:

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Demographic factors / Socio-economic factors</th>
<th>No. of respondents (Frequency)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GENDER</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Male</td>
<td>41</td>
<td>38.68</td>
</tr>
<tr>
<td></td>
<td>b) Female</td>
<td>65</td>
<td>61.32</td>
</tr>
<tr>
<td>2</td>
<td>AGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) 21-25 years</td>
<td>41</td>
<td>38.68</td>
</tr>
<tr>
<td></td>
<td>b) 26-30 years</td>
<td>24</td>
<td>22.64</td>
</tr>
<tr>
<td></td>
<td>c) 31-35 years</td>
<td>19</td>
<td>17.92</td>
</tr>
<tr>
<td></td>
<td>d) 36-40 years</td>
<td>22</td>
<td>20.75</td>
</tr>
<tr>
<td>3</td>
<td>EDUCATIONAL QUALIFICATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Higher Secondary Level/ Diploma/ ITI</td>
<td>9</td>
<td>8.49</td>
</tr>
<tr>
<td></td>
<td>b) Under graduate</td>
<td>82</td>
<td>77.36</td>
</tr>
<tr>
<td></td>
<td>c) Post graduate</td>
<td>8</td>
<td>7.55</td>
</tr>
<tr>
<td></td>
<td>d) Professional</td>
<td>6</td>
<td>5.66</td>
</tr>
</tbody>
</table>
The above table shows the demographic profile of the respondents. Majority of respondents (61.32%) were female. Nearly 39% of respondents have come under the age group between 21-25 years, followed by 23% under age group of 26-30 years. 77.36% of respondents have completed their under graduation and 5.66% are professional. Most of them (60.38%) were unmarried. 48.11% of millennials were private employees. Majority of respondents (70.75%) belonged to nuclear family. 46.23% of respondents have two earning members in their family. Majority of the respondents (43.40%) have one dependent and the respondents who earned Below Rs.20000 were relatively high (32.08%) followed by who earned Above Rs.40000 (30.19%) and who earned between Rs.30000-Rs.40000 were relatively low (11.32%). Majority of the respondents (58.49%) who spent between Rs.10000-Rs.20000 were relatively high and who spent above Rs.30000 were relatively low (15.09%). Nearly 48.11% of the respondents have monthly savings below Rs.5000 and who saved between Rs.10000-Rs.15000 were relatively low (3.77%).

Table 2. Chi-square test for selected variables and financial literacy at 5% level of significance

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Demographic and Socio-economic factors</th>
<th>F-Value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GENDER</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Male</td>
<td>25.913</td>
<td>0.523</td>
</tr>
<tr>
<td></td>
<td>b) Female</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>AGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) 21-25 years</td>
<td>80.772</td>
<td>0.486</td>
</tr>
<tr>
<td></td>
<td>b) 26-30 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) 31-35 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>d) 36-40 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>EDUCATIONAL QUALIFICATION</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Primary data

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### Association between Gender and financial literacy level

Based on gender, from the table it can be shown that P-value (0.486) is more than alpha value (5%), therefore there is no significance difference between gender and financial literacy. Hence accept the null hypothesis i.e. There is no association between Gender and financial literacy level. Thus it can be concluded that the level of financial literacy does not differ between male and female respondents.

### Association between age and financial literacy level

From the table, it can be seen that P-value (0.523) is not significant at 5% significance level, hence accept the null hypothesis i.e. There is no association between age and financial literacy. Thus it can be concluded that financial literacy level does not depend on age.

### Association between education and financial literacy level

From the table it can be seen that P-value (0.929) is not significant at 5% significance level. Therefore accept the null hypothesis i.e. there is no association between education level and financial literacy level. Thus it can be concluded that financial literacy level does not depend on the education level.

### Association between marital status and financial literacy level

From the table it can be shown that P-value (0.341) is not significant at 5% significance level. Hence null hypothesis is accepted, i.e. there is no association between marital status and financial literacy level. Thus it can be concluded that nature of marital status does not influence financial literacy level of the respondents.

### Association between occupation and financial literacy level

From the table it can be seen that P-value (0.031) is significant at 5% significance level. Hence null hypothesis is rejected and alternative hypothesis is accepted i.e. there is an association between occupation and financial literacy level. Thus it can be concluded that occupation influences financial literacy level of the respondents.

### Association between Income and financial literacy level

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Financial Literacy Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculturist</td>
<td>87.208</td>
</tr>
<tr>
<td>Business Person</td>
<td>0.929</td>
</tr>
<tr>
<td>Private employee</td>
<td>197.217</td>
</tr>
<tr>
<td>government employee</td>
<td>0.031</td>
</tr>
<tr>
<td>Housewife</td>
<td></td>
</tr>
<tr>
<td>Student</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>Financial Literacy Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>29.413</td>
</tr>
<tr>
<td>Unmarried</td>
<td>0.341</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monthly Income</th>
<th>Financial Literacy Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below Rs.20000</td>
<td>112.059</td>
</tr>
<tr>
<td>Rs.20000-Rs.30000</td>
<td>0.013</td>
</tr>
<tr>
<td>Rs.30000-Rs.40000</td>
<td></td>
</tr>
<tr>
<td>Above Rs.40000</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monthly Expenditure</th>
<th>Financial Literacy Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below Rs.10000</td>
<td>53.522</td>
</tr>
<tr>
<td>Rs.10000-Rs.20000</td>
<td>0.493</td>
</tr>
<tr>
<td>Above Rs.30000</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monthly Savings</th>
<th>Financial Literacy Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below Rs.5000</td>
<td>86.527</td>
</tr>
<tr>
<td>Rs.5000-Rs.10000</td>
<td>0.371</td>
</tr>
<tr>
<td>Rs.10000-Rs.15000</td>
<td></td>
</tr>
<tr>
<td>Above Rs.15000</td>
<td></td>
</tr>
</tbody>
</table>

Source: Primary data
From the table it can be shown that P value (0.013) is significant at 5% significance level. Therefore null hypothesis is rejected and alternative hypothesis is accepted i.e. there is an association between income and financial literacy level. Thus it can be concluded that financial literacy level depends on the income of a person.

**Association between expenditure and financial literacy level**

From the table it can be seen that P value (0.493) is not significant at 5% significance level. Hence null hypothesis is accepted i.e. there is no association between expenditure and financial literacy level. Thus it can be concluded that financial literacy level does not depend on the expenditure of the respondents.

**Association between savings and financial literacy level**

From the table it can be shown that P value (0.317) is not significant at 5% significance level. Therefore null hypothesis is accepted i.e. there is no association between savings and financial literacy level. Thus it can be concluded that financial literacy level does not depend on the savings of a person.

**Conclusion**

From the study it can be concluded that financial literacy does not depend on gender age, educational qualification, marital status, expenditure and savings as all these selected variables’ p-values were less than 5% level of significance. Level of financial literacy is positively related to occupation and income level i.e. our results indicate that financial literacy level increases with increase in income level and influences with respect to the individual’s occupation. Therefore results are statistically significant. Earlier studies have shown that the savings habit among millennials is not so high. Likewise the whole burden of planning their future in terms of finance is on the young individuals. All this has an impact on their financial position. Need for proper financial literacy and information related to financial matters becomes predictable.

The results of the research suggest that level of financial literacy varies significantly among respondents based on various demographic and socio-economic factors. It can be concluded that financial literacy level gets affected by gender, education, income, marital status and number of dependent whereas it does not get affected by age. Finally it can be concluded that financial literacy level is low among millennials in our Mysore city and necessary actions should be taken by government to increase awareness about financial related issues.

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Pong Game Using AI

Akash Rawat*, Ruchika Panday **, Ashish Kumar Pandey**

* Computer Science & Engineering, IET Dr. RML Avadh University, Ayodhya, India
** Computer Science & Engineering, IET Dr. RML Avadh University, Ayodhya, India

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Abstract- Pong is a simple game. It can provide AI to a computer. Model reaction time, which waits some period of time before making decisions. Two-part strategy: model accuracy, in which the computer knows exactly where the ball will land, and adding a random error factor to pretend that the computer is fallible. In this paper, try to balance the game by making the computer's skills better if it starts losing, or by making it worse if the computer is dominating. It's easy to play Pong. It can give a computer AI. Model precision, where the computer knows precisely where the ball will land, and adds a random error factor to simulate that the computer is imperfect. Model response time, which waits a certain amount of time before making choices. In this work, balance the game by improving the computer's abilities if it starts to lose or making them worse if it is winning.

Key words: Artificial Intelligence, Visual force, Native state space, Optimized state spaces.

I. INTRODUCTION

Modern learning techniques have been significantly affected by the rise of learning games in recent years [1]. Numerous studies have shown that playing games gives students "mental exercise" and that game-related activities increase students' motivation and foster a variety of crucial abilities [2]. Using learning techniques, it is hoped that an AI player would be able to train on a collection of states with various definitions and come to understand the PONG GAME's environment. After finishing the practise set, the player can keep playing as long as they go without getting struck. The number of training runs, learning rate, discount factor, and other characteristics may be used to evaluate the effectiveness of the learning process. According to the industry, AI allows for more interaction between the player(s) and the game. According to academics, games are great test settings for developing AI methods. There is a yearning for better, more lifelike video games that provide higher levels of enjoyment and realism.

A- AI AS THE PLAYER

- Current thread in research.
- Creating AI that interacts with the game in the manner of a human player.
- "Seeing" the game world.
- "Pressing" keys.
- External to the game environment.
- No cheating.
- A robot without the physical robot.

B- AI AS THE CREATOR

- New trend in both industry and academia.

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- AI techniques used to control the game.
- Content creation.
- Adapt levels to suit players ability (Infinite Mario).
- Create weapons based on player tastes (Galactic Arms Race).
- Scene Management.
- Control flow of game to enhance replay ability and maintain a predetermined pacing (Left4Dead).

II. RELATED WORK

There has been a great deal of research done on the use of digital games for learning, with some studies concentrating on the game mechanics and others on instructional strategies that might improve teaching and learning. It is well known that playing digital games encourages students to learn how to collaborate, solve problems, communicate, and experiment—skills that are essential for success in a culture where information is constantly changing [2]. In contrast to practising on a single type of problem, skills acquired through gaming are more likely to transfer, which results in the knowledge and skills becoming automatic and consolidating in memory, allowing the learner to start paying conscious attention to understanding and using new information [3]. Digital games for learning put the player in charge of making decisions by putting him through increasingly difficult tasks and achieving learning through trial and error methods [4]. Digital games, which were first created for fun, have been shown to be helpful for the development of cognitive, behaviour, and social abilities [5]. There is a growing amount of research on the potential advantages of digital games for cognitive development (such as faster information processing [6]), but there is little evidence on how the stage of game play and level of competence influence mental effort. The use of digital games in formal and informal learning environments is now supported by a number of principles [2]. Furthermore, in game design and games' capacity to alter viewpoints and conduct [4], In previous studies on mental effort, electroencephalography (EEG) has been used to monitor participants during game play by measuring changes in their brain activity [7], [8] in order to increase neural efficiency when doing certain tasks [9], [10]. Its may see changes resulting from changes in external perception in the topographical categorization of the electrical activity in the brain [8]. These variations in the activity of various brain bands and zones allow us to deduce cognitive functions like attention and focus, which are essential while playing digital learning games [8], [11].

III. DIVERSE APPROACHES TO STATE DEFINITIONS

Pong Bird is a continuous and dynamic game with an unpredefined environment, this gaming approach pits learning against search methods in an effort to construct an agent that can successfully complete the game's first learning phase. Because it constructs a policy before managing the states it will oppose throughout the game, the Q-learning method is the one that best fits our situation. It is necessary to define the problem's state space in order to facilitate successful learning. The following list of state definitions includes a variety of viewpoints:

**Visualforce and Definition:** GR – The parameter we utilised to quantize the game grid was grid resolution. GR values of 1, 2, and 4 were employed. In the findings section, we go into greater detail about it.

**Native state space:**- The state vector's different elements' ranges are as follows:
- Vertical: ~ 0 – 500
- Horizontal: ~ 0 – 300
- Velocity ~ -9 – 9
(Units for the velocity are pixels and pixels per frame.) It is clear that the state space is larger than 10, which indicates that learning would take too long if we used all of the data from the six states. Accordingly, we chose to apply a variety of space quantization techniques.

**Optimized state spaces:**- Its choose to employ 4 distinct strategies in an effort to reduce the number of states:
- Using only the vertical and horizontal distances,
- Horizontal relativity and vertical distance
- Vertical distance and horizontal relativity
- A Boolean indication of whether velocity and distance are positive or negative.
In order to further reduce the size of the state space, we established the maximum and minimum distances between pipes after testing each distance with various GR values. We count it as the upper-lower bound of the distance outside of this range.

Its obtained new state space sizes for each technique (corresponding to the approaches above) after all those reductions:

- Vertical Distance * horizontal Distance/ GR 2.
- 2-Vertical Distance/ GR.
- 2:20-Vertical Distance/GR.
- 2-Vertical Distance *horizontal Distance/ GR 2.

I made the decision to test out each of those 4 ways to see which one promotes the most effective learning.

Rewards :-
Staying alive between states: 1Dying: -1000.
Scoring +1: 1000.

How Game Work?
Generally speaking, a game's primary execution is divided into iterations by means of a loop that runs continually.
- Games that are constructed from discrete ticks, much like film.
- Each iteration.
- Takes player input.
- Determines the gameworld's new state.
- Shows a new state on the screen.

How to Use the Code
Python 3.6 is the platform we employed. We tried it on a 64-bit Python. In order to create the learning agents, we defined a new game engine based on the open source Pong Bird game.

Files Game.py: It defines a class of abstract games.
PongGame.py: This describes the game Pong.
AgentPongGame.py: Uses an agent to extend the Pong game.
Agent.py: Its uses an agent to extend the Pong game. Different agent classes and state classes are defined.
Main.py: A program for manually adjusting the game's settings.
TestScript.py: Pong games are executed with agents that have different parameter combinations.

Running the game: Install the pyGame library, please (pip install PyGame). Ensure that the easy GUI library is set up (pip install easy GUI) so that the game may be launched with only one set of settings: Main.py in Python.

Parameters and ranges:
Training runs: The episodes required before the agent quits learning. When the bird strikes the pipe, the episode is over. The likelihood of selecting a random action is known as the exploration rate (Epsilon). 0-1.
Learning rate (Alpha): A new Q-mass with a value of 0-1.

Discount factor (Gamma): The element that increased the cumulative prize. 0-1.
Pipe vertical gap: The separation between the lower and upper pipes is 130-160.
FPS: The game will play more quickly the more frames it has. whichever of the natural numbers.
Agent: True if a learning agent is used. False if human players are used.
GR: 1, 2, and 4 are as described in the section on approach.
Datatype: type of state space definition to use:
- 1: Naïve approach.
- 2: Distance only.
- 3: Horizontal relativity and vertical distance.
- 4: Horizontal relativity and vertical distance with bird velocity.
- 5: Horizontal relativity and vertical distance with binary bird velocity.
Agent Mode: In order to complete the learning phase (much) faster, the game starts in agent mode without the GUI interface. There is a set of keys to press (not those on the NUMPAD) in order to switch the GUI mode (in game):

0: no GUI mode - speed is only limited by the processing power.
- 1: 30 FPS
- 2: 60 FPS
- 3: 120 FPS
- 4: 240 FPS

Human Mode: The space key is the sole key required for leaping and starting a game.

Output: Every 50 episodes, the user will get a message throughout the learning period. The top score and average score from the previous 50 episodes are included in the message.

IV. HYPOTHESES

Its address four primary hypotheses in the current work. The first looks into whether players who perform well in the game have more EEG band power modulation. We estimate that better performance will result in more processing and activity, which will enhance game activity and EEG band power modulation. The second hypothesis looks at whether players who are more skilled in the game exert more mental effort. We anticipate that if game activity and engagement both rise with experience, there will be a corresponding rise in EEG-measured mental effort. The other two hypotheses focus on the relationship between mental effort and two extremely popular game-play design aspects, namely the number of attempts/lives and level of difficulty[12].

Players’ performance with the game displays a positive relation with their mental effort. When talking about strong achievers, previous research using standardised assessment exams and game scores showed that higher scores in a learning game do not always equate to higher learning outcomes and effort [13]. By exploring this relationship using brain activity, we may thus gain a better understanding of the link between learning and cognitive ability.

Players’ experience with the game has a positive relation with their mental effort. It believes that because those abilities are key drivers of their mental effort, they would lead to an increase in mental effort as players gain experience [14].

Players’ “number of lives left” has a positive relation with players’ mental effort (the fewer the lives, the higher the mental effort). In learning games, the quantity of attempts or lives remaining is a key design component [15]. Low life totals (or finishing with one life left) are strange situations [16], and earlier game concepts (such as power ups) have been used to enhance learning [17]. However, further research is required to clarify the relationship between the number of remaining tries and the user's mental effort using objective measurements (such as EEG).

The difficulty of the game has a positive relation with players’ mental effort (a more difficult game results in higher degree of mental effort). Researchers have found that users’ mental effort is significantly influenced by difficulty [18], [19]; nevertheless, examining and even quantifying this effect can help us gain new design insights.

V. CONCEPT OF GAME AND ITS WORKING METHODOLOGY

Pong is a 2-dimensional arcade tennis sports video game that is depicted in Figure 1 and is developed in Python. This little project is a remake using the beginner-friendly Python language. In terms of gameplay, it is a two-player game that requires the use of a mouse to control both players from opposite sides. When a player fails to contact the ball and it touches another area of the screen, the game is over. A variety of sounds, JavaScript, and HTML were utilised in the creation of this mini-game. While playing the Pong game, players will be upgraded to a more difficult level as it gets harder and harder. The users of this microproject find it simple to use and comprehend.
The Game: A controlled experiment concentrating on skill learning was created for this investigation. A phrase with a broad definition, skill acquisition (also known as movement-motor learning [20]) includes both motor adaptation and decision-making [21], [22]. In our study [23], Pac-Man, a time-testing game that has previously been used to gauge particular talents (motor skills), was utilised in our study [23]. In particular, Pac-Man was employed, which offered three lives each session and followed all the rules of the game. The four keyboard arrow buttons were used to control the game. From one session to the next, the game's difficulty rapidly grew.

Participants: In this, recruited a total of 17 participants (7 females) aged between 17 and 49 years (mean = 32.05, SD = 8.84). Participants were recruited from the participant pool of the Norwegian University of Science and Technology in Trondheim. Participants were familiar with the game, but none of them had played the game in the previous 2 years. Prior to completing the tasks, participants were informed about the purpose and procedure of the experiment and of the harmlessness of the equipment. Participants were given a movie theater ticket upon completion of the study, as a compensation for their time.

VI. CONCLUSIONS

Q-Learning works The outcomes clearly demonstrate that an agent equipped with a Q-Learning mechanism is capable of learning the game and achieving results that are superior to those of a typical player. State space size It establishes a direct link between the state space's size and the learning time required by the agent. Due to the nature of the Q-Learning algorithm, this is obviously inferred. Additionally, it is the most important parameter (except for the exploration—more on that after this). The learning speed was slower on the bigger state spaces, but it was more constant and monotonous, which is something else we saw. This is because the states are easier to identify when the grid resolution is higher (lower GR factor). The resolution of the actual game doesn't vary with the GR factor; it's always the entire resolution of the game. Thus, on a low-res grid, a good state and a terrible state could be grouped together. Best The smallest state space (method #2-distance alone and grid size 4) produced the greatest results. Exploration During a frame is a turn and there are many (actually, a lot of) frames in a game, we observed in the experiments that the exploration parameter must be close to 0. The game proved impossible to learn, at least during the time allotted for each run, due to an exploration factor of above 0.0001.

ACKNOWLEDGMENT

It is a pleasure to acknowledge many people who knowingly and unwittingly helped me, to complete my project. First of all let us thank God for all the blessings, which carried us through all these years. I extend my utmost gratitude to Er. Ashish Kumar Panday supervisor who has always stood by my side and guided, appreciated and encouraged me to get into more and more ventures. Continuing the same, he enlightened me in the various stages during the development of this project and provided me with many insights and useful examples,
which proved to be of immense help in successful completion of this project. I extend my sincere gratitude to my teachers and guide who made unforgettable contribution. I thank all the non-teaching staff of our institution that was always ready to help in whatever way they could.

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AUTHORS

First Author – Akash Rawat, B.Tech Student, akashrawat7271@gmail.com
Second Author – Ruchika Panday, B.Tech Student, ruchikapandey028@gmail.com

Correspondence Author – Ashish Kumar Pandey, ashishkumarpandey@rmralu.ac.in, 7317441066
Predict-the-Hit: Prediction of Hit Songs based on Multimodal Data

Samyak Jain1*, Parth Chhabra1*, Sarthak Johari1*

{samyak19098, parth19069, sarthak19099}@iiitd.ac.in

1* Undergraduate Student, Department of Computer Science, Indraprastha Institute of Information Technology, Delhi

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Abstract-
Hit Song Science concerns the possibility of predicting whether a song will be a hit before its distribution using automated means such as machine learning software. This has motivated to dig deeper to unravel how different audio features would help to predict if a song would feature in the Billboard Top 100 Chart and build a two-way usability model - both for the musicians composing the music and the labels broadcasting it. The work in this paper also aligns with our team’s vision of exploring real-world applications of machine learning techniques and making them useful in common domains. In this paper, prediction models on data from Million Songs Dataset (MSD), Billboard, and Spotify using machine learning techniques have been explored, and low-level & high-level feature engineering techniques are applied. Finally, a comparison of their performances using various performance metrics has been carried out.

Index Terms- Hit Song, Spotify, Billboard, High-level, Low-level, CNN, MLP, PCA, Logistic Regression, Random forest.

I. INTRODUCTION

With the forever-expanding music industry and the number of people keen on listening to popular music, it becomes essential to come up with a classifier that can predict whether a song is ‘hit’ or ‘non-hit’ to help musicians and music labels [6]. Such a-priori prediction would become useful for music streaming industries to identify potentially interesting songs and their writers [9]. In the field of research, scientists are also fancied by the characteristics that make a song popular [10,11]. Therefore, motivated by this idea, a scheme has been proposed that focuses on developing Machine Learning (ML) models to predict whether a song is a “hit” or a “miss”. For carrying out this task, data is collected from Billboard, Spotify, and Million Song Dataset, and also considered several features of a song, like audio features and related artist data, and, based on that, applied machine learning based classification algorithms to develop models that could help us achieve the desired classification. Through a series of experiments, it is observed that the proposed model is able to correctly predict what choices of a particular feature make a positive impact so that the musicians and music engineers can plan accordingly to give their songs the best chance of being classified as a ‘hit.

We have also included both low-level and high-level analyses. A low-level analysis uses the audio data and raw audio features like spectrograms to train models. The high-level analysis includes using high-level human understandable features like danceability, loudness, and acousticness.

The proposed scheme is depicted in Figure 1.
The rest of the paper is organized as follows: Section II includes a comprehensive literature survey. The description of the datasets considered is given in Section III. The detailed methodology is explained in Section IV, with results represented in Section V. Section VI concludes the paper.

II. LITERATURE SURVEY

A significant amount of work has been done in the field of hit song science in terms of hit prediction for songs based on multiple types of features. Pachet and Roy [4] used external features extracted from the musical ecosystem, such as social media presence, and internal features extracted from audio to predict a song’s popularity. They used 632 manually labeled features for each song to encapsulate all the internal and external features but could not develop an accurate model and concluded it could not be done by state-of-the-art machine learning techniques.

Ni et al. [3] focused on using low-level internal features to predict a song’s popularity. They used a classifier that was a time function along with a shifting perceptron learning agent. It could outperform a random oracle significantly and obtained a 60% accuracy with its predictions but was limited to UK’s billboards and could not generalize well.

Singhi and Brown [2] used 31 rhyme, syllable, and meter features like syllables per line, rhymes per line, etc., to develop their Bayesian network model, which gave them a precision of 21.4% and recall of 45.1%. They had an imbalanced dataset with around 7% of total songs as hits and the rest non-hits.

Yang et al. [1] experimented with deep learning models like convolutional Neural Network and JYnet model for supervised pre-training and auto-tagging and also used a combination of both of these. Compared to shallow models, their experiments produced promising results on two different datasets (Mandarin & Western Pop).

III. DATASET

A. Dataset Extraction

We used a subset of the Million Song Dataset (MSD) [7] of 1 million songs, of which we further used a one-tenth subset. We extracted each song’s high-level audio features and related artist data using Spotipy [8] to query the Spotify API and further obtained 29,371 data points after narrowing it down to songs released between 2006 and 2020. Using billboard.py to query the Billboard API, we also collected 4,778 songs featured on Billboard Top 100 distributed equally between 2006 to 2020, got the audio feature and artist detail for 4,063 songs, and removed the songs that were not released between 2006 to 2020. Some overlapping songs between billboard and MSD data were removed, and finally, we had data of about 9,758 songs, out of which 3,796 were Billboard Hits and 5,962 Non-Hits. A Billboard Hit is labeled as 1, and a non-hit as 0.

We performed both high-level and low-level classification. High-level classification uses high-level human understandable features like danceability, loudness, and acousticness, whereas low-level classification is done by sampling from the actual audio data and using the audio signal spectrogram. Note that all models except CNN use high-level features; CNN uses low-level audio data for classification.

The low-level analysis is helpful as it provides an unbiased classification, i.e., it does not consider high-level factors like artist popularity. This is important because a less-known artist may release a potentially hit song.

B. Data Pre-Processing and Analysis

Out of the extracted 23 total features, we initially reduced the dataset to 16 numeric features that can be used to build classification models. We checked for any missing features (NaN, NULL values, etc.) and found none, as they were already removed during data extraction.

a. Data Standardization

We calculate the skewness of each feature. Since some of the features are skewed from the ideal normal distribution, thus, we have used the Yeo-Johnson power transform to fix the skew and standardize the data. The resultant feature distributions approximate normal distributions with zero mean and unit standard deviation.

b. Feature Selection

To reduce the redundancy and dimensionality of the dataset, we have made a correlation heatmap of the features and have noticed
that - Energy has a high positive correlation with Loudness (0.71) and a high negative correlation with Acousticness (-0.66). Also, Followers and artist popularity have a high positive correlation (0.53), with Artist popularity having a high positive correlation (0.76) with the output label.

Furthermore, we have used pair plots to verify the correlations observed from the heatmap. We observed that energy increases approximately linearly with loudness; the same goes for artist popularity and followers.

Therefore, since the effect of energy and followers on the output label can be modeled just by using loudness and artist popularity, we drop energy and followers. We chose to drop energy because it has a high correlation with two quantities and a low correlation with the output label. Also, loudness approximates a normal distribution better than energy. Artist popularity is preferred as it has a very high correlation with the output label, indicating a high deterministic power.

Fig 2. Correlation Heatmap

Fig 3. Pair-plots of selected features

c. Handling Outliers

Since the data is standardized for a particular feature; we identify the outliers as data points with the absolute value of a Z-score greater than 2.6. Any data point that lies more than 2.6 standard deviations away from the mean is considered an outlier. Therefore, we have tried the threshold Z-score value for all values in the range [2, 4] with a step size of 0.1. The threshold value of 2.6 gave the best results, and after removing the outliers, we are left with 3,690 hits (output label = 1) and 5,486 non-hits (output label = 0). 40% of the data points are hits, and 60% are non-hits.

Finally, after doing all the above preprocessing steps, the revised dataset has 9,176 data points and 14 features.

d. Dimensionality Reduction

T-Distributed stochastic neighbour embedding (t-SNE)

t-SNE minimizes the divergence between two distributions: a distribution that measures pairwise similarities of the input objects and a distribution that measures pairwise similarities of the corresponding low-dimensional points in the embedding.

We have used t-SNE to reduce the dimensions of the data points to two dimensions. Through this, we were able to visualize higher dimensional data and get a sense of similarity between data points.
Principal Component Analysis (PCA)

PCA is used to reduce the number of data dimensions while retaining maximum information stored in it. It tries to maximize the variation retained from the original data distribution. We used PCA to reduce the dimensions of the data points to three dimensions and plot the same. The explained variance ratio per component that we got is as follows:

- $9.9995230e-01$
- $4.77703879e-05$
- $6.88124530e-12$

Furthermore, from the below plots, we could infer that there is a high separability between the classes (hit and not-hit).

IV. METHODOLOGY

Through the proposed methodology, we aim to make a prediction for a song based on its audio features and corresponding artist-related data (popularity) and perform binary classification by predicting it as a billboard hit (label 1) or non-hit (label 0). To perform this task, the following classification models have been used: logistic regression, Gaussian Naive Bayes, Decision Trees, Random Forest, SVM, AdaBoost (base classifier: decision tree), MLP, and CNN. Hyperparameter tuning is also performed using the grid search technique over selected parameters to arrive at the best results. For evaluating the performance of the different classifiers, we have used the performance metrics, including accuracy, precision, recall, and AUC score for ROC curves.

A. Models and their details

To test our models, we split the dataset into training and testing sets through a 70:30 split, with the training set consisting of 6,268 samples and the testing set having 2,687 samples.

a. Logistic Regression

It is a linear classification supervised model that uses a logistic function for classification. Logistic regression is categorized into two types - binary logistic regression and multi-class logistic regression. But, as our task is predicting whether or not a song is hit or not we have used the binary logistic regression.

To come up with the optimal solution, logistic regression minimizes the log-loss logit function.

b. Decision Tree

A decision tree is a non-parametric supervised model for classification and regression tasks. It has a hierarchical tree structure with nodes and edges. The nodes represent the outcomes, and the edges denote the rules by which the tree is made. To make this tree-like structure, the decision tree has two metrics - Gini Ratio and Entropy. For our model, we have used the Gini ratio as the decision metric.

c. Random Forest & AdaBoost

Random forest is an ensembling technique for classification and regression tasks in which multiple decision trees are used during training. For the classification task, the output of the random forest classifier is governed by the voting process of the decision trees in which the majority class is picked.

AdaBoost, short for Adaptive Boosting, is a boosting technique that is used as an ensembling method. This technique assigns higher weights to incorrectly classified samples, thus helping reduce bias and variance in supervised learning tasks. In simple words, AdaBoost helps in converting weak decision stumps into a strong binary classifier.

d. Gaussian Naive Bayes

Gaussian Naive Bayes is a generative model which assumes that each class follows a gaussian distribution and independence of features meaning that the covariance matrices are diagonal matrices.
and also support continuous-valued features. The likelihood of the features is computed using the below-mentioned probability measure.

\[
P(x_i | y) = \frac{1}{\sqrt{2\pi\sigma_y^2}} \exp\left(-\frac{(x_i - \mu_y)^2}{2\sigma_y^2}\right)
\]

e. Stochastic Gradient Descent (SGD) Classifier
The SGD classifier implements a linear model using stochastic gradient descent (SGD) in which the gradient of the loss function is estimated for each sample at a time, thereby updating the model parameters. We implemented this SGD classifier using the Scikit-Learn library.

f. Support Vector Machine (SVM)
SVM is a supervised learning algorithm for classification and regression problems. It tends to estimate parameters w and b that describe an optimal hyperplane to separate samples of the two classes.

However, soft margin SVM was developed to relax the constraints of hard margin SVM to tackle linearly inseparable problems. The soft margin SVM estimates a hyperplane that optimizes the below function.

\[
\omega^*, b^*, \xi^* = \arg\min_{\omega, b, \xi} \frac{1}{2}\|\omega\|^2 + C\sum_{i=1}^{m} \xi_i
\]

where,
\[
y_i(\omega^T x_i + b) \geq 1 - \xi_i; \quad i = 1, ..., m.
\]
\[
\xi_i \geq 0; \quad i = 1, ..., m.
\]

In the above equation, parameter C determines the penalty of misclassification error which is represented by \(\xi_i\). In our work, value of parameter C remains 1 throughout the experiments.

h. Multi-Layer Perceptron (MLP)
Neural networks have become one of the most popular model architectures in today’s world after the rise of deep learning. In this paper, we have proposed a 3-layer MLP consisting of an input layer followed by a hidden layer with 100 nodes and a logistic activation function followed by a 2-node output layer with a sigmoid as the activation function. We used SGD as the solver and a learning rate of 0.01.

i. Convolution Neural Network (CNN)
In neural networks, CNN is one of the most important classifiers for doing image classification tasks and extracting spatial information from the data. In our paper, we have used four convolution layers with ReLU as the activation function and applied batch normalization as well. Finally, after flattening the features, a linear classifier was applied at the end with a sigmoid activation function.

B. Performance Metrics
To evaluate our models, we have used the following performance metrics:-

- Precision

\[
\text{Precision} = \frac{TP}{TP + FP}
\]

- Recall

\[
\text{Recall} = \frac{TP}{TP + FN}
\]

- F1-score

\[
\text{F1-score} = \frac{2 \times \text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}
\]

- ROC Curve - Probability curve that shows the trade-off between sensitivity (True Positive Rate) and specificity (1 - False Positive Rate).

AUC Score - Area under a ROC curve which represents the measure of separability and, therefore, how well a model is capable of predicting correctly.

Here, TP - Number of True Positives
TN - Number of True Negatives
FP - Number of False Positives
FN - Number of False Negatives

Generally, high accuracy, precision, and recall are desired. Precision (ratio of true positives to total positive predictions) is particularly important as we want to reduce the number of false positives (non-hits predicted as hits). This is necessary because music labels would not want to invest in songs that are not potential hits. ROC curve is plotted, and Area under the curve (AUC) is observed. Higher AUC is desired and indicates better prediction ability of the model and good performance.

V. RESULTS & ANALYSIS

A. High-Level Classification
We trained our models using 5-fold (best overall 'k' from 2 to 10) cross-validation while performing a grid search on the hyperparameters. Using the best model obtained by grid search (using precision as the scoring metric as we want to minimize the number of false positives), we calculated the accuracy, precision, recall, and F1 score. A summary of the results on the test data in Table 1.

<table>
<thead>
<tr>
<th>Model</th>
<th>Accuracy</th>
<th>Precision</th>
<th>Recall</th>
<th>F1-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>LR(BGD)</td>
<td>0.927</td>
<td>0.899</td>
<td>0.925</td>
<td>0.912</td>
</tr>
<tr>
<td>DT</td>
<td>0.921</td>
<td>0.934</td>
<td>0.871</td>
<td>0.901</td>
</tr>
</tbody>
</table>
RF | 0.939 | 0.943 | 0.907 | 0.925  
GNB | 0.860 | 0.775 | 0.931 | 0.846  
LR(SGD) | 0.908 | 0.870 | 0.913 | 0.891  
ADA | 0.914 | 0.881 | 0.909 | 0.895  
MLP | 0.972 | 0.954 | 0.976 | 0.965  
SVM-LINEAR | 0.915 | 0.884 | 0.909 | 0.896  

Table 1. Performance evaluation for classification models

From the above experiments, we could infer that the MLP classifier was able to perform the best in terms of all the performance metrics. This is not surprising since ANNs are very powerful function approximators. Another thing to notice was that both the Gaussian Naive Bayes (GNB) and Logistic Regression (LR) classifiers performed poorly on the test set. The reason behind the same could be that the data is not linearly separable, as evident from the t-SNE plots. Also, the features are not completely independent, as is evident from the correlation heatmap in Fig 1, which is a necessary condition for a GNB model to perform well.

Since the dataset is not linearly separable thus, we expected the Decision Tree and Random Forest classifiers to perform well, which they do. Since random forests are an ensemble model on decision trees, it combines the output of various decision trees and thus performs better than a single decision tree. Logistic regression (LR using both BGD and SGD) has comparatively lower precision than Decision Trees and Random Forest. This is expected since logistic regression assumes that the data is linearly separable, which is not true in this case. Furthermore, we tried the SVM classifier with various kernels (RBF, linear and radial), with the linear kernel performing the best. It gave the best performance when compared with LR, AdaBoost & GNB. This is because it tries to find the optimal hyperplane which classifies unseen data better.

We also observed relative feature importance in the Random Forest classifier. As expected, artist popularity has the highest relative feature importance and dominates by a huge margin. This is justifiable because we expect artist popularity to be based on the previous performance of the artist on similar metrics (getting featured on Billboard, awards, etc.). The year has low importance as hit songs are equally distributed across years, and there is no linear dependence of year with other features. The trend can also be justified by observing the correlation heatmap of features with
B. Low-Level Classification

The dataset used for low-level classification contains 7,408 songs (some songs had no audio preview available and so were removed). Due to computational limitations, we sample audio data of only 10 seconds. We do an 80:20 train-test split. The sampling rate of the audio is 44160 (which is the standard sampling rate). This creates data samples of size 331,264.

We used the spectrogram data extracted from the audio files for low-level classification. A CNN with four convolutional layers and one fully-connected layer is used. The model is trained for 30 epochs with a batch size of 128. The initial learning rate is 0.001. Adam optimizer is used for backpropagation.

The results of the model are summarized in Table 2.

<table>
<thead>
<tr>
<th>Model</th>
<th>Accuracy</th>
<th>Precision</th>
<th>Recall</th>
<th>F1-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNN</td>
<td>0.8751</td>
<td>0.8409</td>
<td>0.6964</td>
<td>0.7619</td>
</tr>
</tbody>
</table>

Table 2. CNN Performance Evaluation

Even though this model performs only marginally better than Gaussian Naive Bayes, it is essential to note that this uses only the audio data of the song. The high-level features used in the previous model include artist popularity and followers, which are highly correlated with whether an artist will release a hit song. Using only the raw audio data gives an unbiased result, i.e., it does not consider any biases created by the artist. It is also possible that a less-known artist may release a song that becomes a hit.

VI. CONCLUSION & FUTURE WORK

Since the number of people listening to music is increasing daily, it has become essential to provide listeners with the best hit songs possible. Thus, our paper focuses on predicting whether a song will turn out to be a hit or a miss. We followed various data extraction methods using APIs and different data visualization and analysis techniques to do so. Apart from this, we applied data preprocessing and EDA methods to simplify our original dataset and remove any redundancies. For this binary classification task, we tried different classification models like logistic regression, decision trees, random forests, MLP, SVM, CNN, AdaBoost, and Naive Bayes and compared them based on various performance metrics like accuracy, precision, recall, ROC curve, and AUC score. Other than that, we also provided some inferences about the predictions made by these models and explored different kinds of low-level and high-level feature data.

As part of future work, we believe that the low-level analysis can be improved by making the network deeper (which will require more computational resources). Also, combining high-level and low-level features can give even better results. Currently, we only use spectrogram data for low-level analysis. There are other features as well that can be extracted from audio and can be used for classification models. Also, we aim to train and test our models on a larger dataset.

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AUTHORS

First Authors
Samyak Jain, CSE Undergraduate 2023, Indraprastha Institute of Information Technology, Delhi and email address: samyak19098@iiitd.ac.in

Parth Chhabra, CSE Undergraduate 2023, Indraprastha Institute of Information Technology, Delhi and email address: parth@19069@iiitd.ac.in

Sarthak Johari, CSE Undergraduate 2023, Indraprastha Institute of Information Technology, Delhi and email address: sarthak19099@iiitd.ac.in

Correspondence Author – Samyak Jain, CSE Undergraduate 2023, Indraprastha Institute of Information Technology, Delhi and email address: samyak19098@iiitd.ac.in, +91-9582919388

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Occupational Stress and Personality Factors among Employees

Kambam Lakshminarayana¹, Resu Bhupal Reddy², Madarapu Yethi Raju³ K. Harinatha Babu⁴, Goutham Ram⁵, Jagruth Lingala⁶, Sridevi Godishala⁷

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An individual is subjected to occupational stress when their work demands exceed their abilities, resources, or needs. Stress is dealt with differently by everyone, regardless of their age. There are both physical and emotional effects of stress on individuals. The presence of physical and mental stress is suggested by some experts as necessary for healthy and normal growth to occur. Stress motivates employees to learn new skills and master their jobs, which leads to better productivity, whereas stress that isn't managed effectively causes problems. The study aimed to investigate the relationship between personality and occupational stress among government and private employees. Occupational stress and personality factors were investigated among government and private employees using a descriptive survey design. A total 160 participants with informed consent were administered the Occupational Stress Index (OSI) and Singh's Differential Personality Inventory (SDPI). The results of the study indicate that there is no significant difference between male and female employees regarding occupational stress. Women and men have similar personalities, and employees in the private sector and the government sector have adopted the same personality traits. The study also concluded that both government and private sector organizations have a significant relationship between personality and occupational stress. Government and private sector employees are significantly less likely to experience occupational stress based on their personality traits.

1 Child & Clinical Psychologist, Department of Psychiatry, Government General Hospital (RIMS), Kadapa, Andhra Pradesh
2 Counseling Psychologist, Mind Care Counseling Centre, Hyderabad, Telangana
3 Assistant Professor Psychiatry, Department of Psychiatry, Government Medical College, YSR Kadapa, Andhra Pradesh
4 Counseling Psychologist, Hyderabad, Telangana
5 Special Educator, Christian Fellowship Hospital, Rajnandgaon, Chhattisgarh
6 Scholar, Manipal University, Jaipur, Rajasthan
7 Assistant Professor Clinical Psychology, CRC, Rajnandgaon, Chhattisgarh

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INTRODUCTION

An individual's personality is considered to be a distinctive characteristic of their behavior. Research has focused on personality traits, individual behavior, and occupational stress. In various situations, a person's personality can be defined as a dynamic and organized set of traits that uniquely influence their cognitions, motivations, and behaviors. In terms of behavior, abilities, and qualities, a person's sense of self is comprised of their attitude, judgment, and values. An examination of self-perceptions and their conceptual and perceptual aspects led to a positive self-concept across a range of behavioral patterns on the test (Ram Kumar, Sailaja & Jagruth, 2022). The term "occupational stress" refers to a mismatch between one's abilities and the nature of one's responsibilities. Stress narrated from the workplace is referred to as occupational stress because it is a risk associated with fulfilling occupational requirements. There is an increasing amount of occupational stress in today's world, and most serious health issues are associated with occupational stress. A human being is subjected to occupational stress when the requirements of their job do not match their abilities, resources, or even needs. Everyone processes information differently and deals with stress differently, irrespective of age. Stress has both physical and emotional effects on individuals. Stress, both physical and mental, is suggested by some experts as necessary for normal and healthy growth. When employees are under some degree of stress at work, they become motivated to learn new skills and master their jobs, which results in improved productivity, while the problem arises when stress is not managed appropriately. The introduction of new technologies, changing policies, changing economic conditions, market dynamics, and changes within an organization are some of the factors that influence stress levels in the workforce, which have an impact on individual and organizational productivity. Occupational stress is one of the forms of emotions that are influenced by perception-related anxiety, and both internal and external factors play a significant role. According to Spielberger, (1979) stress has become less negative in nature and, if it is positive, can prove to be an important factor in improving productivity in an organization. It can be detrimental to employees' physical and psychological health and cause frustration, haste, and dissatisfaction at work, if not positive. Therefore, the absence of work may lead to complacency, and stress is, therefore, multidimensional, resulting from employees' perceptions of it as a problem or a benefit.

There have been many studies investigating the relationship between personality type and occupational stress among teachers, but few studies have explored the relationship between personality type and occupational stress in academic managers. It was argued by Ahmad & Ashraf (2016) that occupational stress measured by four constructs, namely pressure at work, support at work, job satisfaction, and nature of the job, had a significant impact on employees' personalities and the overall model was significant at 99.9%. A study examined the relationship between job satisfaction, and occupational stress on government sector bank and non-government bank employees, and found that non-government bank employees felt less job security, had a higher workload and were less satisfied than male employees with their lower level jobs having lower pay and less social security (Anamika, 2016). According to research results, 66% of the doctors reported their workplace as stressful, and the number of women (72.5%) reported their workplace as more stressful than the number of men (60.5%) (Parmar et al., 2015).

Studies have reported that a few personality traits can predict specific work-related behaviors, stress reactions, and emotions fairly well under specific circumstances, including frustration, worry, and anxiety (Kyriacou, 2001). The personality factors that contribute to an individual's ability to cope effectively with stressful situations can be explained by personality researchers, such as Neuroticism.

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(Costa & McCrae, 1985, 1987). In addition, personality characteristics of employees can moderate the effect of stressful situations on burnout, with certain personality traits enhancing or defending negative outcomes (Grundy, 2000; Zellars, Perrewé & Hochwarter, 2000; Van Dierendonck, Grassen & Visser, 2005).

The majority of studies have found a positive relationship between neuroticism (characterized by negative emotional states and predispositions) and high stress (Deary, et al., 1996; Kokkinos, 2005). Grundy, 2000 found a negative relationship between personality type and stress. Desa, et al., (2014) found that personality was significantly correlated with job stress and that job stress correlated positively with psychoticism (r=0.17) and neuroticism (r=0.38), while job stress correlated negatively with extraversion (r=−0.26) and lie (r=0.25). Moreover, it suggested that better knowledge of the influence of personality dimensions on job stress might help in selecting more effective interventions. Based on their study of high school teachers' personality and workplace stress, a study concluded high burnout groups scored significantly high on psychoticism, neuroticism, lie scales, type-A behavior, emotional exhaustion, depersonalization, while low on extraversion, occupational stress, and personal accomplishment. Regardless of the field of inquiry, all individuals experience some level of stress, and employees in the public and private sectors are no exception. Various factors contribute to the difference in stress levels between government and private sector employees, including organizational structures and ways in which work is performed. It is also generally believed that women are more emotional than their male counterparts, which makes them more prone to stress, resulting in lower work productivity. One research also revealed a high level of significant difference in occupational stress of employees working in private and government sectors as private sectors are experiencing more occupational stress than their counterparts (Sudha & Ronica, 2013). Another study showed significant differences in occupational role stress among public and private sector university teachers, whereas women of both sectors experienced somewhat higher levels of stress than men. A lack of modern and technical facilities can lead to role erosions and role stagnation in organizations. The reason for the organization's role stress may be that the roles are not properly allocated, role expectations are high, and the versatility of roles played by women (Luxmi & Sandeepkaur, 2012). It is explained that proactive interventions can be integrated into structures like job control, work schedules, staffing levels, physical work environments and organizational structures (Akanji, 2014). The present study was to determine how occupational stress affects the personalities of employees in the various government and private sectors.

**METHODOLOGY**

The aim of the study was to investigate Personality and Occupational Stress among Employees of the Government and Private sectors. The descriptive survey research design was used to find out the relationship between occupational stress and personality factors among government and private employees.

**Specific Objectives**

- To study the level of occupational stress among employees.
- To study the personality factors among employees.
- To study the level of occupational stress and personality factors among employees in relation to gender, and type of organization.
- To study the correlation between occupational stress and personality factors among employees.
Hypotheses

- There will be a significant difference on occupational stress among employees.
- There will be significant difference on personality factors among employees.
- There will be significant difference of occupational stress and personality factors among employees in relation to gender, type of organization.
- There will be significant correlation between occupational stress and personality factors among employees.

Sample

The study sample consisted of 160 employees from several fields, such as medical, banking, insurance, and railways from private and public sectors in Hyderabad, using the purposive sampling method.

Tools:

1. **Occupational stress Index**

   Occupational Stress Index (OSI) was developed by A. P. Singh and A.K. Shrivastva in the Indian context and consists of 46 statements with a five-point scale from strongly agree (5) to strongly disagree (1). Occupational stress is assessed using the total score on this scale, with higher scores indicating more stress. The reliability index calculated by the split-half method and Cronbach's alpha coefficient for the scale as a whole were .935 and .90, respectively.

2. **Singh’s Differential Personality Inventory (SDPI)**

   Arun Kumar Singh developed Singh's Differential Personality Inventory (SDPI), which is a self-report measure that analyzes various factors of personality among individuals. It measures ten different factors including decisiveness, responsibility, emotional stability, masculinity, friendliness, heterosexuality, ego strength, curiosity, dominance, and self-concept. The maximum score for each dimension can be 15 (fifteen) and the minimum score can be 0 (zero), and the higher the score on any factor, the greater the possessiveness of concern; the lower the score on any dimension, the poorer the possessiveness of concern. The internal consistency reliability of the questionnaire was examined using the odd-even split half method for each personality dimension. It was highly significant with coefficients in the range of 0.73 to 0.90.

Procedure

In the demographic datasheet, the following items were included, name, age, gender, profession, and type of working sector were included. Informed consent was obtained from the participants and those who agreed to participate were administered Occupational Stress Index (OSI) and Singh's Differential Personality Inventory (SDPI). After completion of data collection scoring of all collected data was done according to the manual of each tool. Analysis of data was carried out taking into account the objectives and hypotheses of the study.

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Results and Discussion

Figure 1: Gives demographic data based on the working sector:

![Graph showing demographic data based on working sector]

Figure 1: Demographic data based on the working sector

Figure 2: Gives demographic data based on gender
### Figure 2: Demographic data based on gender

![Gender Distribution](image)

#### Table 1: Mean, SD and significance of occupational stress of employees based on gender

<table>
<thead>
<tr>
<th>Occupational Stress</th>
<th>Gender</th>
<th>Mean</th>
<th>SD</th>
<th>SED</th>
<th>t’ Value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over Load</td>
<td>Male</td>
<td>18.460</td>
<td>3.977</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>17.000</td>
<td>4.017</td>
<td>0.729</td>
<td>2.002</td>
<td>0.08</td>
</tr>
<tr>
<td>Role Ambiguity</td>
<td>Male</td>
<td>11.073</td>
<td>2.732</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>10.900</td>
<td>3.313</td>
<td>0.554</td>
<td>0.312</td>
<td>0.69</td>
</tr>
<tr>
<td>Role Conflict</td>
<td>Male</td>
<td>15.213</td>
<td>3.011</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>15.840</td>
<td>3.101</td>
<td>0.558</td>
<td>1.123</td>
<td>0.23</td>
</tr>
<tr>
<td>Group Pressure</td>
<td>Male</td>
<td>12.833</td>
<td>2.789</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>11.700</td>
<td>2.267</td>
<td>0.463</td>
<td>2.447</td>
<td>0.01*</td>
</tr>
<tr>
<td>Responsibility</td>
<td>Male</td>
<td>9.226</td>
<td>2.196</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>9.100</td>
<td>1.972</td>
<td>0.380</td>
<td>0.331</td>
<td>0.62</td>
</tr>
<tr>
<td>Under Participation</td>
<td>Male</td>
<td>12.580</td>
<td>3.035</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>12.190</td>
<td>3.177</td>
<td>0.567</td>
<td>0.688</td>
<td>0.42</td>
</tr>
</tbody>
</table>

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Occupational stress was found to differ significantly in the areas of group pressure and powerlessness at the 0.01 level in Table -1 and Figure 3, but not in any other area. In terms of group pressure and powerlessness, the Mean+SD values for male employees are 18.46+3.97, 9.68+2.06 and for female employees are 11.70+2.267 and 10.06+2.01 respectively. It

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powerlessness</td>
<td>9.686</td>
<td>10.06</td>
</tr>
<tr>
<td></td>
<td>2.063</td>
<td>2.019</td>
</tr>
<tr>
<td></td>
<td>0.138</td>
<td>0.433</td>
</tr>
<tr>
<td></td>
<td>2.694</td>
<td>1.854</td>
</tr>
<tr>
<td></td>
<td>0.01*</td>
<td>0.15</td>
</tr>
<tr>
<td>Poor Peer Relationship</td>
<td>11.913</td>
<td>11.110</td>
</tr>
<tr>
<td></td>
<td>2.443</td>
<td>2.313</td>
</tr>
<tr>
<td></td>
<td>0.433</td>
<td>0.38</td>
</tr>
<tr>
<td></td>
<td>1.854</td>
<td>0.38</td>
</tr>
<tr>
<td>intrinsic impoverishment</td>
<td>11.393</td>
<td>10.950</td>
</tr>
<tr>
<td></td>
<td>3.106</td>
<td>2.633</td>
</tr>
<tr>
<td></td>
<td>0.525</td>
<td>0.844</td>
</tr>
<tr>
<td>Low Status</td>
<td>8.866</td>
<td>7.530</td>
</tr>
<tr>
<td></td>
<td>2.646</td>
<td>1.976</td>
</tr>
<tr>
<td></td>
<td>0.875</td>
<td>1.526</td>
</tr>
<tr>
<td>Strenuous working conditions</td>
<td>9.673</td>
<td>9.480</td>
</tr>
<tr>
<td></td>
<td>2.515</td>
<td>2.249</td>
</tr>
<tr>
<td></td>
<td>0.4355</td>
<td>0.443</td>
</tr>
<tr>
<td>Unprofitability</td>
<td>6.273</td>
<td>6.000</td>
</tr>
<tr>
<td></td>
<td>1.913</td>
<td>1.550</td>
</tr>
<tr>
<td></td>
<td>0.317</td>
<td>0.861</td>
</tr>
<tr>
<td></td>
<td>0.31</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 3: Mean values of occupational stress of employees based on gender**

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suggests that male employees are better at maintaining group-conformity since they face more unreasonable political and social pressures than female employees. Furthermore, the results indicate that there is no significant difference between men and women in other occupational stress factors. The study found that male employees experience fewer feelings of powerlessness than female employees. According to the results, both male and female employees experience role ambiguity to an equal degree, plan their work effectively and have a clear understanding of what they are supposed to do, but also experience a high workload as well. In addition, the study revealed that both genders experience occupational stress in some areas, such as role conflict and inferiority complex. Moreover, both genders expressed their unhappiness with their superiors as a result of under investigation. Additionally, the study found that both male and female employees share a great deal of responsibility and are both seen to be able to contribute to the development of the organization by offering their valuable suggestions for the development of new policies in working systems. In addition, the findings reveal that the suggestions provided by both the male and female groups of employees are taken in the right direction, and their suggestions for dealing with administrative problems are always solicited when needed. Likewise, both have similar tendencies to express opinions, provide instructions, and make decisions regarding training programs for the employees, but poor peer relationships abound. Despite the opportunity for both genders to utilize their abilities and experiences independently, the social status of both genders is not satisfactory. Inferred, both male and female employees perform their jobs under extreme tense conditions, making their lives complicated, difficult, and cumbersome. Similarly, it emphasized that male and female employees rarely receive compensation for hard work and that the amount owed to them does not correlate with the work done. Accordingly, both male and female employees are experiencing the same level of occupational stress in specific areas. However, only powerlessness and group pressure were different.

Table-2: Mean, SD and significance of occupational stress of employees based on the type of job

<table>
<thead>
<tr>
<th>Occupational Stress</th>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>SED</th>
<th>t</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over Load</td>
<td>Government</td>
<td>17.520</td>
<td>3.927</td>
<td>0.7377</td>
<td>0.9651</td>
<td>0.542</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>18.232</td>
<td>4.152</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Role Ambiguity</td>
<td>Government</td>
<td>10.544</td>
<td>2.841</td>
<td>0.5372</td>
<td>1.712</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>11.464</td>
<td>3.041</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Role Conflict</td>
<td>Government</td>
<td>15.656</td>
<td>3.147</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>15.272</td>
<td>2.963</td>
<td>0.5579</td>
<td>0.688</td>
<td>0.42</td>
</tr>
<tr>
<td>Group Pressure</td>
<td>Government</td>
<td>12.272</td>
<td>2.683</td>
<td>0.483</td>
<td>0.447</td>
<td>0.56</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>12.488</td>
<td>2.616</td>
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</tr>
<tr>
<td>Responsibility</td>
<td>Government</td>
<td>9.128</td>
<td>2.047</td>
<td>0.3849</td>
<td>0.249</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>9.224</td>
<td>2.169</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under</td>
<td>Government</td>
<td>12.512</td>
<td>2.919</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participation</td>
<td>Private</td>
<td>3.265</td>
<td>0.5654</td>
<td>0.311</td>
<td>0.65</td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------</td>
<td>-------</td>
<td>--------</td>
<td>-------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td>Government</td>
<td>10.080</td>
<td>1.869</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Powerlessness</td>
<td>9.592</td>
<td>2.196</td>
<td>0.372</td>
<td>1.312</td>
<td>0.19</td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>11.224</td>
<td>2.351</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Poor Peer Relationship</td>
<td>11.960</td>
<td>2.440</td>
<td>0.4374</td>
<td>1.682</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>Government</td>
<td>11.424</td>
<td>2.569</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>intrinsic impoverishment</td>
<td>11.008</td>
<td>3.246</td>
<td>0.5343</td>
<td>0.779</td>
<td>0.48</td>
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<tr>
<td>Private</td>
<td>8.080</td>
<td>2.388</td>
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<tr>
<td>Low Status</td>
<td>8.584</td>
<td>2.562</td>
<td>0.4521</td>
<td>1.115</td>
<td>0.15</td>
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<tr>
<td>Government</td>
<td>9.552</td>
<td>2.431</td>
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<td></td>
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</tr>
<tr>
<td>Strenuous working conditions</td>
<td>9.640</td>
<td>2.397</td>
<td>0.440</td>
<td>0.200</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>5.920</td>
<td>1.794</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unprofitability</td>
<td>6.408</td>
<td>1.737</td>
<td>0.322</td>
<td>1.515</td>
<td>0.1</td>
<td></td>
</tr>
</tbody>
</table>

Figure 4: Mean values of occupational stress of employees based on the type of job sector

According to Table-2 and Figure 4, occupational stress was not significantly different among government and private sector employees in all areas. In terms of occupational stress in the areas of overload, role ambiguity, role conflict,
group pressure, responsibility, under participation, powerlessness, peer relationship, group pressure and powerlessness, intrinsic impoverishment, low status, Strenuous working conditions and unprofitability, the Mean+SD values for government employees are 17.52±3.92, 10.54±2.84, 15.65±3.14, 12.27±2.68, 9.12±2.04, 12.51±2.91, 10.08±1.86, 11.22±2.35, 11.42±2.56, 8.08±2.38, 9.55±2.43, 5.92±1.79, and for private sector employees are 18.23±4.15, 11.46±3.04, 15.27±2.96, 12.48±2.61, 9.22±2.16, 12.33±3.26, 9.59±2.19, 11.96±2.44, 11±3.24, 8.58±2.56, 9.64±2.39, 6.4±1.73 respectively. It suggests that occupational stress is also experienced by government and private sector employees alike, just as it is among the levels of stress experienced by males and females. Government and private sector employees are experiencing role ambiguity to an equal degree, plan their work efficiently, and understand exactly what they are expected to do, but are also dealing with high workloads. Further, both sectors’ employees experience occupational stress in some areas, including role conflict and inferiority complex. According to the findings, both groups of employee suggestions are taken into consideration, and the suggestions they provide are always solicited when dealing with administrative issues. Both sectors employ employees under extremely complex, challenging, and cumbersome conditions. Furthermore, it also pointed out that the amount paid to the government and private employees does not reflect their efforts. Consequently, both government and private sector employees experience similar levels of occupational stress.

Table-3: Mean, SD and significance of personality of employees based on the gender

<table>
<thead>
<tr>
<th>Domain</th>
<th>Gender</th>
<th>N</th>
<th>Mean</th>
<th>S.D</th>
<th>t-value</th>
<th>Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personality</td>
<td>Male</td>
<td>80</td>
<td>130.53</td>
<td>102.97</td>
<td>0.64</td>
<td>0.261</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>80</td>
<td>123.86</td>
<td>106.35</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 5: Mean values of the personality of employees based on gender

In Table-3, the significance of employee personalities based on gender is shown. In this study, it is evident that there is no difference in personality between male and female employees. The Mean+SD values of the personality of male and female employees are 130.53±102.978 and 123.86±106.35 respectively. It appears, based on the results, that male and female employees have similar personality characteristics.

Table-4: Mean, SD, Significance of personality of the employees based on the type of job

<table>
<thead>
<tr>
<th>Domain</th>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>S.D</th>
<th>t</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Government</td>
<td>80</td>
<td>128.31</td>
<td>98.12</td>
<td>0.56</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>80</td>
<td>127.65</td>
<td>96.32</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Employee personalities are categorized according to the type of job in Table-4 and Figure 6. In this analysis, it can be seen that Government and private sector employees do not exhibit any differences in personality. According to the analysis, the mean and standard deviation of the personality of government and private employees are 128.31+98.12 and 127.65+96.32, respectively. In accordance with the t -values for personality between employees, the t value is 0.56, which is not significant at p<.05 (p=0.23). There is almost no difference in personality between government and private employees, it means they have similar personality traits. In other words, government and private employees share almost similar personalities.

Table-5: Correlation between the personality and occupational stress among the employees

<table>
<thead>
<tr>
<th>Item</th>
<th>Personality</th>
<th>Occupational Stress</th>
</tr>
</thead>
</table>

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<table>
<thead>
<tr>
<th>Personality</th>
<th>1</th>
<th>0.215* (0.03)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupational Stress</td>
<td>0.215* (0.03)</td>
<td>1</td>
</tr>
</tbody>
</table>

*Correlation is significant at 0.05 level

Occupational Stress and Personality are correlated among government and private employees, as shown in table-5. A significant positive correlation exists between Personality scores and Occupational Stress scores at 0.05. This suggests that employees with similar personality characteristics suffer from occupational stress as well. As shown in the above table, there is a significant correlation between personality and occupational stress among employees with an r-value of 0.215 at 0.05 significant levels, which is quite significant.

**CONCLUSION**

The objective of this study was to assess personality and occupational stress among government and private employees. Occupational stress and personality factors among government and private employees were investigated using a descriptive survey research design. As a result of the analysis, there is no significant difference between male and female employees regarding occupational stress, and both genders feel the same level of stress at work.

Furthermore, there is no significant difference between male and female employees in Government and Private Sector Organizations when it comes to occupational stress, and employees in Government and Private Sector Organizations have similar levels of stress. Almost all employees have similar personalities and there is no significant difference in personality between men and women. As a result, there is no significant difference in personality between employees in the government sector and those in the private sector and they adopted the same personality traits.

The relationship between personality and occupational stress is significant in both government and private sector organizations. Employees in of both government and private sectors are significantly less likely to experience occupational stress which is correlated with their personality characteristic.

**LIMITATIONS OF THE STUDY**

- The study was conducted in Hyderabad and only included male and female employees from different government and private sector companies, such as those in the medical sector, banking, insurance, automobiles, etc. As part of the sample, employees from other fields would have been included.
- In this study, 160 employees from different government and private sectors were included, which makes the sample insufficient to generalize the findings.
- The samples' responses were collected using Google form, but the precise results would have been obtained with personal contact.

**FUTURE SUGGESTIONS**

- There is a potential for studies on the mental health, life satisfaction, and psychological well-being of government and non-government employees.
- It is possible to study the spiritual, intellectual, and emotional quotes of government and non-government employees for the purpose of improving their performance.
• It is possible to study the effect of organizational climate on various aspects of employee adjustment.
• The study could be replicated on a larger scale with a more representative population since it was limited to government and private employees throughout the country.

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Agriculture Footprint of Villages of Ellenabad subdivision of District Sirsa

Aman Mann

Assistant Professor Environmental Science
CMK National PG College Sirsa 125055

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Paper Publication Date: 26th September 2022

Abstract- Everything which looks Green is not always clean. Currently, Agriculture emits more greenhouse gases than all our cars, trucks, trains, and airplanes combined and are amongst the greatest contributors to global warming. This Study estimates the Footprint of Cultivation of Wheat Rice and Cotton cultivation in Villages of Ellenabad subdivision of District Sirsa. Greenhouse gas emissions from crops occur due to such activities as Soil preparation, Sowing, Disease and weed control, Nutrition for better yield, Harvesting, transport to market, and upon burning of straw/stubble. The methodology underlying the analysis of the Carbon Footprint of the Agriculture sector was based on the inputs, farm operations (soil preparation, sowing harvesting, transportation, residue burning, etc.), and the yield of the final product. The collected data was translated into CO$_2$ equivalent using conversion factors provided by various references. The benefit of this comprehensive study is prior information at hand, to plan agriculture programs, crop selections, farm practices, and selection of farm inputs in a manner that reduce adding up of greenhouse gases to the atmosphere.

I. INTRODUCTION

There is an overwhelming scientific consensus that the Earth’s climate is changing as a consequence of human activity on the planet. (American Scientific societies, 2009). According to an ongoing temperature analysis conducted by scientists at NASA’s Goddard Institute for Space Studies (GISS), the average global temperature on Earth has increased by about 0.8° Celsius (1.4° Fahrenheit) since 1880. The most important aspect of this change is that the average temperature of the Earth is rising, slowly but steadily, as a consequence of the emission of greenhouse gases (GHGs) and their increasing concentration in the atmosphere (IPCC, 2007). Of the greenhouse gases that contribute to global warming, carbon dioxide (CO$_2$) is by far the most significant (IPCC, 2001a).

Sustainable development and equity provide a basis for assessing climate policies and highlight the need for addressing the risks of climate change. Limiting the effects of climate change is necessary to achieve sustainable development and equity, including poverty eradication. (IPCC, 2014: Summary for Policymakers. In: Climate Change 2014).

Concept of Carbon footprint.

Carbon footprinting has potential as a tool for assessing and comparing GHG performances of different products along with identification of points to improve environmental efficiencies. (Aggarwal and Pandey, 2014). Carbon footprints originated as a subset of the “ecological footprint” proposed by Wackernagel and Rees (1996). Ecological footprint referred to the biologically productive land and sea area required to sustain a given human population, expressed as global hectares. According to this concept, carbon footprint was the land area that will assimilate the CO$_2$ produced during the lifetime of a person or total global population. Definitions of carbon footprints were different among different studies, and the term “carbon footprint” should reflect measure of the exclusive total amount of CO$_2$ emissions that is directly and indirectly caused by an activity or is accumulated over the life stages of a product (Wiedmann and Minx, 2007). Another indicator, derived from Carbon Footprint is “climate footprint,” which was proposed to be used, if all the GHGs were included in the calculation instead of only CO$_2$, but keeping in mind the purpose of assessing the impact of the activity on global climate (Kelly et al., 2009).

Footprints are spatial indicators (Hammond, 2007 and Global Footprint Network, 2007) therefore the carbon footprint should precisely be called a “carbon weight” or “carbon mass” (Jarvis, 2007). However, convenient calculations and widespread acceptance makes CO$_2$e mass the practical unit of carbon footprints. The term “carbon
footprint” has evolved as an important expression of greenhouse gas (GHG) intensity for diverse activities and products.

**Agriculture as a Source of GHG Emissions**

The 38 percent of total land used for agriculture is by far the largest use of land on the planet and much of the rest is unsuitable land for agriculture as it is covered by deserts, ice, mountains, tundra or cities (Ellis et al., 2010). Currently Agriculture emits more greenhouse gases than all our cars, trucks, trains, and airplanes combined is amongst the greatest contributors to global warming, mainly from methane released by cattle and rice farms, nitrous oxide from fertilized fields, and carbon dioxide from the cutting of rain forests to grow crops or raise livestock. (Foley, J. 2014)

The Green house gas emissions from Agriculture, Fisheries and forestry have almost doubled over the past fifty years and would further increase by 2050 to an additional 50% without any effort made to reduce them, the reason is that the population growth will require us to roughly double the amount of crops we grow by 2050. (FAO’s HOW2050, 2011)

The World will likely have two billion more people to feed by midcentury—more than nine billion people. To double the growth the Land use and Inputs have to be increased as the same Area of Agriculture land and the same amount of inputs will not lead to greater production (FAO, 2014)

According to latest CGIAR (Consultative Group on International Agricultural Research) report the global food system, including fertilizer production to transportation, food storage and packaging is responsible for up to one-third of all human-caused greenhouse-gas emissions (Gilbert - Nature Journal, 2012). Agriculture accounted for an estimated emission of over 5.3 billion tonnes CO₂ equivalent in 2011, a 14 percent increase. The increase occurred mainly in developing countries, due to an expansion of total agricultural outputs. (FAO, 2014). Despite large annual exchanges CO₂ between the atmosphere and agricultural lands, the net flux is estimated to be approximately balanced, with CO₂ emissions around 0.04 GtCO₂/yr only (emissions from electricity and fuel use are covered in the buildings and transport sector, respectively) (IPCC 4th assessment report, 2007).

![Figure - Contribution of Agriculture to GHG Emissions in India in 2007 (MOEF, 2010)](image)

**Need for Study**

Haryana is an agrarian state, In Haryana, Sirsa is extensively into Agriculture. As there are no reported studies on Carbon Footprint from Agriculture sector in Sirsa district of Haryana, hence present study was taken up in one of the Tehsils. Sirsa has 4 Tehsils. Ellenabad is one of these. Ellenabad is on the forefront of Agriculture productions due to various factors such as Rich Soil, Good Source of Ground Water, Good Sources of Canal and River Water, Diverse Culture, Varied Agricultural practices in different villages. Hence Ellenabad was selected as Study area for estimation of Carbon footprint from Agriculture.

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Carbon Footprint being a quantitative expression of GHG emissions from an activity helps in emission management and evaluation of mitigation measures (Carbon trust, 2007b).

Agriculture is one of the major contributors to anthropogenic emissions of Greenhouse gases, so the quantification of different agricultural practices is essential for identification of more sustainable practices. Carbon footprinting has potential as a tool for assessing and comparing GHG performances of different agricultural products along with identification of points to improve environmental efficiencies. (Pandey and Madhoolika, 2011)

II. STUDY AREA

This study focuses on the cultivation of Wheat, Rice, Cotton (Bt. Cotton as well as Desi Cotton/the non hybrid in villages of Ellenabad Tehsil of district Sirsa, Haryana. This study considers emissions in regions well fed with river and canal water as well as the one which is solely dependent on pumping of ground water for irrigation. The pattern of crop cultivation is different for both the regions i.e. Wheat and Rice cultivation in well irrigated areas and Wheat and Cotton in the areas which are not served by River Ghaggar or Canals. Rice straw and wheat stubble is normally left in the fields after harvest, and most of it is burned.

Greenhouse gas emissions from crops occur due to such activities in agriculture sector: Soil preparation, Sowing, Disease and weed control, Nutrition for better yield, Harvesting, transport to market and upon burning straw/stubble.

Ellenabad Tehsil

Ellenabad is a Tehsil in the Sirsa District of Haryana. According to Census 2011 information the sub-district code of Ellenabad block is 00392. It has 30 villages.

Ellenabad is located between 29°34’ : 29°51’ North latitudes and 74°87’ : 75°55’ East longitudes. Geographical area of 546.96 Sq. Km (Distt. Census Handbook Sirsa 2011)

The present study was carried out in villages of Ellenabad Tehsil of District Sirsa. Farmers of these villages were randomly selected, after casual interaction, some specific questions related to their own farm practices were asked. The objective of the study was not just to determine the per acre, per crop, carbon footprint in Ellenabad Tehsil, but also to know the cropping pattern and farm practices adopted by farmers of the Ellenabad Tehsil. This Tehsil has a variety of cropping pattern especially in Kharif season; care was also taken to ask questions from farmers who had large land holdings as well as from small and marginal farmers.

List of Villages in Ellenabad Tehsil


Methodology Analysis

The methodology underlying the analysis of the Carbon Footprint of Agriculture sector was based on the inputs, farm operations (soil preparation, sowing harvesting, transportation, residue burning etc.) and the yield of the final product. These characteristics are further used to estimate the energy use and the associated CO₂ emissions. To obtain the objectives of the study, the study was divided into three parts:

- Survey
- Collection of data
- Estimation of GHGs.
Survey
A survey was conducted in 28 villages of Ellenabad Tehsil of District Sirsa. There are 30 villages in Ellenabad Tehsil.

The questionnaire consisted questions related to farm inputs, Fossil fuel consumption, electricity use and other related farm activities. Open ended questions were used so that the farmer can answer freely without any restriction. All the questions were asked to know the consumption of inputs (Diesel Fuel, Electricity for Tube-wells, Fertilizers, and Pesticides) per acre for each crop they grow.

Collection of Data
The basis for the calculation
- The previous year data.
- Amount of main product or the Crop yield.
- Amount and type of raw materials used (like green manure, brown Manure etc)
- Amount of Agro-chemicals used:
  - Amount of pesticides
  - Amount of Fertilizers
  - Diesel Consumed
  - Electricity Consumed

Data gathering from databases and literature
The following sources were used:
- Official statistical data from government bodies
- Scientifically peer-reviewed literature
- Emission factors of fertilizers (emissions from production plus field emissions), Pesticides, diesel used in agricultural machinery or for transport, Electricity consumed.

Estimation of embedded GHGs
The collected data was translated into CO$_2$ equivalent using conversion factors provided by various references. The unit of carbon footprint varies according to entity considerations. Carbon footprint was calculated on per crop season basis. Carbon footprint of various agricultural inputs was calculated in the following manner:

Emissions from Agrochemicals
To estimate the GHG emissions from Agrochemicals viz. Fertilizers and Pesticides (includes fungicides, herbicides insecticides etc.) The following methods were used:

For calculating the emissions from Fertilizers (EM$_{Fertilizers}$):
- **Step 1**: Determine the type fertilizer used
- **Step 2**: Determine the quantity of fertilizer used per acre
- **Step 3**: Calculate using the Formula below

\[
EM_{Fertilizers} = \text{Fertilizer amount (Kg)} \times \text{Emission Factor}_{\text{Fertilizer (Production + use)}} \times \text{Ref.}
\]

(ISCC 205)

<table>
<thead>
<tr>
<th>Fertilizer</th>
<th>Emission Factor</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urea</td>
<td>1.118</td>
<td>IPCC, 2007</td>
</tr>
<tr>
<td>DAP</td>
<td>2.03</td>
<td>IPCC, 2007</td>
</tr>
<tr>
<td>Zinc Sulphate</td>
<td>1.9978</td>
<td>IPCC, 2007</td>
</tr>
<tr>
<td>NPK</td>
<td>1.61</td>
<td>IPCC, 2007</td>
</tr>
</tbody>
</table>

Calculating GHG emissions from Pesticides (EM$_{Pesticides}$)
- **Step 1**: Determine the type of Pesticide
- **Step 2**: Determine the quantity used
- **Step 3**: Calculate the GHG emissions from that pesticide using the formula
EM Pesticides = Input amount * Emission Factor Input (Production + use)  
(ISCC 205)

Table 2 Farm Chemicals CO₂ emission coefficients for per Kg of product used

<table>
<thead>
<tr>
<th>Type</th>
<th>Emission Factor</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herbicides</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,4-D</td>
<td>1.7</td>
<td>Lal, 2004</td>
</tr>
<tr>
<td>Butachlor</td>
<td>5.6</td>
<td>Lal, 2004</td>
</tr>
<tr>
<td>Glyphosate</td>
<td>9.1</td>
<td>Gaillard et al., 1997</td>
</tr>
<tr>
<td>Paraquat</td>
<td>9.2</td>
<td>Lal, 2004</td>
</tr>
<tr>
<td>Pretilachlor</td>
<td>5.5</td>
<td>Gaillard et al., 1997</td>
</tr>
<tr>
<td>Pendimethalin</td>
<td>1.1</td>
<td>Gaillard et al., 1997</td>
</tr>
<tr>
<td>Algrip Metsulfuron</td>
<td>21.14</td>
<td></td>
</tr>
<tr>
<td>Leader Sulfosulfuron</td>
<td>2.91</td>
<td></td>
</tr>
<tr>
<td>Topik Clodinafop</td>
<td>.888</td>
<td>Lal, 2004</td>
</tr>
<tr>
<td>Fungicides</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tebuconazole</td>
<td>1.68</td>
<td>Gaillard et al., 1997</td>
</tr>
<tr>
<td>Propiconazole</td>
<td>4.79</td>
<td>Nalley et al., 2012</td>
</tr>
<tr>
<td>Insecticides</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cypermethrine</td>
<td>11.7</td>
<td>Lal, 2004</td>
</tr>
<tr>
<td>Lambda-cyhalothrine</td>
<td>7.02</td>
<td>Gaillard et al., 1997</td>
</tr>
<tr>
<td>Phorate (Thiamate)</td>
<td>4.2</td>
<td>Lal, 2004</td>
</tr>
<tr>
<td>Acephate</td>
<td>3.55</td>
<td>Green, 1987</td>
</tr>
<tr>
<td>Cartap</td>
<td>9.1</td>
<td>Lal, 2004</td>
</tr>
<tr>
<td>Chloropyriphos</td>
<td>15.37</td>
<td>Green, 1987</td>
</tr>
<tr>
<td>Imidacloprid</td>
<td>1.141</td>
<td>E. Audsley et al., 2009</td>
</tr>
<tr>
<td>Meothrin/Fenpropathrin</td>
<td>0.0017</td>
<td>Garthwaite et al., 2006</td>
</tr>
<tr>
<td>Actara - thiamethoxam</td>
<td>1.1</td>
<td>Lal, 2004</td>
</tr>
<tr>
<td>Polo/diafenthiuron</td>
<td>5.4</td>
<td>Lal, 2004</td>
</tr>
<tr>
<td>Regent</td>
<td>5.7</td>
<td>Lal, 2004</td>
</tr>
<tr>
<td>Acetamiprid</td>
<td>18</td>
<td>Gaillard et al., 1997</td>
</tr>
<tr>
<td>Triazophos</td>
<td>15.36</td>
<td>Gaillard et al., 1997</td>
</tr>
<tr>
<td>Carbaryl</td>
<td>3.1</td>
<td>Lal, 2004</td>
</tr>
</tbody>
</table>

Emissions from Diesel
To estimate the GHG emissions from use of diesel as fuel in farm machinery, the following method was used:

Calculating the emissions by Diesel Consumption by farm machinery (EM Diesel)

- **Step 1:** Determine the type and number of farm operations
- **Step 2:** Diesel used in each operation
- **Step 3:** Calculate emissions from Diesel consumption using the formula below:

EM Diesel = Diesel amount (L) * Emission Factor Diesel (Production + use)  
(ISCC 205)

Diesel consumed by Tractors, Combined Harvesters, levelers, cultivators was added to get a total of diesel consumption by farm machinery.
Emission factor diesel = 2.734 Kg CO₂/l (Emission Factor development for Indian Vehicles, Central Pollution control board, Government of India, August, 2007)

Emissions from Electricity
To estimate the GHG emissions from use of Electricity for Pumping ground water for Irrigation, the following Method was used:

**Calculating GHG emissions from use of Electricity in pumping water (EM\text{Electricity})**

- **Step 1**: Determine the Power of electric motor in a tube-well in hp
- **Step 2**: Determine the running time of motor in days and hours
- **Step 3**: Calculating the GHG emissions from pumping water using an electric motor by formula:

\[ \text{EM}\text{Electricity} = \text{Electricity (KWH)} \times \text{Emission Factor Electricity} \]

(ISCC 205)

(Emission Factor Electricity = 0.82 Kg CO\textsubscript{2} /KWh (CO\textsubscript{2} baseline database for the Indian Power sector, user guide, Version 5, November 2009. Emissions are considered at the power generation point only since estimations at the end use point depends on the number of variable factors. This also gives the most conservative estimation. Formula used to convert to KWh:

Power of motor in hp * Running time (Running time in days and hours is converted as: no. of days * no. of Hours the motor runs each day)

To estimate the GHG emissions from use of diesel as fuel in farm machinery, the following formulae were used:

**Calculating the total GHG emissions (EM) from cultivation (EM\text{Cultivation})**

- **Step 1**: Determine emissions from each characteristic to cultivate a crop:
  - Emissions from Fertilizer
  - Emissions from pesticides
  - Emissions from Diesel consumption.
  - Emissions from Electricity use in pumping water
- **Step 2**: Determine Total yield of the crop
- **Step 3**: Calculate using the formula below:

\[ \text{EM}\text{Cultivation} = \text{EM}\text{Fertilizer} + \text{EM}\text{Diesel} + \text{EM}\text{Electricity} + \text{EM}\text{pesticides} / \text{Crop yield} \]

(ISCC 205)

III. RESULTS AND DISCUSSIONS

Agriculture is the systematic raising of useful plants and livestock under the management of man. (Rimando, 2004). The need for food poses one of the biggest dangers to the planet. Agriculture is among the greatest contributors to global warming, emitting more greenhouse gases than all the cars, trucks, trains, and airplanes combined. Agriculture is an avoidable source of Green house gases as we need food for survival. As the population grows the inputs in Agriculture will increase, leading to addition of Green house gases to the Planet and if the yield is not meeting the needs the effect would be greater as we will tend to grow more crops. For most of history, whenever we’ve needed to produce more food, we’ve simply cut down forests or ploughed grasslands to make more farms, consuming more water; farming is the thirstiest user of precious water supplies (Foley, J. 2015).

The overall goal of estimation of Agriculture’s Carbon Footprint is to obtain a comprehensive picture of the contribution of Agriculture to Global warming. The benefit of this comprehensive study is prior information at hands, to plan agriculture programs, crop selections, farm practices, and selection of farm inputs in a manner which reduce adding up of the green house gases to the atmosphere.

The study carried out in the villages of Ellenabad Tehsil of District Sirsa, Haryana, provides information on the farm practices, the produce at these farms, and the related Green House Gas emissions. A survey of 28 farmers, each farmer from a different village of Tehsil Ellenabad was carried out. The variation in carbon foot print across different crops, different crop seasons was explored.

To attain the objective of the study the analysis of the carbon footprint of agriculture was based on the inputs, farm operations and the yield of the final product. These characteristics are further used to estimate the energy use and the associated CO\textsubscript{2} emissions.

CO\textsubscript{2} is emitted from on-farm and off-farm operations like use of machines, production of fertilizers and pesticides. Farm operations and off-farm practices such as production of fertilizers and biocides (Pathak et al., 2012)
**GHG Emissions from use of Fertilizers**

A fertilizer is any material of natural or synthetic origin that is applied to soils or to plant tissues to supply one or more plant nutrients essential to the growth of plants.

The use of fertilizers is very important in almost every crop to maintain soil fertility, improve crop development, yield and crop quality. Fertilizers are the chief source of plant nutrients. The use of fertilizers, especially mineral fertilizers had been a big catalyst in the happening of Green Revolution.

GHG emissions from agriculture originate mainly in the form of N$_2$O from fertilizer management practices (Le Mer and Roger 2001) Nitrogenous fertilizers are the source of N$_2$O in fertilized soils, whereas the indigenous N contributes to its release in unfertilized soil. (Pathak et al., 2012)

National GHG inventory guidelines provide average and default emission factors for production of fertilizers, GHG emissions from soil under different irrigation, and manure applications etc. In most of the studies, tier3 emissions, particularly of fertilizer application alone, contributed from 45 to 85 % of the total yield scaled carbon footprints (Gan et al. 2011a, b, 2012), whereas changes in soil carbon could turn the carbon footprints of wheat cultivation negative (Pathak et al., 2012).

In villages of Ellenabad Tehsil emissions from Nitrogenous fertilizers (Urea and DAP) in wheat ranged from 81 to 190 Kg CO$_2$/Acre (Table 4.4.1). In rice crop emissions from fertilizers were ranged from 40.6 – 167.7 Kg CO$_2$/Acre (Table 4.1.2). Cotton contributed in the range 50.75 - 139.75Kg CO$_2$/Acre

<table>
<thead>
<tr>
<th>Village</th>
<th>Quantity Urea</th>
<th>Footprint</th>
<th>Quantity DAP</th>
<th>Footprint</th>
<th>Quantity Zinc</th>
<th>Footprint</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amritsar</td>
<td>150</td>
<td>167.7</td>
<td>50</td>
<td>122.98</td>
<td>10</td>
<td>19.978</td>
<td>310.66</td>
</tr>
<tr>
<td>Beharwala</td>
<td>150</td>
<td>167.7</td>
<td>40</td>
<td>81.2</td>
<td>-</td>
<td>-</td>
<td>248.9</td>
</tr>
<tr>
<td>Bhuratwala</td>
<td>150</td>
<td>167.7</td>
<td>50</td>
<td>122.98</td>
<td>-</td>
<td>-</td>
<td>290.68</td>
</tr>
<tr>
<td>Budhimari</td>
<td>125</td>
<td>139.75</td>
<td>50</td>
<td>122.98</td>
<td>20</td>
<td>39.96</td>
<td>302.69</td>
</tr>
<tr>
<td>Dhol Palia</td>
<td>100</td>
<td>111.8</td>
<td>40</td>
<td>81.2</td>
<td>-</td>
<td>-</td>
<td>193</td>
</tr>
<tr>
<td>Ellenabad</td>
<td>125</td>
<td>139.75</td>
<td>40</td>
<td>81.2</td>
<td>10</td>
<td>19.978</td>
<td>240.93</td>
</tr>
<tr>
<td>Himayunkhara</td>
<td>110</td>
<td>122.98</td>
<td>40</td>
<td>81.2</td>
<td>10</td>
<td>19.978</td>
<td>224.16</td>
</tr>
<tr>
<td>Karamsana</td>
<td>125</td>
<td>139.75</td>
<td>40</td>
<td>81.2</td>
<td>-</td>
<td>-</td>
<td>220.95</td>
</tr>
<tr>
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**Pesticides**

Pesticides, Fungicides and Herbicides (aka Weedicides) is another set of important and widely used farm input apart from Fertilizers. Pesticides and subclass Fungicides and Herbicides are clubbed together in this study, as the primary role of these three components is plant protection.

Pesticides are substances meant for attracting, seducing, and then destroying, or mitigating any pest. They are a class of biocide. The most common use of pesticides is as plant protection products (also known as crop protection products), which in general protect plants from damaging influences such as weeds, plant diseases or insects. This use of pesticides is so common that the term pesticide is often treated as synonymous with plant protection product, although it is in fact a broader term. Fungicides are biocidal chemical compounds or biological organisms used to kill or inhibit fungi or fungal spores. Fungi can cause serious damage in agriculture, resulting in critical losses of yield, quality, and profit. Fungicides can either be contact, transaminar or systemic.

Herbicides, also commonly known as weedkillers or weedicides, are pesticides used to kill unwanted plants. Selective herbicides kill specific targets, while leaving the desired crop relatively unharmed. Non-selective kill all kind of plants.

Pesticide manufacturing represents about 9% of the energy use of arable crops. Pesticide manufacturing represents about 3% of the 100-year Global Warming Potential (GWP) from crops (E. Audsley et al., 2009) The most well-established source of information on pesticide manufacturing energy is “Green” (1987) Process energy is the energy required in the manufacturing process to produce the chemicals such as heating, creating pressure and cooling, plus the energy needed to create and transmit that energy to the manufacturing process.

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**Table 7** Insecticide in Wheat
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Table 8 Fungicide in Wheat
Table 9 Herbicides in Rice

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Table 10 Insecticides in Rice

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<th>Thiamate Qt (Kg)</th>
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Table 11 Fungicide in Rice

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GHG Emissions from Electricity used for pumping Ground water

The two primary sources of energy for ground water pumping are electricity and diesel (Malik R, 2009) In Farm operations ground water is mostly pumped using a tube-well that runs on electricity. This leads to CO₂ emissions. GHG emissions from irrigation water pumped by tube-well for Wheat crop was in the range 3670 - 6606 Kg CO₂e/acre. Emissions from Rice were in the range 3915 - 14681 Kg CO₂e/acre. Emissions from Bt. Cotton crop were in the range 3915 - 7830 Kg CO₂e/acre (Table 7)
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**GHG emissions from use of Diesel consumed by Farm Machinery**

Machinery and equipment used in various farm operations like soil preparation, sowing, spraying of pesticides, harvesting and transport of the crop to the market is powered by Diesel as fuel. CO₂ Emissions from the use of diesel in this region ranged from 54.68 - 76.55 Kg CO₂ in Wheat, 60.15 - 73.82 Kg CO₂ from Rice and 49.21 - 73.82 Kg CO₂ from Cotton crop.

**Table 13 GHG emissions from Diesel consumption in farm operations in CO₂ eq.**

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<th>Footprint (KgCO₂e)</th>
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GHG emissions from Cultivation of crops

In a general context, in agriculture, cultivation means tillage, this refers to any of the kinds of soil agitation. But in this study it also includes all the farm operations that need use of men and machinery, for different mechanical actions on soil before and after sowing, on plants, on harvesting, such as tractor driven ploughs, disk harrows, Rotavators, levellers, Ridgers, Mulchers, puddling for preparation of rice paddies, tillage in standing crop to remove weeds, harvesting by use of combined harvesters reaper, thrashers, reapers, power sprayers, planters, seed drills etc. and transportation to the nearest market mostly using a tractors that draws a trolley. These all factors are summed up and are divided by the yield to find out emissions from cultivations. Emissions from cultivation of wheat were in the range 1.86 – 4.86 KgCO\(_2\)/Acre. (Table 9) Emissions from Rice cultivation were in the range 1.50 – 6.82 KgCO\(_2\)/Acre. (Table 10) Emissions from Cotton (Bt. Cotton and Desi Cotton) cultivation were in the range 5.82 – 15.59 KgCO\(_2\)/Acre.

Table 14 GHG Emissions from Cultivation of Wheat
### Table 15 GHG Emissions from Cultivation of Rice Crop

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<th>Fertilizers (KgCO$_2$e)</th>
<th>Diesel (KgCO$_2$e)</th>
<th>Electricity (KgCO$_2$e)</th>
<th>Yield (Kg)</th>
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Table 16 GHG Emissions from Cultivation of Cotton Crop

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<td>450</td>
<td>12.34</td>
</tr>
<tr>
<td>Kesopura</td>
<td>10.29</td>
<td>213.53</td>
<td>62.88</td>
<td>7340.64</td>
<td>1100</td>
<td>6.93</td>
</tr>
<tr>
<td>Khari Surera</td>
<td>12.81</td>
<td>106.65</td>
<td>54.68</td>
<td>6851.26</td>
<td>700</td>
<td>10.06</td>
</tr>
<tr>
<td>Kumbhthala</td>
<td>2.33</td>
<td>213.3</td>
<td>68.35</td>
<td>7340.64</td>
<td>1200</td>
<td>6.35</td>
</tr>
<tr>
<td>Dholpalia</td>
<td>32.48</td>
<td>81.28</td>
<td>49.21</td>
<td>6851.26</td>
<td>450</td>
<td>15.59</td>
</tr>
<tr>
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<td>8.47</td>
<td>106.55</td>
<td>71.08</td>
<td>5872.51</td>
<td>900</td>
<td>6.73</td>
</tr>
<tr>
<td>Mithanpur</td>
<td>10.29</td>
<td>213.53</td>
<td>68.35</td>
<td>6117.2</td>
<td>800</td>
<td>8.01</td>
</tr>
<tr>
<td>Mithi Surera</td>
<td>10.29</td>
<td>213.53</td>
<td>68.35</td>
<td>4404.38</td>
<td>500</td>
<td>9.39</td>
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<tr>
<td>Moosli</td>
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<td>233</td>
<td>71.08</td>
<td>5505.48</td>
<td>1000</td>
<td>5.82</td>
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<tr>
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<td>109.23</td>
<td>49.21</td>
<td>5872.51</td>
<td>400</td>
<td>15.13</td>
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<td>Pohraka</td>
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<td>172.7</td>
<td>54.68</td>
<td>7340.64</td>
<td>1150</td>
<td>6.59</td>
</tr>
<tr>
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<td>6.89</td>
<td>172.7</td>
<td>73.82</td>
<td>7830.02</td>
<td>1100</td>
<td>7.35</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Maxima</td>
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<td></td>
<td></td>
<td>15.59</td>
</tr>
<tr>
<td>Minima</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5.82</td>
</tr>
</tbody>
</table>

IV. CONCLUSION

On the basis of the findings of this study, following conclusions were drawn.

There are broadly two types of crop rotations. One is Wheat-Rice, chiefly in areas that are fed by Ghaggar Water Services that carries flood water, Bhakra Canal System, and tube-wells, these areas have good irrigation facilities; and the other is Wheat-Cotton, chiefly in areas where there is deficiency of irrigation facilities.

Wheat is grown under aerobic conditions; therefore soil emission of CH₄ is zero. From cultivation of wheat the emissions were found to be in the range 1.86 ~4.78 gCO₂e. Emission of N₂O-N from soils due to fertilizer application, the highest contributor other than electricity is Fertilizer with average footprint as: 81.2~167.7 KgCO₂e. (Electricity is a high contributor, especially the part of electricity that is generated by thermal projects) but it is a common factor amongst all the crops.

In rice cultivation the emissions were found to be in the range 1.50~6.82 KgCO₂e. Soil is the major contributor of methane as Rice is grown in flooded fields (Paddy). In this region Rice cultivation is mostly by Transplantation of Rice plants grown in a nursery (TPR) which contributes to more GHG emissions due to continuous flooding of Rice fields. The Direct seeded Rice (DSR) has comparatively lesser emissions in comparison to the TPR method, (Pathak et. al, 2009), but this method (DSR) has not been adopted by rice growers of the study area yet.

Cotton emissions were found to be in the range 5.82~15.59 KgCO₂e. There are no emissions from residue burning in Cotton crop, as cotton sticks are never burnt on the field and are either used as fire wood for cooking in villages or sold to wood and other industries. Yield is an important factor/divisor in the overall footprint from cultivation of a crop. Higher the yield, lesser the carbon footprint. It implies that high yield varieties or farm practices that lead to higher yield help in lowering Carbon Footprint.

Farm practices were almost same amongst the farmers with small land holdings and the ones with large land holdings the difference is only in the quantity of any form of input specifically Agro chemicals and Diesel consumption.

REFERENCES


AUTHORS

First Author – Aman Mann, Assistant Professor Environmental Science, CMK National PG College Sirsa 125055
Brief Analysis of “Coffee Can Investing” approach

Parth Tiwari *, Sanjay Tomar **

* Welham Boys School, Dehradun, India
** Professor of Finance & Investment, FOSTIIMA, New Delhi, India

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I. SYNOPSIS

Financial experts agree that while people have much more money today than they did generations ago, the amount of knowledge on how to manage that money hasn’t kept pace- not at all (Maura Fogarty, 2012). People in India usually look for traditional ways to store wealth, for example, Real estate, Gold, FDs, etc.

Indians usually Investment less in Equity, Bonds, Cryptocurrency, etc; where they can generate possibly higher returns. Then why don’t they? Well, this is because of fear. Surprisingly, this phenomenon is not common only in India but all over the world; I call it ‘poor dad syndrome’. According to this syndrome, people are driven by 2 emotions fear and greed, fear of losing the wealth they have gained and greed to gain more wealth. In a typical Indian household, as the income rises, the expense also increases along with it. They eventually, end up spending more and create liabilities ( as you can see in IMG2). Therefore, rather than increasing spending, it’s better to seed assets to your balance sheet. This can be done through, investing in equity. Long ago, there was a famous technique popularly known as COFFEE CAN INVESTING, which was introduced by Robert Kirby in the 1980s; this idea was further presented and documented in the book, “Coffee Can Investing: The Low-Risk Road to Stupendous Wealth” written by Saurabh Mukherjea, concerning Indian
Stock market. The purpose of this research is to elaborate on how successful is “Coffee can Investment strategy”? How over the 5 years from 2017-to 2022, stocks under the Coffee can basket have performed.

II. INTRODUCTION

Investment is an important tool to create seed assets in your balance sheet and achieve financial independence. By definition, Investment is “the dedication of an asset to attain an increase in value over a while. Investment requires a sacrifice of some present asset, such as time, money, or effort. In finance, the purpose of investing is to generate a return from the invested asset.” There are different ways through which people can invest like an index fund, mutual funds, small case portfolios or equity. In investing, people use different methods, techniques, or options to invest. Some investors look for past performances of the company, while others just care about the fundamentals of the company; many of them are also influenced by external forces such as economic factors and policy structures adopted by government and private industry, and decisions are ultimately made by individuals. In this research paper, we analyze a famous technique for buying a basket of stock, the Coffee Can Investment strategy. This strategy for introduced by Robert Kirby, but what we currently define it, is a modified version of Robert’s initial strategy. “coffee can investing” refers to “buy and forget” approach to investing in the stock markets. It is a low-risk method to create wealth by purchasing a particular stock quantity at a specific price and then holding them for at least ten years to generate high returns. Investors can choose to buy high-performing equity stocks and forget them for a lengthy period. This strategy can provide very high returns but selecting the right stocks is essential. In India, Saurabh Mukherjea, Rakshit Ranjan, and Pranab Uniyal authored a book, “Coffee Can Investing: The Low-Risk Road to Stupendous Wealth.”

This book is a case study of 2 families’ investment journeys, Mr Sanghavi and Mr Talwar. This book charts the rise and fall of their investment journey, and they end with little to no investment after the market crash of 2008 and the real estate correction of 2013. Now both were close to their retirement and they were supposed to plan their retirement, therefore they got in touch with a senior relationship manager at a reputed wealth management company, Nikhil Banerjee. He met with both separately, calculated their net worth, enquired about their long-term financial goals and charted the amount of capital required to fulfil these goals. Later part of the book, he showed them that if they had invested their money in Sensex, debt, gold and cash, to forget about these holdings, and how much returns they could have generated ( in IMG3).
Concerning their financial goals, he suggested they invest in equity, for that he told them to follow the coffee can investment technique and create a coffee can portfolio. In this technique, they invest in 10-25 high-end stocks, for that, they set some parameters to find these stocks. The following were the parameters:

- Companies with a Market capitalization of 1000 crores and above.
- Companies with sales growth of 10% or above for consecutive 10 years or more.
- Companies with a Return of capital employed of 15% or above for consecutive 10 years or more.
- Brand Value of the company
- The competitive advantage of a company or market share.

By using the following filter, he created a basket of 12-14 stocks (as shown in IMG5). Suggested them to hold these stocks for 10 years for maximum returns. Today, we are living in 2022 which means it is almost 5 years for the coffee can portfolio. The purpose of the research paper is to analyze the performance of each stock listed below quarterly, half-yearly and annually. This paper will study each company thoroughly and conclude the effectiveness of the portfolio and draw conclusions about the Coffee can Investment strategy and Coffee can portfolio.

(please pr)

**Objectives**
This study aims to achieve the following objectives:

- To understand the financial satisfaction of an individual, opting to invest in a Coffee can portfolio.
- To understand the rationale behind the *coffee can investment* and to evaluate the efficiency of the following
- To study the companies in the coffee can portfolio, and review their performance on various parameters.
- To evaluate the coffee can portfolio, and simulate returns in real time.
III. LITERATURE REVIEW

They talk about how different securities have different risks attached to them and how the diversification of securities in the portfolio can help not only minimize the risk factor but also maximize the return of the portfolio as the risks involved in some securities might not be involved in the other securities. They have used the Sharpe and Treynor model to evaluate portfolios and also to arrive at the optimal portfolio. Further, they examine the patterns of consistency between Sharpe and Treynor's models and evaluate the efficiency of the Sharpe Single Index model to an optimum portfolio. The period that they have chosen for the study is April 2004 to March 2009 which is 5 years. They conclude that there is no pattern of consistency between the Sharpe and Treynor's Models for efficient securities identification However, the Sharpe Single Index model was able to successfully reach the optimum portfolio by diversifying almost all the unsystematic risk. (Dr. Taneja, Y. P., & Bansal, S. (2011). Efficient Security Selection: A Study of Portfolio Evaluation Technique)

This paper tells us that even though the GDP of India has increased almost three times over the past decade which has resulted in the market capitalization of the Indian companies increasing almost 8 times the development of the capital market has been uneven and the penetration has been limited. This paper tries to study the various investment options preferred by the investors in Mumbai, and also the preference of investors in Mumbai when it comes to debt and equity when compared to the other investment avenues available in the market. The data used for this study is primary data and the research design is descriptive. The data analysis is done by comparing the Age groups to Annual income, Familiarity with investment markets, and expected investment returns, whilst also comparing occupation to Investment Objective, Attitude of Investing to several years funds are blocked, Expected return compared to preferred Avenue of equity, preferred Avenue of bank deposits, preferred avenue of mutual funds, and lastly, Funds blocked compared to expected return. The Chi-Square test has also been used in the analysis. The study was able to find that people mostly prefer Bank Deposits as a secured form of investment. (Dr Nilesh, K. (2017, January). A Comparative Study of Investor Preferences Concerning Debt and Equity while Constructing a Portfolio in Mumbai Region)

Their research revealed at least three important points. The first is that the simulated results for skillful managers, defined as a Sharpe ratio of 0.5, showed wide variation for a five-year simulation. This is a natural consequence of variation but underscores that skillful managers will have periods of underperformance. As the author stress, there’s a big difference between the expected Sharpe ratio and the realized Sharpe ratio. The realized ratio does surface for a large sample of funds, or a single fund over a long period, but individual funds do see large divergences between expected and realized Sharpe ratios over multi-year periods. (March 2011 Legg Mason Capital Management The coffee can approach )

It is suggested to an investor make an informed decision about the stocks that they hold in their portfolio and it is also suggested to an investor to first learn about what a Coffee Can Portfolio is and invest in a Coffee Can Portfolio according to their Medium-term to Long term goals in life such as buying a house, a car or even retiring early. Since the returns that are given by a Coffee Can Portfolio are relatively higher than the other portfolio, Mutual Funds or Asset Classes and the un-systematic risk involved is almost diluted to nil, the investor will be able to easily achieve their Medium-term to Long term goals without

This paper starts by saying that the expected rate of return varies from person to person depending on different factors such as age, income level of investor, nature of the occupation, short-term, middle-term and long-term career goal, the percentage of income the investor prefers to save per annum, the risk appetite of the investor, and selection criteria of different investable tools. It says that Researchers across the world have developed several models, tools and techniques such as Fundamental Analysis, Technical Analysis, Efficient Market Hypothesis, and different portfolio optimization models but at the end of the day there is no sure shot way of guaranteeing results because of the dynamic nature of the market and the huge volatility in the market. It then talks about the portfolio management services that are available now to people who lack the technical knowledge for investing their idle funds. However, the challenge that these portfolio management service providers face is providing returns which are higher than the inflation rate in the market. This paper provides a new direction to which extent the portfolio can be immunized against the risk and uncertainties of the market. Dhar, S. (2013). Portfolio Management Strategies: Its Importance and Challenges under the Changed Circumstances.

Research Gap

The majority of these studies have failed to provide a comprehensive analysis of the companies in the coffee can portfolio and its comparative analysis of returns compared to Nifty 50 or Sensex. Additionally, these studies and hypotheses target the importance of financial literacy and the growth of the economy at large. Lastly, there is no such research analyzing the performance of coffee can portfolio, as suggested by Saurabh Mukherjea, Rakshit Ranjan, and Pranab Uniyal in their book, “Coffee Can Investing: The Low-Risk Road to Stupendous Wealth,” The current study aims to provide a comprehensive analysis of the coffee can portfolio, 5 years after it was introduced to Indian Market; provide statistical data comparing it with index funds such as Nifty 50 and Sensex.

IV. RESEARCH DESIGN

Statement of Problem

The problem here is that people don’t trust the equity market. They correlate investing in the equity market to pure gambling. They fail to understand, that investing in the equity market is a calculated risk to make money. We all want to make money but without taking risks; this is not the way the real world works rather those who dare to take risks, are the ones having the better chance of surviving this world.

Furthermore, people are scared of risks or market crashes but they fail to realize that after every crash there is a bull run. If the following Sensex chart (IMG5) was analyzed carefully after every market crash or correction, there was a bull run which followed it. For instance, after, the Harshad Mehta 1992 scam, the late 1990s dot-com-crash, the 2008 recession or during covid, the markets adjusted. It took the market approximately 9 months to reach pre-covid levels. Furthermore, it reached new highs touching the 60,000 mark once in 2021.

The fact is the longer people hold their positions in the market, they stand more chance of making money for instance the following graph
(IMG6) from Coffee Can Investing: the low-risk road to stupendous wealth shows the probability of making returns according to the holding period. This graph clearly shows that the longer investor holds a portfolio the more chance of making profits stand. Every minute, hour, day, week, month, quarter or year, investors hold their portfolios. They stand a better chance of making profits. The statement problem is that people fail to realize that financial markets are like a chicken with golden eggs; but to make money, a strategy is required. Many Mutual funds are not able to beat indices such as Sensex or NIFTY 50 which has brought into question the high commissions that they charge which are as high as 2 per cent whilst providing returns which outperform the Sensex by only 2-5 per cent. This paper will analyze a better alternative for investors.

**Sources of Data**

- The data collected and used in this research paper is secondary data.
- The data has been collected from various websites to perform the analysis by comparing the returns of the Mutual Funds, Coffee Can Portfolio, NIFTY 50 and Sensex.

**Hypothesis**

- Coffee Can Investing does not give higher returns than Other Asset Classes or Investments
- Coffee Can Investing gives higher returns than Other Asset Classes and Investments
Limitations of the Study

- There is a lack of articles and research papers that are relevant to the topic.
- There are very limited tools which can be used for analyzing this type of data.
- The scope of the study is restricted to the Equity market.

V. Data Analysis

Coffee can Portfolio 2017-2022

The table below shows the coffee can portfolio, as per Coffee Can Investing: the low-risk road to stupendous wealth, by SAURABH MUKHERJEE, RAKSHIT RANJAN and PRANAB UNIYAL. It illustrates an imaginary portfolio of a basket of selected stocks (pg no 76) with their change in price, changes in market capitalization, contribution to the start of the portfolio and contribution to the end of the portfolio.

NOTE: The portfolio designed below is valued at 12,00,000 and approximately 1,00,000 is allocated to each of the stocks in the basket (picked from Coffee Can Investing: the low-risk road to stupendous wealth, pg-76). The measures are set at the following units:

- Stock prices- Rs/₹
- Market capitalization- $/mn
- Amounted invested- Rs/₹
- Contribution to portfolio value at start- %
- The figures of market capitalization are rounded to the nearest tenth million.

Table 1.1

<table>
<thead>
<tr>
<th>S. No</th>
<th>Name of the Stock</th>
<th>Price (Jan 1st, 2017) Rs</th>
<th>No. of shares</th>
<th>Market cap(Jan 1st, 2017) $ mn</th>
<th>Amount Invested Rs</th>
<th>Contribution to portfolio value at start</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HDFC Bank</td>
<td>603</td>
<td>165</td>
<td>45,200</td>
<td>99,495</td>
<td>8.219 %</td>
</tr>
<tr>
<td>2</td>
<td>HCL Technologies</td>
<td>403</td>
<td>248</td>
<td>18,700</td>
<td>99,944</td>
<td>8.32%</td>
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<tr>
<td>3</td>
<td>Lupin</td>
<td>1445</td>
<td>69</td>
<td>6100</td>
<td>99,705</td>
<td>8.30%</td>
</tr>
<tr>
<td>4</td>
<td>LIC housing Finance</td>
<td>550</td>
<td>181</td>
<td>4160</td>
<td>99,550</td>
<td>8.29%</td>
</tr>
</tbody>
</table>
Table 1.2

<table>
<thead>
<tr>
<th>S No.</th>
<th>Name of the stock</th>
<th>Price (31st December 2021) Rs</th>
<th>Market Cap (31st December 2021) $/mn</th>
<th>Value of Amount Invested Rs</th>
<th>Change in market cap (%)</th>
<th>Contribution to the portfolio at the end (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HDFC Bank</td>
<td>1479</td>
<td>110820</td>
<td>2,44,035</td>
<td>145.17%</td>
<td>7.1%</td>
</tr>
<tr>
<td>2</td>
<td>HCL Technologies</td>
<td>1319</td>
<td>45700</td>
<td>3,27,112</td>
<td>144.38%</td>
<td>9.55%</td>
</tr>
<tr>
<td>3</td>
<td>Lupin</td>
<td>950</td>
<td>5430</td>
<td>65,550</td>
<td>10.98%</td>
<td>1.91%</td>
</tr>
<tr>
<td>4</td>
<td>LIC housing Finance</td>
<td>369</td>
<td>2610</td>
<td>65,789</td>
<td>37.25%</td>
<td>1.92%</td>
</tr>
<tr>
<td>5</td>
<td>Page Industries</td>
<td>40431</td>
<td>5830</td>
<td>2,83,360</td>
<td>161.43%</td>
<td>8.27%</td>
</tr>
<tr>
<td>6</td>
<td>GRUH Finance</td>
<td>319</td>
<td>2950</td>
<td>2,00,013</td>
<td>9.25%</td>
<td>5.8%</td>
</tr>
<tr>
<td>7</td>
<td>Amara Raja Batteries</td>
<td>611</td>
<td>1400</td>
<td>65,377</td>
<td>36.07%</td>
<td>1.9%</td>
</tr>
<tr>
<td>8</td>
<td>Abbott India</td>
<td>18654</td>
<td>5580</td>
<td>3,91,734</td>
<td>279.59%</td>
<td>11.4%</td>
</tr>
<tr>
<td>9</td>
<td>Astral Poly.</td>
<td>2118</td>
<td>5670</td>
<td>9,04,386</td>
<td>710%</td>
<td>26.41%</td>
</tr>
<tr>
<td>10</td>
<td>Dr Lal path labs</td>
<td>3811</td>
<td>4220</td>
<td>2,77,502</td>
<td>224.61%</td>
<td>8.1%</td>
</tr>
</tbody>
</table>
Narration

The following tables (tables 1.1 and 1.2) showed to performance of a coffee can portfolio, which was created by using basic parameters for CCP. Moreover, this basket was recommended by the authors of *Coffee Can Investing*. The value of the initial portfolio in 2017 was Rs 12,00,000, were Rs 1,00,000 (approx.) was allocated to each of the 12 stocks in the basket. Each stock in the portfolio consisted of 8.3%-8.6% of the portfolio. At the end of the research, the value of the portfolio is Rs 34,24,021. This is 23.33% CAGR for 5 years. The accuracy of the portfolio was 75% as 8 out of 12 stocks gave positive returns.

Chart 1.1

This chart projects the contribution of each stock to the portfolio value at the start. The chart shows the composition of each stock in CCP in 2017, in percentage value.
Chart 1.2

This chart projects the contribution of each stock to the portfolio value at the start. The chart shows the composition of each stock in CCP in 2022, in percentage value. Stocks like Muthoot Finance and Astral Polycab form 43% of the portfolio. While stocks like LIC Housing Finance, Lupin, Repco Home Finance and Amara Raj Batteries only formed 7% of the present portfolio. These charts (charts 1.1 and 1.2) prove that every stock in one’s portfolio is not a winner and that 30%-40% of stocks carry the portfolio, helping generate returns.

Analysis of the returns CCP-2017-22

The value of the portfolio is Rs 34,24,021. This is 23.33% CAGR for 5 years. The accuracy of the portfolio was 75% as 8 out of 12 stocks gave positive returns. The following chart will illustrate the contribution of each stock toward the growth of the portfolio. Establish the hypothesis that Coffee Can Investing gives higher returns and beats inflation and normal returns.
During the period of 5 years from 2017-22, the portfolio grew three-fold in that span of time; from Rs 12,00,000 to Rs 34,24,021. The star performers were Astral Polycab, which grew ten-fold in that span, and Muthoot Finance, which grew 5-fold in that span. Meanwhile, stocks like Lupin, Amra Raja and Batteries, and LIC Housing finance were flops and lost more than half of their value. Overall, the portfolio grew at 23.33% CAGR and had a success rate of 75%.

Comparing CCP-17 to Market Index, and other asset classes
The following table will be comparing the returns of CCP-17 to market indexes and other asset classes to prove the hypothesis that Coffee Can Investing gives higher returns than Other Asset Classes and Investments. The returns of CCP-17 will be compared to Sensex, Nifty 50, and Gold:

<table>
<thead>
<tr>
<th>S NO.</th>
<th>NAME OF THE ASSET TYPE/CLASS</th>
<th>CAGR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Coffee Can Portfolio-17</td>
<td>23.33%</td>
</tr>
<tr>
<td>2</td>
<td>Gold</td>
<td>11.12%</td>
</tr>
<tr>
<td>3</td>
<td>Nifty 50</td>
<td>13.43%</td>
</tr>
<tr>
<td>4</td>
<td>Sensex</td>
<td>14.85%</td>
</tr>
</tbody>
</table>

NOTE- all returns are inflation-adjusted

CCP-17 turned out to be the best per performers out of all the options, with 23.33% CAGR. Meanwhile, the rest of the assets like equity index and commodities provided interest ranging from 11-15%.

Therefore,

Coffee Can Investing gives higher returns than Other Asset Classes and Investments.

Interpretation
As we can see from the above data if an investor had invested Rs.1 lakh in 2017 in the Coffee Can portfolio; it would today be worth Rs.2.87 lakh when compared to other assets such as Gold (which would be Rs.1.84), Debt (Rs.1.65 lakh), Cash (Rs.1.4 lakhs), Nifty 50 index ( 2.03 lakh) the Coffee Can Portfolio has clearly outperformed expectations than any other asset in terms of returns. From Tables 1.2 and2.1, we can see that the Coffee Can Portfolio has consistently outperformed the Sensex in terms of returns which is clearly better than the returns that the Mutual Funds and it also proves that a great portfolio does not need to have all great stocks. After analyzing the above data, we can say that the Coffee Can Portfolio is the one that not only beats the Sensex but also beats other investments such as Mutual Funds, Gold, Debt, and Cash (Fixed Deposits) by a long Margin.

VI. FINDINGS AND SUGGESTIONS
Although, the returns that Sensex has provided to an investor have been higher than that which is earned by other asset classes such as Gold, Debit, Cash or even Mutual Funds; Coffee Can Portfolio has provided higher returns than that of the Sensex consistently over the past decade (clarified in previous research and literary pieces), so if an investor made an investment in a Coffee Can Portfolio 2 decades ago then today they would have got returns which were not only higher than the Sensex but also other asset classes or even Mutual Funds.
It is suggested to an investor to make an informed decision about the stocks that they hold in their portfolio and it is also suggested to an investor to first learn about what a Coffee Can Portfolio is and make an investment in a Coffee Can Portfolio according to their Medium-term to Long term goals in life such as buying a house, a car or even retiring early. Since the returns that are given by a Coffee Can Portfolio are relatively higher than the other portfolio, Mutual Funds or Asset Classes and the un-systematic risk involved is almost diluted to nil, the investor will be able to easily achieve their Medium-term to Long term goals without applying much technical knowledge.

VII. CONCLUSION

Coffee Can Portfolio require almost minimalistic knowledge about the stock market and financial terms and can be made by anyone who is acquainted with such terms and calculations such as Return on Capital Employed (ROCE), Return on Equity (ROE), Revenue Growth etc. Investing in a Coffee Can Portfolio is the easiest way of ensuring that the risk is minimized and the return is maximized over a long period. Also, there are no commission rates whilst investing in a Coffee Can Portfolio unlike the commission rates in Mutual Funds which eat up most of the returns of the investors. Unlike Mutual Funds and the Sensex, the Coffee Can Portfolio is also secure if and when there is or would be a stock market crash or recession as the investment is made for the medium term to long term and the stock market rebounds from such events within the short term.

A Coffee Can Portfolio beats every other type of Asset such as Gold, Debt or Cash (fixed deposits) and even NIFTY, BSE, Sensex or any other Financial Product such as Mutual Funds or Exchange Traded Funds when it comes to the returns, however investors who have a short term goal or who are not patient with their investments or those who panic do not try to indulge in such portfolios and thus lose out on getting higher returns while minimising their risk. This study aimed at comparing the returns of a Coffee Can Portfolio when compared to Financial Products or Other Asset Classes and we have successfully seen that it has beaten Other Asset Classes and Financial Products by a long margin.

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Abnormal Event Detection and tracking in Surveillance Videos using Neural Networks

LRTDM Bandara¹, G. Gayamini ², and Dr. Thushara Weerawardane ³

¹General Sir John Kotelawala Defence University1, Sri Lanka
² General Sir John Kotelawala Defence University1 2, Sri Lanka
³ General Sir John Kotelawala Defence University13, Sri Lanka

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Abstract—In recent years abnormal event detection has become an important research area because of the following reasons: the increase of the applications of it, the increase of the number surveillance cameras in public locations such as museums, markets, airports, stadiums, train stations, etc., and the advancements of the peoples’ public safety awareness. AED is a subtopic in event detection. In the study of video content, event detection is critical. Abnormal event detection can be applied in ‘smart surveillance monitoring’ systems, which can recognize abnormal incidents in video footage automatically and decide what to do based on the type of abnormal event. The primary premise behind abnormal event detection is to use computer vision technology to extract the characteristics that represent unusual activity from a video and then train a model that can recognize abnormal events. Surveillance footage is typically viewed by human operators who must spot unusual activities in real time and react accordingly. But recently this traditional method has failed due to the increased number of surveillance cameras. When considering about the object or people tracking it is hard to track people using the faces because the low visibility if the video footage in surveillance cameras. Therefore, several other alternate methods are used. By combining the above two technologies a system to detect abnormal events then to identify and track the related persons through multiple videos from multiple cameras is to be developed.

Keywords—Artificial Intelligence, Neural Networks, Abnormal Event Detection (AED), Transfer Learning, Object identification

I. INTRODUCTION

Abnormal event detection also known as AED, a subtopic of event detection, is a difficult study area that has drawn a large number of researchers in recent years. Human activity identification, scene identification, tracking people and objects, and human behavior identification are all examples of event detection. The video surveillance application is the major focus here. Furthermore, this can be used to monitor public locations including railway stations, shopping complexes, packed sports venues, airports, military sites, and so on, as well as smart healthcare institutions for motion and activity tracking of patients and for detecting accidents in elderly homes [1].

Recently the use of CCTV (Closed-circuit television) to record human activity has become well-known. However, there are insufficient human resources to analyze the data. It could also be more expensive, wasteful, and less accurate to use human labor. Human variables such as exhaustion and boredom might also have an impact on the ultimate result. The major objectives of AED are to identify abnormal occurrences in surveillance videos and to increase the accuracy and the efficiency of abnormal event recognition process [2]. AED techniques are primarily divided into two groups: Object-centric approach where the attention is on the abnormal occurrence and the object that causes it. And holistic approach, which is concerned with the direction and flow of objects and people [3].

There are several methods for detecting anomalous events, but the general processes are as follows: (i) raw data is pre-processed to remove noise, (ii) video segmentation, (iii) feature extraction, (iv) feature reduction for accuracy, and (v) event classification using specific algorithms. When it comes to detecting unusual events, there are number of problems and obstacles to overcome such as: Low quality footages can cause poor feature extraction, as a result of the incorrect interpretation of the features, the categorization of events was poor, some similarities in the detected motion pattern may cause separate activities to be identified as the same [4]. Many researchers presented many approaches to improve the detection process’ efficiency, accuracy, and performance. Different methods and
algorithms for abnormal event detection videos utilizing computer vision are examined and reviewed in this paper. [5].

II. LITERATURE REVIEW

There have been a large number of studies on abnormal event detection. Some are focused on Spatio Temporal data [6], CNN (convolutional neural networks), SVM (Support Vector Machine) & LSTM (Long Short-Term Memory) [7], Graph Formulation [7], Oriented GMM (Gaussian mixture model) model [8], etc. have been proven to be successful.

Yilian Wang [6]. Normally, supervised methods are used to detect abnormalities; however, in this research paper, an unsupervised method is proposed, which has the advantage of being able to train and test on unlabeled data sets. Spatial Temporal Saliency is utilized for two key objectives in this approach. (i) Saliency Prediction and (ii) Abnormality Detection. FFT (Fast Fourier Transformation) and Signals are converted into frequency domain with amplitude and phase using IFFT (Inverse Fast Fourier Transformation). The original video signal is then compressed using a High Pass Filter (HPF) in the frequency domain in the temporal dimension, and the analysis is performed using Parseval’s Theorem. The sum of all dimensions in the regularity domain equals the sum of all regularities, according to this theorem.

Feiping Li [8] This paper discusses a method called as Oriented GMM (Gaussian mixture model). Optical flow is utilized as a low-level characteristic in this technique. The GMM model is used at each stage and position during the training phase. In the testing stage, use the likelihood approach to determine probability and discover anomalous activity. It is a non-tracking method in which a likelihood map is built for each frame to discover abnormalities. These likelihood maps help in determining whether or not the behavior is normal.

Dinesh Singh, 2017 [7]. For abnormal video detection, a graph-based technique is used. A graph design technique for video activities was utilized to discover abnormal behavior in video surveillance using graph kernel SVM (Support Vector Machine). The spatial-temporal interest point is represented by the vertices in this graph and the link between the arrival and dynamic forces surrounding the interest point is represented by the edges. Fuzzy membership functions based on their closeness are utilized to find the graph’s edge. Kernel graphs are also used to detect similarities. Finally, the graph is drawn from the video, and abnormalities are detected from the graph using SVM.

Zhaohui Luo [9] Sensitive movement point is a new feature (SMP) method is discussed in this paper. First, the video is analyzed with the help of GMM, and then the SMP (Support Vector Machine) is obtained. Afterwards, the GMM’s threshold value is established. SMP is investigated using Spatio-temporal modeling. Anomalies in spatial-temporal modeling are discovered during the study. Normal behaviors are then assigned to the normal state, while abnormal behaviors are assigned to the variable and unstable state.

Yuan Yuan [10], This paper discusses a statistical detector-based strategy for detecting anomalies. Each data sample is analyzed as they are a collection of patterns. Initially, abnormal events are detected when abnormality scores are high. Simple

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distribution is used due to noise and complexity of the video data. A Gaussian mixture is used for complicated noise complexity.

Dan Xu [11], For the appearance and motion pattern, a double fusion framework is used. To differentiate the motion and appearance patterns, and also joint representation, de noising auto-encoders are used. Finally, SVM is utilized to classify each input and estimate its score. After that, the final fusion is applied to these scores in order to detect abnormal events.

Yuan Gao [12], Oriented Violent Flow (OViF) is a method for changing the magnitude of motion in statistical motion orientations in video data. The goal of OViF planning is to fully utilize the alignment data from the videos. Linear SVM classifier is used for multiple classifiers, which is done on feature specific by ‘AdaBoost’, therefore it improves the rate of violence activity identification.

J.F.P.Kooija [13], The purpose of this paper is to detect hostile behavior in a public location. CASSANDRA is the name of a smart surveillance system discussed here. Audio and video streams are merged into a composite unit here. DBN is used to predict the level of hostility in this method. Then, after removing any further views, the remaining volume EM technique locates the potential object.

Xinlu Zong [14]. The method is focused upon sparse representation. The basic idea behind this technique is to train this model using both normal video and abnormal video data, resulting in two sparse representation models, and then determining whether or not there are abnormal activitoes based on the outputs of the two models. The identification of abnormal occurrences in video is essentially a different problem, in which the model divides a video sequence into two categories: normal and abnormal. Now, abnormal event detection research is mostly focused on two aspects : extraction of different features and classification model design. The construction of a classification model is a model for classifying video frames (normal and abnormal). It is produced through the extraction of features prior to training. The detection model is classified into supervised, semi-supervised, and unsupervised models based on the varying needs of the training set. The semi-supervised model is the most widely used detection model among them. The Histogram Oriented Gradient (HOG) feature is employed in the feature extraction stage.

Feature extraction

Feature extraction is the process of obtaining features from a video stream that signify abnormal events. The model's detection performance is directly affected by the results of feature extraction process. The direction gradient histogram collects features from gradient direction information in the graphic picture's local area to produce a histogram and to communicate the image information. The HOG approach extracts the target contour information in the video with efficiency. Before extracting HOG features, the motion foreground area is split in this paper. For HOG feature extraction, the obtained binarization foreground region is used as the input image. Because most pixels in the binarization image have a pixel value of 0, therefore the time spent extracting HOG feature can be significantly decreased [14].

B. VGGNet (Visual Geometry Group Network)

VGGNet, developed by Karen Simonyan and Andrew Zisserman from Oxford University's Visual Geometry Group (VGG) research lab, came in second place in the ILSVRC 2014 challenge. It consist of a very simple and classic architecture, with two or three convolutional layers and a pooling layer, then two or three convolutional layers and a pooling layer, and so on (for a total of 16 or 19 convolutional layers, depending on the VGG type : VGG16 and VGG19), plus a final dense network with two hidden layers and the output layer [15].

C. Transfer learning

If there is a trained to recognize faces in photos and if you want to train a second neural network to recognize hairstyles, you can jumpstart the process by reusing the first network's lower layers. Rather than randomly implementing the weights and biases of the first few layers of the new neural network, you can set them to the values of the lower levels of the original network's weights and biases. The network will no longer have to learn all of the low-level structures that appear in most photos from scratch; instead, it will only have to learn the higher-level structures. This is referred to as transfer learning [15].
III. PROPOSED SOLUTION

The proposed solution is a system that consist of two main parts.
1. an event detection module (identification)
2. an object re-identification module (person tracking)

The inputs of the first module are the surveillance videos which may or may not contain any abnormal event. Once the videos are fed into the first module of the system it identifies whether an abnormal or an unusual event occurs. If there is any event which is out of the ordinary, it will produce an alert.

IV. RESULTS AND DISCUSSION

When a surveillance video is uploaded to the first module it produces the following graph with a y-axis which goes from 0 to 1. Where 0 represents the normal frames and 1 represent the abnormal frames. Here the video used is from the dataset UCF-Crimes and the content is a fight which goes on between few people which starts as a normal incident and gradually turns into a fight. When the graph exceeds a certain threshold the alert is produced.

The results from the second module are show below. Once the source image / images (source image : the cropped image from...
the video from the first module which contains the person / people) is uploaded to the second module along with the surveillance videos it identifies the person / people and produce an output

Figure 6. this is the source image which is fed into the second module along with the videos

Figure 7. this is the images which the second module identified from videos using the source image

IV. DISCUSSION

Object recognition and event detection are two of the most necessary study topics among image processing experts. In the context of security, identifying abnormal events or behaviors in video surveillance becomes more important. Researchers are becoming increasingly interested in learning about the procedures involved and the algorithms used in this recognition process. In the subject of abnormal activity detection, there are numerous methodologies and strategies available. The most prominent and promising technologies and methodologies are covered in this review paper. In addition, advantages of different technologies and algorithms are compared and reviewed. Many techniques such as Spatio-temporal Saliency Detection, Graph Formulation, Oriented GMM, Based on Sparse reconstruction, and utilizing Statistical Hypothesis Detector have been used in related work. The following are some of the most common technologies used in almost all of the methods listed above:

IV. CONCLUSION

With the fast development of surveillance cameras in various fields to record human behavior, so does the demand for systems that automatically recognize abnormal situations. Abnormal event detection has become a popular topic in computer vision, attracting new researchers. Many scholars have proposed various strategies for detecting such events in video. The primary purpose of this review is to examine the most recent studies in the field of abnormal event detection. The review covers approaches for detecting abnormal events using SVM, CNN, and machine learning classification. These

IV. FUTURE WORK

Currently the 2 modules are running independently with a much more intervention from the user. As the further development, to combine the two modules and to make it more autonomous. To create an interface which is easy to use. Furthermore to increase the efficiency and accuracy of both the abnormal event detection and the person re-identification processes.

IV. REFERENCES


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Critical Studies of Environmental Laws in India

Dr. Shriram Patel
Associate professor (Law)

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Abstract - There are many laws in force in India to preserve the environment but it is still problem that environment pollution could not be stopped effectively. The metro cities in India are most polluted cities, like Delhi and Mumbai. The problem of pollution in big cities still at mass level.

Health is an integrated part of life. Life can’t exist without health. Health is mainly affected by food, water and environment. Article 21 of constitution declares right to food, water and decent environment decent life. What is environment? Environment in modern context sustainable development includes the physical and serial factors of surrounding climate round and some biological factors such as animals, plants etc. under the provisions of Indians constitution every citizen has the right to enjoy free air and water. Therefore, whoever pollute the air and water in such a manner which is harmful and injurious to health shall be deemed to be the violation of the constitution 1

Art 47 of the Indian constitution provides that the state shall regards the raising the level of nutrition and standard of living of its people and the improvement of public health as living as among its primary duties and in the consumption of liquor, intoxicant etc. except for the medicinal purpose, which are injurious to health. 2

The above provision of the constitution was inserted into constitution with a view to protect the public health, unfortunately the said article in part IV, has no legal effect and cannot be given current by the court.

Index Terms- Environment, pollution, Air Pollution, Water Pollution, sustainable development

I. AIR POLLUTION ACT 1981 AND ITS LACUNAS

In order to preserve environment the parliament has enacted. Air pollution (prevention and control) Act 1981, but the said Act could not fulfill the dreams because the Act has some of the lacunas, which are as under:

Section 3 of Air Pollution Act 1981, provides that - Single board will discharge the function of water pollution board, therefore heavy Burdon lies on Single board.

Second lacuna of this Act is renomination of members. Section 1(6) of Air (preventio n Act control of pollution) Act 1981, provides that “members of state board constituted under this Act shall be eligible for renomination.

Third lacuna in this Act is that maximum members are politician, nominated in the board.

Section 43 of the Act provides that magistrate of 1st class or metropolitan magistrate shall take cognizance for offence committed under the Act. The above provisions of court to try offences should be altered and special court should be constituted.

The parliament has enacted a wrong done to use of water creates liability.

1. Civil
2. Criminal

The civil nature has divided in an ordinary and vicarious. In ordinary civil wrong a wrong does are held liable for compensation on account of damaged caused.

Judicial Directions about Environment

If there is any violation or act affecting environment, than it is the duty of executive Magistrate under section 133 of Cr. P.C. to remove such nuisance 3

In charanlal sahu Vs. Union of India 4

The Apex court laid down the principal, that Bhopal gas tragedy claim proceeding Act 1985 was constitutional. It is established principal of law that whoever desires that court should punish the defaulter.

The Burdon of proof does not lie on the person who proceeds against the polluter 5

In suchchidanand pandey vs. State of west Bengal 6

The Honorable Supreme Court of India observed that wherever the problem comes of ecology, courts are bound to see article 48A and 51A.

In Rural litigation and entitlement vs. state of UP 7

The Supreme Court has stopped the digged of lime stone because due to digging up the lime stone the environment has been polluting.

In virendra Gond vs. State of Harayana 8

The Supreme Court has held that under article 21 “Right to life includes”. “Right to protection environment” every person shall have a right to live in fresh and unpolluted environment.

In Hamid Khan vs. State of M.P. 9
It was held in this case that the person who suffering from knee, teeth, infirmity due to consumption of polluted water shall be given free treatment (medicine) whether it be way of surgery if required than the same shall be undertaken at the expenses of state and each person whose surgery is done shall be paid 3000/-.

2. AIR 1990 SC 1480
3. AIR 1999 SC 812
4. AIR 1987 SC 2187
5. AIR 2000 SC 384
6. AIR 1995 SC 57
7. AIR 1993 191

II. CONCLUSION
I don’t find any provision under which the parliament has vested any direction with the state Board to grant exemption to any particular industrial plant or class of plants. A reading of section 17 Air Act meant for taking such steps as may further the object of the act in effective controlling the Air pollution caused by industries. No clause of the said section of act for sake of any provisions of the Air act has the state Board.

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AUTHORS
First Author – Dr. Shriram Patel, Associate professor (Law)
Big Data, And Internet of Things In Biomedical Engineering: A Brief Of Its Applications


Royal Medical Services – Amman, Jordan

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INTRODUCTION

Data from imaging, pathology, genetics, and electrophysiology may all be utilized to obtain a better understanding of illnesses. Biomedical researchers may use data to discover patterns and enhance healthcare decisions. Several big data healthcare systems, such as Hadoop (Armoogum and Li, 2019) and MapReduce (Lee et al., 2020), may be utilized in the biomedical area to synthesis massive volumes of data and extract meaningful insights based on patterns.

Wearable gadgets and Internet of Things (IoT) goods may also obtain benefits from big data to help them function more intelligently for the user (Mohammed et al., 2020). The invention of IoT systems that will include surgical data for training and feedback purposes to increase surgical competence for surgeons in residency is one such biomedical advancement presently in the works.

BACKGROUND: WHAT IS BIG DATA?

Big data is a recent hypothesis and ecosystem in biomedical informatics that converts case-based studies into large-scale, data-driven research. The three primary properties of big data, usually referred to as the 3Vs: volume, variety, and velocity, are widely acknowledged as defining qualities of big data (McCue and McCoy, 2017).

First and foremost, the volume of data in the biomedical informatics areas is rising at a very high rate. Medical imaging such as ultrasound images and x-rays images generates massive amounts of data that have complicated specifications and wider dimensions (Hung and Lin, 2020; Maglogiannis et al., 2020). Another example is the Visible Human Project, that has file away more than 38 GB of female datasets. In healthcare field, there are open sources of datasets that provide different information, analysis and help researchers to aggregate collection and analysis (Massey et al., 2017).
The diversity of data kinds and structures is the second characteristic of big data. The biomedical big data ecosystem consists of many distinct layers of data sources, resulting in a diverse set of data for researchers. Sequencing technologies, such as, generate “omics” data at nearly the entire concentrations of biological modules, from genomes, proteomics, and metabolomics to protein interaction and phenomics (Joshi et al., 2021).

The third feature of big data is velocity, which is considered as the speed with which data is produced and processed. The current generation of sequencing technology allows for the low-cost creation of billions of DNA sequence data per day. Because DNA sequencing necessitates higher rates, big data technology will be adapted to meet the pace at which data is produced, as well as the speed at which it is processed (Pablo et al., 2021).

THE IMPORTANCE OF BIG DATA IN HEALTH CARE

Biomedical and health-care informatics research is increasingly utilizing big data technology. At an unprecedented velocity and scale, large volumes of biological and clinical data have been created and gathered. As, the current generation of sequencing technology allows for the daily processing of billions of DNA sequence data, and the use of electronic health records (EHRs) allows for the documentation of huge volumes of patient data. With technological advancements like the introduction of new sequencing machines, the expansion of innovative hardware and software for parallel computing, and the widespread use of EHRs, the cost of obtaining and interpreting biological data is projected to drop substantially. Big data applications open up new avenues for discovering new knowledge and developing unique techniques for improving health-care quality (Tang et al., 2020).

Big data in health care is a rapidly evolving subject, with several new findings and techniques published in the previous five years. We analyze and discuss big data applications in three key biomedical subdisciplines in this paper: Bioinformatics, clinical informatics, and imaging informatics are the three types of informatics. In bioinformatics, high-throughput experiments make it easier to conduct novel genome-wide association analyses of illnesses, and in clinical informatics. However, the large volume of patient data obtained allows clinicians to make more informed judgments (Saxena and Chandra, 2021). To exchange medical image data and workflows, imaging informatics is increasingly more quickly integrating with cloud platforms. In this paper, we summarize the challenges, gaps, and opportunities for improving and advancing big data applications in health care, as well as the recent progress and breakthroughs in these health-care domains.

BIG DATA APPLICATIONS

BIOINFORMATICS APPLICATIONS
The study of biological system changes at the molecular level is known as bioinformatics research. With today's customized medical trends, there is a growing need to collect, store, and evaluate these enormous datasets in a timely manner. Genomic data may be collected in a short amount of time; thanks to next-generation sequencing technologies. In bioinformatics applications, big data approaches help scientists acquire and analyze biological data by providing data repositories, computational infrastructure, and fast data manipulation tools. Hadoop and MapReduce are widely utilized in the biomedical industry, according to Taylor (Wang and Alexander, 2020).

Researchers classify big data methods and/or tools into different groups based on the main function of every technology which are 1. Data storage and Retrievals 2. Error Recognition 3. Data Analysis 4. Platform Integration Deployment (Mohamed et al., 2020).

CLINICAL INFORMATICS APPLICATIONS

The key biomedical subdisciplines concentrates on the application of information technology in the health-care domain. It involves activity-based research, analysis of relationship between patient main diagnosis as well as underlying cause of death, and storage of data from EHRs and other sources like data from ECG sources (Herrmann, 2020).

Clinical informatics, unlike bioinformatics, do not have as many methods for detecting errors, but it is more concerned with data exchange and security. Clinical informatics work with both structured and unstructured data, creates particular ontologies, and employs natural language processing significantly, which sets it apart from bioinformatics (Watkins et al., 2021).

IMAGING INFORMATICS APPLICATIONS

This subdiscipline (i.e., imaging informatics) can be defined as the study of approaches for producing, controlling, and demonstrating imaging information in a variety of biomedical purposes (Moon et al., 2018). It is bothered with how medical images are switched and evaluated during the course of development health-care methods. With the expanding necessity for more individualized care, the demand for integrating imaging data into EHRs is promptly expanding. Imaging informatics is established roughly instantaneously with the initiation of EHRs and the occurrence of clinical informatics; nevertheless, it is very distinct from clinical informatics because of the dissimilar data categories engendered from numerous modes of medical images (Kabashin et al., 2019).

CONCLUSION

We are presently in the time of “big data,” where big data machinery is being promptly utilized to biomedical and health-care disciplines. In this paper, we exhibited a variety of examples in which big data technology has addressed a key position in modern-day health-care development, as it has entirely changed people’s view of health-care activity. Additionally, in this paper, we realized that bioinformatics is the most important subject where big data analytics are presently being utilized, mainly because of the substantial
volume and involvedness of bioinformatics data. Nevertheless, in other biomedical research disciplines, for instance clinical informatics, and medical imaging informatics, there is massive, unexploited possibility for big data purposes.

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Urban Model Of City Planning Smart Cities

Ghaith Ibrahim Abdel Latif Alshwaheen

Architecture engineer, Mu’ath Bin Jabal Municipality, Ministry of Local Administration, Irbid, Jordan.

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Abstract - Smart urban technologies have started to become the foundation of new and substantial "intelligent" infrastructures over the past two decades, especially in the affluent regions of the developed world, such as Madrid, New York, Paris, San Francisco, and Singapore. The spread of the smart city idea has also significantly impacted how cities and their surrounding regions are planned and developed. Due to the growing interest in the subject, this special issue focuses on two closely related ideas: smart cities and innovative urban technologies. It also includes scholarly writings that offer some priceless insights into how our cities and societies produce knowledge and the spatial effects of information and communication technologies (ICTs).

Index Terms - Smart; City Planning; Big Data.

I. INTRODUCTION

7 billion people live on the world, and of those, 1.2 billion use personal computers. By the middle of 2013, there were 1.5 billion smartphones in use, with a 30% annual growth rate. These devices create a staggering amount of data. In reality, sensor technology has advanced to the point that it is practically plug-and-play, making it possible for anyone to watch and gather data from moving things. For instance, quick automated travel data now tracks demand and supply, device performance, pricing, fuel and energy usage, and other factors in our realm of the city. The information we have for London's public transportation, where 8 million trips are made daily on buses, heavy train, and tubes, comes from the smart card that 85% of all users use. This results in roughly 45 million trips every week, 180 million per month, around a billion every six months, and so on. The data set will never stop unless technology changes, and even then, a continual stream of data will theoretically continue to be produced.

By 2050, six out of ten people will live in cities, as the global urban population is projected to double (Koutra, Becue, & Ioakimidis, 2018). Smart solutions are needed to address the complexity of urban life when dealing with the issue of future "mega-cities" as complex eco-systems and prolonged urbanization (Eremia, Toma, & Sanduleac, 2017). The phrase "smart city" has received a lot of attention recently from decision-makers, industry executives, and the general public. A smart city is a city that uses information and communication technologies to improve the quality of life of its residents while promoting sustainable development, yet there is no single definition for what a smart city is (Capdevila & Zarlenia, 2015).

II. EXPLORATION OF SMART CITIES

The concept of smart cities is still largely being researched. The two ideas that make up the term are smart cities. The term "smart" and its connection to "city" are topics of extensive literary reviews. A city is a living, breathing, autonomous system that interacts with the natural and constructed environments. No one can envision a livable, sustainable, or even smart city in the future. A city is a living, breathing, autonomous system that interacts with the natural and constructed environments. No one can conceive a future city that is livable, sustainable, and even smart without making investments in human and social capital, and no one can dismiss the importance of ICT or the necessity for judicious resource management. The term "smart city" refers to a number of concepts, including "intelligent city" (Komninos, 2011), "digital city" (Jučevičius, Patašienė, & Patašius, 2014), etc. that have commonalities and concentrate on the specific application of technologies to urban settings.

Despite this, the conversation about "smart cities" is mostly focused on ICT issues while gradually taking into account the concepts of "technology," "people," and "institutions" (Nam & Pardo, 2011). In order to increase the competitiveness of future cities, the "smart city" is typically taken into account in the ICT sector's "business" field (Batty, 2013). Reduced energy use, environmental effect, and carbon footprint, as well as ensuring that sectors are competitive for growth and jobs, are the primary challenges.

III. HISTORICAL BACKGROUND

Hippodamus is credited with creating formal city planning, which led to the creation of Miletus, circa 450 BC. Hippodamus is also credited with organizing Miletus' structures and streets. The Greeks credited the formal designs of orthogonal urban planning (Koutra et al., 2018). The first cohesive concepts about the future of society, economy, and urban settlements began to emerge in the 1850s as city planning developed throughout the following centuries, with E. Howard's vision of the "Garden City" becoming the most well-known to this day (Lahanas). Howard advocates the idealistic concept of the 'garden city' to divide the city into numerous wards as a combination of city and countryside.
surrounded by greenbelts placed around large cities with a social dimension (Sharifi, 2016). A turning point in the history of architecture and urban planning in the 20th century, exhibiting G. Fourier's ideas in opposition to the idea of zoning, which divided the city into four basic functions: labor, housing, health, and leisure (Koutra et al., 2018). The term "eco-city" was first coined by the Urban Ecology Group in the middle of the 1970s to emphasize ecological preservation while emphasizing beautiful green surrounds (De Jong, Joss, Schraven, Zhan, & Weijnen, 2015) made up of a synthesis of complex subsystems (Tsolakis & Anthopoulos, 2015). Recent years have seen ideas for the development of "eco-cities" with a clear environmental focus. The term "cyber cities," "digital cities," or "virtual cities" became popular in the 1980s as a result of the idea of instrumenting the city (Angelidou, 2014). Urbanization and information and communication technologies are two key new phenomena that have just emerged (Cocchia, 2014). Virtual city representation, e-government services, and other concepts serve as examples (Suzuki & Finkelstein, 2013). Today, academics debate the efficacy of "smart" city planning as a solution to all urban problems.

IV. SMART CITY PLANNING AND THE DISTRICTS

A city's "smart" planning is a difficult process with competing interests. The issue is twofold: (1) The notion of "smart" is still being explored and developed using a multidisciplinary approach, and (2) Modern cities have been built with a variety of urban features. Any smart city project's planning process is based on a plan created by the districts. Undoubtedly, there are many diverse, often conflicting proposals for the development of "smart" solutions in urban agglomerations, each with a different focus on a different area of expertise.

The "district" level does indeed seem intriguing in an operational and multi-thematic framework for modeling and exemplifying the realization of a "smart city" within the introduction and application of contemporary technology techniques and practices. The "district," which is part of the city's constructive design (Pérez & Rey, 2013), analyzes patterns of energy use and offers practical "planning" solutions for "sustainable" and strategic urban development.

Without a question, cities are complex systems. The "smart" challenge offers the city system a fresh perspective on how to solve specific challenges with practical solutions. In fact, using "smart rules" in city planning calls for creative planning techniques (Greco & Cresta, 2015). The cornerstone to "smart" city planning is integrating strategic goals and teamwork among the essential components that contrast the issues (Chowdhury et al., 2011). The authors' concept of "smart planning" a district entails "smart planning" in a "optimal" and sustainable planning that respects human capital and invests in the quality of life of its users while also taking into account the effective management of resources, the use of technologies, and sustainability objectives. Recently, (Koutra et al., 2018) classify the wide range of the 'smart planning' of a district into five pillars as shown in figure 1 below which are:

1. Smart location: A district's physical limits and linkages to its surroundings (the city center, neighboring districts, etc.) are important considerations for locating it "intelligently."
2. Smart buildings: architectural patterns, including the use of environmentally friendly materials.
3. Smart energy management: The integration of energy design into spatial planning and urban planning is necessary for energy planning to produce "smart" urban solutions.
4. Smart mobility: Reducing pollution is the "bet" of the "smart district" and, by extension, the "smart city."
5. Smart people: An agglomeration's "smartness" cannot be guaranteed by the incorporation of "smart techniques and systems" on buildings or even by "smart" energy management.

![Smart pillars towards a smart district planning](image-url)
V. CONCLUSION

This study illustrates smart city planning and implementation that involve a wide range of factors and players, including local administration, planners, and potential residents. To improve the criteria for sustainable development in cities and create a broad framework for city planners and its stakeholders toward effective methods with regard to specific objectives, urban planning is an intriguing vehicle.

Cities are in fact intricate ecosystems, living things that are constantly metabolizing. Planning a city in the twenty-first century necessitates comprehensive strategies and attempts by fusing several viewpoints, such as: the energy consumption of buildings, the maximization of its renewable resources, the architectural patterns and design to minimize its needs, etc.

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First Author – Ghaith Ibrahim Abdel Latif Alshwaheen
Architecture engineer, Mu’ath Bin Jabal Municipality, Ministry of Local Administration, Irbid, Jordan., Corresponding Author: Ghaith Ibrahim Abdel Latif Alshwaheen
Email: gaitshawheen@yahoo.com
Guiding Principals For Eligibility Criteria On Alcoholic Liver Injury In Rehabilitation Centres: A Qualitative Study In Kenya

George Njoroge*, Catherine Mwenda **, Ezekiel Mecha***, Stanley Waithaka*

*College of Health Sciences, Mount Kenya University
** School of Nursing Sciences and Public Health, South Eastern Kenya University
*** Department of Biochemistry, University of Nairobi Kenya

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Abstract- AIM: United Nations Sustainable Development Goals with its 193 member states aimed to achieve reduced harmful alcohol use by year 2030. Among the key focal points were to develop alcohol care teams whose interest is to reduce acute admissions to hospitals that relate to alcohol, reduce mortality and improve on quality alcohol care. It is agreed that clinician’s multidisciplinary teams should be included to integrate alcohol related treatments across all primary, secondary and tertiary health institutions. The team should formulate and coordinate alcohol related policies in their countries.

METHODS: During the in-depth interview, the voices of the participants were recorded using tape recorders. The recorded voices from indepth interviews were transcribed into verbatim using NVivo 12 software. The transcriptions were first read for familiarization and check for accuracy of the collected data. The qualitative data was grouped into different thematic, coding and indexing of similar statements was done. Emerging themes were analyzed and common statements included in the conclusion. Clearance was sort from the institutional Ethics Review Committee and the National Commission for Science and Technology.

RESULTS: Clinicians who participated narrated of applying head to toe examination to categorize a client who is mildly, moderately or severely sick for admission to the rehabilitation centres or referral to a hospital for further management. Clinician did not mention guidelines for use during admission or referral of patients. Participants queried the availability of guidelines for admission and referral of patients for alcoholic liver injury. There was a mention that even if the guidelines are available then they could be at a Ministry of Health headquarters showing their unavailability to the clinicians.

CONCLUSION: There was need to strengthen guiding principals to evaluate criteria for admission on alcoholic liver disease. There was uncertainty on the availability of structured protocols for use in rehabilitation centres in Kenya which led to clinicians apply other protocols such as head to toe examination as a criteria for assessing status of a client to justify their admission or referral incase of the very sick clients.

Index Terms- Admission, alcoholic liver injury, guiding protocols, referral, rehabilitation centre.

I. INTRODUCTION

Alcohol consumption over long duration has adverse effects to body organs. At the initial stages the effects may be asymptomatic while in adverse stages they may present with notable clinical manifestations. Majority of persons presenting with elevated liver enzymes are asymptomatic and tend to ignore the need for assessment and management of liver injury[1]. It is estimated that asymptomatic alcohol disease progression takes about 15 years; the duration that the candidates of alcoholic liver disease should be follow-up by clinicians[2]. During the asymptomatic period clinician should do a minimum of 5 tests per year for the suitable candidates [2]. If untreated and unfollowed 75% of the alcoholic liver injury patients are diagnosed late when abstinence has little value and treatment is palliative [2].

Late at the asymptomatic period, clients experience symptoms that need medical care. Upon presentation to the rehabilitation centres, clients are taken through the process of admission or referral depending on their medical status. In the United State (US) strategies have been formed such that any person suspected to be an alcohol consumer should be in close contact with clinician for continuous tests and check-ups with a focus to detection of Alcoholic Liver Injury (ALI) [2].

A study in United Kingdom (UK) by [3] reported that the number of admission due to alcohol consumption had shrunked by almost doubled in June 2020 at 28% compared to June 2019 which was at 48.5%. There were many factors that may have influenced these admissions but the researcher prediction was low figures of admission due to the fear of covid-19 in hospitals in the UK. Guided by this principal, there was prediction of low admission to rehabilitation centres in Kenya. Further there was restricted admission to the rehabilitation centres during the covid 19 pandemic.
Many governments in the world had issued restrictions on sale of alcohol on open premises encouraging take away services. [4] reported that some nations had total ban on sale of alcohol while others had categorized it as an essential commodity with restrictions. The pandemic led to increased adverse effects of alcohol with restricted admission.

A study in Argentina by [5] reported that the eligibility criteria for admission to treatment of end stage liver disease was by use of a model referred to as Child-Turcotte-Pugh (CTP) score model. The model is famous for its ability to predict mortality and as such one can remove the client from a waiting list of admission to prioritize for immediate admission. In using the model, mortality has been reduced in many centres.

Clinical guidelines for admission to rehabilitation centres

Various studies have cited guidelines on management of alcoholic liver injury patients. Such guidelines include the European Association for the Study of Liver (EASL) clinical practice guidelines. [6] mentioned that these guidelines should guide for management and evaluation of severity and prognosis for alcoholic liver injury. The use of these guidelines in all set-ups of care is encouraged since they are comprehensive and detailed.

Another set of guidelines was provided by the Asian Pacific Association for the Study of Liver (APASL), the guidelines were similar to those provided by the European association for the study of liver diseases, but [7] said that the difference between the two is that the Asian Association for the study of liver diseases advocate for liver biopsy as the best test despite its risks [7].

From Latin America there is the Latin America Association for the study of liver (ALEH) clinical guidelines. These guidelines were similar to the other two with emphasis that alcohol exclusion takes a key evaluation factor than other etiologies in their evaluation criteria. [8] A study in Chile reported that these guidelines on alcohol has been considered to have far reaching implications than any other substance on the liver [8].

[9] reported that Acute-on-Chronic Liver Failure (ACLF) is a relatively new system of approach to liver disease with a combination of hepatic and extrahepatic organ failure consideration. The study further reported that ACLF encompass the prediction for organ failure, precipitating factors, management strategies and end of life care that evolve around the liver disease. [9] in a study in America reported that the ACLF guidelines are acceptable by the Asian Pacific Association for the Study of Liver (APASL), the European Association for the Study of Liver (EASL) and the North American Consortium for the Study of End-Stage Liver Disease (NACSELD). [10] reported of instances where there could be missed opportunities of grading systems.

[9] in a study in America reported that during clinical judgement healthcare providers should incorporate the ACLF guidelines to arrive to a patient centered approach of care. The guidelines are helpful to arrive to the judgement on what treatment modality to use and when to refer the patient. [9] reported of instances where there could be missed opportunities of grading systems.

Grading system for admission criteria

[11] reported that the North American Consortium for the Study of End-Stage Liver Disease has a grading system based on the extrahepatic organ failure. Clients with two extrahepatic organ failure were graded as grade 2 while grade three was for persons with three extrahepatic organ failure. Grade 2 extrahepatic organ failure included presence of at least two organs that among them are shock, alcohol encephalopathy, end stage renal failure and respiratory failure.

[5] in a study using the North America Consortium for the Study of End-Stage Liver Disease (NACSELD)-Acute-on-chronic Liver Failure (ACLF) score reported that more than 2 organ failures was reported as positive score predicting decompensated liver cirrhosis that was associated with morbidity and mortality. The study further reported that ACLF is considered present when there is severe acute decompensated liver disease in chronic liver disease that leads to multiple organ failure.

[12] reported that NACSELD identified the number of organ failures as the key element in prediction for hospitalization, morbidity and mortality for alcoholic end stage liver disease.

[9] reported of instances where there could be missed opportunities of grading systems.

Importance of guidelines for admission

A study in America by [9] reported on the importance of guidelines when they mentioned about the clinical judgement on admission and treatment. The researchers reported of challenges within the clinician who needed to be guided by the acceptable guidelines for patient-rehabilitation care approach.

Statement of the problem

[9] in a study in America reported of confusion among caregivers on approaches used to care for liver disease patient whatever judgement is made on their care. In Kenya such confusion could be due to missed opportunities from lack of proper guidelines.

A study in Kenya by [13] did not mention on the guidelines used for admission of clients in the Country rather described the patient-centered approach of care while at the rehabilitation centre. Another study by [14] in Kenya did not report on the guiding criteria for admission at the rehabilitation centres.

A study by [15] mentioned on treatment modalities at various rehabilitation centres in Kenya but omitted the criteria used for admission, guidelines or protocols used at these centres. Therefore there are challenges among clinicians at various rehabilitation centres in Kenya on the guiding principals in admission of patients to the centres. A lack of the guidelines signifies use of other modalities which are not internationally acceptable for use in admission or referral of clients with alcoholic liver injury in Kenya.

II. METHODS

Research design

This was a descriptive cross-sectional study. Purposive sampling method was used to select the rehabilitation centres within the regions. All clinicians in the centres were involved in the sampling methods. The study was conducted in two regions within Kenya with the highest number of alcohol users; namely Uasin Gishu and Muranga Counties.

In the selection criteria, nurses with an experience of 6 months or more at the centres were included while those who were unavailable for the indepth interview were excluded.
Data collection method
In-depth interviews were conducted, the voices of the participants were recorded using tape recorders. Trained clinicians moderated during the interview sessions. The tape recorders were secured and safely stored by the researcher awaiting verbatim transcription.

Data analysis
The recorded voices from indepth interviews were transcribed into verbatim using NVivo 12 software. The transcriptions were first read for familiarization and check for accuracy of the collected data. The qualitative data was grouped into different thematics, coding and indexing of similar statements was done. Emerging themes were analyzed and common statements included in the conclusion.

III. RESULTS AND FINDINGS
A total of 15 clinicians were involved in the semi-structured interview which was conducted in the health centres. Among the participants 10 were female while 5 were male.

Guidelines for admission to rehabilitation centres
A question was asked about the availability of guidelines to evaluate alcoholic liver injury. One participant who responded reported that “We do not have guidelines for evaluating liver disease, may be you give us one. Is there any from the ministry, I have never heard of guideline on liver disease”. Another respondent said “Our rehabilitation centre does not use guidelines to evaluate liver injury, but incase someone has liver disease we assess them through physical examination then we embark to start alcohol rehabilitation therapy”.

A similar response was provided by another respondent who said that guidelines to evaluate liver disease are probably found in the ministry headquarters but at the centre they are unavailable.

Another respondent said “You said guidelines, eh eh guidelines are not here we don’t have guidelines here, no no none”.

The study had a question on institutional considerations for admission of Alcoholic Liver Injury clients.

Grading system for alcoholic liver injury
Participants were asked about the grading system for clients with Alcoholic Liver Injury during the admission period. One respondent reported that “During admission we do a focused head to toe assessment for the liver, we are guided by pain scale of 1 to 10 then we divide the scale into 3, we rank the pain as mild moderate or severe to equate to mild, moderate or severe liver injury”. The response was equated as the grading system in this institution. Another responses was by a respondents who said “To be sincere we do not have any specific grading system, what we do here is to assess the general status of the client and if we feel the person is so sick we do not admit them here, we refer them to our referral general hospital”. Another respondent reported that “We do not have structured protocols for grading of our clients. Clients who are admitted to rehabilitation centres with liver problem are observed for improvement or otherwise.

Another respondent said that “We grade the patient general condition where some patients are graded to be taken for psychiatric treatment than alcohol rehabilitation, so the mental status assessment is done for purposes of differential diagnosis”.

A participant responded by saying that grading system for alcoholic liver injury was unavailable and requested if the researcher could introduce the grading system.

Importance of grading system during admission.
Another research question was on the importance of having a grading system for Alcoholic Liver Injury. A respondent said “It is through grading system that we shall know when we should refer the clients or when we should retain them; for now we refer when we think it is right then when we get to the hospital there the clinicians complain to us that we refer when it is too late. I think this will help us alot”.

There was a response from a participant who said “Through grading we are able to know who is more sick and needs referral instead of admission because sometimes you find that we admit all clients and somehow it looks like we are guided by monitory incentive than the status of the client”.

A respondent from the hospital set up reported said “I feel the grading system will help those people in the rehabilitation centres who refer clients here (hospital) because we feel that they wait when it is too late that is when they refer to hospitals; why can’t they refer early, so the grading system will help them do early referral rather than wait until when it is too late”.

IV. DISCUSSION
Guidelines for admission to rehabilitation centres
Respondents who reported on the guidelines for admission did not mention relevant guidelines that guided admission of clients. Studies done on the admission and management of alcoholic liver disease mentioned that clear policies and guidelines were paramount. A study in US on global online alliance for liver studies (GOAL) by [16] mentioned that it was important to have local policies on admission and management for alcoholic liver injury [16].

[17] reported of the European Association on the Study of Liver (EASL) clinical practice guidelines that help to evaluate the severity and prognosis of liver disease across Europe and the world [17].

[8] that the Latin America Association for the study of the liver (ALEH) has provided guideline on the prevention and treatment of alcoholic liver disease. Further they have provided criteria on diagnosis and evaluation of persons in alcoholic states [8].

The researcher did not find the Africa or East Africa association on the study of liver disease and as such unavailability of guidelines on admission due to alcoholic liver injury.

According to [10] Acute-on-Chronic Liver Failure (ACLF) clinical guidelines there should be scientific evidence in grading for assessment, management and evaluation process for hospitalization of patient due to alcohol use disease.

[10] reported that incase of missed opportunities for grading system then the Acute-on-Chronic Liver Failure (ACLF) clinical guidelines are the most preferred approach to grading in assessment, management and evaluation of liver disease.
Grading for alcoholic liver injury

A study in Canada reported that persons of alcoholic liver disease should be properly examined and graded to avoid premature mortality that is untimely and unjustified [18].

Importance of grading system for admission of alcoholic liver injury clients

Some respondents said that a grading system was important since it will offer an opportunity for the care giver to know when to refer or retain clients at the centre. Another respondent mentioned about more sick clients verses fewer sick ones and refer when appropriate than too late. Another respondent mentioned about the suitability of admission criteria than admit all clients presented at the rehabilitation centres. These responses showed the need for the clinician to have a tool for admission of clients due to alcoholic liver injury. They acknowledged that there was a gap on their practice since they lacked the guiding tool. The gap was lack of clear policies and guidelines on the management of these clients. The rehabilitation centres were at a risk of admitting all clients presented for admission without restriction because the guiding principles were not in place. When to refer or otherwise has been left to the institution to do or not to do so. It is a confusing state of ambiguity with no clear direction.

[10] reported of a grading system that involves Grading of Recommendations, Assessment, Development and Evaluation (GRADE) as a process for admission and management of alcohol use disorder clients. The study further reported that these are guidelines established for support in clinical practices for better judgement especially when clinicians are faced with challenges of comorbidities. The clinicians have to focus on the patient’s health status and arrive to the most preferred patient-centered approach of care.

Proposed checklist for evaluation of body system during admission and referral

<table>
<thead>
<tr>
<th>Organ involvement</th>
<th>Alcohol use</th>
<th>Liver</th>
<th>Kidney</th>
<th>Brain</th>
<th>Cardiovascular</th>
<th>Respiratory</th>
<th>Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Follow up in rehabilitation centre</td>
</tr>
<tr>
<td>Yes.</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Consider Admission to rehabilitation centre</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Consider Referral for admission to a hospital</td>
</tr>
</tbody>
</table>

KEY
Liver- ‘No’; plus ‘No’ for other organ involved—follow up at the rehabilitation centre
Liver –‘Yes’; plus ‘No’ for other organ involved—Admit at the rehabilitation centre
Liver –‘Yes’; plus ‘Yes’ for any other organ/organs involved—Refer for hospitalization

V. CONCLUSION

Clinicians offering medical services at different health facilities were not equipped with requisite protocols to guide them for admission and referral of clients with alcoholic liver injury. The clinicians tried different applications to justify the use of other tools for guidance in their performance but this was inappropriate. With such practices, clinicians are expected to miss opportunities with may otherwise have reduced morbidity and mortality on alcoholic liver disease.

Availability of proper guiding principals on the admission and referral of clients with alcoholic liver injury may offer great opportunity to the clinician in early detection and early referral thereby reducing the rate in morbidity and mortality. This would again reduce clinicians blaming one another for referral of very sick patients as experienced during the in-depth interview when one respondent mentioned that the lower tier institutions refer when the clients are very sick.

Africa and Kenya included has no clear protocols compared with other continents such as America, Asia or Europe who have these protocols. There are different institutions assigned responsibilities to conduct joint research to improve or evaluate the importance of these protocols, this being an important milestone missed within Africa and Kenya.

VI. RECOMMENDATIONS

1. In Kenya the continuous alcohol consumption will lead to more and more clients with alcoholic liver disease seeking admission to rehabilitation centres or other tertiary health facilities. The evaluation for suitability to admission is highly needed. The Ministry of Health in Kenya which is tasked to oversee quality care to the people of this republic should facilitate availability of proper protocols for use in rehabilitation centres.

2. The ministry should put mechanism in place to monitor the application of these protocols by all relevant service provision institutions.
3. The protocols should be adopted in various training institutional curricula to equip novice clinicians with early knowledge that will guide them in practice.

4. Clinicians should be re-educated on the guiding principals for admission and referral of clients with alcoholic liver disease.

5. Sustainability in the application of these protocols should be emphasized in all management systems at the lower tiers of health facilities to the high tiers.

6. The protocols should be designed in form of a checklist at admission and referral where the various body systems involved should be evaluated for functioning.

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AUTHORS

First Author – George Njoroge, College of Health Sciences, Mount Kenya University

Second Author – Catherine Mwenda, School of Nursing Sciences and Public Health, South Eastern Kenya University

Third Author – Ezekiel Mecha, Department of Biochemistry, University of Nairobi Kenya

Fourth Author – Stanley Waithaka, College of Health Sciences, Mount Kenya University
Protease-Producing Bacteria Isolated from Beans Effluent-Impacted Soil Harbour *apr* and *npr* Protease Encoding Genes

Obichi, E. A. and Ezebuiro, V.*

National Biotechnology Development Agency, South-South Zonal Centre of Excellence, Regional Centre for Biotechnology and Bioresources Research, University of Port Harcourt, Choba, Rivers State, Nigeria.

*Correspondence: email: victor_ezebuiro@uniport.edu.ng; ezebuirovictor@gmail.com; Phone: +2348064944045

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Abstract

This study employed molecular technique to identify protease-producing bacteria from beans effluent-impacted soil and screened the isolates for the presence of two principal extracellular protease-encoding genes (*apr* and *npr*). Protease-producing bacteria were isolated from beans effluent-impacted soil in Rumuosi, Port Harcourt, Rivers State Nigeria. Protease production was determined by plate screening and enzyme activity assay methods. Three bacterial isolates comprising P2, P3 and P4 were identified based on 16S rRNA gene sequences' analyses. These protease-producing strains were further screened for the presence of the two principal extracellular protease-encoding genes *apr* and *npr* using PCR-based technique. Phylogenetic tree analyses of the sequences obtained from the isolates identified the protease producers as *Alcaligenes faealis* P2, *Serratia marcescens* P3 and *Lysinibacillus* sp. P4. The sequences have been deposited in GenBank under the accession numbers MZ477006.1-MZ477008.1. In addition, PCR results revealed the presence of *apr* gene in *Alcaligenes faealis* P2 and *Serratia marcescens* P3 while only *Lysinibacillus* sp. P4 harboured the *npr* protease gene. Results of NanoDrop Spectrophometry showed that concentrations of the extracted genomic DNA ranged between 308 and 500 ng/µL with the purity ranging between 1.68 and 1.84. Out of the three isolates, *Serratia marcescens* P3 had the highest protease activity (0.26 U/mL). The study has demonstrated that beans effluent-impacted soil harbour protease-producing bacteria. Furthermore, *apr* and *npr* genes can aid proper characterization of extracellular proteases.

Keywords: Cassava effluent, beans effluent, amylase, protease; 16S rRNA gene.

1.0 Introduction

Proteases or peptidases represent a group of industrially important enzymes with capacity to break peptide bonds. Protease account for approximately 60% of the world global industrial enzyme market (Nadeem et al., 2019). Interest in them is due to their application in industrially important products such as foods and detergents. Predominantly, proteases are produced by microorganisms through submerged and solid-state fermentation. Gimenes et al. (2019) reported that huge market demand exists for industrial enzymes. The global market demand for industrial enzymes was reported to stand at approximately $5.6 billion, with a predicted increase of 4.9% at a compound annual growth rate, reaching an estimated $7.0 billion in 2023 (Singh et al., 2016).

In the industries, proteases are applied in the field of detergent, tanning and food industries, meat processing, cheese production, silver recovery from photographic film, production of digestive enzymes and medical treatment for harmful wound and inflammation as well as in pharmaceutical industry (Muthulakshmi et al., 2011).
Many bacteria have been reported as efficient producers of proteases and amylases. Binod et al. (2013) reported that *Bacillus* protease was first marketed commercially in 1959 and became big business when Novozymes in Denmark started to manufacture it, with major detergent manufacturers patronizing it around 1965. Most alkaline and neutral proteases have been reportedly produced by bacteria belonging to members of the genus *Bacillus* including strains such as *B. subtilis*, *B. stearothermophilus* etc. (Razzaq et al., 2019) however, other bacteria such as *Alcaligenes* sp., *Serratia* sp. etc have also been implicated. *Bacillus clausii* particularly, was recommended for use at a commercial scale for the production of alkaline protease with the use of peptone, Cu, and fructose as the sole source of energy. The optimum pH and temperature recommended was 8 to 9 and 37 to 40 °C, respectively (Vadlamani and Parcha, 2011).

Proteases have been classified based on their tolerance to pH as acidic (2.0–5.0), alkaline (8.0–11.0) and neutral (7.0) (Mukhtar and Haq, 2008). According to Baraniya et al. (2016) alkaline metallo-peptidase (apr) and neutral-metallopeptidases (npr) are two key bacterial protease-encoding genes. Vasantha et al. (1984) first reported that alkaline and neutral proteases are regulated by apr and npr genes, respectively. The abundance of these genes in bacteria was reported by Baraniya et al. (2016). This study was therefore designed to identify protease-producing bacteria from beans effluent-impacted soil and screen the isolates for the presence of two principal extracellular protease-encoding genes (apr and npr).

2.0 Materials and Methods

2.1 Isolation and Screening of Protease-Producing Bacteria

Protease-producing bacteria were isolated from beans effluent-impacted soil from Rumuosi, Obio Okpor L.G.A., Rivers State, Nigeria (Figure 1). The soil was air-dried, sieved to remove debris and serially diluted to 10⁻⁶ dilution. The diluted sample was plated on skim milk agar plates and incubated at 30°C for 48 h (Anbu et al., 2013). After incubation, the colonies with clear zones were selected and inoculated into freshly prepared skim milk agar (Priyadarshini et al., 2019) plates by spotting them on the agar surface and incubating for 48 h. Development of clear zones on skim milk agar plates confirmed the production of protease. Protease production was further confirmed by casein hydrolysis assays.

![Figure 1: Map of Rivers state with the study area highlighted](image-url)
Pure cultures of the selected bacterial isolates P2, P3 and P4 were inoculated in nutrient broth [consisting of (g L\(^{-1}\)): peptone, 5; Beef extract, 3; NaCl, 5] followed by incubation at 37 °C for 24 h to get a standardized inoculum (0.5 OD at 600 nm with 3.5 x 10\(^5\) cfu/ml).

2.3 Protease Assay

The selected isolates were inoculated into 20 mL of protease production medium comprising: lactose 10 g; casein 10 g; KH\(_2\)PO\(_4\) 2 g; K\(_2\)HPO\(_4\) 2 g; MgSO\(_4\) \(\cdot\)7H\(_2\)O 1 g) and incubated for 48 h on a rotary shaker (200 rpm) at room temperature (Sharma et al., 2014; Saraswathy et al., 2013; Tambekar and Tambekar 2013). After incubation, the culture media were centrifuged at 5000 rpm for 20 min and at 4 °C. Cell free supernatants were collected and used as the crude enzyme for protease assay. Protease assay was conducted by a modified method by Cupp-Enyard (2008). Casein dissolved in different pH buffers [acidic (pH:4), neutral (pH:7) and alkaline (pH:9)] were used as the substrate for the assay. The reaction mixture contained casein and the crude enzyme solution. The mixture was incubated at 37 °C for 10 min. Thereafter, the reaction was stopped by addition of 3 ml of 20% ice-cold trichloro acetic acid (TCA). Precipitated proteins were removed by centrifugation and 0.5 ml of the supernatant was mixed with 2.5 ml of 0.5 M Na\(_2\)CO\(_3\) and kept for 20 min at room temperature. Finally, Folin’s phenol reagent was added to the mixture, kept for 10 min and absorbance was measured at 660 nm against the blank sample. The amount of enzyme required to liberate 1 μmole of tyrosine per ml per minute under the standard conditions defined one unit of protease activity (Hameed et al., 1999).

2.4 Selection of protease-producing bacteria

The bacteria (P2, P3 and P4) with highest zones of clearance and highest activities were selected for further studies. Pure cultures of isolates in triplicate were maintained on casein supplemented minimal agar slant in a refrigerator (Haeir Thermocool, China) for future use.

2.5 Identification of the Bacterial Isolates

Bacterial genomic DNA extraction was carried using ZR Soil Microbes DNA Mini-Prep extraction kit (Zymo Research Corporation, South Africa). The quantity and purity of the extracted genomic bacterial DNA were analysed using an ND-1000 spectrophotometer (Thermoscienitific, Inqaba Biotech, South Africa) and agarose gel electrophoresis system. The genomic DNA was stored at -20 °C. The amplification of the 16S rRNA gene of the isolates was carried out using primer sets 27F (5\(^\prime\)AGAGTTTGATCMTGGCTCAG\(\)3\(^\prime\)) and 1492R (5\(^\prime\)GGGTACCTTGTTACGACTT3\(^\prime\)). The PCR reaction was carried out in 25 µL reaction volume, containing 12.5 µL of the Master Mix (Zymo Master Mix), 0.4 µL of each primer, mixed with 5 µ of the DNA template. Sterile nuclease free water of volume, 6.7 µL was added. The following PCR conditions were used: Initial denaturation (95 °C for 5 min), denaturation (95 °C for 30 sec.), annealing (52 °C for 30 sec), extension (72 °C for 45 sec.), and final extension step (72 °C for 3 min) and was cooled for 4 °C. About 5 µL of the amplified products was run on agarose gel electrophoresis at 120 V for 15 min to determine the quality of the products. The amplified products were also purified using DNA clean and concentrator (DCC) kit (Zymo research institute, South Africa) in preparation for sequencing.

PCR products of the bacterial DNA were sequenced using Sanger method of sequencing with 3500 ABI genetic analyser at Inqaba Biotechnical Industries, South Africa. The sequences generated by the sequencer were visualized using Chromaslite for base calling. BioEdit was used for sequence editing, Basic Local Alignment Search Tool (BLAST) was performed using NCBI (National Center for Biotechnology Information) database. Similar sequences were downloaded and aligned with ClustalW and phylogenetic tree drawn with MEGA 6 software.

2.6 Detection of apr and npr Protease-Encoding Genes
In order to detect the presence of \textit{apr} and \textit{npr} protease-encoding genes, the extracted DNA was subjected to PCR procedure. Primers used for the detection of \textit{apr} and \textit{npr} genes were as reported by Bach \textit{et al.} (2001). The primer sets, their composition, position, melting temperature (\(T_m\)), and length of amplicon is given in Table 1.

**Table 1:** Oligonucleotides used as primers for specific amplification and detection of genes for alkaline metallopeptidases (\textit{apr}), neutral metallopeptidases (\textit{npr})

<table>
<thead>
<tr>
<th>Gene</th>
<th>Composition</th>
<th>Position (nt)*</th>
<th>(T_m) (2AT+4GC) °C</th>
<th>Length of amplicon (bp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\text{FP apr I})</td>
<td>5’-TAYGGBTCAAYTCCAAYAC-3’</td>
<td>808–827</td>
<td>52–60</td>
<td>194</td>
</tr>
<tr>
<td>(\text{RP apr II})</td>
<td>5’-VGCAGATCGACRTTRCC-3’</td>
<td>985–1002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\text{FP npr I})</td>
<td>5’-GTDGAYGCHCAYTAYTAYG-3’</td>
<td>214–233</td>
<td>54–66</td>
<td>233</td>
</tr>
<tr>
<td>(\text{RP npr II})</td>
<td>5’-ACMGCATGBGTYADYTCATG-3’</td>
<td>437–446</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3.0 Results and Discussion

#### 3.1 Protease Production by the Bacterial Isolates

Results of plate screening for casein hydrolysis are presented in Table 1. The highest protease producer was isolate P3 with protease activity of 0.26 U/mL.

**Table 1:** Screening and assay characteristics of the protease-producing bacterial isolates

<table>
<thead>
<tr>
<th>Isolate code</th>
<th>Halo zone (cm²)</th>
<th>Tyrosine release (µmol/mL)</th>
<th>Protease activity (U/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2</td>
<td>4.16</td>
<td>0.176</td>
<td>0.19</td>
</tr>
<tr>
<td>P3</td>
<td>5.73</td>
<td>0.232</td>
<td>0.26</td>
</tr>
<tr>
<td>P4</td>
<td>2.55</td>
<td>0.202</td>
<td>0.22</td>
</tr>
</tbody>
</table>

#### 3.2 Molecular Identification of Protease Producers

The concentration, purity, quality, and phylogenetic tree construct for the protease-producing bacteria are presented in Table 2 and Figure 2. The 3 protease producers were identified as \textit{Alcaligenes faecalis} P2, \textit{Serratia marcescens} P3 and \textit{Lysinibacillus} sp. P4.

**Table 2:** Description of the isolates accession, GenBank closest matches, % identity of the protease- and amylase-producing bacteria

<table>
<thead>
<tr>
<th>S/N</th>
<th>Isolate Name</th>
<th>Strain</th>
<th>Accession No</th>
<th>GenBank Closest Match</th>
<th>% Identity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>\textit{Alcaligenes faecalis}</td>
<td>P2</td>
<td>MZ477006</td>
<td>\textit{Alcaligenes faecalis} IMJ8</td>
<td>98</td>
</tr>
<tr>
<td>2</td>
<td>\textit{Serratia marcescens}</td>
<td>P3</td>
<td>MZ477007</td>
<td>\textit{Serratia marcescens} ZK</td>
<td>99</td>
</tr>
<tr>
<td>3</td>
<td>\textit{Lysinibacillus} sp.</td>
<td>P4</td>
<td>MZ477008</td>
<td>\textit{Lysinibacillus} sp. A3-19</td>
<td>99</td>
</tr>
</tbody>
</table>
3.3 Discussion

This study was designed to identify protease-producing bacteria from beans effluent-impacted soil and screen the isolates for the presence of two principal extracellular protease-encoding genes (apr and npr). PCR techniques have shown high reliability in targeting specific regions of microbial DNA. In this present study, PCR technique was employed in the identification of protease-producing bacteria and in the determination of the presence of alkaline metallo-peptidase (apr) and neutral-metallopeptidases (npr) genes. The protease-producing bacteria were identified as *Alcaligenes faecalis* P2, *Serratia marcescens* P3 and *Lysinibacillus* sp P4. Their sequences have been deposited in GenBank under the accession numbers: MZ477004.1- MZ477006.1. This study is unique as it is the first report to the best of our knowledge on the isolation of protease-producing bacteria from beans effluent-impacted soil. However, few studies have reported protease production from protein rich wastes (Saxena and Singh, 2011; Yazid *et al*., 2016).

*Alcaligenes faecalis*, *Serratia marcescens* and *Lysinibacillus* sp. have all been previously implicated in protease production. Thangam *et al.* (2000) reported that *Alcaligenes faecalis* isolated from tannery soil produced protease efficiently. Similarly, *Alcaligenes faecalis* was reported as an efficient alkaline protease producer by Marathe *et al.* (2018). The findings of this study corroborate these claims as the *Alcaligenes faecalis* strain P2 used in this present study produced protease under alkaline condition. The best protease-producing bacterium was *Serratia marcescens* P3 with protease activity of 0.26 U/mL. *Serratia marcescens* has been reported to produce efficient protease by other studies. Jo *et al.* (2008) reported high protease production by the same bacterium. Iqbal *et al.* (2018) also reported efficient alkaline protease production by *Serratia marcescens*. *Lysinibacillus* sp. P4 used in this study produced neutral protease. Many *Bacillus* species have been reported as efficient producers of both alkaline and neutral proteases (Akhavan-Sepahy and Jabalameli, 2011; Amira and Eida, 2016).

Functional PCR analysis of the DNA isolated from the isolates revealed protease-encoding genes: alkaline metallo-peptidase (apr) in *Alcaligenes faecalis* P2 and *Serratia marcescens* P3 and neutral-metallopeptidases (npr) in *Lysinibacillus* sp. Baraniya *et al.* (2016) reported that these basic protease-encoding genes are widely distributed among bacteria. This study corroborates Baraniya *et al.* (2016) assertion as all the bacterial isolates harboured either of the genes. The presence of these genes may have conferred on the isolates their pH preferences.
Conflict of Interests

Authors have declared that no conflicting interests exist.

References


The prevalence of anemia, its association with dietary patterns and nutrient intakes among children aged 6 to 24 months: a systematic review.

Rhoda Ama Koranteng¹, Dery Bede², Dr Charles Apprey¹

¹ Department of Nutrition and Dietetics, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.
² Dietetics and Nutrition Unit, Effia Nkwanta Regional Hospital, Takorad, Ghana.

Abstract- Purpose: Anemia threatens healthcare system worldwide with enormously high prevalence among the vulnerable groups in society posing a huge economic burden. The purpose of this paper is to investigate the prevalence of anemia and its association to dietary patterns and nutrient intake among children.

Method: A systematic review was done on published studies that looked at prevalence of anemia and its association with dietary patterns and nutrient intakes among children aged 6 to 24 months. PubMed, Doaj, Google scholar and Google advanced search databases were searched from a period sof 8th July 2021 to 29th July 2021. Quality assessment was done for all papers based on their methodology.

Findings: Online search yielded a total of 365 papers of which 79 were appropriately titled but 21 remained after removing duplicates. 11 of the studies could not be included because they were anemia treatment protocols and reviews. 10 studies that met inclusion criteria in terms of abstracts and methodology were included in the study. Majority of the studies associated anemia prevalence with nutrient intakes; vitamin A or serum retinol levels (4 out of 10) articles and c-reactive protein deficiency was associated with anaemia (2 out of 10) articles. Also inadequate consumption of iron-rich foods as a dietary pattern was associated with high prevalence of anemia among children 6 to 24months.

Practical implications: Most of the studies were conducted in developed countries and this implies that there is a rarity of data in developing countries where prevalence of anemia is high. There is the need for more studies to be steered in this area among developing countries.

Index Terms- Anemia, dietary patterns, nutrient intakes

I. INTRODUCTION

Anemia denotes red blood cell mass and hemoglobin concentrations of less than the fifth percentile for age. It is categorized into microcytic, macrocytic, and normocytic, based on the mean corpuscular volume. The condition is further classified as mild anemia with a Hb concentration of 10.0-10.9g/dL, moderate anemia with a Hb concentration of 7.0-9.9g/dL, and severe Anemia with a Hb concentration of less than 7.0g/dL. Anemia is also one of the leading micronutrient deficiencies, currently being recognized as the most prevalent nutritional deficiencies and the second leading cause of disability nutritionally (Woldie, Kebede, and Tariku, 2015). According to the World Health Organization, Anemia affects about 273 million preschool children, thus affecting about 42.6% of such children. The organization again, in 2011, further indicated that the prevalence of Anemia across the globe was highest in Africa, at about 64.6%. In 2008, data from the Ghana Demographic and Health Survey indicated that about 78% of children aged 6–59 months were estimated to be anemic (Ewusie et al., 2014). A study conducted by Stevens et al. (2013) showed that the prevalence of Anemia in the country had dropped to 67%, which was still higher than the global prevalence. Due to the complex interactive nature of Anemia with many factors such as health and nutrition, it has major consequences on the socio-economic development of the population. Other causes of Anemia include viral infections, malaria, hemolysis, chronic disease, folate, and vitamin B12 deficiencies. These other causes are significantly associated with dietary patterns and nutrient intake. Crucial for life-long health and well-being, nutrition and nurturing are essential during the first years of life, especially when new foods are introduced to children. Nutrient requirements are considerably elevated and deemed vital for developing children below two years. Nutrients usually evaluated include iron, as breast milk alone is not rich in iron to supply the growing child's needs during the complementary feeding stage, thus to 24months. Iron as a micronutrient is needed to synthesize hemoglobin, an indicator of Anemia, and its deficiency is also seen as the major cause of Anemia. Nutrient intake, especially micronutrients and dietary diversity, provides adequate iron, folate, and Cobalamin in producing Red blood cells.

A systematic review of all studies published in this field is necessitated to assess anemia risk among young children and also report on it trends and associations with nutrient intake and dietary patterns. This will enable preventive and reductive actions to be taken to reduce this menace drastically. This writes up compiled published studies done on prevalence of anemia and one or more
nutrients consumption or dietary patterns among children below two years.

II. METHODOLOGY

SEARCH STRATEGY

A systematic review was done and all published data from 2000 to 2021 to search for all data on the dietary patterns, nutrient intakes and their associations with anemia of children below two years. In veracity, the severity of the anemia suffered by various children and the sexes of the children were of little consideration, indicating that all studies involving the target population were included. The main search engines included Google Scholar, Pubmed, Doaj and Google advanced search. The search was conducted systematically to find the association between nutrient consumption, dietary patterns and the outcome of anemia.

INCLUSION AND EXCLUSION CRITERIA

Below was the inclusion criterion

- Population: Human population (Children below 2 years)
- Study designs: Experimental and Observational studies
- Outcome: Anemia
- Exposures: Dietary pattern, nutrient intake

The following search results were excluded
- Reviews
- Reports on various protocols used in treating anemia patients were excluded
- Various case studies that did not meet the inclusion criteria

SEARCH RESULT

With the repeated articles eliminated and articles that did not meet the criteria also excluded the total number of 365 journal articles was obtained from the various search engines. Unluckily some of the full texts of the articles could not be accessed. At the end of the systematic search, only ten remained.

365 articles published with key words anemia, nutrient intake and dietary patterns

286 papers didn’t meet the eligibility criteria

58 papers were duplicates from the various search

Removal of anemia treatment protocols and reviews

79 articles remained after reading the articles

21 remained after removing duplicates

10 remained
THE FINDINGS ON THE STUDIES INVOLVING DIETARY PATTERNS AND NUTRIENT INTAKE ASSOCIATIONS WITH ANEMIA
A summary of the results based on the various searches is presented below.

STUDY DESIGN
The prevailing study designs used in the various studies were observational studies where dietary patterns or nutrient intakes were associated with anemia simultaneously or individually.

EXTRACTION OF DATA
Data was extracted based on study source (Author, year of publication), country in which study was conducted, study design, data collection procedures, prevalence of anemia, nutrient intake or dietary pattern involved, age of participants and major findings.

STUDY POPULATION, SETTING AND COUNTRY
The populations of the various studies were similar. The subjects were health male and female children mostly between the age 6 months and 24 months. The exclusion criteria were mainly non breastfed children and children who suffered from various chronic conditions or diseases.

DIETARY PATTERNS AND NUTRIENTS CONSIDERED IN THE STUDY
Nutrients considered are Carbohydrates, Proteins, Fats, vitamins A, C, B12, B9, Iron, Calcium and Selenium. Dietary diversity and the consumption of iron-rich foods were dietary patterns of consideration. In one study, non-vegetable based dietary pattern and vegan diets among various children concerning the anemia status were considered (Fajolu et al., 2007).

III. MAIN FINDINGS
One remarkable associate of the prevalence of anaemia is inadequate vitamin A intake or serum retinol levels time as reported by most the journals (Morasso et al., 2003; Gamble et al., 2004; Nabakwe et al., 2005; Mahfuz et al., 2019). Apart from that, the inclusion of vegetables and animal protein less than three times a week in the diet was significantly associated with anemia (Fajolu et al., 2007). In addition, decreases in the consumption of iron-rich foods and inadequate intake of foods rich in heme iron compared to high non-heme iron intake were associated with anaemia (Reboso Perez et al., 2005; Akalu et al., 2021). As reported by (Soh et al., 2004), a significant outcome from the study revealed that c-reactive protein deficiency was associated with iron deficiency anaemia. Moreover, the prevalence of anaemia is dependent on multi-sectoral factors, with nutrition and nurturing being major determinants.

IV. RESEARCH GAPS
Table 1 Summary of the main findings of the research

<table>
<thead>
<tr>
<th>AUTHOR</th>
<th>STUDY DESIGNS</th>
<th>NUTRIENTS OR DIETARY PATTERN INVOLVED</th>
<th>PREVALENCE OF ANEMIA</th>
<th>AGE OF CHILDREN</th>
<th>OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Morasso et al., 2003)</td>
<td>Not stated in abstract</td>
<td>Vitamin A, Iron</td>
<td>66.4%</td>
<td>6 to 24months</td>
<td>Anemia prevalence was significantly higher in children who had never taken iron supplements.</td>
</tr>
<tr>
<td>(Nabakwe et al., 2005)</td>
<td>Cross-sectional</td>
<td>Vitamin A</td>
<td>92%</td>
<td></td>
<td>There was no difference in hemoglobin level of children with normal serum retinol and those with low serum retinol.</td>
</tr>
<tr>
<td>(Gamble et al., 2004)</td>
<td>Community-based survey</td>
<td>Iron and Vitamin A</td>
<td>42.5%</td>
<td>Preschool</td>
<td>Both iron deficiency and severe vitamin A deficiency were significantly associated with anaemia.</td>
</tr>
<tr>
<td>(Mahfuz et al., 2019)</td>
<td>Birth cohort study</td>
<td>Iron and Vitamin A</td>
<td>Not stated in abstract</td>
<td>7 to 24months</td>
<td>low retinol levels were associated with increased anemia prevalence.</td>
</tr>
</tbody>
</table>
Cross-sectional studies

<table>
<thead>
<tr>
<th>AUTHOR AND COUNTRY</th>
<th>AIM OF STUDY</th>
<th>MAIN FINDING</th>
<th>GAPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Morasso et al., 2003) Argentina</td>
<td>Determining the prevalence of vitamin, A and iron (ID) anemia</td>
<td>a) Anemia prevalence was significantly higher in males, in children with low birth weight, in those who had never taken iron supplements and among the poor, both structural and by income. b) Low iron and vitamin A deficiencies.</td>
<td>A large sample size would have been beneficial</td>
</tr>
<tr>
<td>(Nabakwe et al., 2005) Kenya</td>
<td>Determining and correlating the prevalence of vitamin A deficiency, anaemia and malaria parasitaemia to hemoglobin, ferritin, and acute phase response.</td>
<td>a) Hemoglobin levels in children with normal serum retinol and children with low serum retinol did not differ. b) Ferritin was not substantially different between children with</td>
<td>• Smaller sample size. • Much work should be done on all serum micronutrient</td>
</tr>
<tr>
<td>Study</td>
<td>Purpose of Study</td>
<td>Findings/Implications</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>(Gamble et al., 2004) Republic of the Marshall Islands</td>
<td>Characterizes contributions to anemia in pre-school children from vitamin A and iron deficits</td>
<td>Both iron and vitamin A deficiencies were independent risk factors for anemia, but inflammation was not a significant risk factor for anemia among these preschool children. Cumulative impact of macronutrients and micronutrients deficiencies on anemia rates also needs to be probed.</td>
<td></td>
</tr>
<tr>
<td>(Mahfuz et al., 2019) Bangladesh</td>
<td>To identify the factors associated with micronutrient deficiencies and association of plasma micronutrient concentration trajectories from 7 to 24 months</td>
<td>Deficiencies in iron and vitamin A were independent anemia risk variables but inflammation was not a major anemia risk factor in these preschool children. Low concentrations of ferritin and retinol are connected with higher anemia prevalence.</td>
<td></td>
</tr>
<tr>
<td>(Soh et al., 2004) New Zealand</td>
<td>Determining biochemical iron deficit and identifying ferritin-related factors</td>
<td>The presence of suboptimal iron status Very low proportions of children with inadequate C-reactive protein being anemic.</td>
<td></td>
</tr>
<tr>
<td>(Fajolu et al., 2007)</td>
<td>To determine the prevalence of IDA and some factors associated with it</td>
<td>High prevalence of anemia. Poor consumption rate of iron rich foods was significantly associated with IDA. The study population was smaller</td>
<td></td>
</tr>
<tr>
<td>(Appiah et al., 2021) Ghana</td>
<td>To identify the predictors of child undernutrition and anemia</td>
<td>child's past morbidity and exclusive breast-feeding rate ominously contributed to anemia among the children Dietary diversity does not significantly contribute to anemia among the children. • Study design could not establish causality. • Small sample size</td>
<td></td>
</tr>
<tr>
<td>(Reboso Perez et al., 2005) Cuba</td>
<td>Prevalence of iron deficiency anemia in children</td>
<td>High prevalence of anemia. Serum vitamin A values were associated to anemia Inadequate intake of foods rich in heme iron compared to high intake of non heme iron</td>
<td></td>
</tr>
<tr>
<td>(Zou et al., 2021) China</td>
<td>The association between dietary patterns and anaemia among children</td>
<td>Anemia status and dietary patterns are significantly associated</td>
<td></td>
</tr>
<tr>
<td>(Akalu et al., 2021) South Africa</td>
<td>To determine the prevalence of good consumption of iron-rich foods and its associated factors among children</td>
<td>Low prevalence of good consumption of iron-rich foods among children. The consumption of iron rich foods was associated with anemia. Child, family and community-level factors are significantly associated</td>
<td></td>
</tr>
</tbody>
</table>
V. DISCUSSION

Numerous researches show that the effects of certain micronutrients and dietary patterns on the anemia rate are remarkable. The study shows that the prevalence of anemia is related to iron and vitamin A deficits (Morasso et al., 2003). However, sex, birth weight, supplementation of micronutrients, and economic status were key factors. Studies by (Gamble et al. 2004; Soh et al. 2004; Mahfuz et al., 2019) showed that the different intakes of micronutrients were substantially related to childhood anemia. The individual roles of the different micronutrients in anemia prevalence were clear, but it is tough to know the impact of synergistic micronutrients on anemia status. The influence of micronutrients and their role in hematomical components cannot be over emphasized. Some studies that measure deficiency rates have shown that nutrients can affect an individual's hemoglobin level. The search revealed that low consumption of iron-rich meals by children impacts the prevalence of anemia (Fajolu et al., 2007). Akalu et al. (2021) also reports that iron-rich food consumption is, therefore, an important area of research associated with anemia. A correlation with anemia in dietary patterns such as dietary diversity among young children has been described by (Appiah et al., 2021; Zou et al., 2021). In addition to the high incidence of anemia in serum retinol content, inadequate consumption of foods rich in heme iron is also linked to the high intake of non-heme iron (Reboso Perez et al., 2005). An anemia child is likely to have poor dietary and nutrient intake. Most nutrient intakes were lower, hence considered deficient, than the recommended daily allowance. Cross-sectional studies have dominated the results of this study, so create a study that provides specific information on the current situation while providing insight for large-scale Bosomtwe and Ghana studies as a whole. Neither study revealed either dietary patterns or anaemia-related nutrient intakes. The link between dietary patterns, nutrient intake, and anemia is essential.

VI. LIMITATIONS

There are some limitations to this research work. Majority of the studies reviewed were done in developed countries therefore results of the study may not be applicable to low-income countries. Also, most of the studies were cross sectional and did not assess cause and effect relationship but only looked at prevalence of anemia, dietary patterns and nutrient intakes. The inaccessibility to full articles of some papers that met the inclusion criteria by title and abstract is also a limitation to the study.

VII. CONCLUSION

The impact of dietary patterns and nutrient intake on the general wellbeing of children below 2 years cannot be overemphasized. Their roles in various systemic and physiological processes in the human body attribute them to the likelihood of developing anemia in children. It is evident that most studies done so far on determinants and causative factors of anemia do not focus on the association dietary patterns and specific nutrient intakes and the condition.

REFERENCES


AUTHORS

First Author – Rhoda Ama Koranteng, Department of Nutrition and Dietetics, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

Second Author – Dery Bede, Dietetics and Nutrition Unit, Effia Nkwanta Regional Hospital, Takorad, Ghana.

Third Author – Dr Charles Apprey, Department of Nutrition and Dietetics, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.
Abstract- The motive of this paper was to examine how functionality of alternative banking channels influence the level of customer satisfaction in Tanzanian commercial banks sector. The study conducted in Arusha city, by using a descriptive survey design. The population for the study was staff and customers of twenty commercial banks branches operating in Arusha city. Simple and purposive sampling techniques were used to select a sample size of about 110 respondents to be involved in the study. The questionnaire instruments used to collect primary data, which were analyzed by the use of descriptive statistic and Ordinal regression Analysis. The findings revealed that there is significant positive relationship between functionality of ABCs attributes and the level of customer satisfaction in Tanzanian commercial banks sector. The study recommends that banking and financial institution Act 2006 be modified to accommodate adoption and use electronic banking, in so doing, banks can use PINs, instead of signatures. This will simplify handling of cyber crime cases more easily than it is now

Index Terms- Functionality, alternative banking channels, customer satisfaction

I. INTRODUCTION

Most marketers and customer researchers believe customer satisfaction to be a critical theoretical and practical issue (Jamal, 2004). Customers are satisfied with a product or service if their judgments of its performance after purchase and use differs from their pre-buy expectations (Sharma and Ojha, 2004). On the other hand, satisfaction is acknowledged as a factor in satisfaction evaluations because of the impact it has on the experience of purchasing and using the product or service (Homburg et al, 2006). In other terms, we can argue that satisfaction is a post-buy appraisal of the product's quality based on the customer's expectations prior to purchase (Kotler, 1991). Consumer effective responses, according to Dube Rioux (1990), can better predict customer happiness than cognitive evaluations. Recruitment and long-term relationships built on high levels of client satisfaction through offering quality services are thought to lead to loyalty (Zimonjic, 2018).

Customer satisfaction in the banking industry measures how well customers' wants and expectations are met by banking products and services. According to the literature, customer satisfaction can be assessed by considering a variety of factors, including service quality, client loyalty, repurchase behaviour, and trust, among others (Anderson and Fornell, 2001; Anderson and Mittal, 2000), with the conclusion that a happy client is loyal and increases an organization's profitability. Only thrilled or extremely satisfied clients continue to use the services of the provider (Salmen and Muir, 2003; Dubrovski, 2001). The banking sector is very competitive (Lee and Moghavvemi, 2015; Venezataya et al., 2019; Bente, 2018), and emerging online, high-tech banks continue to pose a threat to established, brick and mortar institutions. Younger generations have a clear requirement for their banks in terms of service, security, swiftness, convenience, availability, content, design, privacy, fees, and costs associated with the most recent technologies.

It's a new way to conduct banking transactions: alternative banking channels (ABC) (Chang, 2015). In the mid-1990s, this approach was first developed, and it has since become increasingly essential (Allen et al., 2001). It's called "alternative banking channels" when a bank provides its customers with information or services via a computer or TV (Allen et al., 2001). A more advanced service is one that allows consumers to access their accounts and do transactions via the internet, or to purchase things online (Daniel, 1999). As banking information and communication technology (ICT) advances, people are able to perform financial transactions from anywhere, without having to physically visit a bank, through the development and use of alternative banking channels (ABCs) (Ndungu, 2007; Kumar et al., 2014 and Ngago, 2015). The spread and application of Information and Communication Technology (ICT) in developing countries has been more rapid than that of any previous technology in human history. All of today's banking tools, such as ATMs, internet banking, credit and debit cards, mobile banking, SIM-banking, and agency banking, are included in the ABCs utilised by financial organisations (Chebii, 2013). For many customers, ABCs are a more convenient option than traditional branch banking, according to Kumbari (2017). As part of their multi-channel distribution strategy, several of the world's biggest banks
are shifting away from managing branches to managing ABCs, a branch model that balances retail and small business customer needs (Bradley & Stewart, 2013). In the United Kingdom (UK) retail banking used alternative banking channels, and it has been reported to be a success in growing personal current accounts in commercial banks (Benston, 2014). A report by Kumar et al (2014) emphasizes that ABCs in developed countries has been of success as most of the commercial banks adapting new banking channels in order to reach the large population in the world. In most African countries, ABCs have been adopted by commercial banks as a new way of serving customers and reaching those customers who are found in marginalized areas. For instance in Angola the commercial banks adopted the use of internet and mobile phone in banking service as a result of the huge demand for e-banking from the business community as well as the urban retail customers (Sijola and Ndlovu, 2013). According to Ngumi, (2013) the use of ABCs such as mobile banking, agency banking, and internet banking is increasing day by day in east African countries. In Tanzania, financial institutions such as commercial banks and microfinance institutions have been deploying both traditional and new alternative channels for banking activities, such as internet and mobile banking and agency banking, in order to facilitate the provision of financial services to their customers. Tanzanian mobile banking services include NMB mobile (NMB), TPB popote (TPB), and CRDB-SIM banking (CRDB), as well as agency banking through Fahari Huduma and Umoja Switch (Mazwile, 2014). It is critical for bankers to comprehend the current electronic banking system usage trend. According to several researchers, many foreign internet users exhibit similar behaviours and preferences across countries (Quelch and Klein, 1996). Other scholars have investigated the internet in the context of traditional civilizations while being constrained by national borders (Park and Jun, 2003). Some studies have looked into the challenges surrounding the evolution of alternative banking channels (Sohail and Shanmugham, 2003) and the success elements in various electronic delivery channels in the banking context (Ong and Cheng, 2003).

1.1. Problem statement

Customer satisfaction is a manager’s best tool for retaining loyal consumers. Great personnel will always be a company’s backbone. The approach and resources you give employees can boost employee performance. CRM is a strategy and tool, or weapon. CRM comes to life when you and your workers use it to stay on track and anticipate market changes (Anderson & Kerr, 2002). Customer satisfaction is a concern in many developing countries like Tanzania, particularly the banking industry. Satisfied customers often repurchase and tell others about a company’s products and services. If this happens often, customers will become loyal to the company. In Tanzania, banks using alternative banking channels compete by serving customers without opening bank branches (Kwarteng, 2015). Customer satisfaction leads to repeat purchases, brand loyalty, and favourable word-of-mouth (Mattoi, 2015). Alternative banking channels establish a new service delivery channel and add value to banks and clients (Hwang et al., 2007; Murphy, 2007). Amato-McCoy (2005) proposes that e-transfer and e-bill will attract customers to electronic banking. Researchers studied electronic banking client preferences (Suganthi et al., 2001; Sohail and Shanmugham, 2003). According to the literature, banks that don't employ e-banking may lose consumers (Kwarteng, 2015). Banks offer internet banking and other online services to boost consumer satisfaction (Shittu, 2010).

In Tanzania, there have been various problems with electronic banking, such as theft of depositors' money through ATMs and other channels, low or limited internet availability, broken ATMs, and others. In light of the aforesaid concerns, the researcher wanted to see if banking customers are still happy. Electronic banking vs customer satisfaction has been thoroughly examined globally, but Tanzanian studies did not cover all aspects that hinder customer satisfaction. The researcher decided to fill this gap by studying more variables than prior studies in Tanzania. The study aims to answer what electronic banking elements influence customer satisfaction in commercial banks. This study examines the effectiveness of alternative banking channels in Tanzanian commercial banks. This report examined how ABC functionality affects customer satisfaction in Tanzanian commercial banks. The study's findings help the banking industry develop customer satisfaction strategies.

II. Conceptual Consideration

Alternative banking channels blend modern information technology with traditional banking services. Minimizing operating costs and maximizing revenue improve e-banking (Sannes, 2001; Reibstein, 2002). Alternative banking channels service is a self-service by customers, so it requires less resources and lower transaction and production costs for banks (Southard and Siau, 2004; Witman and Poust, 2008). Alternative banking channels services are expected to impress commercial bank customers if they are delivered practically to meet the clients' needs and wants. Customer satisfaction means meeting needs and wishes. Customer satisfaction is a person's joy or dissatisfaction in a product's performance or outcome compared to expectations (Musiime and Biyaki, 2010). Customer satisfaction is the percentage of customers whose reported experience with a firm, its products, or its services (ratings) surpasses established goals (Farris et al., 2010). This study defines customer satisfaction as how well a product or service matches a customer's expectations.

2.1 The Technology Acceptance Model (TAM)

Bagozzi, Davis, and Warshaw's (1992) Technology Acceptance Model is the most popular innovation adoption model. This approach has been used to study how people use new technology. TAM's sequential linkage of belief-attitude-intention-behavior predicts user adoption of new technology. TAM is an adaptation of Theory of Reasoned Action (TRA) in regard to information systems, which notes that perceived usefulness and perceived ease of use determine an individual's attitudes towards their intention to use an innovation, with the intention serving as a mediator to the actual use of the system. Perceived usability affects perceived usefulness. Hanafizadeh et al. (2014) employed TAM for system adoption. This idea says perceived usefulness and simplicity of use drive system adoption and utilisation (Bankole, et al., 2011). Many electro-banking adoption studies extend or complement the original TAM by adding relative advantage, personal innovativeness, perceived danger, perceived cost of use, lifestyle compatibility (Hanafizadeh, et al., 2014), and perceived
security (Hsu, Wang and Lin, 2011). TAM allows external elements to affect perceived utility and usability (Davis, 1989). TAM believes consumers can act and choose freely. In practise, consumers may face obstacles that prohibit them from acting freely, such as the rationalization of traditional banking channels, which is why many have adopted mobile banking in the past decade (Hanafi Zadeh, et al., 2014). Yousafzai et al. (2010) said TAM is better than other models for explaining online banking behaviour. Jongu (2014) agrees that e-banking delivers convenience, promptness, and cost savings to customers. Banks also want to increase their market through e-banking. Kleijnen et al. (2004) found that mobile technology has helped financial firms introduce new financial innovations.

Empirical Literature Review

Accessibility

Accessibility, the capacity of users to access web-based information and services, depends on numerous aspects. Format, user hardware, software, settings, internet connections, environmental conditions, and user skills and impairments are all factors (Godwin-Jones 2001; Hackett and Parmanto, 2009). "Web accessibility" refers to making website material accessible to people with disabilities. Providing a text equivalent for image content on a website allows visitors with visual difficulties to use a screen reader. Accessible web sites for people with disabilities also address download speed and discoverability (Godwin-Jones 2001; Hackett et al, 2004; Hackett and Parmanto, 2009). Jun et al (1999) found reliable/prompt responses, attentiveness, and ease of use affected customer service quality and satisfaction.

Convenience

E-banking allows clients to access the internet at any time and place. Computer accessibility is also a relative advantage (Daniel, 1999, Black et al, 2001; Polatoglou and Ekin, 2001; Gerrard and Cunningham, 2003). Some service quality variables are generally satisfactory and others are predominantly dissatisfiers, with attentiveness, responsiveness, caring, and friendliness being the main sources of satisfaction. Integrity, reliability, responsiveness, availability, and functioning are dissatisfactory. According to Ainscough and Luckett (1996), consumer engagement encourages e-banking users. Gerrard and Cunningham (2003) cite other variables crucial to the success of e-banking, such as an innovation’s capacity to match consumers’ demands via website features. Interactive loan calculators, exchange rate converters, and mortgage calculators on bank websites attract users and non-users. A UK study identified five essential service quality attributes, including security, convenience, speed, and product variety (White and Nteli, 2004). Therefore, convenience increases client pleasure.

Privacy

Customers have reservations about the e-privacy bank's policies (Gerrard and Cunningham, 2003). Trust has a significant impact on users' willingness to engage in online transactions involving money and personal sensitive information (Friedman et al, 2000; Wang et al, 2003). Privacy is a significant consideration that may influence users' willingness to use e-commerce platforms. To ensure information privacy, encryption technology is the most prevalent feature at all bank sites, complemented by a mix of several unique identifiers, such as a password, mother's maiden name, a memorable date, or a few minutes of inactivity immediately locks users off the account. Furthermore, the Secure Socket Layer protocol, which is widely used for online credit card payment, is designed to provide a private and reliable channel between two communicating entities; the use of a Java Applet that runs within the user's browser; the use of a Personal Identification Number, as well as an integrated digital signature and digital certificate associated with a smart card system (Hutchinson and Warren, 2003). Thus, a combination of smart cards and biometric recognition utilising fingerprints provides more secure and convenient computer access control than the password method. Zeithaml et al. (2000) created e-SERVQUAL to assess the quality of e-services, identifying 11 dimensions: access, ease of navigation, efficiency, flexibility, reliability, personalization, security/privacy, responsiveness, assurance/trust, site aesthetics, and price knowledge.

Security

Assurance concerning security refers to the extent to which the website ensures the protection of consumers' money and personal information, a subject of growing academic interest (Kimery and McCord, 2002; Miyazaki and Krishnamurthy, 2002). Security can be ensured by showing the logos of reputable third parties and providing a privacy statement and information on the security of the shopping methods. Displaying a trusted third-party emblem, for example, ensures a certain level of security protection and has been demonstrated to greatly influence how consumers perceive the trustworthiness of e-suppliers (Jiang et al, 2008). The development of Web browsers enabled Internet banking. Consumers do not need to purchase any software (all they need is a browser) to conduct online banking, nor do they need to keep any data on their computer, backup any data, or wait for software upgrades or new versions (Kolsaker and Payne, 2002; Dong-Her et al, 2004). All transactions take place on a bank's secure server via the internet. The bank possesses all of the necessary data and software to carry out the transactions. Customers visit the bank's website, log in, and then use the bank's internet services. Account access and review, transfer of funds across accounts, bill payment, and a growing list of additional services and products are typical bank services. Because security is vital in internet banking, there are numerous protocols for internet security of encrypted data packets (Kolsaker and Payne, 2002; Dong-Her et al; 2004). Customers are unaware of the encryption; nonetheless, because to security limits, only certain versions of popular internet browsers are suitable to some banks (Kolsaker and Payne, 2002; Dong-Her et al; 2004).

Design

The objective of aesthetic design is to achieve a level of visual appeal and user satisfaction in a website. Knowledge elicitation, information organisation and structure, information retrieval, and information presentation were the four parts of content preparation that were examined and recognised by Proctor et al. (2002, 2003). It is strongly advised that users of different ages, as well as users with a range of capabilities and limitations, be engaged to try the new service and provide input while it is being designed. This should be done prior to the deployment phase. The accessibility of the websites that financial institutions
provide for their customers should be tested using both automated technologies and user accessibility trials.

Content
It should be highlighted that one of the variables impacting online banking acceptance is website content on online banking (Jayawardhena and Foley, 2000, and Pikkarainen et al., 2004). Quality designs, graphics, or colours, on the other hand, and a proclivity to convey a positive image of the bank, would promote the effective use of navigation. There is a growing corpus of study on the influences on customer satisfaction in the setting of internet banking. (Jayawardhena and Foley, 2000) demonstrated that user satisfaction is influenced by web site aspects such as speed, web site content and design, navigation, interactivity, and security. Previously, Doll and Torkzadeh (1988) identified five quality dimensions that influence "end-user" satisfaction in an online environment: content, accuracy, format, ease of use, and timeliness.

Speed
There is a link between download speed and user satisfaction (Hoffman and Novak, 1996). However, download speed is determined by the nature of the site's downloaded material, computing gear, and the mode of connection used to download information (Jayawardhena and Foley, 2000). The majority of sites' demonstrations are short snapshots, and some viewers must download the application to view the presentation. Most individuals believe that downloading can introduce undesirable infections and take up hard disc space. Slow response time following any e-interaction frequently leads to a delay in service delivery and leaves customers wondering whether or not the transaction was completed (Jun and Cai, 2001).

Fees and Charges
Service quality features are significant in the e-banking business because human-internet interaction is the primary service delivery and communication route. E-banking may have a competitive edge by providing high-quality services that meet consumers' expectations at cheaper costs. According to certain research, e-banking has successfully lowered operating and administrative costs (Devlin, 1995; Siriluck and Speece, 2003). Because of cost reductions, e-banks can charge lower or no service fees and offer better interest rates on interest-bearing accounts than traditional banks (Gerlach, 2000; Jun and Cai, 2001).

2.3 Conceptual framework
The literature tells us that for a customer to be fully satisfied especially when purchasing or rather using financial services offered through alternative banking channels there are almost nine important attributes that must be fulfilled by a specific commercial bank. These attributes are; accessibility, security, availability, convenience, speed, content, design, privacy and fees charged. The attributes mentioned above have positive relationship to customer satisfaction in commercial banks. Normally there are two types of customer satisfaction first one is called transaction-specific and the other one is called cumulative (Boulding et al., 1993; Andreassen, 2000). The conceptual frame work treats customer satisfaction as transaction-specific. Thus, customers in this paper are those who consume the services, satisfaction denotes customer’s desire to maintain a business relationship with the commercial banks and it is also the feelings of the customers towards the services provided by the commercial banks. On the other hand customer satisfaction in this study is the pleasures obtained by customers for the services provided by the commercial banks refer figure 2.1 herein below
Figure 2.1 Conceptual framework of the study

Researcher’s construct, 2022

From the above conceptual framework the independent variable is the alternative banking channels measured in terms of accessibility, convenience, content, design, fees and charges, privacy, security and speed, while dependent variable is the customer satisfaction. Functionality of Alternative Banking channels is the one which determines the acceptability of electronic services offered by banks via alternative banking channels. Indeed functionality of each of the following facets, which is accessibility, content, convenience, design, fees charge, privacy, security and security have an impact on customer satisfaction in commercial banks in Tanzania.

III. METHODOLOGY

The study adopted a descriptive survey design, to examine the functionality of alternative banking channels on customer satisfaction, whereby respondents were chosen from bank customers and employees of the domestic commercial banks in Arusha city. Responses were collected from 40 bank officials from their respective banks branches, which in total amounted to 20 banks and 70 bank customers from different banks in Arusha city; these were asked to give their views on how the practicability of alternative banking channels influence the level of customers satisfaction in Tanzanian commercial banks. The study used both simple and purposive sampling techniques to select respondents. Simple random sampling was employed to obtain information from bank customers while purposive sampling was used to retrieve information from bank officials. The study adopted a combination of qualitative and quantitative approach. The combination was considered to be important first of all because it would increase the validity of information, and secondly qualitative data would complement the quantitative one, thus giving a clear picture. According to Kothari (2004) qualitative approach as a function of a perception and impressions of a researcher whereby he/she gives subjective assessment of behavior, opinion and attitude, whereas quantitative approach engage generation of data in quantitative form which can be subjected to thorough quantitative analysis in a prescribed and rigid way. However, Dawson (2002), provides that there are weaknesses and strengths in both quantitative and qualitative approaches and none is superior to another. The study was conducted in Arusha city where twenty (20)branches of commercial banks operating in the city were investigated. A sample size of one hundred (110) respondents were considered desirable, this is as per Kish (1965) and Sudman (1976) whom
content that the sample size of between 100 and 200 respondents is suitable for statistical analysis.

The study used questionnaires as primary data collection method and personal interview guide. The questionnaire design was pre-tested and redesigned through personal interviews with bank managers and banks customers by undertaking the pilot study work (Aaker et al., 2001). Then 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 0.843, refer to table 3.1 appended. For a newly developed questionnaire a coefficient of 0.7 is recommended, therefore 0.843 was considered adequate for this study. The internal consistency reliability is considered higher when the Cronbach’s alpha coefficient is closer to 1, (Sekaran, 2003).

IV. FINDINGS AND ANALYSIS

Information communication technology has brought significant changes in banking industry in Tanzania. Most of the respondents confessed that innovation has revolutionized almost everything in commercial banks especially in services provision. This is fully backed by the use of alternative banking channels as a mode of distribution, which fosters customer satisfaction quickly. Some of the respondents said alternative banking channels improved customer satisfaction in the banking industry, especially in commercial banks. Presence of alternative banking channels had made it possible to reach and render services to many customers as they require in a fastest mode of operation. This enabled banks to serve customers in rural and urban areas which in itself motivated their customers and public at large. Customer satisfaction is a phrase that does not only express a happy customer, but rather complex than that. Customer satisfaction is actually a term most widely used in the business and commerce industry. It is a business term explaining about a measurement of the kind of products and services provided by a company to meet its customer’s expectation (Jenkins (2007). To some, this may be seen as the company’s key performance indicator (KPI). In fact customer satisfaction is an important facet in marketing of goods or services. However most of the respondents stated that customer satisfaction in banks especially when using ABCs will only happen if and only if functionality aspects of alternative banking channels perform adequately. Most of the respondents revealed that functionality attributes which include, accessibility, convenience, content, design, fees, privacy, security and speed are very crucial facets to consider for the customers to be satisfied.

4.1 Testing of the hypothesis

Hypothesis is a specific statement of prediction, which describes in concrete rather than theoretical terms what a researcher expect to happen in the study. The ordinal regression is used to test hypotheses because the researcher was testing for goodness of fit or better still relationship. The study was guided by the following hypotheses:

H₀: There is no significant relationship between ABCs services and customer satisfaction.

H₁: There is a significant relationship between ABCs services and customer satisfaction.

4.2 Descriptive statistical analysis

The researcher distributed one hundred (120) questionnaires to respondents and managed to collect back One hundred and ten (110) fully filled questionnaires, which is equivalent to ninety two percent (92%) response rate. It was demographically revealed that (73%) of the respondents were females and (27%) were males. It was further found that the respondents fall under the following age group 18-25 years constitutes (13%), 26 – 30 years constitutes (38%), 31-40 years, constitute of (13%), 41 years-50 years constitute of (0%), 51 years and above constitute (36%). It was revealed that in terms of marital status (34%) of the respondents were single and (66%) were married. In terms of education levels (79%) of the respondents had college and university education, and (21%) of the respondents had secondary school education. Moreover the researcher wanted to know whether the respondents have bank accounts, and it was revealed fifty four percent (54.5%) of the respondents had savings accounts, while twenty seven percent (27%) of the respondents had current accounts. Besides fourteen percent (14%) of the respondents had both current and savings accounts, and (4.5%) of the respondents possess fixed deposit accounts.

4.2.1 The functionality of the ABCs influence on Customer satisfaction in Tanzanian commercial banks

The study investigated on what exactly harness customer satisfaction when alternative banking channels is used as a method of distribution. It was found there are almost eight important attributes that influence customer satisfaction in commercial banks when using alternative banking channels, as a method of distribution. The attributes were as follows accessibility, convenience, content, design, fees and charges, privacy, security and speed. If the financial institutions are using alternative banking channels as a mode of distribution the above mentioned attributes deem to be most important in facilitating customer satisfaction. That is when we talk of quality service dimensions in alternative banking channels one must consider the attributes mentioned above because they contribute to quality dimension of the very service. Thus the study examined the extent to which these factors harness customer satisfaction in commercial banks operating in Arusha city by using the response model of five likert scale points, ranging from 1=Not at all satisfied, 2= Slightly satisfied, 3=Satisfied, 4=Very satisfied and 5=Extremely satisfied. Then respondents were asked to respond or rate towards these short statements. There-after, descriptive analysis was employed to analyze the results thereof. Refer to table 4.1 appended.

The study employed descriptive analysis whereby the mean scores of 1.00-2.50 indicated that functionality of alternative banking channels has contributed very little towards customer satisfaction, the mean score of 2.51-3.50 indicated that functionality alternative banking channels has contributed satisfactorily on customer satisfaction. It was further set that mean scores of 3.51-3.99 and 4.00-5.00 were taken to indicate that functionality of alternative banking channels has contributed highly and very highly towards customer satisfaction respectively. The summarized results were depicted in Table 4.2 above. The results generally revealed that the functionality of alternative
banking channels has high contribution (a weighted mean 4.00) on customer satisfaction. This definitely due to the fact that most of the variables used were highly rated at the mean which reflect that the functionality of alternative banking channels have contributed some benefits to the bank customers that triggered customer satisfaction. Specifically basing on the variables measured, customer of the banks strongly commend that accessibility (mean 3.78), convenience (mean 3.78), privacy (mean 3.89) and speed (mean 3.72), has contributed highly to customer satisfaction of the commercial banks in Tanzania. Moreover it was revealed that content (mean 4.04), design (mean 4.02), fees and charges (mean 4.4), and security (mean 4.04), has shown very high influence towards customer satisfaction in commercial banks sector in Tanzania. It was further found that the standard deviation was close to mean since it was 0.883 from the mean. This implies that there is no big dispersion or variance from the study data.

On the other hand it was revealed that ninety three point six percent (93.6%), of the respondents were of the opinion that accessibility of the ABCs services influence customer satisfaction to the great extent, while only six point four percent (6.4%), said accessibility brings slightly satisfaction to the customer of the commercial banks in Tanzania. This can be due to accessibility of the services as well as the availability of the information to many bank customers Kawamala (2013) and Ishengoma (2011). Convenience was another attribute which was scrutinized and it was revealed that ninety point nine percent (90.9%) of the respondents confess that convenience foster customer satisfaction whereas nine point one percent (9.1%) of the respondent said convenience had slightly influence on customer satisfaction in commercial banks in Tanzania. Content in the banks’ web site had the impact on customer satisfaction up to ninety five point five percent (95.5%), while four point five percent (4.5%) said it had slight impact on customer satisfaction in commercial banks in Tanzania. Design was also measured and it was found that one hundred percent (100%) of the respondents strongly accepted that it brings customer satisfaction in commercial banks in Tanzania. On fees and charges it was found that these two bring customer satisfaction in opposite direction. When customers receive good interest from the banks, customer satisfaction definitely increase, but when charges are far more customers will be dissatisfied. What is important is the charges or fees must be commensurate to the value received by the customers, if this happens customers will still be satisfied by the services offered. It was revealed that ninety nine point one percent (99.1%) of the respondents accepted that fees and charges had an impact on customer satisfaction and point nine percent (.9%) of the respondents had the opinion that fees and charges slightly impact customer satisfaction in commercial banks. Another attribute which trigger customer satisfaction in commercial banks when using ABCs as a method of distribution is privacy, it was explained that ninety seven point three percent (97.3%) of the respondents had the opinion that privacy influence customer satisfaction in commercial banks, while three point seven percent (3.7%) said privacy had no influence or had slight influence on customer satisfaction in commercial banks in Tanzania. The study checked further on security and speed attributes, the results were as follows ninety six point four percent (96.4%) and eighty nine point one percent (89.1%) had opinion that security and speed respectively influence customer satisfaction in commercial banks sector in Tanzania. Besides, three point six percent (3.6%) and ten point nine percent (10.9%) of the respondents contributed that security and speed had slight or no influence on customer satisfaction in commercial banks in Tanzania.

4.3 Ordinal regression Analysis

The study variables and measurement procedures were as follows; the independent variable is alternative banking channels measured by accessibility, availability, speed, security, content, privacy, convenience, and fees, while the dependent variables is the level of customer satisfaction measured by customer loyalty in Tanzanian commercial banks. The Ordinal Regression analysis was performed to examine functionality impact of alternative banking channels (accessibility, availability, speed, content, privacy, convenience, security and fees) on the level of customer satisfaction, in Tanzanian commercial banks The study further checked on the model fitting information given the following null hypothesis; $H_0$ : No significance difference between Baseline model to final model. Decision criterion adopted was, If $P$<0.05 (reject), and $P> 0.05$ (accept). Now since our $P<0.05$, then the Ho must be rejected, hence the alternative hypothesis will prevail that is $H_1$: there is significance difference model between Baseline and final model. On the other hand the Goodness –of- Fit test was examined and shows that the model fits the data well since the Pearson test shows that it is not statistically significant as it is greater (0.541) than 0.05.

The Pseudo R-square was examined, and it was found that the study had $P$-$R^2$ = 0.989. This Pseudo R-square is the same as $R^2$ in linear regression. The model summary depict that there is a Significant (P-$R^2$= 0.989) relationship between the functionality of alternative banking channels and the level of customer satisfaction. The study revealed that at $P$-$R^2$ = 0.989, which is equivalent to 98.9% of the total variance of customer satisfaction in commercial banks, is attributed by functionality of ABCs attributes. This implies that (98.9%) percentage of variability on the level of customer satisfaction is explained by the regression models or rather the independent variables. That is to the great extent the independent variables (accessibility, convenience, content, design, fees, privacy, security and speed) have perfectly explained the changes on the level of customer satisfaction by ninety eight point nine percent (98.9%).

Beside the study undergo test of Parallel lines which revealed that P- value >0.05, meaning that the location parameters or slope is the same across response categories. That is all coefficients help us to show the direction of the relationship among variables. Moreover, parameters estimates which measures the relationship between the functionality of ABCs and customer satisfaction. The study examined the relationship between the functionality of alternative banking channels influence and the level of customer satisfaction, in Tanzanian commercial banks sector. The alternative banking channels were measured by considering necessary items which harnessing customers satisfaction that include speed, convenience, security, content, design, accessibility, privacy, fees charge and customers satisfaction. The study was statistically significant with P values less than 0.05. The study revealed that there is an increased probability of falling at greater levels of customer satisfaction that is rise to the levels of; 33.3, 14.2, 0.40, 0.182, and 17.94 due to a unit increase on accessibility, convenience, fees, security, and

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http://dx.doi.org/10.29322/IJSRP.12.09.2022.p12951
speed, compared to design. This means one unit change increase in any of the attributes mentioned above lead to increase in customer satisfaction in commercial banks in Tanzania. On the other hand, the study a unit increases in content and privacy will bring customer dissatisfaction in Tanzanian commercial banks to the tune -19.3 and -9.20, respectively. The management should monitor the two attributes so as not affect customer satisfaction in the industry.

V. CONCLUSION AND RECOMMENDATIONS

Basing on the findings and analysis the study revealed that alternative banking channels reduces time in transactions as well as crowd and queues in the commercial banks. Bank customers can easily sit at homes, or at the offices to have transfer of money, recharge of vouchers, making payments to different entities. Most banks in Tanzania have offered electronic banking successfully, and at the same time increased level of customer satisfaction. However for this to happen the functionality of the system in place must be efficient and effective. Moreover, it is necessary that users need to be technically sound in order to use alternative banking channels facility properly and accurately. More importantly the study found that the functionality of alternative banking channels attributes (accessibility, convenience, content, design, fees charge, privacy, security and speed) have proven to influence positively the level of customer satisfaction in commercial banks in Tanzania. It can be concluded that functionality of alternative banking channels influence customer satisfaction of commercial banks in Tanzania significantly. The use of alternative banking channels in commercial banks has brought a significant impact not only on customer satisfaction but also in number of customers recruited and turnover too. It was also noted that the commercial banks have made more commission income from transactions done through alternative banking channels like; ATM, mobile phones and electronic fund transfer, agency banking 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 class innovations. Tanzania has adopted alternative banking channels without guidelines or policies. The government through Bank of Tanzania (BOT), should issue policies on adoption and use of alternative banking channels in Tanzania banking industry, as it was noted that there is not proper laws on adoption of alternative banking channels. The Banking and Financial Institution Act of 2006 do not cover the alternative banking channels practice. The law still insists on documentary evidence and signature recognition, while in alternative banking channels PIN is used for recognition. Thus, this has an implication in cases of cyber crimes that are increasing is we go on, the laws which we have will not help to decide cases of this nature.

The banks are advised that in case of mobile banking, banks are dealers to the Central Bank, 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. 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.

REFERENCES


**Figure 2.1 Conceptual framework of the study**

![Diagram of conceptual framework]

Source: (Survey data, 2022)

**Table 3.1 Reliability test**

<table>
<thead>
<tr>
<th>Cronbach's Alpha</th>
<th>Cronbach's Alpha Based on Standardized Items</th>
<th>No. of Items</th>
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<tr>
<td>.843</td>
<td>.838</td>
<td>18</td>
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</tbody>
</table>

Source: (Survey data, 2022)

**Table 4.1 Functionality attributes in ABCs that influence customer satisfaction in Tanzanian Commercial banks**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Likert Scale</th>
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<td>1  2  3  4  5  N  Mean  Std</td>
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http://dx.doi.org/10.29322/IJSRP.12.09.2022.p12951

www.ijsrp.org
| Source: Field Data, 2022 |

### Table 4.2 Model Fitting Information

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<thead>
<tr>
<th>Model</th>
<th>-2 Log Likelihood</th>
<th>Chi-Square</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept Only</td>
<td>387.623</td>
<td>387.623</td>
<td>7</td>
<td>0.000</td>
</tr>
<tr>
<td>Final</td>
<td>0.00</td>
<td>387.623</td>
<td>7</td>
<td>0.000</td>
</tr>
</tbody>
</table>

### Table 4.3 Goodness-of-Fit

<table>
<thead>
<tr>
<th></th>
<th>Chi-Square</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson</td>
<td>57.194</td>
<td>42</td>
<td>0.059</td>
</tr>
<tr>
<td>Deviance</td>
<td>70.238</td>
<td>42</td>
<td>0.004</td>
</tr>
</tbody>
</table>

Link function: Logit.

### Table 4.4 Pseudo RSquare

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cox and Snell</td>
<td>0.971</td>
</tr>
<tr>
<td>Nagelkerke</td>
<td>0.989</td>
</tr>
<tr>
<td>McFadden</td>
<td>0.885</td>
</tr>
</tbody>
</table>

Link function: Logit.
Table 4.5 Test of Parallel Lines

<table>
<thead>
<tr>
<th>Model</th>
<th>-2 Log Likelihood</th>
<th>Chi-Square</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null Hypothesis</td>
<td>.000</td>
<td>.000</td>
<td>42</td>
<td>1.000</td>
</tr>
<tr>
<td>General</td>
<td>.000(^a)</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.

a. The log-likelihood value is practically zero. There may be a complete separation in the data. The maximum likelihood estimates do not exist.
Estimation of atmospheric instability during dust storms: A case study of Dalanzadgad station, Mongolian Gobi

Tergel Shijirtuya*, Gan-Erdene Tsengel**

*Research Division of General Circulation and Long-Range Prediction, Information and Research Institute of Meteorology, Hydrology and Environment
**Research Division of Surface Water, Information and Research Institute of Meteorology, Hydrology and Environment

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Abstract - Although many scientists have focused on the spatiotemporal distribution of dust storm in Mongolia, there are a few studies have considered physical process.

The atmospheric stability parameters such as Brunt-Vaisala frequency (N), Gradient Richardson Number (Ri) and Eady Growth Rate (σ_E) were evaluated on 3 different cases of heavy dust storms which are occurred from March to May 2020, covered almost all over Mongolia, using reanalysis data produced by European Centre for Medium-Range Weather Forecasts and radiosonde data from “Dalanzadgad” aerological station in Dalanzadgad, Umnugovi. Differential equations of N, Ri and σ_E are solved using finite difference method.

The results of the study reveal that the distribution of dust storm represented well by both Ri and σ_E stability parameters, while linear relationship between dust storm and N as well as the buoyancy component of Ri was not found.

Key words - atmospheric instability, baroclinic stability, dynamic unstable, static stable, wind shear

I. INTRODUCTION

A dust storm is a phenomenon in which dust is released into the atmosphere under the influence of strong winds and then moves to a certain space. Dust storm highly depends on atmospheric circulation system, meteorological parameters near the ground surface and soil properties (Goudie, 1983; Qian et al., 2002; Wang et al., 2004; Shao and Dong, 2006). When the cyclone becomes active near the ground surface related with upper level through, pressure gradient increases and strong winds are created. Dust storms are generated by these strong winds, from the Gobi Desert (Chen et al, 1991; Kurosaki and Mikami, 2003; Jugder et al, 2014). Researchers described the threshold wind speeds when dusts are released exceed 6.0 m/s or more over the Mongolian Gobi Desert region (Natsagdorj et al., 2003; Kurosaki and Mikami, 2007; Jugder et al., 2014).

Dust particles generated by dust storm from the Gobi Desert region of southern Mongolia and northern China (inner Mongolian autonomous region) release into the atmosphere and transport over the East Asian region, such as Korea and Japan, even can reach to the western coast of US through the pacific (Husar et al, 2001; Shao and Wang, 2003; Tsedendamba et al, 2019). Some negative impacts such as lost and deaths, delays in pasture for livestock, closures of roads, delays of flights occur during severe dust storms, due to the reduction of visibility (Natsagdorj et al, 2003; Shao and Wang, 2003, Jugder and Shinoda, 2011). Atmospheric windblown dust presents serious risk for human health, especially for the respiratory and cardiovascular system (Perkins 2001, Zhang et al., 2016; Goudie, 2020).

In Mongolia, about 60 percent of annual dust storms occur in the spring time, and around 65-91 percent occurs in a daytime and 9-35 percent observes in the nighttime, while dust storms extend an average of 3-6 hours per day (Natsagdorj et al., 2003). Natsagdorj et al described that dust storm mostly occurs when relative humidity is less than 40%. According to the observation data of more than 30 meteorological stations in Mongolia, from 1960 to 2013, the number of days with dust storm is increased almost 3 times (MARCC, 2014).

In general, dust storm studies mostly tend to estimate the synoptic process during a dust storm, weather and climatic parameters, soil surface properties and wind speed thresholds for dusts (Shinoda et al., 2010; Jugder and Shinoda, 2011; Ishizuka et al., 2012; Jugder et al., 2014).
al., 2014). A few surveys (Lanigan et al., 2016) calculated an atmospheric stability during dust storm is one of the reasons to do this study.

The main objective of this study is to calculate an atmospheric stability during dust storm period in spring time, over Mongolia.

II. DATA USED

In this study, we used the radiosonde data which measured at 00 UTC (local time: UTC+8) in the morning and 12 UTC in the evening from March to May 2020, at “Dalanzadgad” radiosonde station at Dalanzadgad (43°34'N 104°26'E), Umnugovi province, Mongolia. Figure 1 shows the location of “Dalanzadgad” radiosonde station.

Figure 1. Elevation map of Mongolia

Dalanzadgad station is located in the southern part of Mongolia and is one of the four upper air stations in there. Of those four stations, only Dalanzadgad station is located in the Gobi Desert which has high frequency of dust storm (Natsagdorj et al., 2003). Therefore, we chose this station to calculate the stability parameters during dust storm. Interpolation was made to convert measured pressure values to standard levels.

Table 1. Description of GTS1 Radiosonde

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Temperature</th>
<th>Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>1060hPa – 5hPa</td>
<td>(-90)°C – (+50)°C</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.1hPa</td>
<td>0.1°C</td>
</tr>
</tbody>
</table>

Also, we used ECMWF reanalysis (ERA5) pressure level data (Hersbach et al, 2018) for the areas where radiosonde launch is not performed (Table 1). In this study, we used air temperature, humidity and wind speed values at 16 layers from 850 to 100 hPa pressure level from the ERA5 reanalysis data, for each of the above periods.

Table 2. Description of ERA5

<table>
<thead>
<tr>
<th>Data type</th>
<th>Grid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal resolution</td>
<td>0.25°x0.25°</td>
</tr>
<tr>
<td>Vertical resolution</td>
<td>37 pressure level</td>
</tr>
<tr>
<td>Temporal resolution</td>
<td>hourly</td>
</tr>
</tbody>
</table>

Source: https://www.ecmwf.int/
III. METHODOLOGY

Strong dust storm occurred on March 24, April 15, May 15, 2020, over the most part of Mongolia. We calculated the atmospheric stability parameters on these days.

Atmospheric instability

Instability occurs variously in the atmospheric motion. Static or thermal instability due to the vertical distribution of air temperature occurs when it is greater than dry adiabatic temperature gradient in unsaturated air and greater than moist adiabatic temperature gradient in the saturated air (Holton, 2004). Such kind of instability can be defined by Brunt-Vaisala frequency which is expressed as follows

$$N = \left( \frac{g}{\theta_{va}} \frac{\partial \theta_{va}}{\partial z} \right)^{1/2}$$  \hspace{1cm} (I)

Where \( g = 9.81 \, \text{m/s}^2 \) is gravitational acceleration, \( \theta_{va} \) is the ambient virtual potential temperature, and \( \partial \theta_{va}/\partial z \) is the vertical gradient of the ambient virtual potential temperature. When \( N \) is equal to or greater than zero, the atmosphere is stable, while less than zero is considered to be in an unstable state (Holton, 2004).

Hydrodynamic instability is caused by the uneven distribution of air flow velocities. The theoretical application of hydrodynamic instability can do numeric evaluation of the mechanism of numerical and other characteristics on development stages and further evolutions of atmospheric vorticities and waves (Stull, 1988). One form of hydrodynamic instability which caused by the interaction of Coriolis force and buoyancy is baroclinic instability, expressed in Richardson number.

$$Ri = \frac{\frac{\partial \theta_{vs}}{\partial z}}{\frac{\partial v}{\partial z} + \frac{\partial U}{\partial z}}$$  \hspace{1cm} (II)

Where \( T_v \) is virtual absolute temperature, \( \theta_{vs} \) is virtual potential temperature, \( z \) is height, \( U \) and \( V \) are wind components toward the east and north. Theoretically, air is dynamic unstable when the Gradient Richardson number (\( Ri \)) is less than 0.25 (Miles, 1961; Howard, 1961), and turbulent motion predominates (Stull, 1988).

\( \frac{\partial \theta_{vs}}{\partial z} \) in equation (II) is buoyancy of air mass, \( \left( \frac{\partial U}{\partial z} \right)^2 + \left( \frac{\partial V}{\partial z} \right)^2 \) is shear between vertical layers of air flow. Since, \( \frac{\partial \theta_{vs}}{\partial z} \) is called buoyancy and \( \left( \frac{\partial U}{\partial z} \right)^2 + \left( \frac{\partial V}{\partial z} \right)^2 \) is called wind shear.

One another parameter which can express the baroclinic instability is Eady Growth Rate.

$$\sigma_E = 0.3098 \frac{f}{N} \left| \frac{\partial U(z)}{\partial z} \right|$$  \hspace{1cm} (III)

Where \( f \) is Coriolis parameter \( f = 2\Omega \sin \varphi \), \( \Omega = 7.292 \times 10^{-5} \, \text{rad/s} \) is the angular speed of the earth, \( \varphi \) is the latitude, \( U(z) \) is vertical profile of the eastward wind component and \( N \) is Brunt-Vaisala frequency. \( \sigma_E \) has the advantage of representing system development in the environment as well as atmospheric instability (Simmonds and Lim, 2008). Generally, atmospheric instability occurs when the wind is moving through the horizontal and vertical dimension along with the horizontal inhomogeneity of air temperature. As a result of hydrodynamic instability, synoptic scale cyclone vortices and atmospheric wave motions cause various kind of weather phenomena (Natsagdorj, 2017). Using These instability parameters \((N, Ri, \sigma_E)\), calculations were made for the actual observation (radiosonde) and ERA5 reanalysis data for each of the above three periods.

IV. RESULTS

To determine the atmospheric stability, the solutions of equations (I), (II) and (III) described above were calculated on the days of dust storms using the finite difference method. In the calculation of stability along the vertical dimension of the atmosphere, we used radiosonde measurement data of “Dalanzadgad” upper air station in Dalanzadgad, Umnugovi province. The calculation of stability in the horizontal distribution was based on ERA5 reanalysis data with resolution of 0.25°x0.25°.

A. Vertical distribution of the atmospheric stability

Atmospheric stability parameters were calculated for each of the three cases which are mentioned above is divided into three stages: “before the dust storm”, “during dust storm” and “after dust storm”, using radiosonde data of “Dalanzadgad” station, and the results are shown in Tables 3, 4 and 5. Table 3 shows the period “before dust storm”, Table 4 shows the period “during dust storm” and Table 5 shows the period “after dust storm”, respectively. The calculations were performed as described in the “Methodology” section, and the values of \( \sigma_E, N, \) buoyancy and wind shear were multiplied by \( 10^6, 10^7, 10^8 \) and \( 10^9 \), respectively to convert whole values.

As can be seen from the Table 3, the values of \( Ri \) are greater than 2 and \( N \) is greater than 0, which ensures that the atmosphere is hydrodynamically and statically stable on all the pressure levels. The value of \( \sigma_E \) which calculated by the average of the three cases of
dust storms is ranging between from 2 to 20, indicating that the atmosphere is in a static and hydrodynamic stable state before the event.

Table 3. Instability parameters calculated by radiosonde measurement data of the “Dalanzadgad” station (before dust storm period)

<table>
<thead>
<tr>
<th>Pressure levels</th>
<th>( \sigma_E )</th>
<th>( Ri )</th>
<th>( N )</th>
<th>buoyancy</th>
<th>Wind Shear</th>
</tr>
</thead>
<tbody>
<tr>
<td>850</td>
<td>19.14</td>
<td>1.50</td>
<td>1.61</td>
<td>2.96</td>
<td>32.83</td>
</tr>
<tr>
<td>825</td>
<td>5.80</td>
<td>11.96</td>
<td>1.31</td>
<td>1.81</td>
<td>2.74</td>
</tr>
<tr>
<td>800</td>
<td>18.28</td>
<td>1.50</td>
<td>0.90</td>
<td>0.81</td>
<td>10.65</td>
</tr>
<tr>
<td>775</td>
<td>16.05</td>
<td>1.50</td>
<td>0.90</td>
<td>0.81</td>
<td>5.61</td>
</tr>
<tr>
<td>750</td>
<td>14.54</td>
<td>2.61</td>
<td>1.01</td>
<td>1.13</td>
<td>3.93</td>
</tr>
<tr>
<td>700</td>
<td>6.62</td>
<td>7.83</td>
<td>1.04</td>
<td>1.20</td>
<td>2.02</td>
</tr>
<tr>
<td>650</td>
<td>10.77</td>
<td>6.52</td>
<td>0.96</td>
<td>1.04</td>
<td>2.82</td>
</tr>
<tr>
<td>600</td>
<td>8.71</td>
<td>14.66</td>
<td>0.88</td>
<td>0.91</td>
<td>3.58</td>
</tr>
<tr>
<td>550</td>
<td>6.66</td>
<td>14.04</td>
<td>0.84</td>
<td>0.82</td>
<td>2.53</td>
</tr>
<tr>
<td>500</td>
<td>5.23</td>
<td>25.15</td>
<td>1.00</td>
<td>1.03</td>
<td>0.53</td>
</tr>
<tr>
<td>400</td>
<td>5.07</td>
<td>27.23</td>
<td>0.98</td>
<td>0.96</td>
<td>0.48</td>
</tr>
<tr>
<td>300</td>
<td>2.40</td>
<td>84.67</td>
<td>1.04</td>
<td>1.13</td>
<td>0.13</td>
</tr>
<tr>
<td>250</td>
<td>3.45</td>
<td>129.82</td>
<td>1.78</td>
<td>3.22</td>
<td>0.72</td>
</tr>
<tr>
<td>200</td>
<td>2.52</td>
<td>142.14</td>
<td>2.17</td>
<td>4.71</td>
<td>0.61</td>
</tr>
<tr>
<td>150</td>
<td>2.32</td>
<td>320.40</td>
<td>2.07</td>
<td>4.31</td>
<td>0.34</td>
</tr>
<tr>
<td>100</td>
<td>3.44</td>
<td>49.99</td>
<td>1.92</td>
<td>3.68</td>
<td>0.79</td>
</tr>
</tbody>
</table>

As shown in Table 4, the value of \( Ri \) is between 0.04...0.09 at a pressure level of 850-800 hPa, which indicates that the atmosphere was in hydrodynamic unstable state, and the value of \( N \) is greater than 0, that the atmosphere exists under static stable state. The main reason to exist under the hydrodynamic unstable state is wind shear between the pressure layers. For the \( \sigma_E \), greater than 100 at the pressure levels of 850 and 825 hPa, indicates the presence of baroclinic unstable conditions in the atmosphere, as well as the fact the system is in active development. Also, \( N \) was less than 0 during dust storm which occurred on 15th of May, and atmosphere was existing under the static unstable state, buoyancy was supported baroclinic unstable condition more or less, but relatively small in value. Since \( N \) was negative, \( \sigma_E \) was also negative, with an absolute value was greater than 100.

Table 4. Instability parameters calculated by radiosonde measurement data of the “Dalanzadgad” station (during dust storm)

<table>
<thead>
<tr>
<th>Pressure levels</th>
<th>( \sigma_E )</th>
<th>( Ri )</th>
<th>( N )</th>
<th>buoyancy</th>
<th>Wind Shear</th>
</tr>
</thead>
<tbody>
<tr>
<td>850</td>
<td>104.89</td>
<td>0.04</td>
<td>0.62</td>
<td>0.91</td>
<td>117.92</td>
</tr>
<tr>
<td>825</td>
<td>128.51</td>
<td>0.09</td>
<td>0.44</td>
<td>0.47</td>
<td>45.72</td>
</tr>
<tr>
<td>800</td>
<td>83.67</td>
<td>0.67</td>
<td>0.35</td>
<td>0.22</td>
<td>35.07</td>
</tr>
<tr>
<td>775</td>
<td>70.99</td>
<td>0.38</td>
<td>0.35</td>
<td>0.25</td>
<td>6.52</td>
</tr>
<tr>
<td>750</td>
<td>21.66</td>
<td>0.32</td>
<td>0.54</td>
<td>0.30</td>
<td>10.70</td>
</tr>
<tr>
<td>700</td>
<td>19.66</td>
<td>0.83</td>
<td>0.79</td>
<td>0.68</td>
<td>9.20</td>
</tr>
<tr>
<td>650</td>
<td>13.40</td>
<td>1.39</td>
<td>1.00</td>
<td>1.14</td>
<td>8.01</td>
</tr>
<tr>
<td>600</td>
<td>27.14</td>
<td>4.83</td>
<td>0.98</td>
<td>1.10</td>
<td>13.64</td>
</tr>
<tr>
<td>550</td>
<td>22.27</td>
<td>6.90</td>
<td>1.00</td>
<td>1.07</td>
<td>4.76</td>
</tr>
<tr>
<td>500</td>
<td>13.47</td>
<td>2.82</td>
<td>1.14</td>
<td>1.32</td>
<td>5.73</td>
</tr>
<tr>
<td>400</td>
<td>9.94</td>
<td>4.91</td>
<td>1.11</td>
<td>1.25</td>
<td>2.98</td>
</tr>
<tr>
<td>300</td>
<td>5.36</td>
<td>29.49</td>
<td>1.14</td>
<td>1.31</td>
<td>1.47</td>
</tr>
<tr>
<td>250</td>
<td>8.75</td>
<td>23.03</td>
<td>1.86</td>
<td>3.47</td>
<td>7.31</td>
</tr>
<tr>
<td>200</td>
<td>4.29</td>
<td>18.79</td>
<td>2.16</td>
<td>4.68</td>
<td>3.33</td>
</tr>
<tr>
<td>150</td>
<td>2.08</td>
<td>180.72</td>
<td>2.06</td>
<td>4.23</td>
<td>0.24</td>
</tr>
</tbody>
</table>
In the Table 5, atmospheric stability parameters are same as the period before dust storm. A difference is $\sigma_E$ couldn’t get enough value even atmosphere is in hydrodynamic unstable state as a result of wind shear was more at a pressure level of 850 hPa. In other words, it indicates the atmospheric process was going shut down.

Table 5. Instability parameters calculated by radiosonde measurement data of the “Dalanzadgad” station (after dust storm period)

<table>
<thead>
<tr>
<th>Pressure levels</th>
<th>$\sigma_E$</th>
<th>$Ri$</th>
<th>$N$</th>
<th>buoyancy</th>
<th>Wind Shear</th>
</tr>
</thead>
<tbody>
<tr>
<td>850</td>
<td>49.25</td>
<td>0.18</td>
<td>1.48</td>
<td>2.31</td>
<td>199.38</td>
</tr>
<tr>
<td>825</td>
<td>28.19</td>
<td>1.07</td>
<td>1.31</td>
<td>1.74</td>
<td>154.16</td>
</tr>
<tr>
<td>800</td>
<td>14.03</td>
<td>4.47</td>
<td>1.10</td>
<td>1.23</td>
<td>12.55</td>
</tr>
<tr>
<td>775</td>
<td>21.38</td>
<td>4.23</td>
<td>1.36</td>
<td>1.92</td>
<td>41.36</td>
</tr>
<tr>
<td>750</td>
<td>21.75</td>
<td>2.76</td>
<td>1.48</td>
<td>2.22</td>
<td>21.30</td>
</tr>
<tr>
<td>700</td>
<td>16.19</td>
<td>1.73</td>
<td>1.45</td>
<td>2.19</td>
<td>12.42</td>
</tr>
<tr>
<td>650</td>
<td>9.84</td>
<td>7.40</td>
<td>1.24</td>
<td>1.65</td>
<td>2.63</td>
</tr>
<tr>
<td>600</td>
<td>5.61</td>
<td>2.89</td>
<td>1.23</td>
<td>1.52</td>
<td>21.87</td>
</tr>
<tr>
<td>550</td>
<td>30.37</td>
<td>2.10</td>
<td>1.45</td>
<td>2.12</td>
<td>147.32</td>
</tr>
<tr>
<td>500</td>
<td>31.06</td>
<td>9.55</td>
<td>1.19</td>
<td>1.42</td>
<td>53.03</td>
</tr>
<tr>
<td>400</td>
<td>3.02</td>
<td>6.75</td>
<td>1.04</td>
<td>1.10</td>
<td>2.45</td>
</tr>
<tr>
<td>300</td>
<td>22.43</td>
<td>18.87</td>
<td>1.15</td>
<td>1.34</td>
<td>18.69</td>
</tr>
<tr>
<td>250</td>
<td>14.89</td>
<td>12.61</td>
<td>1.67</td>
<td>2.83</td>
<td>11.04</td>
</tr>
<tr>
<td>200</td>
<td>3.68</td>
<td>29.23</td>
<td>2.08</td>
<td>4.34</td>
<td>3.92</td>
</tr>
<tr>
<td>150</td>
<td>5.48</td>
<td>22.65</td>
<td>2.11</td>
<td>4.44</td>
<td>2.69</td>
</tr>
<tr>
<td>100</td>
<td>2.42</td>
<td>173.39</td>
<td>1.98</td>
<td>3.95</td>
<td>0.43</td>
</tr>
</tbody>
</table>

As shown in Table 5, the value of $Ri$ is less than 0.25 at a pressure level of 850 hPa, which is dynamically unstable. $Ri$ is a parameter which depends on buoyancy and wind shear. However, according to this study, the numerical value of buoyancy component of hydrodynamic instability was around 0.2-3.0 at each stage of the three cases. Theoretically, since the time we have chosen is spring, the buoyancy may have little effect on hydrodynamic instability in absolute terms due to the fact that the soil surface is not sufficiently warm enough to allow air mass buoyancy to occur rapidly.

B. Horizontal distribution of the atmospheric stability

According to the observational data provided by "National Agency of Meteorology and Environment Monitoring", dust storm was occurred on 24th March, 2020 over the most of the central part of Mongolia, and during this period wind speed reached 10-18 m/s. The disaster lasted from 09:48 to 19:11 (local time: UTC+8) in the central part, and the spatial distribution of the coverage period is shown in Figure 2.
Fig. 2. Spatial distribution of wind speed (m/s) and dust storm over Mongolia, on 24th March 2020 (by the real observation data from 08:00 to 20:00).

Figure 3 shows the spatial distribution of the mean value of $\sigma_E$ and the smallest value of $R_i$ calculated by ERA5 reanalysis data, during from 08:00 to 20:00 on 24th March 2020, at a pressure level of 850 hPa. Both the figures drawn by actual observation (Fig. 2) and reanalysis data (Fig. 3) are similar for spatial distribution. While, atmospheric dynamic and baroclinic instability were relatively high on the east side of Khentei mountain and it is a reason to occur snow storm in this area.

On 15th April 2020, wind speed reached 14-18 m/s in the southern east part of Mongolia. Figure 4 shows the wind speed distribution during this period. In addition, the calculation of stability values using the ERA5 reanalysis data are shown in Figure 5. It looks similar in terms of spatial distribution as before. In particular, the distribution map of the mean value of $\sigma_E$ calculated by the reanalysis data clearly shows the dust storm process.
Fig. 4. Spatial distribution of wind speed (m/s) and dust storm over Mongolia, 15th April 2020 (by the real observation data from 08:00 to 20:00)
Also, on 15th May 2020, wind speed reached 10–20 m/s in the most parts of the central, eastern and southern part of Mongolia, causing dust storm that reached disaster level. Figure 6 shows the spatial distribution of the actual observed wind speed during the process, and Figure 7 shows the distribution of the values of $\sigma_E$ and $Ri$ calculated by the reanalysis data. The distribution maps of $\sigma_E$ and $Ri$ mapped by ERA5 reanalysis data show the spatially detailed snow and dust storm areas. The results of this study show that if we have a more accurate spatial analysis data, we can use it to calculate $\sigma_E$ and calculate the spatial distribution of dust storms in areas not known for observation.
Fig. 6. Spatial distribution of wind speed (m/s) and dust storm over Mongolia, 15th May 2020 (by the real observation data from 08:00 to 20:00)
V. CONCLUSIONS

In this study, we calculated the atmospheric stability parameters on the three cases (24th March, 15th April and 15th May 2020) of strong dust storm covered over the most area of Mongolia. The following conclusions are drawn from the results of the calculation of the atmospheric static and hydrodynamic instability parameters for each stage of dust storm.

The parameters $R_i$ and $N$ which represent the atmospheric stability calculated in this study, are 0.04...0.09 and 0.44...0.62 at the atmospheric lower layers of 850-825 hPa, respectively, during dust storms means that they reached the threshold value which indicates the atmospheric instability and we consider that the parameters can determine the dynamic and static state of the atmosphere, theoretically.

Atmosphere is in static unstable state doesn't have a major effect on dynamic instability, but rather supports it. In other words, dynamic instability depends on wind shear, even atmosphere is in any state of static.

The horizontal distribution of $\sigma_E$ and $R_i$ calculated by ERA5 reanalysis data coincides with the actual observation data, indicating that it is possible to calculate the dust storm distribution using these parameters.
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AUTHORS

First Author – Tergel Shijirtuya, meteorology, tergel.shijir@gmail.com.

Second Author – Gan-Erdene Tsengel, hydrology, tsg.0124@gmail.com.

Correspondence Author – Tergel Shijirtuya, tergel.shijir@gmail.com, teegiisemi@gmail.com, +976 89064608.