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# Effect of Graphic Organizer and Instructional Scaffolding on Argumentative Essay Writing Performance: A Critical Analysis

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**Abstract-** This study investigated the effect of graphic organizer and instructional scaffolding on argumentative essay writing performance among TESL undergraduates. The study employed an experimental research using the pre-test and post-test design involving 60 TESL undergraduates who underwent lessons on argumentative essay writing using two different delivery modes, namely 'Graphic Organizer with Instructional Scaffolding' (GOIS) which is the experimental group and 'No Graphic Organizer No Instructional Scaffolding' (NGNI) which is the control group. The TESL undergraduates of the experimental group went through the GOIS delivery mode comprising four stages of learning; Stage 1: The Introduction; Stage 2: Assisted Group Discussion; Stage 3: Writing an Individual Essay and Stage 4: Peer Review for a duration of four weeks. The control group (NGNI) went through normal delivery mode comprising four stages of learning without the use graphic organiser or instructional scaffolding; Stage 1: The Introduction, Stage 2: Peer Learning, Stage 3: Individual Essay Writing and Stage 4: The Review. A one-way ANCOVA was used to analyse the overall argumentative essay writing performance of the students. Results showed that the group which underwent the GOIS delivery mode performed significantly better in the overall argumentative essay writing performance ( $p < .05$ ) compared to the control group which went through the NGNI delivery mode. The research confirmed that the GOIS delivery mode is effective in enhancing argumentative writing performance among TESL undergraduates. In line with this, the research ends with a recommendation for educators to adopt the GOIS delivery mode in the future to ensure that undergraduate students' argumentative writing skills are enhanced.

**Index Terms-** Graphic Organizer, Instructional Scaffolding, Argumentative Essay Writing, Sociocultural Theory, TESL Undergraduates

## I. INTRODUCTION

Mastering the writing skill is the most challenging and difficult task compared to other language skills (Tayib, 2015). Writing and mastering the argumentative essay, although found to be challenging, is a key skill for writing success (Thompson, 2017) and acknowledged as significant for "general life purposes" (Dastjerdi & Samian, 2011, p.68). Likewise, presenting arguments in written form is vital as it plays an important role in the social, academic and professional success (NCES, 2012 as cited in Wilson, 2014). The ability to write a quality argumentative essay was noticed to promote the cognitive ability of students to think critically, solve problems, generate and justify solutions, formulate ideas and make decisions (Cho & Jonassen, 2002). Thus, being able to write a good argument is believed to help students to develop their critical thinking and research skills as well as to develop and logically defend a position (Thompson, 2017).

The essay writing assignments (such as the argumentative writing) is central to most English as a Second Language (ESL) courses in tertiary education in Malaysia (De Rycker & Ponnudurai, 2011) and is also regarded as an essential form of written discourse specifically in Malaysian University English Test (MUET). The writing component in MUET has been identified as an essential component for undergraduates and contributes as the second-highest weighting 30% of the overall test (Kanestion et al., 2016). In the component, students are expected to write an argumentative essay. Thus, it becomes imperative to provide sufficient mastery of the argumentative skills among students as MUET is a requirement for entry into graduate programmes.

However, argumentative writing is not an easy communicative task because it requires complex cognitive and linguistic skills (Nippold & Ward-Lonergan, 2010) and appropriate use of conjunctions as it connects paragraphs, sentences and clauses (Uzun, 2017). The argument is the essence of critical thinking that entails making a case to sustain a claim, identifying supporting evidence from various sources that connect the claim reasonably, using warrants that support the connections between the claim and the supporting evidence as well as backing the warrants with support (Hillocks, 2011). Thus, undergraduates are urged to master all the above-mentioned skills not only in TESL but also in all other courses to create reliable and persuasively written arguments based on acceptable logical support (Botley & Hakim, 2014). In essence, the ability to write an argumentative essay at

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the tertiary level does not only assist undergraduates to become critical thinkers but also reflective thinkers (Ponnudurai, 2011) who can convey personal opinions effectively (Ka-kan-Dee & Kaur, 2015).

Today, many young adults enter tertiary education without the skills needed to think critically and to construct cogent arguments (Kellogg & Whiteford, 2009). Previous studies have also discovered that ESL students at the tertiary level lack proficiency in writing argumentative essays (Spawa & Hassan, 2013). Based on a study conducted by Saadiah Darus (2009 as cited in Mohamed, 2016), Malaysian ESL students are weak in their writing proficiency and encounter many challenges using appropriate words and phrases to convey ideas even though they have been learning the English language for several years. Additionally, Bipinchandra et al. (2014) also discovered that students are not able to relate their ideas in writing as it focuses more on the product than the process of writing and they are not able to grasp the skills needed due to lack of time, especially during group-based activities. On the other hand, Intaraprawat (2002 as cited in Saito, 2010) asserted that students' inability to compose effective argumentative essays may lie in the difficulties to take a position on controversial issues, provide reasons or supporting evidence to convince or accept their position.

According to Ponnudurai (2011), students at the tertiary level were found to be fluent in their spoken language but unfortunately, they were not able to make discernment, arguments, support or even make reflections in their argumentative writing due to insufficient content. Further, they were also found to have difficulties in using appropriate vocabulary in their writing. Along with this, students were also found to encounter problems using complex syntactic patterns, choosing suitable elements of arguments in composing argumentative essays or arguing and proposing a convincing thesis statement in their argumentative writing (Ka-kan-Dee & Kaur, 2015). Scholars had also noticed that students lack implicit knowledge about the argumentative conventional pattern, providing clear supporting evidence and refutation (Udomyamokkul, 2004 as cited in Saito, 2010) and have limitations in the use of conjunctions (Mohamed, 2016; Uzun, 2017; Muftah, 2014). As a result, argumentative writing appears as the most challenging type of writing (Ponnudurai, 2011).

One of the reasons for the challenges faced in the argumentative essay writing is the inappropriate teaching methods (Tayib, 2015) and the current instructions used by trainee teachers in argumentative writing which were found to be rather instructor-centred and exam-oriented (Bipinchandra et al., 2014). The lecture method which is employed during instruction in higher institutions has failed to provide appropriate support and scaffolding for the students to write (Hussin, 2008). The lecture method, according to Hussin (2008) requires not only good linguistic competence among educators but also advanced critical thinking skills such as presenting logical and convincing arguments, generating and justifying ideas and evaluating facts to form judgments. Thus, although the lecture method has been conceived as a valuable teaching approach for pedagogical reasons, it is acknowledged that there is a need for the particular method to be improved by incorporating more dialogic and interactive teaching and learning approaches (French & Kennedy, 2016). According to Zakrajsek (2018), the lecture method can impact negatively on students' learning as it is always linked to lecturer's ineffectiveness of delivering the lesson such as monotone deliveries, boring slide presentation and distributing notes that contain old information.

Further, Mann (2009) also claimed that the lecture method does not offer much room for interaction or active learning environment for students. Mann's findings were further collaborated by Kelly (2017) who affirmed that most college courses are lecture-based for it is and still known as the dominant time-tested instructional method. The lecture method is straightforward and the instructors are the sole source of information with complete control over the lesson. However, according to Kelly (2017), although the lecture method can be very engaging as many educational institutions offer faculty recorded lectures for students, yet, students may also find lectures boring as they are not able to ask questions, challenge each other's thinking, there is no grouping for differentiation and there is no opportunity for instructors to check for students' understanding. Briefly, the lecture method is dull and dreary, as evidenced by Berk's (2009, p.3) research that indicated "*about 50% of college students are unmotivated, disinterested and disengaged from classroom instruction*".

Additionally, the way students experience learning (Abdul-Hafid Kamil, 2011; Lap & Truc, 2014), teachers' practice on teaching and delivering their writing instructions as well as failure to employ effective feedback mechanisms were found to be among the reasons that contribute to writing difficulties among students (Sahin, Bullock & Stables, 2002). Budimlic (2012) asserts that most instructors give feedback as a one-way practice to assess students' achievement, but the type of feedback in the form of dialogic interaction between student-teacher and student-student at the end of a lesson can be valuable for both parties in helping them to improve and refine their learning and teaching process. According to Vacca, Vacca and Mraz (2011), active engagement in social interaction among students enables them to shoulder their responsibility towards learning. However, Mercer (2008) and Harvey (2011) suggested for the use of exploratory talk among students through adult guidance helps students attain higher-order thinking, improve reasoning skills and become more sophisticated users of the language. But, Zulkurnain and Kaur (2014) pointed out that educators fail to create interactive learning experiences to improve the knowledge of undergraduates in English language (such as the argumentative writing) and this has resulted in poor language proficiency among those groups (Malaysia Today, 2005).

Moreover, various impressions of learning among students have been linked to educators' qualities such as teaching experiences, the field of expertise, the amount of knowledge, competencies, training and professional development (Kepol, 2017). According

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to Chong and Teng (2018, p.103), besides all these qualities “... a good lecturer should always be prepared to listen to students to diagnose their learning progression.” But, Goh (2008) discovered that educators did not possess the necessary qualities and there is a lack of pedagogical knowledge. They were found to have problems in directing and supporting their students in comprehending concepts and assisting them to correlate their prior knowledge to new thoughts. Therefore, the problem “*had manifested itself in the absence of expertise in the subject matter, unimaginative teaching, inability to relate concept to real situation and the lack of useful and timely feedback*” (Goh, 2008, p.66). Additionally, Tucker and Strorage (2005) also pointed out that the educators’ teaching quality not only has an effect on how much students learn but also has an effect on students’ achievement.

Due to the writing proficiency and pedagogical limitations found in the teaching of writing among TESL undergraduates, there is a need to look for an alternative instructional method that can provide a more conducive and supportive learning environment where the teacher acts as a facilitator and can help their students to achieve their goals (Jumaat & Tasir, 2014). Additionally, students must have the opportunity to ask questions and provide feedback as well as get support from their peers and educators in learning new tasks. In order to achieve these, students must have interest in the learning material, educator and teaching methods as they are equally important factors for students’ achievement and understanding in the subject area (Chukwuagu, 2016). Hawkins (2011) claimed that instructional scaffolding using graphic organizers is the key method that develops students’ learning by offering a supportive environment and at the same time cultivate student independence.

Sharrock (2008) pointed out the importance of graphic organizer as an important scaffolding tool that aid students in visualizing connection to their prior knowledge and newly learned knowledge as well as guiding the stages of the writing process. According to Sharrock (2008), the graphic organizer “...depicts the relationships between facts, terms, and or ideas within a learning task” (p.3). Kohler (2009) asserts that the “graphic organizers can be constructed for exploring cause and effect, main idea and details, sequences, decision making, making predictions, and almost any other type of thinking and learning” (p.1). In line with these scholars, Dexter and Hughes (2011) claimed that the graphic organizers are able to improve factual recall of information and students’ higher-order thinking skills. They contended that students who were offered the use of completed graphic organizers to write their essays have significantly more relational knowledge statements within their writing compared to those without the use of graphic organizers. Therefore, studies done using the graphic organizers were evident to be significant for students to learn within and beyond classrooms and aid students in their higher-order thinking skills and learning (Sharrock, 2008; Kohler, 2009; Bishop et al., 2015; Miller, 2011).

A wide range of studies has looked into the impact of instructional scaffolding using various strategies on students’ writing. Among those studies were teacher prompting techniques in writing performance (Allenger, 2015); strategies-based instruction on learners’ writing quality (Rahimi & Norooziasam, 2013). Other related studies include direct instruction and strategy modelling on students’ writing development (López, Torrance, Rijlaarsdam & Fidalgo, 2017), scaffolding based instruction in writing performance (Obeiah & Bataineh, 2015), scaffolded instruction to optimize learning (Larkin, 2002) and Toulmin Model of Argument on the problem-solving strategies (Wilson, 2014). Additionally, other scholars have also looked into the efficacy of graphic organizers and instructional scaffolding in writing in various contexts to promote integration of arguments and counterargument (Nussbaum & Schraw, 2007), summary writing (Fergus, 2009), genre-specific writing tasks (Hawkins, 2011), students’ revision in the pre-writing stages (Lee, 2007) and teaching writing (Lancaster, 2011).

Therefore, based on previous studies, the present study aimed to discover the probable positive impact of “Graphic Organizer with Instructional Scaffolding” (GOIS) as a delivery mode on argumentative writing performance among TESL undergraduates. This study contributes to the Sociocultural theory (SCT) which focuses on the importance of social interaction and mediation in knowledge construction. Thus, in this study, the researchers have analysed the use of instructional scaffolding through social interaction and mediation. It includes an analysis of the role of the facilitator, peers and graphic organizers in the learning zone on the knowledge construction of argumentative writing of different groups using different delivery modes. This will enable educators to employ the SCT in the teaching and learning of argumentative academic writing to alleviate the problems experienced and encountered by TESL undergraduates which have been highlighted by past literature.

The outcomes of the present study provide more understanding of the use of graphic organizers and instructional scaffolding and will greatly contribute to the educators of TESL undergraduates to apply them in their teaching practices. Thus, the significance of this study can be ascertained from its contribution to research, practice and theory in the teaching of argumentative essay writing.

## II. MATERIALS AND METHODS

Two types of instruments were employed in this study. They were the argumentative essay graphic organizer and pre-test and post-test argumentative essays. The graphic organizer was inclusive of three main sections, that is, the ‘Introduction’ with a ‘Body Paragraph’ and a ‘Conclusion.’ The ‘Body Paragraph’ section inclusive of three reasons, each with supporting details and shreds of evidence followed by the counterargument and rebuttal claim sections. The pre-test and post-test argumentative essay writing booklets consisted of an argumentative essay topic and clear instruction about the tests.

An experimental research using a pre-test and post-test design was adopted to investigate the effect of graphic organizers on the overall argumentative essay writing performance. This design is suitable and appropriate for investigating the comparative effects of the GOIS and NGNI on the argumentative writing performance of the TESL undergraduates. This design includes a pre-test measure followed by intervention and a post-test. The TESL undergraduates identified for the study were two intact classes originally with 30 students ( $n=30$ ), one as the experimental group and another as the control group. The pre-test was implemented at the beginning of the research to evaluate prior knowledge of students' in argumentative essay writing. During the intervention period of four weeks, the experimental group went through four stages of learning using the graphic organizer as instructional scaffolding, Stage 1: The Introduction; Stage 2: Assisted Group Discussion; Stage 3: Writing an Individual Essay, and Stage 4: Peer Review. However, the control group went through lessons based on the lecture mode without the use of graphic organizers and instructional scaffolding. At the end of the intervention, a post-test was carried out to measure the argumentative essay writing performance. The main objective of the research is to identify the effect of graphic organizers and instructional scaffolding on the overall argumentative essay writing performance among TESL undergraduates. In line with this, the research question that guided the research is as follows:

Is there any significant difference in the overall argumentative essay writing performance between the GOIS and NGNI delivery modes?

A total of 60 students were identified and selected by the researchers, one as the experimental group ( $n=30$ ) and another as the control group ( $n=30$ ). Cohen, Manion and Morisson (2007) recommended 30 students as the sample size to reach a general conclusion about the population as a whole. Students' consent forms were distributed and collected with the help of the TESL coordinator in the university college to show evidence of the student's voluntary participation in the study. The equivalence of the experimental (GOIS) and control (NGNI) groups was determined based on their semester writing test score results and they were found to be homogeneous.

A conceptual framework (Figure 1) was designed by the researchers and used to guide and keep the present research on track.

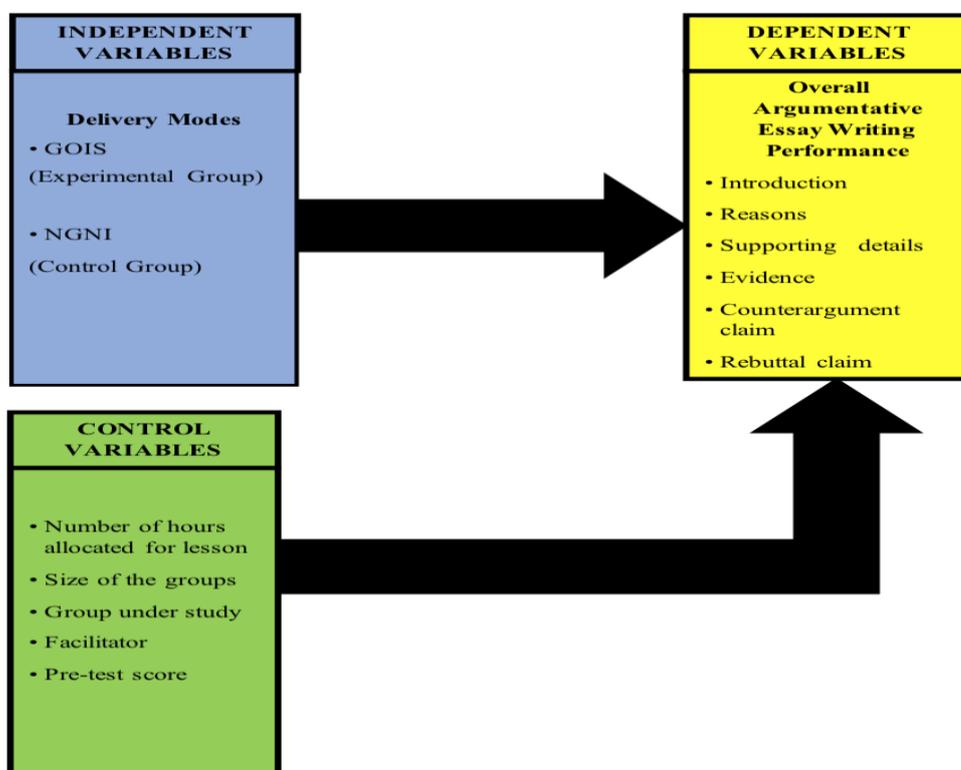


Figure 1. Conceptual Framework of the Study

The independent variables of this study are the delivery modes, which were operationalised in two conditions, that is, the GOIS and NGNI. The GOIS delivery mode function as the study intervention. The lecture method is included as a control condition, which is referred to as 'No Graphic Organizer No Instructional Scaffolding' (NGNI). The rationale for including the lecture

method (NGNI delivery mode) as the control group is to enhance our understanding of the effectiveness of the present study intervention.

The dependent variable of this study is the overall argumentative essay writing performance and the constant or controlled variables of the study are the number of hours allocated for a lesson, the size and type of students involved in the study, the facilitator and lastly the pre-test score which acts as the covariate. The overall argumentative essay writing performance was measured as an overall construct and inclusive of seven categories, that is, the introduction, reason, supporting detail, evidence, counterargument claim, rebuttal claim, and conclusion. The introduction includes the first impression for the readers that describes the writer's point of view or claim and acts as a roadmap for the entire essay. The introduction is important as it grabs the readers' attention (Muniandy & Ram, 2011). Next, the body paragraph which includes the reason that states the support for the claim and normally answers the question 'why'. Normally an argumentative essay requires three reasons and they justify why the writer's position is better. The supporting details include additional information to make each of the presented reason stronger. Supporting details are crucial as they support the writer's point of view and make the argument convincing. The evidence also comes in a paragraph and provides facts, examples, statistics or data connected to the writer's reasons and claim to convince the readers. The counter-argument claim, on the other hand, presents possible arguments against the writer's claim while the rebuttal claim presents the writer's response to the counter-argument claim. Finally, the conclusion includes the last section of the essay that summarizes the arguments and supporting points which are important to update the readers on its purpose, importance and features (Muniandy & Ram, 2011).

The purpose of the pre-test and post-test in this study was to investigate the argumentative writing ability in terms of the overall argumentative essay writing performance of the two delivery modes, namely GOIS and NGNI. The pre-test was administered before the treatments but the post-test was administered after the treatments. The pre-test and post-test argumentative essay writing booklets consisted of an argumentative essay topic and clear instruction about the tests. In line with this, students were also required to fill in the following information; students' intake year, semester, course and date of the tests. The duration of time suggested for the pre-test and post-test was an hour. The number of words required for the test was 350 words as that was the word limit required in the TESL Diploma course. Besides, it is also suggested that for writing good essays, students need to practise the basic elements and it is best to practice in short and focused assignments (Yale University, 2016). The argumentative essay topics for the pre-test and post-test were varied and selected based on topics applicable to students' life. This is consistent with the "National Evaluation and Technical Assistance Center for the Education of Children and Youth Who Are Neglected, Delinquent or At-Risk" (NDTAC, 2006) which stated that administrators should not give the same questions to their students for the pre-test and post-test. The reason for this is to avoid students from producing invalid data as their improvement cannot be accredited to the skills they have developed if they are already familiar with the test questions. Thus, the improved performance cannot be attributed to improvement in skills but rather to their familiarity with the test.

The analytical scoring rubric used for scoring the argumentative essay writing performance was the 'Analytic Scoring Rubric for Argumentative Writing' (ASRAW) adapted from Stapleton and Wu (2015) which is based on Toulmin-like elements. This was further modified by the researchers to score the pre-test and post-test argumentative writing performance of the TESL undergraduates. Toulmin's model (1958) had been used by many scholars (Zainuddin, 2006; Qin & Karabacak, 2010). The validity of the 'Scoring Guide for Toulmin's Criteria for Argumentation' lies as a basis for argumentative writing assessment where evaluators make assessments "...based on the clarity of the writer's problem statement and claim, the quality and quantity of data or reasons to support the claim, and the quality and quantity of warrants connecting data to the claim" (Saito, 2010, p.31).

The ASRAW rubric (Stapleton & Wu, 2015) was constructed with the following scales; 0 and 5 for the 'claim' category, 0 to 10 for the 'counterargument claim/alternative points of view' and 'rebuttal claim', and 0, 10, 15, 20 and 25 for the 'data', 'counterargument data/supporting reasons for alternative point(s) of view' and 'rebuttal data' categories. In the present study, the ASRAW rubric was modified by the researchers with the following scales; 0 to 2 for 'introduction', 'counterargument claim', 'rebuttal claim' and 'conclusion' categories while 0 to 4 for the 'reason', 'supporting detail' and 'evidence' categories. The 'claim' category from the ASRAW rubric was changed to 'introduction' and the content was modified. Further, the 'reason', 'supporting detail' and 'evident' categories were added as a new category by the researchers by modifying the content from the category of 'counterargument data/supporting reasons for alternative point(s) of view'. The ASRAW rubric was modified by the researchers so that it can act as a clear structure for scoring the argumentative essay writing performance for the present study. The analytical scoring rubric that the researchers adapted is inclusive of seven divisions; introduction, reason, supporting detail, evidence, counterargument claim, rebuttal claim, and conclusion. The scores for the introduction (ranges from 0 to 2), reason, supporting detail and evidence (ranges from 0 to 4) and the counterargument claim, rebuttal claim and rebuttal claim (ranges from 0 to 2). The "*analytical scoring is useful in the classroom since the results can help teachers and students identify students' strengths and learning need*" (Jonsson & Svingby, 2007, p.132)

To ensure the reliability of the scoring criteria for the overall pre-test and post-test argumentative essay writing performance, a total of 8 argumentative essays from the two delivery modes were rated by the researcher with another inter-rater and an inter-rater correlation was done between the two. Holsti's coefficient of reliability (1990 as cited in Qian, 2010) was used to check the

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inter-rater reliability for the overall argumentative essay writing performance. The result of the C.R. was above 0.75 which indicated excellent agreement from both raters and this is clearly illustrated in Table 1.

**Table 1. Inter-rater Reliability for the Overall Argumentative Essay Writing Performance (Pre-test/Post-test)**

| Pre-test     |              |           |                 | Post-test    |              |           |                 |
|--------------|--------------|-----------|-----------------|--------------|--------------|-----------|-----------------|
| Rater 1 (n1) | Rater 2 (n2) | Agree (m) | C.R. (2m/n1+n2) | Rater 1 (n1) | Rater 2 (n2) | Agree (m) | C.R. (2m/n1+n2) |
| 8            | 8            | 6         | 0.75            | 8            | 8            | 7         | 0.88            |

Keys: m = number of coding decisions agree by two judges  
 n1 = number of coding decisions made by judge 1  
 n2 = number of coding decisions made by judge 2

To ease the analysis, the 60 argumentative essays were grouped according to the two delivery modes. The experimental group with GOIS was tagged from GOIS01 to GOIS30 and the control group from NGNI01 to NGNI30.

### III. RESULTS

It was hypothesized that there will not be any significant difference in the overall students' argumentative essay writing performance among the two groups. As indicated in the method section, to test this hypothesis, a pre-test and post-test argumentative essay was employed and measured for seven divisions: 'introduction,' 'reason,' 'supporting detail,' 'evidence,' 'counter-argument claim,' 'rebuttal claim,' and 'conclusion.' The scores for the 'introduction' (ranging from 0 to 2), 'reason,' 'supporting detail,' and 'evidence' (ranging from 0 to 4) and the 'counter-argument claim,' 'rebuttal claim,' and 'conclusion' (ranging from 0 to 2) were used as the scale for measurement. The pre-test and post-test argumentative essays were marked to determine if the two delivery methods used for the TESL undergraduates had made any difference to their overall argumentative essay writing performance.

Analysis of the covariate (ANCOVA) was conducted to assess the effect of GOIS and NGNI delivery modes on the overall argumentative essay writing performance among TESL undergraduates after controlling the effect of pre-test of argumentative essay writing performance. The two assumptions of ANCOVA which are homogeneity of regression slopes  $F_{(1,58)} = 0.306$ ,  $p=0.582$ ,  $\eta^2 = 0.005$  (Table 2) as well as the homogeneity of variance  $F_{(1,58)} = 1.292$ ,  $0.260$  were assumed (Table 3).

**Table 2. Homogeneity Test of Regression Slopes for Overall Argumentative Essay Writing Performance**

| Tests of Between-Subjects Effects |                         |    |             |        |      |                     |
|-----------------------------------|-------------------------|----|-------------|--------|------|---------------------|
| Source                            | Type III Sum of Squares | df | Mean Square | F      | Sig. | Partial Eta Squared |
| Corrected Model                   | 3685.404 <sup>a</sup>   | 3  | 1228.468    | 11.748 | .000 | .386                |
| Intercept                         | 3530.198                | 1  | 3530.198    | 33.760 | .000 | .376                |
| Group                             | 267.054                 | 1  | 267.054     | 2.554  | .116 | .044                |
| Pre-test                          | 336.918                 | 1  | 336.918     | 3.222  | .078 | .054                |
| Group * Pre-test                  | 32.046                  | 1  | 32.046      | .306   | .582 | .005                |
| Error                             | 5855.846                | 56 | 104.569     |        |      |                     |
| Total                             | 186125.000              | 60 |             |        |      |                     |
| Corrected Total                   | 9541.250                | 59 |             |        |      |                     |

Note: Dependent Variable: Overall Argumentative Essay Writing Performance (Post-test)

a. R Squared = .386 (Adjusted R Squared = .353)

**Table 3. Homogeneity Test of Variances for the Overall Argumentative Essay Writing Performance**

| F     | df1 | df2 | Sig.  |
|-------|-----|-----|-------|
| 1.292 | 1   | 58  | 0.260 |

Note: \*Dependent Variable: Argumentative Essay Writing Performance (Post-test)

\*Tests the null hypothesis that the error variance of the dependent variable is equal across groups

a. Design: Intercept + Pre-test + Group

The result in Table 4 indicates that there is a significant difference in the overall argumentative essay writing performance between GOIS group (Mean=61.75, SD=1.870) and the NGNI group (Mean = 46.867, SD=1.869) at  $p < 0.05$ .

**Table 4. Effect of Graphic Organizers and Instructional Scaffolding on the Overall Argumentative Essay Writing Performance among TESL Undergraduates**

| Delivery Modes | Mean±SD      | Adjusted Mean             | Mean difference<br>(95% CI) | P-value              |
|----------------|--------------|---------------------------|-----------------------------|----------------------|
| GOIS           | 61.67± 8.938 | 61.75 <sup>a</sup> ±1.870 | Re                          | Re                   |
| NGNI           | 46.83±11.633 | 46.67 <sup>a</sup> ±1.869 | 15.009 (8.577-21.442)       | <0.001 <sup>b*</sup> |
| F              | 32.96        |                           |                             |                      |
| ANCOVA         | df 1,57      |                           |                             |                      |
| p              | <0.001*      |                           |                             |                      |

Note: \* Re = (Reference group for comparison)

SEM= Standard error of the mean

a. Adjusted Mean

\*b. Adjusted P value for multiple comparisons, Bonferroni  $p < 0.05$

As noted in Table 3, the GOIS delivery mode was effective compared to the NGNI delivery mode in improving the overall argumentative essay writing performance among TESL undergraduates. As a result, this study rejects the null hypothesis and accepts the alternative hypothesis and concludes that there is a significant difference in the overall argumentative essay writing performance between the groups. Therefore, through systematic instructional scaffolding based on Ellis and Lantolf (2000) and learning environment involving interaction between facilitator and students was effective in improving the overall argumentative essay writing performance. Additionally, with facilitative tools such as the graphic organizers and strong mediation skills and guidance provided by the facilitator, a higher level of success in the argumentative essay writing performance had been achieved especially in the GOIS condition.

In this study, performance in the overall argumentative essay writing performance among the delivery modes, namely, GOIS and NGNI were analysed using the one-way ANCOVA followed by the Bonferroni's *post hoc* test. The results conclude that the overall argumentative essay writing performance was better when the GOIS delivery mode was adopted (61.75±1.870) compared to the NGNI delivery mode (46.67±1.869) ( $p < 0.001$ ). As a whole, the GOIS delivery mode was better compared to the NGNI delivery mode in the overall argumentative essay writing performance of the groups.

The results of the present study implicate that there is a significant difference observed in the overall argumentative essay writing performance between the two groups. The GOIS group has outperformed the NGNI group. The positive effect of graphic organizers and instructional scaffolding on argumentative essay writing performance as evidenced in this study is in line with findings of previous studies (Sharrock, 2008; Lee & Tan, 2010; Delrose, 2011; Hawkins, 2011; Huggins & Edwards, 2011; Qin, 2013; Bishop et al., 2015; Meera & Aiswarya, 2014; Obeiah & Bataineh, 2015; Tayib, 2015; Mahmudah, 2016).

#### IV. DISCUSSION AND CONCLUSION

In review, the researchers believe the GOIS delivery mode had enabled the students in the experimental group to perform exceptionally well in the overall argumentative essay writing performance compared to their counterparts in the NGNI group. The GOIS delivery mode had enabled students to experience learning through the following mediation; facilitator and peers as human mediators and graphic organizers and language as symbolic tools. As proven in previous research, the findings of the present study showed that the facilitator in the GOIS group played an important role as a mediator in giving appropriate support so that the students could move towards independent learning (Obeiah & Bataineh, 2015) and this could have helped the students to increase their skill and development (Ahmed, 2017) in their argumentative writing performance. This is also consistent with Vygotsky (1978) who asserted that a more experienced person can provide the students with scaffolding to support their evolving understanding of knowledge domains or development of complex skills. This was evident from students learning experiences which revealed that the GOIS group had experienced a supportive learning environment with the presence of the facilitator.

In the GOIS group, the facilitator's role was to offer students with explicit instruction and guidance using the graphic organizer that is tailored to their needs and as a result, enabled them to construct quality essays. This was consistent with the assertion made by a few scholars such as Lantolf and Thorne (2006) as well as Yang and Wilson (2006) that in a social environment, the help of peers and skilled educators are vital in learning. Additionally, a previous study had also revealed that ESL students who received scaffolded instruction from their facilitators were found to have outperformed in their academic writing performance compared to those without scaffolded instruction (Baradaran & Sarfarazi, 2011).

The GOIS group was also found to interact actively by exchanging and sharing their ideas using the graphic organizers with their peers during group work activities and as a result, they were able to exchange and share their ideas. This is consistent with the sociocultural theory which is closely interlaced with collaboration in a real setting that allows students to view and come out with a conclusion through sharing ideas with their peers in the group (Majid & Stapa, 2017). According to Shabani (2016), framing social interaction activities clearly and purposefully can lead to students' development. Therefore, the interaction process experienced by the GOIS group could have been the reason why the GOIS group has outperformed their counterparts in the overall argumentative essay writing performance.

Additionally, other possible reasons for students in the GOIS group to outperformed students in NGNI group can be interconnected to the teaching approach employed by the facilitator. The GOIS group has adapted a simple step-by-step instructional scaffolding approach from Ellis and Larkin (2000) which is inclusive of four learning stages using various approaches. This is in line with the view of Obeiah and Bataineh (2015) who stressed that a step-by-step approach and the amount of help provided by the facilitator in various stages can help students to become independent learners. In the GOIS condition, the facilitator employed the modelling and questioning approach at the beginning stage of the lesson to guide the students using the argumentative graphic organizer to write the argumentative essay. Therefore, the modelling and questioning approach could have helped students to stay active, focused and concentrate on their learning throughout the lesson and thus, aided the students to accomplish their argumentative tasks from the actual to potential level through interaction (Shi, 2017). The findings of this study are also congruent with the findings of López et al. (2017) that modelling significantly improves writing skill although employed for a short duration. According to Spectrum Newsletter (2008), if appropriate modelling according to students' needs, interest and abilities fail to meet the expectations, scaffolds will not help. However, this did not happen to the GOIS group. In line with this, students in the GOIS delivery mode were also instructed to work in small groups with the presence of a facilitator as evident in this study who provided guidance and help for students to work collaboratively in accomplishing the learning task. At the same time, during these collaborations, students could have shared their ideas, renegotiated their opinions and concluded as evident in this study from students' dialogue.

Furthermore, students went through various activities throughout their learning sessions, for instance, reading articles related to argumentative topics and completing the graphic organizers, drawing an argumentative essay graphic organizer and finally writing an individual essay. Thus, the facilitator could have applied his expertise in leading the learning process while students went through various activities and these could have transformed their interpersonal activities into inter-psychological activities gradually (Shi, 2017). Moreover, the role of students who are committed to contributing ideas to learn and the facilitator who provides encouragement and support to engage interaction between peers during group work (Webb et al., 2014) were evident in this study. Therefore, these may be the reason for the GOIS group to outperform students in the NGNI group in the overall argumentative essay writing performance. Additionally, the peer-review sessions where students had to exchange their essays with their peers, read and review them could have given the students opportunities to learn from each other and helped them to understand the mistakes that they may have overlooked. As a result, this would have provided opportunities for students to accommodate with different level of knowledge in order to progress in their learning to write the argumentative essay (Alibali, 2006). Therefore, the researchers believe these activities might have benefitted students in the GOIS group to outperform students in the NGNI group in the overall argumentative essay writing performance.

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In line with these reasons, the group work activity using the graphic organizers to accomplish the argumentative tasks might have guided the students to interact and develop their argumentative writing skills. The findings are constant with Gagne and Parks (2013) who claimed that interaction during group work is capable of fostering learning through shared scaffolding which enables students to accomplish a given task successfully. Finally, the researchers believe the GOIS group which is supported by the sociocultural theory had outperformed the NGNI group as it is strongly inspired by the sociocultural theory which emphasized on social interactions that take place in meaningful contexts (Vygotsky, 1978).

Though research on the effect of graphic organizers and instructional scaffolding on argumentative writing in the educational field has been extensive, it is still relatively unexplored among TESL undergraduates, especially in the local context. This is expected as the use of graphic organizers and instructional scaffolding has not been widely adopted in higher education institutions despite having strong theoretical support in the sociocultural learning theory. As such, this research can contribute significantly to a better understanding of the instructional strategy. As mentioned earlier, this study had adopted experimental research using a pre-test and post-test research design. However, it must be conceded that there are some limitations to the study. The treatment sessions were limited and future research increases the sessions to ensure that the effectiveness of the instructional scaffolding process is determined more accurately. In terms of quantitative data analysis, this study had used the 'Analysis of Covariance' (ANCOVA) to analyse the effect of graphic organizers and instructional scaffolding on the overall argumentative writing performance among TESL undergraduates. Future studies might want to use the ANCOVA to analyse the effect of graphic organizers and instructional scaffolding in different contexts. However, to yield rich and solid data that would be useful in revealing uniqueness among the two groups; GOIS and NGNI, a qualitative analysis should also be conducted to obtain an in-depth understanding of the nature of the interaction processes in the argumentative writing among the groups with the different conditions.

In sum, the present study had revealed that the GOIS delivery mode has effectively transformed students' learning to be better than the NGNI delivery mode, which is conventional and still dominates over other methods in disseminating knowledge among TESL undergraduates in the local context. The GOIS delivery mode has been proven to be able to engage students in their learning and also promote students' argumentative writing performance better than the lecture mode (NGNI). The GOIS delivery mode which comprised group work activities had also enabled students to develop competencies such as cooperative learning, cognitive strength and personal skills that are vital for undergraduates. These were possible with the presence of interaction and graphic organizers as facilitative tools as well as strong mediation skills on the part of the facilitator who was able to provide systematic instructional scaffolding during the learning process. The result contradicts the claim made earlier by Verenikina (2008) who was doubtful about the benefits of instructional scaffolding. In fact, the use of graphic organizers and instruction scaffolding had also proven to be a better approach compared to the presently used lecture method in this institution where the study was conducted.

However, the potentials of graphic organizers and instructional scaffolding to promote higher tertiary level students' argumentative writing performance compared to the lecture method have yet to be adequately proved. Thus, the evidence on which delivery mode is more superior in enhancing argumentative writing performance is still inconclusive and needs to be explored further. As far as this study is concerned, the GOIS group had outperformed the NGNI group in the overall argumentative essay writing performance. Further, this study has indicated that GOIS delivery method has stimulated and harnessed students' interactions and should be given consideration in the teaching and learning of argumentative writing tasks among TESL undergraduates. The research ends with a strong recommendation that the use of graphic organizers and instructional scaffolding in groups to cater to students' interaction process can become an ideal strategy to be adopted by academicians in the process of teaching argumentative writing among not only for TESL undergraduates but also for all other graduates in higher academic institutions as the benefits would definitely enhance students' writing skills which are crucial for future employment.

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# Enhancing knowledge on positive living together with sexual and reproductive health among HIV infected adolescents on anti-retroviral therapy: A quasi-experimental study

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**Abstract-** Information on positive living as well as sexual and reproductive health (SRH) is essential for HIV infected adolescents on anti-retroviral therapy (ART). There was very little intervention study among them and effects of intervention have not studied yet. A quasi-experimental study encompassing baseline assessment, intervention and post-intervention assessment after one month was done by applying a mixed-methods design at Mandalay and Magway in 2019. Current study aims to assess the effectiveness of the intervention in terms of knowledge and attitude on SRH and positive living. Intervention package included aspects of positive living incorporated with SRH information which were conducted in group sessions including body mapping, case scenarios and discussions. Flyers describing the messages on positive living and SRH were distributed at the end. Face-to-face interview with HIV infected adolescents on ART, focus group discussions with their guardians and key informant interviews with service providers were conducted. Descriptive statistics were shown accordingly and bivariate analysis was done using paired t-test and McNemar test. A total of 76 adolescents aged 10-15 years participated in the intervention. Mean age was 12.9±1.7 years and 56.6% were male. Over 88% were attending the school and 53.9% were double orphans. At post-intervention assessment, overall SRH knowledge score was significantly increased (19.8±8.7 and 31.6±7.2, p<0.001, total 44 items). Specifically, improved knowledge scores regarding puberty (3.6±1.9 and 6.3±1.6, p<0.001), adolescent pregnancy (3.1±1.5 and 4.4±0.9, p<0.001), contraception (3.3±2.2 and 6.9±2.5, p<0.001), sexually transmitted infections (2.2±1.3 and 3.3±1.2, p<0.001) and HIV (7.5±3.8 and 10.6±3.1, p<0.001) were seen. Improved knowledge score on positive living was also seen (9.0±6.9 and 14.9±5.9, p<0.001, total 22 items). Proportions of adolescents with negative attitude on SRH was reduced at post-intervention assessment (27.6% and 9.2%, p<0.01). Health care providers indicated that provision of positive living and SRH information is one of the gaps in transitional care of HIV infected adolescents. Providers desired to extend the intervention by using the flyers at their ART clinics. Improved knowledge on positive living and SRH among HIV infected adolescents was achieved by applying the simple intervention package. Sustainability at the

**Keywords** – HIV infected adolescents, sexual and reproductive health, positive living, quasi-experimental, Myanmar

## I. INTRODUCTION

Globally, adolescents living with HIV are a growing cohort and most of them acquired HIV infection vertically from their parents. On the other hand, some adolescents got infection from other routes during their childhood or early adolescence. With the increasing use of antiretroviral therapy (ART), children with vertically acquired HIV infection are reaching adolescence. In 2018, there were approximately 1.6 million adolescents aged 10-19 years living with HIV worldwide.<sup>1</sup> Adolescence represents the transition period from childhood to adulthood with a significant puberty changes leading to complete physical, mental and sexual maturity.<sup>2</sup>

Previous studies have documented the presence of unmet need for sexual and reproductive health (SRH) information,<sup>3,4</sup> sexual debut among children under the care of pediatric health service,<sup>5</sup> and unmet need for contraception.<sup>6</sup> A review on comprehensive SRH education found that adolescents aged 10 to 14 years were at high-risk of adopting reproductive risk behaviors and suffered from the reproductive health consequences.<sup>7</sup> The interventions addressing SRH in early adolescents (10-14 years) were recommended to be the priority issues.<sup>8</sup>

Living positively with HIV includes receiving health care, taking care of sexual health (e.g- safe sex practice), staying active and socially engaged, taking enough rest, taking care of personal hygiene and nutrition, and avoiding unhealthy behaviors (alcohol drinking, smoking, drug use, unsafe sex, etc). In general, positive living includes keeping one's mind healthy, one's body healthy, one's soul healthy and living responsibly with HIV and preventing new HIV infections.<sup>9</sup>

Previous intervention study in Myanmar had documented that mindfulness-integrated reproductive health package was effective for improving SRH knowledge and psychological behavior of HIV infected and affected adolescents.<sup>10,11</sup> One of the specific objectives of the Strategic Plan on Reproductive Health (2014-2018) is to expand reproductive health information and services for adolescents and youths.<sup>12</sup> Information related to

adolescents before referring to adult ART site. Current intervention package includes providing SRH information incorporated with aspects of positive living. Intervention activities were conducted in group sessions with active participation of adolescents. Yet, there was no intervention study focusing on positive living and SRH together. Therefore, current study was conducted with the aim of assessing the effectiveness of intervention on sexual and reproductive health and positive living among HIV infected adolescents on ART. Specific objectives were 1) to identify and compare the awareness, knowledge and attitude regarding SRH and positive living among HIV infected adolescents on ART before and after the intervention, and 2) to determine the perspectives of health care providers and guardians regarding the intervention. The Findings from current intervention study would become input in planning comprehensive care of HIV infected adolescents before transferring to adult site.

## II. METHODOLOGY

### *Study design, area and population*

A quasi-experimental study encompassing baseline assessment, intervention and post-intervention assessment after one month by applying a mixed-methods design was conducted in Mandalay and Magway. HIV infected adolescents on ART, their guardians and service providers were the study populations.

Inclusion criteria: HIV infected adolescents on ART aged 10-15

Exclusion criteria: 1) HIV infected adolescents on ART who have intellectual disabilities according to the information from providers and guardians, 2) HIV infected adolescents on ART who are hospitalized or bed-ridden

### *Sample size and sampling*

Considering the proportion of adolescents having good SRH knowledge among HIV infected adolescents as 40% and at least 35% of knowledge improvement after the intervention, precision 0.05, power 80%, and loss to follow-up 5%, required sample size was 76. Purposive sampling was applied and adolescents were recruited through Myanmar Positive Group (MPG) and peer counselors from public ART centers. For qualitative data collection, two focus group discussions (FGDs) with selected guardians and four key informant interviews (KIIs) with service providers were done.

### *Intervention package*

Intervention package was developed by adapting the SRH messages for adolescents and module of training on positive living.<sup>9</sup> The package included information on positive living and information on sexual and reproductive health specific to the adolescents. Adolescents had to attend the group session which lasted approximately 3-4 hours. The group sessions were conducted separately for each gender and moderated by principal investigator and co-investigator.

### Components of “Positive Living”

- Prevent further transmission of HIV
- Receive regular health care

- Stay active & socially engaged
- Take enough rest & nutrition
- Take care of personal hygiene
- Take care of sexual health
- Avoid unhealthy behaviour: Alcohol, Smoking, Drug use

### Components of “Sexual and Reproductive Health”

- Puberty: Physiological changes, Menstrual cycle
- Adolescent pregnancy and its consequences
- Contraception
- HIV
- STI

### *Data collection procedure and tools*

Training of interviewers was done at Department of Medical Research before intervention activities and assessments. Baseline assessment was conducted to explore the adolescents’ knowledge and attitude on SRH and positive living before the intervention. Intervention activities were conducted applying group discussion, case scenarios and health education sessions. Evaluation of the outcomes was done at post assessment after one month by both quantitative and qualitative methods. Face-to-face interviews were done with adolescents using a structured questionnaire. Focus group discussions (FGD) and key informant interviews (KII) were also conducted with guardians and service providers.

### *Data management and analysis*

Data entry and analysis of quantitative data was done using EpiData 3.1 and SPSS version 21. Descriptive information was described by using frequency or mean/median as appropriate. Responses on knowledge questions were given a score of “1” for correct answer and “0” for incorrect answer. Total knowledge score was calculated for each SRH component and also for total SRH questions. Possible total knowledge score for SRH ranged from “0” to “44”. Similarly, total knowledge score was calculated for question on positive living and possible total score ranged from “0” to “22”. Response on each attitude question was given a score of “1” to “5” depending on the direction of the statement whereas having positive attitude got higher score. Total attitude score was calculated and possible scores ranged from “9” to “45”. Then, it was categorized into “negative attitude” and “positive attitude” by using the cut-off value of “27” since neutral value for each item was “3” and there were “9” attitude items. Comparisons of outcomes between baseline and end-line assessments were done by using paired “t” test, McNemar test and student “t” test. Qualitative information was analyzed by using manual thematic analysis.

### *Ethical consideration*

Informed consent from the guardians and assent from the adolescents were requested after thorough explanation about the study’s objectives. Confidentiality and anonymity of the participants’ information was strictly maintained. Ethical approval was obtained from Ethics Review Committee of Department of Medical Research. Informed consents were also taken from all the guardians and providers before FGD and KII.

### *Expected applicability*

Evidence based information resulted from current intervention could be applied for improving comprehensive care of HIV infected adolescents. Responsible service providers

acknowledged the intervention and expressed the desire to continue at their ART clinics.

### III. FINDINGS

A total of 76 adolescents aged 10-15 years participated in the intervention. Table (1) shows the background characteristics of adolescents on ART. Their mean age was 12.9±1.7 years and 56.6% were male. Over 88% were attending the school and 53.9% were double orphans.

Table (1) Background characteristics of HIV infected adolescents on ART

| Characteristics            | Number   | Percentage |
|----------------------------|----------|------------|
| <b>Gender</b>              |          |            |
| Male                       | 43       | 56.6       |
| Female                     | 33       | 43.4       |
| <b>Age</b>                 |          |            |
| Mean±SD                    | 12.9±1.7 |            |
| Min-Max                    | 10-15    |            |
| <b>Schooling</b>           |          |            |
| Out of school              | 9        | 11.8       |
| Currently attending school | 67       | 88.2       |
| <b>Parental status</b>     |          |            |
| Both parents alive         | 14       | 18.4       |
| Paternal orphan            | 11       | 14.5       |
| Maternal orphan            | 10       | 13.2       |
| Double orphan              | 41       | 53.9       |

As shown in Figure (1), considerably higher proportions of adolescents could mention the male and female puberty changes at post-intervention than at baseline. Highest proportional difference between two assessments was seen regarding the knowledge on sperm production at puberty (17.1% and 71.1%).

baseline and post-intervention is described in Table (2). At post-intervention assessment, substantial increase in total knowledge score on SRH was seen in comparing to baseline (19.8±8.7 and 31.6±7.2, p=0.0001, total items: 44). As shown in the table, improved scores were detected for all SRH topics at post-intervention assessment. Likewise, considerable improvement in knowledge on positive living was detected (9.0±6.9 and 14.9±5.9, p=0.0001, total items: 22). Additionally, proportion of adolescents with negative attitude on SRH significantly reduced at post-intervention (27.6% and 9.2%, p=0.007).

Table (2) Comparison of knowledge scores and attitude on SRH and positive living among HIV infected adolescents on ART at baseline and post-intervention

| Characteristics                          | Baseline<br>N=76 | Post-intervention<br>N=76 | p-value             |
|--|------------------|---------------------------|---------------------|
| <b>Total SRH knowledge</b>               |                  |                           |                     |
| Mean±SD                                  | 19.8±8.7         | 31.6±7.2                  | 0.0001 <sup>a</sup> |
| Min-Max                                  | 1 – 36           | 13 – 44                   |                     |
| <b>Knowledge on SRH topic</b>            |                  |                           |                     |
| Puberty                                  | 3.6 ± 1.9        | 6.3 ± 1.6                 | 0.0001 <sup>a</sup> |
| Adolescent pregnancy                     | 3.1 ± 1.5        | 4.4 ± 0.9                 | 0.0001 <sup>a</sup> |
| Contraception                            | 3.2 ± 2.2        | 6.9 ± 2.5                 | 0.0001 <sup>a</sup> |
| STI                                      | 2.2 ± 1.3        | 3.3 ± 1.2                 | 0.0001 <sup>a</sup> |
| HIV                                      | 7.5 ± 3.7        | 10.6 ± 3.0                | 0.0001 <sup>a</sup> |
| <b>Attitude on SRH (n,%)</b>             |                  |                           |                     |
| Negative attitude                        | 21 (27.6)        | 7 (9.2)                   | 0.007 <sup>b</sup>  |
| Positive attitude                        | 55 (72.4)        | 69 (90.8)                 |                     |
| <b>Knowledge on positive living</b>      |                  |                           |                     |
| Mean±SD                                  | 9.0±6.9          | 14.9±5.9                  | 0.0001 <sup>a</sup> |
| Min-Max                                  | 0 – 22           | 3 – 22                    |                     |
| <b>Attitude on positive living (n,%)</b> |                  |                           |                     |
| Negative attitude                        | 11 (14.5)        | 11 (14.5)                 | 1.0 <sup>b</sup>    |
| Positive attitude                        | 65 (85.5)        | 65 (85.5)                 |                     |

<sup>a</sup>paired t-test; <sup>b</sup>McNemar test  
STI: Sexually Transmitted Infections

As shown in Table (3), gender difference in change in knowledge score was seen and the change was higher in male than female adolescents (13.9±8.4 and 8.9±8.1, p=0.01). Over 98% satisfied on the intervention and 80% of them interested more on the positive living than SRH.

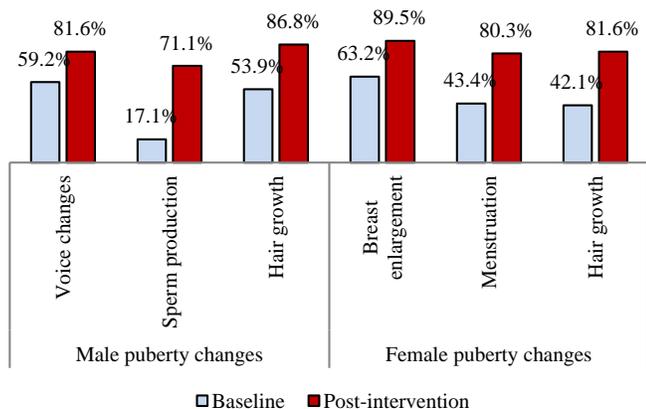


Figure (1) Knowledge of HIV infected adolescents on male and female puberty changes at baseline and post-intervention assessments (n=76)

Comparison of knowledge scores and attitude on SRH and positive living among HIV infected adolescents on ART at

Table (3) Comparison of change in knowledge scores on SRH and positive living among male and female HIV infected adolescents on ART

| Characteristics                                     | Male adolescents<br>N=43 | Female adolescents<br>N=33 | p-value <sup>c</sup> |
|---|--------------------------|----------------------------|----------------------|
| Knowledge score change on SRH (Mean±SD)             | 13.9±8.4                 | 8.9±8.1                    | 0.01                 |
| Knowledge score change on positive living (Mean±SD) | 6.8±6.4                  | 4.7±5.0                    | 0.13                 |

<sup>c</sup>t-test

During key informant interviews, the service providers pointed out the importance of filling the gap in comprehensive care of HIV infected adolescents. They highlighted that current intervention could provide essential information for the infected adolescents. According to the providers, though SRH information was critical for the HIV infected adolescents, there was no specific SRH service provided for them. Providers acknowledged that discussion on concept of positive living especially about the health risk behaviors was beneficial for the infected adolescents.

Some of their expressions were as follows:

“Discussion is good as it includes about risk behaviors like smoking, alcohol drinking under the topic of positive living. At that age, it would become primordial prevention. They have already experienced from systemic effects of ART. Thanks for telling about those things since it is the best if they could avoid smoking and alcohol drinking” (Responsible provider from Mandalay)

“Though I know that SRH information should be provided I’m not sure what kind of information we should discuss at what age...” (Responsible provider from Magway)

“We could produce vinyl poster from the information of this flyer... and train our peers. And then peers can disseminate the information to the adolescents at the time of ART visit. We can also distribute the flyers... we could continue like that after the intervention” (Responsible provider from Magway)

During focus group discussion with parents/guardians, many of them agreed with the intervention package on positive living and SRH. Most appropriate age for provision of SRH knowledge was discussed and many of them indicated “13-14 years” while some of them mentioned as “10 years”.

“I think, 13-14 years is appropriate to learn SRH information since they could understand at that age” (46 years old mother)

“I think, one should know about reproductive health around 10 years of age... since they are using mobile phones and they may also know from others...” (34 years old mother)

“It’s better to talk by the providers than the parents since they could learn more knowledge. It’s also good that training is held on school holidays...” (34 years old mother and 67 years old grandmother)

#### IV. DISCUSSIONS

Current intervention package tried to fill an important gap in comprehensive care of HIV infected adolescents on ART by enhancing their knowledge on positive living and SRH. Providers acknowledged the benefits of intervention and showed their willingness to continue the intervention.

Positive living is a lifestyle which should be adopted by an HIV-infected person to live life as fully as possible and to improve the quality of life of people living with HIV.<sup>9</sup> At post-intervention assessment, adolescents’ knowledge on positive living improved significantly which showed the effectiveness of intervention. Improved knowledge would lead to positive practices in their adult life. If the HIV infected adolescents lived positively and responsibly, then it could help in reducing further transmission of HIV.

Likewise, improved knowledge and attitude on SRH was seen at post-intervention assessment. Evidences had shown that HIV infected adolescents have SRH needs and they are at risk of engaging in sexual risk behaviors.<sup>13,14</sup> A review of the intervention studies on SRH among young people living with HIV identified that most interventions used cognitive behavioral therapy and/or psychosocial support resulted in positive SRH behavioral outcomes. The review also highlighted that there have been a limited number of evaluated interventions to strengthen SRH of young people living with HIV.<sup>15</sup> Though there were some intervention studies, comparison of effectiveness of these intervention studies was difficult since different studies applied various intervention approaches focusing on different issues of SRH.

In Thailand, a clinic-based intervention program on HIV infected adolescents through group and individual sessions was well accepted by the adolescents and was able to improve their knowledge and attitude. The program focused on sexual risk reduction, health knowledge, coping skills and life goals.<sup>16</sup> A study on sexual health programming among HIV positive adolescents in South Africa had documented that provision of social protection could reduce unprotected sex.<sup>17</sup>

During qualitative discussions with service providers, they pointed out the lack of specific SRH intervention and services as the important gap in comprehensive care of HIV infected adolescents. Similarly, previous studies in India and African countries had documented the health care needs and service delivery gaps for HIV infected adolescents such as integrated comprehensive SRH services, standardized transition and quality counseling.<sup>18,19</sup>

Certain strengths of current intervention should be documented. This was the first evaluated intervention study with integrated package of positive living and SRH information for adolescents living with HIV. It applied simple participatory methods like body mapping, two-way discussions and case scenarios. Flyers of summary information were also distributed as a training material to enhance their understanding. Besides strengths, there were certain limitations that should be acknowledged. Lack of control group might have some drawbacks that we could not compare the effects of intervention with the non-

intervention group. Furthermore, we did not identify other sources of SRH information among the adolescents.

## V. CONCLUSION

Improved knowledge on positive living and SRH among HIV infected adolescents was achieved by applying the simple intervention package which could be easily utilized in ART clinic settings. Sustainability at the study sites and expansion to other areas should be considered.

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# Decision-Making Of Headmasters At Junior High Schools In North Minahasa Regency

## (A Multi-Case Study On Smp N 1 Kalawat And Smp N 2 Kauditan)

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**Abstract:** Decision-Making of Headmasters is a strategy adopted by headmasters to overcome problems encountered by schools in achieving goals. Research objectives: To describe and analyze the decision-making process using passing standards, content standards, management standards. The research methodology employed qualitative approach, informants consisted of headmasters, teachers, students and supervisors. Data were collected using interviews, observation, and documentation. Data processing procedures consisted of data collection, data reduction, data display, and conclusion. Research results: 1a. The decisions of the Headmaster of SMP N 1 Kalawat were made by: involving subordinates, deliberating, concluding, deciding, directing, conducting approaches, distributing tasks, providing incentives, being patient, distributing works until they are done. 1b. graduation standards: improving competence, implementing the 2013 curriculum in learning, curricular and extra-curricular activities. Assessment, determination of graduation. Content Standards: establishing a curriculum development team, making a curriculum, supervising, evaluating. d. Process Standards: facilitating and coordinating, supervising, evaluating. 2a. The decisions the Headmaster of SMP N 2 Kauditan were made by: providing opportunities for subordinates to give input, deliberating, distributing works, paying attention to needs. 2b. Graduation Standards: motivating, carrying out curricular activities and extracurricular activities, supervising, motivating students and teachers, holding tests, holding school examination, holding computer-based national exams. 2c. Content Standards: establishing a curriculum development team, supervising. 2d. Process standards: implementing a school curricula, supervising and providing reinforcement. Conclusion: The decision-making the headmasters is generally good. This can be seen that they are successful in the involvement of subordinates in the decision-making process and the Decision-Making of Headmasters is related to passing standards, content standards, process standards.

**Keywords:** decision-making of headmasters, graduation standards, content standards, process standards

### INTRODUCTION

#### A. Background

The involvement of subordinates in the decision-making process has an objective to make the decisions more profoundly because they are thought by many people. In particular, if the decision covers various aspects such technical, administrative, human relations, financial, and so on. Subordinates feel that they are involved in the decision-making process, their involvement is in the form of inputs and opinions, while the final decision remains in the leadership, who has the authority to make decisions. However, in a group decision, the decision must be made by the leadership group, not by a single leader.

Likewise, the decision-making process at the level of educational units or schools should involve teachers as part of educational organizations. "Teachers as educators must have adequate quality because they are one of the microcomponents of a

very strategic education system and play a significant role in the school education process” (Suyanto and Hisyam in Syamsi, 2000: 43). In developing the professional duties of teachers as educators, teachers and trainers are expected to be able to make a significant contribution to the achievement of the goals that have been set. However, it is inevitable that good and bad performance of a teacher is affected by various factors from both individuals and their work environment such as capability and skills to carry out learning tasks, family background, lack of infrastructure, insufficient human resources, inadequate compensation, and unsatisfactory leadership style of headmasters, especially in the decision-making process.

Providing subordinates with encouragement to have a commitment in carrying out their duties is important for a leader in achieving goals as stated by Wibowo (Syamsi, 2000: 44) that "Subordinates will improve their performance if they have a commitment to what they are responsible for. Although it requires improvement, it will encourage people." Motivating subordinates is very important for a leader so that the work can be done successfully, as written by Kambey (1999: 135) "Every job in any field, in addition to requiring personal capabilities or skills, requires sufficient motivation in a person, so that the work can be successfully done as well as possible".

Decision-making reflects a leader's character. Therefore, whether a decision made is good or bad is not only judged after the consequences have occurred, but the decision is one of the forms of leadership, so that:

1. Decision theory is a methodology for structuring and analyzing uncertain or risky situations, in this case decision is more perspective than descriptive.
2. Decision making is a mental process in which a manager obtains and uses data by using other means, shifting answers to find relevant information and analyzing data: managers individually and in teams organize and monitor information.

Decision making is a process of choosing among alternatives – alternative actions to overcome the problem of superior quality are largely determined by the headmaster's. Besides, the behavior and ways of the principal as a leader and the pattern of decision making greatly affect the behavior and the way the principal as a leader in decision-making patterns greatly affects the behavior and attitudes of his followers. In this case, how the principal influences stakeholders to play a maximum role in achieving goals. Therefore, the focus of decision making is on the ability to analyze the situation by obtaining information as accurately as possible so that problems can be resolved (Rivai in Syamsi, 2000: 42). Based on the observations of decision-making researchers at SMP N 1 Kalawat, and SMP N 2 Kauditan, the decision-making process, implementation of decision making, monitoring of decision making, and follow-up monitoring of decision-making results have not been implemented properly. Therefore, the researcher chose the title "Decision Making for School Principals in Junior High Schools in North Minahasa Regency (Multi Case Study at SMP N 1 Kalawat and SMP N 2 Kauditan).

## **B. Limitation of Problem**

Decision making is the process of choosing among alternative actions to solve a problem. The guidelines for how to make effective decisions are: Knowing the causes of problems, knowing the causes if the problem is allowed to drag on, formulating the problem clearly, making sure that the objectives of the decision do not conflict with the goals of the organization as a whole, involving subordinates in the decision-making process, having to be confident that the implementation of the decision will be successful, assessing the results of the implementation of the decision, using a flexible approach, (Syamsi, 2000: 14). From this concept of decision making, the problems are formulated as follows:

1. How are the subordinates involved in the of decision-making process of the Headmasters of SMP N 1 Kalawat and SMP N 2 Kauditan?

2. How are the decisions made by the headmasters of SMP N 1 Kalawat and the head of SMP N 2 Kauditan in relation to graduation standards?
3. How are the decisions made by the headmasters of SMP N 1 Kalawat and SMP N 2 Kauditan in relation to content standards?
4. How are the decisions made by the headmasters of SMP N 1 Kalawat and SMP N 2 Kauditan in relation to management standards?

### **C. Research Objectives**

In line with the aforementioned formulation of the problems, this research aims to:

1. Describe and analyze the involvement of subordinates in the decision-making process of the headmasters of SMP N 1 Kalawat and SMP N 2 Kauditan;
2. Describe and analyze the decision-making of the headmasters in relation to graduation standards at SMP N 1 Kalawat and SMP N 2. Kauditan;
3. Describe and analyze the decision-making in relation to content standards at SMP N 1 Kalawat and SMP N 1 Kauditan;
4. Describe and analyze the decision-making in relation to management standards at SMP N 1 Kalawat and SMP N 2 Kauditan.

## **THEORETICAL REVIEW**

### **A. Concepts of Leadership**

Leadership can determine whether an organization is able to achieve the goals that have been set. Leadership has a series that is manifested as the ability to influence the behavior of others in certain situations so that they are willing to work together to achieve agreed goals. Tannenbaun, Wescler, and Massarik (Chairunnisa, 2016: 105) argue that leadership has an interpersonal influence that is carried out in situations through a communication process and is directed at achieving goals. According to MiftaToha (Chairunnisa, 2016: 106), leadership can also be defined as an activity of influencing other people or an art of influencing the behavior of others or an art of influencing human behavior, both individually and in groups. Leadership can take place anywhere, as long as someone shows their ability to influence the behavior of others towards the achievement of certain goals. Stongnil, Bas (Chairunnisa, 2016: 107) states that leadership is an interaction between group members. Leadership occurs when a member of a group modifies the motivation or abilities of others in the group.

Tati Rosmiyanti and Dedy Kurniady (TIM Dosen, 2009: 125) wrote definitions of leadership according to experts as follows:

1. Ralph M. Stogdill argues that leadership is a process of influencing group activities organized towards goal determination and achievement.
2. Sondang P. Siagians argues that leadership is a motor or driving force of all the resources and tools available to an organization.
3. Robert Dubin argues that leadership in an organization means the use of power and making decisions.
4. Fred E. Fiedler argues that leadership is an individual in a group who provides directive and organizing tasks that are relevant to group activities.
5. Kimball Wiles argues that leadership is any contribution to the establishment and attainment of group purpose.

Carter V. Good gives two definitions of leadership, namely: “(1) *The ability and readiness to inspire, guide, direct, or manage other.* (2) *The role of interpreter of interest and objectives of a group, to grow up recognizing and accepting the interpreter as spokesman*”, (TIM Dosen, 2009: 125-126).

Mulyasa (Kompri, 2014: 207) states that headmaster is a person who has professional abilities who work based on a mutually agreed pattern of professional performance to facilitate and support successful learning. The success of learning is closely related to the performance of teachers who carry out their duties. In order to achieve optimal teacher performance, a democratic and professional leadership of the headmaster is required. Therefore, it can be seen that the leadership of the headmaster is highly influential on teacher performance. Accordingly, it is suspected that there is a correlation between headmaster leadership and teacher performance. This means that the better the leadership of the headmaster, the better the performance of the teachers. On the contrary, the worse the leadership of the headmaster, the lower the performance of the teachers.

According to Mulyasa (Tarhid, 2017: 141-155) states that in the new paradigm of education management, a headmaster should function as educator, manager, supervisor, leader, innovators and motivator (EMASLIM). The leadership success of the headmaster can be measured using these six dimensions. The demands on schools are increasing. This fact demands the accountability of the headmaster to improve the academic aspects of students in facing challenges in the new century. One of the challenges is continuous school improvement. Therefore, according to Sorenson et al. (Ansyar, 2015: 426), the headmaster should become an instrument of school change. This means that the headmaster should take the initiative to make changes to the curriculum to improve student learning achievement continuously. This should be an important mission of the headmaster, serving as a call to which the headmaster needs to respond positively, if he/she wants to be successful as a curriculum and learning leader in addition to being an effective school leader (Sorenson at al. in Ansyar, 2015: 426). Research reveals that effective schools, according to Reynolds and Teddlie & Raynolds (Ansyar, 2015: 426) are synonymous with the characteristics of effective leadership.

Leadership is a contribution from someone in cooperative situations. Leadership and group are two things that cannot be separated from one another. There is no group without leadership, and leadership only exists in situations of group interaction. A person cannot be said to be a leader if he is outside the group; he must be in a group where he plays leadership roles and activities.

## **B. Concepts of Decision Making**

Davis (Syamsi, 2000: 3) states that “Decision is a result of solving problems faced with tasks”. Furthermore, Terry (Syamasi, 2000: 3) argues that “Decision-making as a key part of managerial activities is a process through which a series of activities are selected, which reflects the best alternative action for problem solving”. Reksogadiprodo and Handoko (1982: 144) compile definitions of decision-making from experts as follows:

1. Curits R. Finch and Robert L. MCGough (Reksogadiprodo and Handoko, 1982: 144) in their book entitled “*Administering and Supervising Occupational Education*” defines decision-making as an action and a number of existing alternatives. They also view decision-making as a basic function of leadership.
2. Meanwhile, H. Malayu S.P. Hasibuan (Nur A, 2015: 131) gives a definition that decision-making is a process of determining the best decision and a number of alternatives for carrying out activities in the future.
3. Furthermore, according to Max (Chairunnisa, 2016: 138) “Decision making is commonly defined as choosing from among alternatives”.
4. According to G.R. Terry, Iqbal Hasan (Chairunnisa, 2016: 140), “Decision-making can be defined as the selection based on same criteria of one behavior alternative from two or more passible alternatives”.
5. Meanwhile, Sondang P. Siagian (Chairunnisa, 2016: 140) states "Decision-making is a systematic approach to the essence of a problem of collecting facts and data, determining which alternatives and taking the most appropriate action.
6. According to Prajudi Atmosudirjo, decision is a closing of the thought process about a problem to address questions of what should be done to solve the problem by making a choice of one alternative (Chairunnisa, 2016: 140)

Decision among alternatives contains three definitions, namely: 1) There is a choice based on logic or consideration; 2) One of the best out of several alternatives must be chosen; 3) There are goals to be achieved and those goals are getting closer to those goals (James A.f.Stoner in Chairunnisa, 2016: 140). Therefore, it can be concluded that decision is the result of resolving the problems faced firmly. A decision must be able to address questions about what is discussed in relation to planning.

Based on this definition, it can be seen that decision-making is not a trivial or easy activity. Decision is born from a long and complicated process in which there is intensive discussion. Decision-making is the ability to analyze situations by obtaining as accurate information as possible in order to solve problems. It is very clear that, in schools, decision-making is a shared responsibility for which the process must involve all related parties such as teachers, administrators, parents, committees, the community if necessary. There is a decision-making that only involves a group of people, for example, only the leaders, but the process must involve the leaders and not only determined by the headmaster.

## RESEARCH METHODOLOGY

### A. Type of Research

A qualitative research is a method of exploring and understanding meanings that a number of individuals or groups of people think comes from social or human problems. Its process involves important efforts such as asking questions and procedures, collecting specific data from participants, analyzing data inductively (Creswell, 2017: 121). This research attempted to reveal the model of decision-making for multi-cases by headmasters in SMP Negeri 1 Kalawat and SMP Negeri 2 Kauditan.

### B. Data and Data Source

Data collected in this research were classified into two types of data, namely primary data and secondary data (Yunus in Nurza, 2017: 37). Primary data were data obtained directly in the field by means of direct interviews with informants. Secondary data included minutes of meeting, letters and school documents.

### C. Method of Data Collection

1. In-depth interviews in relation to the decision-making of headmasters. The interview activity in this research refers a conversation between the researcher and the informants which was conducted face-to-face. It was related to the decision-making for multi-cases by the headmaster of SMP N 1 Kalawat, and the decision-making for multi-cases by the headmaster of SMP N 2 Kauditan. The interview activity in this research aimed to provide information about the headmaster's decision making and the teacher's feedback to the headmaster's decision making and student's feedback to the headmaster's decision making and its implementation in Minahasa Regency.
2. Field observations. Field observation, according to Bogdan and Biklen (1998), is "a pure observation, an observation that made deliberately so that the object being observed does not change due to the presence of the researcher". The observations were made directly on the object of research to strengthen and round out the truth from the results of interviews with informants.
3. Documentation study. The documentation study in this research was intended to study a number of documents related to the research focus, namely the model of decision-making by the headmasters of SMP Negeri 1 Kalawat of Kalawat Subdistrict and SMP Negeri 2 Kauditan of Kauditan Subdistrict.

### D. Method of Data Analysis

Data analysis in a qualitative research was carried out simultaneously with the data collection process. The final analysis was conducted after the field observation, or the analysis was carried out after the data from the field had been collected. Therefore, research findings in the field were formed into theory, not from existing theories but developed from data in the field.

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This type of research was multi-case, so that data analysis was carried out in two stages: single data analysis (individual case analysis) and cross case data analysis.

## **RESEARCH RESULTS AND DISCUSSION**

### **A. Research Results**

The results of the interview regarding the model of decision-making by the headmaster of SMP N 1 Kalawat of North Minahasa were as follows:

1. Decision Making Process: Giving subordinates opportunities in the decision-making process, namely giving input or questions, recording input, deliberating, concluding, deciding, directing, conducting approaches, distributing tasks, providing incentives, being patient, distributing tasks until they were done.
2. Graduation Standards: The headmaster carried out his duties very well, namely facilitating, supervising teacher preparation (learning tools), teaching and learning activities, carrying out assessments, coordinating with related parties, expressing good character (being a model for healthy schools).
3. Content Standards: Establishing a school curriculum making team, making curriculum, conducting supervision and evaluation.
4. Process Standards: Facilitating, coordinating, and supervising the making of lesson plans and learning activities in accordance with the 2013 curriculum, and conducting evaluations

The results of the interview regarding the decision-making by the headmaster of SMP N 2 Kauditan of North Minahasa were as follows:

1. Decision-Making: The Headmaster of SMP N 2 Kauditan were providing opportunities for subordinates to give input, deliberating, distributing tasks, paying attention to needs, finding solutions to solve problems.
2. Graduation Standards; Organizing, motivating, coordinating, carrying out curricular and extra-curricular activities, conducting supervision, motivating students, holding quizzes, holding school examination and computer-based National examination, creating and implementing school rules.
3. Standard contents: Establishing a curriculum development team, making a curriculum, distributing tasks in teams, checking teacher administration, conducting classroom supervision, checking journals once a week.
4. Process Standards: Implementing the school curriculum, checking teacher administration, carrying out clinical supervision and providing reinforcement.

### **B. Discussion**

Based on the results of the research, there were several aspects to be discussed in relation to the decision-making of headmasters at SMP N 1 Kalawat and SMP N 2 Kauditan, as explained below:

1. National Education Standards  
Serving as the key driving force for school development and advancement and being responsible for improving the quality of school, the headmaster must be sensitive to changes in education in order to complement and develop so that quality is maintained.

Edwar Salis (Nur 2015: 160) argues that indicators of improving the quality of education in schools are seen from the education components, including quality of graduates, quality of teachers, headmaster, school staff (administrative personnel), laboratory assistants and technicians, library staff, learning process, facilities and infrastructure, school management, curriculum

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implementation, assessment systems and so forth. Equitable improvement in the quality of primary and secondary education refers to standards in accordance with applicable regulations. The main reference for the quality assurance system for primary and secondary education is by the National Education Standards (SNP), which was stipulated by the central government through the National Education Standards Agency (BNSP). SNP is the minimum standard set by the government in the education sector which must be met by the educational unit and all stakeholders in managing and administering education.

## **2. Decision-Making Process at SMP N 1 and SMPN 2**

According to W. Haynes (Simon, 1991: 4), decision making is an obligation of every individual. A decision is good serving as a consideration to reach a conclusion, which is a part for all headmasters. Simple decision making may be able to emphasize a relationship between options or a selection for a case towards action from either the availability of alternatives or options to obtain the desired result. The headmaster makes decisions through a process like when planning a budget, planning an organization's work, interviewing a prospect teacher, watching student lining up for a flag ceremony or making an adjustment to a project.

The decision-making process is real in organizations, as stated by Lester Coch and John R.P. French in their study (Simon, 1991: 340) regarding participation in decision-making that "The results are clear and definite that employee participation in decision-making increases production. In educational organizations, followers of the generalization summarize a great deal of research and literature on teacher participation in decision making. 1. Participation in decision-making is positively related to teachers' satisfaction with teaching skills. 2. Teachers prefer headmaster to involve them in decision-making. 3. Decisions fail because of poor quality or because they do not accept them. 4. Teachers do not expect to be involved; in fact, too little. 5. The roles and functions of teachers and administration in decision-making are required in various problems encountered. Grey's (Simon, 1991: 9) assumes a rational model of decision-making is the most effective result if it follows four steps in the process of an investigative situation; 1) Developing alternatives; 2) evaluating alternatives; 3) Selecting one and the best; 4) Implementing.

Likewise, educational organizations encounter various types of problems so that they must be able to choose the appropriate model in order to have a positive influence on the school organization and themselves. The decision-making process of the headmaster of SMP N 1 Kalawat involved teachers, administrators and related parties. The involvement of subordinates, i.e. teachers, administrators, parents, committees and other related parties was evident in daily activities in teacher and employee meetings as well as teacher and parent meetings. The headmaster always gave subordinates opportunities to be involved in making decision, giving input, deliberating, deciding and even conditioning in order to create communication and cooperation for smoothly completing tasks. The headmaster in carrying out his duties always coordinated and collaborated with the school committee, treated his subordinates like family, recognized the strengths and limitations of each member, filled in the gaps in work, gave incentives and distributed tasks until they were done. The involvement of subordinates in the decision-making process of the Headmaster of SMP N 2 Kauditan went well by involving subordinates giving input, deliberating, making a clear distribution of work, supervising, paying according to workload, finding solutions to solve problems.

## **3. Decision-Making of Headmasters in Relation to Graduation Standards**

Graduate Competency Standard refers to a qualification of the ability of graduates which includes attitudes, knowledge and skills of students that must be met or achieved from an educational unit at the primary and secondary education levels (Law number 20 of 2003). The graduate competency standards in the 2013 curriculum consist of qualification criteria for students' competency that are expected to be achieved after completing their study period in educational units at the primary and secondary education levels. Monitoring and evaluation are carried out periodically and continuously in each period in order to reveal the achievement and conformity between the graduate competency standards and graduates from each education unit and the

curriculum used in certain educational units. The results obtained from monitoring and evaluation are used as input for improving the graduate competency standards of in the future. Junior high school and Islamic Junior High School graduates must have competence in the dimensions of attitude, knowledge and skills.

Likewise, the decision-making of the headmaster of SMP N 1 Kalawat were related to preparing students by developing their potential, equipping them with knowledge in accordance with the 2013 curriculum, conducting assessments for every subject starting from daily scores, mid-semester scores, semester scores including knowledge, attitude, and skills for grades 7 and 8. Meanwhile, for grade 9, graduation requirements were completion of study for six semesters, added with school exam scores and computer-based national examination scores. In addition to curricular activities, there were also extra-curricular activities, such arts, sports, scouting and Junior Red Cross. This school was a pilot school for a healthy school (it has counseling services, healthy toilet, beautiful garden, 3 types of trash bins, drinking water provided in the classroom). The learning implementation went well. Before learning began, the teacher in charge and security guard were already present at the school ready to welcome the students by shaking hands. At the school, students were trained to pay attention to personal hygiene and the environment. The headmaster monitored the implementation of activities, created an effective teaching and learning environment, distributed tasks as needed, motivated, improved teacher competence, improved administration, improved the welfare of teachers and employees by working together to build entrepreneurship with the aim of improving the welfare of its members. Excellent character development involved all school members. The implementation of learning in SMP N 2 had slight differences, namely implementing the 2013 curriculum in learning, exercising supervision, motivating, teachers providing enrichment for learning materials, giving more exercises, making analyzes, conducting assessments.

Tyler (Chairunnisa, 2016: 301) describes education as a process in which there are three things that we need to distinguish, namely educational goals, learning experience, and learning evaluation. Evaluation is intended as an activity to see the extent to which educational goals reflect the desired behavior changes in students, so what is important in the evaluation process is to check the extent to which the desired behavior changes have occurred (Tyler in Chairunnisa, 2016: 302). By obtaining information about the extent to which these educational goals have been achieved by students individually or in groups, decisions can be made about what actions need to be taken regarding the teaching program and the student concerned. The follow-up of evaluation results that directly concern the interests of students is in the form of providing guidance in order to improve the results that have been achieved and to plan study programs for each student.

According to M. Yudah (Inriyani, 2017: 1), extracurricular activity as a program outside school hours are developed to facilitate the curricular program with this activity. This activity is carried out by planning student activities, namely activities that must be carried out at school in order to achieve educational goals and to attempt to shape character, personality development of talents, interests and uniqueness of students.

#### 4. Decision-Making of Headmasters in relation to Content Standards

Curriculum implementation seeks to transfer curriculum planning into operational action. Curriculum evaluation is the final stage of curriculum development to determine the extent of learning outcomes, the level of achievement of the programs that have been planned, and the results of the curriculum itself. The curriculum development does not only involve people who are directly related to education, but involves many people, such as politicians, businessmen, parents of students, and other elements of society interested in education (Kompri, 2014: 172-173), as seen in Figure 1.



Figure 1. School Curriculum Development Meeting

The main challenge today is designing a relevant and accountable curriculum. Accountability can be achieved partially by matching curriculum. Matching means that standards, content, assessment, and teaching strategies are coherent, and create a complementary match (Drake in Kompri, 2014: 174). According to Marzano, quoted by Stronge (Kompri, 2014: 174), one of the factors that must be considered at the school level is a guaranteed and possible curriculum to be implemented.

Law number 20 of 2003 concerning National Education System article 36 paragraph (3) states that curriculum is developed in accordance with the level and type of education within the framework of the Unitary State of the Republic of Indonesia by considering: 1) Increase in faith and piety; 2) Increase in noble character; 3) Increase in potential, intelligence, and interest of students; 4) Regional and environmental potential diversity; 5) Regional and national development demands; 6) Demands of the world of work; 7) Development of science, technology and art; 8) Religion; 9) Dynamics of global development; and 10) National unity and national values;

Serving as one of the components of education, the curriculum plays a very important role in delivering the expected educational goals. Therefore, it is the main force that affects and shapes the learning process. Mistakes in the curriculum development will cause the failure of an education. Herman H. Hornee as quoted by Iskandar Wiryokusumo and Usman Mulyadi (Kompri, 2014: 175) provides three bases for curriculum development: 1) Psychological basis: used to meet and identify competence obtained and needs of students; 2) Sociological basis: used to identify the demands of society for education; 3) Philosophical basis: used to identify the values to be achieved.

Based on programs and plans that have been made, students carry out learning activities to develop and change behavior in accordance with predetermined goals (Kompri, 2014: 175-176). This was evident in the curriculum developed by the school based on the 2013 curriculum. It was developed together by headmaster, committee, teachers, and even stakeholders. However, the headmaster had to be responsible from the development to its application in learning. For example, in developing the curriculum for SMP N 1 Kalawat, the headmaster established a curriculum development team consisting of teachers, administrators, school committees, and supervisors to develop the school curriculum based on the 2013 curriculum, including: basic framework, curriculum structure, learning load and calendar, supervision and evaluation, making syllabi and learning implementation plan (RPP), annual program (PROTA) and semester program (PROSEM), having documents for teachers and parents meeting, setting the Minimum Mastery Criteria for school and the Minimum Mastery Criteria for subjects. Likewise, SMP N 2 Kauditan had a school curriculum developed by a curriculum development team, consisting of teachers, headmaster, and committees. The school curriculum was based on the 2013 curriculum.

The curriculum in a school is a tool or effort to achieve the educational goals desired by the school, which are considered appropriate and crucial in achieving educational goals, so that one of the steps to be done is to review the goals that have been used by the school. (Soetopo & Soemanto in Junaedi, 2012: 1). This means that if the desired goals have not been achieved, the tools used must be reviewed to achieve such goals, in this case the curriculum. The existence of the curriculum as a structured learning organization is a preparation for students. Students are expected to obtain a number of new experiences which in the future can be developed in line with their development.

Moreover, the curriculum for teachers or educators serves as : 1) A guideline for working in making and organizing learning experiences for students; 2) A guideline for evaluating the development of students in absorbing a number of experiences provided.

## 5. Decision-Making of Headmasters in Relation to Process Standards

Regulation of the Minister of Education and Culture number 22 of 2016 concerning process standards for primary and secondary education confirms that process standards refer to criteria for the implementation of learning in educational units to achieve graduate competency standards. The process standards are developed by referring to the graduate competency standards of and content standards that have been set in accordance with the provisions in Government Regulation no 19 of 2005 concerning national education standards as amended by Government Regulation number 32 of 2013 concerning regulation on government regulation number 19 of 2005 concerning national education standards. The learning process in educational units is held in an interactive and inspiring manner. It also provides sufficient space for initiative, creativity, and independence according to the talents, interests and physical and psychological development of students, learning, and assessment of the learning process in order to increase the efficiency and effectiveness of the achievement of graduate competencies as shown in Figure 2 below:



In accordance with graduate competency standards, learning standards include the development of the dimensions of attitude, knowledge and skills, which are elaborated for each educational unit. The three dimensions of competence have different acquisition trajectories (psychological processes). Attitude is acquired through the activity of “memorizing, understanding, applying, analyzing, evaluating, creating”, skills are acquired through the activity of “observing, questioning, trying, reasoning, presenting and creating”. The characteristics of competency along with differences in acquisition trajectories also influence the characteristics of process standards. In order to strengthen the scientific approach, integrated theme (themes between subjects) and themes in one subject, it is necessary to apply discovery/inquiry learning. In order to encourage the ability of students to produce contextual work, both individually and in groups, it is highly recommended to use a learning approach that produces problem solving-based work (project-based learning). The learning process is entirely directed at the development of the three dimensions which are not separable from each other. Therefore, the whole learning process creates personal qualities in attitude, knowledge and skills.

In student management, teachers play a more indirect role. Some of the roles of teachers in student management are serving as a committee in admitting new students, during orientation period the teacher makes students able adapt quickly to their new school environment, teachers playing a role in recording student attendance, teachers motivating students to always achieve high, teacher should be an exemplar in creating school discipline so that students can imitate it. The learning process at SMP N 1 can be described as follows: before the learning activities, the headmaster together with the teachers held a workshop, distributed assignments, gave decrees, checked teacher administration and monitored the implementation of learning, enhanced learning in an interactive, inspirational, and fun way; improving teacher competence, built communication and coordinated with committees, parents, teachers, administrators, alumni and other institutions such as the police, public health centers, drug agencies, government and local communities; Had rooms and student work, had achievements, improved the welfare of teachers and employees. Overall, the management of SMP N 2 Kauditan was already good by implementing curriculum, supervising

administration and implementing learning, having achievements; carry out learning in an interactive, inspiring, and fun way; improving the implementation of education, improving education, affection to balance the development of cognition, and fostering the next generation to be able to continue development. The education manager should be responsive to changes in order to respond. One of the ways is by changing or adjusting the organizational structure, establishing a new structure that is suitable and taking a step forward, namely creative.

## 6. Program Planning

The role of the headmaster as a driving force in all activities at school requires that the headmaster has more abilities than other members of the school. The success of an educational institution reflects the competence of the headmaster in managing all kinds of action for the benefit of the school. The managerial Competence includes: 1) Able to formulate school planning; 2) Able to develop school organization; 3) Able to lead teachers and staff; 4) Able to manage school facilities and infrastructure; 5) Able to manage school community relationships in order to seek support for ideas, learning resources, and school funding; 6) Able to manage students, especially in the context of admitting new students, and developing student capacity; 7) Able to manage curriculum development and teaching and learning activities in accordance with the direction and goals of national education; 8) Able to manage school finances in accordance with the principles of accountable, transparent and efficient management; 9) Able to manage school administration in supporting school activities; 10) Able to managing school special service units in supporting learning activities and student activities at school, 11) Able to apply entrepreneurial principles in creating innovations that are useful for school development; 12) Able to create a work culture and climate that is conducive to student learning; 13) Able to manage school information in supporting program development and decision-making; 14) Skilled in utilizing advances in information technology; 15) Skilled in managing production/service activities in supporting school funding sources and as a source of student learning; 16) Able to carry out supervision of the implementation of school activities in accordance with prevailing supervisory standards.

## CONCLUSION

### A. Conclusion

1. SMP N 1 Kalawat; a) The Decision-Making Process of the Headmaster of SMP N 1 Kalawat; Cooperating with committees, teachers, parents and other institutions, providing opportunities for subordinates to give input in the decision-making process, recording important matters, deliberating, concluding and deciding. Moreover, in more complex matters, before conveying to parents, the headmaster first coordinated with the committee, and in conveying to parents the headmaster asked for support from the School Committee: Directing, approaching, distributing tasks to until they were done, handling patiently, providing incentives. b) the Decision Making of the Headmaster of SMP N 1 Kalawat in relation to the graduation standards; Distributing team assignments for each activity, making and implementing school rules, motivating teachers, inviting parents to cooperate in guiding students, carrying out curricular and extracurricular activities, providing assistance and supervision, implementing curriculum in learning, maximizing student learning activities, providing examples, motivating students, holding daily quizzes, semester tests, school examination, National-based School Examination (USBN), Computer based National Examination (UNBK). c) The Decision-Making of the Headmaster of SMP N 1 Kalawat in relation to Content Standards: Establishing a school curriculum development team, making school work plans, making a school curriculum, conducting supervision and evaluation; d) The Decision-Making of the Headmaster of SMP N 1 Kalawat in relation to the Standard Process: Coordinating, facilitating, supervising the development of learning plans and learning activities according to the 2013 curriculum, holding interactive, inspirational and fun learning, improving teacher competence, improving teacher welfare, cooperating with related institutions.
2. SMP N 2 Kauditan; a) The process of decision-making of the Headmaster of SMP N 2 Kauditan: Involving subordinates by providing input, deliberating, distributing work, finding solutions for solving problems, conducting supervision,

providing incentives. b) The Decision-Making of the Headmaster of SMP N 2 Kauditan in relation to the Graduation Standard: Coordinating, motivating, carrying out curricular and extra-curricular activities, supervising, motivating students and teachers, holding quizzes, school exams and computer-based national examination; Making and implementing school rules, paying according to workload. c) The Decision-Making of the Headmaster in relation to the content standards: Establishing a curriculum development team, making a school curriculum according to the 2013 curriculum, distributing assignments, checking teacher administration, conducting supervision, checking teacher journals once a week. d) The Decision-Making of the Headmaster in Relation to Process Standards: Implementing the school curriculum, organizing an interactive, inspirational and fun learning, checking teacher administration, carrying out clinical supervision, and providing reinforcement, paying according to workload.

## B. Suggestions

1. The headmasters build good cooperation with related parties and seeks to adapt to new things that can improve the quality of the school.
2. The headmasters strive to complement the shortage of existing teachers and education personnel, to involve teachers and other education personnel in training, socialization, Deliberation of Subject Teacher (MGMP), workshops; monitoring, directing and motivating.
3. The headmasters develop and implement the school curriculum.
4. The headmasters formulate the vision, mission and goals of the school.
5. The headmasters provide facilities and infrastructure in accordance with the school's needs.
6. The headmasters manage school funds effectively and efficiently.
7. The headmasters build entrepreneurship among school members, for example a cooperative.
8. The headmasters conduct a self-evaluation at least once a year and is willing to be accredited in order to maintain and improve the quality of the school.

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# A case report for Primary Hyperparathyroidism in the elderly patient with complex issues

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**Background-** Primary Hyperparathyroidism (PHPTH) can occur at any age but more common in postmenopausal women and men above 50. Primary treatment for PHPTH is surgery and NICE recommends referring cohorts with symptoms, or target organ damage or adjusted serum calcium  $\geq 2.85$  mmol/L.

**Index Terms-** Primary hyperparathyroidism, comprehensive geriatric assessment

**Abbreviation:** PHPTH, primary hyperparathyroidism; PTH, parathyroid; CT, computerized tomography; CGA, comprehensive geriatric assessment.

## I. CASE

A 75 years old gentleman was admitted with abdominal pain, vomiting and confusion.

He was diagnosed with PHPTH a year ago, listed for parathyroidectomy regarding refractory hypercalcemia. COVID-19 pandemic delayed his surgery. Clinically, he was dehydrated, emaciated with body weight of 44.85 kg and Clinical frailty score of 6.

His background was stroke and back pain.

His calcium was 3.86 mmol/l (ref: 2.2-2.6 mmol/L) and PTH was 67.9 pmol/ml (ref: 8-24 pmol/ml). Endocrinology advised intensive IV fluid followed by IV zoledronic acid aiming adjusted calcium level below 3.0 mmol/L. He was taken over by the geriatricians for deterioration in general and for developing complex issues: delirium secondary to urinary tract infection and hypercalcemia, urinary retention, low mood, poor nutrition and multiple falls. He described suicidal intent, being assessed by mental health team, commencing mirtazapine. Regular dietitian's review suggested nasogastric (NG) feeding when weight loss by 5.5 kg was documented within 2 weeks. Unfortunately, he was not compliant with nasogastric tube despite appropriate measures. A repeat CT to look for secondary causes was unremarkable and TSH in this case was normal while CT scan identified a small thyroid nodule.

His calcium was still high (3.05 mmol/L) and again treated with zoledronic acid followed by cinaclet (calcinemetic agent) as per guideline. His oral intake and mobility were slowly improved altogether with delirium. His MMSE was 18/30, not having capacity, hence, the case conference was held and the MDT team decided to go ahead with surgery. The operation went well with post op D2 calcium 2.21 mmol/L. Histopathology results evidenced adenoma.

Finally, he was discharged to the respite after 75 days in hospital for rehabilitation and now mobilizing with a frame, gaining weight and improving cognitively.

## II. LITERATURE REVIEW

Primary hyperparathyroidism (PHPT) predominantly affects the elderly, with a peak incidence between ages 55 and 70. U.S. longitudinal population-based studies have found that women 65–74 years old have an annual detection rate of 99 cases per 100,000, compared with 15.7 per 100,000 in the general population (1).

With the passing of time, the diagnosis of primary hyperparathyroidism is increased because of the improved understanding of the characteristics of disease and routine screening of serum calcium. The presentations in the older age group might differ from general population where the mental disturbances may be the complaint in 50%. These may include slight or severe neuropersonality changes, principally depression, acute organic psychosis in most severe cases, or just lack of initiative in most cases. The diffuse psychiatric symptoms usually cannot be distinguished from other manifestations of aging (2).

Classical features of renal, musculoskeletal, gastrointestinal and psychiatric symptoms are commonly found in cases with rapidly increasing calcium level; however, asymptomatic in slowly increasing calcium level. In resource rich countries, over 85% of cases with PHPT are asymptomatic (3).

NICE NG<sup>132</sup>, 4<sup>th</sup> International workshop and American Association of endocrine surgeon recommends baseline investigations including serum Calcium, Parathyroid hormone level, tests to exclude familial hypocalciuric hypercalcemia, vitamin D level and target organ damage although the indications for specific tests slightly differ in each guidance. In suggesting parathyroid surgery, NICE recommended symptomatic patients, calcium level 2.85 mmol/l and above, osteoporosis (T score < -2.5), fragility fracture and renal stone disease whereas 4<sup>th</sup> international workshop and American Association of endocrine surgeon covered wider inclusion criteria such as age <50, vertebral fracture (by X ray, CT, MRI or Vertebral fracture assessment), creatinine clearance <60, urinary calcium >10 mmol/L, nephrocalcinosis, renal stones, non traditional symptoms (reflux, fibromyalgia, neuropsychiatric, neuromuscular), patients unwilling to follow conservative monitoring protocol and Coronary artery disease.

American Association of Endocrine surgeon advised parathyroid surgery is more cost effective than conservative or medical treatment. Cervical ultrasound or other high intensity imaging is recommended preoperatively. Clinically relevant

thyroid disease should be assessed preoperatively and should be managed during operation. Cure defined as eucalcemia at more than 6 months.

Comprehensive Geriatric Assessment (CGA) is a process of care including a multidimensional holistic assessment of an older person, formulation of a plan to address issues concerning the person addressed (and their family and carers when relevant). Interventions are carried out, progress is reviewed and the original plan reassessed at appropriate intervals with the modified interventions to customize the individual.

Evidence shows that CGA is effective in reducing mortality and improving independence, hospital admission and impact of frailty (5)

### III. DISCUSSION

In our case; diagnosis and treatment plan was ascertained, however, the new complex issues directly or indirectly related to the primary disease made the surgery deemed unfit. Comprehensive geriatric assessment helps identifying the problems to optimize the preoperative conditions. Although surgery might be straightforward in the younger population, the older people with frailty issues are more succumb to deterioration and holistic care on individual needs matter the most.

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# A Literature Review of Research Between Supply Chain Constraints Issues and Decree of The Government of Indonesia During Covid-19

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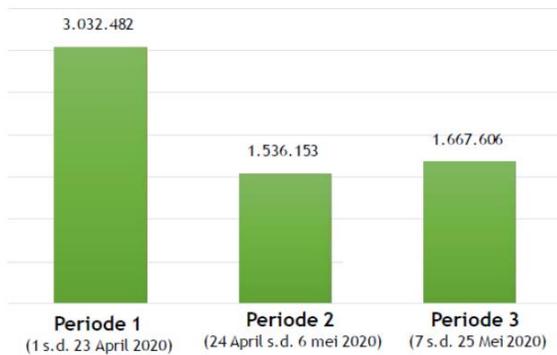
**Abstract- Purpose** - The purpose of this study is to find out more about supply chain problems during the Covid-19 pandemic in Indonesia and how government decisions help solve supply chain problems, by forming several policies by adjusting the situation and conditions during the Covid-19 pandemic in Indonesia. **Methodology** - We use some literature both from Indonesia and from research abroad which are related and have a similar relationship with the problems that occur in Indonesia today relating to supply chain constraints. The literature is taken from several previous research journals, government regulations, and reviews of research conducted by previous researchers. **Result and findings** - lower interest rates, tax elimination, and direct assistance to business actors to provide assistance to ensure the smooth running of the supply chain and reduce spikes in costs and prices for necessities in the community. The leniency of regulations to facilitate supply chains to be able to distribute goods and services to various regions is not hampered even though Covid-19 is hitting Indonesia. **Research implication** - This study seeks to add to the still limited literature on supply chains during the Covid-19 pandemic in Indonesia. Also, this research can be used as a framework for educational institutions such as universities and government agencies to provide important references regarding supply chain management during the Covid-19 pandemic, especially in Indonesia. **Limitation** - The study was carried out by analyzing some of the existing literature and more research is still needed regarding the efficiency and effectiveness of government policies on supply chain control and performance during the Covid-19 Pandemic in Indonesia, and the results are based on descriptive analysis only. **Future research** - Further studies can use research-based on quantitative analysis to measure the extent of supply chain constraints and the efficiency of the Indonesian government's decisions in overcoming supply chain problems in Indonesia during the Covid-19 pandemic.

continued to increase by 207,203 infected cases as of Thursday, September 10, 2020. In a number of these cases, 147,510 patients were declared cured and 8,456 patients were declared dead (BNPB, 2020) and followed by the World Health Organization (WHO) decision to announce Covid-19 as a pandemic on March 11, 2020. On that date, the world's infected cases had reached 121,000 cases (Utomo, 2020). One month later, President Joko Widodo announced and declared Covid-19 a national disaster. This determination was based on the Presidential Decree (Keppres) of the Republic of Indonesia no. 12 of 2020 concerning the determination of the Non-Natural Disaster for the Spread of Corona Virus Disease 2019 (Covid-19) as a National disaster (Sekretariat Kabinet RI, 2020). To accelerate the handling of the Covid-19 pandemic, the Indonesian government has issued several strategies and preventive policies that are continuously being carried out to minimize the risk of the spread of the coronavirus (Djalante, et al., 2020). According to the Badan Siber dan Sandi Negara (National Cyber and Crypto Agency) (2020), the most important strategic stages related to company operational processes and supply chain security risk management to minimize the impact of COVID-19 on the business continuity process are the preparation and planning stages. Inadequate preparation causes instability in the existing supply chain. This is due to the existence of a government policy to impose Large-Scale Social Restrictions (PSBB) in almost all regions of Indonesia. PSBB not only inhibits the flow of people's movement but also hinders the movement of industry, distribution of goods, and the circulation of money (Baldwin & Mauro, 2020). A significant decline has also occurred in the trend of growth in the number of freight trains on Indonesian freight trains during the pandemic. This is due to the disconnection of the supply chain which causes rail goods transportation activities to decline (Direktorat Jendral Perhubungan Darat, 2020).

**Index Terms**- Supply Chain Management, Logistics System, Covid-19 Pandemic, Indonesian Government Policy

## I. INTRODUCTION

Since the Indonesian government confirmed that there were the first two positive cases of the Corona Virus (COVID-19) in Indonesia on March 2, 2020, the spread of COVID-19 has



**Figure 1: Total cargo of Indonesian freight trains**  
*Source: Direktorat Jendral Perhubungan Darat (2020)*

Further research is needed to understand the main barriers to supply chain management in Indonesia during Covid-19. Therefore, this study further aims to discuss trends, challenges, and perspectives on supply chain management systems in Indonesia during a pandemic. Based on this discussion, a solution was produced for the supply chain system in Indonesia, especially for the new normal Covid-19 pandemic.

## II. RESEARCH MOTIVATION

The supply chain that runs in the public sector in 2020 tends to slow down, followed by a policy of regional restrictions in various regions in Indonesia as a measure to prevent the spread of Covid-19 in Indonesia (Mas'udi & Winanti, 2020). According to Permana (2020) states that the pandemic and the new normal provide opportunities for the people's economic sector to enter the supply chain, which so far has only been controlled by big players and no longer places it on the periphery of the economic system.

Problems in the supply chain not only hit Indonesia but also other countries such as China as the first country infected with Covid-19. At the start of the second quarter in April when factory workers returned to their routine, the supply chain in China was still not as smooth as before the outbreak period (Chin, et al., 2020). Several preventive steps taken by China to boost their economic growth rate by reducing the social insurance burden on individual companies, reducing investment in infrastructure, increasing consumption, maintaining liquidity and lowering borrowing costs, stabilizing jobs, and more stimulus policies are being developed (Kupferschmidt & Cohen, 2020).

The Indonesian government has currently issued policies that focus on the community, such as direct social assistance, tax incentives, relaxation and restructuring of SME loans, expansion of SME financing, and business recovery and consolidation (SETKAB, 2020). This policy has been running positively in the community, marked by the distribution of Rakyat Business Credit (KUR) which has increased significantly as well as credit expansion by state-owned banks which is expected to help recover the pace of the economy and save the supply chain that was hampered at the beginning of the Covid-19 pandemic at the beginning of the year 2020 (Kementerian Koordinator Bidang Perekonomian Republik Indonesia, 2020). Additional subsidies for KUR that focus on SMEs are expected to provide fresh air for entrepreneurs to survive this pandemic.

Further research is needed to understand the main obstacles to the supply chain cycle in Indonesia during the Covid-19 pandemic. Therefore, this study aims to evaluate and identify barriers and risks to the supply chain in Indonesia during the Covid-19 pandemic to overcome supply chain interruptions in Indonesia during the Covid-19 pandemic.

## III. RESEARCH PROBLEM

The number of closings of factories, shops, companies, and SMEs has an immediate impact on one another among business actors. This is supported by downstream factories that rely on the spare parts they produce by SMEs. Without the spare parts and good logistics required to load materials and deliver products, many factories can barely produce or have no place to store their products (Xinhau, 2020). The same thing also applies in Indonesia, where the process of the supply chain is hampered where there is a decrease not only in production but also in the logistics supply chain, according to a report from Aprindo in Mayasari (2020), namely a decrease in demand of up to 60% due to limited transportation fleets. On the other hand, there is a surge in demand through e-commerce applications, which is the best choice for people to still be able to meet their needs.

The increase in demand from e-commerce has not made supply chain stability run smoothly during the Covid-19 pandemic in Indonesia. This is due to strict regional restrictions with the implementation of health protocols which make it difficult for the supply chain to meet community needs. Limited raw materials from suppliers is also another factor in supply chain inhibition. Reduction of labor due to reduced company income in carrying out the production process causes scarcity of the supply chain and demand that continues to explode from time to time. However, the amount of supply chain growth still tends to decline, which is a crucial issue that must be addressed to increase supply chain growth and economic stability in Indonesia ahead of the new normal Covid-19 period.

## IV. LITERATURE OVERVIEW

### *Supply Chain*

Disruption of the supply chain can pose significant challenges and can affect the performance of an organization (Hendricks & Singhal, 2003). The incidence of natural disasters such as the tsunami in Japan in 2011 to the financial crisis in 2008 has provided a concrete picture of how the interconnectedness and nature of the supply chain can amplify even the smallest disruption (Hendricks & Singhal, 2003). So that various studies have emerged that try to explain the antecedents of robust supply chains, starting from the network level (Kim, et al., 2015) to the organizational level (Bode, et al., 2011).

The level of disruption to business networks during the Covid-19 pandemic has challenged much of the previous understanding of resilient supply chains. Recent research states that this crisis has caused a rapid decline in several business and economic indicators, including the flow of productivity to global GDP (Harris, 2020). Several business sectors have also been hit due to the policy of reducing working hours and this is followed by a 16.24% reduction in workforce (Baveja, et al., 2020) and

exacerbated by the closure of workplaces. According to Araz et al. (2020) that the Covid-19 pandemic is the biggest disruption and has had the most severe impact on global supply chains in the past decade. Each pandemic and supply chain provides its own imitation model of global supply chain disruption and predicts the severity of the impact of the Covid-19 pandemic on supply chain performance in various aspects (Ivanov, 2020).

In short, the Covid-19 pandemic has placed unprecedented pressure on supply chains in Indonesia and globally in most business and product categories. Previous literature on supply chain forecasting and disruption has been able to provide an early picture of the indications of the factors that can cause it. So that the Indonesian government with all the preventive steps that have been taken can predict the demand that will explode in the initial phase of the Covid-19 pandemic so that it can provide early warning and can give more priority to important supply chains.

## V. LOGISTIC MANAGEMENT

According to the definition issued by the council of Logistics Management in Szymonik (2012) where logistics management is part of supply chain management which is responsible for planning, implementing, and controlling forward and backward flow that is efficient, effective and as a storage of goods, services and related information between points. origin and point of consumption to be able to meet handling needs. Responding to the problem of the Covid-19 pandemic requires an update on the need to be able to review previous literature on supply chain and logistics management (Laan, et al., 2016) and disaster relief management (Gupta, et al., 2016), risk management and practices resilience in supply chains (Wieland & Wallenburg, 2013) (Hohenstein, 2015) and to be able to better understand operations in epidemic control (Dasaklis, et al., 2012) (Hobbs, 2020).

The regional lockdown policies and large-scale restrictions (PSBB) that apply in various regions including Indonesia (Hirawan & Verselita, 2020) have led to a dramatic increase in demand for consumer goods and a pattern that is difficult to predict (Joshi & Rahman, 2015). To overcome this challenge, several entrepreneurs are working with government agencies, organizations, and business stakeholders to solve supply chain logistics problems in order to control the growing demand.

### Supply chain constraint issues in emerging country

Supply chain constraints as well as stronger demand have recorded significant growth (Saptana, 2016). Several industries targeted at the supply side were forced to close their businesses, most of which were marginal companies (Baldwin & Mauro, 2020). Resolutions are needed to be able to realize more productive changes to reduce the adverse impact of constraints on supply chain profitability (Simatupang, et al., 2004). There are two ways in which a supply chain constraint-based approach can help managers improve supply chains, namely by providing a reliable global performance measure that helps chain members measure progress on achieving total supply chain revenue and by focusing on remedial efforts that have a dramatic impact on the performance of the supply chain (Stefanovic, 2014).

Supply chain constraints and economic losses were followed by the economic decline of all business networks caused by shocks due to the Covid-19 pandemic (Shafi, et al., 2020). The impact of

this supply chain constraint occurred as a result of regional lockdown policies and social restrictions in various regions in Indonesia in order to reduce the spread of the Covid-19 virus (Ozili & Arun, 2020). The production process experiences barriers to social lockdowns and restrictions in various regions due to insufficient product availability between companies and will cause obstacles to both production and control activities in the supply chain (Oxford Business Group, 2020). These conditions ultimately require adjustment of policy strategies related to supply chain settlement and adjustment during the Covid-19 pandemic so that supply chain stability is maintained.

## VI. INDONESIA GOVERNMENT POLICIES REGULATING SUPPLY CHAINS

During the Covid-19 pandemic, there was a decline in logistics performance which affected the fulfillment of supply chains in Indonesia. In 2019 the logistics business grew 15%, while in 2020 during the 5 months of the Covid-19 pandemic in Indonesia, it experienced a drastic decline and lost and fell to 60%, while the business utility was only around 40% (APTRINDO, 2020). Until August 2020 only 40% of the total supply chain distribution capacity was working, this was due to the social lockdown and restriction policies set by the government since the beginning of the Covid-19 pandemic in Indonesia (Patunru, et al., 2020). Several strategic steps have been taken by the government to stabilize the supply chain and logistics distribution to the public in full, starting from relaxing the repayment of principal loans for freight forwarding companies for 12 months, either through investment loans through banks or non-banks (leasing), to reducing loan interest rates by 50 %, income tax Article 21 (Pph Article 21) is eliminated for 12 months, relaxation of income tax article 23 (Pph Article 23), relaxation of income tax article 25 (Pph Article 25), providing direct cash assistance to industry players to support supply chains, and certainty of business permits and operating permits for transportation vehicles (APTRINDO, 2020).

## VII. LITERATURE SUMMARY

There are 10 strategies to improve and overcome supply chain constraints according to Simatupang et al. (2004) namely utilizing an ERP system that has automatic features and supply chain management functionality, using standardization of ERP, increasing supply chain transparency, gaining data insights through ERP, real-time inventory management, monitoring vendor performance, level of awareness of expenses, increasing return management, just-in-time model and streamlined accounting. However, with the conceptual integration of the previous theory and the conceptual framework of the theory above (Simatupang, et al., 2004) (Saldanha, et al., 2015) (Simatupang, et al., 2004) (Larsen & Bagchi, 2002) (Sanders & Premus, 2005), this paper has identified four main strategies that will be used in analyzing overcoming supply chain constraints in Indonesia. The four main strategies are based on increasing supply chain transparency, real-time inventory management, monitoring vendor work, and level of awareness of expenses. According to (Yuan, 2011) defines the constraints of the supply chain involving internal and external processes: therefore the four strategies above

will be classified into internal and external factors based on the source of their impact. Internal factors are caused from within the company, while external factors are influenced from outside the company.

Internal factors consist of increasing supply chain transparency and the level of awareness regarding expenditures. Increasing supply chain transparency in the business sector will be the main measure of the success and sustainability of the supply chain during the Covid-19 Pandemic, especially in Indonesia. This section will study the attitudes, perceptions, and knowledge of business owners about supply chain transparency that they have been implementing so far because it is very important to be able to find out more details about supply chain handling and further policy decisions from business owners. Expenditure monitoring is also an important aspect of the sustainability of the supply chain, especially during the Covid-19 pandemic, because there is limited space for the continuity of the supply chain, causing both business owners and the community and government to work together to provide the best gap for the continuity of supply chains in Indonesia.

On the other hand, external factors include real-time inventory management and monitoring of vendor performance. Some of the current problems during the Covid-19 pandemic are the disconnection of the supply chain as a result of regional lockdowns and social restrictions imposed in several regions which makes it difficult to get the main raw materials for production. Not only raw material difficulties but lack of supervision on vendor performance has led to a decline in the quality of the existing supply chain. The granting of limited permits and access for business actors to provide flexibility in the distribution of their supply chains by the Indonesian government has not yet been able to solve this problem. This is due to the reduction in the number of employees due to the lack of income due to lockdowns and restrictions on areas in various areas that narrow the space for production from existing business patterns. More support from the government is needed and a little leniency on public space and safety guarantees for workers. The government has provided assistance in the form of tax concessions and direct cash assistance to businesses to continue their business, which more or less has helped sustain the supply chain to meet needs during the Covid-19 pandemic in Indonesia. Therefore, it is necessary to have a government perception regarding the extent to which the supply chain has been running and to acknowledge government support for supply chain constraints in Indonesia. In addition, testing the readiness of the new work structure of the supply chain is also very important to find out how effective the new policies that have taken place during the Covid-19 pandemic in Indonesia are.

**Table 1. Literature Summary of Supply Chain Constraints during the Covid-19 Pandemic and Indonesian Government Policies**

| Key Element    | Description                                       | Source  |
|----------------|---|---|
| Organizational | Knowledge of overcoming supply chain constraints. | (Saldanha, et al., 2015), (Simatupang, et al., 2004), (Larsen & |

Organizational culture in managing the supply chain. (Bagchi, 2002), (Sanders & Premus, 2005), (APTRINDO, 2020)

Market and Industry Adoption of supply chain constraint handling. (Nowakowska & Moroz, 2013), (Lockamy & Draman, 1998), (Larsen & Bagchi, 2002)

External Support The policies of each industry to overcome supply chain constraints. (Nguegan & Mafini, 2017), (Simatupang, et al., 2004), (Sabet, et al., 2017), (APTRINDO, 2020)

Government policy Government initiatives in implementing supply chain policies during the Covid-19 pandemic. (OCHA & RCO, 2020), (OECD, 2020), (Goller, 2020), (APTRINDO, 2020)

The availability of a research center to support the handling of supply chain constraints during the Covid-19 pandemic. Regulations and policies for supply chain handling.

## VIII. RESEARCH CONTRIBUTION

The findings of this paper not only identify constraints and constraints on supply chain distribution during the Covid-19 pandemic that hinder the circulation and distribution of goods and services but also indicate important steps that other countries can replicate in taking policies to remove bottlenecks in supply chains. in Indonesia. Thus, the conceptual framework and findings of this paper may be applied in other developing countries that have similar problems with Indonesia today. The paper also identifies steps the Indonesian government has taken to prevent bottlenecks in Indonesia's supply chain. Therefore, business actors and businesses can focus on returning to producing goods and services in order to restore economic activity in Indonesia. In addition, full support from the government and the policies that have been issued are very important in regulating the regulation and circulation of goods in the supply chain in Indonesia during the Covid-19 pandemic and can be used as guidelines and references to support and improve the supply chain that was hampered at the beginning of the Covid-19 pandemic.

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# Data-Driven High Collision Location Identification and Corrective Countermeasures on Roads in Kenya

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**Abstract-** Road traffic crashes are recorded for various reasons such as establishing the damage, to estimate the economic cost of road crashes and to use this information to adequately plan and provide safer road transport infrastructure. In Kenya, the Traffic Police Department record crash information since they are always the first to attend to accident scenes. The data recorded by Traffic Police may often be counterchecked through the Ministry of Health (M.o.H) at the hospital level for post-crash and trauma care as well as organizations offering paramedicine services. Varying scales of injury may only be determined at the hospital during road crash injury management and prevention hence the need to establish an integrated data management system.

Road safety data collection processes have a great impact on the choice of an effective road safety intervention/measure since it majorly relies on the judgment and decisions of the traffic police and road safety officers. 'Safe System Approach' advocates for a sustainable safety solution in road transport through total involvement of persons and activities during planning, design, construction, operation and management of the roadway. This system identifies persistent errors in the road transport system that have been associated with causes of road traffic crashes.

This research paper identifies the existing gaps in better road safety management which would include inaccuracy in data collection and analysis leading to poor road safety treatments/countermeasures. It also demonstrates that through identification of key safety performance indicators, the lead agency in road safety in Kenya can prioritize the use of funding for road safety in order to achieve better results.

Many Low and Middle-Income countries have deficiency in road safety data collection and analysis and this has a negative impact on better road safety management. Ordinarily, Kenya Traffic Police have the mandate to record road accident data but this has also been a hindrance in the level of accuracy of the data. Most of the data recorded has not been analysed properly to reveal better strategies to improve road safety. This paper will demonstrate how a data-driven high collision identification system can largely improve blackspot management through developing and implementing possible countermeasures to the road safety problems as a way of minimising crash risk.

**Index Terms-** Crash Data Analysis, Engineering Interventions, Road Safety.

## I. INTRODUCTION

In 2018, injuries due to traffic accidents were rated the eighth primary cause of mortality among people of all ages [1]. Most road traffic deaths involve vulnerable road users including pedestrians and cyclists in developing countries. [2]. In developing countries alone, injuries due to crashes contribute to about 85% of road traffic deaths globally compared to about 7% in high income countries [1]. The decade of action (2011-2020) on road safety failed to achieve the target of reducing road traffic deaths by 50% hence a majority of governments gathered in Stockholm in February 2020 to discuss possible interventions for the vision 2030 for road safety by adopting the Stockholm Declaration on Road Safety [3]. In a separate publication by members of the academic expert group, it has been suggested that better road safety management will incorporate collaboration between Governments, Non-governmental Organizations, Academia, Manufacturers, Road Agencies and Industry to achieve positive results on prevention of road traffic deaths in addition to sustainable practices and reporting as one of the practices countries should adopt. [4].

## II. METHODOLOGY

The data collection was coordinated through the Kenya Police Headquarters in Ruaraka in Nairobi and involved obtaining data from 121 police bases all over the country. This was achieved in close liaison with the National Traffic Department. The data received was in hard copy for complete years of 2011 to 2016. The hard copy data was entered in Excel tables and analysed on the national, regional, corridor and sectional detail. Finer analysis at specific locational level was also carried out.

To enable complete analysis to establish trends, rigorous the data cleaning and modifications was conducted. The information in the forms as received from the police records was very general and not useful for the purposes of transportation planning and designing of road safety countermeasures hence the need for an extensive data cleaning.

The traffic volumes (ADT) data represented 2014 data from Kenya Roads Board. This data was supplemented with historical data from past projects undertaken on Kenya National Highways Authority (KeNHA) roadways where information was available.

In addition, some information was obtained from National Transport and Safety Authority (NTSA) from their public portal.

### III. RESULTS AND ANALYSIS

The data was processed and analysed to provide trends in accident occurrence, severity as well as to identify areas of high collisions or Black Spots.

#### A. Annual Trends

Nationally, a total of 28,030 crashes were reported and recorded for complete years 2011 to 2016. The crashes were characterised as fatal, serious or slight injury. The property damage crashes were not recorded. The trend shows a decreasing number of crashes over the years with the highest occurrence in 2011 at 5477 and the lowest in 2016 at 4036 occurrences, amounting to 1% to 14% year over year reduction as illustrated on Figure 1.

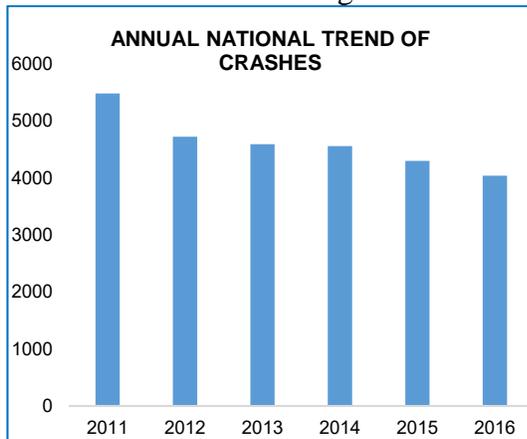


Figure 1: National Annual Trend of Crashes

Table 1 below gives a summary of some of the general statistics.

Table 1: National General Statistics

|   | 2011   | 2012   | 2013  | 2014  | 2015  | 2016  |
|---|--------|--------|-------|-------|-------|-------|
| Total No of crashes                         | 5477   | 4718   | 4587  | 4554  | 4296  | 4036  |
| No of Fatal crashes                         | 2203   | 2040   | 2193  | 2182  | 2257  | 2017  |
| No of Casualties                            | 5477   | 4718   | 4587  | 4554  | 4296  | 4036  |
| No of Fatalities                            | 2576   | 2378   | 2567  | 2516  | 2631  | 2418  |
| Fatalities/ 100000 inhabitants <sup>1</sup> | 5.840  | 5.408  | 5.813 | 5.784 | 5.983 | 5.347 |
| Fatalities/ 10000 vehicles <sup>2</sup>     | 13.626 | 11.398 | 10.9  | 9.869 | 9.184 | 8.207 |

#### B. Type of Crashes

A review of the accident type shows that 29% of the crashes involved pedestrians, 2% pedal cycles, 22% involved motor cycles, while 47% involved other motor vehicles including heavy goods vehicles and cars either singularly or with each other as illustrated in Figure 2.

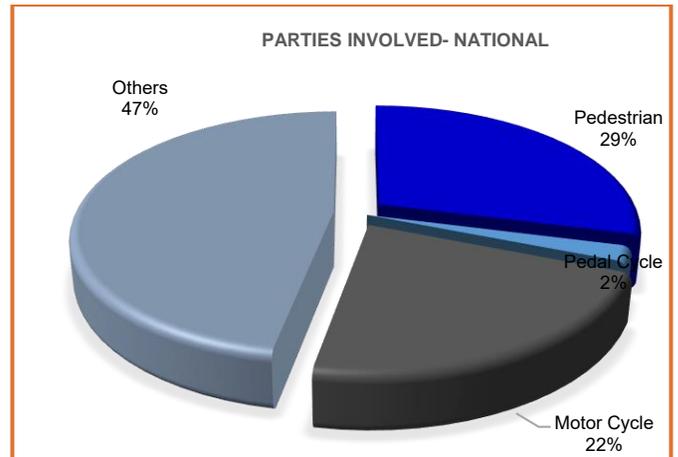


Figure 2: Parties Involved- National

Nairobi region recorded the highest number of pedestrians involved crashes accounting for 54% of the regional total with the lowest being Eastern region at 6%. Western region recorded the highest pedal cycle and motor cycle involved crashes at 4% and 40% respectively. In the remaining regions, pedestrian involved crashes averaged between 20 - 25%.

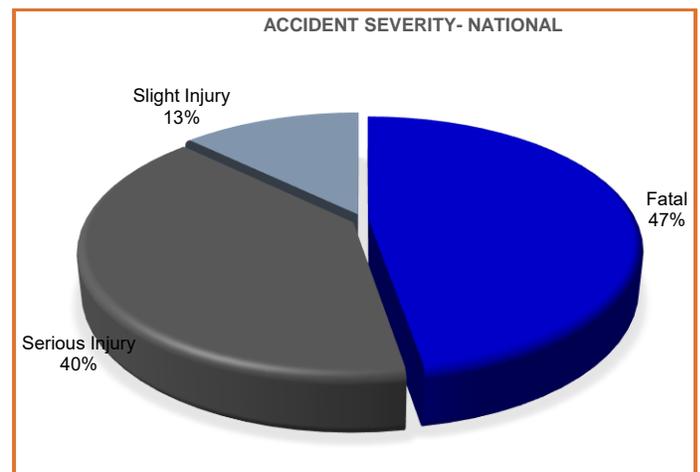


Figure 3: Accident Severity- National

Fatal crashes accounted for 47% of the total number of crashes, serious injuries 40% while slight injuries 13% as indicated on Figure 3. On the analysis of the likelihood of a fatal crash occurring, Nyanza region recorded the highest at 64%, meaning in case of a crash, the likelihood of it resulting into death was 0.64. Nairobi had the lowest fatal crash probability at 0.34; attributable to the road network being mostly urban and therefore the vehicle

operating speeds are controlled. Five out of the eight regions recorded probability of a fatal crash at more than 0.5 as illustrated on Figure 4.

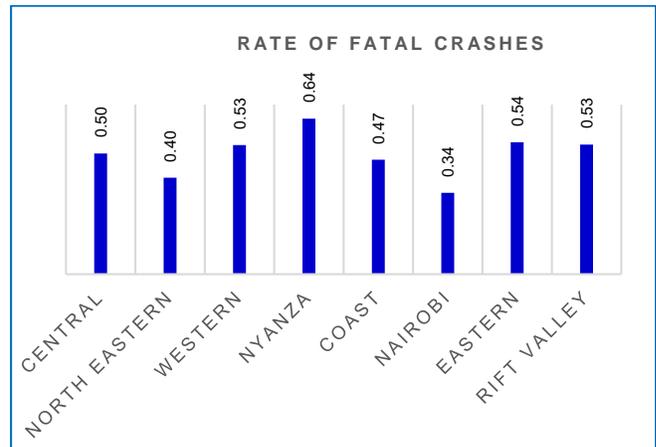


Figure 4: Likelihood of Occurrence of Fatal Crashes- National

### C. Time of Day Distribution

The time of day distribution of the crashes was 64% to 36% as shown in Figure 5. The hourly distribution of the crashes exhibits two peaks; one in the mid-morning between nine am to one pm in the afternoon and the second peak in the evening from five to nine in the evening. The increase in the number of crashes is attributed to the high volume of traffic during both periods.

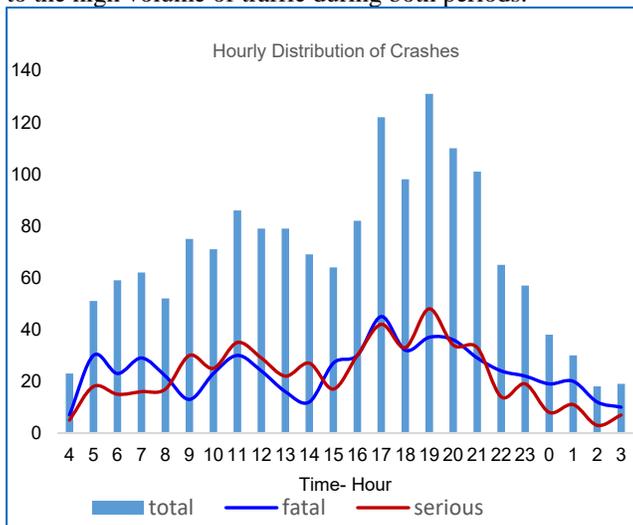


Figure 5: Hourly Distribution of Crashes

### D. Causes of Crashes

The likely causes of any crash is recorded using over 120 cause codes that the investing police offices assigns based on their assessment of the collision site. The list of causes codes used by Traffic Police was retrieved from the police department. Figure 6 shows the most common accident causes recorded during the analysis period.



Figure 6: Causes of Crashes- National

The trends point to the following facts:

- Losing control, proceeding at excessive speeds and overtaking improperly formed the three of the five highest causes of accidents nationally, pointing to high speeding as being a major detriment to road safety. This is compounded by the high pedestrian volumes that generally use the roadway corridors considering effects of high-speed differentials.
- Pedestrian issues contributed to 5822 (20%) of the crashes. These included issues such as heedless of traffic while crossing, walking, standing or playing on the road as well as slipping and falling.
- 6495 crashes were due to speeding and loss of control making up 22% of the crashes. Related to this was poor manoeuvring such as cutting in, swerving, overtaking improperly and right turning which contributed 14.5% of the crashes.
- Errors in judgement and negligence such as misjudging clearance, distance or speed and failing to comply with traffic signals, crossing without due care at junctions and pedestrian crossings and reversing negligently caused 6727 (23%) of the crashes.
- Only a paltry 130 crashes (0.4%) were attributed to the condition of the road such as slippery road surface, poor road condition another road conditions.
- Of great concern is the percentage of crashes that are attributed to unknown causes which was the second highest code. This points to inability of the investigating officer’s inability to assess the most probable cause and hence poor quality of the data collection process.

*E. Casualties*

Analysis of the number of casualties involved in the crashes depict a reducing trend from 2011 to 2016, generally following the overall accident trends as already noted. However, disaggregated data on the casualties (age, gender, road user type) was not available from the Traffic Police at the time of data collection. Figure 3 7 illustrates the national annual trend in the number of casualties from 2011 to 2016.

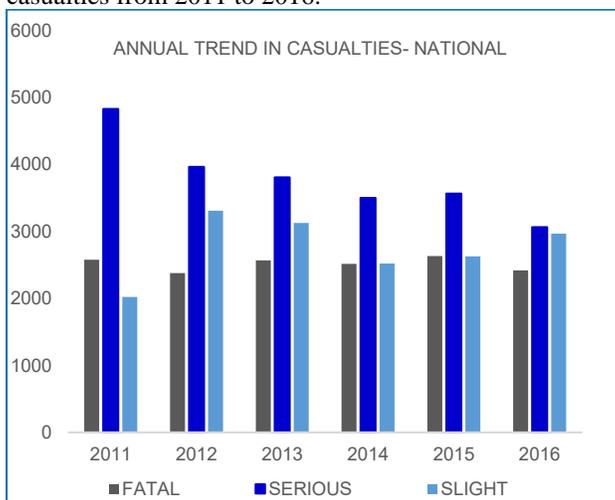


Figure 7: Annual Trend in Casualties- National

While the comparative analysis of the data obtained from the Traffic Police and the official records in the Statistical Abstract depict similar trends in reduction in number of casualties over the years, there is a variance in the number of casualties over the same period. The discrepancy in number of fatal crashes averages about 580 annually, with the highest discrepancies in numbers evident in the slight injury crashes. Table 2 below better illustrates this.

Table 2: Comparative Analysis of Number of Casualties- National

|  | YEAR    | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|--|---------|------|------|------|------|------|------|
| Data from the Statistical Abstract (2016)                  | FATAL   | 3302 | 3141 | 3191 | 2907 | 3057 | 2965 |
|  | SERIOUS | 8467 | 7434 | 6299 | 5140 | 4731 | 4661 |
|  | SLIGHT  | 7144 | 5037 | 4934 | 3971 | 4350 | 5533 |
| Primary Data obtained from the Traffic Police Headquarters | FATAL   | 2576 | 2378 | 2567 | 2516 | 2631 | 2418 |
|  | SERIOUS | 4825 | 3962 | 3805 | 3498 | 3562 | 3061 |
|  | SLIGHT  | 2022 | 3307 | 3124 | 2519 | 2627 | 2965 |

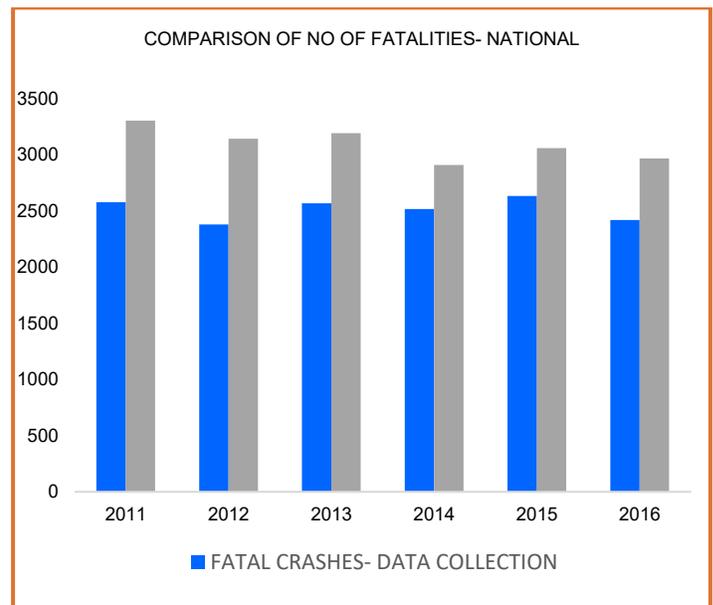


Figure 8: Comparative Analysis of the Number of Fatalities- National

Figure 8 above illustrates the comparison of the number of fatalities of the data from statistical abstract and the data collected from the Traffic police department. The two sets exhibit a similar trend of reduction of number of fatalities from 2011 to 2016. 2011 shows the highest number for both cases decreasing gradually over the years with slight peaks in 2013 and 2015. The discrepancy in numbers could be attributed to the misreporting of data from the local police stations during the exercise.

### F. High Accident Locations

Detailed analysis of high accident locations and Black Spots was established using the observed trends. The Figure 9 shows the top ten high accident locations nationally. Up to 120 crashes were recorded on those locations over the six-year period.

The top ten high accident locations are all along the major highways. The high volumes of traffic and the conflict of the road users contribute to the high rate of crashes. Further to this, all the top ten locations are along the Northern Corridor. While the crash rates remain high along the Northern Corridor, there have been previous numerous efforts geared towards enhancing the road safety.

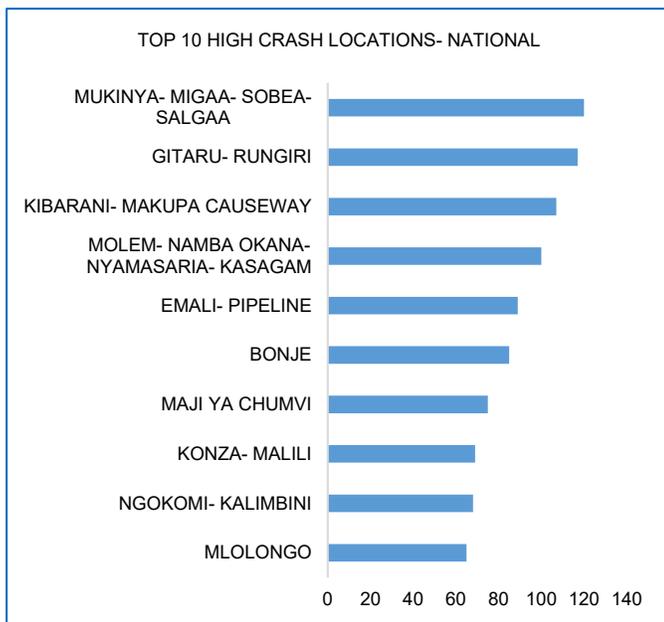


Figure 9: Top Ten High Crash Locations- National

## IV. BLACK SPOT ENGINEERING COUNTERMEASURES

Road safety challenges are often divided into two major groups including delineation safety problems at Black Spots and Geometrical Infrastructure deficiency induced blackspots or lengths as candidate spots and sections. Delineation safety problems include missing road markings, missing vertical directive, regulatory, warning and information signs as well as missing rumble strips, roadside guardrails and barriers protecting motor vehicles against run-off. On the other hand, geometrical infrastructure deficiency induced black spots or lengths as candidate spots and sections and the negative impacts such as elevation and cross-sectional slopes and curvatures on the roadway and pavement proper.

### A. Infrastructure induced Black Spots

Infrastructure induced black spots occur due to inaccurate road design and construction processes. These black spots are often linked to inadequate design of the highway geometry to accommodate vehicular traffic travelling at particular speeds. However, there are a number of Engineering Countermeasures that can be established for the deficiencies that come due to

insufficient engineering provisions. These deficiencies include poor asphalt pavement surface conditions, sharp horizontal curvature, blurred visibility and short distances, insufficient cross-sectional geometry, reduced lane widths, insufficient shoulder widths, lack of crash barriers, steep embankment and clear zones, absence of rumble strips, separators between pedestrians and cyclist from motorized vehicles, conflict points at cross road, intersections, interchanges and roadside link, missing delineation, road marking, road studs, absence of warning signs.

Some of the corrective engineering measures/remedial actions may be sorted in rectifying the shortfalls in the construction process. The measures are categorized into five major groups such as delineation hazard management, Traffic signs and road markings, traffic calming measures, black spot pavement damage rehabilitation and voluminous roadway body reconstruction at blackspot locations.

Delineation hazard management involves establishing roadside clear zones, free of obstruction by fixed objects such as electrical poles, trees, boulders and culvert parapets; roadside crash barriers, guardrails and bridge end protection. Others include roadside design elements such as shoulders, verges, embankments and drains, reliance on sight distance and roadside encroachment by street markets. Traffic signs and road markings such as centreline, double centreline, edge-line, reflective studs, and intersection line markings. Traffic signs have a significant impact on driver awareness on the road and such signs including vertical traffic signs and chevron signs have a positive impact on road safety. Traffic calming measures include speed control measures such as rumble strips, gates and speed breaking humps for motorized traffic. For non-motorized traffic such as pedestrian and cyclists, other measures have proven to be more effective such as separation of vulnerable road users from motorized traffic by use of kerbs, sidewalks, cycleways, pedestrian safety fences and crossings, pedestrian refuge islands and bus bays.

Pavement rehabilitation at black spots have the possibility of improving road safety especially in areas where pavement failure involves rutting, bulging, potholes, fragmentation, fissurization and edge failure in wearing and binder asphalt courses. Pavement settlement at bridge approaches or insufficient compaction on road base layer can be hazardous to motorized traffic. Other roadway failure leading to blackspots include areas of potential rock falls from cut slopes, mud flow, landslides, subgrade washout by adjacent rivers and failure on high embankments due to blockage of seepage water.

### B. Remedial Accompanying Measures

Whereas corrective engineering measures alone cannot resolve the safety gaps or problems at most dangerous spots and sections, significantly more attention needs also to be given to aspects, which are within the domain of responsibility of NTSA, e.g.:

- i. Increased traffic police presence by patrolling most dangerous hilly and winding road sections, thereby focussing on over-speeding and careless overtaking (Act No. 33 of 2012, Clause 4. (1) (d) “ensure the provision of safe, reliable and efficient road transport services”

- ii. Targeting ignorant pedestrians and bicyclists in educational campaigns on dangers of high-speed roads (Act No. 33 of 2012, Clause 4. (2) (f) “facilitate the education of members of the public on road safety”)
- iii. Better driver education in driving schools with higher quality control standards (Act No. 33 of 2012, Clause 4. (2) (i) “establish systems and procedures for, and oversee the training, testing and licensing of drivers”)
- iv. Stricter theoretical and practical driver examination with participating judgement by traffic police (Act No. 33 of 2012, Clause 4. (2) (b) “conduct motor vehicle inspections and certification”)

## V. CONCLUSION AND RECOMMENDATION

Road safety is a critical component of building a better society. It is therefore important to incorporate road safety audit strategies in the development of road infrastructure. The intention of the road safety audits is to evaluate the road system and identify gaps that would lead to crashes for timely mitigation for prevention of crash occurrence.

It is also important for road agencies and safety organisation to enhance crash data collection by development of automated procedures. The procedures should encompass the use of a checklist that immediately identifies the possible countermeasures that can be utilised to diagnose the identified gaps for immediate rectification.

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# Concept of Antigravitation

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**Abstract-** This paper consists of the concept behind the force against the gravitation, and the force is named as force of Antigravitation. Here multiple queries being solved, especially for the researchers to study about the anti-force concept. The thing is explained under the reference of Newton's law of gravitation. This hypothesis may help to understand the real face of the force of attraction and repulsion.

**Index Terms-** Antigravitation phenomenon, Concept of Antigravitation, Force of Antigravitation, Gravitation and Antigravitation, Law of Antigravitation.

## I. INTRODUCTION

Newton discovered the law of gravitation. An apple falls down from the tree, but it doesn't fly in sky. He gave the law that the gravity of earth attracted the apple down. One question here arises, why that apple didn't fly up?

$$F_g = \frac{Gm_1m_2}{r^2} \text{ ----- [1]}$$

This was the mathematical formula he constructed. Two bodies attract each other. Again a question arises here. If every object attracts each other, then why don't we get attracted by those objects which exist around us? If the bus or faster train passes next to us, we do not get attracted by that. If this thing does not happen, which means Newton's law of gravity holds wrong?

A simple answer to this question is **No!** Newton's law of gravitation never goes wrong. As always a coin has two aspects, here itself we have two different aspects. Those two aspects are the reason of all occurrences.

Here we need to study the formula which Newton discovered. Why did he mention 'G' into the formula? No matter mass and distance is usual for the concept.

'G' is universal gravitational constant which has the unit 'Nm<sup>2</sup>/kg<sup>2</sup>'. This constant is adjusted into the equation to balance the Force value. When two masses and their distance was calculated; we got the 'Force' experimentally different but calculations were saying something different. And to match experimental values with calculated values, he adjusted the term 'G'.

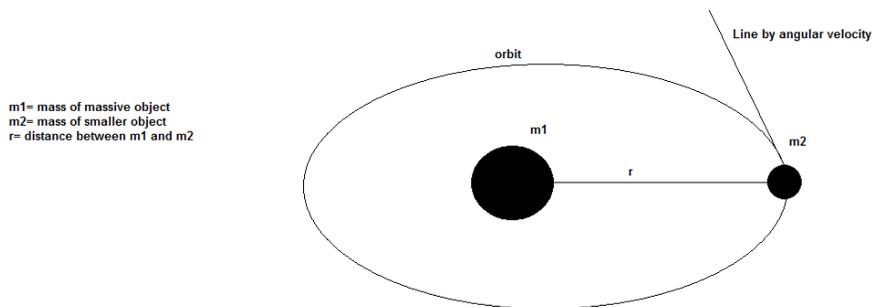
Sophisticated thing was; we observed 'G' value was constant universally. Now this term gives an idea, the masses and distance was relevant, what thing made us to arrange some extra values to match experimental and calculated values? And the thing was 'gravity'.

The concept is cleared. Every object is attracted by each other with some specific force. This happens because of gravity. Now what is the reason behind it of not attracting the objects around us or apple did not fly up? The answer is; all this happens because of antigravitation. Where there is gravity there is antigravity too. And may be this concept controls the universe.

All planets do not imbalance from their orbit from sun, they are in perfect orbit, all the things on the earth are also balanced by the same phenomenon. Hence this concept was literally crucial to be introduced. Hence we need to make a law i.e. Antigravitational law.

## II. ELABORATION OF THE CONCEPT:

This is the example of planetary motion. How all the planets are strict in their respective orbit. If we pretend only gravity is the reason all planets are in their orbit, then m2 should be attracted by the m1, but this never happens. The reason behind is antigravitation, which is caused because of angular velocity. And especially planetary motion is controlled by these two forces i.e. gravitational force and antigravitational force.



r = Distance of m<sub>1</sub> to m<sub>2</sub>

### III. MATHEMATICAL EXPLANATION:

F<sub>g</sub> is due to m<sub>1</sub>, that m<sub>1</sub>'s gravity attracts m<sub>2</sub>.  
 F<sub>ag</sub> will be due to velocity of m<sub>2</sub>.

As Newton introduced the formula for the force of gravitation. Here I am introducing the formula for force of antigravitation. I denote this term as F<sub>ag</sub>, i.e.

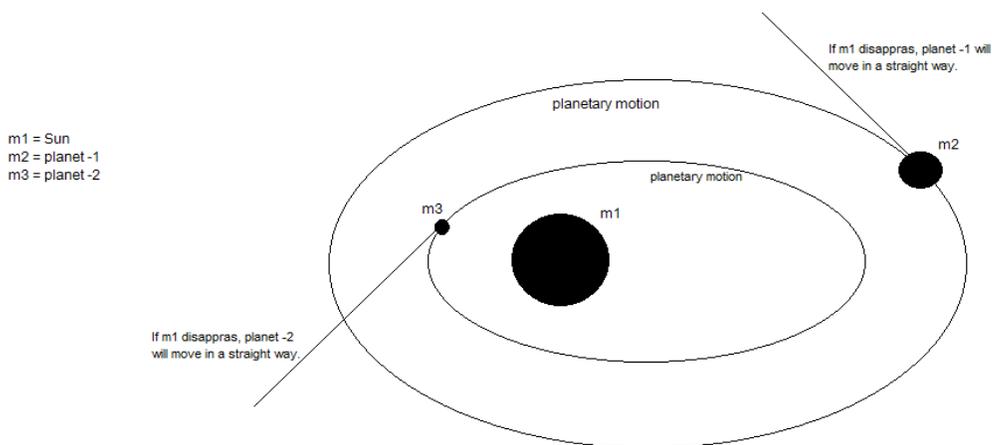
$$F_{ag} = \frac{m_2 v^2}{r} \text{ ----- [2]}$$

Here we denote our attributes such that:

- F<sub>ag</sub>= Force of Antigravitation
- m<sub>2</sub>= Mass of revolving object
- v = Velocity of revolving object

Here we see three different cases and their respective consequences with equation [1] and equation [2] :

- 1) If F<sub>g</sub> = F<sub>ag</sub> :  
 The object will be in the motion. i.e. planets are revolving around the sun.
- 2) If F<sub>g</sub> > F<sub>ag</sub> :  
 The object will be attracted towards center. i.e. planets will be attracted towards the sun.
- 3) If F<sub>g</sub> < F<sub>ag</sub> :  
 The object will lose contact with center and will go in tangent path. i.e. planets will leave solar system and will go straight.



This mathematics proves that, planetary motion is not only because of force of gravitation but also force of antigravitation.

Let's see some examples regarding this concept:

- 1) Mars revolves around the sun. Then F<sub>g</sub> = F<sub>ag</sub> :

$G = 6.67408 * 10^{-11} \text{ N.m}^2/\text{kg}^2$   
 $m_1 = 1.989 * 10^{30} \text{ kg}$  (mass of Sun)  
 $m_2 = 6.39 * 10^{23} \text{ kg}$  (mass of Mars)  
 $r = 2.279 * 10^{11} \text{ m}$  (Distance of Mars to Sun)  
 $v = 24004.935 \text{ m/s}$  (Velocity of Mars around the Sun)

Newton's law of gravitation:

$$F_g = \frac{Gm_1m_2}{r^2}$$

If we substitute above values in the equation [1], we get  
 $F_g = 1.633196343838789 * 10^{21} \text{ Newton}$

According to equation [2]

$$F_{ag} = \frac{m_2v^2}{r}$$

If we substitute above values in above equation, we get  
 $F_{ag} = 1.615688380352566 * 10^{21} \text{ Newton}$

Here we got two values.  $F_g$  and  $F_{ag}$ . And both the values are approximately equal. Hence we claim that Mars is revolving around the Sun.

2) Venus revolves around the sun. Then  $F_g = F_{ag}$  :

$G = 6.67408 * 10^{-11} \text{ N.m}^2/\text{kg}^2$   
 $m_1 = 1.989 * 10^{30} \text{ kg}$  (mass of Sun)  
 $m_2 = 4.867 * 10^{24} \text{ kg}$  (mass of Venus)  
 $r = 1.088 * 10^{11} \text{ m}$  (Distance of Venus to Sun)  
 $v = 35021.388 \text{ m/s}$  (Velocity of Venus around the Sun)

Newton's law of gravitation:

$$F_g = \frac{Gm_1m_2}{r^2}$$

If we substitute above values in the equation [1], we get  
 $F_g = 5.457952437270218 * 10^{22} \text{ Newton}$

According to equation [2]

$$F_{ag} = \frac{m_2v^2}{r}$$

If we substitute above values in above equation, we get  
 $F_{ag} = 5.4865477059855964 * 10^{22} \text{ Newton}$

Here we got two values.  $F_g$  and  $F_{ag}$ . And both the values are approximately equal. Hence we claim that Venus is revolving around the Sun.

#### IV. STATEMENT OF ANTIGRAVITATION LAW:

Every particle attracts every other particle in the universe according to the Newton's law of gravitation, but this law states only about attraction. There is not only attraction in the universe but repulsion as well. To balance the motion there must be two forces, one which was explained by Newton, another one I am explaining here.

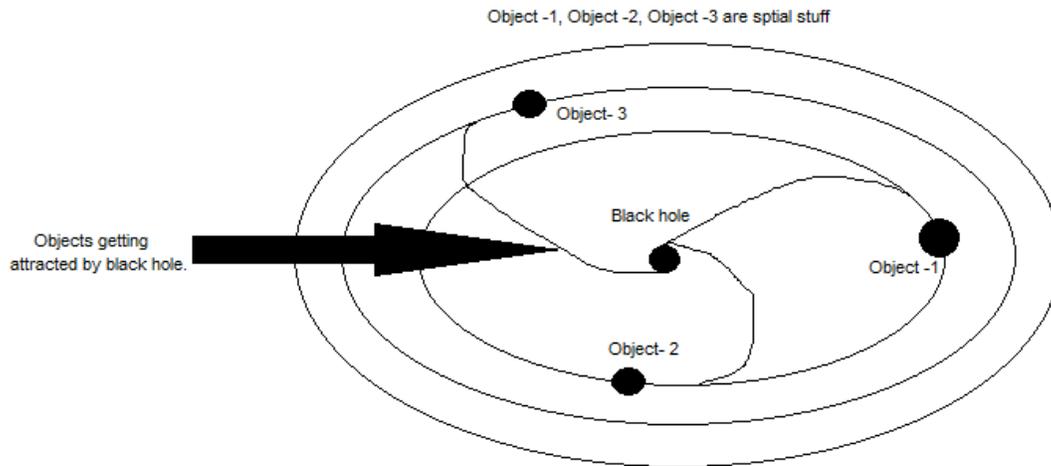
Antigravitation law states that the force of repulsion in two bodies varies with the mass of lower body along its velocity square and inversely as the distance between them.

$$F_{ag} = \frac{m_2v^2}{r}$$

More clearly the planetary motion in our solar system fits this law. As I have given possible solutions above which prove the exact phenomenon. This motion has two equal forces, i.e. gravitational force and antigravitational force. The motion of planets will happen if and only if these two forces are equal. Any change in that forces will make certain changes, which are shown in above cases as well.

#### Why does black hole attract everything in it?

The answer is there in second case,  $F_g > F_{ag}$ . Of course black holes do have very huge gravity, hence nothing can escape from it. And for special stuff here  $F_{ag}$  is much smaller than  $F_g$ . This is actually the reason for our galaxy formation.



This is how all motions happen.

#### V. RESULTS OR FINDINGS:

Now looking towards the equation  $F_{ag}$ , we eventually got that this equation is nothing but the explanation of centripetal force, which takes place when a body is moving around the specific heavy object and balanced in a circular motion. Any how the object is balance against the gravity, hence we declare that the force of gravity is opposed by centripetal force, we named this force as **Antigravitational force**, whereas the force is **centripetal force**.

The point is to observe that the body didn't attract the star while force of gravity exists over; even the planet was moving against the gravity. Keenly we say, that is antigravitation. Now that depends on the motion with the body of universe, hence the formula structure would be different at different places. Finally we conclude there is a force definitely acting over the body against the gravitational force and that is nothing but **the force of antigravitation**.

What **Albert Einstein** mentioned about the motion of planets around the sun is due to space curvature, and **Isaac Newton** stated some other reason. Hence by looking at this point we conclude that both concepts are true. The balance into the planet and star is due to gravitational force and motion of planets is due to space curve. Instead both the concepts hold true. Now here one more phenomenon we understood i.e. **Antigravitation**.

#### VI. CONCLUSION:

Hope here we get a conclusion with the answer of the question that why we don't get attracted by the bodies around us? Hence the simple answer is **antigravitation**. There may be some antigravitational force which does not let us get attracted towards any higher object as that of planets' centripetal force.

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# Henoch Schönlein Purpura- A Small Vessel Vasculitis: Case Report

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**Abstract-** Henoch-Schönlein purpura (HSP) is an acute IgA-mediated multisystem disorder, characterized by the involvement of vessels of the skin, gastrointestinal tract, kidneys, joints, and rarely the lungs and central nervous system. The annual incidence varies geographically from 6.2 to 70.3 per 100,000 population in the pediatric group with a male predominance (Male: Female = 1.2: 1.0). The triggers for HSP are widespread ranging from basic allergens such as insect bites to infections with Epstein Barr virus, adenoviruses, Mycoplasma, Legionella, even vaccines such as typhoid, measles, yellow fever and medications such as beta-lactam antibiotics, erythromycin, quinine or quinidine. The pathogenesis is believed to include a dysregulated immune response, that results in a pro-inflammatory state, with deposition of IgA and C3 complexes in the walls of the small vessels. The clinical criteria for diagnosis, as defined in 2006 by the European League Against Rheumatism and the Pediatric Rheumatology European Society, requires palpable purpura along with one of the following: predominant IgA deposition on biopsy, arthritis or arthralgia, renal involvement (hematuria/proteinuria), or abdominal pain. Renal involvement occurs in the form of glomerulonephritis, which is exhibited in approximately 30-50 % of the patients, and is the principal cause of morbidity and mortality in the patients. HSP is a clinical diagnosis but tests may be conducted to detect any associated complications of the disease. The management of HSP focuses on a bimodal strategy of supportive care and management of complications of the disease. The supportive care includes hydration and analgesia. Corticosteroid or immunosuppressant may be added to reduce the extent of inflammatory tissue damage in severe cases.

**Index Terms-** Henoch Schönlein Purpura, HSP, Palpable Purpura, Small Vessel Vasculitis.

## I. INTRODUCTION

Henoch-Schönlein purpura (HSP) is an acute IgA-mediated multisystem disorder, characterized by the involvement of vessels of the skin, gastrointestinal tract, kidneys, joints, and rarely the lungs and central nervous system [1]. It has been stated that the highest incidence exists in the age group of four-eight years, with up to 90% of the cases occurring prior to age of 10 years [2]. The annual incidence varies geographically from 6.2 to 70.3 per 100,000 population in the pediatric group with a male predominance (Male: Female= 1.2: 1.0) [3]. Vasculitis disorders are classified as small, medium and large vessel vasculitis depending on the size of the blood vessel involved. HSP is typically characterized as a small vessel vasculitis disorder [1].

## II. CASE FINDINGS

A 7-year-old male, resident of Pune, presented to the hospital with complaints of painful swelling of his right elbow and left knee joint for a week. This was followed by a progressive rash which initially involving the buttocks and then the lower limbs. Rash was associated with intermittent undocumented fever spikes. Patient also reported moderate grade, intermittent, non-progressive, diffuse pain over the abdomen. Patient denies any hematuria, oliguria, malena, vomiting, testicular or chest pain and hemoptysis. On Examination, the left knee joint was erythematous, mildly swollen and tender with restricted movements and there was also mild swelling in right elbow joint. Skin examination showed multiple purplish, palpable purpuric lesions, involving the buttocks and lower limbs. The rash involved both the flexor and extensor aspects of the thigh, popliteal fossa, and medial aspect of the leg (**Figure 1A and B: Palpable purpura and Figure 2: Pustular lesion**). The remainder of physical examination was completely normal. The differentials considered are as described in **table I**.

The laboratory investigations commenced with a complete blood count (CBC) which showed, normal red cell and platelet count with mild leukocytosis protein (Hb- 12.1g/dL, TLC- 11100/mm<sup>3</sup> and Platelet count-3.84/mm<sup>3</sup>). The protein on spot urine test was found to be 10.28 mg/dL. The blood urea nitrogen (BUN) and creatinine levels were found to be within normal limits. Renal biopsy was not indicated due to normal renal function tests. Ultrasonography (USG) of the abdomen and pelvis was conducted to investigate the cause of abdominal pain and demonstrated no abnormal findings. X-ray of right elbow and left knee showed minimal joint effusion and soft tissue swelling. Skin biopsy with indirect immunofluorescence showed deposition of IgM in the skin. The investigations have been

described in **table II**. Finally, using the EuLAR and PReS criteria, the diagnosis of HSP was made. According to this criterion, the patient suffers from HSP, due to presence of palpable purpura and arthritis/arthritis and diffuse abdominal pain [4].

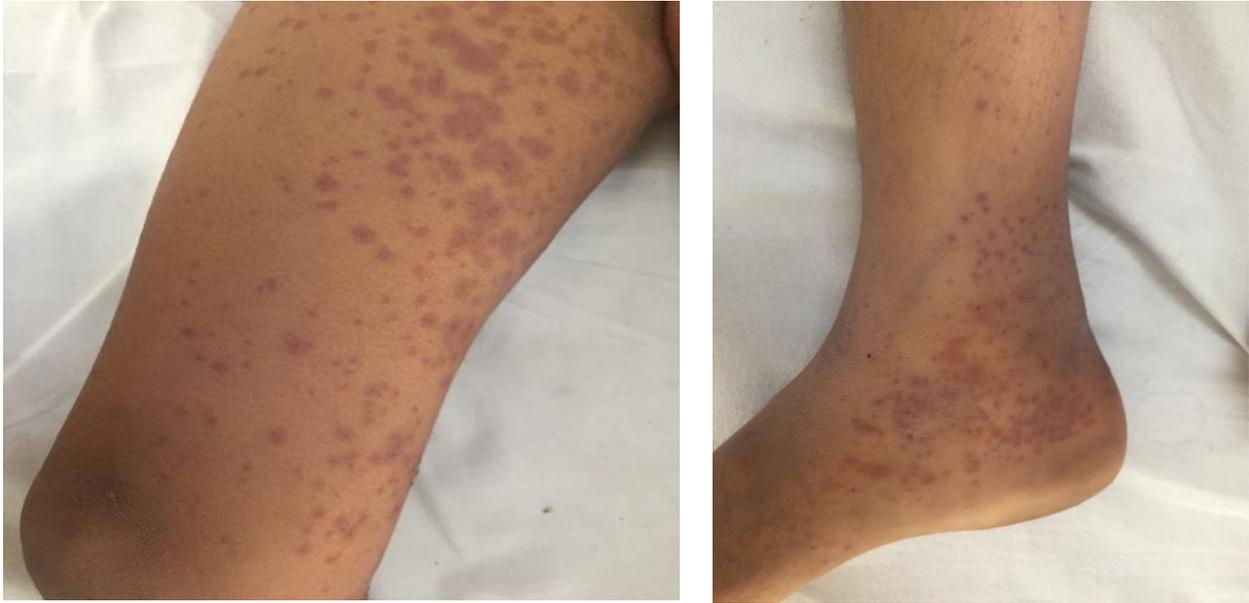
Over the hospital course, the child was hemodynamically stable and was maintained on acetaminophen and nonsteroidal anti-inflammatory drugs. His elbow and knee swelling subsided gradually. He was discharged on oral analgesic Ibuprofen plus, which contains 200mg of ibuprofen and 325mg of acetaminophen, to be taken twice daily with a plan to follow up on an out-patient basis.

**Table I: Differential Diagnosis for HSP**

| <b>DIFFERENTIALS FOR HSP</b> |  |
|------------------------------|--|
|                              | <ul style="list-style-type: none"> <li>• Microscopic Polyangiitis</li> <li>• Wegener’s Granulomatosis with Polyangiitis</li> <li>• Immune thrombocytopenic purpura</li> <li>• Hypersensitive vasculitis</li> <li>• Systematic lupus erythematosus</li> </ul> |

**Table II: Investigations for diagnosis of complications of HSP**

| <b>INVESTIGATION</b>                 | <b>REPORTED FINDINGS</b>                           |
|--------------------------------------|--|
| <b>X ray Right Elbow Joint</b>       | Minimal soft tissue swelling seen                  |
| <b>Ultrasound Abdomen and Pelvis</b> | No significant abnormality detected                |
| <b>CBC</b>                           | Hb: 12.1 g/dl TLC: 11100 N:64, L:29 PLT: 3.84 lakh |
| <b>Urine analysis</b>                | No red cells, casts. 1 +Protein present            |
| <b>Creatinine and BUN</b>            | 0.4 mg/dl and 18 mg/dl                             |
| <b>Protein on Urine spot test</b>    | 15.64 mg/dl  |
| <b>Renal Biopsy</b>                  | Not performed                                      |
| <b>Skin Biopsy</b>                   | IgM deposition in the skin                         |



**Figure 1 A and B: Palpable Purpura of HSP over the lower limbs**



**Figure II: Pustular lesions of HSP**

### III. REVIEW OF LITERATURE

Henoch- Schönlein Purpura is a childhood small vessel vasculitis, characterized by non-thrombocytopenic palpable purpura, arthritis or arthralgias, gastrointestinal and renal involvement [4,5]. In 1801 Dr. William Heberden, physician in London, described the first case of HSP in a 5-year old boy who reported severe painful inflammation of the joints, acute abdomen, hematuria and a purpuric rash over his leg. The young patient experienced all four hallmarks of HSP: arthritis, gastrointestinal involvement, renal inflammation and purpura. Johann Schönlein (1837) and Edouard Henoch (1874) reported some additional cases years after Heberden. They observed

that the disorder often followed upper respiratory tract infections and was not always self-limited, sometimes progressing to serious renal involvement [6].

The pathogenesis of HSP has not been clearly elucidated as of yet. However, some potential triggers have been identified, ranging from basic allergens such as insect bites to infections with Epstein Barr virus, adenoviruses, Mycoplasma, Legionella, even vaccines such as typhoid, measles, yellow fever and medications such as beta- lactam antibiotics, erythromycin, quinine or quinidine. The pathogenesis is believed to include a dysregulated immune response, that results in a pro-inflammatory state, with deposition of IgA and C3 complexes in the walls of the small vessels [7-9].

The clinical criteria for diagnosis, as defined in 2006 by the European League Against Rheumatism and the Pediatric Rheumatology European Society, requires palpable purpura along with one of the following: predominant IgA deposition on biopsy, arthritis or arthralgia, renal involvement (hematuria/proteinuria), or abdominal pain [4]. In comparison to adult patients, the prevalence rates of joint and gastrointestinal (GI) involvement were higher in pediatric HSP patients in some studies [10,11]. Renal involvement occurs in the form of glomerulonephritis, which is exhibited in approximately 30-50 % of the patients, and is the principal cause of morbidity and mortality in the patients [12-14]. According to the metanalysis conducted by Chan et al., children older than 10 years were more likely to have renal involvement [15]. Although HSP nephritis usually occurs within 4–6 weeks of the preliminary presentation, it might also be a delayed complication, so a 6-month follow-up with urinary evaluations is recommended after the onset of HSP [16,17]. disease may sometimes have an atypical presentation such as seizures, limb weakness, focal deficits, painful menstruation, hematemesis, malena, subcutaneous edema and orchitis [18]. Some studies report an association of HSP with Kawasaki's disease (KD) and dilated coronaries. Vedagiriswaran et al. described a five-year-old patient, who presented with concurrent HSP and KD, including dilated coronary arteries [19]. Similarly, Heldrich et al. discussed a three-year-old who presented with KD, developed Hemolytic Uremic Syndrome on day three, and then HSP by second week [20]. Furthermore, HSP patients may experience some complications such as Berger's disease, intussusception, orchitis, Gullian Barre Syndrome and Hypertension [18].

HSP is a clinical diagnosis but tests may be conducted to detect any associated complications of the disease [21]. These include urine routine to detect blood or proteins in urine and serum IgA levels. Serum BUN and creatinine levels should be done to assess renal injury. Renal biopsy follows the renal function tests when they indicate possible renal injury. Renal biopsy demonstrates proliferative glomerulonephritis with IgA deposition in the mesangium of the kidney. Renal biopsy is a definitive, but invasive way to diagnose renal involvement, yet it is not routinely obtained. It would be advantageous to determine a noninvasive measure to predict renal involvement in HSP patients [15]. Indirect immunofluorescence may be conducted for IgA, IgM and C3 deposits, while USG abdomen-pelvis to detect concurrent intussusception and to further investigate the cause of abdominal pain. Skin biopsy from the involved sites will show leukocytoclastic vasculitis with IgA or IgM or complement deposits [22]. According to a cross-sectional study by Ataepour et al., IgM deposition in the skin is a marker of joint involvement and does not indicate any associated renal disease [22]. However, the same study also shows that deposition of C3 in the skin does indicate renal involvement, which is parallel to the results of another retrospective study conducted by Johnson et al [22,23].

The management of HSP focuses on a bimodal strategy of supportive care and management of complications of the disease. The supportive care encompasses adequate hydration and analgesia. For mild pain, a regular paracetamol with or without a short course of NSAIDs such as ibuprofen (10 mg/kg TDS) or naproxen (10 mg/kg BD) can be used if not otherwise contraindicated. However, for moderate to severe pain necessitates addition of glucocorticoids, which have been shown to reduce the duration of abdominal and joint pain, but do not impact long-term renal complications. Oral prednisolone 1-2 mg/kg/day (maximum 60 mg/day) or IV methylprednisolone 0.8-1.6 mg/kg/day (maximum 1g/day) can be used while symptoms persist [3,5]. Immunosuppressive drugs (cyclophosphamide, azathioprine, cyclosporine A, and mycophenolate mofetil) in combination with high-dose IV pulse steroids are recommended if there is no benefit from steroids alone [24-26]. According to the Kidney Disease Improving Global Outcomes (KDIGO) guidelines, ACE inhibitors or Angiotensin receptor blockers (ARB) should be used to counteract and reduce proteinuria or nephrotic syndrome associated with IgA deposition in the mesangium [27]. Plasmapheresis or intravenous immunoglobulin therapy used for cases refractory to steroids and immunosuppressive drugs. Prognosis depends on organ involvement [24-26]. Renal involvement is associated with poor prognosis. Adults have worse prognosis as compared to children [15].

#### IV. CONCLUSION

HSP is an acute IgA- mediated small vessel vasculitis with involvement of skin, joints, kidneys or bowel. The disorder can be diagnosed clinically by history and physical examination. However, investigate may be necessitated to evaluate complications of the disease. The treatment is mainly supportive care with use of analgesic and anti-inflammatory agents. Steroids or immunosuppressive agents may be required for refractory cases.

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# A project to improve process of quality assurance system at the laboratory of District General Hospital Kalutara using adapted Lang's framework model for change

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## **Abstract- Introduction**

Reliability, accuracy and timeliness of laboratory test results are very important in laboratory Quality Assurance (QA). Accurate test results helps to prevent unnecessary treatment, treatment complications, delays in correct diagnosis and unnecessary diagnostic testing. Laboratory QA cycle consists of pre-analytical, analytical and the post analytical stages which affect the accuracy of test results.

District General Hospital Kalutara (DGHK) is one of the largest health care institutions in Kalutara district. This Hospital serves not only people of Kalutara district but also those from the other districts such as Rathnapura and Galle. This project aimed to improve the process QA at the laboratory of DGHK using adapted Lang's framework model for change.

## **Methodology and Results**

The pre interventional phase was to assess the process of QA at DGHK and to identify gaps in quality assurance in the laboratory processes and practices of medical laboratory technologists and nursing officers. Both qualitative and

quantitative techniques were conducted during this phase for data collection.

It was observed that there were issues in pre-analytical, analytical and the post analytical stages of laboratory cycle. Specimen collection, specimen quality and the specimen transport in pre-analytical stage, equipment errors and other related errors in the procedures in analytical stage and results reporting, record keeping, and distribution of reports in post analytical stage were selected as major problems. Therefore a package of interventions was undertaken to address above issues and was developed using adapted Lang's framework model for change at DGHK to improve QA system. All the medical wards and short staying unit at Emergency Treatment Unit were prioritized and selected for interventions as majority of samples were sent by them.

QA committee was established and a nonconformity handling form was developed and implemented. Further, sample collection manual was prepared. Sample collection counter and facilitator service was introduced and an internal circular was issued for providing guidance for the new interventions. Initial steps were

undertaken to establish a Laboratory Information Management System.

Post interventional evaluation was done using the same techniques that were used in the pre intervention phase to assess the effectiveness of the interventions. Desk review of sample register book and other relevant documents revealed that there was a significant reduction in turnaround time after implementing the interventions

### **Conclusions**

Interventions were effective in improving total QA Process with reducing laboratory errors in all three stages of cycle.

Sample collection manual had helped in reduction of errors in relation to specimen collection, quality, and the transportation. Sample collection counter, the record keeping mechanisms and report delivery systems were effective in improving post analytical errors. There was a significant reduction in turnaround time after the interventions.

It is recommended to implement this project in other units of the DGHK and in other institutions of the country for quality assurance of laboratory process.

**Index Terms-** Quality Assurance, District General Hospital Kalutara, pre-analytical stage, analytical stage and the post analytical stage

### **INTRODUCTION**

#### **Background information**

Ministry of Health is committed to improve and strengthen government health sector. In this context laboratory services plays a vital role in the patient care services and this sector need

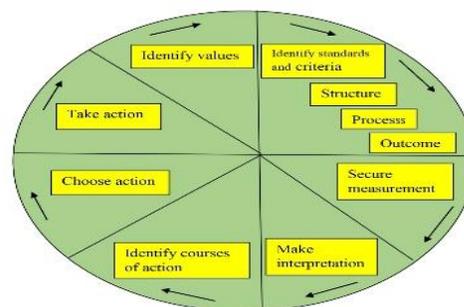
to be improved by strengthening Quality Assurance (QA) of the services they provide.

QA is a management method that is defined as “all those planned and systematic actions needed to be provide adequate confidence that a product service or result will satisfy given requirement for quality and be fit for use”. A quality assurance programme is defined as “the sum total of the activities aimed at achieving that required standards (ISO 1994). The WHO (World Health Organisation) definition of QA is a total process whereby the quality of lab reports can be guaranteed.

Activities of QA may be varied and numerous, including research, clinical audit, setting monitoring of standards, evidence-based practice, continuing professional development, lifelong learning, and infection control, health and safety.

There are varieties of conceptual models that have been published as models for evaluation. One such model Lang’s framework for change (Annexure 1) has been used successfully as a model for QA programme (QAP).

**Figure 1: QA cycle adapted from Lang’s cycle**



QA cycle is used to assure the quality of care. It consists of identifying values, setting objectives, describing patient care

in measurable terms, securing measurement, evaluating the results and act completing the cycle.

### **Objectives**

- **General objective**

To improve the process of Quality Assurance System (QAS) at the laboratory of DGHK using adapted Lang's framework model for change.

- **Specific objectives**

1. To evaluate the existing process and practices to identify gaps in the QAS at the laboratory of DGHK.
2. To develop appropriate interventions to identified gaps using adapted Lang's framework model for change at the laboratory of DGHK.
3. To implement the interventions to improve the QAS in the laboratory process at the laboratory of DGHK.
4. To assess the effectiveness of the process after implementing the interventions to improve the QAS at the laboratory of DGHK.

### **Methodology**

This was a hospital based interventional study.

#### **Setting**

Project was implemented at DGHK. This is the largest government hospital in Kalutara district. It serves as the final referral center in the district .Haematology and biochemistry sections of the laboratory that carries out Full Blood Count (FBC), Erythrocyte Sedimentation Rate (ESR), Prothrombin

Time/International Normalized Ratio (PT/INR), Lipid Profile, Liver Function Test, Serum Electrolytes were selected for this project. Male and Female medical wards (7, 8, 9 and 16)) and Short Staying Unit (SSU) were selected for rest of the project.

#### **Study population**

There were 26 Medical Laboratory Technologist (MLT) working at the institution including chief MLT. All of them were selected for this project because as a practice they have been rotated within 6 months period between 4 main sections of the lab.

There were 104 Nursing Officers (NOs) and 4 sisters working in the selected wards and SSU. All of them were selected for the project.

Director, Relevant Consultants, Chief MLT and Sisters /in charge NOs were selected for KIIs.

#### **Study instruments**

Qualitative tools – FGDs, KIIs

Quantitative tools - Interviewer administered Questionnaires for MLTs and NOs

Indicators to measure the quality of the laboratory process and results

Percentage of samples with appropriate container

Percentage of samples with appropriate volume

Availability of selected practices in the laboratory process

Usefulness of the QA process to deliver quality results

#### **Study implementation**

## **Study execution**

*QA committee* was established

*Training programmes on QA*

*Error reporting system/Nonconformity handling form* was developed

*Workshops* were conducted

*Sample collection counter and facilitator service* was introduced

*A sample collection manual* was prepared

*Internal circular* was issued

## **Data collection**

This was done by the Principal Investigator (PI) with four trained medical students.

## **Data analysis**

Data gathered from surveys was analyzed using the Statistical Package for the Social Sciences data analyzing software (SPSS) software

## **Ethical and Administrative approval**

Ethical approval was obtained from the Ethical Review Committee of Faculty of Medicine, University of Colombo.

Approval for the project proposal was obtained from the Board of Study in Medical Administration. Permission was obtained from Director DGHK.

## **Risks and Benefits**

The study was not a human interventional type and there was no risk to the participants.

## **Results**

### **Pre intervention**

KIIs

Defect in sample collection procedures due to lack of awareness.

Lack of proper methods to transport the samples

Unavailability of visible Standard Operating Procedures

Non availability of error reporting system

Lack of systematic mechanism to record keeping

Unavailability of report sending system

FGDs

Non availability of continuous training and workshops to improve awareness

Non availability of assign worker for responsibility of sending the samples

### **Post intervention**

KIIs

There has been significant reduction in sample collection errors

There has been significant reduction in transportation errors

Standard Operating Procedures displayed near the equipment

Documentation of sending the samples were improved

Report sending delay were significantly reduced

ample errors were recorded

FGDs

Awareness has been improved due to continuous training programmes and workshops

Samples sending process was streamlined

Awareness has been improved due to continuous training programmes and workshops

Samples sending process was streamlined

Testing errors such as sample preparation defects including human errors were corrected using awareness.

Shortcomings of entering patient's information to the machines were also reduced

### **Quantitative assessment**

Only few MLTs (8%) experienced that samples sent were 100 % in an appropriate container before the intervention but 52% of MLTs experienced that samples sent were in an appropriate container after the intervention. There was a significant improvement ( $P=0.000$ ) in perception of MLTs that samples sent were in an appropriate container after the interventions at 5% significance level.

None of the MLTs experienced that samples sent were 100 % in an appropriate volume before the intervention but 44% of MLTs experienced that samples sent were in an appropriate volume after the intervention. There was a significant improvement ( $P=0.000$ ) in perception of MLTs that samples sent were in an appropriate volume after the interventions at 5% significance level

Over 95% of MLTs perceived that QA process is useful to deliver quality results both before and after the intervention. But only 82% of nurses perceived that QA process is useful to deliver quality results before the intervention and this was increased to 93% after the intervention. Perception of NOs in this regard has improved significantly ( $P=0.000$ ) after the intervention. However Above table shows  $p = 0.070$  ( $p > 0.05$ ) and the relationship was statistically not significant in MLTs response of usefulness of the QA process to deliver quality results. This is because most of MLTs new QA process is useful to deliver quality results.

### **Conclusions**

Laboratory investigations are of vital importance in clinical diagnosis. This system at DGHK was found to have several gaps which prevented it from supplying accurate results. Gaps identified, during pre-interventional assessment were under 3 phases of laboratory cycle. Specimen collection, specimen quality, and the specimen transport. They were in the pre analytical phase equipment errors and related errors in the procedures in the analytical phase of the cycle. Further results reporting, record keeping, and distribution of reports were in the post analytical phase.

Reduction of process gaps were achieved by designing interventions to improve the QA system using modified Lang's framework model for change adopted through the QA committee.

Post interventional assessment showed that the sample collection manual which was developed to improve pre analytical stage of laboratory cycle had helped in reduction of errors in relation to specimen collection, quality, and the transportation. Related errors in the procedures in the analytical phase were minimized with the improvement of knowledge and the awareness of the MLTs Further, sample collection counter, the record keeping mechanisms and report delivery systems were effective in improving post analytical errors. In addition, when comparing pre and post interventional assessment there was a significant reduction in TAT. Apart from usefulness of the QA process to deliver quality results by MLTs, all the other measured variables by MLTs and NOs were statistically significant.

When evaluating this project, process and outcome indicators have shown that the strategies implemented for improving laboratory quality assurance process at DGHK were successful.

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# Effectiveness of Kangkungan (*Ipomea Crassicaulis*) to Reduce BOD Levels of Tofu Waste Using the Phytoremediator Method

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**Abstract-** Tofu is one of the foodstuffs favored by the people of Indonesia, this is why there are many tofu industries in Indonesia. The tofu industry is a fast growing industry in Indonesia. There are about 75 tofu industries in Malang city, where most of the tofu industry is in the form of home industry. Wastewater from the tofu industry is produced from the washing, boiling, pressing and molding processes of tofu, so the quantity of waste water produced is quite high. Tofu liquid waste contains very high pollutants or organic pollutants which can cause environmental pollution because it contains organic substances that cause rapid microbial growth in the waters. Considering the high potential for water pollution due to the tofu-making industrial liquid waste, a strategy is needed to control water pollution by treating the tofu industrial liquid waste before discharging it to the environment. One way is by means of phytoremediation. Phytoremediation is a method of removing pollutants using plants. Aquatic plants that are often used include water hyacinth, Kangkungan (*Ipomoea crassicaulis*), umbrella papyrus, and water bamboo. Phytoremediation techniques are widely applied in several countries, such as Asia, America, and Europe. Kangkungan (*Ipomoea crassicaulis*) is a type of plant that is easy to breed. This is one of the considerations for using kangkungan (*Ipomoea crassicaulis*) in phytoremediation. In addition, many types of waste can be processed by kangkungan (*Ipomoea crassicaulis*). The purpose of this study was to determine the effectiveness of using kangkungan (*Ipomoea crassicaulis*) in reducing levels of tofu waste. The results of the study showed that tofu liquid waste treatment using the phytoremediation method using kangkungan (*Ipomea cracicaulis*) was proven to reduce BOD levels in tofu liquid waste.

**Index Terms-** Tofu Waste, Kangkungan, Phytoremediation.

## I. INTRODUCTION

Tofu is one of the foodstuffs favored by the people of Indonesia, this is why there are many tofu industries in Indonesia. The tofu industry is a fast growing industry in Indonesia. There are about 75 tofu industries in Malang city, where most of the tofu industry is a home industry. Every tofu industry produces tofu every day using 90 kg of soybeans per day. Meanwhile, for every 1 kg of soybeans requires 45 liters of water and will produce 43.5 liters of liquid waste. So it can be calculated that the amount of liquid waste discharged into the environment is 3915 liters per day. This of course will pollute the aquatic environment, because almost all tofu industries do not process their liquid waste before it is discharged into the water. Wastewater from the tofu industry is produced from the washing, boiling, pressing and molding processes of tofu, so the quantity of waste water produced is quite high. Tofu liquid waste contains very high organic pollutants or pollutants which can cause environmental pollution because it contains organic substances that cause rapid microbial growth in waters (Ratnani, 2011). This can result in decreased oxygen levels in the waters. In addition, tofu liquid waste also contains suspended substances, resulting in turbidity in the waters. In order to reduce the pollution load, an effective and inexpensive method of processing is required. Tofu industrial liquid waste has COD (Chemical Oxygen Demand) of 5759 mg / L, BOD (Biochemical Oxygen Demand) of 580 mg / L, TSS (Total Suspended Solid) of 552 mg / L, and pH of 3.9. This value is above the quality standard of PerMen LH No. 05/2014 concerning the tofu industrial waste water quality standard, namely BOD (150 mg / L), COD (300 mg / L), TSS (200 mg / L) and pH (6-9). Tofu industrial liquid waste which is disposed of without further processing will cause several problems for the environment. Usually the problem that arises is in the form of deposition and decomposition of organic material in the water bodies receiving the waste which ultimately worsens water quality.

In general, water pollution by tofu industrial wastewater will decrease the dissolved oxygen content in water (due to the breakdown of organic matter) and eventually create an anaerobic atmosphere that will disrupt ecosystems and life in the waters. Considering the high potential for water pollution due to the tofu-making industrial liquid waste, a strategy is needed to control water pollution by treating the tofu industrial liquid waste before discharging it to the environment. One way is by means of phytoremediation. Phytoremediation is a method of removing pollutants using plants. Aquatic plants that are often used include water hyacinth, kangkungan (*Ipomoea crassicaulis*), umbrella papyrus, and water bamboo. Phytoremediation techniques are widely applied in several countries, such as Asia, America and Europe in dealing with environmental pollution, especially water pollution. One type of plant that is capable of remediating

waste is kangkungan (*Ipomoea crassicaulis*). Kangkungan (*Ipomoea crassicaulis*) is a type of plant that is easy to breed. It is easy to breed, this is one of the considerations for using Kangkungan (*Ipomoea crassicaulis*) in phytoremediation. In addition, many types of waste can be processed by kangkungan (*Ipomoea crassicaulis*). The purpose of this study was to determine the effectiveness of using kangkungan (*Ipomoea crassicaulis*) in reducing levels of tofu waste.

## II. LITERATUR REVIEW

### **Tofu Industrial Waste**

Tofu industrial waste is generated from the tofu making process. The waste produced consists of two types, namely solid and liquid. The impact of solid waste has not yet been felt on the environment, because solid waste can be reprocessed into oncom or it can also be made for animal feed such as chickens, ducks, cattle, goats and pigs (Disyamto et al, 2014). Tofu industrial liquid waste is the largest part and has the potential to pollute the environment. Most of the liquid waste produced comes from the thick liquid that is separated from the clumps of tofu in a clumping and filtering process called whey. Other liquid wastes originate in the sorting and cleaning process, stripping the skin, washing and filtering, washing process equipment and floors. The amount of liquid waste produced by the tofu making industry is proportional to the use of water in its processing. The amount of water needed and the amount of liquid waste generated based on the results of existing research is 45 and 43.5 liters for each kilogram of soybean. Biological Oxygen Demand (BOD) is a parameter for assessing the amount of dissolved organic matter and showing the amount of oxygen required by the activity of microorganisms to biodegrade organic substances in liquid waste. Tofu industrial liquid waste contains high dissolved organic materials (Wardana, 2004). A high BOD value indicates that there are many organic compounds in the waste, so that a lot of oxygen is needed by microorganisms to break down organic compounds. A low BOD value indicates the decomposition of organic waste by microorganisms (Zulkifli and Ami, 2001). The impact caused by the pollution of tofu industrial waste organic matter is a disturbance to biotic life, a decrease in water quality caused by an increase in organic matter content (Herlambang, 2002). The resulting liquid waste containing suspended or dissolved solids will undergo physical, chemical and biological changes that will cause health problems because it will produce toxic substances or create a medium for the growth of germs or other harmful germs. If left untreated, the wastewater will turn blackish brown and smell bad. If this waste is channeled into the river it will pollute the river and if it is still used it will cause health problems in the form of itching, diarrhea, cholera, colitis and other diseases, especially those related to dirty water and poor environmental sanitation (Kaswinarni, 2007).

### **Phytoremediation**

Phytoremediation is the washing out of pollutants that are remediated by plants, including trees, grasses and aquatic plants. This washing can mean the destruction, inactivation or immobilization of pollutants into harmless forms. Phytoremediation is a system that uses plants, where the plants work together with microorganisms in the media to convert, stabilize or destroy contaminants to be less or not dangerous at all, even into materials that are economically useful. Environmental factors that affect the phytoremediation process include types of plants, weather/climate factors, temperature and pH. The mechanism of phytoremediation consists of several basic concepts, namely phytoextraction, phytovolatilization, phytodegradation, phytostabilization, rhizofiltration and interactions with pollutant degrading microorganisms (Hidayati, 2005). Biofilter as a way of processing waste by using plants that have rhizosphere microbes have the ability to decompose organic and inorganic objects in wastewater (Suriawiria, 2003). This shows that the ability of aquatic plants to filter dissolved materials in wastewater has the potential to be used as part of the wastewater treatment business. Reed et al. (2005) suggested that in the process of treating wastewater in ponds that uses water plants, there is a process of filtering and absorption by the roots and stems of aquatic plants, the process of exchange and absorption of ions. In addition, water plants also play a role in stabilizing the effects of climate, wind, sunlight and temperature. Phytoremediation is an effort to use plants to reduce waste concentrations and environmental pollution problems either exsitu using artificial ponds or reactors or in-situ (directly in the field) on soil or water contaminated with waste (Soetrisnanto et al. 2012). The liquid waste to be treated is planted with certain plants that are able to absorb, collect and degrade certain pollutants contained in the waste. Aquatic plants can filter, adsorb organic particles and absorb metal ions in wastewater through their roots (Safitri 2009).

### **Kangkungan (*Ipomoea crassicaulis*)**

*Ipomoea crassicaulis* Rob. or better known in the Java region as kangkungan, is a shrub that can reach 2 meters in height, sometimes it can grow taller if there are lots of nutrients in the soil. This plant can be used as an ornamental plant, often grows wild. Grows in humid areas, especially areas that have high moisture content. On the banks of rivers, roadsides and in rice fields. Its fast growth sometimes makes people think that this plant is a weed, so it must be destroyed. Kangkungan usually grows along river banks, moist soil or roadside. Sometimes this plant is also commonly used as an ornamental plant (van Stenis, 1992). According to research conducted by Nailufari (2008), it shows that kangkungan plants can reduce the levels of pollutants in textile dyeing waste such as pH, BOD, COD, TSS, total ammonia and sulfide. This kangkungan plant also has the advantage that it is easy to grow, wild so it is easy to get and this plant can also survive in polluted conditions.

## III. RESEARCH AND METHODOLOGY

Before doing the experiment, what must be done first is to test the toxicity of the tofu liquid waste and then carry out the acclimatization process which aims to adapt the plants to the climate or temperature in the environment they have just entered. Kangkungan (*Ipomoea*

*crassicaulis*) plants that will be used are acclimatized for one month. The next stage is to prepare the reactor used in this study. There are 4 reactors used in this study, 3 reactor units containing plants while 1 reactor is used as a control. Where each reactor will be given kangkungan (*Ipomoea crassicaulis*) of 25 gr, 50 gr and 75 gr. The acclimatization process of Kangkungan (*Ipomoea crassicaulis*) is carried out by planting Kangkungan (*Ipomoea crassicaulis*) in tofu liquid waste that has been diluted with clean water with a concentration of 25% (one liter of tofu wastewater is diluted with three liters of clean water/water faucet). The purpose of this acclimatization is to make plants accustomed to the conditions of the waste that will be used in the process of conducting research. Acclimatization is carried out for one month. The implementation stage is the stage of the wastewater treatment process using kangkungan (*Ipomoea crassicaulis*). Where before this stage is carried out, the BOD content of tofu liquid waste is measured first. After that, the Kangkungan (*Ipomoea crassicaulis*) plant is continuously fed with tofu waste. Measurement of BOD levels every 2 weeks. The data analysis used was a completely randomized design, with 3 replications each.

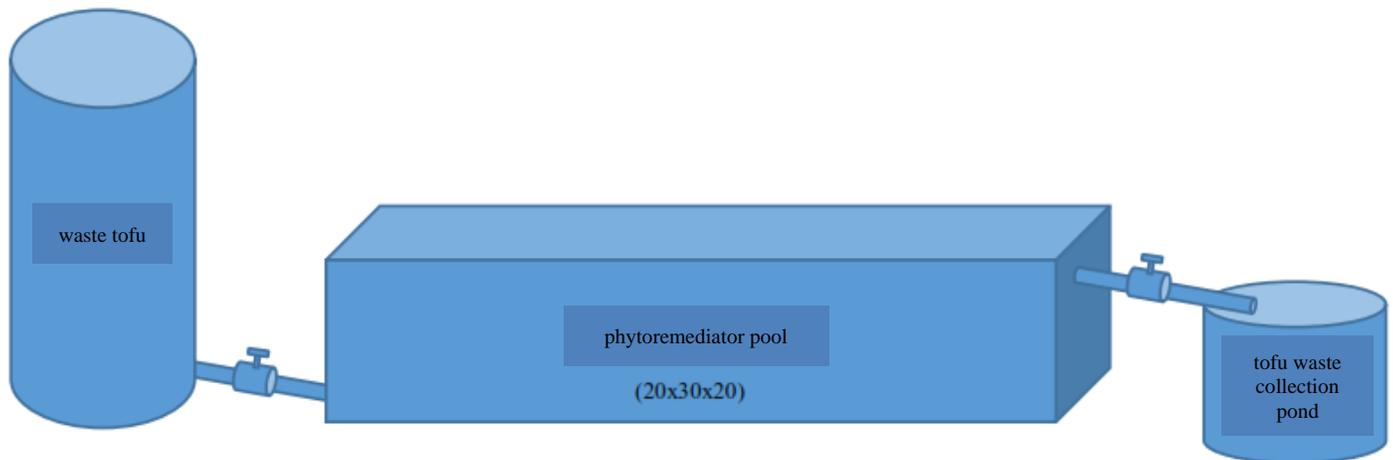


Figure 1. Research Reactor

#### IV. RESULT AND DISCUSSION

The characteristics of the tofu waste used in this study were a BOD of 1369 mg / l. before observing the tofu waste, dilution it first for the acclimatization process. After diluting the characteristics of the waste which was diluted into BOD of 921.30 mg / l. In accordance with the Minister of Environment and Forestry Regulation No. 05/2014 concerning the quality standard of waste water for soybean processing businesses and / or activities, which states that the quality standard for BOD content is 150 mg / l. So with the results of the initial analysis it is known that the tofu waste water content does not meet the quality standard requirements if it is directly discharged into water bodies.

The analysis of the waste content is carried out every 2 weeks. The initial BOD content of tofu waste was 921.30 mg / l, far beyond the quality standards set. The amount of BOD content in tofu waste is caused because tofu waste has a high enough protein content, this is in accordance with the statement from Sungkowo, et al. (2015) which states that the large BOD value in tofu industrial waste is due to the high protein which is an organic substance contained in tofu waste so it requires dissolved oxygen for the decomposition process. The value of BOD levels at the end of the observation decreased to 241.77 mg / l for T1 treatment, 213.89 mg / l for T2 treatment, and 197.45 mg / l for T3 treatment. The decrease in BOD levels was also caused by the greater number of kangkungan plants in the sewage treatment reactor when compared to other researchers. The large number of kangkungan plants contained in the sewage treatment reactor causes the plant density to also be high. Treatment using kangkungan (*Ipomea cracicaulis*) was able to reduce BOD levels in tofu waste. Tofu waste contains a lot of biodegradable materials that can be easily broken down by microorganisms. The use of kangkungan has been proven effective in reducing BOD levels in tofu waste. The process of reducing pollutants in liquid waste using water plants is a collaboration between plants and microbes in these plants (Nurkemalasar et al., 2013). The rate of BOD reduction in tofu waste by using the phytoremediation method using kangkungan plants can be seen in Figure 1 below.

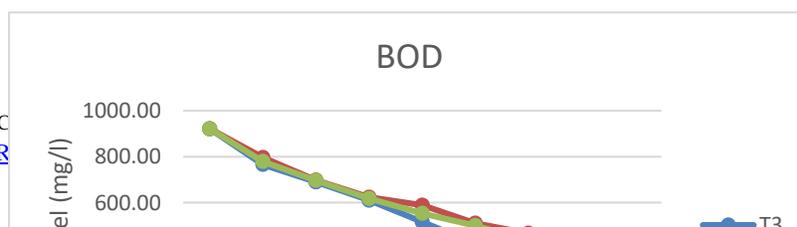


Figure 1. BOD Rate Graph

The results showed that the most effective reduction in BOD levels was in T3 treatment, treatment with 75 gr of kangkungan. This is because the number of plants in the T3 reactor is the most so that the plant density in the T3 reactor is tighter than in the other reactors. Where the higher the plant density, the more effective the absorption of BOD by plant roots will be. With the higher the density of the plant, the microorganisms will grow around the roots, resulting in the process of decomposing contaminants by microbial activity around the roots that will take place more (Euis, 2011). BOD is an indicator of organic pollution in waters. Kangkungan (*Ipomea cracicaulis*) is a plant that is sensitive to conditions where a nutrient found in water is insufficient and has a good response to high nutrient concentrations.

The decrease in BOD levels in this study was caused by the phytoremediation process that occurred in kangkungan plants which began in the rhizofiltration process, the adsorption process or deposition of contaminants in plant roots then absorbed by the roots and entered into the stems and spread to all parts of the plant. This process, organic substances will undergo a biological reaction and accumulate in the plant stems and then continue to the leaves (Sriyana, 2006). The lowering of BOD levels is due to the activity of microorganisms that convert complex organic compounds into simpler compounds. By changing these complex compounds into simpler compounds, these compounds will be more easily absorbed by the roots of kangkungan. By reducing the amount of organic material contained in tofu liquid waste, the population of microorganisms will decrease so that the oxygen needed to decompose these complex compounds is also reduced. With the decrease in oxygen needed, the dissolved oxygen value will be higher so that the BOD value will decrease. Not all plants can be used in the phytoremediation process, this is because not all plants can carry out the metabolic processes, volatilization and accumulation of all pollutants with the same mechanism. Apart from the types of plants, environmental conditions also have an influence on the plant growth process used for the phytoremediation method. If the plants grow well, the accumulation process of contamination using the phytoremediation method can run optimally.

## V. CONCLUSION

The results of this study concluded that the use of kangkungan (*Ipomea cracicaulis*) to treat liquid waste tofu by using the phytoremediation method was proven effective in reducing BOD levels in tofu waste. There is a significant difference in the BOD levels of tofu waste before processing with the phytoremediation method with kangkungan plants with the BOD levels of tofu wastewater after processing. In addition, the large number of plants also makes a difference in reducing the BOD levels of tofu liquid waste. The number of kangkungan (*Ipomea cracicaulis*) plants as much as 75 grams was proven to be effective in reducing the BOD levels of tofu wastewater from 921.30 mg / l to 197.45 mg / l

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# Improving Minigold Purchasing Decisions As An Investment Option For Indonesians As A Promotion Effect Through Social Media And Wom Marketing

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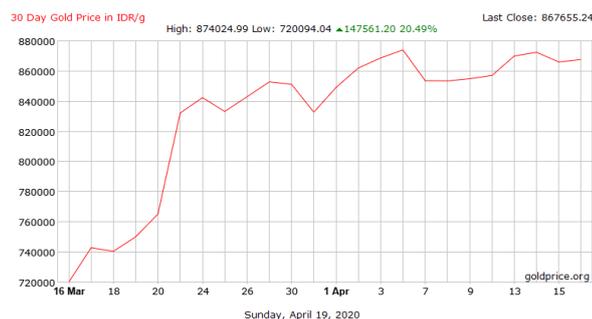
<http://dx.doi.org/10.29322/IJSRP.10.10.2020.p10612>

**Abstract:** Promoting with a promotional strategy through the web, particularly with social media, will increase sales wide and doesn't need high-ticket promoting prices. Customers also will find it easier to search out data concerning the merchandise they need to shop for. With this social media, an efficient promoting communication strategy are going to be fashioned, specifically the Word Of Mouth (WOM). WOM marketing includes a lot of competitive advantage in conveyance of title business data. This is often as a result of WOM marketing is of course supported social environmental opinions that are felt to be a lot of honest and there's no specific motive in conveyance of title data to alternative customers. Information analysis during this study used path analysis. Path analysis is employed to research the information obtained, as a result of from the model ready there's a relationship between variety of variables which will be calculable at the same time. The variable quantity in one existing relationship can become the variable quantity within the next relationship. Intervening variables are variables that have an effect on the link between the variable quantity and therefore the dependent variable. Sobel's results show the effect of social media marketing mediated by WOM marketing on purchasing decisions for Minigold as an investment option for people in Indonesia, during this case the number of indirect influence is 0.091 that is that the results of multiplying the constant of  $0.396 \times 0.299 = 0.091$  with a significance price of 0.02 and therefore the price is smaller than 0.05. The results of the hypothesis state that social media marketing mediate by WOM marketing has an impression on buying selections for Minigold as associate investment choice for individuals in Indonesia.

**Keywords:** Social media marketing, WOM marketing, Investment decisions.

## INTRODUCTION

Consciously or not, what's sure is that our folks have protected the worth of their property as a variety of anticipation for future wants. They need taken an easy hedge. Gold as associate quality to guard the worth of wealth isn't solely done by our folks, presently gold remains a part of the quality portfolio of worldwide fund managers (hedge funds). Gold commodities are thought-about as assets that are free from inflation risk, therefore if there's a sign of a rise within the rate of inflation or economic conditions don't show growth, world fund managers can divert their portfolios by shopping for gold as they're. Make out now once the world economy is sluggish because of Covid-19. As a way of typical gold hedging, they conjointly usually apply it to many alternative assets they own. The selection depends on the character of the fund owner, as a result of every selection can amendment the danger at hand. It's like land, that is additionally experiencing associate adjustment to inflation for merchandise (inflation). However, this quality carries a special risk than gold. Gold is clearly easier to sell, land isn't. In another sense, gold is a lot of liquid than land (minigold.id, 2020).



Graph 1. World crude gold price

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The rise in land costs was comparatively slower than gold. The rise in costs and sales conjointly depends on the placement and abstraction policies established by the government. This in fact may be a completely different risk from gold. Gold is a lot of risky in terms of security as a result of it's easier to lose because it is taken and this is often a risk for gold storage. Completely different perceptions of risk also will build different selections in investment decisions. However, gold hedging is barely an endeavor to reduce losses because of the danger of value changes or inflation. Meanwhile, alternative risks should still exist if the owner of the fund buys gold. There's a clear stage that the owner of funds are going to be free of the danger of impairment because of general value will increase due to inflation. Maybe the sentence that each massive scale associated novice investors invariably hold is safe and there'll ne'er be an inflation drawback. Then many of us say that there's no investment instrument which will defend the worth of investment nonetheless gold. There's no risk of counterparties once holding gold, mercantilism tangible assets freelance of others. The tangible assets during this hand can become even a lot of necessary once the monetary crisis hits. Those that are looking a significant monetary crisis within their country can acumen necessary tangible quality is in the variety of gold. Consistency within the buying power of this gold value has fallen to United States of America \$ five hundred / troy oz in the last 2 years, in fact the costs of alternative commodities also will decline. Statistics show a correlation between the value of gold and therefore the price of human commodities. If the value of gold goes down, we are going to not expertise a decrease in welfare, as a result of we are able to still get the specified quantity of gold. Not hooked in to the government in comparison to banknotes whose price depends on the choices of the government and bureaucrats of every country, the worth of gold doesn't rely on them in the least. By holding gold, there's no have to be compelled to worry concerning government selections relating to interest rates and therefore the like. Assets outside of banking with gold have the chance to possess assets that are fully outside the influence of the industry. The planet of banking round the world, while not exception developed countries is usually haunted by crises from time to time. With gold you may be free from the vortex of a banking crisis which will arise anytime and anyplace.

Promoting with a promotional strategy through the web, particularly with social media, will increase sales wide and doesn't need high-ticket promoting prices. Customers also will find it easier to search out data concerning the merchandise they need to shop for. Reviewing the amount of social media access in Indonesia through cell phones. It's plain that social media are presently usually wont to market merchandise, together with Facebook and Instagram. With this social media, an efficient promoting communication strategy are going to be fashioned, specifically the Word Of Mouth (WOM). WOM is an efficient and least expensive style of promotion. Happy customers can tell others concerning smart experiences about the merchandise (Kotler and Armstrong, 2014). WOM marketing includes a lot of competitive advantage in conveyance of title business data. This is often as a result of WOM marketing is of course supported social environmental opinions that are felt to be a lot of honest and there's no specific motive in conveyance of title data to alternative customers. Improved technology not limits WOM marketing to face-to-face language things, however will be over the phone or social media. The success of Minigold's marketing strategy using social media cannot be separated from consumer investment behavior. The amount of Facebook and Instagram accounts of too several gold sellers makes it troublesome to create a option to get gold as a way of investment. As a results of too several accounts being created, fewer customers place confidence in company-generated advertising and switch to word of mouth as a result of it's a lot of reliable and trustworthy. Seeing what's happening, the investigator can conduct a study entitled Increasing Minigold Purchase selections as associate Investment choice for Indonesians as a Promotion result through Social Media and WOM marketing.

## LITERATURE REVIEW

### Promotion

Service promotion needs a lot of stress on up the standard of services that are dole out (Tjiptono, 2014). Promotion isn't simply introducing a product or benefits in its product, however promotional activities are geared toward human activity with customers, in order that firms will introduce, persuade, influence, or encourage customers to shop for merchandise or services that the corporate has offered to consumers (Permana, 2017). This is often terribly helpful for building a whole image during a company relating to shopper perceptions of a product (Dane et.al., 2013). The promotion combine consists of many strategies for human activity service advantages to potential and actual customers (Tjiptono, 2014). A number of the promotion strategies contains advertising, promotion, sales, marketing, personal commercialism and promotional material. Promotion is one variety of effort created by firms in interacting with customers or human activity with potential customers (Rusmini, 2013). Advertising are going to be effective if it's done unendingly in order that the publicised product is well recognized by many of us. Advertisements will be delivered by many media, together with newspapers, radio, brochures, e-mails, social media, websites and tv (Bayunitri, 2013).

### Consumer behavior

Consumer behavior is a private activity that's directly concerned in getting and victimisation merchandise and services together with the decision-making method within the preparation and determinants of those activities (Swastha et.al., 2000). Consumer behavior is that the study of unit buying and exchange processes involving the acquisition, shopper and disposal of products, services, experiences and concepts (Mowen, 2002). Consumer behavior is that the behavior shown by customers in searching for, buying, using, evaluating and disbursement merchandise and services that are expected to fulfill their wants (Schiffman et.al., 2000). The America promoting Association defines consumer behavior as a dynamic interaction between effects and psychological feature, behavior and therefore the atmosphere during which humans exchange activities in life (Sumarwan, 2004). Therefore consumer behavior is associate action taken by customers directly in getting, intense and disbursement

merchandise and services together with the decision-making method that precedes and follows actions (Adnan, 2018). Buying selections created by customers will certainly not be made alone, each call taken will certainly undergo many stages, together with entry, analysis of user wants, relating to the advantages to be obtained and varied alternative stages (Adnan, 2018). The a lot of complicated the choices that has to be taken, sometimes the a lot of concerns to shop for. The kinds of shopper shopping for behavior are supported the extent of involvement and therefore the degree of distinction, specifically complicated shopping for behavior, buying behavior that reduces dissonance, usual shopping for behavior, and buying behavior that seeks diversity.

### Buying Decision

The idea of commercialism is an endeavor that expects a rise in shopper purchase price for the corporate (Kotler et.al., 2016). Buying decision are how for customers to determine what to shop for in keeping with the worth of their wants (Alfred, 2013). Social media marketing has been delineate in analysis conducted by previous researchers (Putter, 2017), (Samson et.al., 2014), (Alfian et.al., 2019) and (Sudarsono et.al., 2020). The acquisition call method consists of 5 selections, specifically (Kotler et.al., 2016) :

1. Drawback recognition, is that the shopping for method for realizing a haul or want that's triggered by internal or external stimuli.
2. Disbursement of knowledge, at this stage the client learns the whole and products options that may be purchased, then compares them with alternative competitive merchandise.
3. Analysis of alternatives, this stage may be a outline of drawback recognition and data retrieval, patrons pays the best attention to merchandise that give advantages that meet their wants.
4. Buying selections buying already includes a shopping for call however this decision are going to be influenced by the attitudes of people and things that don't seem to be anticipated.
5. Post-purchase behavior, this stage can confirm whether or not the client gets satisfaction with the merchandise he has bought. This will affect the buyer's decision to make repeated purchases or not to promote the product to others or not.

Purchase fraud may be a combination of integrated data to gauge 2 or a lot of various behaviors then confirm one selection (Sangadji et.al. 2013). The acquisition call has seven parts, specifically (Swastha et.al., 2000) :

1. selections concerning the kind of product
2. selections about the form of the merchandise
3. selections about disapproval
4. selections about sales
5. selections about the amount of merchandise
6. selections about once to shop for
7. selections about a way to pay

Buying decisions are influenced by consumer behavior, firms should acknowledge consumer behavior to search out out what customers want, in order that the corporate is anticipated to fulfill shopper wants which can have a control on loyalty. There are many roles of customers in buying (Kotler et.al., 2008):

1. Leader, specifically the primary person to counsel shopping for an exact product or service.
2. Associate prestigious purchaser, that is, an individual whose views or recommendation provide weight to the ultimate call.
3. Higher cognitive process, specifically those that very confirm half or all of the buying selections.
4. Buyers, specifically those that build real purchases.
5. Eaters, specifically those that consume or use merchandise or services.

### Social Media Marketing

Social media may be a means that or manner for customers to share data within the variety of text, images, audio and video with people and firms or contrariwise (Kotler and Keller, 2016). Social media may be a new communication unit and is a tool which will give varied styles of interaction that weren't antecedently offered to standard individuals (Brogan, 2010). The symptoms used are relationships, communication, post-purchase interactions and data formats (Ekasari, 2014). Social media may be a assortment of internet-based applications developed on the idea of net ideology and technology and has the likelihood to form or exchange user-generated / UGC content (Kaplan and Haenlein, 2010). UGC is content in many forms cherish blogs, chats, wikis, posts, discussion forums, tweets, files, audio, video, digital pictures and alternative forms created by users of on-line systems or services offered on social media (Moens et.al) ., 2014). Social media marketing is that the use of technology, channels, and software system from social media that aims to form valuable communication, delivery, exchange and offers for stakeholders in a corporation (Tuten and Haym Salomon, 2017). Social media marketing is a company's process of creating and promoting activities related to online marketing on social media platforms that offer value to stakeholders (Pham and Gammoh, 2015). Social media marketing has been delineate in analysis conducted by previous researchers (Putri, 2016), (Abzari et.al., 2014), (Balakishnan et.al., 2014), (Jurnia et.al., 2015), (Rahadi et.al., 2013), (Siswanto, 2013), (Maulani et.al., 2019), (Campurasi, 2016) and (Khan et.al., 2015). The goal of thereforecial media promoting is to supply content that may be shared with users through its social networks so on facilitate firms increase price and expand client reach. Social media marketing conjointly helps firms get immediate feedback from customers and potential customers, giving them a friendly impression. Social media marketing has four parts (Gunelius, 2011), specifically making content, sharing content, connecting and building communities.

### Word Of Mouth Marketing

Word Of Mouth, specifically promoting activities through person-to-person intermediaries, written or transmission tools involving the expertise of buying services or the experience of victimisation merchandise and services. customers use word of

mouth to speak concerning dozens of brands daily from media and recreation merchandise cherish movies, TV shows and publications to food merchandise, travel services and retail stores (Andari, 2016). Word Of Mouth promoting may be a marketing strategy and it may also be referred to as word of mouth marketing. The definition of word of mouth promoting (Sernovitz, 2012) is: giving individuals a reason to speak concerning your stuff, in order that the language is simpler to happen. WOM marketing has been delineate in analysis conducted by previous researchers (Bhayani, 2016), (Bruce et.al., 2012), (Chevalier et.al., 2006), (Chu et.al., 2011) (Gupta et. al., 2010), (Lopez et.al., 2014), (Park et.al., 2009) (Shan et.al., 2015) and (Trusov, 2009). There are three dimensions of WOM supported the message giver and receiver, specifically (Sweeney et.al., 2012): (1) content, that describes the content of messages in keeping with performance, responses to issues and perceptions, value-values, therefore supporting the thought that WOM conjointly includes a rational dimension, (2) content richness, specifically the depth, intensity, and clarity of the message itself. Wealth includes aspects of the content, cherish the language used and therefore the data concerned within the message. (3) delivery power, specifically the strength of the message sent. this is often involving the manner the message is delivered not with the content (Mahdiasukma et.al., 2018). This reflects the strength of the recommendation's intent. Word Of Mouth promoting will be done purposely or accidentally. to try to to WOM marketing designedly (reinforced by word of mouth) needs excellent designing. one in all the most effective WOM marketing plans is to concentrate to the five basic parts of WOM marketing, specifically (Sernovitz, 2012): speakers, topics, tools, half taking and chase.

## RESEARCH METHOD

### Population and Sample

Population may be a generalization space consisting of objects or subjects that have sure qualities and characteristics that are determined by researchers to be studied then conclusions are drawn (Sugiyono, 2017). The population during this study are all investors who get minigold merchandise. The sample is a component of the amount and characteristics of the population (Sugiyono, 2017). The sample during this study were many investors who bought minigold merchandise. victimisation non-probability sampling techniques, specifically purposive sampling with the subsequent characteristics:

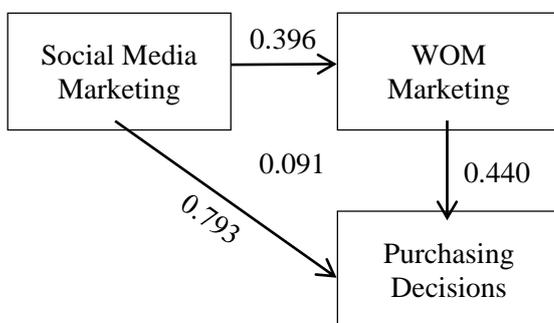
1. Get a miniglod product.
2. Change data concerning the minigold.
3. Change data to minigold retailers and distributors.

### Data Analysis Technique

Technique information analysis during this study used path analysis. Path analysis is employed to research the information obtained, as a result of from the model ready there's a relationship between variety of variables which will be calculable at the same time. The variable quantity in one existing relationship can become the variable quantity within the next relationship. The intervening variable may be a variable that affects the link between the variable quantity and therefore the dependent variable (Ghozali, 2015). Checking the mediation hypothesis will be done employing a procedure developed by Sobel and called the Sobel Test. This check tests the strength of the indirect result of the variable quantity on the dependent variable through intervening.

## RESULTS

The results of the regression analysis show the influence of social media marketing mediate by WOM marketing on buying selections of Minigold as an investment selection for individuals in Indonesia.



Source: Data processed, 2020.  
Figure 1. Path Analysis Results

Direct effect = 0.793  
Indirect effect =  $0.396 \times 0.229 = 0.091$

Sobel's results show the effect of social media marketing mediated by WOM marketing on purchasing decisions for minigold as an investment option for people in Indonesia, during this case the number of indirect influence is 0.091 that is that the results of multiplying the constant of  $0.396 \times 0.299 = 0.091$  with a significance price of 0.02 and therefore the price is smaller than 0.05. The results of the hypothesis state that social media marketing mediate by WOM marketing has an impression on buying selections for Minigold as associate investment choice for individuals in Indonesia.

## CONCLUSION

Promoting with a promotional strategy through the web, particularly with social media, will increase sales wide and doesn't need high-ticket promoting prices. Customers also will find it easier to search out data concerning the merchandise they need to shop for. With this social media, an efficient promoting communication strategy are going to be fashioned, specifically the Word Of Mouth (WOM). WOM marketing includes a a lot of competitive advantage in conveyance of title business data. this is often as a result of WOM marketing is of course supported social environmental opinions that are felt to be a lot of honest and there's no specific motive in conveyance of title data to alternative customers. Sobel's results show the effect of social media marketing mediated by WOM marketing on purchasing decisions for Minigold as an investment option for people in Indonesia, during this case the number of indirect influence is 0.091 that is that the results of multiplying the constant of  $0.396 \times 0.299 = 0.091$  with a significance price of 0.02 and therefore the price is smaller than 0.05. The results of the hypothesis state that social media marketing mediate by WOM marketing has an impression on buying selections for Minigold as associate investment choice for individuals in Indonesia.

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# The status of Basa fish *Pangasius bocourti* in cage culture in An Giang province, Vietnam

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**Abstract-** Cage culture of Basa fish (*Pangasius bocourti*) in An Giang province was investigated through interview 55 households in Chau Doc city (20 households), Tan Chau (20 households) and An Phu districts (15 households). The collected information included general information of households, technical and financial variables in cage aquaculture. The results showed that each farming household had 3.36 cages with average volume of 623 m<sup>3</sup>/cage. The high stocking density of 151 fish/m<sup>3</sup> leads to the high yield of 1,457 kg/10 m<sup>3</sup>/crop in this kind of cage culture. After a culture period of around 10 months, the fish reached commercial size of 940 g/fish. The survival rate was high, 89.1%, and FCR was 1.85. The initial investment for cage farming was very high, in average of 19.8 million VND/10 m<sup>3</sup>. Within one crop, the input cost was 33.3 million VND/10 m<sup>3</sup> and gained profit was 10.75 million VND/10 m<sup>3</sup> and the profit ratio was 0.32 times. The common challenges of Basa cage aquaculture were identified as polluted water, unstable farm-gate price and lacking investment capital.

**Index Terms-** An Giang, cage culture, *Pangasius bocourti*, technique

## I. INTRODUCTION

An Giang province, an upstream province of the Mekong River Delta in Vietnam which is dominated in aquaculture production. In 2017, people produced 361,332 tons aquatic products, accounting for 13.5% of aquaculture production in the Mekong Delta (General Statistics Office, 2018). The number of cages for fish production in An Giang increased from 2,294 cages (290,891 m<sup>3</sup>) in 2008 to 5,244 cages (966,689 m<sup>3</sup>) in 2016. The fish farming in cages in An Giang province was long time developed along rivers in all of districts and town such as Cho Moi district, Long Xuyen City, An Phu, Chau Thanh, Tan Chau Town and Chau Doc City. The main culture species were Basa fish (*Pangasius bocourti*), red tilapia (*Oreochromis* sp.), silver barb

(*Barbonymus gonionotus*), snakehead (*Channa striata*) and giant snakehead (*Channa micropeltes*) (Fisheries Department of An Giang Province, 2017). Basa fish *Pangasius bocourti* was one of the dominated cultured species in cage in An Giang province, and it was found as favorable species cultured in An Giang province. In-depth research on *Pangasius bocourti* have been done e.g. seed production (Cacot *et al.*, 2003), nutrition requirement (Hung *et al.*, 2004), disease resistance (Van Doan *et al.*, 2014; Meidong *et al.*, 2018), and nutritional value (Thammapat *et al.*, 2010). However, limit information on farming practice of Basa fish (*Pangasius bocourti*) cage culture, especially in An Giang province, Vietnam where the fish have been dominated. This study was conducted to evaluate the technical and financial efficiency of the *Pangasius bocourti* cultured in cage system in An Giang province to provide background information for the sustainable development of *Pangasius bocourti* cage aquaculture in the Mekong River.

## II. METHODS

The study was conducted from May 2018 to October 2018 at three selected sites with condensed cages including Chau Doc City, Tan Chau District and An Phu District in An Giang Province.

Secondary data was aggregated from the report of Department of Agriculture and Rural Development of An Giang province, Fisheries Department of An Giang province.

Primary data were collected by face to face interviews of households doing *Pangasius bocourti* cage culture. There were 55 households were interviewed, 20 households in Chau Doc town, 20 households in Tan Chau district and 15 households in An Phu district. Information was collected on the education background, years of experience in fish farming farm infrastructure e.g. total culture volume of cages, cages preparation. And information on farming practice was also asked i.e. fish feed, crop per year, stocking density, seed size, harvest size, yield, survival rate. Financial analysis included fixed cost, variable cost, total revenue,

profit and profit ratio. Information on the advantages and disadvantages of the farming model was also recorded.

After pilot testing of a draft questionnaire on two farmers, the final questionnaire was verified. The interviews were conducted by the main author and two trained interviewees together with a local authority representative. Technical and financial data were presented by frequency of occurrence, mean value, standard deviation, maximum value and minimum value. Differences in technical and financial efficiency between groups classified in volume of cages were tested through one-way ANOVA and Duncan test at a significance level of 95%.

### III. RESULTS AND DISCUSSION

#### 3.1 General information

Results showed that Basa fish cage culture farmers in An Giang province was 42.0 years old in average (Table 1). Farmers had an average of 4.0 years in Basa fish farming experience with maximum of 20 years and minimum of one year. The experience in Basa fish farming was mostly 1 - 4 years (70%), 5 - 8 years (18.3%), 9 - 12 years (10.0%) and 12-15 years (1.7%). The dominated of less experience farmers from Basa fish cage rearing is mainly due to the inherit of the second generation of people live in the region. In term of management, all farmers know how to operate the cage culture of Basa fish, however, long-term experience may have better management practice.

The number of labors in the household ranged from 1 to 9 persons, with an average of around 3 people per household, of which the average number of labors participating in the Basa fish cage culture was from 1 to 5 people per household. Besides, farmers also hired labors for Basa cage culture with the number of hired labor was 1 to 3 persons/household. The labor force participating in the Basa cage culture was mainly men (83.33%), because of heavy works required e.g. feed transport, feeding, harvest, diving to check the cage and cage caring.

There was no specialized aquaculture educated farmers operating the Basa cage culture in An Giang province. Many of them had secondary school (45%) and primary school (44%), the remaining were high school (3%) and illiteracy (8%). Compared to snakehead farming in the same region, it was a little bit higher in education level (Sinh and Chung, 2009). However, the limit educational level in Basa fish cage culture, the application of modern techniques was also limited. Thus, farmers need the support from local technical staffs on upgrade farming practice, especially on disease diagnosis.

#### 3.2 Cage culture production characteristics

Basa fish farmers possessed many cages, 3.36 cages/household in average, maximum of 10 cages. The cage volume was 623 m<sup>3</sup>/cage in average, maximum of 1,040 m<sup>3</sup>/cage and minimum of 225 m<sup>3</sup>/cage. The cage is of 16.2 ± 2.46 m average in length and 7.03 ± 0.96 m average in width and the average water depth was 5.35 ± 0.78 m. The cage for Basa fish culture in this study was a little bit bigger than cage for *Pangasius bocourti* culture previously described in Hong (2014) with an average volume of 578 m<sup>3</sup>/cage, an average length of 15 m, an average width of 4.5 m and an average water depth of 4 m.

#### 3.3 Cage culture farming practice

At present, hatchery farms in An Giang province have been successfully to produce *Pangasius bocourti* fingerlings, satisfied the demand for seed supply. Basa (*Pangasius bocourti*) fingerlings at size of 61.9±4.29 g/fish was commonly stocked into cage at stocking density of 151±19.5 fish/m<sup>3</sup>. This result was similar to the research result of Hong (2014) of 150 fish/m<sup>3</sup>. The survival rate of *Pangasius bocourti* in this study was estimated of 89.1% higher than that of Long et al. (2014) with survival rates ranging from 83.3% to 88.7%. The total amount of feed provided for cages was on average 2,595 kg/10 m<sup>3</sup>/crop. The feed used for *Pangasius bocourti* farming was mainly commercial pellet (86.0%). Some households used a combination of pellet feed and trash fish (10.5%) and few households only used home-made feed (3.9%). Home-made feed consists of 20% green vegetables, 50% rice bran, 30% trash fish, snails, mussels and minced fish heads. Therefore, FCR of each farmer was also different. FCR in the households using pellet feed alone was 1.85. The higher the FCR, the higher the production costs and reduce profits. Feeding by pellet feed reduced the impact on aquatic resource because trash fish mostly came from fishing inshore.

The rearing period to reach commercial size of 940±56.3 g/fish was around 10 months which longer than the culture period of *Pangasianodon hypophthalmus*, 6-8 months (Phan et al., 2009). Following the classification of cage volume into 225-500 m<sup>3</sup>, 500-700 m<sup>3</sup> and 700-1040 m<sup>3</sup>, the stocking density, survival rate and productivity of these 3 groups of cage volume were not significantly different (p> 0.05). With long term experience in basa culture, the high stocking density would increase Basa productivity (Table 4).

Table 1: Age, labor and number of years of experience of the Basa fish farmers

| Contents  | Minimum | Maximum | Average |
|---|---------|---------|---------|
| Age   | 25      | 67      | 42      |
| Total number of labors on household (persons)     | 1       | 9       | 3.25    |
| The number of labors from family member (persons) | 1       | 5       | 2.15    |
| The number of hired labors/employees (persons)    | 1       | 3       | 1.51    |
| Years of farmer experience (years)                | 1       | 20      | 4       |

Table 2: Cages for Basa fish culture

| Contents                          | Minimum | Maximum | Average     |
|-----------------------------------|---------|---------|-------------|
| Number of cages (cages/household) | 1       | 10      | 3.36 ± 2.25 |
| Volume (m <sup>3</sup> /cage)     | 225     | 1,040   | 623 ± 199   |
| Length (m)                        | 10      | 20      | 16.2 ± 2.46 |
| Width (m)                         | 5       | 7       | 7.03 ± 0.96 |
| Water depth (m)                   | 4       | 6.5     | 5.35 ± 0.78 |

Table 3: Farming practice of Basa fish cage culture

| Contents   | Value     |
|--|-----------|
| Culture duration (days/crop)                               | 308±11    |
| Stocking density (fish/m <sup>3</sup> )                    | 151±19.5  |
| Initial weight of fingerling (g/fish)                      | 61.9±4.29 |
| Harvesting weight of fish (g/fish)                         | 940±56.3  |
| Survival rate (%)  | 89.1±5.14 |
| Productivity (kg/10 m <sup>3</sup> /crop)                  | 1,457±174 |
| The total volume of feed used (kg/10 m <sup>3</sup> /crop) | 2,595±472 |
| FCR  | 1.85±0.13 |

Table 4: Comparison of technical parameters of *Pangasius bocourti* cultured in cage system

| Contents | Cage volume groups               |                                  |                                   |
|----------|----------------------------------|----------------------------------|-----------------------------------|
|          | 225-500 m <sup>3</sup><br>(n=15) | 500-700 m <sup>3</sup><br>(n=23) | 700-1040 m <sup>3</sup><br>(n=17) |

|   |                        |                        |                        |
|---|------------------------|------------------------|------------------------|
| Stocking density (fish/m <sup>3</sup> )   | 147±19 <sup>a</sup>    | 152±13 <sup>a</sup>    | 151±21 <sup>a</sup>    |
| Survival rate (%)                         | 88.0±8.1 <sup>a</sup>  | 88.5±3.9 <sup>a</sup>  | 90.2±3.4 <sup>a</sup>  |
| Productivity (kg/10 m <sup>3</sup> /crop) | 1,417±212 <sup>a</sup> | 1,473±130 <sup>a</sup> | 1,477±203 <sup>a</sup> |

Values of the same row with different letters were significantly different ( $p < 0.05$ )

### 3.3 Financial aspects

The total investment cost and average depreciation cost of the Basa cage aquaculture were  $19.8 \pm 4.36$  million VND/10 m<sup>3</sup> and  $0.41 \pm 0.09$  million VND/10 m<sup>3</sup>/crop. The cost for building cage was the highest fixed cost,  $19.2 \pm 4.28$  million VND/10 m<sup>3</sup> (accounting for 97% of total fixed cost). The cost of feed processor in cage using home-made feed was  $0.51 \pm 0.022$  million/10 m<sup>3</sup> and the cost of transportation was  $0.04 \pm 0.015$  million/10 m<sup>3</sup>. The cost of building the cages accounted for the highest proportion which was similar to investigation of Tuyen (2012), the cost of cages was of 95.5%, 2.7% for machinery and 1.8% for transportation.

For total variable cost, it required  $32.9 \pm 5.44$  million VND/10 m<sup>3</sup>/crop, in which feed cost was  $28.3 \pm 5.08$  million VND/10 m<sup>3</sup>/crop (accounting for 86% of variable cost) and seed cost was  $3.41 \pm 0.44$  million VND/10 m<sup>3</sup>/crop (accounting for 10%). This result was also similar to the findings of Tuyen (2012), the feed costs accounted for 82.7% and the seed cost was 6.8%.

This means the cost for operation of Basa cage culture was remained stable following years. The remaining costs accounted for a low proportion such as lime costs, fuel costs and labor costs. Total revenue of the Basa cage farming was  $44.1 \pm 5.45$  million VND/10 m<sup>3</sup>/crop. The profit was  $10.7 \pm 0.02$  million VND/10 m<sup>3</sup>/crop with net profit ratio reached 0.32 times. The selling price of commercial Basa was often unstable, depending on market demand. At the time of investigation, average selling price of Basa was  $30,268 \pm 761$  VND/kg.

The financial analytical results from the three groups of cages showed that the profit and net profit ratios were not significant difference ( $p > 0.05$ ). However, the average profit and net profit ratio of the group with cage volume above 700 m<sup>3</sup> was higher than that of others. This can be explained by the cost of constructing large cage was lower than that of small cages ( $p < 0.05$ ) and labor cost for large cages was also lower than that of small cages ( $p > 0.05$ ) (Table 8 and 9).

Table 5: Fixed costs of Basa cage culture

| Contents                          | Fixed costs<br>(million VND/10 m <sup>3</sup> ) | Number of years of<br>use (years) | Depreciation costs<br>(million VND/10 m <sup>3</sup> /crop) |
|-----------------------------------|---|-----------------------------------|---|
| Cage                              | 19.2±4.28                                       | 50                                | 0.38±0.08   |
| Feed processor                    | 0.51±0.22                                       | 15                                | 0.02±0.01   |
| Transportation by boats to inland | 0.04±0.15                                       | 10                                | 0.002±0.007   |
| Total fixed cost                  | 19.8±4.36                                       | -                                 | 0.41±0.09   |

Table 6: Variable costs of Basa cage culture

| Contents   | Value<br>(million VND/10 m <sup>3</sup> /crop) |
|------------|--|
| Feed       | 28.3±5.08                                      |
| Fingerling | 3.41±0.44                                      |
| Fuel costs | 0.46±0.13                                      |
| Labors     | 0.44±0.24                                      |
| Lime       | 0.26±0.12                                      |
| Others     | 0.01±0.02                                      |

|                      |           |
|----------------------|-----------|
| Total variable costs | 32.9±5.44 |
|----------------------|-----------|

Table 7: Financial efficiency of the Basa cage culture

| Contents  | Value      |
|---|------------|
| Total revenue (million VND/10 m <sup>3</sup> /crop) | 44.1±5.45  |
| Total cost (million VND/10 m <sup>3</sup> /crop)    | 33.3±5.42  |
| Profit (million VND/10 m <sup>3</sup> /crop)        | 10.75±0.02 |
| Net profit ratio (times)                            | 0.32±0.004 |
| Selling price (VND/kg)                              | 30,268±761 |

Table 8: Profit and net profit ratio of Basa cage culture following different cage volumes

| Contents                                     | Cage volume groups            |                                  |                               |
|--|-------------------------------|----------------------------------|-------------------------------|
|  | <500 m <sup>3</sup><br>(n=15) | 500-700 m <sup>3</sup><br>(n=23) | >700 m <sup>3</sup><br>(n=17) |
| Profit (million VND/10 m <sup>3</sup> /crop) | 9.02±3.79 <sup>a</sup>        | 10.41±3.63 <sup>a</sup>          | 11.18±4.11 <sup>a</sup>       |
| Net profit ratio (times)                     | 0.28±0.13 <sup>a</sup>        | 0.32±0.13 <sup>a</sup>           | 0.34±0.12 <sup>a</sup>        |

Values of the same row with different letters were significantly different ( $p < 0.05$ )

Table 9: Cage cost, variable cost and labor costs of Basa cage culture following different cage volumes

| Contents  | Cage volume groups            |                                  |                               |
|---|-------------------------------|----------------------------------|-------------------------------|
|   | <500 m <sup>3</sup><br>(n=15) | 500-700 m <sup>3</sup><br>(n=23) | >700 m <sup>3</sup><br>(n=17) |
| Building cage costs (million VND/1 m <sup>3</sup> ) | 2.38±0.50 <sup>a</sup>        | 1.94±0.26 <sup>a</sup>           | 1.77±0.37 <sup>b</sup>        |
| Variable costs (million VND/1 m <sup>3</sup> /crop) | 3.29±0.65 <sup>a</sup>        | 3.32±0.56 <sup>a</sup>           | 3.28±0.56 <sup>a</sup>        |
| Labor cost (million dong/1 m <sup>3</sup> /crop)    | 0.059±0.033 <sup>a</sup>      | 0.038±0.25 <sup>a</sup>          | 0.039±0.10 <sup>a</sup>       |

Values of the same row with different letters were significantly different ( $p < 0.05$ )

### 3.4 Advantages and disadvantages

#### 3.4.1 Advantages

The geological location of An Giang province was favorable for fish farming in cages, full of river branches. This was a prerequisite, affecting the efficiency of fish farming. Therefore,

many farmers think that they had opportunity to place their fish cages. Placement of cages must be within the planning area for aquaculture development issued from the provincial authority. Information included as (i) the bottom of cages must be at least 0.5 m away from the river bottom, (ii) cages placed in parallel must be at least 10 m apart, (iii) serial installation must be at least

200 m apart. The location of the cages is one of advantage of Basa farming claiming by many of farmers because of one-way flow of water from upstream, and there was no high tide amplitude. With great depth, it was convenient to place fish cages. Fishermen need to promote this advantage and comply with regulations on placing cages to make cage culture more effective and sustainable.

Another advantage was that river water from upstream flows downstream and brings about a lot of natural fish resources. Farmers could use this source for making home-made feed. In addition, the successfulness of artificial breeding of Basa fish had also contributed to the development of Basa cage aquaculture.

Table 10: The advantages of Basa cage aquaculture

| Contents                            | Number of observations | Ratios (%) |
|-------------------------------------|------------------------|------------|
| Appropriated site for placing cages | 35                     | 64.4       |
| Available feed                      | 31                     | 55.6       |
| Available seed apply                | 22                     | 40.0       |
| Not require high technology         | 10                     | 17.8       |
| High markets price                  | 6                      | 11.1       |

### 3.4.2 Disadvantages

River water quality seems polluted. According to farmers, in addition to regular waste from thousands of cages, aquaculture ponds, residues of pesticides and fertilizers of agricultural land and untreated waste of aquatic processing plants have also made the water resource increasingly polluted. Polluted water increased fish disease and reduced productivity, influenced to farmers' income. The second challenge was that the farm gate price of Basa was not stable, fluctuated erratically, and being difficult for

prediction. Many farmers invested in a large-scale farming model; unstable farm gate price led to reduced farmer's profit. This has affected the efficiency farming of Basa cage culture in recent years. The other challenge was lacking capital for investment that Basa fish farming required. The limited loan from local bank would reduce the expansion of the Basa cage culture in the area. Therefore, local governments should support fish farmer to access the loan from bank with acceptable interest rates. In addition, poor seed quality and frequent disease occurrence also influence to the Basa cage culture.

Table 11: The challenges of Basa cage aquaculture

| Contents                    | Number of observations | Ratios (%) |
|-----------------------------|------------------------|------------|
| Polluted water              | 33                     | 60.0       |
| Unstable farm gate price    | 28                     | 51.1       |
| Lacking capital             | 18                     | 33.3       |
| Low quality seed            | 9                      | 16.4       |
| Frequent disease occurrence | 6                      | 11.1       |

## IV. CONCLUSION

Basa cage culture in An Giang is typical by high survival rate and stocking density 151 fish/m<sup>3</sup>; productivity of 1,457 kg/10 m<sup>3</sup>/crop at commercial size of 940 g/fish, culture for around ten months. The financial analysis results revealed that profit ratio was

0.32 times with several challenge need to be addressed. It would be proposed a proper management from the authority for sustainable development of this kind of cage culture production following the reduction of environmental impact, increase the livelihood of the farmer.

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# Contribution of Non-Governmental Organization's Financial Services on Social Economic Development in Rwanda: Case of Plan International's Village Saving and Loan Associations Project Model in Bugesera District

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**Abstract-** The study intended to assess the economic status of the beneficiaries of savings in the village and loans associations in Bugesera District, Rwanda. The researcher adopted the descriptive survey design because the study sought to gain insight or perception into a phenomenon as a way of providing basic information in the area of study. The study population was composed of 696 in total from which a sample size of 254 was calculated using Yamane formula. The researcher used structured questionnaire and interview to collect primary data. Data was analyzed into tables and graphs applying descriptive statistics (frequency, percentages and mean) using SPSS version 21.0. The results revealed that majority (94%) testified that VSLA's changed their lives and restored the community status. Findings also showed that 78% of participants mainly improved their agribusiness and livestock compared with before joining VSLAs, 8% were in the business activities, 6% participated in the government employee and 6% were in civil society and the rest 2% were engaged in the house keepers and tailoring activities. The VSLAs beneficiaries gained 26.99 % domestic animals such as goats and chicken, 6.9 percent gained home cows, 18 percent gained home beds, 18 percent mattress, 9% beneficiaries gained their own house, 7% of mobile phone, 6 % of mobile phone, 3 % of television, 3% owned bicycles, 2 % owned computers and 1% owned motorcycles. The achievements in terms of assets were improved compared with the conditions before entering in VSLAs. The recommendation is to sensitize all non VSLAs beneficiaries to join VSLAs. VSLAs are a good vehicle for mobilizing savings and improving the socioeconomic status of the participants. Therefore, more efforts should be made to ensure that these are well managed and that the beneficiaries are able to obtain maximum benefits of these associations. The Rwandan government should establish and formulate different policies to help VSLAs operations for sustainability of these informal financial institutions

**Index Terms-** Model of project, Social Economic Development, Village Savings and Loans Association, Rwanda

## I. INTRODUCTION

Most of the poor live in rural areas especially in developing countries where people do not find enough food, health facilities, and rely on subsistence agriculture (Conning, 2007). Moreover, these areas do not have financials, when financial institution are not available, households use informal mechanisms instead. The widespread use of ROSCAs, ASCAs, susu-collectors, and similar informal financial networks is a testament to this (Rutherford, 2001; Collins, et al., 2009).

Economic empowerment of African communities has been of a great concern to many International NGOs. All over the world all NGOs are seeking to empower communities through different project models. Some models like Village Savings Loans Associations (VSLAs) model are being used by Plan International to empower low income earning households. This is being done so that they may avoid creating dependency among those families and to help them cultivate the culture of saving as they sustain the interventions done by these NGOs so that there may be a positive impact on project performance. More than three quarters (¾) of the world population constitutes a much less fortunate group herein described as the low income earners (United Nations Conference on Trade and Development UNCTAD, 2019).

An initiative that is popular in Africa that brings together different people with intentions for savings is referred to as a saving group. There is flexibility in saving groups where by individuals freely join the group, there is also security of savings, any other type of savings is village savings initiated at the first time by Plan International.

According to Plan International (1991), information indicates that the group savings played a great role to create and to make follow up functions and bore suitable product. It sometimes demands loans or donations from abroad in order to be self-sufficient (Allen & Staehle, 2007) and this is common for ASCA (Accumulative Savings and Credit Associations).

The problems associated with poverty continue to increase in developing countries (World Bank, 1990), and this causes the inability to attain the expected standards of living. This is commonly identified by comparing the incomes and expenditures

and then classify different people in the groups of poor class or rich class. As a result, a large number of Micro Finance initiatives have been established as a worldwide economic empowerment strategy to enable the low income earners, individuals and households to have access to financial services. These provide vehicles where it is relatively easier to access credit as well as an avenue to saving services to reduce household poverty, improve human capabilities and to reduce extreme vulnerability among the poor (Stuart, 2011). Such people are in most instances unable to access or afford the services of big banks hence the timeliness of the VSLA which is an economic development approach intended to benefit low income earners, poor farmers and the marginalized groups like the women by providing them financial services, such as; savings, credit and of recent.

As social economic condition is defined as an economic and sociological combined total measure of a person's work experience of an individual's or family's economic and social position in relation to others, based on income, education, health, and occupation (Allen & Staehle, 2007), it is obvious that there is a positive relationship between Voluntary savings and loans and social economic status. Most of the population in Bugesera District continue to live in extreme poverty. This poverty is seen through diversified factors like small lands with poor fertility, ignorance, and the lack of family planning. From such situation, the consequences are low production, food insecurity, and malnutrition with disease related, joblessness, children dropouts from school, increasing number of street kids, crimes, reduced purchasing power, increasing number of HIV/AIDS patients, and decline of life expectancy. These problems negatively impact on the family income and hamper the quick and sustainable development. Despite this situation some of the opportunities helping to uproot such illustrious problems were set in terms of government policy to attend vulnerable people by grouping them into cooperatives, health insurances, and village saving and loans association sensitized and initiated by Plan International, in the context of combining efforts to improve lives and realize different income generating activities.

Access to finance is known to improve the socio-economic status of households by providing the households with disposable income to meet their basic needs (Collins, et al., 2009). Nevertheless, most of people living in rural and suburbs areas find it difficult to access and use financial services because any development start from the cities and reach the rural areas after (Daley, 2009). The VSLA model overcomes many of these obstacles and reaches the very poor and rural population better than formal, centralized microfinance institutions (Gugerty, 2007). Village saving and loan associations are autonomous and self-managing time-bound village savings and loans associations. Therefore, village savings and loan associations microfinance model is exclusively categorized under the community saving and credit groups that collect members saving to provide loan and small insurance services to its members. It essentially enables the poor to become their own bankers (Allen & Staehle, 2007).

Despite the huge budgets spent in community development projects, desired impact on project performance is not clear. International, government and non-governmental agencies realized more and more that the main reason of many unsuccessful development projects was (and still is) the lack of using sustainable project models in implementation of projects

(FAO,2011). World Vision (2010) revealed that the vulnerable families of the registered children have little or no shelter, inadequate food supply, their health is poor, they are unemployed and a few of their children drop out of school due to lack of school fees or other basic needs despite of World Vision having been in Rwanda for 20 years. The performance in all the projects implemented has been low compared to the budget spent every year.

The sustainable community development has been a crucial concern of government and NGOs by putting a lot of effort in empowering rural communities so that they can be self-reliant and able to replicate the project impact. To ensure a rapid growth of economy a series of policy were undertaken including working in associations and cooperatives for work effectiveness and fostering investment MINECOFIN (2013). Low income population however were refrained from. As reported by Rwanda Development Board (RDB), despite the contribution of Rwandan Government supported the establishment of Village Savings and loan associations as a way of providing financial accessibility to rural Rwandans who cannot afford big loans from the banking institutions in order to support their micro business, performance of SME's in the rural areas is still low (RDB report, 2014). Low income people have got very limited access to financial loans. They are incapable to endure microfinance's loan standards, broader collaterals and increasing interest rates refrain from loan access.

According to Sibomana and Shukla (2016), VSLAs have proven to be very effective in accelerating growth and building local capacity. VSLA members have access to highly responsive and safe financial services, and this enables them to upscale economic activities, improve household health and welfare, acquire business skills, educate their children, and improve the quality of their social lives both within the family and the surrounding community. Non-governmental organizations engage in VSLA to organize low income generating communities to access money services. Plan International Rwanda has been supporting people to enhance social economic development through the establishment of Village Savings and Loan Association (VSLA).

However, the social economic impact of the community is still questionable and hence raising questions of why VSLA project model was introduced. For World Vision project performance is measured according to the people who are empowered by the project. Plan International has used different interventions to empower the communities among them linking the communities to Vision Finance Company to provide micro credits and saving services to enable the low income households to carry out the income generating activities and improve the living standards but providing financial services in remote areas remains a major challenge because of poor infrastructure (World Vision ,2012) thus most of the remote areas have no access to any formal financial services. The main purpose of this study is to assess the impact of village savings and loan association (VSLA) project model on social economic development in Rwanda, Case study of Plan International's VSLA project model in Bugesera District.

The general objective of the study is to investigate the impact of village savings and loan association (VSLA) project model on social economic development in Rwanda, Case of Plan

International's VSLA project model in Bugesera District was the general objective of this study.

### 1.3.2 Specific Objectives

- i. To assess the economic status of the beneficiaries of in Village saving and loans associations
- ii. To examine family social economic development for members of the Village saving and loans associations
- iii. To examine how VSLAs empower family towards enhancing risk management and resilience for households in BUGESERA District.

## II. LITERATURE REVIEW

### 2.1.1 Village savings and loan associations in Africa

At the first instance VSLAs was introduced by Plan International in the year of 1991 in Nigeria and later spread out in sixty-one countries in different continent such as Africa, Asia, and America whereby the active members are above six million (VSLA, 2015). This idea as from ROSCAs (Rotational Savings and Credit Associations) had the purpose to be improve the sustainability of the group through making essential funds and avoid the capture of some elites (Ksoll, et al., 2016); to make flexibility to them so that they can borrow at least three times of what they saved if there is an abundant money (Brannen, 2012; Ksoll, et al., 2016); as well as to persuade the members of the community whose income is low to save, the borrowers in VSLAs pay interests for the money they borrow to the rest of the group members, this encourages those who invest more and discourages those who borrow money for nothing or for non-productive activities (Brannen, 2012) which is different from ROSCAs. ROSCAs develop itself with no external facilities. After having meetings in each targeted village the agents of VSLAs facilitates the training. In the beginning there a visit for every week in the three first months for the groups. Savings, credit and insurance are three products of group work in VSLAs. Money for savings is collected in each meeting done every week and it is compulsory to all members. Buying one share a week for every member is a must the maximum shares are only five. The value of share is designed by the group members and it is written in the regulations (Ksoll, et al., 2016; Allen, 2002). If individuals, ask the amount of money that it is beyond the amount saved the group take decision of who should get money according to prescribed rules of the group.

The rate of interest is also decided by the group (Klonner, 2008). For Rwandan government any money borrowed is charged 10 percent or thirty percent of interest. The regulations on how the loans should be given are set by the institutions (Ksoll, et al., 2016).

The group should decide on fines to any late payment of loans appropriately as it can cause the households to suffer much. To be late to pay is considered as embarrassing situation (Allen & Staehle, 2007). The highest rate of interest is 4 to 5 per month. The interest on savings is lower to the interest from loans, this is because all the savings are not borrowed always so that the interest may be collected all the time. By the end of the year the members of the group may decide to quit or to remain in the group according to his/her own understanding and the group also may decide to chase away a member due to the behavior issues and may also

decide to welcome another new member in the group (Ksoll, et al., 2016)

### 2.1.2 The VSLAs project model as NGO's financial services

The commonly known informal financial system all over the world is VSLA. It starts by collecting the share of all members in every months and gives all the money collected to one member of the group (ID, 2012). The person to receive the money is determined by the rotation that ensures that no member is substituted without receiving money. The group members who live in the same area meet together to make a meeting on the use of loans. According to Anderson and Baland (2002) the meeting continues to happen until each member receives the money contributed. The meeting process repeats itself until each member has received the pot (Anderson & Baland, 2002). In summary in the VSLAs the members contribute the same amount of money and every member get the sum of collected money at time.

Due to the sparse populations in Africa, the highest level of illiteracy, HIV and chronicle diseases, it looks prohibitive to bring the cost of micro-finance. The VSLAs resolved the problems related to poverty in rural areas more than the formal financial services. It helps the population to be their own banks (CARE, 2004). VSLAs do not require loans or donations from external, it is self-sufficient. All its activities are informal. It is different from SACCO (saving and credit cooperative), it does not receive funds from external and it is not registered in the government as it does not give taxes. VSLAs do not prevent flexibility to ask loans and flexibility in repayment conditions so that the clients can find it difficult to pay. The number between fifteen and thirty of population can form the small group who save their little amount of money each week (Allen, 2002).

After many months when the group has accumulated the savings of shares, it can initiate the activity of giving loans. Any member has right to get loan from the savings no matter how much money he/she saved but again no one is allowed to exceed three times of his/her savings. All the loans here are in short-term type at least one month and the rate of interest should not go beyond 5 percent per month. This is at the lower level compared to other institutions that give loans and charge thirty percent per month (Mutesira, 1998). Any group must be capable of setting the terms of paying and ensures that any late return is not fined as it may annoy many members. On agreed date by the end of the year the money sayings may be shared by the group members, each member get money according to his/her savings.

When the representatives of the families misuse the money the borrowed for useless things, it causes a big loss and trouble for the whole family for example the wives are forced to sell their possession to make the family survive in order to pay the debt again it forces them to ask for another loan somewhere else to pay another this undermines greatly the economic development of the family and discourages the all members to work. Analysis showed that loans for women are used carelessly by their men and this makes problems in the period of repayment. Misunderstanding amongst the family members to use the microcredit systems depends on their different understandings and the mindset they have about the role of microcredit programs in the raise of family economy. For instance, the saying that micro-finance has the great impact on the poverty reduction in the households based on the indicators from different families as explained by different researchers. The reason which is very logical is that if the poorer

is able to ask for loan and makes sure that he/she repays the interests on time, he/she also learns the management skills for small businesses or the management of the few resources they have it is also the way of empowering themselves in the management process. Nevertheless, there is a discussion on whether the financial indicators reflect on who plays a great role among the household expenditures and good resources management so that once a loan is given to the family there is an individual who is supposed to be responsible more than others (Brody, et al., 2006).

### 2.1.6 Socio-economic development

This was used to mean economic and social and economic development. Burkey (2004) said that economic development in Uganda, especially rural areas refers to the level of life people have that allow them to live well and have the savings for example if the family's economic activity is agriculture, it will have what to eat and reserve some for selling. There is a positive correlation between microcredit and development of community. Microcredit has great effects on the socio-economic development, there should be the promotion of microcredit among people (White, 1992). Microcredit has a big role on the eradication of poverty by creating financial opportunity and equipping poor people with the skills to fight against poverty.

It is commonly known that the family income affects the education of children in the family because if the income is very low children do not even have enough materials to go to school and then paying for them school fees is more likely impossible. Family's income also affects other areas for example finding the needs of children such as food, shelter. Poor water and clothes, this causes many families to start abusing their children in early age by engaging them in the forced labor. Different studies interested to find out whether the families who involve in income generating activities, savings and other financial services fall above or below the lines of poverty. The findings shows that in the communities where VSLAs program is advanced there is high level of savings and taking out money as loans comparing to the areas where VSLAs is not there (Beaman, Karlan & Thuysbaert, 2014).

Participation of people in VSLAs helped them to escape poverty and become rich in the most of rural areas in Burundi (Bunder, 2012). The families' assets as well as the wellbeing of children improved as it was explained by different parents and children from the families that profit from VSLA. There is an increment in family livestock, development of agriculture and improvement of general income in the families that involve in VSLA (IPA, 2014). Controlling the villages is of the strategies to mitigate the risks that may raise in economy, this also includes control of migration of different households. Based on the evidence the researchers showed that even if there is slow improvement but again it is not static, comparing to the previous years there is an indicator that savings group improved the lives of people.

In few words several findings show that there is an improved life among the saving group members. There is a convincing evidence in Burundi about the improvement of economy due to the saving group membership. Many researchers focus on the recent group savings and compare the starting savings and where their members are now (Bunder, 2012). Moreover, the

newly created business may fail as the same way it can succeed, like Karl (2012), showed that one generating activity does not produce the same results every time due to difference factors. The financial development and well management is the most important for many ways such as in education as well as in other sectors.

## 2.2 Empirical Literature

VSLAs is brought to people in the rural areas where having access to formal financial services is a problem in order to help to improve the economy and practice financial services informally. Nevertheless, the effects of the VSLAs has been scattered all over the world. In Rwanda, Plan International in the collaboration of the government and other stakeholders worked with population in the rural areas to develop this system and now it is at the level which is appreciable. The promotion of the group members has led to the improvement of the economy of different group members and then their life are now better compared to the previous one. In the families experienced the kind of drought the VSLAs guided them to come out from the dangerous problem they should suffer with for a long time. But the researcher was not able to find out the level at which the VSLAs affected the live of members and the level of the self-reliant they have achieved, what identified is only the impact in general.

The poor are able to take financial decisions which are complex and are able to use the limited resources they have to meet their all needs, they are able to use all the available opportunities in maximum ways. The focus is to improve to health conditions of poor by helping them to get what they need in easy ways (Yunus, 2008).

By using formal financial services together with informal services the non-governmental organizations start to promote financial savings of individuals in the rural areas. The group savings depends on the starting organizations to implement VSLAs, however this formal financial services start without enough funds but gradually improves (Mohmed, 2002). The abilities of people in rural areas, to participate in economic development of the country starting from the development of the household is called economic empowerment (Eyben, 2009). Empowerment in economy improves the abilities of poor to have access to the economy, techniques for saving, initiating the income generating activities, etc. social and economic development is the best in ensuring the well-being of families.

## 2.4 Theoretical framework

### 2.4.1 Finance Growth Theory

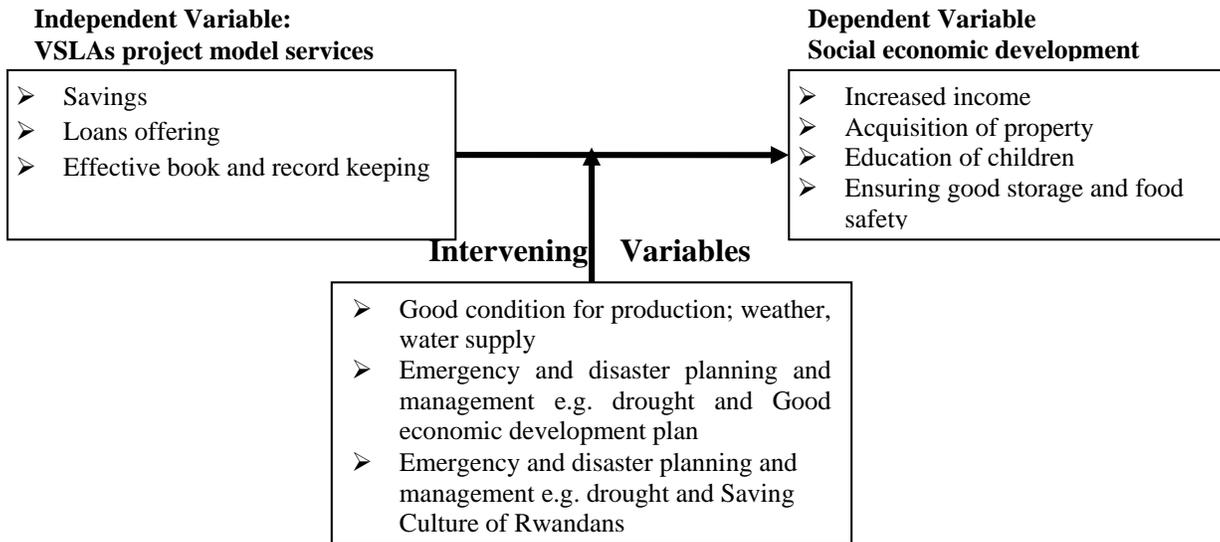
In this study the researcher wanted to have access to the accessibility and effects of economic inclusion. It means being served by the financial programs as an individual. If one does not use financial services or products that are used by others, it is known as financial discrimination (Fin Scope, 2013). It is known that according to different theories inequality to access to financial services leads to the imbalance in economy and slow income generating activities which results to poverty. Contrary have equal opportunities to access financial services leads to the flexibility, hardworking and courage for better future. As for this study financial services will have independent variables, which is financial services qualities and utilization of it to have influence and describe the dependent variables of financial groups which are

marginalized. As VSLAs is affordable and productive most of people strive to join it.

### 2.4.2 The Social Wealth Theory

This social theory according to Putan (1993) derives from social capital that is the institutions and the social relations, behavior and various that rule the people in the social and economic development. It is therefore considered as the sources of welfare.

### 2.5 Conceptual framework



**Figure 1: Conceptual framework**  
**Source: The researcher, 2020**

Lack of loan and saving facilities in rural areas encouraged VSLAs. When people do not have ways to benefit from formal financial services, the VSLAs is the most one thing they do and survive as if they access financial services. The most strategies to be used is first to engage people in the activities and be responsible of activities and beneficiaries at the same time, another big thing is to make them more self-reliant (IPA, 2016). The main idea of VLAS is that the loan will help in economic development by creating small businesses, by managing the limited resources and avoiding unnecessary expenditures. The most reliable measure of economy is expenditure of consumptions. Therefore we use consumptions expenditures to analyze the welfare. VSLAs have the great impact on the nutrition and well-being of people in Rwanda.

## III. METHODOLOGY

### 3.1. Research Design

Tromp and Kombo (2006), defines research design as the scheme which is outlined and planned to provide the responses to the researcher’s problem. The research design can be seen as the organization of the collection of some data characteristics and the conditions by analyzing the data in the ways that aim combining relevant to the research objective. As the researcher Kothari (2004) said, “the research design is said to be the action plan of the data collection, organization and analyzing them”. In this research, descriptive design was used as an approach which use both qualitative and quantitative methods.

### 3.2 Target population and Sampling design

According to Burns and Groves (1993), a target population refers to the elements representing the individual, things, and objects of event and situation which have some sample of the same criteria. The researcher has chosen the population which was 15 E.S Sectors, 75 E.S Cells, 15 Entrepreneurship, cooperatives, and business promotion officer at sector level which are in charge of VSLAs at local government level, 11 Plan International staff and 580 beneficiaries of VSLAs supported by Plan International.

As Denscombe (2008) asserted, the sample must be carefully selected to be representing the whole population to provide the information that can scientifically be tested. To select VSLA members, the random sampling techniques was used and, simple stratified sampling used by selecting the respondents to the side of the leaders and was selected purposely. The number of the respondents was determined using the Yamane (1967) formula:

$$n = \frac{N}{1 + Ne^2} = \frac{696}{1 + 696 * 0.05^2} \approx 254$$

**Table 1: Targeted population and sample size**

| Group of respondents | Targeted population | Sample size |
|----------------------|---------------------|-------------|
| E.S Sectors          | 15                  | 6           |
| E.S Cells            | 75                  | 27          |
| E.C.B.P officer      | 15                  | 6           |

|                            |     |     |
|----------------------------|-----|-----|
| VSLAs Beneficiaries        | 580 | 211 |
| Plan International officer | 11  | 4   |
| Total                      | 696 | 254 |

Source: Researcher (2020)

### 3.4. Data Collection and Analysis

The methods of collecting data are described as the process of preparing and organizing the information or data (Burns & Grove, 1993). The researcher used the questionnaires and the guided interview. The questionnaires were the basic instruments of collecting data in this research which were structured, and self-administered. The researcher designed questionnaires for the VSLAs beneficiaries. These structured questionnaires administered to this category of respondents whose views, opinions and attitudes on how VSLAs affect the social economic development. The interview was utilized to collect the information from Entrepreneurship, cooperatives, and business promotion officer, E.S for both sectors and Cells and for Plan International due to their number is limited and their time.

The data analysis procedures involve scrutinizing of the acquired information and making inference as said by Kombo and Trompo (2006). The data collected was according to the objectives of the study. Thorough the description of the informants the data was categorized and analyzed using SPSS version 21.0 and was presented in percentages and tables as well as graphics and averages in order to get the research findings correctly and specific.

## IV. FINDINGS AND DISCUSSIONS

### 4.1 Social Demographic Characteristics of the Respondents

The section shows the background of the respondents according to their categories such as age, family status, and gender. The total number of the respondents was 254 and they were made up of 6 E.S Sectors, 6 E.C.B.P officers, 27 E.S Cells, 4 Plan International officers and 211 VSLA's members. The

response from the field were the village and saving loan associations' members who were involved in different activities of the associations of two years and more. The background of the village and saving loan associations members were contributed for assessing how they are affected significantly towards their social economic development.

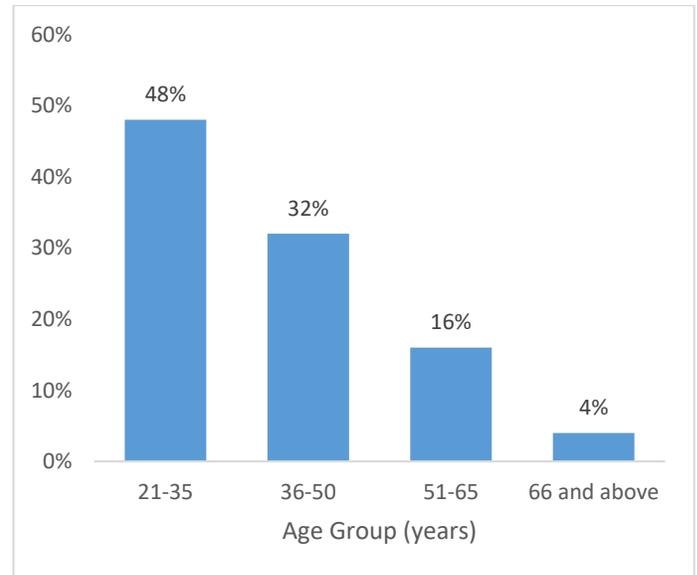


Figure 2: Age of Respondents

Source: Field data, 2020

Figure 2 shows that 48% of participants were in age of 21 and 35 years level of 32% of the participants were in age of 36 and 50 years, and 16% were in age of 51 and 65 years. It indicates the aged members, they are more in economic activities and more productive with the comparison of other people. The VSLA's beneficiaries aged of 66 years and beyond cover 4% of participants. The case of our country Rwanda, the starting years of retirement were at 65 years and it is also normal to check out different population among the members in VSLA's works.

Table 2: Statistics of gender of respondents

| Respondent | ES SEC | ESCELL | ECBP OFFICER | P.I OFFICER | VSLA's BENEFICIARIES | %     |
|------------|--------|--------|--------------|-------------|----------------------|-------|
| Female     | 5      | 17     | 2            | 3           | 119                  | 58.66 |
| Male       | 1      | 10     | 4            | 1           | 92                   | 41.34 |
| Total      | 6      | 27     | 6            | 4           | 211                  | 100   |

Source: Field data, 2020

The research findings on gender of respondents are summarized in Table 2. represented the distribution of 254 and they were made of 6 E.S Sectors, 6 E.C.B.P officers, 27 E.S Cells, 4 Plan International officers and 211 VSLA's Beneficiaries so the majority of participants were female with percentage of 58.66 % due to the comparison of percentage of males which is about 41.34%. This indicate that most women were participated in VSLA's works than the male participants. Due to the role played in social economic developments of the country and due to the consequence caused by 1994 genocide of Tutsi, there was big number of women compared with the number of males in Rwanda. And most of the participants were the winners of the households;

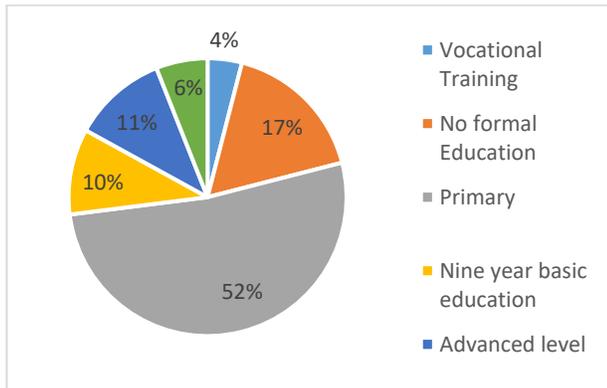
hence involving in VSLA's works. In Rwanda and in others country in this world, the saving and cumulative associations were performed to reduce the scarcity and promote economy.

Table 3: Marital status of the respondents

| Status   | Respondents | Percentage |
|----------|-------------|------------|
| married  | 151         | 71.56      |
| widowed  | 28          | 13.27      |
| divorced | 7           | 3.31       |
| single   | 25          | 11.84      |
| Total    | 211         | 100        |

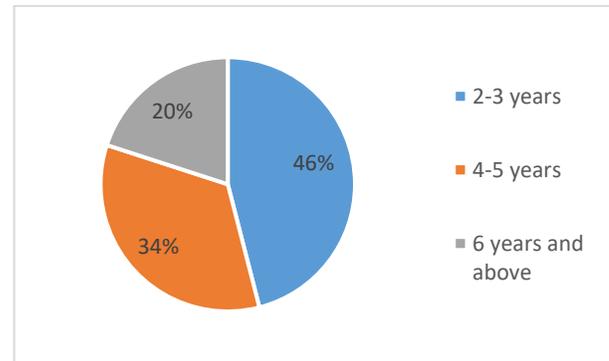
Source: field data, 2020

The results revealed that 71.56% of the participants had already married, 13.27% of participants were widowed, 11.84% were still singles and the divorce level were 3.31%. The data collected from the participants were the large amount of VSLA's beneficiaries had already married this shows that it indicated they impacted toward social economic developments at their home level.



**Figure 3: Educational level of respondents**  
Source:field data, 2020

Profitable works improvement is better enforced through education system. It is indicated in Figure 3 where 52% of research participants had passed primary education, 6% of respondents also attend university education, 17% of participants had not formally educated lastly the 10% of the participants passed 9 year basic education and 4% attended vocational training and finally 11% of the respondents attended fully secondary education. The results revealed that all categories of education were involved in VSLA's means there is no education characteristics to enter in VSLA's group and indicated that each individual people is welcomed to participate in VSLA's as members of it means everyone has all priority to join the VSLA's with commitments. The empowerment of VSLA's beneficiaries and their integrity capacity in the region where they live compared with their capacity of reading and writing then all populations had presented in VSLA's (Benda, 2012). The particular groups are not involved in VSLA's activities are those people who can afford their contribution towards their community due to their misbehaviors this indicated that VSLA's is include everyone. Generally the commitment of each people to join the VSLA changed positively their condition of living and particularly their social and economic developments. The evaluations are concerned on the experience of VSLA's membership in the participation of saving and credit association works.



**Figure 4: Experience in VSLA's activities**  
Source:field data,2020

The results revealed in this study indicated that 46% of the participants has been VSLA's beneficiaries of the 2 to 3 years, 34% of respondents had been VSLA's beneficiaries for the 4 to 5 years while 20% of respondents have been VSLA's beneficiaries 6 years and above. The reason why the large people of VSLA's beneficiaries who have been actively participated in VSLA's activities for 5 years and below due to the improvements shown by the oldest VSLA's members had been in activities for only 11 years, the first beneficiaries have begun in 2006.the model utilized by VSLA's beneficiaries were also related with this

## 4.2 Presentation of Findings

### 4.2.1 The economic status of the beneficiaries of VSLAs

The national economic development in Rwanda were practically impacted with the political challenges and different civil war in the age of 1990's and the genocide against Tutsi of 1994 and population faced with the consequences. The Rwanda bank events and increase widows and orphans' vulnerability Table 4 had revealed that 16% of participants widows confirming a deplorably and vulnerable one in Bugesera District. Also a high of density have high sector of rural regions like Ngeruka and Juru.

In the rural areas, population had not enough farms to provide them adequately for their households. Example the research showed the inclusion of the beneficiaries before entering in VSLA, each respondents said "I feel lonely after losing my husband the world was huge for me, the life showed the very big challenge because we were renting house therefore I can't know how people like me could perform a business with absence of husband, i decided to mind hardly and work effectively in order to feed and pay education tuition fees to my 3 children, after that received a message from my colleagues about VSLA and I decided to be a part of them in the group of 30 beneficiaries where each member provide 400 frw per week after 6 months I applied the loan from the group where I took 30000 for creating a small business of fruits and all my mind was changed completely in the reality of business, thus I build my house, all children succeeded their education generally I found VSLA is a good rich family (Respondents, May, 2019)"

Due to testimonies from the respondents VSLA's created the relationship and friendship and lives of the member were changed positively in social interactions after joining VSLA's. The results from interviews of VSLA's beneficiaries and authorities revealed that the community of vulnerable group and marginalized people because of the 1994 genocide against Tutsi, many people lost their

important relatives, friends, parents as well as siblings then the VSLA become healthy after joining VSLAs. For the context of social insecurity also noted that different people made issues including the safety needs, fears and dependence syndrome sprits which has a big number of participants. It needs the rebuild more confidence, reconstructions of self-reliance in the community participants in right ways. The results reveled that VSLA's their majority (94%) testified that VSLA's changed their lives and restore the community status. the research indicated the joining VSLAs had improved different facilities such as insurance of health, provision of electricity and water tapped for VSLAs beneficiaries.

The study shown that 33% of participants include the VSLA beneficiaries who accessed the electricity in the home, 21% accessed the tapped water and 80% of them accessed the healthy insurance specifically the mutuelle de santé. Table 4 findings shown that 78% of participants mainly improved their agribusiness and livestock compared with the before joining VSLAs, the 8% were in the business activities, 6% were participated in the government employee and 6% were in civil society and the rest one 2% were engaged in the house keepers and tailoring activities, Table 4 shows the findings of the study how the participants access different facilities.

**Table 4: Descriptive Statistics of responses**

| Facilities                    | SD | %    | D | %    | N  | %    | A   | %     | SA  | %     | Mean   | Std. De |
|-------------------------------|----|------|---|------|----|------|-----|-------|-----|-------|--------|---------|
| Business                      | 2  | 1.01 | 4 | 2.02 | 15 | 7.5  | 9   | 4.5   | 168 | 84.97 | 4.2828 | 1.29458 |
| Farming and livestock keeping | 1  | 0.5  | 5 | 2.52 | 8  | 4.04 | 14  | 7.07  | 170 | 85.87 | 3.1919 | 1.79495 |
| Government employment         | 2  | 1.01 | 5 | 2.02 | 11 | 5.55 | 10  | 5.05  | 170 | 85.87 | 4.2475 | 1.23172 |
| Private sector employment     | 4  | 2.02 | 3 | 1.51 | 12 | 6.06 | 138 | 69.69 | 41  | 20.72 | 4.6515 | .82768  |
| Domestic animals husbandry    | 5  | 2.52 | 5 | 2.52 | 5  | 2.52 | 26  | 13.13 | 157 | 79.31 | 4.241  | .81381  |
| Other facilities              | 4  | 2.02 | 4 | 2.02 | 5  | 2.52 | 21  | 10.6  | 164 | 82.84 | 4.5909 | 1.07549 |

Source:field data,2020

**4.2.2 The social economic development for members of VSLA**

Through VSLAs, beneficiaries were engaged in the saving of tangible assets to change their development background. Table 5 shows the information for assets which were gained after participating in VSLA's. The VSLAs beneficiaries gained 26.99 % domestic animals such as goats and chicken,6.9 percent of home cows,18 percent of home beds,18 percent mattress, 9% beneficiaries gained their own house,7% of mobile phone,6 % of mobile phone, 3 % of television possessors, 3% bicycles, 2 % owned computers and 1% for motorcycles. The achievements in terms of assets were improved compared with the conditions before entering in VSLAs. In the developments of Rwanda cows indicated the rich people in this regards the governments adopted different programme like Girinka means have a cow to the poor people to enhance their life condition in term of drinking milk produced and improve the agriculture based on fertilization in their farms. the respondents owned their adequate home house in Rwanda community, it gives a very big value to owner means that the beneficiaries identified itself in the poorest based on ubudehe program therefore VSLAs were improved the life conditions of beneficiaries' property in order they access the how they fight against the poverty and improved welfare. The study revealed that when using paired sample T-test, this one is helpful to find if participation in VSLAs facilitate the beneficiaries to acquire more property or assets.

Table 5 indicate the order of the improvement made by the VSLAs beneficiaries in possession of properties after joining VSLAs. The study shown the cows before and after join of VSLAs by using paired t-test with degree of freedom of 99 equalized with 4.734 where P-value were 0.0000 that were not beyond of 0.05 with the confidence level of 95%,the lower were 0.192 and the

upper one were 0.468. The assumption of possession of cows were not improved after joining VSLAs were rejected which is not confirmed in the findings where it indicated that there is statistically significant in means cows after beneficiaries joined. For the domestic animals possessions after and before participating in VSLAs at 95 percent of level of confidence where the interval is 1.368 and 3.032 and t-test of 99 were equalized with 5.246 with 0.000 of P-value not greater than 0.05 .in this regard the domestic animals were confirmed that they were improved in domestic animals after joining VSLAs indicating that after joining which is statistically difference in possession means the VSLAs influenced the member to get the domestic animals in advance compared with the existed situation before joining VSLAs.

For owning the motorcycle after and before joining VSLAs the P-value were 0.045 in the range of less than 0.05 with the interval Of 0.001 and 0.079 and t-test of 2.031 and the mean value of having motorcycles for beneficiaries the findings shown that owning motorcycle after and before joining VSLAs were improved, thus there was a statistical significant difference means owning motorcycle had increased after joining the VSLAs, the same case for bicycles increased and the findings revealed that bicycles is very important tools used in domestic activities especially in Bugesera district

The material improved also after joining VSLAs compared with the situation of before joining VSLAs which means that the possession of radios was improved at level of confidence 95% with the P-value of 0.0000 not less 0.05 with the interval of 0.107 and 0.273 accordance with t-test of 4.533, the possession of radio were increased after joining VSLAs. Generally, the owning different assets for VSLAs beneficiaries were improved in their everyday life as it indicated in Table 5.

**Table 5: Members improvement in assets possession after they joined the VSLAs**

| Assets acquired after and before Joining the VSLA                          | TEST VALUE |     |                 |           |   |          | Mean       | Std. Deviation | Std. Error Mean |
|--|------------|-----|-----------------|-----------|---|----------|------------|----------------|-----------------|
|  | t          | df  | Sig. (2-tailed) | Mean Diff | 95% Confidence Interval of the Difference |          |            |                |                 |
|  |            |     |                 |           | Lower                                     | Upper    |            |                |                 |
| Cow after VSLA - cow before VSLA   | 66.906     | 211 | .000            | 3.70202   | 3.5929                                    | 3.8111   | 4.7020     | .77858         | .05533          |
| Other domestic animals after VSLA - other domestic animals before VSLA     | 76.088     | 211 | .000            | 3.75253   | 3.6553                                    | 3.8498   | 4.7525     | .69397         | .04932          |
| Motorcycle owned after joining VSLA - motorcycle owned before joining VSLA | 68.338     | 211 | .000            | 3.72222   | 3.6148                                    | 3.8296   | 4.7222     | .76643         | .05447          |
| Bicycle owned after joining VSLA - bicycle owned before joining VSLA       | 60.230     | 211 | .000            | 3.05556   | 2.9555                                    | 3.1556   | 4.0556     | .71385         | .05073          |
| Radio owned after joining VSLA - radio owned before joining VSLA           | 59.613     | 211 | .000            | 3.64141   | 3.5210                                    | 3.7619   | 4.6414     | .85953         | .06108          |
| Television owned after joining VSLA- television owned before joining VSLA  | 65.813     | 211 | .000            | 3.70202   | 3.5911                                    | 3.8130   | 4.7020     | .79151         | .05625          |
| Cell phone owned after joining VSLA - cell phone owned before joining VSLA | 61.523     | 211 | .000            | 3.67677   | 3.5589                                    | 3.7946   | 4.6768     | .84094         | .05976          |
| Computer owned after joining VSLA - computer owned before joining VSLA     | 35.682     | 211 | .000            | 3.28283   | 3.1014                                    | 3.4643   | 4.2828     | 1.29458        | .09200          |
| Bed owned after joining VSLA - bed owned before joining VSLA               | 17.183     | 211 | .000            | 2.19192   | 1.9404                                    | 2.4435   | 3.1919     | 1.79495        | .12756          |
| Mattress owned after joining VSLA - mattress owned before joining VSLA     | 37.099     | 211 | .000            | 3.24747   | 3.0749                                    | 3.4201   | 4.2475     | 1.23172        | .08753          |
| House owned after joining VSLA - house owned before joining VSLA           | 62.079     | 211 | .000            | 3.6515152 | 3.535517                                  | 3.767514 | 4.651515E0 | .8276765       | .0588204        |

Source: Field data, 2020

As it designated in Table 5, the paired sample t-test were accurate to measure the improvement before after joining VSLAs, the beneficiaries increased and statistically significant, then the study proved that welfare of VSLAs beneficiaries increased their assets as it is shown Table 5.

**4.2 3 Empower family towards enhancing risk management and resilience for households**

Table 6 shows that 94% of participants agreed that they improved in 12 past months while 6% did not agree with the statements. Therefore, the participants accepted that VSLAs impacted their social economic developments for improvements. The discussion revealed that VSLAs helped beneficiaries to

increase their source of income for the purpose of enhancing the quality of life, for the mean participants indicated many things that VSLAs provided to the beneficiaries on social economic development such as empower women to equip their house (households) and for men changed their mindsets and economically the family generated the income in different assets (one Cell leader, 2019).

The t-test used for one sample test, the level of confidence was 95% and lower interval were 0.89 and 0.99 as upper level with the degree of accuracy of 99 which is equivalent to 39.392 at P-value of 0.000 which less than 0.05, the findings confirmed VSLAs indicated that it has very positive changes towards their welfare situation as it is indicated in Table 6.

**Table 6: Improvements tested by using T-test one sample test**

|  | Test Value = 0 |     |                 |                 |   |        |
|--|----------------|-----|-----------------|-----------------|---|--------|
|  | t              | df  | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference |        |
|  |                |     |                 |                 | Lower                                     | Upper  |
| Empower family towards enhancing risk management and resilience for households | 96.365         | 211 | .000            | 4.75253         | 4.6553                                    | 4.8498 |

**4.4 Challenges on Loan Repayment**

About 89% repay their loans, while 11% had different reasons showing why they did not repay the loans taken from VSLAs. The different reasons given by the respondents are as shown below:

**Long period of sickness**

Some borrowers gave the reason that they were sick soon after taking a loan. This situation affected members in repayment of their loans. It is in line with what Medibank (2011) has reported that, “illness has a direct effect on both the quality and quantity of work undertaken.” Therefore, a long period of absence also can lower self-confidence and reduce the efficiency of the business. The information given by one Plan International officer supported this where he had to say,

“When a VSLA member with a loan is sick for a long period, it is very difficult for him/her to pay back that loan; some prefer to drop out from their group.” (One of Plan officer, 27 April, 2019)

It is understandable that the sickness costs a lot of money for medical expenses. However, it cannot be a reason to drop out

from the group. For a person with integrity, may ask a favor to his/her VSLA for an extra time of repayment. Otherwise, dropping out from the group with loan it is another issue on both sides; to the borrower and to the financial institution.

**Poor project management**

Some of VSLA members are not knowledgeable and take loans with poorly planned projects especially those who use VSLAs as their model of savings. This model is used like a lottery and in this logic none can guess who will pick the right number. As Truman (2017) stated that:

“Project management is a set of principles, the application of knowledge, skills, tools, and techniques to project activities to meet project requirements through an integration of the project management processes. These include: initiating, planning, executing, monitoring and controlling and closing.”

Thus, all these principles and processes are in general unknown to VSLA members since most of them have no skills about project. Once a person gets an idea about what to do, she/he immediately takes a loan from VSLAs which can be easily misused for different purposes forgetting that it was a loan to be repaid later. In the end, single non repayment of loan may affect all VSLA members and end up by failing the VSLAs’ operations.

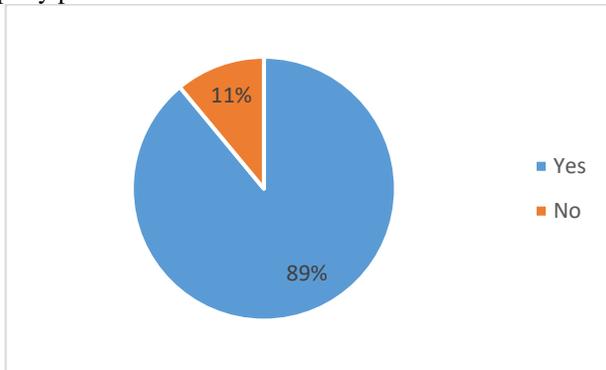
**The presence of defaulters**

Freedom from solid internal regulations allows VSLA’s greater flexibility because they rely on trust and forget about sanction and mechanisms to reduce the risk of lending. This implies that some VSLA members called “*babihemu*” means “defaulters” join VSLAs just to take loans and soon after that they disappear from the group. This is in line with what Keitany (2011) reported that, failure to pay loans poses the greatest risk to stability of the multi-billion savings and credit co-operative societies (SACCOs). This is why the issue of defaulting in VSLAs becomes a big issue because into the collapsing of VSLAs due to the lack of funds for guarantee like in formal financial institutions. In addition, the information given from FGD and interviews showed that, many VSLAs collapsed because of different challenges faced in loan repayment. Some of the non-VSLA members who were interviewed highlighted these challenges as their main reason of dropping out of these VSLAs.

**Gender issues/decision-maker in the household**

During this study, the interviewees pointed out few VSLA members face some challenges of misunderstanding between husbands and wives. It often happens that when the wives take loans from VSLAs, their husband may misuse the money since they consider themselves to be decision makers. As it was defined by Khamati-Njenga (2002) Gender is “a concept which refers to a system of socially defined roles, privileges, attributes and relationships between men and women which are learned and not biologically determined.” Therefore, gender roles shape an identity to the person, that is, determines how people perceive, how they are expected to think and act as female or male. Other researcher emphasizes this point by arguing that, “Roscas represent an empowering tool, especially for marginal and vulnerable people. The funds women receive are used in solving household problems and reduces dependence to their husbands” (Benda (2012). Therefore, the loans obtained from VSLAs might

be well managed by both sides (husbands and wives). This is in line with what another researcher who has reported that, “It is helpful for borrowers to remember that a loan is not an asset: it is a liability that must be repaid, and when it is taken out a period of time must elapse before a return is generated.” (Allen, 2002) This means that, a loan can increase risks to livelihoods of the borrowers when it is badly managed. Normally, before anyone takes out a loan, he/she may calculate the probability of being able to pay it back; but the higher the probability, the higher the risks are elevated. When the VSLA members were asked about their loan repayment status, the majority (89%) testified that the loan is properly paid.



**Figure 5: Repayment of loan taken from VSLAs**  
Source: field data, 2020

Additional information about the challenges of loan repayment was also highlighted by one of the Cell leaders as he had to say the words summarized as: In general, VSLA members repaid well their loans but the problem was still in the management of VSLAs. There is a misbehavior of few VSLA leaders who take advantage of the ignorance of their members and misuse their savings. Some VSLA members take loans without a sustainable project or a well-planned income generating project, other VSLA members participate in different VSLAs; hence they take that opportunity to obtain multi loans from different sources and their repayment becomes a challenge. Also, the VSLA members should build trustworthiness among themselves before creating savings groups. This means that they should know each other and create solid internal regulations before taking any action because there is no particular government policy covering VSLA members and their savings.” (One cell leader, 25April, 2019)  
Generally, VSLAs mobilize relatively small funds while contributing to positive subjective perception as well, thus fostering further members’ welfare because of their production and reproduction of values. They also have a say on social aspects such as friendship, networks, mutual support and entrepreneurial skills development and thus have significant contribution to members in particular and to the community development at the large.

## V. CONCLUSIONS AND RECOMMENDATIONS

The study objective was to analyze the effect of VSLAs towards beneficiaries’ economic achievements. This research was also governed by the theory of social wealth and finance. Those two theories linked with the results of the study on social economic

status. The results showed that beneficiaries financially improved after joining VSLAs. VSLAs beneficiaries managed to obtain loan for different objectives, for instance, for gaining education, house facilitation, food accessibility, access of health insurance and improving at the access of assets possessions. Hence, they are able to improve their socioeconomic wellbeing.

## Recommendations

The recommendations were drawn to the VSLAs beneficiaries

- Mobilization to be done for the young people because it is important towards the Rwandan communities and VSLAs to influence the young generation to embrace the culture of savings.
- VSLAs are a good vehicle to empower the vulnerable people especially the poor and women. The recommendation is to sensitize all non VSLAs beneficiaries to join VSLAs
- There is need to improve internal regulations as rules of all VSLAs beneficiaries before any operations such as establishments of report and monitoring and evaluation system and to make a follow up.
- The recommendation also VSLAs beneficiaries should be trained on taking loan and how to use the loan loans for productive activities.

## To government and Stakeholder

- VSLAs play key roles such as creation of friendship, learning pearly and the recommendation is VSLAs should be mobilized on social capital use money in VSLAs as grassroots communities.
- Avoid the subjectivity of VSLAs recruitment and recommendation is to respect the criteria of ubudehe programme in order to impact the life condition
- The VSLAs are one way of educating the people for giving them the acquired knowledge, skills and values of loans management and cooperative inclusions and therefore the stakeholder are recommended to increase the availability of technical and managerial training for VSLAs beneficiaries
- The Rwandan government should establish and formulate different policies to help VSLAs operations for sustainability of these informal financial institutions

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# Personality Traits and Readiness for Learning: A Review

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**Abstract-** The aim of this paper is to identify the relationship between personality traits and readiness for learning based on a review of recent literature. The paper, to a large extent, uses literature to appraise the postulations of James Marcia in the Identity Status Theory, which is an extension of the work of the psychologist Erik Erikson. In applying the identity status theory, this paper attempts to explain how personality traits are extensions of identities at different state of formation. Understanding these traits can be instrumental in helping a learner to commit to learning. The author shows that the knowledge of personality style and identity may help a teacher to determine the best methods for teaching different learners. The paper concludes that people learn and teach differently because they are different. Consequently, teachers should endeavour to understand the potential interpersonal frustrations and curtail unnecessary conflicts by creatively adjusting teaching according to the different personalities of learners.

**Index Terms-** Personality, Traits, Readiness, Learning

## I. INTRODUCTION

Personality traits are key determinants of academic achievement in school. Personality is the unique set of characteristics and qualities that unequivocally defines an individual across situations and contexts. A trait is any aspect of personality that is reasonably characteristic and distinctive. The concept of a personality trait is rooted in common sense and everyday observation. Personologists consider or conceive traits as internal predispositions that are relatively stable over time and across situations. It can also refer to the broad individual differences in socio-emotional functioning. Personality traits therefore may be distinguished from other variables that appear to be less socio-emotional and more cognitive in nature such as values, attitudes, worldviews and schemas.

The notion that people could be grouped into different types or categories goes back at least to the time of Hippocrates (about 400 BC), whose ideas were later embellished by Galen (about AD 150). People were thought to be of four groups which were; the choleric (irritable), melancholic (depressed), sanguine (optimistic) and phlegmatic (calm). Each personality type was thought to reflect an excess of one of the bodily fluids. Carl Jung (1993) however argued that people are either introverts or extroverts. According to him, an introvert tends to be alone a lot, behaves as if shy, and prefers solitary activities to social interaction. When confronted with stress, the introverts withdraw into themselves. On the other hand, an extrovert is not shy and prefers to spend time

with others. When confronted with stress, they seek a group to talk to.

## II. PERSONALITY TRAITS

According to McCrae and Costa (2003), personality traits are basically characteristics ascribed to individuals based on their patterns of behaviour, thoughts and emotions. Different models have been postulated to advance discussions of personality traits and their effect on various human endeavours. However, the most commonly used model is the Five-Factor Model (Parks-Leduc, Feldman & Bardi, 2015). This model categorizes several behavioural and identity characteristics into five groups of traits, namely Openness to experience, Agreeableness, Extraversion, Conscientiousness, and Emotional stability (Parks-Leduc *et al.*, 2015). Openness to experience encompasses such characteristics as curious, intellectual, imaginative, creative, innovative, and flexible (vs. closed-minded, shallow, and simple). On the other hand, Agreeableness is a trait attributed to people who tend to be helpful, good-natured, cooperative, sympathetic, trusting, and forgiving (vs. rude, selfish, hostile, uncooperative, and unkind). Extraversion describes people who are sociable, talkative, optimistic, ambitious, assertive, reward-seeking, outgoing, and energetic (vs. introverted, shy, reserved, quiet, and unadventurous). Conscientiousness defines people who are organized, responsible, dependable, neat, efficient, and achievement-oriented (vs. disorganized, lazy, irresponsible, careless, and sloppy). Lastly, Emotional stability comprises calm, self-confident, stable, resilient, and well-adjusted (vs. neurotic, nervous, insecure, fearful, and anxious).

Personality traits are important for understanding of the environment, or ideas and how individuals engage with others. A wide consensus among researchers for the Five Factor Theory (McCrae and Costa, 1997, 1999, 2003) conjectures that the five structural personality traits or basic tendencies are universal across nationalities and transcend culture (Cattell, 1943; Goldberg, 1993). According to Goldberg (1993), the five factors of personality help to provide a scientific framework for organizing the multitude of differences that are characteristic of human beings everywhere. Consequently, these five dimensions of personality have dominated studies on individual differences (Saksvik & Hetland, 2009), and have been proven to inform behaviour (Armenakis *et al.*, 1993; Kornør, & Nordvik, 2004; Shahrazad, Lukman, Murni, *et al.*, 2011; Van Egeren, 2009). It is therefore important to examine how these traits in learners influence their readiness to learn.

### III. READINESS FOR LEARNING

Readiness for learning is the capacity to receive, internalize and act on acquired skills. It is a paradoxical concept that implies preparation for something else (learning), yet, as a process, it also requires learning. It is plausible to say readiness for learning is the individual state where one is physically, mentally and emotionally ready to learn. Preparedness to learn is a gimmick, an easy way to rapidly increase the rates of learning contrary to not geared up to learn which diverts attention away and one cannot learn successfully (Prakash, 2012). Hypothetically, it may be difficult for learners to prepare unless they are helped (taught) to prepare to learn. Readiness for learning is important since, as Schindler (2013) argues, even the most optimal conditions for teaching and learning may disfavour certain learners who are not prepared to meet the demands of the learning environment. The unforeseen deception of unpreparedness to learn is shattering as it tends to decrease the efficiency and effectiveness of teaching. One reason, for instance, could be the fact that learners may not have “attained the physical and mental maturity, the foundation of concepts and the language or the social and emotional adjustment necessary for learning at the level which the teacher is attempting” (Schindler, 2013, p. 301). Therefore, teaching must be appropriate to the readiness level of the learners; otherwise, the goals of teaching will be untenable.

Readiness for learning was initially proposed in relation to early childhood education, with particular concern being to ensure that pre-schoolers are prepared to get in and remain competent in acquiring knowledge within established educational systems. However, it is not merely a construct aimed at ensuring that no child is left behind; it entails a process of capacity building that is subject to many forces, both within and outside the learner’s control. According to Heller, Wolfe and Steinberg (2017), contemporary students must cultivate the full range of intellectual, interpersonal, and intrapersonal capacities that have been grouped together under the banner of deeper learning. What role do personality traits play in the process of students’ cultivation of these capacities?

The aim of this paper is to identify the relationship between personality traits and readiness for learning based on a review of recent literature. The paper, to a large extent, uses current literature to appraise the postulations of James Marcia in the Identity Status Theory, which is an extension of the work of the psychologist Erik Erikson.

### IV. IDENTITY STATUS THEORY AND INDIVIDUAL CHARACTERISTICS

Identity is non-cognitive and plays a pivotal role in research on education, given that under some circumstances it may influence school choices, classroom behaviours, career performance, and the disposition of adolescents towards schooling (Flores-Crespo, 2007). According to Erikson (1968), forming identity mainly ensues at adolescence, and begins at the point when the adolescent copes with social demands and developmental challenges and attempts to give meaning to his choices and commitments of his life. Therefore the main view of Identity Status Theory is that a person’s sense of identity is determined mainly by the choices and commitments they make towards some personal and social traits (Kroger & Marcia, 2011).

On the premise of Erikson’s theory and the two dimensions of exploration and commitment, Marcia (1966) presented an identity status paradigm, in an attempt to render the concept of identity formation amenable to research. Marcia (1993) identified four identity statuses by which late adolescents and young adults undertake identity defining decision in different domains and namely: Achievement (commitment followings exploration), Moratorium (low commitment, high exploration), Foreclosure (high commitment, low exploration) and Diffusion (low commitment, low or without exploration).

Table 1 below presents four key identity statuses and how they affect individuals.

**Table 1: Identity Statuses and Individual Characteristics**

| Identity Status      | Characteristics of individuals   |
|----------------------|--|
| Identity achievement | <ul style="list-style-type: none"> <li>- Solid with important focuses in their lives</li> <li>- Retain some flexibility, but are not easily swayed by external influences and pressures in their chosen life directions</li> <li>- Persevere against obstacles, unless proceeding becomes clearly unrealistic</li> <li>- Have room for understanding the experiences of others</li> <li>- Reliable and sources of strength for others</li> </ul>                                   |
| Moratoriums          | <ul style="list-style-type: none"> <li>- Struggling to define themselves</li> <li>- Lively, engaging, conflicted, and sometimes tiring to be around</li> <li>- May try to draw others into their identity formation project</li> <li>- Often exquisitely morally sensitive</li> <li>- Best of outcomes: make self-relevant choices and move on to the firm commitments of identity achievement</li> <li>- Worst of outcomes: can become paralyzed in their vacillations</li> </ul> |
| Foreclosure          | <ul style="list-style-type: none"> <li>- Appear as strong and self-directed as achievements</li> <li>- There is a brittleness, and, hence, underlying fragility, to their position</li> <li>- Have difficulty considering alternatives seriously; they thus maintain their stances defensively and either deny or distort disconfirming information</li> <li>- Seek conforming positions which helps them to find self and familial affirmations</li> </ul>                        |

|                     |   |
|---------------------|---|
| Identity diffusions | <ul style="list-style-type: none"><li>- Have a weak or non-existent exploratory period and an inability to make definite commitments</li><li>- Can be whatever current influences shape them to be</li><li>- At their best, they can appear extremely flexible, charming, and infinitely adaptable</li></ul> At their worst, diffusions are lost and isolated, beset by feelings of emptiness and meaninglessness |
|---------------------|---|

Source: Adapted from Kroger and Marcia (2011)

In applying the identity status theory, this paper attempts to explain how personality traits are extensions of identities at different state of formation. Understanding these traits can be instrumental in helping a learner to commit to learning. According to Luyckx, Teppers, Klimstra and Rassart (2014), personality have been known to be some of the key contributors to variations in identity development among people. Similarly, Vancea (2014) observes that “The psychic maturity level reached by an individual depends on the way in which he succeeds in accepting and going through identity crises, eventually assuming a clear, precise and authentic personal identity” (p. 5-6). However, these authors lament that there is a research gap on the relationship between personality traits and current identity models. In contribution to filling this gap and address the paucity of studies, this paper examines the relationship between personality traits and readiness for learning, which is conceptualized as part of an identity commitment.

#### V. PERSONALITY TRAITS AND LEARNING

In their 2011 book titled *How to Teach Now: Five Keys to Personalized Learning in the Classroom*, Powell and Kusuma-Powell urges teachers to understand their students well. Among the benefits they enumerate for knowing students is the teachers’ ability to gauge fully every learner’s capacity and readiness for learning. Such knowledge will then enable the teachers to create a psychologically safe environment for every learner. Knowing a student’s readiness level will also enable the teacher to define strategies for accessing the curriculum to enhance participation. According to Powell and Kusuma-Powell, contemporary teachers must demonstrate a heightened emotional intelligence in the classroom.

Komaraju, Karau, Scmeck and Avdic (2011) have studied the big five personality traits, learning styles and academic achievement. They found that conscientiousness and agreeableness had a positive relationship with key learning styles, namely synthesis analysis, methodical study, fact retention and elaborate processing. These findings suggest that these personality traits are likely to be ready for deep learning styles. From the instant study, extraversion and openness also registered fair performance with elaborate processing learning styles. On the other hand, Komaraju et al. (2011) found that neuroticism was negatively associated with all these learning styles. This means that neurotics are not ready to learn using these deep learning approaches and teachers may need to alter their goals and styles to meet the needs of such learners. The authors conclude that students who are intellectually curious are more ready to learn than those who are emotionally unstable.

In a study of personality traits, learning and academic achievements, Jensen (2015) observes that openness is marked by

a student’s desire to know more. Accordingly, such students have both the intrinsic drive to seek out knowledge and allow themselves to be extrinsically stimulated to learn. The implication is that openness as a personality trait allows for greater readiness for learning. Jensen further notes that openness is positively linked to deep learning and negatively correlated to surface learning. Conscientiousness also had a significant, albeit less strong, association with deep and achieving learning. He however reports a weak association between deep learning and extraversion and agreeableness. Lastly, students who lack emotional stability (neurotics) exhibit a higher affinity for surface as opposed to deep learning.

Corker, Oswald and Donnellan (2012) observe that of the big five personality traits, conscientiousness presents a strong predictor of preparedness for high academic achievement. A key factor in conscientiousness that researchers single out as the greatest driver for the desire to learn is self-efficacy (Cupani & Pautassi, 2013). Nonetheless, Corker *et al.* note that learners with this type of trait need purposeful guidance to stay committed to their academic pursuits. The reason is that these learners tend to gravitate towards laziness and loss of focus. They also tend to be negligent and early quitters.

On the other hand, Steele-Johnson and Leas (2013) have found that openness has an indirect influence on student’s readiness for learning and ultimately on their academic performance. This indirect effect stems from the fact that learners with this type of trait tend to easily slip into conventions so as to gain social acceptance, instead of seeking to be creative and independent of mind. To such learners, subscribing to conservative views may be easier and a way of showing that they accommodate other people’s ideas. According to Steele-Johnson and Leas, however, openness is a stronger predictor of learning at the lower levels of education compared to conscientiousness, which is strongest at the higher levels of learning. This may be explained by the fact at a younger stage, most open children are honest and down-to-earth.

Studies that explore the influence of emotional stability on learning mostly examine the impact of neuroticism on students’ performance. For instance, Richardson, Abraham and Bond (2012) predict that neuroticism may render a learner completely dysfunctional in the classroom setting due to its associated factors. These factors include stress, unhealthy behavior patterns and low self-esteem. However, Beckmann, Beckmann and Birney (2013) argue that neuroticism can even drive students to concentrate more on trying to resolve their internal issues by acquiring skills. Therefore, neuroticism does not always imply a student is not ready to participate in a learning environment. It may simply imply the need for the teacher to make certain adjustments to help that student tap into their internal motivators for knowledge-seeking actions.

Richardson *et al.* (2012) also observe that learners with agreeableness may desire collaborative learning set-ups in order to perform. These authors also paint a similar scenario for students with extraversion personality traits. According to them, extraversion promotes outward looking behaviour which can distract a learner from their academic work. Therefore, they caution that learners with these two trait types tend to lose focus easily. As such, the best approach to helping such learners is to

provide social learning groups. Such groups will provide them with a place of affirmation and social identity. Based on the literature review, Table 2 below provides a summary of the potential issues that teachers may need to address across the personality trait categories in relation to students' readiness for learning.

**Table 2: Personality Traits, Student Characteristics and Readiness for Learning**

| <b>Personality Trait</b> | <b>Low score characteristics of students that could impair with readiness for learning</b>  |
|--------------------------|---|
| Openness                 | Down-to-earth: Can be naïve and gullible<br>Uncreative and conventional/conservative: Does not interrogate existing ideas and assumptions.<br>Prefers routine: Reluctant to change or take up new subjects.<br>Uncurious: Does not show 'hunger' for learning.  |
| Agreeableness            | Ruthless: Can be unconcerned with fellow learners<br>Suspicious: Does not trust the teacher or colleagues.<br>Stingy: Does not collaborate with other learners<br>Antagonistic, critical, irritable: Tendency to be the notorious noise-maker in class.<br>Easily distracted: Lacks focus/short attention span.           |
| Extraversion             | Reserved/quiet: Would rather not ask questions, even when they desire to.<br>Loner: Hates group works.<br>Sober, passive, unfeeling: Lost in their own world/day-dreaming in the classroom.   |
| Conscientiousness        | Negligent: Loses marks for minor mistakes/lack of attention to detail<br>Lazy: Loves last-minute actions<br>Disorganized: Finds it hard to revise from poorly constructed notes<br>Late: Misses out on key introductory topics<br>Aimless: Always disoriented during learning<br>Quitting: Gives up when things get tough |
| Emotional stability      | Neurotic: Always afraid to fail leading to inaction or hyperactivity.<br>Short-tempered: Reactive to situations<br>Self-satisfied, comfortable: Does not see the need to seek more knowledge or understanding of issues<br>Unemotional, hardy: Lacks emotional intelligence   |

Source: Adapted from Feist and Feist (2009)

## VI. JAMES MARCIA'S IDENTITY STATUS: IMPLICATIONS ON READINESS FOR LEARNING

Expanding in the foundational works of Erik Erikson, James Marcia (1966) proposes two criteria that are necessary for a mature identity achievement. These are crisis and commitment. Crisis refers to the struggle or emotional turmoil a person goes through in making choices; commitment on the other hand, describes the amount of personal investment an individual exhibits in making a choice. These are important to identity because without some sort of crisis or deep soul searching in making important life decisions one has to question whether a decision is really one's own. Similarly, without a strong commitment to life choices, there is the possibility one has not weighed the full rewards and costs of these choices and will most likely abandon them as soon as soon as opposition or difficult circumstances arise.

When a teacher reflects on this, it is important to recognize the fact that students will be ready to learn only when they make a conscious decision to actively take part in the learning process. In addition to this without commitment, effective learning cannot take place. In summary, one's self-image plays a significant role in forming one's sense of identity and having a healthy individuality is a premise for creating an industrious leaning environment. To properly assess a student's readiness to learn, teachers need to look at key indicators of personality and identity. These include temperament, show of personal abilities or unique talents, the student's cultural and family background and personal identity.

### Temperament

Temperament describes how a person feels and acts. Bould, Joinson, Sterne and Araya (2012) describe temperament using concepts such as emotionally, activity and sociability. Emotionality is the tendency show distress and the tendency to become upset easily and intensely. This distress stems from fear and anger. On the other hand, activity includes tempo, vigour and endurance while sociability refers to the preference one has to be with others as opposed to being alone (Bould *et al.*, 2012). Social rewards that stem from one's sociability include the presence of others sharing an activity, attention, responsibility, and initiation. The combination of these three aspects of temperament yields very diverse personality types. Just as everyone has unique talents individuals also have unique temperaments.

Dougherty (2016) posits that over 60% of children in the world fall into one of three temperament categories, namely: easy or flexible; difficult, active or feisty, and slow to warm up or cautious. The first group represents a calm and happy personality, identified by how a child loves to sleep and eat well. The second group comprises children who are fussy and easily distracted, marked by short attention span, irregular sleeping and eating habits and irrational fear or neuroticism. The last category is composed of children who are withdrawn, but tend to react sharply, mostly negatively, to new experiences. These children need gradual exposure to new learning experiences. Therefore, it is important to examine how a learner's temperament drives them towards or away from the desire to pursue knowledge. Teachers should strive to recognize the various temperaments represented in a classroom setting and the different learning styles that every temperament may need.

### Abilities

Every person is endowed with certain abilities, which gradually develop through maturation and learning. The ability to learn, engage in abstract ideation or reasoning and solve problems is referred to as intelligence (Legg & Hutter, 2007). A special ability such as a talent for music or mechanical things is called aptitude. Intelligence influences personality by providing a student with means of recognition, an outstanding quality. The bright child achieves rewards from parents and teachers for his or her accomplishments. Abilities also provide a motivation to learn as a student with, say, a special talent desires to exercise and perfect it. This explains why innate abilities are useful tools for assessing a student's readiness for learning. Having these abilities is not synonymous with being ready to learn; in fact learners who feel able may not see the need to seek more knowledge or training. Therefore, they may need motivation to step out of their state of contentment and to remain curious about abilities they may be lacking.

### Culture and Family

Whether or not a child was raised in the rural and less developed regions of Africa or the sophisticated cities of the United States, cultural and family circumstances do have an impact on their readiness to learn. Culture determines the experiences a person has, the frustrations and adjustments he must deal with against the standards of conduct required of him within the learning environment (Futterman, 2015). Each culture has its own distinctive value, morals, and ways of behaving. It dictates the rules for child training and relationships within a family. According to Futterman, culture and family imbue in a child a worldview that may restrict or expand their ability to learn. Parents' behaviour and perceptions of school and schooling could also promote or undermine a child's readiness to learn. For instance, parents who perceive teachers as experts may not exert additional effort to prepare their children for learning.

### Identity

'Who am I?' is a question constantly confronted from childhood through adolescence and onto adulthood. The essence of personality development is to create identity, distinct from those of others (friends, peers, parents, relatives, church members, teachers, etc.). A sense of identity is not innate or inborn. When a child goes to school, they identify themselves as learners. However, to what extent does this self-definition result in actual transition in the mind of the child? However, a child within a school context is at the same time a person with several personalities, including sexual orientation, religious beliefs, gender, race or ethnicity, socio-economic class, physical or mental abilities, political background, etc. (DiPietro, 2007). It is important when assessing a child's readiness for learning that teachers pay attention to all the identities that could distract a child from learning.

## VII. CONCLUSION AND PRACTICAL IMPLICATIONS

The knowledge of personality style and identity may help a teacher to determine the best methods for teaching different learners. Some students pass a more "take charge" manner

(“tellers”) while others prefer to come at problems by raising tough questions (“askers”). Therefore, equipped with the knowledge of the different personality types, the teacher will develop a suitable model to hold the attention of every learner. Teachers are encouraged to provide a balanced style of teaching so that all students are catered for and motivated to learn. The teacher should endeavour to understand the potential interpersonal frustrations and curtail unnecessary conflicts by creatively adjusting teaching according to the different personalities of learners.

Personality types also affect learners’ self-concept, which is a key determiner of learning motivation. Teachers will often find it difficult to motivate reluctant learners unless they identify the root causes of their (learners’) self-concepts. Self-concept comprises all that one knows or thinks they know about themselves. It includes one’s evaluation of self, how competent and effective they consider themselves to be, what they expect of themselves, and one’s identity. Therefore, a proper understanding of how self-concept affects learning orientation can help teachers to motivate all types of learners effectively. Ultimately, as highlighted in this paper, temperament and personality type theories show that people learn and teach differently because they are different. Therefore, learning about temperament and personality types can help teachers to appreciate themselves as teachers; to better understand their students, and identify as well as deal effectively with theirs and their learners’ strengths and weaknesses.

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# Ring of Adjacency Matrices of Digraphs

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**Abstract-** This paper shows, that under the piecewise addition modulo 2, and piecewise multiplication of adjacency matrices of digraphs, the basic properties for a ring are being satisfied.

**Index Terms-** Ring, Adjacency Matrices, Digraphs, Piecewise Addition modulo 2 and Piecewise Multiplication.

## I. INTRODUCTION

The most general algebraic structure with two binary operations is the ring (Fraleigh, 1989).

The theory of rings grew out of the study of two particular classes of rings, polynomial rings in  $n$  variables over the real or complex numbers and the “integers” of an algebraic number field (Fraleigh, 1989).

There are many examples of rings which had been presented and studied. Here are some examples of rings: The rational, real and complex numbers form rings and they even form a field and likewise they are commutative rings. The Gaussian integers as do the Eisenstein integers. The set of integers modulo  $n$  forms also a ring. The power set of  $S$  becomes a ring if we define addition to be the symmetric differences of sets and multiplication to be the intersection. This is an example of a Boolean ring. A Ring  $R$  is said to be a Boolean ring if  $a^2 = a$  for every  $a \in R$ . The set of all continuous real-valued functions defined on the interval  $[a, b]$  forms a ring (even an associative algebra) the operations are addition and multiplication of functions. We have also the ring of Cauchy Sequences. It is known that the set of all  $n \times n$  matrices having elements of  $R = \text{set of real numbers}$  as entries, under the usual addition and multiplication of matrices is a ring.

Cabanlit (2016) has shown that the set of  $n \times n$  adjacency matrices of graphs under the piecewise addition and multiplication modulo 2 would constitute as a ring.

In this paper, we will show that the set of  $n \times n$  adjacency matrices of digraphs under the piecewise addition and multiplication modulo 2 would constitute as a ring.

The adjacency matrix is the matrix associated with graphs and digraphs. Graphs and digraphs have many realistic applications. They are used as models in Sociology, Communication and Transportation.

## II. RESULTS AND DISCUSSION

The adjacency matrix of a digraph that has  $n$  vertices is the  $n \times n$  matrix whose  $i, j$ th element is 1 if there is at least one directed edge between  $P_i$  and  $P_j$  and zero otherwise, where  $P_i$  and  $P_j$  are vertices of a digraph. Note that the adjacency matrices in this paper are not necessarily symmetric matrices consisting of zeros and ones. Moreover, the diagonals are all zeros, since digraphs do not have loops.

We consider the following definitions of sum and product of two adjacency matrices.

**Definition 1.** If  $A = [a_{ij}]$  and  $B = [b_{ij}]$  are  $n \times n$  adjacency matrices of digraphs  $G_1$  and  $G_2$ , then the sum  $A \oplus B$  is the  $n \times n$  adjacency matrix  $C = [c_{ij}]$  of a new digraph  $G_3$ , defined by

$$c_{ij} = a_{ij} + b_{ij} = \begin{cases} 0, & \text{if } a_{ij} + b_{ij} = 0 \text{ or } a_{ij} + b_{ij} > 1 \\ 1, & \text{if } a_{ij} + b_{ij} = 1 \end{cases}$$

The matrix C is obtained by adding corresponding elements of A and B with the corresponding definition of the sum of values. This makes the sum of two adjacency matrices to be an adjacency matrix of another digraph.

**Definition 2.** If  $A = [a_{ij}]$  and  $B = [b_{ij}]$  are  $n \times n$  adjacency matrices of digraphs  $G_1$  and  $G_2$ , then the product  $A \otimes B$  is the  $n \times n$  adjacency matrix  $C = [c_{ij}]$  of a new digraph  $G_3$ , defined by

$$c_{ij} = a_{ij}b_{ij} = \begin{cases} 0, & \text{if } a_{ij} = 0 \text{ or } b_{ij} = 0, \text{ or } a_{ij} = 0 \text{ and } b_{ij} = 0 \\ 1, & \text{if } a_{ij} = 1 \text{ and } b_{ij} = 1 \end{cases}$$

The matrix C is obtained by multiplying corresponding elements of A and B with the corresponding definition of the product. This makes the product of two adjacency matrices to be an adjacency matrix of another digraph.

With the above definitions of sum and product, we can now state that the set of  $n \times n$  adjacency matrices together with these two binary operations constitute a ring.

**Theorem 1.** The set R of  $n \times n$  adjacency matrices of digraphs together with the sum  $\oplus$  in **Definition 1** and product  $\otimes$  in **Definition 2** is a ring.

Proof: To prove we must satisfy the eight (8) properties of a ring. Note that R is a non empty set.

*Property 1.* The operation  $\oplus$  is a binary operation.

From **Definition 1**, it is clear that the sum of two  $n \times n$  adjacency matrices is also an adjacency matrix. Moreover, the diagonals are all zeros.

*Property 2.* The binary operation  $\oplus$  is associative.

Let  $A = [a_{ij}]$ ,  $B = [b_{ij}]$  and  $C = [c_{ij}]$  be  $n \times n$  adjacency matrices of graphs  $G_1$ ,  $G_2$  and  $G_3$ , respectively. Then  $A \oplus [B \oplus C] = [A \oplus B] \oplus C$ . This follows from the fact that addition of  $n \times n$  matrices is associative.

*Property 3.* The existence of an identity element E in R such that  $E \oplus A = A \oplus E = A$  for all  $A \in R$ . (This element E is an identity element for  $\oplus$  on R).

The identity element in this case is the adjacency matrix whose entries are zeros.

$$\text{That is } E = \begin{bmatrix} 0 & 0 & 0 & \dots & 0 \\ 0 & 0 & 0 & \dots & 0 \\ 0 & 0 & 0 & \dots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & \dots & 0 \end{bmatrix}$$

*Property 4. The existence of additive inverse.*

The elements of the additive inverse of  $A$ , an  $n \times n$  adjacency matrix are defined as follows: Suppose  $a_{ij}$  are the elements of  $A$ , we let  $-a_{ij}$  to be the corresponding elements of  $-A$ , where  $-A$  is the additive inverse of  $A$ . Then, we have:

$$-a_{ij} = \begin{cases} 0, & \text{if } a_{ij} = 0 \\ 1, & \text{if } a_{ij} = 1 \end{cases}. \text{ Thus, the inverse of } A \text{ is } A \text{ itself.}$$

As an example: Suppose  $A = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ , then  $-A = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ . Thus, the inverse of  $A$  is  $A$  itself.

*Property 5. The binary operation  $\oplus$  is commutative.*

The commutative law follows from the fact that addition of matrices is commutative.

*Property 6. The operation  $\otimes$  is a binary operation.*

From **Definition 2**, it is clear that the product of two  $n \times n$  adjacency matrices is also an adjacency matrix. Moreover, the entries are either zeros or ones and the diagonals are all zeros.

*Property 7. The binary operation  $\otimes$  is associative.*

Let  $A = [a_{ij}]$ ,  $B = [b_{ij}]$  and  $C = [c_{ij}]$ , then we have

$$\begin{aligned} A \otimes (B \otimes C) &= [a_{ij}] \otimes \{ [b_{ij}] \otimes [c_{ij}] \} \\ &= [a_{ij}] \otimes [b_{ij}c_{ij}] \\ &= [a_{ij}(b_{ij}c_{ij})] \\ &= [(a_{ij}b_{ij})c_{ij}] \\ &= [a_{ij}b_{ij}] \otimes [c_{ij}] \\ &= \{ [a_{ij}] \otimes [b_{ij}] \} \otimes [c_{ij}] \\ &= (A \otimes B) \otimes C. \end{aligned}$$

*Property 8. The Distributive Laws hold.*

For all  $A, B, C \in R$ , we have

$$A \otimes (B \oplus C) = (A \otimes B) \oplus (A \otimes C) \text{ and } (A \oplus B) \otimes C = (A \otimes B) \oplus (A \otimes C).$$

Let  $A = [a_{ij}]$ ,  $B = [b_{ij}]$  and  $C = [c_{ij}]$ , then we have

$$\begin{aligned} A \otimes (B \oplus C) &= [a_{ij}] \otimes \{ [b_{ij}] \oplus [c_{ij}] \} \\ &= [a_{ij}] \otimes [b_{ij} + c_{ij}] \\ &= [a_{ij} (b_{ij} + c_{ij})] \\ &= [a_{ij} b_{ij} + a_{ij} c_{ij}] \\ &= [a_{ij} b_{ij}] \oplus [a_{ij} c_{ij}] \\ &= (A \otimes B) \oplus (A \otimes C). \end{aligned}$$

The same way can be used to show that the right distributive law is true.

With the above definitions of a binary sum and product, and we have shown that all the properties are being satisfied, we are able to form a new ring consisting of all  $n \times n$  adjacency matrices of a digraph.

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# Tranexamic Acid Pre-Operative Prophylaxis To Reduce Bleeding During Femoral Interlocked Intramedullary Nailing: A Randomized Control Study

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**Abstract: Objectives:** To evaluate the efficacy of intravenous Tranexamic Acid as pre-operative prophylactic management for patients undergoing Open Reduction Internal Fixation (ORIF) Interlocked Intramedullary Nailing of the Femur in minimizing intra-operative bleeding at Level III trauma Center in a tertiary government hospital.

**Methods:** Patients were admitted under the Department of Orthopedics Level III trauma Center in a tertiary government hospital. Baseline hemoglobin and hematocrit was taken upon admission along with x-ray of the femur. Laboratories upon admission served as baseline prior to the operation. A repeat hemoglobin and hematocrit were done prior to the scheduled surgery if the patient has delayed surgery for more than two weeks. Single blind sampling was used. All the patients in the study underwent ORIF IM Nailing of the femur. Patients in the Tranexamic group was given tranexamic acid 1gm after induction of anesthesia. Postoperative estimated total blood loss was recorded and postoperative hemoglobin and hematocrit levels were determined. The control group that was included in the study underwent ORIF IM Nailing of the Femur but were not given Tranexamic Acid. Postoperative estimated total blood loss was recorded and postoperative hemoglobin and hematocrit levels were determined. Estimated blood loss was determined from anesthesia records.

**Results:** In our study, 17 patients were given TXA while 14 patients served as the control group and did not receive TXA. During surgery, there was a note of minimal bleeding especially upon skin incision and muscle splitting compared to those patients without TXA. Results also showed that there were significant differences in the drop in hemoglobin and hematocrit levels and in the estimated blood loss compared to the control group. During this study, we also note that the rate of blood transfusion were minimized on the TXA group compared to the non- TXA group.

**Conclusion** The results of the study showed that there is a significant difference in the drop in the hemoglobin and hematocrit level between the patients who received tranexamic acid and those who did not receive tranexamic acid. Furthermore, there is also a significant difference in the estimated blood loss between the two groups. This showed that tranexamic acid is an effective prophylactic drug that reduces bleeding among patients with femoral shaft fracture undergoing open reduction interlocked intramedullary nailing.

**Keywords:** Tranexamic Acid, Hemoglobin, Hematocrit, Estimated Blood Loss, Interlocked IM Nailing Femur.

## I. INTRODUCTION

The Province of Iloilo, home to 1.81 million people, records nearly 5,000 road crash incidents in the first half of 2017. According to the 2014 data from the Philippine Statistics Authority, 733 people died from road crash accidents in Region VI. If population is taken into account, Western Visayas is the most affected region in the Islands of Visayas in terms of road crash deaths (Francisco, 2017).

Through the years, treatment methods involving fractures evolved from non-operative to operative management. Intramedullary nailing has become the gold standard for operative treatment of femoral diaphyseal fractures (Brumback, et al, 2006).

Open reduction intramedullary nailing of the femur is extensive and blood is usually needed to undergo the procedure. However, due to scarcity and difficulty in securing blood, it is considered one of the reasons for the delay in surgery.

Tranexamic acid (TXA) is an antifibrinolytic drug that has been shown by several studies to be effective in reducing blood loss and blood transfusions after orthopaedic surgeries (Amer KM, Rehman, Amer K and Haydel, 2018; Dai, Zhou, Zhang, H., and Zhang, J., 2018; Gausden, et al., 2017; Goldstein, Feldmann, Wulf, and Wiesmann, 2017; Lin, and Woolf, 2016; Sridharan, and Sivaramakrishnan, 2018; Vijay, Bedi, Mitra, and Das, 2013). Several studies have reported the role and efficacy of TXA in hip and knee replacement surgery. However, the effectiveness of TXA use in orthopaedic fracture surgeries specifically in femoral shaft fractures still remains unclear. The purpose of this study is to investigate the effectiveness and safety of TXA treatment in reducing blood loss in patients who underwent open intramedullary nailing surgeries for femoral shaft fractures.

#### General Objective

To evaluate the efficacy of intravenous Tranexamic Acid as pre-operative prophylactic management for patients undergoing Open Reduction Internal Fixation (ORIF) Interlocked Intramedullary Nailing of the Femur in minimizing intra-operative bleeding at Level III trauma Center in a tertiary government hospital.

#### Specific Objective

1. To describe the demographic profile of patients given intravenous Tranexamic Acid as pre-operative prophylactic management for patients undergoing Open Reduction Internal Fixation (ORIF) Interlocked Intramedullary Nailing of the Femur as to:
  - A. Age
  - B. Sex
2. To determine the efficacy of Tranexamic Acid as pre-operative prophylactic management for patients undergoing Open Reduction Internal Fixation (ORIF) Interlocked Intramedullary Nailing of the Femur as to:
  - A. Estimated Blood Loss
  - B. Drop in Hemoglobin Level
  - C. Drop in Hematocrit Level

## II. RESEARCH AND COLLECT IDEA

This study was designed to evaluate the efficacy of intravenous Tranexamic Acid as pre-operative prophylactic management for patients undergoing Open Reduction Internal Fixation (ORIF) Interlocked Intramedullary Nailing of the Femur in minimizing intra-operative bleeding at a Level III trauma Center in a tertiary government hospital.

#### Research Design

A randomized control study design was employed in the study.

#### Study Setting

This study was done at Level III trauma Center in a tertiary government hospital.

#### Duration of the Study

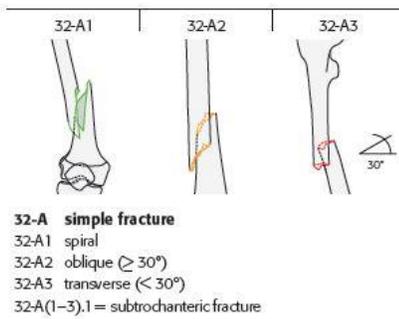
This study was conducted from January 2018 to June 2019.

#### Participants/Subject/Respondents

All patients admitted with fracture of the middle shaft of the femur classified according to AO who underwent ORIF Interlocked Intramedullary Nailing.

#### Inclusion Criteria

- 1.) age 20-70 years old
- 2.) have simple fracture at the middle 3<sup>rd</sup> of femoral shaft classified in AO as AO 32-A



(Source: AO Trauma)

3.) injury resulted from motor vehicular accident.

**Exclusion Criteria**

- 1.) patients with multiple injuries including femoral shaft
- 2.) patients with co-morbid conditions and bleeding disorders

**Procedure of the study**

Patients were admitted under the Department of Orthopedics Level III trauma Center in a tertiary government hospital and have fractures of the middle 3<sup>rd</sup> of the femur classified according to AO specifically AO 32-A underwent Open Reduction Internal Fixation (ORIF) Interlocked Intramedullary (IM) Nailing. All participants were oriented, apprised and an informed consent was secured prior to the study.

Baseline hemoglobin and hematocrit was taken upon admission along with x-ray of the femur. Laboratories upon admission served as baseline prior to the operation. A repeat hemoglobin and hematocrit was done prior to the scheduled surgery if the patient has delayed surgery for more than two weeks. Single blind sampling was used.

All the patients in the study underwent ORIF IM Nailing of the femur. Patients in the Tranexamic group was given tranexamic acid 1gm after induction of anesthesia. Postoperative estimated total blood loss was recorded and postoperative hemoglobin and hematocrit levels were determined.

The control group that was included in the study underwent ORIF IM Nailing of the Femur but were not given Tranexamic Acid. Postoperative estimated total blood loss was recorded and postoperative hemoglobin and hematocrit levels were determined. Estimated blood loss was determined from anesthesia records.

**Data Analysis Procedure**

The results of the study were analyzed using Statistical Package for Social Sciences (SPSS) version 19. Independent T-test was used to analyze the data.

**III. RESULTS AND FINDINGS**

From January 2018 to June 2019, 50 patients were randomized in the study of which 19 were excluded because of existing co-morbidities. Data from thirty one patients were analyzed after randomization, 17 patients were given TXA and 14 patients were not given TXA. The study population consist of 22 males and 9 females, with the mean age of 64.

Table 1. Demographics  
 Sex

|        | Frequency | Percent |
|--------|-----------|---------|
| Male   | 22        | 4.2     |
| Female | 9         | 1.7     |
| Total  | 31        | 100     |

Age

|       | Frequency | Percent |
|-------|-----------|---------|
| 20    | 6         | 1.1     |
| 21    | 1         | .2      |
| 22    | 1         | .2      |
| 24    | 3         | .6      |
| 25    | 2         | .4      |
| 26    | 1         | .2      |
| 27    | 1         | .2      |
| 28    | 2         | .4      |
| 29    | 1         | .2      |
| 33    | 1         | .2      |
| 34    | 1         | .2      |
| 35    | 1         | .2      |
| 36    | 1         | .2      |
| 37    | 1         | .2      |
| 39    | 1         | .2      |
| 45    | 1         | .2      |
| 51    | 1         | .2      |
| 57    | 1         | .2      |
| 59    | 2         | .4      |
| 60    | 1         | .2      |
| 64    | 1         | .2      |
| Total | 31        | 100     |

**Patient Distribution**

|              | Frequency | Percent |
|--------------|-----------|---------|
| with TXA     | 17        | 3.2     |
| with out TXA | 14        | 2.7     |
| Total        | 31        | 100     |

In the study groups, baseline hemoglobin (Hgb) and hematocrit (Hct) were requested upon admission prior to surgery. If there was a delay of surgery, baseline hemoglobin recorded is the repeat hemoglobin prior to the surgery.

Table 2. Baseline Hemoglobin

|       | Frequency | Percent |
|-------|-----------|---------|
| 11.00 | 1         | .2      |
| 11.50 | 2         | .4      |
| 12.00 | 3         | .6      |
| 12.30 | 2         | .4      |
| 12.50 | 2         | .4      |
| 12.60 | 1         | .2      |
| 12.80 | 1         | .2      |
| 13.00 | 4         | .8      |
| 13.20 | 3         | .6      |
| 13.40 | 4         | .8      |
| 13.50 | 1         | .2      |
| 13.60 | 2         | .4      |
| 13.70 | 2         | .4      |
| 14.10 | 2         | .4      |
| 14.90 | 1         | .2      |
| Total | 31        | 5.9     |
| Total | 527       | 100.0   |

**Table 3. Baseline hematocrit**

|       | Frequency | Percent |
|-------|-----------|---------|
| .31   | 1         | .2      |
| .35   | 5         | .9      |
| .36   | 1         | .2      |
| .37   | 4         | .8      |
| .38   | 4         | .8      |
| .39   | 5         | .9      |
| .40   | 6         | 1.1     |
| .41   | 2         | .4      |
| .42   | 2         | .4      |
| .44   | 1         | .2      |
| Total | 31        | 5.9     |
| Total | 527       | 100.0   |

**Drop in Hemoglobin Level**

Baseline hemoglobin levels were noted in each study group. Drop of hemoglobin levels were compared between the two study groups. This study showed that there is a significant difference between the change in hemoglobin levels between patients who received tranexamic acid and the non-TXA group. This showed that the TXA group had lower blood loss ( $M = 1.42, SD = 0.63$ ) than the non-TXA group ( $M = 2.01, SD = 0.97$ ),  $t(29) = 2.05, p = 0.05$ .

Table 4: Drop in the hemoglobin level of both the TXA and non-TXA groups.

| Group         | N  | Mean | SD   | Df | T    | P    | Interpretation |
|---------------|----|------|------|----|------|------|----------------|
| TXA Group     | 17 | 1.42 | 0.63 | 29 | 2.05 | 0.05 | Sig            |
| Non-TXA Group | 14 | 2.01 | 0.97 |    |      |      |                |

\*significant at  $\alpha = .05$

**Drop in Hematocrit Level**

Baseline hematocrit levels were noted in each study group. Drop of hematocrit levels were compared between the two study groups. The results showed that there is a significant difference between the change in hematocrit levels between the TXA group and the non-TXA group. This shows that the TXA group had lower blood loss ( $M = 0.024, SD = 0.012$ ) than the non-TXA group ( $M = 0.051, SD = 0.027$ ),  $t(29) = 3.75, p = 0.001$ .

Table 5: Drop in the Hematocrit Level of both the TXA and non-TXA groups

| Group         | N  | Mean  | SD    | df | T    | P     | Interpretation |
|---------------|----|-------|-------|----|------|-------|----------------|
| TXA group     | 17 | 0.024 | 0.012 | 29 | 3.75 | 0.001 | sig            |
| Non-TXA group | 14 | 0.051 | 0.027 |    |      |       |                |

\*significant at  $\alpha = .05$

**Estimated Blood Loss**

Estimated blood loss was calculated based on the anesthesia record which included suction drain, and sponge count after surgery. Results showed that there is a significant difference between the estimated blood loss between TXA group and the non-TXA group. This shows that the TXA group had lower blood loss ( $M = 394.12$ ,  $SD = 42.87$ ) than the non-TXA group ( $M = 478.57$ ,  $SD = 108.69$ ,  $t(29) = 2.95$ ,  $p = 0.006$ ).

Table 6. Estimated blood loss of both the TXA and non-TXA groups

| Group         | N  | Mean   | SD     | df | T    | P     | Interpretation |
|---------------|----|--------|--------|----|------|-------|----------------|
| TXA group     | 17 | 394.12 | 42.87  | 29 | 2.95 | 0.006 | sig            |
| Non-TXA group | 14 | 478.57 | 108.69 |    |      |       |                |

\*significant at  $\alpha = .05$

**Discussion**

Tranexamic acid is a synthetic antifibrinolytic drug used to prevent bleeding. There are three methods of administering TXA to reduce blood loss; intramuscular, oral and intravenous. In one study by Benoni and Fredin, (1996) tranexamic acid reduced the number of patients receiving blood transfusion and the number of blood units transfused to one third compared to those who underwent surgery without TXA.

In our institution, femoral fracture is one of the most commonly managed long bone fractures. Prior to surgery, blood is prepared and the difficulty in securing them has been one of the reasons for the delay in surgery- The present study was conducted in our institution in order to evaluate if TXA is helpful in minimizing bleeding during surgery. Although several studies have been conducted in the use of TXA in total knee arthroplasty and hip arthroplasty, this study was formulated to determine if TXA is also applicable in other femoral fracture surgery especially in performing Interlocked Intramedullary Nailing.

Yi, et al, (2016) used intravenous combined with topical administration of TXA in patients undergoing a primary unilateral total hip arthroplasty and showed that it significantly reduced postoperative bleeding and transfusion rate. The results of this study also showed that IV TXA significantly decreased blood loss compared to those patients who were not given with TXA. This is shown by the significant difference in the drop in hemoglobin and hematocrit levels between the two groups.

In our study, 17 patients were given TXA while 14 patients served as the control group and did not receive TXA. During surgery, there was a note of minimal bleeding especially upon skin incision and muscle splitting compared to those patients without TXA. Results also showed that there were significant differences in the drop in hemoglobin and hematocrit levels and in the estimated blood loss compared to the control group. During this study, we also note that the rate of blood transfusion were minimized on the TXA group compared to the non-TXA group.

In a meta-analysis study by Dai et al, (2018) on the effectivity of tranexamic acid for reducing bleeding and transfusions in primary total knee arthroplasty, it revealed that TXA is safe and effective and no note of adverse effects were mentioned during the procedure.

Vijayet al (2016) reported in their study that TXA significantly reduces postoperative blood loss and transfusion requirements during major hip and femoral surgeries.

**IV. CONCLUSION**

The results of the study showed that there is a significant difference in the drop in the hemoglobin and hematocrit level between the patients who received tranexamic acid and those who did not receive tranexamic acid. Furthermore, there is also a significant difference in the estimated blood loss between the two groups. This showed that tranexamic acid is an effective prophylactic drug that reduces bleeding among patients with femoral shaft fracture undergoing open reduction interlocked intramedullary nailing.

**Recommendation**

For future studies, large sample population size and inclusion of patients with more complicated femoral fractures is recommended to further evaluate the use of TXA for orthopedic surgery specifically femoral shaft fracture. Rate of blood transfusion may also be included as one of the variables in future studies to further determine the effectivity of TXA in reducing blood loss.

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# The Influence Of Transformational Leadership Style And Organizational Commitment To Teacher Performance Through Work Satisfaction As An Intervening Variable

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**Abstract**— This study has the aim to find out: 1). the effect of the principal's transformational leadership style and organizational commitment on job satisfaction and teacher performance; 2). the effect of job satisfaction on teacher performance; 3). the significance of job satisfaction in mediating the effect of transformational leadership styles and organizational commitment on teacher performance. This research was conducted in Malang Regency High School, East Java, Indonesia. Retrieval of data using a questionnaire instrument to assess respondents' perceptions that contain 41 statement items. The sampling technique in this study was carried out by the method of purposive sampling with the number of respondents totaling 54 teachers, all of whom were ASN status and were already certified. Data analysis uses multiple linear regression followed by path analysis (path analysis) to compare the effectiveness of direct and indirect effects through intervening variables (job satisfaction). The conclusions of this research are: 1). Transformational leadership style and organizational commitment influence job satisfaction and teacher performance; 2). Job satisfaction affects teacher performance; 3). Job satisfaction mediates the effect of transformational leadership styles and organizational commitment on teacher performance.

**Index Terms**— transformational leadership style, organizational commitment of teacher performance, teacher job satisfaction

## 1 INTRODUCTION

In the industrial era 4.0 as it is today, quality education is a must to prepare the nation's next generation to face the future. The quality of education can be achieved by striving to improve all systems and components of education such as improving the quality of teacher performance, curriculum improvement by the times, the distribution and improvement of educational facilities, creating a conducive learning climate, and government policies that favor education progress. (Mulyasa: 2007: 36). Teacher performance is a key factor in school success in creating an ideal learning environment and learning process.

The teacher with ASN status in 2020 has a fairly high welfare compared to several decades before. As a result, the salary scale factor is not a dominant factor in improving performance. Job satisfaction is more influenced by factors of work atmosphere, comfort of working with other teacher colleagues, as well as factors that are reassuring principals and non-authoritarian leadership. Principal's leadership is an important factor in influencing the level of job satisfaction of teachers and employees in schools.

Furthermore, organizational commitment also becomes an important variable in several studies of performance because the organizational commitment has an impact on teacher performance and job satisfaction. If the teacher has a high organizational commitment, then he will do the job, responsibility, and work as well as possible in school. Thamrin (2012) conducted a study whose results showed that organizational commitment and transformational leadership had a positive effect on job satisfaction and employee performance. Kovjanic (2013) reinforces the statement and states that job satisfaction becomes an intervening variable between transformational leadership variables and employee performance. Siswanti's research(2014) also found the conclusion that job satisfaction acts as an intervening variable or a mediating variable.

Research on the transformational leadership style of high school principals and their influence on teacher performance is currently rarely conducted in Malang Regency, East Java. Job satisfaction that affects teacher performance also needs to be examined whether it has anything to do with transformational leadership. Of course, the organizational commitment variable which is also a factor of good and bad teacher performance also needs to be examined.

With the above background, the researcher wants to uncover the influence of transformational leadership styles and organizational commitment on teacher performance with job satisfaction as an intervening variable. The author finds the following problems that need to be investigated: 1) an influence on the principal's transformational leadership style on teacher performance; 2) an effect of

organizational commitment on teacher performance; 3) Is there an influence on the principal's transformational leadership style on teacher job satisfaction; 4) an effect of organizational commitment on teacher job satisfaction; 5) an influence of job satisfaction on teacher performance; 6) job satisfaction mediate the effect of transformational leadership style and organizational commitment on the performance of teachers.

## 2. RESEARCH METHODS

The design used in this study is a quantitative survey method. The method approach is ex post facto because research variables already exist and events have occurred before without any treatment or manipulation of the independent variables of the researcher. This study assesses respondents' perceptions that include the relationship of independent variables, namely transformational leadership of school principals and teacher organizational commitment with intervening variables, namely teacher job satisfaction and dependent variables, namely teacher performance in 5 state high school, namely Sumberpucung state high school, Pagak state high school, Kepanjen state high school, Gondanglegi state high school, Tumpang state high school, and all of them are in Malang Regency, East Java. Data collection in this study was carried out by a questionnaire containing 41 items of statements, interviews, and a literature study. The testing instrument of the results of filling out the questionnaire by respondents in this study consisted of the validity test and the reliability test. The classic assumption test consists of multicollinearity, autocorrelation, heteroscedasticity, and normality tests. Furthermore, linear regression analysis is used to examine the direct effect of transformational leadership styles and organizational commitment on job satisfaction and to find out how much influence. Whereas multiple linear analysis is used to examine the direct influence of transformational leadership style, organizational commitment, and job satisfaction on teacher performance and how big and significant the effect is. Hypothesis testing consists of several steps, namely: total determination coefficient, statistical test f, t-test. After all, tests have been carried out, proceed with path analysis. This analysis was conducted to test the magnitude of the effect of intervening variables in bridging the independent and dependent variables.

## 3. RESULTS AND DISCUSSION

### a. Multicollinearity Test Results

The results of the search for VIF values are presented in table 4.10.

Table 4.10

Multicollinearity Test Results

| Variabel                          | VIF            |                |
|-----------------------------------|----------------|----------------|
|                                   | Substructure 1 | Substructure 2 |
| Transformational leadership style | 1,348          | 1,522          |
| Organizational commitment         | 1,348          | 1,516          |
| Job satisfaction                  | -              | 1,516          |

Source: Primary data, processed 2020

The multicollinearity test results in table 4.10 illustrate that all the independent variables for substructure 1 and substructure 2 turned out to be less than 5 VIF values, as stated in the above theory that if the VIF value is less than 5 then it means that the regression model in this study is independent and free from the problem of multicollinearity.

### b. Autocorrelation Test Results

Autocorrelation should not occur in the regression model because if it occurs then the sample variant is considered unable to represent the population. We can see an equation that does not occur autocorrelation there by looking at the Durbin-Watson value. Based on the results of SPSS version 20 test results are as follows.

Table 4.11

Autocorrelation Test Results

| No | Variable       | Du   | Durbin Watson | 4-Du | Keterangan                  |
|----|----------------|------|---------------|------|-----------------------------|
| 1  | Substructure 1 | 1,63 | 2,140         | 2,37 | No autocorrelation occurred |
| 2  | Substructure 2 | 1,67 | 1,717         | 2,33 | No autocorrelation occurred |

Source: Primary data, processed 2020

Table 4.11 illustrates that the value of the Durbin Watson sub-structure 1 is 2.140 greater than 1.63 (Du) and smaller than 2.37 (4-Du). The conclusion is that autocorrelation does not occur. The Durbin Watson sub-structure 2 value of 1,717 is greater than 1.67 (Du) and smaller than 2.33 (4-Du). The conclusion is the same, namely no autocorrelation.

### c. Heteroscedasticity Test Results

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Multiple regression models should not occur heteroscedasticity in them. This heteroscedasticity test was performed using the Glejser test.

Table 4.12

Heteroscedasticity Test Results

| Variabel                          | P value Substructure 1 | P value Substructure 2 |
|-----------------------------------|------------------------|------------------------|
| Transformational leadership style | 0,998                  | 0,995                  |
| Organizational commitment         | 0,988                  | 0,997                  |
| Job satisfaction                  | -                      | 0,994                  |

Source: Primary data, processed 2020

Table 4.11 shows that all independent variables have significance whose value is greater than 0.05 so it can be concluded that heteroscedasticity does not occur. Therefore, the multiple regression model used in this study is appropriate for the prediction of teacher performance based on input from each independent variable.

**d. Normality Test Results**

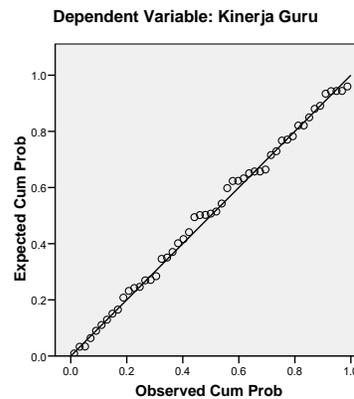
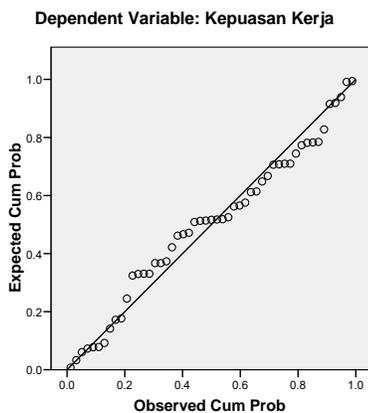
If the point data is spread around a diagonal line, then this shows data that has been normally distributed and vice versa if the tiki points are spread vertically horizontally and away from the diagonal axis means that it is not normal. The normality test is carried out on substructure 1 and substructure 2.

Figure 4.1 and 4.2

Data Normality Substructure 1 & Substructure 2

Normal P-P Plot of Regression Standardized Residual

Normal P-P Plot of Regression Standardized Residual



Source: Primary

In figures 4.1 and 4.2, it can be seen that the data (points) reside and follow the flow of horizontal lines. This indicates that the research data relating to the research variables have a normal distribution.

**Structural Equation Model Test Results**

$$\begin{aligned}
 R^2 &= 1 - \boxed{\times} \\
 &= 1 - \boxed{\times} \\
 &= 1 - \boxed{\times}
 \end{aligned}$$

$$\begin{aligned}
 &= 1 - (0,812) (0,455) \\
 &= 1 - 0,370 \\
 &= 0,630
 \end{aligned}$$

The total value of the determination coefficient of 0.630 means that 63% of the diversity of information that can be explained by the model. The information contained and recorded in the data is 63% which can be explained by the model, the rest (37%) has not been found in the model and errors.

**1. The influence of transformational leadership styles and organizational commitment on job satisfaction**

To analyze and test the effect directly and calculate how much the direct effect can use the linear regression method. The results of the calculations are described in table 4.13 below.

Table 4.13

Effect of Transformational Leadership Styles and Organizational Commitment on Teacher Job Satisfaction

| Variabel                            | Regression coefficient | t value | P value |
|-------------------------------------|------------------------|---------|---------|
| Transformational Leadership Styles  | 0,339                  | 2,492   | 0,016   |
| Organizational Commitment           | 0,333                  | 2,446   | 0,018   |
| R                                   | =                      | 0,583   |         |
| R square (R <sup>2</sup> )          | =                      | 0,340   |         |
| Adjusted R Squared                  | =                      | 0,313   |         |
| t value                             | =                      | 12,388  |         |
| P value                             | =                      | 0,000   |         |
| Variabel endogen = Job Satisfaction |                        |         |         |

Source: Primary data, processed 2020

By looking at the data in table 4.13 it can be concluded that the effect of transformational leadership style on teacher job satisfaction is significant at the level alpha of 5% and p of 0.016, with a regression coefficient of 0.339. It can also be interpreted as the better the transformational leadership style is applied, it can increase job satisfaction. The effect of organizational commitment on job satisfaction is significant at the level of 5% with a p-value of 0.018, and a regression coefficient of 0.333. The meaning is organizational commitment affects teacher job satisfaction. Therefore, if a person has a high organizational commitment, job satisfaction will also increase.

The magnitude of the coefficient of determination is shown by the summary model, where the Adjusted R Squared value is 0.340 or 34% and the magnitude of the influence of other variables is 66%. This illustrates that the contribution of the influence of transformational leadership style variables and organizational commitment to the teacher job satisfaction variable is 34%. While 66% of other job satisfaction variables are influenced by several other variables not found in this study.

**2. The Effect of Transformational Leadership Style, Organizational Commitment and Job Satisfaction on Teacher Performance**

To analyze and test the effect directly and calculate how much the direct effect can use multiple linear regression methods. The test results can be seen in Table 4.14.

Table 4.14

The Effect of Transformational Leadership Style, Organizational Commitment, and Job Satisfaction on Teacher Performance

| Variabel                               | Regression coefficient | t value | P value |
|--|------------------------|---------|---------|
| Transformational Leadership Style      | 0,676                  | 8,246   | 0,000   |
| Organizational Commitment              | 0,176                  | 2,149   | 0,037   |
| Job Satisfaction                       | 0,177                  | 2,161   | 0,036   |
| Variabel endogen : Teacher Performance |                        |         |         |
| R                                      | =                      | 0,890   |         |
| R square (R <sup>2</sup> )             | =                      | 0,793   |         |
| Adjusted R Squared                     | =                      | 0,779   |         |
| F value                                | =                      | 59,848  |         |
| P value                                | =                      | 0,000   |         |

Source: Primary data, processed 2020

Data 4.14 above explains that the influence of transformational leadership style on teacher performance is significant at the level of 5% with a p value of 0,000 and a regression coefficient of 0.676. It can be concluded that the transformational leadership style influences teacher performance, the better the application, the teacher's performance will also improve. Furthermore, the effect of

organizational commitment on teacher performance is significant at the level of 5% with a p value of 0.037, a regression coefficient of 0.176. It can be concluded that organizational commitment influences teacher performance. So the better and higher organizational commitment a teacher has, the better his performance will be.

The effect of job satisfaction on teacher performance is significant at the level of 5% with a p value of 0.036, a regression coefficient of 0.177. It can be concluded that job satisfaction affects teacher performance, the better job satisfaction the teacher performance will also increase. The value of adjusted R square is 77.9% and the influence of other variables is 22.1%. It can be concluded that the contribution of the influence of transformational leadership style variables, organizational commitment and, job satisfaction to teacher performance variables is 77.9%, while 22.1% of the teacher performance variables is influenced by variables that do not exist in this study.

### 3. Effect of Transformational Leadership Style and Organizational Commitment on Teacher Performance Through Job Satisfaction

Path analysis is used as a hypothesis testing method in this study, namely by using multiple regression, then carried out filtering and significance. To see the influence between research variables is shown in table 4.15 below.

Table 4.15

Summary of Results of Direct, Indirect, and Totals from Path Analysis

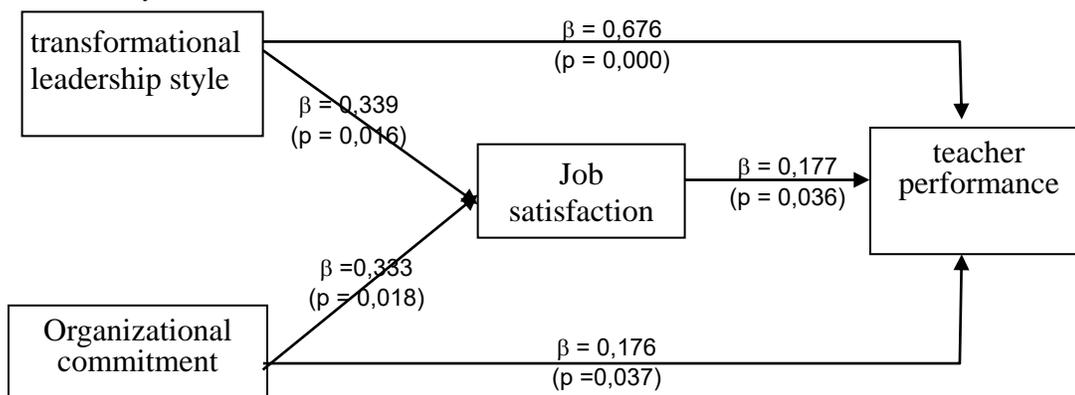
| Variabel   | Direct Effects | Prob   | Indirect Effects      | Total Influences |
|--|----------------|--------|-----------------------|------------------|
| Transformational leadership style → Job satisfaction                       | 0,339          | 0,016* | -                     | -                |
| Organizational commitment → Job satisfaction                               | 0,333          | 0,018* | -                     | -                |
| Transformational leadership style → Teacher Performance                    | 0,676          | 0,000* | -                     | -                |
| Organizational commitment → Teacher performance                            | 0,176          | 0,037* | -                     | -                |
| Job satisfaction → Teacher performance                                     | 0,177          | 0,036* | -                     | -                |
| Transformational leadership style → Job satisfaction → Teacher performance | 0,676          | -      | 0,339 X 0,177 = 0,060 | 0,736            |
| Organizational commitment → Job satisfaction → Teacher performance         | 0,176          | -      | 0,333 X 0,177 = 0,059 | 0,235            |

Source: Primary data, processed 2020

Based on Table 4.15, it can be seen the total effect of the transformational leadership style variable on teacher performance is (0.736) and greater than the direct effect (0.676). Likewise for organizational commitment variables on teacher performance, where the total effect is greater (0.235) the amount of direct influence (0.176). These results indicate that job satisfaction is an intervening variable in the influence of transformational leadership style and organizational commitment to teacher performance because the total value is greater than the value of direct influence.

Figure 4.3

Path Analysis Results



Source: Primary data, processed 2020

#### **a. Description of Transformational Leadership Styles, Organizational Commitment, Job Satisfaction, and Teacher Performance**

Transformational leadership style is formed by 4 factors namely Idealized influence, Inspirational Motivation, Intellectual stimulation, and Individualized consideration. The main thing that shapes the transformational leadership style is that Individualized consideration is reflected in the Principal willing to listen to the difficulties and complaints experienced by teachers at school. A leader must be sensitive and concerned about the problems experienced by his subordinates and always motivate them to solve these problems. The channel to collect the complaints is usually done in an informal condition during lunch together or formally during an official meeting with the teachers. That way the teacher will feel enthusiasm and comfort at work and awareness arise to change better every day. How is the view of Bass and Avolio (1994) states that the transformational leadership style is a leadership style in which a leader and his subordinates together improve morale and mutual motivate so that they can develop and achieve better performance.

Organizational commitment is formed by Affective Commitment, Continuance Commitment, and Normative Commitment. The main thing that supports organizational commitment is Affective Commitment reflected by respondents feeling comfortable working in this school. Following what was conveyed by Allen and Meyer (1990) that affective commitment is the emotional connection of an employee to his company. This commitment is influenced by the comfortable conditions felt by employees and the feeling of belonging to the organization. The comfortable feeling at work felt by the teachers increases their organizational commitment.

Job satisfaction consists of satisfaction with salaries, promotional opportunities, coworkers, and satisfaction with supervisors. The main thing that can support job satisfaction is that satisfaction with co-workers is reflected in the respondents enjoying the process of working with other teachers. Colleagues are one of the important factors to increase teacher job satisfaction because they have great job satisfaction when encouraged by coworkers who trust each other at work. The teacher with ASN status in 2020 has a fairly high welfare compared to several decades before. As a result, the salary scale factor is not a dominant factor in increasing job satisfaction. Job satisfaction is more influenced by factors of work atmosphere, the comfort of working with other teacher colleagues, As Lufthans (2006) states that job satisfaction is influenced by whether or not relationships between co-workers.

The main thing that can improve teacher performance in this study is the evaluation of learning which is reflected in the answers of respondents who use a variety of assessment methods (practice, craft assignments, project assignments, etc.) and hold additional hours and special consultations for students whose grades are not good. According to the Ministry of National Education (2008: 21) Teacher performance is an effort made by teachers to carry out learning tasks as well as possible in planning teaching programs, implementing learning activities, and evaluating learning outcomes. The ability factor in evaluating learning is very important to master because it relates to future learning planning so that it is better and mistakes in previous learning are not repeated. Evaluation is also useful for measuring how much learning objectives can be achieved.

#### **b. The Effect of Transformational Leadership Style on Job Satisfaction**

The Transformational leadership style affects job satisfaction. Transformational leadership style plays a role in increasing job satisfaction, because if a school teacher does not feel satisfied at work, then the objectives of the school will not be achieved. Applying a transformational leadership style means the leader will lead, guide, influence, motivate workers, and work with all teachers to achieve the goals to be addressed. That way the teachers will feel cared for and increase their job satisfaction. The results of this study support Priyatmo (2018), Anggraeni & Santosa (2013), Thamrin (2012), Handoko (2015), Nugroho (2018), Umer (2012) who stated that transformational leadership styles affect job satisfaction.

#### **c. Effect of Organizational Commitment on Job Satisfaction**

Organizational commitment affects job satisfaction, which means the higher organizational commitment can increase job satisfaction. Teacher job satisfaction is a very important factor in efforts to achieve school success. The success of the school is inseparable from the role of the teacher involved because if the teacher has a high organizational commitment, the teacher will be more productive in quality in doing his work.

Organizational commitment is closely related to job satisfaction. Teachers who have a high organizational commitment to school tend to be more satisfied and will also be comfortable working at school because they consider school to be part of their family. Teachers who have high organizational commitment will do more than are assigned to them. Recognizing the importance of organizational commitment, the teacher's commitment to the organization needs to be developed. The results of this study support Nugroho (2018), Wardani, et al (2017) who state that organizational commitment influences job satisfaction.

#### **d. The Effect of Transformational Leadership Style on Teacher Performance**

Transformational leadership style influences teacher performance, which means that if the application of transformational leadership is done well, teacher performance will increase. Transformational leaders make subordinates believe, respect, and are loyal to these leaders so that teachers are always motivated to work faster and more compact and synergistic. A leader must be able to be in front of being an example, working with employees to move them and always motivating them to work better. The results of this study support Priyatmo (2018), Thamrin (2012), Handoko (2015), Nugroho (2018), Umer (2012), Budiwibowo (2014), Wardani, et al (2017), Sunarsih (2017) who state that leadership styles transformational effect on performance.

#### **e. The Effect of Organizational Commitment on Teacher Performance**

Organizational commitment has a significant effect on teacher performance. When seen from the positive regression coefficient, it can be concluded that the higher the organizational commitment the teacher's performance will also be higher, and vice versa. Commitment to each teacher is very important because it is directly proportional to the teacher's responsibility for his work compared to teachers who have low organizational commitment. Teachers who have organizational commitment will work optimally so that they can devote their attention, thoughts, energy, and time to their work as expected by the school. The results of this study are in line with Nugroho (2018), Wardani, et al (2017) who prove that organizational commitment influences teacher performance.

#### **f. Effect of Job Satisfaction on Teacher Performance**

Job satisfaction has a significant effect on teacher performance. This means that the higher the level of job satisfaction, the teacher's performance will also increase. When a teacher feels happy and satisfied inside work then he will feel at home in school doing the tasks and responsibilities by predetermined targets.

Satisfied teachers will encourage teachers to perform better. Teachers who feel satisfied at work always arrive on time. The teacher becomes happy and does not complain about the tasks and work in carrying out their work. Teachers who have job satisfaction also appear from harmonious relationships with other teachers and superiors. The results of this study support Priyatmo (2018), Thamrin (2012), Handoko (2015), Nugroho (2018), Wardani, et al (2017) who state that job satisfaction influences performance.

#### **g. The Effect of Transformational Leadership Styles and Organizational Commitment on Teacher Performance Through Job Satisfaction**

Job satisfaction can mediate the influence of transformational leadership styles on teacher performance, which means that transformational leadership styles can improve teacher performance if the teacher feels satisfied in carrying out his duties and responsibilities. This shows that job satisfaction plays a role in increasing teacher performance, because every teacher who works at school, must be satisfied at work. If at a school the teacher does not have a sense of satisfaction at work, then the performance will be low. With a transformational leadership style, follower trust is followed and the leader behavior attributes, the teacher is more comfortable, motivated and without feeling pressured, so the teacher achieves the expected performance of the leader. The results of this study support Priyatmo (2018), Handoko (2015), Wardani, et al (2017) who choose the statement that job satisfaction mediates the effect of transformational leadership on performance.

Job satisfaction can bridge the effect of organizational commitment on teacher performance, which means that teachers who have a high level of organizational commitment can improve teacher performance if they are satisfied at work. The results of this study support Nugroho (2018) which states that job satisfaction becomes a mediating variable in the study of the effect of organizational commitment on performance. Pradiansyah (1999: 31) describes that without organizational commitment, it is difficult to expect an active and serious role from existing employees. Commitment is not something that just appears. A Commitment must be fostered and fostered. Therefore commitment must continue to be built to stick in the hearts of employees in this case the teacher.

### **4. CONCLUSIONS AND SUGGESTIONS**

Based on the analysis of the results of the research and the discussion carried out, the conclusions can be drawn as follows: 1) Descriptive statistical results show that the transformational leadership style is formed by Idealized influence, Inspirational Motivation, Intellectual stimulation and Individualized consideration. The main thing that shapes the transformational leadership style is that Individualized consideration is reflected in the Principal willing to listen to the difficulties and complaints that are experienced. Organizational commitment is formed by Affective Commitment, Continuance Commitment and Normative Commitment. The main thing that supports organizational commitment is Affective Commitment reflected by respondents feeling comfortable working in this school. Satisfaction with salary, promotion opportunities, coworkers, and satisfaction with the principal's leadership. The main thing that can support job satisfaction is that satisfaction with co-workers is reflected in the respondents enjoying the process of working with other teachers. Teacher performance is shaped by the process of planning learning, carrying out learning activities and evaluating learning outcomes. The main thing that can improve teacher performance is that learning evaluation activities are reflected in respondents who use a variety of assessment methods and hold additional hours and special consultations for students whose grades are poor; 2) Transformational leadership style affects job satisfaction, which means that the better application of a transformational leadership style can increase job satisfaction; 3) Organizational commitment affects job satisfaction, which means that a higher level of organizational commitment can increase job satisfaction; 4) Transformational leadership styles affect teacher performance. This means that teacher performance can be improved through the application of a good transformational leadership style; 5) Organizational commitment influences teacher performance, which means that teachers who have a high level of organizational commitment can increase teacher performance; 6) Job satisfaction affects teacher performance, which means that higher job satisfaction can improve teacher performance; 7) Job satisfaction mediates the effect of transformational leadership styles and organizational commitment on teacher performance. This means that the better application of transformational leadership styles and supported by high organizational commitment can improve teacher performance if teachers have high job satisfaction at work.

Suggestions related to the results and discussion of the above research are as follows: 1) It is better if the principal as a leader is willing to listen to ideas and input from the teachers. Feedback can be heard through meetings or even informal activities at lunch, rest, etc.; 2) For employees to have a high organizational commitment, the leader should create a conducive working atmosphere at school, one of which is by harmonizing relations between teachers, so that teachers feel comfortable and happy working at school; 3) School leaders should always pay attention and increase teacher job satisfaction so that they perform better

For the next researcher, it is necessary to develop more broadly with variables that are not only limited to this research variable, for example, coupled with the teaching experience variable, increasing the number of school objects studied, or examining the influence of the corona virus pandemic (COVID-19) which is now taking place.

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# Sri Lanka – GCC temporary economic migration corridor and the circular migration of Female Domestic Workers

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**Abstract-** Sri Lanka-GCC temporary economic migration corridor which boomed in the early 1980s quickly became feminized with increasing number of women moving back and forth as Female Domestic Workers. The recruitment process of Female Domestic Workers in Sri Lanka presents several peculiarities. Apart from well-established push and pull factors of economics, there are a number of mooring factors which forms the migration decision especially in the Female Domestic Workers who follows a circular migration pattern. A survey conducted in 2019 in Kuwait and Saudi Arabia sheds some light on these mooring factors. It provides that monetary gain is the main push and pull factor and factors such as debt free departure, psychosocial assurance through upfront payments, familiarity with destination, personal networks, escapism, socio-cultural traits and negative stereotyping are operate as mooring factors in migration decision. The study underlines that some of the established ideas on female migrant domestic workers cannot be applied in *toto* to circular Female Domestic Migrant Workers.

**Index Terms** - Sri Lankan female migrant worker, Sri Lanka GCC migration corridor, circular migration, migration agent

## I. INTRODUCTION

Migration for economic purposes is a global occurrence and a historical development. From different types of economic migration patterns, the temporary economic migration has become the prevalent and growing trend in the post-world War II era. One of the world's largest outflows of temporary migrant workers are originating from the Asian region heading mainly towards the Member States of the Gulf Cooperation Council (GCC) in the Middle East.

The oil boom in the 1970s in the Arabian states (now referred to as GCC Member States) provided an impetus to jump-start large scale development projects, which required large amount of labour at all levels. The abolition of slavery (1962 in Saudi Arabia and the rest earlier) and radical changes occurred in lifestyles also attracted a segment of workers employed by households for domestic work. At the inception, temporary migrant labour in GCC Member States was sourced from the neighbouring countries and from Africa. By the mid-1980s this

trend had changed and the Afro-Arabian labour was swapped for Asian labour. This was an attempt to avoid the spread of radical and socialistic political ideologies, as well as to safeguard the political interests of monarchies in the Gulf. The underlying perception of the Asian workforce was to the effect that politically neutral, docile, flexible, easily monitored and filtered and willing to work at lower wages (Rajan, 2020; Kapiszewski, 2006). The 'open door demographic policy' adopted by the GCC countries, allowed temporary migration without age or skills restrictions. All these factors encouraged large scale Asian migration (Hussain, 2016; Al-Ubaydli, 2015) and thus established the Asia-GCC migration corridor. The absorption of migrant workers into the GCC Member States has been extraordinary, with 90 percent of the population in states such as the State of Qatar consists of temporary non-resident migrant workers (Babar and Gardner, 2016). The Asians, both male and female, who migrated to GCC regions were predominantly low skilled workers, including construction workers, truck drivers, cooks, helpers, office boys, custodians and domestic servants. A limited portion of professional/skilled positions were also opened mainly for the South Asians.

As the name denotes, the temporary economic migration is a time-bound, transient flow of migrants from outside the boundaries of a country. Due to its non-permanent nature, migrants have a general intention and plan to return to their place of origin after the assignment (Abella, 2006; Uriely, 1994). The GCC member countries offer opportunities for labour at various skill levels to address their labour needs, whilst permanent immigration of foreigners is neither desired nor socially accepted in the GCC (Baldwin-Edwards, 2005).

A key component in temporary economic migration in the GCC member states is the *kafala* (sponsor) system. This sponsorship system, which has long-standing roots in the cultural traditions of the GCC region, (Babar and Gardner, 2016) provide short term contacts for the migrant workers, in most cases for twenty-four months. This system has come under severe criticism in the recent times, though some of the Gulf countries have made public arguments that any change to this *kafala* system would be detrimental to their economic competitiveness in the global arena (Gardner, 2010). Though many scholars and human rights organizations consider the *kafala* system to be an absolute

deleterious mechanism, new research reveals that the migrants view this system also as a protective apparatus (Matsuo *et al*, 2020). Nonetheless, the issue of 'visa trading' or unofficially 'selling' the worker's visa to another sponsor has become a long term issue. (Al-Ubaydli, 2015) Hiring visa traded workers via the black market is attractive to sponsors as they can bypass recruitment fees and deny workers their full rights. (Al-Ubaydli, 2015; Shah, 2009) This *kafala* system is tied to labour sourcing through manpower agencies and agents. This is a vast profit-making industry (Gardner, 2012) with profit distribution to all agents related to the recruitment process. However, criticism has been levelled at this process as it often forces migrants and their families to incur significant debts (IOM, 2019; Hoang, 2015) and their earnings are often used to cover these debts. This recruitment process has reciprocal causes and effects leading inexorably to a vicious circle, which promotes a circular pattern of migration.

The 'feminization' of the GCC migration corridor began with the GCC economic boom, with an estimated two million Asian women now working in this region (1). Women migrated mainly as reproductive occupations (2) such as domestic work in private households and informal commercial services (Piper, 2008; Yamanaka & Piper, 2005). The Female Migrant Domestic Worker (FMDW) is a special group of migrant workers who migrate from their country of nationality to work in private homes in another country, performing various tasks such as cooking, cleaning, and caring for children or the elderly (Jayasuriya & Opeskin, 2015). International Labour Organization (2013) estimates that sixty-three per cent of the 2.1 million domestic workers in the GCC are women and one in five of them are engaged in domestic work. This group drew considerable attention from researchers in the 1990s due to its size and the issues involved (Wickramasekara, 2002).

Sri Lankan migrant workers joined the workforce in the mid-1980s (Rajan, 2016; Gunatilleke, 1986) with the *laissez-faire* economic reforms introduced in Sri Lanka from 1978. At present, GCC countries are the destination of choice for ninety-four per cent of the Sri Lankan migrant workers (Siriwardene, 2015), among them, a significant portion of female migrant domestic workers (FMDW).

## II. IDEOLOGIES AND MODELS OF ECONOMIC MIGRATION

Classical, Neo-Classical and Structuralist approaches predominate in discerning the social, economic and business factors behind human economic migration. The classic ideology of *homo-economicus* (economic man) is in the root of the ideologies of Classical and Neo-classical ideologies (Gardner, 2012). Classical ideology provides that human agents are constantly rational, narrowly self-interested and assesses optimally the end-results of his/her action (Zabieglik, 2002). This optimal end-result is the economic gain or the 'dollar-hunt', which could be fulfilled by migration. This ideology has been reinforced by the Rational Choice theory (Anisworth, 2019; Levin & Milgrom, 2004). The neo-classical economic ideology premises how market functions are decided based on demand and supply cycle (Jones, 2012; Wiles, 1979). The same ideology can be applied to the labour market, as it determines the demand/

supply of labour and labour migration. The classic push, pull and mooring (PPM) is brought forth with this neo-classical migration ideology. The push and pull factors are linked to migrant workers home state and to the state of his/her destination respectively. The push factors such as extreme poverty, political oppression, poor living standards and less economic opportunities etc. motivate an individual to migrate to another country voluntarily, and the pull factors such as higher wages, demand for labour, political and religious freedom, better education and economic opportunities etc. attracts these individuals to the countries of destination. The 'mooring factors' could be termed as the cost-benefit analysis of the migration decision. The push and pull factors do not work in isolation but interdependently with the mooring factors (O'Reilly, 2015).

Structuralists have presented the nature of modern industrial economies have created an environment for migrant labour. One structural explanation is the concept of 'dual labour markets' (Bentolila *et al*, 2019; Dickins & Lang, 1985; Watcher, 1974; Poire, 1969) which assumes that labour markets in these labour receiving countries consist of two segments; the high-skilled labour sector and low-skilled worker sector. This concept assumes that migration from less developed countries into more developed countries is a result of a pull created by a need for labour in the developed countries in their secondary market, as the natives either do not have the capacity or do not want to perform these jobs. The GCC labour market is a classic example in this context. Another structural approach, the Worlds Systems theory, provides that migration is a natural outcome of the economic globalization (Hoffmann-Nowotny, 1989) and cultural globalization (Strikwerda, 2000). This has further developed into 'post-Structuralist culturalism' (Green, 1994). The 'new economics model' of migration underlines that migration as a decision made by families or groups (Stark, 1984) and the migration decisions are made of an analysis of plausible cost-benefits. The push-pull factors are also being considered in this decision making. Contemporary approaches of migration is an admixture of above theories, models and examine that migration is a process that has more micro-level elements connected to larger macro-level factors connected to economic, social and political factors.

In the context of circular migration, ideologies such as 'cosmopolitanism', Nationalism and Cumulative causation has been brought forth. 'Cosmopolitanism' or the 'working-class cosmopolitanism' (Yeoh, 2013) is based on the ideologies of globalization and developmentalism, is the migrant's privileged access to social capital and economic muscle of the receiving state multiple times. The ideology of nationalism (Ishii *et al*, 2020; Babar & Gardner 2016; Forstenlechner & Rutledge, 2011) has been provided with two ends; first to 'balance the demography' as the foreign workers would shoulder a large portion of work, which otherwise has to be done by the nationals of the country, and second to provide the nationals in the GCC states, a supra status. This translates into the nationalist ideology of the states, where they consider the citizens of the country are the 'men of the soil'. The *kafala* system in place in the GCC is a classic example of this ideology, which is also a symbol of asymmetric power relation between the citizens and the migrants. The idea of cumulative causation (Massey, 1990), propounds that

dynamic interplay of migrant remittances, local income distribution and network growth create a powerful feedback mechanism that sustains a cumulative causation for migrant for repeat migration.

Migration of Sri Lankans, especially the Female Migrant Domestic Workers (FMDWs) is a result of a combination of various factors highlighted in the above ideologies and no single theory could explain all the complexities involved (Ukwatte 2010; Karunaratne & Abeygunawardene, 2018). Piper (2008) underlines that the pattern of migration of females needs to be looked at a 'gendered' point of view as patterns, as well as causes and consequences of the movements, are gender-specific. Giddens (1976) 's structuration approach has been referred to as a plausible base to examine gender and migration in Sri Lanka (Ukwatte, 2010; de Silva, 2006).

### III. ECONOMIC MIGRATION OF SRI LANKA

Sri Lanka is a South Asian island nation, a home to some 21 million people (2018), which is located in the Indian Ocean, South-East of India. Having gained independence from the British Raj in 1948, the country made significant strides in human development and social development. Nevertheless, it is for a long time locked in the economic terms as a developing country and recently graduated to an upper-middle-income country (World Bank, 2018). In terms of human development, Sri Lanka has achieved a near-universal level of education at 96.3 percent (2018), with adult female literacy rate at 90.8 percent (UNESCO), which is the highest in South Asia. The social welfare programs of the governments since independence have positively contributed to a relatively high standard of living. Recent legislative changes have strengthened the rights of women including equality under the law, and in family matters, including marriage, divorce, child custody, and inheritance.

#### Migration patterns of Sri Lanka

Historically, four economic migration patterns could be observed in Sri Lanka. The first flow, to Malaysia, and occurred during the pre-Independence period. Soon after Independence in 1948, Sri Lankan groups migrated to Singapore and Hong Kong. They were predominantly middle-level skilled migrants and the numbers were minute. A large flow of migration occurred in the 1960s when professionals began to migrate to countries such as Australia, Canada and UK, permanently. This was mainly due to the demand for qualified labour in these countries as well as domestic instabilities arising from socio-economic strains. (Dias & Jayasundara, 2004) The next major wave of economic migration occurred in the 1980s to the GCC countries which drew both skilled and unskilled male and female workers for short employment contracts, producing a pattern of circular migration (Gamburd, 2010; Ukwatte, 2005). In 2014 and 2015 Sri Lanka received US\$ 7,036 and 6.98 billion \$ respectively in remittances, which account for 8.4 percent of the GDP, well ahead of earnings from apparel (\$5 billion), tourism (\$ 4.4 billion) and agricultural exports (\$ 2.7bn) of which tea was \$ 1.5bn (Central Bank Report 2015). At present, migrant labour represents 23 per cent of Sri Lanka's total labour force (IPS, 2018).

#### Feminization of migrants and the dominance of Female Migrant Domestic Workers of Sri Lanka

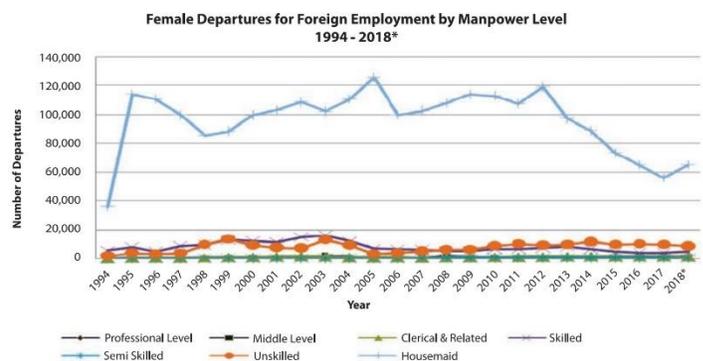
Internal and international mobilization of female labour is one of the outstanding features of the open economy (Ukwatte, 2010) introduced in 1978 to Sri Lanka. This paved the way to evolve the nature of the role of Sri Lankan women from a passive housewife to a breadwinner and provided more active roles in the economic markets (Kottegoda, 2006; Jayaweera, 1995). However, pervasive female unemployment coupled with perceived improvement in socio-economic status of women through economic migration, became a persuasive advertisement for women to migrate for work (Ukwatte, 2010). In the first two decades, starting from 1988, when the statistics are available, female migrant worker departures exceeded that of the males. In 1990, approximately three females departed for every male departure, making Sri Lanka one of the countries which had the highest female migration in the world (Frantz, 2014). Although the demand for Sri Lankan male workers declined in the mid-1980s with the economic slowdown in the GCC countries, the departure of Female Migrant Workers increased further. These numbers later came closer to parity and in 2012, after more than two decades, male departures exceeded female departures for the first time.

Graph 1- Female migration from Sri Lanka - 1986- 2018



(Source- Sri Lanka Bureau of Foreign Employment)

Graph II - Female departures (Female Migrant Domestic Workers vs total Female Migrant Workers)



(Source- Sri Lanka Bureau of Foreign Employment)

The percentage of Female Migrant Domestic Workers (FMDW) or *housemaids*, in common parlance, has fluctuated from 79 – 92 percent from the total female migrations throughout the period. Typically, these Female FMDWs are aged between 35-45 years and educated to 6-10 grade. Some 70 percent of them are unemployed in Sri Lanka and 80 percent of them are married at the time of their departure. (Weeraratne, 2015; SLBFE, 2020). Financially, FMDW's are Sri Lanka's most successful export (Jayasuriya & Opeskin, 2015; Ratha *et al*, 2014) and they contribute as the single largest export earnings (Kelegama, 2004).

#### *High demand for Sri Lankan Female Domestic Workers?*

From the vantage point of the GCC recruiters, several distinct features of the Sri Lankan FMDWs could be highlighted.

*Price point:* Compared to Filipino female migrant domestic workers, Sri Lankan FMDWs are considered to be an inexpensive option. The salary per month of a domestic worker is so low that they are affordable even for low-income level earning families in the GCC (In Saudi Arabia prior to the minimum wage was \$ 120 per month (pre-2000), \$173.50 (2000), \$ 200 (2012), \$ 240 (2013), and \$ 300 (2016 to date) compared to \$ 400 paid for a Filipino domestic worker). This is viewed as a major driver of demand though the comparatively high cost of initial recruiting a Sri Lankan FMDW, at approximately \$ 3500 to \$4,750 per person. (Weeraratne, 2020; Embassy of Sri Lanka Riyadh, 2019). Studies show that the prospective *kafeels* are prepared to spend a higher amount of money to recruit a Sri Lankan FMDW due to the social edge that Sri Lankan FMDWs brings forth over the others.

*Social edge:* Sri Lankan FMDWs has earned a reputation as loyal, obedient, hardworking, multitasking workers. Other particular features underlined are that they are 'clean', well-mannered and showing unwavering love for children (bringing up children as their children) (Sri Lanka Embassy Riyadh & Kuwait, 2019). However, this notion of obedience and hard work have been interpreted as abuse by Ukwatte (2010), Dias & Jayasundere (2004) and Eelens (1990).

#### *Peculiarities of Sri Lanka - GCC Female Domestic Worker Corridor*

*Informal sub-agent culture:* the recruitment of FMDWs in Sri Lanka involves sourcing through formal (licensed) recruitment agents and informal sub-agents. In this recruitment model, the most powerful player is the sub-agent, who is an informal entity operating at the grass-root level to mediate between the formal recruitment agent and the prospective FMDW. This subagent culture is common in South Asian countries, though India has banned this practice while in Nepal they are licensed through formal agents. The growth of subagent culture in Sri Lanka is

mainly due to the increased demand for Sri Lankan FMDWs from the GCC.' Disreputable sub-agents mostly search for the uneducated, creating a 'deception trap' over salary levels, working hours and type of employment (Gardner, 2012). They further entice the prospective FMDW and her family with incentives and edited versions of the success stories of their previous clients. This sub-agent also assists the potential migrant to navigate the migration process. The bargaining power of sub-agents allows them to shop around different recruiting agencies and demand higher commissions for services (Weeraratne, 2018). Sub-agents are criticized for engaging in malpractice which leads to exploitative and abusive situations for migrants. However, it has been argued that formalizing the sub-agent model would lead to low wages and low incentives for the FMDW (Weeraratne, 2018; Pellizzari, 2010).

*Upfront payment of incentives:* In addition to absorbing the entire recruitment cost, paying a fee upfront is a unique practice which largely exists only in the Sri Lanka-GCC corridor, which is also a notable current development. At the beginning, this was provided only to Muslim Female Domestic Workers as a method to attract them to culturally similar families in the GCC (Weeraratne, 2020). In 2016, an FMDW who migrated to Saudi Arabia received an upfront incentive up to US \$ 1,000. This has subsequently decreased and by 2019 the incentive stood at \$ 500 for a novice first-timer and \$ 800 or more for an experienced FMDW with language expertise. This incentive payment has been criticized as a practice which can lead to debt bondage, making it difficult or impossible for a migrant worker to leave an abusive employer. It has also been observed that some of the FMDWs are absconding from the households of their employment, citing non-payment of wages during the initial months of employment. The main reason for this non-payment is the employers 'misunderstanding' that he/she has paid 3 months of wages upfront to the domestic worker. There are instances of some FMDW working for 3-4 months and returning to Sri Lanka only to then proceed to another country to secure the upfront fee again. Upfront payment provides a drive for the circular migration of FMDWs. The United Nations Committee on the Migrant Workers and their Families (CMW) in its Sri Lanka country review in 2016 made a recommendation to 'abolish the practice of having to pay a motivational fee before leaving the State party... and consider adopting a no placement fee policy'(55 (e) CMW 2016).

Given that the 'total cost of migration' is being absorbed by the prospective sponsor, even the poorest of the Sri Lankan poor could leave as a FMDW, which is contrary to the generalized view provided by Tapinos (1990). This is an additional driver which often increases the FMDW's desire for migration.

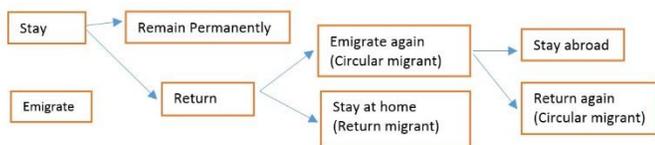
#### IV. CIRCULAR MIGRATION

Though the term 'circular migration' or repeat migration first appeared in the late 1960s and 1970s. By the 1990s, the term was used to refer to international economic migrants in both developing and advanced industrial countries. The iterative dimension or the fluid pattern of back-and-forth cyclic repetitive movement of a migrant across borders is a distinguishing factor of circular migration from the return migration where a migrant

makes only one roundtrip between the places of origin and destination. The migration pattern usually involves both return and repetition (Wickramasekara, 2002) and by definition, all circular migrations are temporary.

Academics have identified two main types of circular migration; spontaneous (voluntary) and managed. The spontaneous circular migration that occurs as a result of migrants' decisions, without government intervention (Newland, 2009). In the managed circular migration, governments seek to facilitate or instigate circular migration, intending to provide an alternative to unauthorized spontaneous migration (Newland, 2009). Circular economic migrants are generically referred to as 'guest workers' or 'temporary workers' and have no right to permanent settlement (Abella, 2006). This movement is viewed positively on the basis of accumulation of human and financial capital (Zimmermann, 2014; Cassarino, 2008; Wickramasekara, 2002).

*Decision tree of circular migration*



(Vadean and Piracha, 2009)

Though circular migration has become the attractive option for many migrants, it has been criticized for its impact on the families of the migrant workers and their communities. While comprehensive global data on circular migration does not exist (Jan & Saarela 2019; Newland 2009), it is estimated that one-third of temporary economic migrants are circular migrants. In the GCC- Asian migration corridor, this comprises a quarter (Wickramasekara, 2013). India, Philippines, Bangladesh, Sri Lanka are identified as the main source countries (Newland, 2009). These workers are employed on fixed-term contracts ranging from one to three years and they re-migrate with new contracts for another similar short-term periods. (Wickramasekara 2013, 2002). Circular migration is one of the most visible migration patterns in the Sri Lanka – GCC migration corridor.

**V. CIRCULAR MIGRATION OF SRI LANKAN FMDWS**

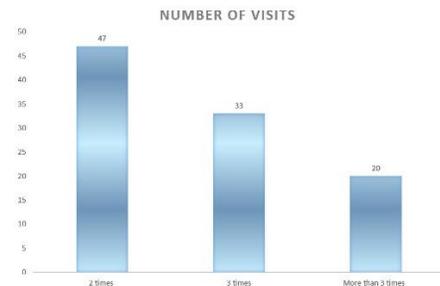
It is estimated that a quarter of Sri Lankan FMDWs who are leaving from Sri Lanka are circular migrants (Wickramasekara, 2013). These female circular migrants are moving back and forth between the GCC multiple times during their adult working life. They start this journey in their mid-20s and return home periodically and, often, permanently when they reach their 40s and 50s, effectively spending almost two decades of their adult life in this migration cycle.

The pattern of 'step migration' where migrants leave the first destination not to return to Sri Lanka but to head to a second destination (Weeraratne, 2015), which could be noted in Sri Lankan male migration, is not prevalent among the FMDWs. The FMDW always returns to Sri Lanka before proceeding to another

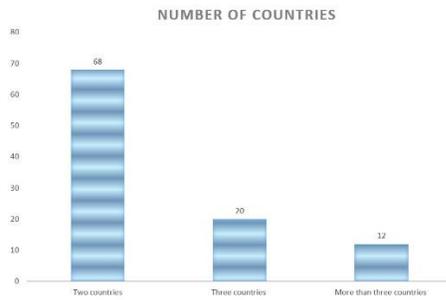
destination. The trend of 'hopping' to multiple destinations in their active working life is a key attribute of Sri Lankan circular FMDW as well. It has been observed that most first time FMDWs are moving to Kuwait and it remains their main choice for repeat migration. Saudi Arabia is their second choice and many FDWs who have served once in Kuwait move to Saudi Arabia. The UAE as a hotspot for FDWs is a recent trend, given the UAEs flexibility in converting tourist visas to work visas. The Sri Lankan government-mediated exclusionary policies, such as minimum age and Family Background Report, has reduced the number of FMDWs leaving the country for GCC with legitimate work visas. However, the flexibility of the visa regime in the UAE has enabled FMDWs to circumvent some of the State imposed barriers in the recent past.

A survey conducted in 2019 involving 100 FMDWs, in Saudi Arabia and Kuwait, historically the two main destinations for Sri Lankan housemaids (Weeraratne, 2014), postulating on the Push Pull and Mooring model (PPM) provides some of the insights to the reasons and motivations circular migration of Sri Lankan FMDWs. The FMDWs involved in this research belong to the age structure spanning from 28-45, which is the general age of the FMDWs (Weeraratne, 2014), are married and have children 10 years or older. The circular migration pattern and demographics of these FMDW are as follows:

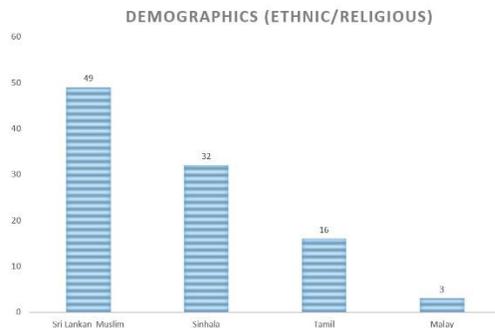
*Graphs III*



*Graph IV*



Graph V

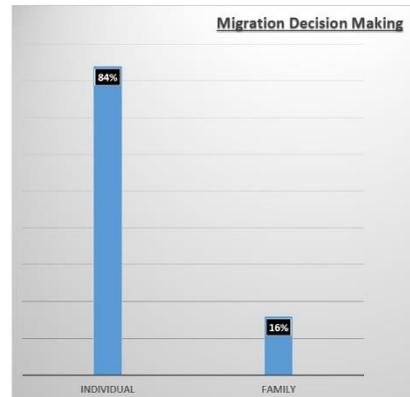


This entire cohort of FMDWs participated in the survey underlined that the primary reasons and motivation for their second departure were economic, with no other means available for them to support their families once they have returned from overseas. This concurs with Gardner (2016), Jayasuriya & Openskin (2015), Ukwatte (2010), Kottegoda (2006) who underline that the cyclic pattern of migration occurs when there are no economic alternatives or opportunities for the migrant workers. Monetary gains which could be made in the migration process has become the main push factor for the FMDW's decision to leave the country. Monetary gains have invariably become the main pull factor as well. (Afsar, 2011; Athukorala, 1990). When deciding with both push and pull factors in play, the entire cohort of the group indicated they are more focused on the economic gain that they receive at the end of the tour of duty which is close to 300 percent higher than they get while in Sri Lanka. This concurs with Gardner (2016) that the circular migrant's analytic lens is principally focused on the end-result rather than the experience.

The main push factors of the Sri Lankan FMDWs, such as higher unemployment, unemployment of husbands and unavailability of economic opportunities (Ukwatte, 2010; Gamburd, 2005; Athukorala, 1990) apply to the circular migrants as well. Other main pull factors such as better country situation, entertainment, access to services, family links (Bandita, 2015; Jayasuriya & Openskin, 2015; Piper, 2013; Rosewarne, 2012) and push factors such as natural disasters, social unrest (Bandita, 2015) have not been underlined by the FMDWs who took part in the survey, except for 3 percent of the FMDWs who cited the internal conflict in Sri Lanka as the reason to leave the country for the second time. The inhibitors of migration, such as policies governing emigration, immigration and border crossing (Czaika and De Haas, 2013) have also not been highlighted by the FMDWs who participated in this survey. Therefore, economic

factor could be seen as the central premise and the only main pull and push factor for Sri Lanka- GCC FMDW circular migration corridor.

Graph VI

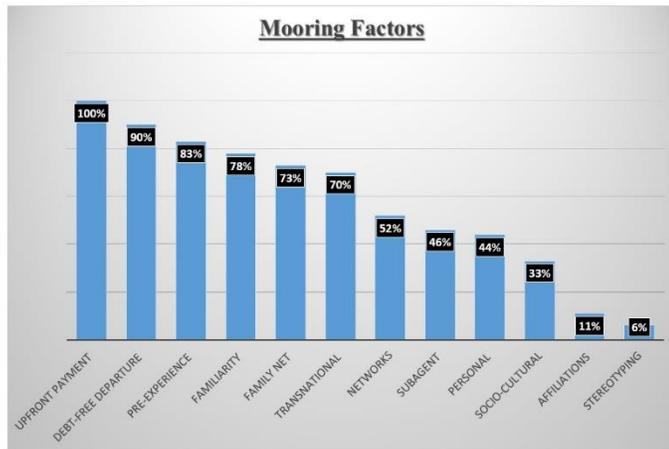


For eighty-four percent of the FMDWs who participated in this survey, the decision to leave the country for the second time or beyond has been an individual decision. The position of Gardner (2016, 2012); Massy *et al* (1998) and Stark (1991), that the decision to migrate to the Gulf is not often an isolated decision process, but a family decision, cannot be applied *in toto* to a circular migrant. It is apparent that the circular FMDW's agency is much higher than that of the first-timer and a circular FMDW takes this individual decision while considering a host of underlying extra-economic personal and social factors.

#### VI. FINDING THE 'OTHER': MOORING FACTORS

There are complex underlying extra-economic reasons connected to the migrant's decision to migrate from the country for a second or subsequent time. These extra-economic reasons/mooring dynamics/ mediating drivers (Van Hear, 2018; Nyberg-Sørensen & Van Hear, 2003) in migration literature were identified as personal (Lee, 1966) and social factors that impact decision of the migration, migration intentions and actions (Moon, 1995). These mooring factors enable, accelerate or diminish the migration decision. The migration decision is a complex interplay of both push and pull factors and moorings to arrive at the best decision taking into account the best options available (O'Reilly, 2015). The survey revealed the following mooring/mediating dynamics:

Graph VII - Mooring factor in migration decision making



**Upfront payment:** The key mooring factor is the ‘upfront payment’ which is being received by the FMDW before her departure. As discussed earlier, this incentive for the FMDW is a major deciding factor to leave the country as well as instant relief from her immediate financial difficulties. The sub-agents who are scouting for prospective FMDWs are focusing on the FMDWs who have returned, as ‘experienced’ FDWs fetch a high price in the labour market. These FMDWs are offered higher ‘upfront payment’ as well as a higher monthly remuneration. This cannot be categorized at face value as a non-economic factor; however, the psychological catalyst that this would provide is more than an economic condition.

**Debt free departure:** The idea of debt-free departure is also an incentive as the total cost of the departure process is being taken care through the payment received from the prospective sponsor. Previous experience: FMDW’s choices and consequences of their past decisions and behaviour (Bakewell *et al.*, 2016) coupled with the previous experience of their occupation also an important factor in the decision making process.

**Familiarity with destination:** Most of the circular migrant FMDWs have developed a bi-localized (Orsella, 2008) identity. In this process, FMDW learns to see the world through a ‘double habitus’, a set of impulses and unconscious motivations which is structured in both places. This bi-focality (Rouse, 1992) could be developed into a hybrid or fluid identity. Localization of cultural and religious markers could be observed in most of the FMDWs who participated in this survey.

**Supportive family safety nets:** A survey conducted in 2008 in Sri Lanka indicates that sixty nine per cent of the women had a relative to take care of their children. This cohort of FMDWs indicated that eighty two per cent of them left their children either with their mother or with the eldest daughter. Upon inquiry as to why not with a relative, the considered answer was that their relatives could not be trusted. Little mention was made on husbands who take care of children. The FMDWs who left their children were of the view that the education of these children improved as they could now afford tuition fees, books etc (3).

**Trans-national relationships:** Their ability to keep the ‘transnational’ relationships (Porters, 1996) and the ‘transnational migration space’ through regular phone calls, regular remittances and active participation in family decision-making at home also brought comfort to the circular migrants and thus an incentive to move with her job.

**Personal networks:** Most of the return migrants keep alive their informal personal networks (Horinuki, 2020; Bakewell *et al.*, 2016), through social media and personal communication media such as Face Book, IMO and WhatsUp groups. In the GCC, migrant workers create subaltern networks while constantly checking the forms of networking that are permitted within the strict controls of the host governments. Ideas exchanged in these groups influence FMDWs decision-making. As revealed in the survey, almost all the survey participants are members of such trans-national networks from which they receive updates, guidance and support for their next expedition. These invisible and informal networks also offer migrants psychological and spiritual fulfilment as well.

**Sub-agent rapport:** The rapport with the recruitment sub-agent and the recruiting agency is another deciding factor. Information received from the migration agents is highly significant within this context. The FMDWs who undertook the survey indicated that sub-agents encouraged them to migrate and offered their support by providing necessary documentation and pre-departure preparations.

**Personal Issues:** These issues are explicitly connected to the family life of the FMDW back in Sri Lanka. The survey revealed that as much as sixty two per cent of the FMDWs returned to Sri Lanka after their first overseas vocation to find that their families were scattered, with husbands abandoning them and moving with other partners. Such women have no other way of survival or motive to stay home and so leave again as FMDWs. Harrowing tales of abusive or dysfunctional relationships were prevalent. For them, circular migration is an effective escape mechanism.

**Socio-cultural issues:** These entails caste, race and religious practices prevalent in the rural areas in Sri Lanka, where most of the FMDWs hail from. A pertinent issue highlighted by the FMDWs is the implicit taboo in the Sri Lankan Muslim society for women employed as domestic aids, though there is no such reservation when they go abroad as FMDWs. This is on the premises of purported affinity of the Muslim society with the GCC countries. Thirty per cent of FDWs who are of the Islam faith provided that the ‘religion’ is a major determinant in returning to Saudi Arabia.

**Personal affiliations:** Survey also revealed that some of the FMDWs have been able to establish connections with men of the same nationality or from other nationalities. These cross border affiliations have also prompted the FMDWs decision to return to the Gulf.

**Negative stereotyping:** Social stigma restricts opportunities for the FMDWs to find other employment or affinities once they are back in Sri Lanka. The idiomization of FMDWs with lurid sobriquet ‘foreign whores’ has increasingly left the FDWs with a myriad of social issues and abuses in their social strata. This negative stereotyping could be identified as a trigger as well as a mooring factor.

The above opinions expressed by the FMDWs surmises the gamut of interrelated powerful mooring factors, which drives the FMDWs to shape her opinion to make a second move to go overseas.

## VII. OTHER OBSERVATIONS

This survey also underlines the failure of managing the return migration in Sri Lanka. Though return migration has been called

the least understood aspect of the migration process (Hall 2017), much focus was given to this aspect in Sri Lanka (ILO, 2015; Collyer *et al.*, 1999; Athukorala,1990). Structuralist ideology underlines that return returnees, once they arrive, tend to orient their savings in unproductive investments and conspicuous consumptions due to their need to be "reaccepted" into society (Cassarino, 2004). This is not completely analogous with the Sri Lankan FMDWs. In most cases, women migrants find very little of their earnings remaining as savings or investment as their family members have used these remittances only for consumption (Kottegoda, 2006). The resultant cumulative causation (Massey *et al.*, 1990) makes the migrant worker's subsequent migration inevitable. Though the Government of Sri Lanka, international organizations such as IOM and other NGOs are placing their focus on educating the FMDWs to manage the return migration, the survey indicated that sixty per cent of the FMDWs are uninformed and unorganized about their return. It was also revealed that ninety per cent of the FMDWs started to "spare some money" for themselves only at the second round of migration circle. This survey revealed that thirty per cent of the second timers and seventy per cent of third timers intended to return to the GCC, which indicates a habitualization of their act, (Cohen & Jónsson, 2011) forming a 'culture of migration'. The survey participants also indicated that their agency is strongly enabled and minimally constrained by structural conditions imposed by an individual's social relations.

This Survey reconfirms that these FMDWs assumed the same domestic chores that they used to carry out before their departure, but with added sophistication. They have not acquired any additional 'employable skill' (4). Therefore the widely held idea of using the skilled acquired aboard in the country of origin is not quite applicable to the return FMDWs. Almost all the FMDWs in the survey accepted that they have 'no skill to do any other job' other than day to day household chores. They had no intention of diverting to other employment options such as employment in Free Trade Zones which is a common option available to unemployed females in Sri Lanka.

### VIII. POSSIBLE TRAJECTORIES OF FUTURE FMDWS

Whilst shifting from the migration policy of the '80s and '90s, at present, the Government of Sri Lanka emphatically and overtly discourages women leaving as FMDWs (5). The implementation of obtaining Family Background Report (FBR), a clearance certificate for FMDWs which came into effect on 15th July 2013 effectively bans women with children under the age of five from migrating overseas. However, this circular has been challenged by various quarters and in October 2016, the UN Committee on Migrant Workers and their families (CMW) in its concluding observations recommended that the State party withdraw this circular (25(e)).

Except for Saudi Arabia (6), these restrictions have not totally discouraged the FMDWs from leaving the country which presents a paradoxical situation. The government's strong aversion towards FMDWs leaving for the GCC corridor has effectively made women search for other alternative departure methods, including through tourist visa, to circumvent the imposed movement restrictions. The government has not placed

a strict imposition barring females leaving the country, mainly owing to the pressure emanating from the Labour recruitment agencies.

### Departures of FMDWs

| Country | 2009  | 2010  | 2011  | 2012  | 2013* | 2014  | 2015  | 2016  | 2017  | 2018  | 2019  | 2020 |
|---------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| KSA     | 42856 | 35107 | 32692 | 58121 | 39871 | 35676 | 28398 | 24358 | 11241 | 13560 | 12852 | 2632 |
| Kuwait  | 31362 | 36020 | 35057 | 29467 | 27021 | 25920 | 22837 | 17770 | 23637 | 31856 | 28519 | 5125 |
| UAE     | 11801 | 11320 | 8925  | 8299  | 12103 | 11882 | 9278  | 7730  | 7239  | 6076  | 6276  | 1639 |
| Oman    | 2805  | 3182  | 2366  | 2020  | 1973  | 2507  | 3451  | 6161  | 5328  | 5277  | 5803  | 1451 |
| Qatar   | 6205  | 7788  | 7005  | 5303  | 5906  | 4136  | 3195  | 2815  | 2739  | 2860  | 2894  | 387  |

Source: SLBFE (2020) \*FBR implementation

At present, the Government of Sri Lanka has adopted a new policy of destination diversification by adding new 'male-oriented' markets such as South Korea, Japan and East European countries and explicitly encourages male workers to leave overseas for skilled work. The main intention of this process is to increase the remittance flows to Sri Lanka by complimenting and countervailing the dip in remittances generated by the FMDWs (SLBFE, 2018). However, the validity of this remittance maximization model has been called to question. Weeraratne (2020) provides that the dip in the remittances since 2015 owes to the decrease in the number of housemaids as well as the increase of skilled male workers, who remit less. The above survey data is also commensurate with the findings that FMDWs are remitting steadily in larger percentages (Le Goff, 2016). However, males who are doing unskilled jobs tend to remit high amounts if they receive a high salary (Karunaratne & Abeygunawardana, 2018) while skilled & professional migrants are remitting less to their home country. If the government of Sri Lanka wants to effectively use the remittance increase model, then they have either to expand the unskilled-high earning sector and skilled workers by a minimum of fifty per cent to substitute the FMDW earnings. The GCC recruiters are of the view that Sri Lanka cannot provide the sufficient numbers and the skill levels of male workers that they seek (7). The Arabization and 'nationalization' processes of the destination countries in the aftermath of COVID-19 pandemic have also cut down both skilled/unskilled male recruitments, but interestingly, this has not affected the domestic sector. Therefore, it is doubtful that the new remittance maximization model of Sri Lanka would work out as it deems to be.

At present, the Government of Sri Lanka faces a dilemma. On one hand, it increasingly desires the remittances provided predominantly by the FMDWs, on the other hand, they have faced challenges in expanding male migrant workers as well as encouraging them to remit more. This leaves the Government with no choice but to allow the neoliberal globalized economic conditions to dictate the terms of migration. Though circular migration is not a panacea, the current circular migration trends are certainly suited to contemporary circumstances.

Given the fact that issues such as the female poverty and structural anomalies of reintegration are yet to be addressed, the circular migration of the FMDWs to the GCC will continue, or perhaps thrive in the current post- COVID 19 situation.

#### END NOTES

1. This is defined as rising number of independently migrating women in the migration streams (Piper, 2005:5)
2. The term 'reproductive' work refers to those activities related to (a) human reproduction and (b) maintaining and sustaining human beings throughout their life cycle (Truong, 1996:32).
3. Most of the FMDWs experience breakdowns in their marriages when they return. Lack of interest for education, poor and wrong leadership and low educational performance are common among the migrant worker's children, including mental and behavioral problems (Ukwatte, 2010)
- 4 For males it is mainly 'de-skilling' as they do menial jobs. (Athukorala, 1990)
5. Consideration of reports submitted by States parties under article 73 of the Convention pursuant to the simplified reporting procedure Second periodic reports of States parties due in 2011 (October 2016)
6. The reductions in mainly visible in Saudi Arabia, and is mainly owing to the negative publicity generated through the execution of an underage domestic worker Rizana Nafeeq in 2012 and opening some markets like Bangladesh and African countries to source domestic workers. Kuwait's flexible visa and labour regime has also become a major pull factor.
7. Author's discussion with the Mega Recruitment Companies in Saudi Arabia revealed that Sri Lanka cannot provided the numbers in categories of skills that they are needed. (December, 2019)

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#### ETHICS

The FMDWs who participated in this survey were ensured confidentiality and received oral and written information about the study topic, aim and procedures, voluntary participation, and their right to withdraw at any time. The interviews were conducted in privacy.

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# Improve Writing Performance for English Majors through the Use of Portfolios

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**Abstract-** English writing is an important skill for students; however, many English majors at universities in Vietnam have problems in writing English. Therefore, the aim of the research is to seek solutions to enhance English writing performance for English majors through the use of portfolios. The specific objectives are to draw up a procedure for creating and assessing writing portfolios, to evaluate the impacts of portfolios on English majors' writing performance, and to collect students' and teachers' feedback regarding the benefits and drawbacks of portfolios and possible solutions to enhance the effectiveness of portfolios. To conduct the study, the quasi experimental research design was used along with the survey and the expert method. Sixty students were chosen randomly; 30 of them were assigned to the experimental group (portfolio) and the others were put into the control group (non-portfolio). All of these students were required to take writing pre-tests and post-tests while only the experimental group answered a feedback questionnaire. The results show that using portfolios plays an important role in improving and enhancing English writing competence for English majors. Students' and lecturers' feedback concerning the use of portfolios in writing courses are, in general, also quite positive. Besides, the research proposes some suggestions for minimizing the shortcomings of using portfolio to enhance the potentiality of this method and make it more interesting, meaningful and effective.

**Index Terms-** academic writing, English majors, portfolio, writing competence, writing assessment.

## I. INTRODUCTION

English writing is one of the essential skills for conveying knowledge gained in a particular field of study. This is an important skill for students in general and English majors in particular because it helps learners memorize, activate and reinforce the vocabulary, grammar features, structures, idioms, and ideas that they have learnt. According to Bello (1997), "writing also enhances language acquisition as learners experiment with words, sentences, and larger chunks of writing to communicate their ideas effectively and to reinforce the grammar and vocabulary they are learning in class".

Writing test results at Thai Nguyen University of Education in Vietnam show that English majors have many problems in writing an English essay. They find it difficult to open up their essays, brainstorm ideas, and employ correct words and structures in their essay. Sometimes, they also have difficulties in organizing the essay in an optimal and logical way. They need a rich source of quality material tailored to their level in order to be able to produce a good writing piece.

Training programs under the credit system have reduced the time students spend studying in classrooms, so students' awareness of self-study, the methods of self-study and the identification of self-studying contents clearly and scientifically have a huge impact on students' English performance. In addition, developing the skills of systematizing learning and reference materials is extremely important because it not only helps students become active and creative in learning but also helps English lecturers direct student-centered teaching methods easily and effectively.

In recent years, portfolios have been used in many English writing classes as portfolios can not only document students' achievements, but also illustrate how their writing skills have developed over the years. Yang (2003) stated: "Portfolio is considered as a compilation of students' work, which documents their effort, progress and achievement in their learning, and their reflection on the materials negotiated for the portfolio". Although the utilization of portfolios to enhance English writing skill has been widely

applied all over the world and showed many positive advantages, this method is still relatively new and less popular among many university students in Vietnam.

Looking into the context of writing classes at Thai Nguyen University of Education, to save time, many lecturers tend to assign students writing tasks and assess their performance merely based on these tasks. However, when portfolios applied in writing class, the conventional teaching style in which teachers give a writing task and students write only one draft no longer takes its dominant place. Instead, students have more opportunities to improve their writing in a series of drafts. They keep making improvements and progress in writing until their product is satisfactory.

Therefore, this study was conducted to seek solutions to enhance English writing skills for English majors through the use of portfolios. The specific objectives are to draw up a procedure for creating and assessing writing portfolios, to evaluate the impacts of portfolios on English majors' writing performance, and to collect students' and lecturers' feedback regarding the benefits and drawbacks of portfolios as well as possible solutions to enhance the effectiveness of portfolios.

## II. LITERATURE REVIEW

### 2.1. Key concepts

#### *Writing performance*

Writing performance can be referred to as the process of performing writing tasks (Wehmeier, 2001). Brown (2000) defined writing performance as the actual production of linguistic events. In the present study, it can be defined as the scores that the students get in the writing tasks.

#### *Writing as a process*

According to Kirby (2002), "the creative writing process permits the author to construct through a series well planned out stages, a thorough piece of writing that is both organized in its presentation and thorough in its development" (p. 1). Seow (2005) defined a writing process as an individual activity with four primary stages, namely planning, drafting, revising, and editing" (p. 315). In the present study, a writing process involves five writing stages that the students have to undergo to produce a writing piece, which are preparing, planning, drafting, revising, and editing. We added the preparation stage into the process as we could see that many of our students need this step to collect related materials to perform their writing tasks. In deed, they need to collect related writing samples, useful language and structures from reliable sources.

#### *The concept of portfolio*

The word portfolio derives from the Latin verb portare, which means to carry and the Latin noun foglio, which means sheets of paper. Barnard & Deyzel (2003) defined a portfolio as a portable, systematic and purposeful collection of works selected to provide information about attitude, level of development and growth during a given period of time. It is a powerful visual tool that can demonstrate evidence of self-assessment, personal reflections, learning, growth and development and a comprehensive overview of skills."

Yang (2003) referred to portfolio as "a compilation of students' work, which documents their effort, progress and achievement in their learning, and their reflection on the materials negotiated for the portfolio". This research adopts this definition as it is suitable with the context of writing classes at our university.

### 2.2 Previous research

Many studies have been conducted to investigate the effectiveness of using portfolio on students' writing performance. For instance, Aydin (2010) carried out a case study at Balikesir University, Turkey, with a group of 39 EFL students. The results suggested that portfolio keeping helps learners to develop not only writing skills, but also content knowledge and grammatical competence; however, some students claimed that portfolio keeping is boring, time-consuming and tiring.

A quantitative study was conducted by Song and August (2002) to compare the writing performance of two groups of advanced ESL students at Kingsborough Community College, City University of New York. Both groups had been enrolled in the course of ENG composition 2. At the end of the course, one group were assessed on the basis of portfolios as well as the writing assessment test while the other were assessed using the writing test only. The results showed that the students were twice more likely to pass the test when

they were evaluated by portfolio than when they were required to do the writing test only. Portfolio assessment seems to be a more appropriate assessment alternative for ESL learners.

Anderson, Mallo, Nee, and Wear (2003) conducted an action research to improve writing skills for first and fifth-graders. These skills involved capitalization, punctuation, word spacing, and the use of descriptive words. The participants consisted of 41 first grade pupils and 69 fifth grade pupils in a elementary school located in a Midwestern suburb. Portfolios and journal writing were selected as intervention strategies for the study. Questionnaires, checklists, rubrics, and document analysis logs were utilized to record the progress of students' writing skills. On a weekly basis, the researchers organized teacher-student conferences to discuss students' writing drafts. The research found that journal writing and portfolios were effective interventions as they showed students' growth and improvements in their writing and reflection.

Apple and Shimo (2004) investigated students' perceptions of portfolio compilation in an EFL setting in Japan. The targeted population were 61 students in two separate universities attending English writing courses. A portfolio of students' works was used as the only means of assessment, and a self report questionnaire was used to gather learners' feedback. According to the research results, the students strongly believed that portfolio creation helped them improve compositional and expressive writing ability. The study also emphasized the benefits of portfolio assessment compared with traditional testing.

It can be seen that there are many studies related to "portfolio" and the results are universal: portfolios can help students improve their writing performance. Therefore, we decided to conduct this research in the context of Thai Nguyen University of Education to build an optimal procedure for creating and assessing writing portfolios, which is suitable to our situation, and then evaluate its impact on our students' writing performance.

### III. METHODOLOGY

#### 3.1. Research design

The present study utilized the quasi experimental research design, which is the pretest-posttest nonequivalent groups to evaluate the impacts of portfolios on English majors' writing performance. The expert method was also employed for gaining comments from experts to optimize the procedure for creating and assessing writing portfolios. Finally, a survey was conducted to collect students' feedback regarding the benefits and drawbacks of portfolios and possible solutions to enhance the effectiveness of portfolios.

#### 3.2. Participants

All the third-year English majors at Thai Nguyen University of Education (TNUE) are the participants of the study. The total number of participants is 60. 30 of them were assigned to the experimental group (portfolio group) and coded as E1-30 while the others were put into the control group (non-portfolio group) and coded as C1-30.

All of these students were required to take a writing pre-test and post-test while only the experimental group answered a feedback questionnaire.

#### 3.3. Data collection instruments and procedure

**Pre-test:** Prior to the experiment, the participants (both experimental and control groups) were given an English Writing Test as a pre-test.

**Post-test:** At the end of the experiment, another English Writing test was given to the students as the post-test.

A pre-post test design requires the researcher to collect data about the students' level of writing performance before the intervention took place, and then to collect the same data after the intervention took place. In this study, the pre-post test design allows the researchers to make inferences on the impact of portfolio compilation on students' writing performance by comparing the differences between the pre-test and post-test results.

The test papers were marked analytically based on IELTS Task 2 Writing Band Descriptors (public version). Students' writing papers were assessed separately by two raters (the researcher and a senior English teacher) on each of the four criteria: Task Achievement, Coherence and Cohesion, Lexical Resource, Grammatical Range and Accuracy. Performance on each criterion was judged along nine levels of performance from 1 to 9. The final score was the average score of the two raters.

**Expert survey questionnaire:** An expert survey questionnaire was administered to collect opinions from a group of 10 experts concerning the procedures for compiling writing portfolios and the Portfolio Scoring Rubric in order for the researchers to perfect these procedures.

**Writing portfolio process**

The experiment took place in one academic year with two academic writing courses. The same writing assignments of the coursebook were given to both experimental and control groups. The two groups were taught by the same teacher (the researcher). While the control group was taught in a traditional way (non-portfolio), the experimental group received the treatment (portfolio compilation).

At the beginning of each course, all the students were well informed of the learning outcomes, which are summarized in the following table.

**Table 1. Outcomes of academic writing courses**

| Academic year     | 2018 - 2019  |  |
|-------------------|--|--|
| Semester          | Semester 1   | Semester 2   |
| Course            | Academic English Writing 1   | Academic English Writing 2                             |
| Learning outcomes | Students are able to:<br>+ produce simple, complex, compound, complex-compound sentences.<br>+ produce different kinds of paragraphs | Students are able to produce different kinds of essays |

The portfolio group were required to show evidence of their learning process and results in the form of a portfolio. They were also guided on the steps of compiling portfolios, considerations, sources of reference materials, kinds of input information, portfolio assessment methods, etc.

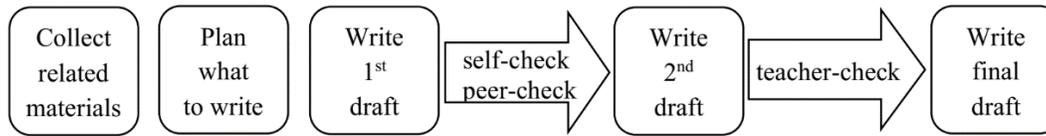
Based on our own experience in teaching writing, we drew up a procedure for compiling portfolios. After revising the procedure several times, we consulted experts, who are also senior English lecturers from some universities in Vietnam. Thanks to their valuable opinions, we could finalize a Procedure for Creating Writing Portfolios, which involves six main stages, namely Preparing, Planning, Drafting, Revising and Editing and twenty steps as detailed in the following table.

**Table 2. Procedure for Creating Writing Portfolios**

| Process          | Step No. | Steps   |
|------------------|----------|---|
| <b>Preparing</b> | 1.       | Collect writing samples from reliable resources             |
|                  | 2.       | Collect useful languages from reliable resources            |
|                  | 3.       | Collect tips from reliable resources                        |
| <b>Planning</b>  | 4.       | Make an outline   |
|                  | 5.       | Identify what to write about                                |
|                  | 6.       | Consider whom to write for                                  |
|                  | 7.       | Generate Wh-questions about the topic                       |
|                  | 8.       | Make a list of ideas on the topic                           |
|                  | 9.       | Freely write down words and phrases about the topic         |
|                  | 10.      | Collect information about the topic selected before writing |
| <b>Drafting</b>  | 11.      | Write a series of drafts                                    |
|                  | 12.      | Focus on contents and the development of ideas              |
|                  | 13.      | Ignore grammar, spelling and punctuation mistakes           |
| <b>Revising</b>  | 14.      | Reread the draft to see if it makes sense                   |
|                  | 15.      | Revise the content of the draft                             |

|                |     |   |
|----------------|-----|---|
|                | 16. | Revise the organization of ideas in the draft.                  |
|                | 17. | Exchange the drafts with peers for suggestions and improvements |
|                | 18. | Review the draft based on the teacher’s comments                |
| <b>Editing</b> | 19. | Rewrite the draft after its revision                            |
|                | 20. | Proofread the draft for spelling, grammar and punctuation       |

The process of portfolio-based writing can be summarized in the following diagram:



**Figure 1. The process of portfolio-based writing**

During the implementation of portfolios, the teacher reviewed the students' portfolio contents and provided comments and suggestions for revision on a weekly basis. No grades were given to the first and second versions; grading is delayed until the final draft of each assignment is submitted. At the end of the academic year, students' portfolios were submitted for final assessment.

**Student feedback questionnaire**

Firstly, the researcher required all the students to write down what they felt about writing a portfolio. Based on their feedback, the questionnaire was designed to gather the participants’ feedback relating to portfolios, including such aspects as procedure/steps, benefits, disadvantages, attitudes of participants and possible solutions to enhance the effectiveness of using portfolios in writing courses. The questionnaire was designed in a mixed format, including 3-point Likert statements, close-ended questions and open-ended questions.

**Portfolio Scoring Rubric**

We have also developed a Portfolio Scoring Rubric (see Table 3) for grading the students' portfolios and perfected it after having consulting experts. Five levels of performance are signified in the rubric: A – Excellent (Score 8.5-10.0), B Good (Score 7.0-8.4), C - Satisfactory (Score 5.5-6.9), D – Poor (Score 4.0-5.4), and F – Failure (Score 0.0-3.9). These levels were identified based on the grading scale of the academic credit system of our university, which is very familiar with the students. For each level, there are five criteria (portfolio completeness, variety of entries, use of different stages in the writing process, organization and presentation, and overall improvement).

Each level reflects students’s writing performance across all the criteria. Under each level, a number of descriptors are included. Such descriptors can make each score level distinct from the others. Therefore, when assessing portfolios, teachers need to consider all the criteria and descriptors together or holistically. The total possible score is 10.0. Clear instructions concerning how to employ this rubric were also provided.

**Table 3. Portfolio Scoring Rubric**

| Score level                           | Criteria  | Descriptors  |
|---------------------------------------|---|--|
| <b>A<br/>Excellent<br/>(8.5-10.0)</b> | 1. Completeness                                   | The portfolio is complete (all the required contents are included).  |
|                                       | 2. Variety of entries                             | The portfolio displays a wide variety of writing pieces.   |
|                                       | 3. Use of different stages in the writing process | The portfolio perfectly reflect use of different stages in the writing process.  |
|                                       | 4. Overall improvement                            | The portfolio highly shows improvement in writing:<br>+ Writing drafts display significant changes and developments in the student’s use of the writing stages.<br>+ Final writing products are almost free of errors and well edited. |
|                                       | 5. Organization and presentation                  | The contents of the portfolio are well organized and well presented.   |

| Score level                             | Criteria  | Descriptors   |
|---|---|---|
| <b>B<br/>Good<br/>(7.0-8.4)</b>         | 1. Completeness                                   | The portfolio is almost complete (less than 20% of the required contents are missing).  |
|   | 2. Variety of entries                             | The portfolio displays a variety of writing pieces.   |
|   | 3. Use of different stages in the writing process | The portfolio contents adequately reflect use of different stages in the writing process.   |
|   | 4. Overall improvement                            | The portfolio shows significant improvements in writing:<br>+ Drafts show acceptable degree of changes and developments in the student's use of the writing stages.<br>+ Final writing products effectively communicate to the reader but contain a few writing errors. |
|   | 5. Organization and presentation                  | The contents are generally well presented and organized in appropriate format.  |
| Score level                             | Criteria  | Descriptors   |
| <b>C<br/>Satisfactory<br/>(5.5-6.9)</b> | 1. Completeness                                   | The portfolio is quite complete (20%-40% of the required contents are missing).   |
|   | 2. Variety of entries                             | The portfolio displays a collection of writing pieces.  |
|   | 3. Use of different stages in the writing process | The portfolio contents somewhat reflect use of the different stages of the writing process.   |
|   | 4. Overall improvement                            | The portfolio shows moderate improvement in writing:<br>+ Drafts display some changes and development in the student's use of the writing stages.<br>+ Final writing products contain several writing errors but do not hinder comprehension.                           |
|   | 5. Organization and presentation                  | The contents of the portfolio are organized in a satisfactory format but there are some problems in presentation.   |
| Score level                             | Criteria  | Descriptors   |
| <b>D<br/>Poor<br/>(4.0-5.4)</b>         | 1. Completeness                                   | The portfolio is generally complete. (40%-60% of the required contents are missing).  |
|   | 2. Variety of entries                             | The portfolio displays a limited collection of writing pieces.  |
|   | 3. Use of different stages in the writing process | The portfolio contents poorly reflect use of different stages in the writing process.   |
|   | 4. Overall improvement                            | The portfolio shows minor improvement in writing:<br>+ Drafts are insufficient to display change and development in the student use of the writing processes.<br>+ Final writing products contain some writing errors that interfere with understanding.                |
|   | 5. Organization and presentation                  | The contents of the portfolio are poorly organized with problems in presentation.   |
| Score level                             | Criteria  | Descriptors   |
| <b>F<br/>Failure<br/>(0.0-3.9)</b>      | 1. Completeness                                   | The portfolio is incomplete. (more than 60% of the required contents are missing).  |
|   | 2. Variety of entries                             | The portfolio displays unrelated writing pieces.  |
|   | 3. Use of different stages in the writing process | The portfolio contents do not reflect use of different stages in the writing process.   |
|   | 4. Overall improvement                            | The portfolio shows little improvement in writing:<br>+ Drafts are not present.<br>+ Final writing products contain numerous errors that hinder comprehension.  |
|   | 5. Organization and presentation                  | The components of the portfolio are organized and presented poorly.   |

Two graders participated in grading the portfolios to eliminate the elements of bias in assessment. Each rator read and marked the students' portfolios independently using the rubric, and then the average of the two raters' scores was calculated to assign a final score.

### 3.4. Data Analysis

The quantitative analysis of data was conducted to assess the effect of the portfolio compilation on the students' writing performance. Collected data were processed manually.

## IV. RESEARCH RESULTS ANALYSIS AND DISCUSSION

### 4.1. The impacts of portfolios on students' writing performance

In order to evaluate the impacts of creating portfolios on students' writing performance, we compared the portfolio group with the non-portfolio group in terms of their writing scores. The following chart illustrates the scores in the writing pre-test and post-test gained by students in both groups.

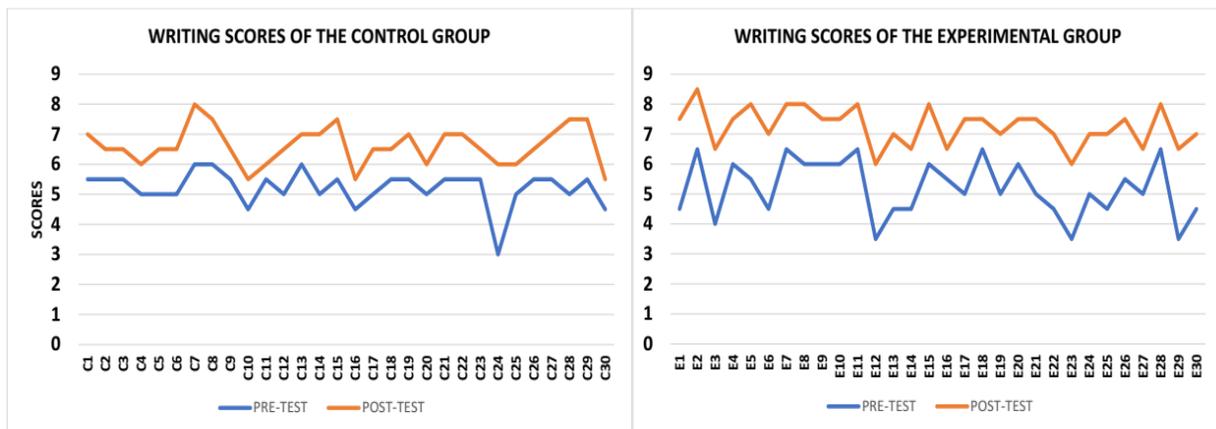


Figure 2. Writing test scores of students

It can be clearly seen that the gap between the pre-test scores and the post-test scores of the experimental group (portfolio) is significantly bigger than that of the control group (non-portfolio). In details, the pre-test scores of both groups are relatively low, primarily ranging from 4 to 6; some students even got mark 3 or 3.5. However, after taking two Academic English Writing Course, their writing performance has improved remarkably. It is visible that the post-test scores gained by the portfolio groups are mainly in the range of 7 to 8. By contrast, the post-test scores of the non-portfolio group are mainly in the range of 6 to 7.

For a more detailed analysis, the average scores of students are calculated and revealed in the chart below:

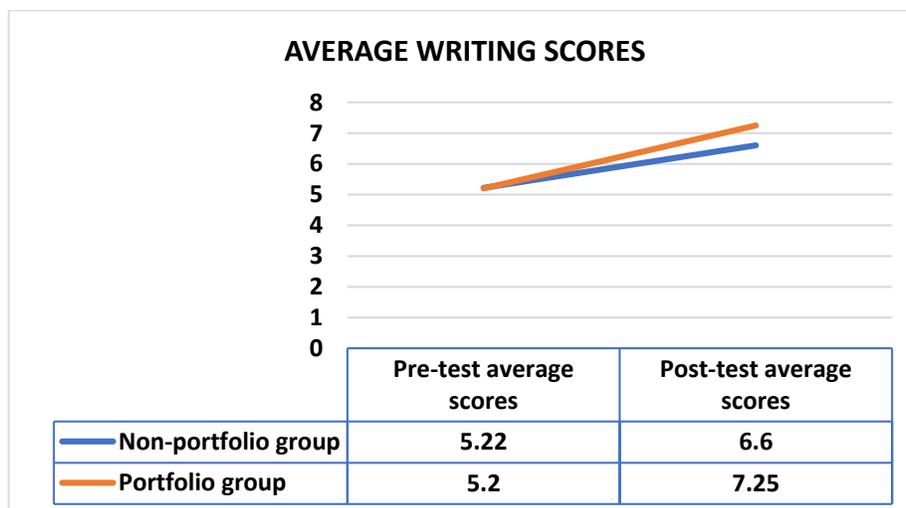


Figure 3. Average writing scores of students

It can be seen that all of the students made a gradual improvement in academic writing performance. It is also noticeable that there is a big difference between pre-test scores and post-test scores of the 30 participants in the experimental group while there is a smaller gap between pre-test scores and post-test scores of the 30 students in the control group.

To be specific, the average writing score of the experimental and control group in the pre-test is 5.20 and 5.22 respectively. In other words, both groups' level of writing proficiency is almost similar. However, after an academic year, in the post-test the average score of the control group is much lower than that of the experimental group. Actually, the average post-test score is 6.60 for the non-portfolio group and 7.25 for the portfolio group. This indicates a big difference of 0.65 points between the two groups. Therefore, it can be concluded that creating portfolios has a positive effect on learners' writing performance.

#### 4.2. Results of grading student's portfolios

To gain more information on the progress of the students in the portfolio group regarding their writing performance, we also analysed the results of grading the portfolios created by the students as can be seen in Figure 3. To grade these portfolios, we utilized the Portfolio Scoring Rubric.

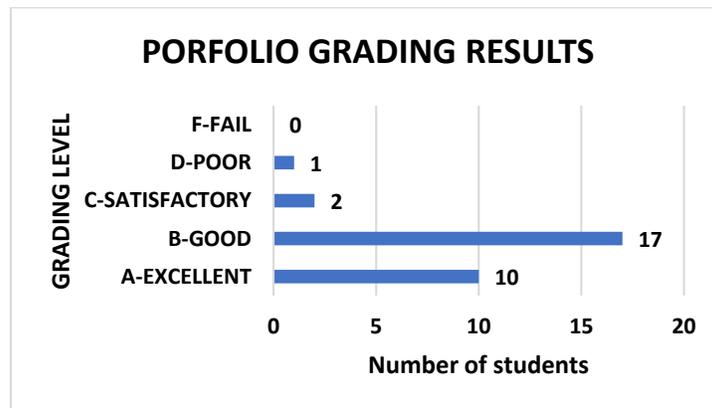


Figure 3. Results of grading student's portfolios

The figure indicates that one third of the students in the portfolio group got Grade A-Excellent for their Portfolio and more than half got Grade B-Good. Only 2 students received Grade C-Satisfactory, only one students got Grade D-Poor, and none of the portfolios was graded F-Fail.

While marking the students' portfolios, we noted that their writing performance has improved significantly over time in terms of vocabulary, grammar, spelling, punctuation and organization. Regarding vocabulary, students showed how their vocabulary increased in their portfolios as a result of the process of searching information, reading, and writing the drafts. Relating to grammar, we could see that most of the students made grammatical mistakes on the first draft, but after receiving peer check and teacher's correction, they recognized the mistakes and corrected them on the final writing product. Coming to the organization of the writing pieces, we compared the writing drafts and saw that students made a lot of progress in organizing the appearance and structure for their essays. Finally, the researchers noted that the experimental group could manipulate the writing steps in performing the writing task effectively. They did not jump into the writing stage directly but step by step prepared related materials, made a plan, drew up an outline, wrote some drafts, made revision before editing their final version. Gradually, the students became more organized and methodical when writing.

From all the analysis above, it can be noticed that when creating writing portfolios, students were given opportunities to prepare materials, develop ideas, write drafts, revise, and even edit their own writing. Therefore, the quality of their writing increased.

#### 4.3. Students' feedback on portfolios

The results of the feedback questionnaires for students show that most of the students are interested in learning English writing through compiling portfolios. They would like to use portfolios not only to learn English writing but also to improve other aspects in learning the English language.

Thirty students, who had finished compiling their writing portfolio, completed the questionnaire, which was designed basing on their notes of feelings about portfolios. Table 1 summarized the students' attitude toward creating portfolios.

**Table 4. Students' attitude toward portfolios**

|                                    | Statements   | Disagree   | Undecided  | Agree          |
|------------------------------------|--|------------|------------|----------------|
| 1                                  | I enjoy compiling the portfolio.                           | 5          | 6          | 19/30          |
| 2                                  | I am motivated to learn writing through Portfolio.         | 5          | 7          | 18/30          |
| 3                                  | My English writing skills have improved.                   | 1          | 2          | 27/30          |
| 4                                  | I am more confident in English writing                     | 2          | 6          | 22/30          |
| 5                                  | I feel satisfied with my portfolios.                       | 2          | 4          | 24/30          |
| 6                                  | I actively participate in compiling Portfolio.             | 4          | 3          | 23/30          |
| 7                                  | I am familiar with compiling portfolios.                   | 4          | 6          | 20/30          |
| 8                                  | It is very useful for me to review my friends' portfolios. | 3          | 4          | 23/30          |
| 9                                  | Compiling the portfolio is not a stressful process.        | 2          | 5          | 23/30          |
| 10                                 | The portfolio is a useful self-study learning tool.        | 2          | 3          | 25/30          |
| 11                                 | Portfolios should be applied widely.                       | 0          | 5          | 25/30          |
| <b>Total = <math>\Sigma</math></b> |  | <b>30</b>  | <b>51</b>  | <b>249/330</b> |
| <b>Percentage</b>                  |  | <b>10%</b> | <b>17%</b> | <b>83%</b>     |

As can be seen from the table, most of the students have positive attitudes toward Portfolios (83%). They perceived that the portfolio had been a useful self-study learning tool (25/30), motivated them in learning English writing (18/30) and should be applied widely (25/30). Most of the participants enjoyed compiling the portfolio (19/30), appreciated that their English writing skills have improved (27/30), and they gained much more confidence in English writing (22/30).

When asked to give further opinions relating to various aspects of Portfolios, the students who took part in the research gave some other ideas as summarized below:

**Table 5. The benefits of compiling Portfolios**

| Ideas   | Frequency |
|---|-----------|
| <b><i>The benefits of compiling Portfolios</i></b>  |           |
| • It helps me gain more knowledge about English writing.  | 3         |
| • It helps me arrange the contents I've learnt in order.  | 2         |
| • I know what I have learned and how my English writing has improved through portfolios.                      | 4         |
| • It helps me remember all important contents of English writing before final exam.                           | 3         |
| • I can know more about useful vocabulary and improve grammar, which helps me improve your writing skill.     | 3         |
| • It helps me revise important knowledge easily.  | 3         |
| • I have a lot of sample English essays as reference materials.   | 2         |
| • It helps me get and organize ideas in my essays more scientifically.  | 2         |
| • It helps me to save their essays during my studying English writing.  | 2         |
| • It helps me be aware of grammatical mistakes.   | 1         |
| • It helps me save time in searching for resources of reference materials.                                    | 2         |
| • It is easy for me to find the structures or sample essays.  | 2         |
| • It helps me understand the strategies of writing an English essay.  | 2         |
| • Through portfolios, I can take note of vocabulary, grammar and sample essays.                               | 1         |
| <b><i>The drawbacks of compiling Portfolios</i></b>   |           |
| • It wastes a lot of time collecting reference materials, then compiling, sometimes rechecking and rewriting. | 22        |

|   |    |
|---|----|
| • Sometime, it makes me feel stressed to complete my portfolio  | 27 |
| <b>Suggested Solutions</b>  |    |
| • Students should make weekly plan clearly  | 12 |
| • Lecturers should check students' portfolios regularly   | 14 |
| • Lecturers should suggest the ways to organize portfolios and make an outline of main contents for students to include in the portfolios | 15 |
| • Lecturers should set a timeline for students  | 8  |

#### 4.4. Experts' opinions about the use of portfolios

The experts (English lectures) also expressed strong preference on the use of portfolios in their teaching curriculum of English writing because of the benefits that portfolios bring about.

All the experts (n=10) stated that they were very interested in implementing portfolios during their writing courses, and all of them felt that the technique of using portfolios was effective. In particular, the lecturers expressed their opinions related to students' portfolios, which were summarized in the table below:

**Table 6. Experts' opinions about the use of portfolios**

| Ideas  | Frequency |
|--|-----------|
| <b>Benefits of implementing portfolios</b>   |           |
| • Portfolios make the writing courses to be more student-centered  | 2         |
| • Portfolios help lecturers get more detailed feedback about daily lectures  | 2         |
| • Portfolios allow one-to-one interaction between the lecturer and the student   | 4         |
| • Portfolios encourage the emergence of a more democratic environment  | 4         |
| • Portfolios make learning outcomes more transparent   | 2         |
| • Portfolios draw on students' strengths rather than focusing on their weaknesses                                      | 3         |
| • Portfolios promote individualized learning   | 5         |
| • Portfolios make students more active in learning   | 2         |
| • Portfolios regulate the habit of studying  | 2         |
| • Portfolios make students take responsibility of their own learning   | 4         |
| • Portfolios help eliminate testing anxiety  | 4         |
| • Portfolios encourage students to demonstrate their individual differences  | 2         |
| <b>Drawbacks of implementing portfolios</b>  |           |
| • It is difficult to grade and assess students' portfolios.  | 3         |
| • Compiling portfolios takes students a lot of time and effort.  | 2         |
| • Monitoring students' portfolio compiling process takes lecturers a lot of time and effort.                           | 2         |
| <b>Suggested Solutions</b>   |           |
| • Teaching writing should take place in a nicely decorated room where each student can have a nice portfolio box.      | 2         |
| • Clear instruction, procedures, requirements, and marking criteria should be provided on the first day of the course. | 2         |
| • Lecturers should make portfolios become a compulsory part of the English writing course.                             | 3         |

On the whole, the results of the survey questionnaires show that most of the students and lecturers had a favourable opinion about the use of portfolios in writing courses. There are some disadvantages of implementing portfolios; however, they are outweighed by the numerous benefits and they can be partly overcome by the possible solutions as recommended above.

## V. CONCLUSION

The present study has shown that despite recent changes in teaching English writing, portfolios plays an important role in improving and enhancing English writing performance for English majors. Comparing to the non-portfolio class, the portfolio class has made much more significant progress in their writing performance in all aspects of vocabulary, grammar, idea development and organization. The students in the portfolio group have become more matured and organized writing process as a result of experiencing the different stages of the writing process from collecting relevant materials, making an outline, writing several drafts, making revisions to making editions so as to produce the final version.

In addition, most of the English lecturers and majors have a positive attitude toward Portfolios, and they listed many benefits which portfolios implementation brings about for not only the students, but also for the lecturers and the curriculum itself.

Besides the benefits, some problems related to portfolios implementation have also been identified and investigated. The biggest problems involve organization, time management and assessment.

To solve these problems, the participants proposed some solutions. For example, students should make weekly plan clearly and make an outline for the draft before compiling Portfolios; lecturers who teach English writing should suggest the ways for students to organize their portfolios logically, help students make an outline of main contents for their portfolio, set a timeline for students and check students' portfolios regularly.

With all of these benefits of utilizing portfolios as investigated during the two writing courses at Thai Nguyen University of Education, the researchers highly recommend that portfolios should be made an integral part of not only writing courses but also other subjects.

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# (ISES) Intelligent Smart Energy Stiller

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STEM Egypt school 2014-2017  
Faculty of Dentistry, Ain Shams University 2017 –

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**Abstract-** Lack of water resources and water pollution are some of the major hazards to the security of our water. Do you know the amount of water that consumed and produced in Egypt?

This year Egypt's water needs stand at 76 billion cubic meters and will keep increasing dramatically in a direct relation with increase of the population. The River Nile supplies Egypt with about 55.5 billion cubic meters each year which represents about 69.8% of Egypt's water needs. Moreover, citizens still depend on the fresh water as the main source to obtain drinkable water. In addition, there are about 38 million Egyptian citizens suffering from the water pollution issue, in addition, about 5.4 tons of pollutants are being thrown into water every year? Therefore, the problem mainly was the lack of clean water resources.

In this project, we are attempting to depend on seawater as a major source for the drinkable water. We will evaporate the seawater by depending on the sunrays to evaporate salty water and get distilled water [3].

**Index Terms-** Reflector – Heater – Solar energy – LDR – Arduino

## I. INTRODUCTION

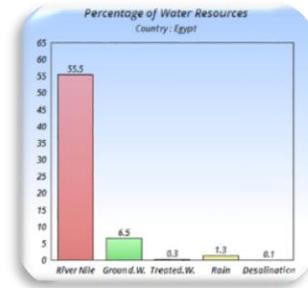
It is well known that Egypt faces several severe problems and grand challenges and the lack of the clean water resources is one of them, as shown in *figure 1*. The problem of the leakage of the water clean resources is a problem that the whole world suffers from now [3].

Most of the trials are about how to rely on another sources and the more common source is the water from seas and oceans.

This water are somehow clean except that there are some salts and small amounts of impurities that must be cleaned. There are many ways to treat these water like the RO systems and Carbon nanotubes and using natural light and heat energy to evaporate the water. We found that depending on natural light and energy is cheap, efficient, and keep the environment clean because we didn't burn any fossil fuel to get energy. We have used benefit of sun heater idea, and we used glass tube, dark black tube, parabola reflector, LDR, and Arduino.

We hope that this project will meet the design requirements tested by our prototype that to decrease the energy used so there would be a decreasing in the cost and being green to the environment.

Figure 1



## II. MATERIALS & METHODS

We used a variety of materials to build the prototype and perform our test plan as shown in the following. Materials and Methods of performing the test plan. We decided to turn our idea into a real model by performing a simple prototype that will express the whole idea. In order to make this prototype. Therefore, we used the following materials: glass tube, PVC tube, black metal tube, reflector, condenser, thermal insulator, silicon, glue, arduino board, LDR, bread board, servo motor, resistors and jumpers.

## III. RESULTS

After we had determined our design requirements which are high efficiency, clean environment and cast. We tried to test our prototype. We started our experiments to test our design requirements:-

### Efficiency:

Firstly, we did our experiment in different conditions such as: sunny day and cloudy day distilled water we found that the average of the distilled water is near to the ideal results that is from 8 to 10 liters per day, so our prototype achieve efficiency higher than the plants which evaporate the seawater by using electricity or fuel. Also if we use large scale we will find the results in the following table:-

### Cost:

We've calculated the price of every liter of water that we produce and calculated the price of every liter that produced by government water treatment plants, then we've compared the two prices of them as shown in tables 1 and 2.

Our liter casted the price of the energy that used to treatment only (2.5 watt per hour, 10 watt per 4 hours, 30 watt per day, .9 kilo watt monthly) and produced approximately 37.5 liter per 4 hours (0.004 L.E for liter) is lower than the government liter cost (0.05 L.E for liter), we've succeeded to achieve this design

requirement. In addition, the following table represent the results of this test plan. Note:- Whole of these data collected by considering that our scale is 2 meter square.

Table I:

| Day condition | Project's scale (meter square) | Production (Liter) |
|---------------|--------------------------------|--------------------|
| Sunny day     | 2                              | 18.75 L            |
| Sunny day     | 5                              | 46.8 L             |
| Sunny day     | 10                             | 93.75 L            |
| Cloudy day    | 2                              | 13.125 L           |
| Cloudy day    | 5                              | 32.8 L             |
| Cloudy day    | 10                             | 65.6 L             |
|               |                                |                    |

Table II:

| Amount of energy that we used | Amount of water that we produced | Price of our water | Price of government water |
|-------------------------------|----------------------------------|--------------------|---------------------------|
| 2.5 watt                      | 18.75 L                          | .004 L.E           | .95 L.E                   |
| 7.5 watt                      | 56.25 L                          | .012 L.E           | 2.85 L.E                  |
| 25 watt                       | 187.5 L                          | .04 L.E            | 9.5 L.E                   |
| 50 watt                       | 562.5 L                          | .08 L.E            | 19 L.E                    |

**Eco-friendly:**

Finally, after we had done our experiments we did not observe any exhausted like carbon dioxide or fumes Emit from the prototype. In addition, it did not affect the environment badly and keep the human health, as shown in the following real figures 2 and 3.



figure 2

figure 3



#### IV. DISCUSSION

The right to sustainable water is the right of everyone to enjoy safe and clean water. However, Egypt suffers from many water problems that may prevent its development such as: Water Pollution, Lack of Water Supplies, and Spread of Diseases. As shown in the following figures. There are about 9 million cubic meters of fresh water that are wasted annually in Egypt by different human activities like washing, showering or in toilets.

The right to sustainable water is the right of everyone to enjoy safe and clean water. However, Egypt suffers from many water problems that may prevent its development such as: Water Pollution, Lack of Water Supplies, and Spread of Diseases. As shown in the following figures. There are about 9 million cubic meters of fresh water that are wasted annually in Egypt by different human activities like washing, showering or in toilets.

The reflector is put behind the prototype to reflect the rays of the sun to make the prototype face the sun from every directions. The dark tube absorb the rays of sun and help to increase the temperature, and the small gab between the glass tube and the drack tube help to increase the speed of evaporation because of decreasing the amount of seawater, so the water will evaporate [1]. After water evaporating, the water vapor rises and get into the condenser, and it condenses in the condenser then, the water turns into distilled water without any salts.

There's an electronics part to control the moving of the prototype by using Arduino, LDR, motor and arm to make the prototype move with the sun (as shown in the previous figure).

Solar radiations spans a wide spectrum beyond the visible range of light. It is estimated that 44% of the light emitted by the Sun is visible with 7% in the ultraviolet range and 49% in the infrared range. When visible light impacts with the surface of the Earth or its atmosphere, it loses much of its energy in the process and most of this is later emitted back into space as longer wavelength infrared radiation.

Capturing this energy using a Nano antenna array could serve two important purposes. The energy could be used to power numerous electronic devices, and it could also be drawn away from equipment like computer

There are factors effect on the result of the project like (Temperature, Amount of water, Gab between the glassy tube and the dark tube, and ratio of salt in water).

The prototype also showed the ability to work properly and end the processes without losses in any stage. Its electrodes decays

after a while as result of the chemical reaction. That could be concluded from the hypotheses that we used to construct the prototype. The results are verified and administrated by "Dr. Mohammed Abdel Aziz" and written in a way that can be repeated. Moreover, the percentage of error and tools used in the test are previously mentioned.

#### V. CONCLUSION:

The solution was chosen but our research will never end. We really aim to design a practical solution for Egypt's water challenge. So we put in our plans some topics of research to improve our solution.

We are going to do research about use the micro controllers to make the prototype depends on it only in its move, and make the prototype work at night by using solar cells and store its energy in a battery then use this energy at night by using it to work electric heater to evaporate water at night.

In addition, we recommend putting in mind the possibility of finding out more efficient materials that offer very high permeability of water [2].

In addition, we are going to increase the efficiency of our project by decreasing the gap between the glassy tube and the dark tube by using the equation:

$$Q = m \cdot C_p \cdot \Delta T$$

Q is the het net,  $m$  is the flow rate,  $C_p$  is constant, and  $\Delta T$  is  $T_{out} - T_{in}$  [4].

Solar energy is a near perfect source of energy, one where no pollution is related to it. It causes no poisonous gasses or destruction of rain forests, thus we can depend on it in order to purify the sea water to become drinkable water. Hence the countries will be able to use our idea in different places such as:-

- 1) Tourist village:- for supporting their resident with drinkable water and do not rely on the fresh water which come from long distance.
- 2) The Coastal area that have not any sources of the drinkable also can use our idea in order to get renewable source of the drinkable water [5].

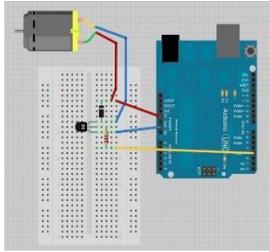


Figure 4

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# Factors That Affect Students' Performance in College Algebra in Some Selected Colleges of Education in Ghana

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**Abstract-** This study sought to find out factors that affect the performance of pre-service teachers in college algebra in some selected Colleges of Education in the Bono Region of Ghana. A quantitative survey design was employed in this study. The study was conducted in two Colleges of Education and sixty – six (66) second-year pre-service teachers offering 4-year Bachelor of Education(B.Ed.) Programmes in both Primary and Junior High School ( JHS) education randomly selected. A five- point Likert scale questionnaire was used to collect data on the three factors (students' attitude, motivation, and lesson presentation). Twenty (20) items questionnaire was administered to the pre-service teachers to collect data. The data were analyzed and the descriptive statistics involving means and standard deviation as well as correlation, regression, and paired samples t-test were used to address the research questions. The findings revealed that the poor performance of students in college algebra in colleges of education in Ghana was caused by students' negative attitude, motivation and lesson presentation. It is, therefore, recommended that these negative attitude needs to be corrected by instilling in students the values in mathematics. Teachers teaching college algebra should be innovative and use the appropriate technique to teach the concepts in college algebra. The government and stakeholders in teacher education should provide necessary materials and other resources in colleges of education to harness the potentials of pre-service teachers.

**Index Terms-** Factors, College Algebra, Performance

## I. INTRODUCTION

Primitive man had no opportunity for using sophisticated equipment and materials for building their shelters and construction of roads. There were no measuring instruments for measuring lengths and heights of their buildings but they were able to count, measure, locate, estimate, and calculate materials that would be used. Mathematics began when people started counting. The language as a cultural artefact manifests through the use of symbols and other representations.

Language acquisition plays a key role in concept formation. The symbolic representations in mathematics are the language which is communicated to the learners for the formation of mathematical concepts. Algebra is a branch of mathematics in which letters and other symbols are used to represent numbers and

quantities or formulae and equations. Other branches of mathematics have some aspects of algebra in them. Algebra can be found in Geometry, Arithmetic, Transformation, calculus etc. Most in mathematics perceive algebra as a purely abstract form of mathematics and that it cannot be objectified. The perception of abstractness of algebra poses a challenge to learners understanding of the concept.

Most mathematical classroom discourses are full of symbolic representations and manipulations. The basic school mathematics curriculum is anchored on the area of algebra. Algebra has many aspects including symbols and expressions, linear equations, quadratic equations, relations and functions, algebra of polynomials, and combinatorics etc. The pre-service teachers at colleges of education in Ghana need to have sound knowledge in algebraic thinking.

Algebra serves as a bedrock to elementary school mathematics so its content and pedagogical knowledge are essential. According to Moses and Cobb (2001), algebra has proven to be a gatekeeper limiting some students' access to higher education and mathematically oriented careers. Many students admitted to the college of education in Ghana beset difficulties in algebra courses. Students find algebra courses challenging due to some factors which could have been avoided at the foundation level. The misconception in algebra has led to students' anxiety, fear, and attitudes. The dire consequence was the higher failure rates in college algebra and other courses in mathematics. According to Driscoll (1999), "Algebraic thinking has three central habits of mind: the doing – undoing, building rules to represent functions, and abstracting from the computation.

Mathematics as a mother of all subjects is being taught in all areas of Ghanaian educational settings. The Basic school pupils especially crèche start their day with identification of geometric objects in the classroom. Pre – number activities which provide the basis for children to acquire early number concepts and foundations of later skills in mathematics need to be handled by a competent and experienced teacher. The meaningful mathematics understanding is through communication by symbolic representations.

Ghana has forty-six (46) public colleges of education whose core mandate is to train teachers for both JHS and Primary schools. The entry requirements for Colleges of Education in Ghana are not different from public Universities.

The Public Colleges of Education have over the years trained teachers for both Primary and Junior High Schools. The

Colleges train student – teachers in various subjects' curricula including Mathematics. Before someone can teach mathematics at the basic level, he/she needs to be taught the content (which is the subject matter or concept) and the pedagogy (which is the teaching skills, styles, procedures etc.). The Mathematics Pedagogical Content Knowledge is the authority of every Mathematics teacher. Elementary and college algebra is the course being offered by pre-service teachers in colleges of education in Ghana. Algebra I and Algebra II are the courses in mathematics that are taught in the first year, the first semester of the B.Ed. Four - year programmes in the colleges of education in Ghana. According to Chief Examiner's report from the Institute of Education, the University of Cape Coast, students' performance in these two algebra courses was abysmal in 2018/2019 academic year-end - of - the first-semester examination. There were high standard deviations associated with the mean scores of Algebra I (12.46%) and Algebra II (12.45%).

The prospective teachers from some Colleges of Education failed willfully in both courses. The problem emanated from the elementary school level and continue to be the dominant factor for poor performances of students in mathematics. Student's perceptions of algebra at the secondary school level alluded to their understanding of mathematical concepts at the college level. There is a wide gap between the students' transition from number concepts to algebraic concepts in mathematics. The variables that influence students' performance in college algebra courses in the Colleges of Education in Ghana are both inside and outside the school. These factors affect greatly the learners' performance in mathematics, especially algebra.

Problem-solving is the heart of every subject and ability to model the problem from a different perspective in mathematics develops the cognition in an individual. The word problems in mathematics must be modelled into mathematical language. According to Mayer and Wittrock (2006), problem-solving is a cognitive process directed at achieving a specific goal when no solution method is at hand for students.

The teacher's content and pedagogical knowledge in algebra are vital for the development of students' algebraic thinking skills. Teachers and students attitudes, the availability and adequate teaching and learning materials and other resources determine the performance level or the level of development of algebraic thinking. The students understanding of unknowns (variables) in algebra is intuitively developed to coordinate "letters" or literal symbols. "The fact that literal symbols can represent unknowns

sometimes interfere with students' ability to understand situations where they represent quantities that vary (Malisani and Spagnolo, 2009). Students' algebraic thinking skills slow down because it is more difficult to take the letter 'x' as a variable if one is used to working only in a context where it represents specific unknown. Students conceive symbols as an abstract entity and so if they are used to represent the unknowns or variables, then there is no objectivity in Algebra.

The performance of pre-service teachers in algebra at Colleges of Education in Ghana is a major concern to stakeholders in education. The successfulness of algebraic thinking problem is the substance on immeasurable of factors. Students, teachers and school factors have a bearing on the learning of mathematics. The study seeks to examine pre-service teachers' factors that influence their performance in College Algebra. It also sought to explore school-based factors that affect students' performance in College Algebra in some selected colleges of education in Ghana.

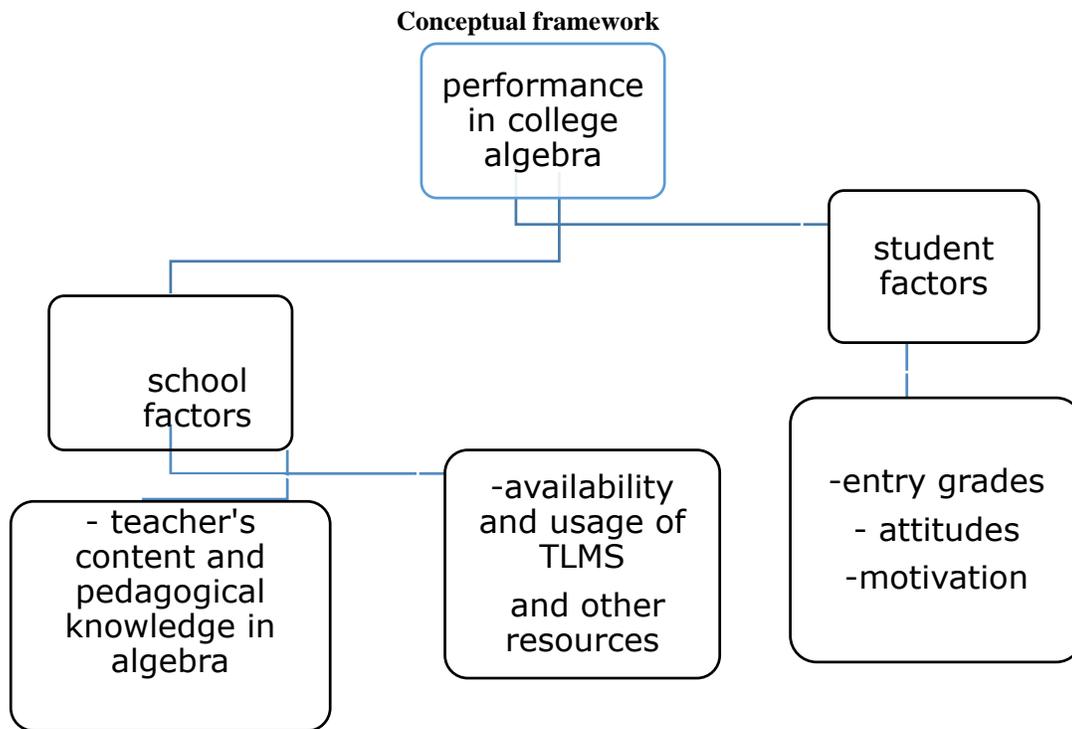
Research on factors that influence the pre-service teachers' performance in college algebra in Colleges of Education in Ghana is a serious issue in teacher education in Ghana. The teachers teaching mathematics at the basic level must have in-depth mathematical knowledge in both content and pedagogy. The study sought to examine the following questions:

1. What factors affect students' performance in College Algebra?
2. What influence do students' 'Entry Grades' have on their College Algebra performance?
3. What impact do students and school factors have on students' college algebra performance?
4. What are possible effects of the use of TLMs (ICT tools. i.e. CAS) on teaching and learning of College Algebra?

## II. REVIEW OF RELATED LITERATURE

The variables to be studied were the students' factors and school factors. The factors are the independent variables while the students' performance is the dependent variable. Students' performance in college algebra in Colleges of Education in Ghana depend on these important thematic areas. The school factor and student factors.

The figure below shows some possible relevant factors that influence students' performance in College Algebra



**Figure 1: factors affecting students' performance in College Algebra**

### 2.1 Students Attitudes towards College Algebra

The attitudes of pre-service teachers towards mathematics especially College Algebra influence their performance. Students' perception and beliefs about the competence and expectations in school directly connected to their engagement levels, as well as to the emotional states that promote or interfere with their ability to be academically successful (National Research Council, 2000; as cited in Akey (2006) and Enu (2015)).

The attitudes of students determine the extent to which the concept of algebra would be learned. Students with positive attitudes put in more effort in learning the concept and they excel always in mathematics due to their active participation in the lesson. Mathematics teachers achieve their stated objectives when students develop positive attitudes towards the lesson. Algebra is about doing and students who developed a passion and interest in it, understand the concept relationally.

### 2.2 Motivation

Students become more active and excited to interact with the learning environment when they are inspired. Teachers can instil the interest of mathematics in students when they are allowed to personally involve in the lessons. Students' motivation in mathematics both intrinsic and extrinsic bring about their meaningful learning in the classroom. Motivation, both intrinsic and extrinsic, is a key factor in the success of students at all levels of their education (Teach thought teachers, 2017).

According to J.S. Farrant (1968), lack of motivation on the part of both teachers and students contribute to poor performance. Mathematics teacher's motivation in the subject helps to bring an effective classroom discourse. Teachers who are motivated enough are more excited and poised to teach mathematics with the

passion to harness the potentials of students in College Algebra. The role of the teacher affects the interest of the students both positively or negatively in College Algebra. Parents and peers interaction in mathematics offload the negative perceptions about mathematics thereby increasing the students' participation in the lesson.

### 2.3 Teaching and Learning Resources

Effective teaching and learning of mathematics can be achieved with the availability and use of materials and resources. Teaching resources play a significant role in learning. According to Ankomah (1998), cited in Enu (2015), "effective teaching and learning greatly lied on the competences of its human resources as well as material resources which were needed for the impartation of knowledge".

The use of modern computer-based technology in teaching algebra helps to bring about functional algebraic concepts on the part of students

### 2.4 Teacher's Content and Pedagogical Knowledge

Teachers play an essential role in inculcating the academic standards to students. These standards can be achieved when the teachers who are facilitating the students' learning are grounded in both the content and pedagogical knowledge in mathematics. An effective mathematics teacher is the one who has a mastery of the subject matter and knows how to impart to students using the teaching and learning resources to bring out the innate potentialities of the learners.

Teachers teaching College Algebra in the College of Education should possess the remarkable mathematical traits for meaningful delivery of the lesson. Mathematics teachers' content

knowledge, teaching style motivates students and spark their curiosity in learning the tasks. Most students learn greatly through the lesson presented by the teacher. The attitudes and motivation of students are determined largely by teacher factors.

### III. METHODOLOGY

The population for the study comprises all Colleges of Education in the Bono and Ahafo Regions of Ghana. However, the sample consisted of sixty – six (66) pre-service teachers selected randomly from two Colleges of Education from the Bono Region. The study would use descriptive statistics in which a survey research design would be adopted. The instrument that would be used for the study is a survey questionnaire that measured students' attitudes, motivation, teaching and learning resources, and teacher's knowledge in college algebra. The five (5) point Likert scale questionnaire made of twenty (20) items. Seven (7) of the items measured students' attitude towards college algebra, Eight (8) items measured motivation, and lesson presentation seven (7) items. For checking the internal consistency for each scale, the reliability statistics report from SPSS output showed that Cronbach's Alpha values of: students' attitude (N = 7) = .727, motivation (N = 8) = .766, and lesson presentation (N = 7) = .727. The Cronbach alpha coefficient above .7 is acceptable (DeVellis, 2003).

Data that was collected from students' response questionnaires were coded and analyzed using SPSS. Descriptive

statistics involving means and standard deviation as well as inferential statistics involving correlation, regression, and pair sample t-test statistics were used to address the research questions.

### 3.1 Participants

The participants for the study were 66 pre-service teachers in two selected Colleges of Education in the Bono Region of Ghana. The students in the second year were given 5 points Likert scale survey questionnaires consisting of 20 items.

### IV. RESULTS/FINDINGS

The results from students' questionnaires showed the possible factors in the Colleges of Education that may affect the performance of students in College Algebra. The 66 selected students from the two colleges of Education for the study were asked to indicate which of their opinions towards College Algebra course in a five (5) point Likert scale. In the twenty (20) items, measuring students' attitudes, motivation, teaching resources and lesson presentation.

The students' response questionnaires on the item statements on their attitude towards college algebra, motivation and lesson presentation (school factors) were analyzed descriptively and their means and standard deviations are summarized in the table in table7 at Appendix I. The means and standard deviations of descriptive statistics on school and students factors shown in table 1 below.

**Table 1: Descriptive statistics of overall Means and Std. Deviations of students' response to the factors that affect students' performance in College Algebra (N = 66)**

| FACTORS          |                     | Mean   | Std. Deviation |
|------------------|---------------------|--------|----------------|
| Students' factor | Students' Attitude  | 2.2619 | .69517         |
|                  | Motivation          | 2.4139 | .68954         |
| School factor    | Lesson presentation | 2.1667 | .60432         |

#### 4.1 Students' Attitudes towards college algebra

The sampled pre-service teachers for the study were asked of their views on classroom mathematics discourse and their performance in college algebra. The responses from the students helped to detect the particular kind of attitudes that affected their performance. The results showed that 53.1% with (Mean = 1.58) indicated that they strongly disagree (15.2%) and disagree (37.9%) on the statement 'I like symbols, they do make me think always in mathematics lessons'. The statement 'I learn algebra well on my own' 51.5% with (Mean = 1.88) stated that they strongly disagree (27.3%) and disagree (24.2%). Again 50% with (Mean = 2.17) responses of students indicated that they learn algebra well with the used of projectors. However, the majority of students indicated that they like college algebra. The statement 'I learn mathematics well when it is presented step by step in class', 87.9% with (Mean

= 3.11) indicated that they agree (47.0%) and strongly agree (40.9%).

Comparing the mean responses with the overall mean score (Mean = 2.2619 and SD = 0.69517) of students' attitude showed that the majority of students had a positive attitude towards college algebra.

#### 4.2 Motivation

The sixty – six (66) sampled second-year college of education students were asked to indicate what motivates them to study college algebra. The responses from students showed that 66.7% of students indicated they Agree (45.5%) and Strongly Agree (21.2%) with (M = 2.56, SD = 1. 242) to the statement of motivation by parents; 77.3% indicated they Agree (47.0%) and Strongly Agree (30.3%) with (M = 2. 91, SD = 1.077) on teacher's motivation. More than 50% of the students indicated that they are

motivated to learn college algebra with the use of audio-visual materials, Agree (53.0%) and Strongly Agree ( 19.7%) with ( M= 2.68, SD 0 1.139 ). From the descriptive statistics in table 1, students' motivation had overall ( M = 2.4129, SD = 0.68954). The means for the three statements above were greater than ( M = 2.4129 ). Therefore, parents, teachers, and TLMs motivates students and enhance their understanding of college algebra.

**4.3 Lesson presentation**

The students' response to questionnaires on lesson presentation was about the teacher's pedagogical content knowledge and teaching and learning resources. From table 1, the descriptive statistics showed the overall Mean = 2.1667 and Standard Deviation = .60432. Out of 66 students, 87.9% Agree 47.0%) and Strongly Agree (40.9%) with ( M = 3.11, SD = 1.111)

indicated that their teachers present the algebra lessons well with the use of TLMS. 72.7% indicated that they Agree ( 53.0%) and Strongly Agree( 19.7%) to the statement on the use of visual and manipulative materials. Most students who indicated they want group work and discussions in college algebra class were 80.3%, Agree (40.9%) and Strongly Agree (39.4%) with ( M = 3.03, SD = 1.095).

Opore (1999) also asserted that the provision of the needed human and material resources goes a long way to enhance academic performance. Ankomah (1998) noted that effective teaching and learning greatly lied on the competences of its human resources as well as material resources which were needed for the impartation of knowledge

**Table 2: The performance grades of students in WASSSCE core mathematics and college algebra**

| WASSSCE Core Mathematics Grade | Freq (%)   | College Algebra Grade | Freq (%)  |
|--------------------------------|------------|-----------------------|-----------|
| A1                             | 2 (3.03)   | A                     | 8( 12.12) |
| B2/B3                          | 28(42.42)  | B/B+                  | 7( 10.61) |
| C4                             | 11( 16.67) | C/C+                  | 22(33.33) |
| C5/C6                          | 25(37.88)  | D/D+                  | 18(27.27) |
|                                |            | E                     | 11(16.67) |

Table 3 above showed the pre-service teachers' entry grades in WASSSCE core mathematics into public colleges of education in Ghana. The cut-off point was C6 and the number of students who entered with C5/C6 was 25 representing 37.88%. Out of 66 students, only two (2) entered with A1 (3.03%). After the first semester examination, 8(12.12%) of students had A and

11(16.67%) had E (Fail). The results from the table show that students entered the college of education with good grades. However, 11(16.67%) of them failed in college algebra examination at the end of the first semester.

**Table3: Relationship between College performance and WASSSCE core mathematics grades, students' attitudes, students' motivation, and lesson presentation (N = 66)**

| College Algebra Grade | WASSSCE Core mathematics grade | Students' attitude | Students motivation | Lesson presentation |
|-----------------------|--------------------------------|--------------------|---------------------|---------------------|
| Pearson Correlation   | .271*                          | .381**             | .434**              | .414**              |
| Sig.(2-tailed)        | .028                           | .002               | .000                | .001                |

\*. Correlation is significant at the 0.05 level (2-tailed).

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

From table 3, the correlation between the performance of college algebra (dependent variable) and independent variables (core mathematics; students' attitude; students' motivation; and lesson presentation). The relationship between college algebra

performance and core mathematics is very weak (i.e.,  $r = 0.271$ ) and significant at  $p = 0.028 < 0.05$  level (2 – tailed) The correlation between the college algebra performance and the factors: students' attitude, students' motivation, and teacher lesson

presentation were moderate with ( $r = 0.381, \rho = 0.002; r = 0.434, \rho = 0.000$  ; and  $r = 0.414, \rho = 0.001$  respectively).

**Table4: Regression analysis showing Impact of Students and school factors on College algebra performance (N = 66)**

| R    | R – Square | F (Sig.)     | Standardized Coefficient | t     | Sig. |
|------|------------|--------------|--------------------------|-------|------|
| .438 | .192       | 4.914(0.004) | -.113                    | -.398 | .692 |
|      |            |              | .425                     | 1.230 | .223 |
|      |            |              | .122                     | .406  | .686 |

A regression analysis model was used to explore how well students’ attitude; motivation and teacher lesson presentation could predict students’ performance in college algebra. The regression equation with all the three predictors was significantly related to college algebra performance with an  $R^2$  of 0.192,  $F(3, 62) = 4.914, \rho = 0.004$ . The standardized coefficients of the three factors (predictors) were -.113, 0.425 and 0.122 for students’ attitude, motivation, and teacher lesson presentation in that order. The standardized coefficients in the regression modelled in the equation below:

$$\text{College Algebra Performance} = - .113SA + 0.425SM + 0.122TLP,$$

where SA means students’ attitude, SM means students’ motivation and TLP means teacher lesson presentation.

The factors in the model above showed that students’ motivation appeared to be a strong predictor of college algebra performance while teacher lesson presentations and students’ attitude appeared to be quite acceptable. The negative sign of students’ attitude indicates it has an impact on the students’ college algebra performance. When the students’ attitude increases, it tends to decrease their performance in college algebra. It is also clear that there is a positive relationship between the dependent variable (college algebra performance) and the independent variables, (students’ motivation; Teacher lesson presentation). Students’ motivation has the strongest impact on the performance of students in college algebra with a significant value of 0.004. The regression analysis verified that the  $F$ -value was significant indicating that the independent variables predict the dependent variable (see Table 5)

**Table 5: Paired sample t-test of grades of College algebra and WASSSCE Core mathematics**

| Performance            | N  | Mean  | SD     | Effect size | t- value | df | p - value |
|------------------------|----|-------|--------|-------------|----------|----|-----------|
| College algebra grade  | 66 | 60.26 | 11.047 | 0.14        | -3.235   | 65 | 0.002     |
| Core mathematics grade | 66 | 64.77 | 6.930  |             |          |    |           |

Analysis from the table7 shows there is a significant difference between the WASSSCE core mathematics grades (Mean = 64.77, SD = 6.930) and College algebra grades (Mean = 60.26, SD = 11.047), with  $t(65) = -3.235, \rho - \text{value} = 0.002$ . Since  $0.002 < 0.05$ , there was any evidence to suggest that a significant difference exists between the College algebra grades and WASSSCE core mathematics grades. WASSSCE core mathematics does not have any effect on college algebra. There was a statistically significant decrease in performance grades. The mean decrease was 4.515 with 95% Confidence Interval ranging from  $-7.302$  to  $-1.728$ . The calculated eta square statistic (0.14) indicates a large effect size (i.e.14%) of the variance in college is explained by core mathematics. Therefore the performance of

students in college algebra was not largely influenced by their WASSSCE mathematics grades.

## V. DISCUSSION

The results from the data analysis showed that the students’ factors: students’ attitude and motivation greatly affect the performance of students in college algebra. The students’ attitude contributes to the poor performance of students in college algebra. The students’ attitude affected performance. Students who developed a bad attitude towards the course college algebra performed poorly in the semester examination. The more the students’ attitude the more the decline of performance in

mathematics. Motivation is the driving wheel to any success in mathematics, especially algebra. The students' motivation from parents, school, teachers, peers, reinforce their learning of mathematics at the college level. The students' entry grades in WASSSCE core mathematics into public colleges of education do not affect the performance of students in college algebra through 8(12.12%) out of 66 students had grade A. The entry cut-off point was C6 but at the end –of –first-semester examination in 2018/2019 academic year 11(16.67%) of 66 students had E (Fail).

The regression modelled equation showed the negative Standardized coefficient ( $r = -.113$ ) of students' attitude and correlation coefficient of 0.381 is very small as compared with motivation and teacher lesson presentations. The mean and standard deviation of WASSSCE core mathematics performance was better than college algebra (Table 6). The weak correlation coefficient ( $0.271, \rho = 0.028$ ) between performance in college algebra and core mathematics attest to the fact that students entry grades do not have an impact on college algebra performance.

The availability and the use of teaching and learning materials (TLMs) such as computer algebra system (CAS), computer Excel, projectors, and other computer applications help to promote and enhance teaching and learning of college algebra in colleges of education in Ghana. Teacher's content and pedagogical knowledge in college algebra is a key to meaningful teaching of the course.

## VI. CONCLUSION AND RECOMMENDATIONS

This study sought to explore students' personal and school factors that affect the performance of college algebra in some selected colleges of education in Bono Region of Ghana.

The results from the analysis clearly showed that poor performance of students in college algebra in colleges of education in Ghana was not affected by their entry grades. However, the students' attitude towards college algebra contributed to the poor performance at the end – of – semester examination. The students' entry grades, attitude, and motivation constitute the student factors while the teacher lesson presentation (teacher's pedagogical content knowledge and availability and use TLMs) constitute school factors. Students learn best when they are motivated by their parents, teachers, and peers. The application of technology to teaching and learning of college algebra, using Excel application for drawing linear and quadratic functions, calculators and other materials help teachers to impart the concept to learners in the classroom. Instructional materials motivate students and encourage them to study lesson providing them with the opportunity to have access to information and to evaluate it (Akkoyunlu (2002).

In conclusion, it was found out that the poor performance of students in college algebra in colleges of education in Ghana was as a result of students' negative attitude, motivation and lesson

presentation. It is, therefore, recommended that these negative attitude needs to be corrected by instilling in students the values in mathematics. Again teachers should be innovative and use the appropriate technique to teach the concepts in college algebra. Furthermore, teachers are encouraged to develop a positive attitude in their students to enhance their understanding and passion for mathematics. The government and stakeholders in teacher education should provide necessary materials and other resources in colleges of education to harness the potentials of pre-service teachers.

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**APPENDIX I**

**Table 6: Mean Scores and Standard Deviations of items on the scale of the factors by school and students subscales**

| Statement   | Mean | Std. Deviation |
|---|------|----------------|
| I like doing mathematics because of algebra   | 1.94 | 1.021          |
| I like symbols, they do make me think always in mathematics lessons                         | 1.58 | .978           |
| College Algebra is a course which is very interesting to me and I enjoy it                  | 2.33 | 1.155          |
| I like translating stories into literal symbols and letters in mathematics                  | 1.94 | 1.036          |
| I liked mathematics because of letters( x and y)  | 1.95 | .902           |
| Algebra is an aspect of mathematics which I do better in an examination than other aspects. | 2.08 | 1.219          |
| I feel easy working problems in algebra courses   | 2.42 | 1.151          |
| I do much better in algebra courses when they are presented with manipulative materials     | 1.91 | 1.262          |
| I find it easy to translate word problems into algebraic symbols                            | 2.47 | 1.205          |
| I find algebra lessons interesting when working with visual materials                       | 2.68 | 1.139          |
| I always feel comfortable during mathematics lesson   | 1.97 | 1.176          |
| I enjoy algebra lessons when working in groups  | 3.03 | 1.095          |
| I find it interesting to represent a quantity by a symbol                                   | 2.35 | 1.222          |
| I learn mathematics well when it is presented step by step in class.                        | 3.11 | 1.111          |
| I do relate any word problems in mathematics to real-life situations                        | 2.35 | 1.398          |
| My parents provide me a set of materials for learning mathematics                           | 2.56 | 1.242          |
| I learn algebra well with the used of projectors  | 2.17 | 1.090          |
| I learn algebra well on my own  | 1.88 | 1.183          |
| My teacher explains the concepts well during algebra lessons                                | 2.91 | 1.077          |
| I do better in mathematics when working with friends  | 2.41 | 1.467          |

**APPENDIX II**

**Table7: Paired Samples Correlation, Means, and Standard Deviations Statistics of students' college algebra and Core mathematics grades**

|                        | Mean  | Std. Deviation | Correlations | Sig. |
|------------------------|-------|----------------|--------------|------|
| College algebra grade  | 60.26 | 11.047         |              |      |
| Core mathematics grade | 64.77 | 6.930          | .271         | .028 |

# Exploring Strategies For Financial Resource Mobilization In Public Secondary Schools In Kapenguria Constituency West Pokot County Kenya.

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**Abstract-** In light of the one hundred percent transition from primary to secondary schools, greater investment of resources in education is key. However, the present state of most secondary schools in Kenya is quite deplorable. Some of the books in the library are obsolete, inadequate equipment in the laboratory and buildings overdue for renovation are some of the indicators that the schools have a financial challenge. The study explored strategies for financial resource mobilization in public secondary schools in Kapenguria Constituency West Pokot County Kenya. The study was guided by the following research questions; To what extent is school fees payment as a form of financial resource mobilization effective among secondary schools in Kapenguria Constituency, West Pokot County, Kenya? To what extent has government financial intervention assisted schools as a form of financial resource mobilization among secondary schools in Kapenguria Constituency, West Pokot County, Kenya? To what extent is community resources as a form of financial resource mobilization effective among secondary schools in Kapenguria Constituency, West Pokot County, Kenya? and to what extent have income generating activities assisted schools as a form of financial resource mobilization among secondary schools in Kapenguria Constituency, West Pokot County, Kenya? The study was guided by the financial agency theory and adopted the cross sectional survey design. The target population was composed of principals and Board of Management chairpersons. A Questionnaire was used to collect data. Quantitative data was analyzed using percentages and frequencies. The findings were that schools to a large extent relied on school fees payment as a financial resource mobilization strategy. Other resource mobilization strategies were income generating activities and donations from the community. It was recommended that awareness campaigns should be held by the Ministry of Education, Science and Technology to sensitize parents on the importance of paying school fees on time and that The Ministry of education should allocate more funds to constituencies so as to enable needy students benefit from bursaries.

**Index Terms-** Exploring; Strategies; Financial Resource Mobilization.

## I. INTRODUCTION

Education remains the main catalyst for development in any society whether in the developed or developing world. The future development of the world and individual nations hinge

more than ever on the capacity of individuals and countries to acquire, adopt and advance knowledge (Emana, 2019). In addition, efficient management of schools resources is crucial in order to make the school a pleasant, safe and comfortable center that will increase students attendance, motivation and willingness to participate adequately in both curricula and co-curricular activities (Amos & Koda, 2018).

A school itself is an organisation which requires human, financial and material resources for the purpose of achieving its goals and objectives. Every government owes its citizens basic secondary education as one of the social welfare services. The majority of governments however have not been able to meet the rising cost of education hence seeking alternative ways of funding education. This include diversity of funding sources and efficiency enhancing measures which are required to cover the significant financial investments for expanding access and improving the quality of secondary education (Yang, & Yu, 2019).

Globally, there has been a realization of the need to ensure that schools have sufficient financial resources for smooth operations but most importantly to ensure that they meet their goals of positively impacting the economy by producing the required human resources (Banka, & Bua, 2015). The importance of resources in the management of learning institutions cannot be underrated. It is not possible to deliver effective education without relevant resources. The difference made by availability and use of financial resources in schools is critical in improving the internal efficiency of education. Finance as a resource, plays a crucial role in the development of education (Singh, 2019). There are a wide variety of ways of financing educational investments. Governments which are sufficiently determined can devise strategies for shifting some of the financial burdens of education to individual students and their families through tuition fees or student loans, to employers through levies and payroll taxes or to local communities through self-help building or help with operation costs. In addition, they may devise taxes earmarked for education such as graduate or professionals surtax. All these are in realization of the fact that central government funding is not only or necessarily the most desirable way to finance education investments (Berhanu, 2018). Globally, there are a number of means and ways of creating resources for learning institutions. Such strategies encompass the prudent use of existing school financial resources and mobilizing even more for sustainability (Kingori, 2015).

Regionally, schools in Africa have been forced to develop financial resource mobilization strategies. These has been mainly due to the fact that Governments in Sub-Saharan Africa spend far

much less on education financing than the developed nations yet about 15% of the school-age population lives in these countries. In some countries' like South Africa, Ghana and Zambia, public schools, tuition is free although students pay an entrance fee and buy uniforms. Most supplies are free and some students received government scholarships (Kisige & Neema-Abooki, 2017). Clough, Fang, Vissa, and Wu, (2019) however indicates that school principals in these regions face increasing administrative difficulties. These include inadequate and badly constructed buildings; shortage of books and equipment; lack of proper school furniture particularly desks; poor or sometimes non-existent maintenance and repairs; untrained and half-trained teachers who seldom stay long in the profession; over-crowded classrooms; poor communication and few supporting services especially health services. As a result, the administration of schools has become one of the most taxing jobs in the whole education system. In relation to the structure of physical facilities, Alhassan, Reddy and Duppati, (2019) indicated that the development efforts of schools have sometimes been frustrated because of lack of space for extension of the school, lack of housing for teachers and worse still, lack of essential facilities like desks, chalk, books, and so on. In Kenya, an analysis of the Kenyan government funding reveals that the education sector specifically in the secondary schools category still has large financial gaps which have not been met through government funding. According to Gill and Karakulah, (2019), to adequately fund Free Tuition Secondary Education (FTSE), extra resources away from general tax revenue need to be sought. A report by the Institute of Policy Analysis and Research (IPAR) in 2009 indicated that even with FTSE, schools still needed money for lunch, school infrastructure and boarding facilities. Further, households are also expected to provide non-discretionary items such as school uniforms, sport kits, books and stationery. Accordingly, the institute did recommend that schools should establish localized fee waiver mechanisms and income generating activities. This situation has left secondary school principals in a dilemma. They therefore, have to be proactive and design financial resource mobilization strategies that would assist them cover for the deficits needed to ensure that the school operations continued. It was therefore against these background that the study sought to evaluate the financial resource mobilization strategies in secondary schools.

## II. STATEMENT OF THE PROBLEM

In light of the one hundred percent transition that the government want to attain for students wishing to join secondary education, simply to maintain educational services at present levels will require a greater investment of resources in education (Gill, & Karakulah, 2019). To expand educational services will require even more financial resources. Present levels of spending on education are already straining government budgets. In fact, in several cases it represents a huge chunk of government expenditure (King'athia, 2013). At the same time, the government revenues has reached a plateau due to slowed economic growth owing to foreign debts and other macro-economic problems affecting the Kenya (Kisige & Neema-Abooki, 2017). Despite the ministry of education efforts to train Principals on financial resource management it has been observed that the condition of teaching and learning have not improved much over

the last two decades (King'athia, 2013). Ojwang (2026) did a study in Homabay on financial resource mobilisation strategies and internal efficiency of public secondary schools in Rachuonyo south sub-county. The finding was that retention rates had positive relationship with all the strategies in question a part from community funds which showed a negative relationship.

Wakoli and Kitainge (2019) did a study in Bungoma on relationship between financial resource mobilisation and internal efficiency of technical training institutions. The finding was that that there existed weak positive relationship between financial resource mobilization and internal efficiency of public training institutions. The reviewed studies focused much on the resource mobilization and internal efficiency of institutions but much investigation were not done on which strategy mobilized more funds. Therefore, this study explored strategies for resource mobilization in public secondary schools in Kapenguria Constituency, Kenya?

## III. RESEARCH DESIGN AND METHODOLOGY

The study adopted the cross sectional survey design. Simple random sampling was employed. The study used only the questionnaire to collect data. To test validity, expert opinion. The study used the test-retest method to establish the reliability of the items in the questionnaire.

## IV. RESULTS

The following were the results of the study,

### i School Fee Payment as a Financial Resource Mobilization Strategy

The sought to establish extent to which school fees payment is a financial resource mobilization strategy in most schools in Kapenguria constituency. The study findings were presented in Table

**Table 1: Distribution Frequency of School Fee Payment as a Financial Resource Mobilization Strategy**

| Statements   |   | Very Large extent | Large extent | Small extent | No extent at all |
|--|---|-------------------|--------------|--------------|------------------|
| All the students pay fee on time   | f | 19                | 5            | 4            | 10               |
|  | % | 50                | 13.2         | 11           | 26               |
| School fees is the main source of school income                              | f | 28                | 4            | 2            | 2                |
|  | % | 74                | 11           | 5.3          | 5.3              |
| The school fees structure has costs meant to cater for all school operations | f | 00                | 00           | 00           | 00               |
|  | % | 00                | 00           | 00           | 00               |
| Total Fee collected by the school mostly is sufficient                       | f | 2                 | 1            | 00           | 2                |
|  | % | 5.3               | 2.6          | 00           | 5.3              |
|  | f | 27                | 3            | 1            | 7                |

|   |   |      |     |     |       |
|---|---|------|-----|-----|-------|
| Students means average fee collected is much higher | % | 71.1 | 7.8 | 2.6 | 18.42 |
|---|---|------|-----|-----|-------|

According to data presented in Table 1, 19(50%) of the respondents reported that to a very large extent students pay school fees on time the reason attributed to the finding was that parents were aware of the importance of timely fee payment as it guarded against students disruption of studies. The finding was in line with that of Musavin, (2015) who established that non-payment of school levies by parents negatively affected educational programs and school projects. 10 (26%) of the respondents were of the opinion that to no extent at all is fee paid in time. The meaning of the finding was that there were parents/ guardians who were either unable to raise fees when the term began and therefore they staggered the payment or they never completed paying fees throughout the term. And this is the reason why other strategies of resources mobilization in schools come in hand to cater for deficit whenever fees levies are not sufficient. 28(74%) of the participants reported that to a very large extent fee payment is the main source of income in most schools. The indication of the finding is that if there is no timely fee payment by learners then there is like hood that running most programs in the school will be grounded. The finding agrees with that of Nyaga, (2015) who noted that there were delays in school fees payments in all the schools and that it had serious effects on the teaching and learning process. However, 2(5.3%) of the participants reported that to no extent at all was fee payment a

main source of income in schools. The finding is anchored on the report of the gazette notice of 2015 and 2017, the ministry of education recommended that the maximum cost of day schooling was Kenya shillings 22,244 while that of boarding schools was at Kenya shillings 66, 424 and Kenya shillings 69, 810 for special needs secondary schools. And thus this meant that school managers have to come up with some other strategies such as hiring the school buses, playgrounds and the main halls as shown in Table 1 so as to top up the deficit that is not catered for by the government. Most of the participants were of the opinion that the school fees structure has costs meant to cater for all school operations and perhaps this was the reason why other strategies for mobilizing resources were put in place so as to enable school managers get sufficient funds to run the schools throughout an academic year. As shown in Table1 (5.3%) of the participants reported that to a very large extent total fee collected by the school mostly is sufficient and 00% of the respondent reported that the at no extent at all was fee collected sufficient to run schools' programs and hence the reason for mobilizing resources using other sources.

**ii Government Financial Intervention as a Financial Resource Mobilization Strategy**

The study sought to establish the extent to which government financial intervention is a financial resource mobilization strategy in public secondary schools in Kapenguria constituency, West Pokot County. The study findings were presented in Table 2

**Table 2: Distribution Frequency of Government Financial Intervention as a Financial Resource Mobilization Strategy in Schools**

| Statements   |   | Very large extent (1) | Large extent (2) | Small extent(3) | No extent at all (4) |
|--|---|-----------------------|------------------|-----------------|----------------------|
| Free tuition allocations for students by the government are timely and sufficient                | f | 5                     | 8                | 10              | 15                   |
|  | % | 13.15                 | 21.05            | 26.32           | 39.47                |
| The government offers bursaries to needy students in sufficient amounts boosting school revenues | f | 22                    | 10               | 6               | 00                   |
|  | % | 57.89                 | 26.32            | 15.78           | 00                   |
| cost sharing principal has helped the institution grow its physical resource                     | f | 5                     | 10               | 20              | 3                    |
|  | % | 13..15                | 13.89            | 52.63           | 7.9                  |
| Government allocations account form the largest share of the schools budget                      | f | 30                    | 2                | 3               | 3                    |
|  | % | 78.94                 | 5.26             | 7.9             | 7.9                  |
| Government financial interventions are the only revenues by the school                           | f | 1                     | 1                | 10              | 26                   |
|  | % | 2.63                  | 2.63             | 26.32           | 68.42                |

Data presented in Table 2 show that 15 (39.47%) of participant and 10(26.32%) of the participants were of the opinion that to a small extent free tuition allocation for students by the government are timely and sufficient. The finding meant that there government financial interventions do not cater for all the needs of the schools. The reasons include; delays in release of government financial interventions and the insufficiency that might result from reliance on such financial resource. Free Tuition Secondary Education were inadequate and delayed before

disbursement. Sometimes due to bureaucracies in the processing of the funds, delays are experienced causing panic and outcry among the school stakeholders. The Kenya budget to education is comparatively large yet seems to be inadequate requiring consolidated support for sustainability. And thus the reason for other resources which school managers put in place in order to realize sustainability. The finding was in agreement with that of Wanjala and Hussein, (2017) who had established that even after the introduction of subsidized fee the enrollments rates remained

low, because finances to support Free Tuition Secondary Education were inadequate and delayed before disbursement. Further the same authors had established that, the implementation of subsidized fees programme by the government of Kenya has not greatly influenced access to quality education in public secondary schools. 13 (43.20%) of the participants to a large extent felt that Free tuition allocations for students by the government are timely and sufficient. The reason that was attached to the finding was that the participants were representing the schools which had been in existence for over 20 years and therefore they had developed in terms of structure and therefore the financial aid that they received from the Ministry of Education seemed to be enough.

According to the data presented in Table 2, 22(55.89%) of participants agreed that to a very large extent the government offers bursaries to needy students in sufficient amounts boosting school revenues. The implication of the finding is that bursaries are one of the resources that finance the running of the schools. But 00 (00%) of the participants reported that to no extent at all are bursaries sufficient to boost school revenues. The meaning of the finding is that there are some students who do not receive perhaps because they are not needy and therefore the schools in which such students are in have not realized the importance of the bursaries.

The other reason which can be attached to the finding is that there are rising demands for educational requirements and it is marred with a lot of irregularities ranging from delays in disbursement by the government to biased allocation by the constituency bursary committees. Indeed political interference has compromised equity considerations in award of bursaries. While the poor who are not able to afford the extra charges in schools are denied the fund, some rich, politically connected individuals are awarded the bursaries or they influence award to some of their relatives. The finding contradicts with that of Commonwealth (2016) which states that the needy children should be awarded scholarship, bursaries and other mechanisms laid down so as to boost their education in various learning levels.

iii Community Resource Mobilization as a Financial Resource Mobilization strategy

The study sought to evaluate extent to which community resource mobilization is a financial resource mobilization strategy in Kapenguria constituency, West Pokot County. The study findings were presented in Table 3.

**Table 3: Distribution Frequency of Community Resource Mobilization as a Financial Resource Mobilization strategy**

| Statements  | Very large extent (1) | Large extent(2) | Small extent(3) | No extent at all (4) |
|---|-----------------------|-----------------|-----------------|----------------------|
| NGOs frequently fund development in the school              | f 1                   | 1               | 00              | 36                   |
|   | % 2.6                 | 2.6             | 00              | 94.73                |
| CDF allocations has been instrumental to develop the school | f 30                  | 4               | 00              | 4                    |
|   | % 78.94               | 10.52           | 00              | 10.52                |
| Old boys of the schools often support development projects  | f 10                  | 5               | 3               | 20                   |
|   | % 26.31               | 13.15           | 7.9             | 52.63                |
| The school has conducted harambee to support development    | f 5                   | 25              | 3               | 5                    |
|   | % 13.15               | 65.78           | 7.9             | 13.15                |
| Well-wishers provide development funds to the school        | f 2                   | 1               | 5               | 30                   |
|   | % 5.26                | 2.63            | 13.15           | 78.94                |

Community resource mobilization is the process of engaging communities to identify community priorities, resources, needs and solutions to schools in such a way as to promote development in schools. According to data presented in Table 3, 36 (94.73%) of the participants reported that to no extent at all do NGOs frequently fund development in the school. This finding meant that within the area where the study was conducted the NGOS are not based there and therefore, they do not part of the community partners who fund the schools. Another meaning to the finding is that could be there are NGOS around the area but there is nobody influential around the area of study who can do a proposal requesting them to fund some structures in the schools. However, 1 (2.6%) of the participants reported that to a very large extent NGOS frequently fund development in the school. The

finding meant that even though the NGOS fund schools, to a small extent their contribution is not significant in most schools. 30(78.94%) of participant were to a very large extent that CDF allocations has been instrumental to develop the schools because CDF is a form of subsidy that assists in bridging the investment gap left by poor parents and guardians. According to CDF Act of 2003, Constituency Development Fund was intended to improve on access to secondary education through creating capacity for improved enrolment and to ensure transition and completion rates through provision of bursary to needy students and education takes the lion's share of the total allocations from CDF. However, 4(10.52%) of the participants reported that to a small extent were CDF allocations has been instrumental to develop the schools. The meaning of the finding is that CDF allocations to schools in some

parts of Kapenguria constituency is marred with more hurdles for instance favoritism during allocation or even misappropriation by the in charge.

20 (52.63%) of the participants were of the view that to no extent at all do old boys of the schools often support development projects. The meaning of the finding was that the act of humanity is totally not a common practice among the alumni of the schools. But, 5 (13.15%) of the participants reported that to a very large extent old boys of the schools often support development projects. The meaning of the finding would be that these old boys understand are aware that education is fundamental to development of any society and thus supporting it to thrive is key. Another meaning of the finding is that, would be the old boys were supported by guardians during their various stages of learning and therefore they feel they have a moral obligation to give back to society. The other meaning of the finding is that some old boys partner with their local community so that alumni can provide assistance to the area while also having the opportunity to build relationships with community members and leaders. The other reason would be that some old boys often want to stay connected to their alma mater and help future generations of alumni have the same opportunities and positive experiences they did while they were in schools. Banka and Bua, (2015) contradicted this results by noting that Old Students Associations' contribution to school recruitment of teachers and maintenance of students' discipline significantly affect secondary school management.

25(65.78%) of participants were of the opinion that to a large extent schools have conducted harambees to raise funds. The meaning adduced from the finding is that the Harambee movement is a unique way of financing education in Kenya since the independence period to the present. Harambee movement achieved a different dimension with the introduction of University fees payment in July, 1991. The reason why perhaps harambees are held is because the community understands that working together for a common good is better and it also demonstrates that the community members indeed own and they are proud of their

schools. Data in Table 3 show that 30(78.84%) of the participants were of the opinion that to no extent at all do

Well-wishers provide development funds to the school. The finding might mean that no free money is donated to schools by people who no interest in the schools. Or the other meaning of the finding would be that community members have not been mobilized to help in developing the schools. Ngeiywa, (2016) contradicted this results by noting that church donors have really developed secondary schools infrastructure. The meaning of the finding is that well-wishers, donors and other community initiatives is hard to come by owing to the hardships that already exist in the region. This could be a reason why the community efforts might direct their efforts to other initiatives such as food programs as opposed to school programs. The region also is located in the semi -arid areas of Kenya and hence might be miles away from the major urban areas of the country from where they can attract help from major donors.

Other reasons might include the inability of the principals in the region to develop initiatives to attract community resources for example attracting donors in the region to fund school infrastructure. The principals need to develop skills to attract community resources. This will ensure that the community resources such as donors get to know the needs of the schools and as a result will be able to contribute to the development of the school. Donor funding for example by the church influence students sponsorship mainly those who are bright and from humble background.

**iv Income Generating Activities as Financial Resource Mobilization Strategy**

The study sought to establish the extent to which income generating activities is a financial resource mobilization strategy in Kapenguria constituency, West Pokot County. The study findings were presented in Table 4

**Table 4: Distribution Frequency of Income Generating Activities as Financial Resource Mobilization Strategy**

| Statements  |   | Very large extent(1) | Large extent (2) | Small extent(3) | No extent at all (4) |
|---|---|----------------------|------------------|-----------------|----------------------|
| The school hires some of its physical resources to outsiders            | f | 36                   | 2                | 00              | 00                   |
|   | % | 94.74                | 5.26             | 00              | 00                   |
| The school farm products supplement the school budgets                  | f | 2                    | 1                | 00              | 33                   |
|   | % | 5.26                 | 2.63             | 00              | 86.84                |
| The schools offers services such as printing and photocopy to outsiders | f | 5                    | 2                | 1               | 30                   |
|   | % | 13.15                | 5.26             | 2.63            | 78.94                |
| Teachers living in the school pay for rent                              | f | 26                   | 7                | 1               | 1                    |
|   | % | 68.42                | 18.42            | 2.63            | 2.63                 |
| School kitchen provides catering services                               | f | 15                   | 8                | 10              | 2                    |
|   | % | 39.47                | 21.05            | 26.32           | 5.26                 |

Odundo and Rambo (2013) emphasizes on the importance learning institutions coming up with of income generating activities. As shown in the Table 4, 36(94.7% ) of the participant were of the view that to a large extent the schools hire some of its physical resources to outsiders. The meaning of the finding is that the managers of the schools out source for funds to help them run their schools. The other meaning of the finding is that the schools that hire the physical facilities such as buses and playground as shown in Table 1 are those ones that are developed in terms of structure and could be they sit at an area of above five acres. 33(86.84%) of the participants reported that to no extent at all do the school farms products supplement the schools' budget. The reason why the finding is so is because most schools in the constituency sit on small hectares of land and therefore, farming activities may not be that vibrant. The other reason which may be attached to the finding would be that the constituency is located in an arid area in Kenya and perhaps that is why farming is not possible.

30 (78.94%) of the respondent reported that to no extent at all do the schools offers services such as printing and photocopy to outsiders. The meaning of the finding would be that if the services are extended to the outer community of the schools, the schools will be deemed to be business hubs and this will be a threat to the security of the students and as well it will disrupt learning and other activities in the school. The finding contradicted King'athia, (2013) who revealed that that income generating activities which could have eased the burden of educational financing were not fully exploited by school managers. It concluded that most principals lacked entrepreneurial and business skills to exploit income generating activities as an alternative source of education financing to promote students retention. 26 (68.42%) of the participants reported that teachers living in the schools' houses pay rent. The meaning of the finding is that teachers are paid an enhanced house allowance and therefore, they cannot be housed the schools freely. The other meaning of the finding is that school houses is an income generating activity and pay rent means compliance. 23(60.52%) as shown in Table 4 most of the respondent reported that school kitchen provides catering services. The meaning meant that during school holidays and weekends they engage themselves in sourcing for funds which is a good idea.

#### V. RECOMMENDATION OF THE STUDY

From the findings and conclusions of the study the following recommendations were made;

##### i)Community leaders and Parents

It was recommended that the community leaders should mobilize parents /guardians ,church leaders on the importance of assisting schools with finances so as to enable them develop infrastructure. There is also an urgent need to educate members of the community the importance and role of Harambee .

##### ii)County Directors of Education

There is need for this stakeholder to raise awareness amongst principals and teachers on the need to come up with projects which are not labour intensive so as to assist school raise funds.

##### iii)Ministry of finance

There is need for the Ministry of finance to increase capitation to each student since from the findings it was realized that fee payment is the major source of resource mobilization in schools.

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# A Qualitative Analysis Of The Coping Strategies Of Kenyan Teachers

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**Abstract:** The current school context with its growing emphasis on quality and accountability is exerting significant performance pressure on teachers. It is important to understand how teachers cope with stressors in their every-day duty of teaching. Since the phenomenon of coping strategies among school teachers has received little attention in Kenya, this study sought to qualitatively explore the coping strategies used by teachers of secondary and primary schools when facing stressors in their working conditions. Eighteen teachers were purposively sampled through maximal variation sampling. Data were collected through semi-structured, face-to-face interviews. Each interview was audio-taped, transcribed verbatim and coded according to the constant comparative method of data analysis. Results showed that teachers used two problem-focused strategies and two emotion-focused strategies as the primary coping approaches to various problems they encountered in the course of duty. While some of the coping strategies used by the teachers in this study were valuable in the short term, they were not necessarily effective in the long term. As such, the implication for policy is that teachers need support to cope with stressors exceeding their coping resources by being provided with instructional resources, reduced workload, enhanced compensation and adequate participation in decision making in the school.

**Keywords:** Coping strategies, working conditions, stress, teachers.

## 1. INTRODUCTION

The current school context with its growing emphasis on quality and accountability is exerting significant performance pressure on teachers (Richards, 2012). The recent introduction of teacher appraisal systems, policy changes in teacher management and the introduction of a new curriculum are shaping the working conditions of Kenyan teachers. In addition to these recent changes, teachers also face poor administrative support, high workloads, lack of resources, inadequate time to prepare for instruction, poor professional relationships with colleagues, difficult interactions with parents, student misbehaviour and inadequate compensation (Howard & Johnson, 2004).

The levels of stress of teachers have escalated with increased teacher performance expectations but supportive conditions and resources have not (Richards, 2012). Persistent exposure to occupational demands is interpreted by individuals as stress. Occupational stress resulting from aspects of working conditions of teachers involves unpleasant emotional experiences such as frustration, tension, anxiety, anger and depression (Boylard, 2011). While a certain level of stress exists in any profession, evidence suggests that teachers suffer more work-related stress than non-teachers (Blase, 1986). Consequences of stress and burnout include reduced productivity, efficacy, illness, psychopathology and deterioration in social and family relationships (Harlow, 2008).

Teaching stress is a function of exposure to the sources of stress and the employment of coping resources (Callan et al., 1994). The conditions that cause teachers immense stress are largely beyond their power to control when such conditions are the result of policy changes within and outside the school system (Richards, 2012). For instance, Kenyan teachers can neither alter the country's financial realities nor decide how many more students will be added to a classroom. But they can look for ways of coping with their earnings and manage their workloads. As such the only real power stressed teachers possess is their choice of coping strategies. This study was prompted by an interest in the successful coping strategies teachers use in their working conditions. Finding out how teachers master different coping strategies can help to improve the perceptions and realities of problems in the work environments of teachers.

While previous research on teacher stress in Kenya has primarily focused on the sources of stress (Jeserem, 2006), minimal research attention has been directed toward coping with stressors in the working conditions of teachers. In addition, research into teacher coping has relied largely on quantitative methods that employ highly structured survey instruments which may greatly limit the research participant's responses. Consequently, in the area of teacher coping, using qualitative methods which give research participants opportunities to explain in detail the coping strategies have rarely been used in Kenya. By examining multiple views through qualitative approaches, we can better understand the conceptions teachers hold about their coping strategies. With this understanding, researchers can better isolate variables and develop models about coping strategies.

Coping is a way people consciously choose to reduce stress by altering its causes (Lazarus & Folkman, 1984). Stress plays an important role in the coping process as individuals within organizations enact strategies to ease or completely alleviate stressful events in their job contexts (Griffith et al., 1999).

While the findings of different studies on the coping strategies used by teachers reveal a diversity of strategies, two main categories manifest: problem-focused coping and emotion-focused coping (Lazarus & Folkman, 1984). Problem-focused coping, is aimed at problem solving or doing something to alter the source of the problem. Emotion-focused coping, is aimed at reducing or managing the emotional distress that is associated with a problem. People use problem-focused approaches when they believe a problem can actually be changed (Vorell, 2012). Conversely, when someone believes a situation cannot be changed, he or she enacts an emotion-focused approach and works to change his or her internal appraisal of the stressor (Griffith et al., 1999).

Coping resources such as psychological, social and organizational means available to a person influence whether a particular coping strategy can or will be implemented (Callan et al., 1994). This study defines coping as the process in which teachers engage to manage the stressors in their working conditions that they identify as exceeding their personal or organizational resources.

The coping strategies adopted for interpretation of the interview data in this study are based on the theoretical categorization of Carver, Scheier, & Weintraub (1989) which identifies the particular coping responses under problem-focused coping and emotion-focused coping. Typical responses in problem-focused coping are active coping, planning, suppression of competing activities, restraint coping and seeking of instrumental social support. Coping responses of emotion-focused coping are seeking of emotional social support, positive reinterpretation, acceptance, denial, turning to religion, focus on and venting of emotions, behavioural disengagement, mental disengagement.

## 2. METHOD

**Research Design:** A qualitative research methodology was employed to gain insight into the nature of coping strategies employed by teachers to respond to the stressful occurrences in their working conditions. The study was designed to focus on the general question, What strategies are used by teachers to cope with stressors in their working conditions? Collective case study method was used to provide vivid descriptions and explanations of coping strategies (Stake, 2005).

**Participants:** Data for this study were gathered from a population of 427 teachers in two sub-counties of Garissa county in North Eastern Kenya. Eighteen (18) teachers were purposively sampled through maximal variation sampling based on the characteristics of school level, gender and school locale (Creswell, 2015). In addition, sample size was determined by Data Saturation Point.

**Interviews:** Data were collected through semi-structured, face-to-face interviews of 30 to 90 minutes length. The single-participant interviews consisted of broad, open-ended questions designed to describe the day-to-day coping strategies of teachers. Prompts were used to elicit more detailed information. Each interview was audio-taped and transcribed verbatim and coded according to the constant comparative method of data analysis.

## 3. RESULTS AND DISCUSSION

The general research question addressed by this study was: What strategies are used by teachers to cope with stressors in their working conditions?

Analysis of the interview transcripts revealed that teachers used two problem-focused coping strategies and two emotion-focused strategies as the primary coping approaches to various problems in their working conditions. The problem-focused coping strategies were: active coping and planning, while the emotion-focused strategies were: acceptance and behavioural disengagement. The strategies employed by teachers to cope with stress problems experienced in their working conditions are presented below.

**Time Constraints:** Data show that teachers used problem-focused strategies in order to deal with problems of inadequate time in their daily teaching chores. In particular, teachers who had difficulty covering the content of the syllabus actively coped by creating additional teaching time in order to complete the syllabus. While non-regular teaching time for boarding secondary schools was Saturdays and evenings, day secondary schools and primary schools used early morning sessions before the start of regular lessons. The inability to cover the syllabus by teachers was a more pressing problem in secondary schools than primary schools because in secondary schools there is potential for students to be sent away for outstanding school fees within the school term. The extract below from a day secondary school teacher explains inadequate teaching time as a consequence of learning interruption when students are sent home for unpaid school fees or for short mid-term holidays and their coping responses.

“We are not able to cover the syllabus on time because there are many breaks in between. Sometimes students are sent for fees, there is a long period of half term lasting a week. So, teachers have decided to create extra time either early in the morning on school days, Saturdays or use PE lessons”.

A boarding secondary school teacher also elucidated on how the teachers struggled in a race against time to utilize non-work hours to complete what they consider as voluminous curriculum content.

“The syllabus is very wide in most subjects and the regular time given is not enough. So, we manage to cover the syllabus because of teaching on Saturdays. We also teacher after 4:30 pm and at night during preps, all sponsored by the school”.

Even though the teaching time is affected by factors beyond the control of teachers, they are compelled to espouse ways of coping so as to meet the expectations of the curriculum in as far as content handling is concerned. Teachers use personal, planning and collaboration time to cope with limited instructional time. This finding corroborates another revelation by the teachers that there was lack of adequate time to collaborate with colleagues and prepare for teaching. Government policy prohibits teachers from teaching outside the regular hours but teachers must cover the curriculum content so that students are prepared for national examinations.

**Lack of Parental Involvement:** Interview data revealed that teachers relied on acceptance and active coping strategies to deal with lack of parental involvement in student learning. Interview data revealed that most parents did not follow up with the learning of their children as most did not visit schools to monitor their children’s progress and find solutions to academic or discipline problems. Teachers coped with this problem by accepting and tolerating the situation and working with the few who demonstrated concern for the studies of their children as one teacher put it: “We work with the few parents who turn up”. Teachers also coped actively by taking audacious measures to get parents to respond to calls from the school. Among the measures was denying students access to class until their parents appeared in the school to engage the teachers on issues affecting their children as described by one teacher.

“Before the students went on strike we suggested a parents’ meeting. We had 480 students. Out of 144 parents of form one students only 20 parents turned up. In form two out of 100 parents only 7 turned up for the meeting. After they struck we told parents we would not allow a student into the school who is not accompanied by his parent. So, we got the majority of the parents and guardians”.

**Student discipline problems:** In coping with student discipline problems, teachers depended primarily on acceptance and behavioural disengagement strategies to reduce the effects of the stressors. Interviews also revealed that teachers adopted acceptance coping with student apathy by becoming accustomed to the situation since they could do nothing about it. One secondary teacher, for instance, explained how students wasting time was a prevailing problem rooted in school culture about which teachers could do nothing to change but reconcile to.

“We have become used to students wasting time. It is like we have developed immunity. It is like after all that is how things are and as an individual I can do nothing about it. It is not that I lack the passion and the zeal to teach but the system is not supportive”.

In instances where teachers felt they were likely to suffer retribution from students or the government for the corrective measures they took against misbehaving students, they resorted to behavioural disengagement by ceasing to make effort to institute disciplinary measures as elaborated by a teacher in the quote below.

“We read in the news yesterday that a teacher was jailed for three years for slapping a student. Such measures have discouraged teachers from getting involved in student discipline issues and the results is that students are all over the country burning schools. There is a lot of indiscipline problems among students because teachers no longer sacrifice to stay longer hours in school to monitor and deal with student issues. They only come to teach and don't have interest in managing student discipline including guidance and counselling students”.

**Teacher Empowerment:** Teachers who were frustrated by lack of consultation in school decision-making coped through behavioural disengagement by giving up the prospect of being engaged constructively by school authorities. Interview data showed that secondary school teachers were less likely to challenge unilateral decisions and less comfortable raising important issues and concerns in the school because some secondary schools lacked an open consultative environment where teachers could liberally raise matters of concern with the school administration. The comment of one teacher captures the problem and the disengagement strategy,

“What do you do? Your boss has decided. The moment you talk about it [a decision] you will be in trouble. We just keep quiet and suffer in silence. This has effect on the morale of the teachers”.

The disengagement strategy revealed by the participants is a demonstration of the teachers' lack of a strong belief in their ability to control what happens to them. This sense of fatalism can potentially breed indifference as teachers elect to completely not participate in decision-making in the school.

**Teacher compensation:** Teachers used a number of ways to cope with problems of compensation. First, to actively cope with inadequate remuneration, the teachers admitted to venturing into personal business and conducting private tuition for willing students to supplement their income from the government.

Secondly, teachers actively coped with the lack of promotion through optimism and unrelenting in applying for promotion as one teacher noted: “The teachers keep trying and continue to apply for promotion when TSC advertises. They don't give up”.

Thirdly, to cope with their dissatisfaction with the terms and conditions of service, teachers said they were always exploring options of getting out of teaching. This coping by planning was demonstrated by teachers pursuing higher academic qualifications in fields other than teaching as one teacher remarked,

“TSC said you wait for vacancies to be announced in a given establishment for a teacher with higher qualification to be considered. This is one of the areas that is now discouraging the teachers. So, some teachers are therefore opting to do non-education courses so that they are able to leave teaching finally”.

Fourthly, teachers also admitted to being in constant search of employment opportunities outside the government teaching sector. The statement of one teacher represents the planning that teachers were engaged in while searching for alternative employment opportunities.

“If I get another opportunity of employment even on contract today I will not think twice about it because of the poor terms and conditions of service. And by the way every teacher is a job seeker”.

These findings show that teachers preferred to maintain the current job while supplementing their income from other gainful engagements. The teachers also sought to improve future job prospects by studying courses in other fields and engaging in job search behavior (Astarlioglu et al., 2011). These coping strategies express teachers’ proactive actions as they look forward to control either their current job or future job by taking behavioral actions.

To cope with poor medical services, the teachers reported seeking alternative services to what was offered under the insurance cover. They took active steps as individuals to spend personal funds to obtain services and medications that the health facility mandated by the insurer could not provide. One teacher observed that: “The medical insurance is a sham. The health facility that is accredited by the insurer to serve the teachers does not have the personnel, the service and medicines required. So, we go to other hospitals and use our money to get treatment”.

#### 4. CONCLUSION AND IMPLICATIONS

Learning to cope with stress successfully has benefits for teachers. While teachers may not be able to change the various factors in their working conditions such as the level of support from parents, the number of students in the classroom, or the availability of instructional materials, they have the power to practice coping strategies that either directly address the sources of job-related problems or minimize the emotional consequences of stress. Some coping strategies, such as active coping, reported in this study offer some valuable options that may improve a teacher’s sense of well-being (Howard & Johnson, 2004). For example, the supplementary ways of earning an income may improve the pecuniary situation of teachers. Others, such as acceptance, are particularly important in circumstances in which the stressor must be accommodated to, as opposed to being changed (Carver et al., 1989). For instance, teachers accommodating to lack of involvement in decision-making in the school.

This study reveals that the fretfulness of stress in the lives and performance of Kenyan teachers cannot be ignored. From an organizational point of view, stress can lead to significant loss of skilled and experienced teachers from the teaching workforce (Richards, 2012). Stressed teachers who stay within the profession are likely to be increasingly less productive in their jobs. For the benefit of students as well as the society, the matter of teacher coping deserves the attention and support of employers and policymakers. While some of the coping strategies used by the teachers in this study were valuable in the short term, they were not necessarily effective in the long term. As such, policy implications are that the teachers need support to cope with stressors that exceed their coping resources by being provided with instructional resources, reduced workload, enhanced compensation and adequate participation in decision making in the school.

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# Response Surface Optimization of Some Process Condition in Bioethanol Production Using Fresh Water Microalgae Biomass

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## Abstract:

**Background:** The increase in the price of fossil fuel, strict government regulations on exhaust emissions and future depletion of worldwide petroleum reserves trigger studies to look for alternative fuels. Bio-ethanol from different kinds of biomass is one way to reduce both consumption of crude oil and environmental pollution. Although extensive efforts have been put in place to evaluate the potential of microalgae as a biofuels feedstock during the past 4–5 decades but there is currently limited information on the state of Microalgae biomass conversion to ethanol, this study aimed at harnessing the potentials of microalgae as third generation biomass for bioethanol production.

**Materials and Methods:** The hydrolysis of Spirogyra biomass was carried out using dilute acid, amylase and combine acid and enzyme hydrolysis. Fermentation of the algal hydrolysate were done using baker's yeast (*Sacchromyces cereviacea*) isolated from sugarcane juice. Some important process conditions (pH, temperature and incubation time) were subjected to optimization using response surface methodology in order to assess their effect in relation to the bioethanol yield. The modeling and statistical analysis were performed using Design expert software, version 6.0.6.

**Results:** the maximal bioethanol yield of 12 % was obtained with pH of 5.2, at 37.5°C for 152hrs. So also three dimensional contour surface interactions of the parameters shows positive effect of incubation time with less effect of pH and temperature ranges used respectively. Subjecting the product to FT-IR revealed the presence of single carbon bond ( $2981\text{cm}^{-1}$ ), methyl ( $1417\text{cm}^{-1}$ ) and OH group ( $3331\text{cm}^{-1}$ ) and boiling of  $78.73 \pm 0.03^\circ\text{C}$ .

**Conclusion:** Base on the result of this study fresh water Spirogyra spp, could serve as low cost biomass for bioethanol production using combine acid and enzyme hydrolysis at optimized pH, temperature and incubation time.

**Key words:** Bioethanol, Spirogyra biomass, Baker's yeast (*Sachromyces Cereviacea*), fermentation, hydrolysis.

## i. Introduction

A development is 'sustainable' if it "meets the needs of the present without compromising the ability of the future generations to satisfy their own needs. The world population reached 7.3 billion in 2015, and projected to increase by 33% to reach 9.7 billion in 2050, and by 53% to cross 11.2 billion in 2100 (Thirumvengadathen and Thrimalai, 2017). This rapid growth of human population has led to mounting energy demands, which is projected to increase by 50% or more by 2030 (Eyasu *et al.*, 2018) and

the natural petroleum from fossils cannot meet-up the current consumption rate, which is already reported to be 105 times faster than nature can create (Shukla *et al.*, 2016). Fossil fuels are non-renewable sources of energy and their global supplies are unlikely to last more than 120 years if are to be used at current rate of consumption (ICPC, 2007).

Micro Algal feed stocks are regarded as one of the most promising nonfood feed stocks for biofuels and that Algae based technologies could be a key tool for reducing greenhouse gas emission (Mamta and Rajiv, 2011). Zhenyi (2013) reported that microalgae are the dominant algae being researched for biodiesel production and can also be utilize for ethanol production by converting their storage material to fermentable sugars. The absolute absence or near absence of lignin makes the enzymatic hydrolysis of algal cellulose less costly and time saving in bioethanol production (Karunakaran *et al.*, 2018). In addition, Micro algae have fast growing ability than land and require much less water than the traditional cereals, produce more biomass, can be grown in salt water or in sewage water with minimal impact on freshwater resources, easily biodegradable and relatively harmless to the environment if spilled (Shukla *et al.*, 2016). Generally, microalgae (red, brown, and green) are obtained from natural and cultivated resources (Nguyen *et al.*, 2012). The harvested microalgae are mainly used for production of different hydrocolloids, e.g., agar and alginate and small amount of these materials are also used for production of food (Yazdani *et al.*, 2014).

Traditionally, the yeast *Saccharomyces cerevisiae* has been used all over the world as the major ethanol fermenting microorganism. The larger size, thicker cell wall, better growth at low pH, less stringent nutritional requirement and greater resistance to contamination give yeast advantages over bacteria for commercial fermentation (Tiwari, 2015). Several microbes, including *Clostridium* sp., have been regarded as ethanologenic microbes, but the yeast *Saccharomyces cerevisiae* and facultative bacterium *Zymomona smobilis* are better candidates for industrial alcohol production.

In general, the steps for bioethanol production from biomass include pretreatment, enzymatic hydrolysis, fermentation, and distillation (Sulfahri *et al.*, 2016). Almost all kinds of macroalgae can be converted to bioethanol by degrading their polysaccharides into corresponding monosaccharide, followed by fermentation with suitable microorganisms (Jin *et al.*, 2014). However, the development of microalgae conversion technology is still at an early stage, and the researches were conducted mainly on lab-scale (Jinyun *et al.*, 2015).

The response surface methodology (RSM) is extensively used in bioethanol production as this model predicts experimental modifications like changes in operational conditions, various processing steps, which ultimately help in designing an experimental setup with minimum requirements and maximum yields (Demirbas, *eta al.*, 2011). RSM comprises of a group of mathematical and statistical procedure that can be used to study the optimization of culture conditions and it has already been successfully applied for optimization of media and culture conditions in many fermentation processes for production of ethanol, enzymes and amino acids (Dash *et al.* 2017).

The objective of this study is to assess the potentials of micro-algae biomass for bioethanol production using *Saccharomyces cerevisiae* and to optimize pH, temperature and incubation time for bioethanol production by response surface optimization (RSM).

## ii. MATERIALS AND METHOD

### Collection of Water sample

Water sample was collected from Ajiwa Dam Katsina state. Ajiwa Dam is located at Batagarawa local government area of Katsina state and lies between latitude 12°30'-13°00' North longitude 7°30'-8°00' East in the Sudan savannah ecological zone of Nigeria. The elevation of the site is about 518m above sea level. The Dam has catchment area of 1678km with 12 metres height and spill ways of 60 meters, lift pump of 1040km/hr capacity. The water sample was collected using a 100ml brown bottle container as described by Indabawa (2014). The samples were transported in a clean transparent robber container with ice to Department of Plant Biology, Bayero University Kano for microscopic screening of microalgae.

### Isolation and Identification of microalgae

The micro algae were isolated using pipetting method (Sulfahri, 2016). Individual microalgal cell was microscopically identified using microalgae identification guide developed by (Pelmer, 1980).

### Microalgae Culture

Individual cell of *Spirogyra spp.* being the most dominant specie was picked using capillary tube and inoculated in to the medium (BG-11). The Culture was allowed to grow and bloom in photo-bioreactor for three weeks in the Department of Biochemistry Bayero University Kano before harvesting for bioethanol Production.

### Post-harvest Processing of the Biomass

The cultured algae were harvested and subjected to sun drying to remove moisture content for 72hrs. The dried biomass was then grounded and sieved with 1mm pore size. Fine powder of the spirogyra biomass was used for all fermentation and optimization experiments.

### Isolation and preparation of yeasts inoculum

Exactly 3kg of sugarcane stalk was collected from Yan rake market in Kano state Nigeria. The stalk was squeeze using clean mortar and the resulting juice were collected in clean petri dishes. After 2hrs of exposure to air 1ml of sugarcane juice was taken

aseptically into test tubes. The samples were then serially diluted 10-fold in sterilized distilled water. One ml of the serially diluted sediment was inoculated by streaking on plates of standard yeast extract potato dextrose agar media (YPD) (supplemented with chloramphenicol (0.05 mg/l) (Nwachukwu, 2001) and incubated at 28°C for 24 hours (Offosu appiah 2013). Cell suspension (10ml) of *Sacchromyces cereviacea* prepared from 2 days old slant culture was inoculated in to 100ml of medium and incubated at 30°C for 48hrs on a rotary shaker. The *S. cereviacea* cells were then collected by centrifugation and inoculum concentration of 0.3 % (dry weight/volume) was utilized for the fermentation.

**Hydrolysis of microalgae biomass**

The biomass was subjected to combine dilute acid and enzymatic hydrolysis. The biomass was first hydrolyzed with 5% 2N HCl, at 121°C for 45 min and then neutralized to pH 4.5 with citrate buffer. The solution was then incubated with 3% amylase enzyme preparations and kept in a water bath for 12 h. Then centrifuged at 3000 rpm for 35 min and filtered to obtain clear supernatant for fermentation.

The three hydrolysates were analyzed for total reducing sugars before fermentation with *Sacchromyces cereviacea*.

**Optimization of pH, temperature and incubation time for bioethanol production from microalgae (*Spirogyra spp*)**

The statistical model based optimization was used to study the effect of pH, temperature and incubation time on ethanol yield using Central Composite Design (CCD). pH, (A), temperature (B) and incubation time (C) were taken as independent variables and ethanol yield was chosen as the dependent variables (Table 2). The resulted twenty runs experiment from the software CCD-based were carried out with different combinations of variables (Table 3.4). The modeling and statistical analysis were performed using Design expert software, version 6.0.6. All fermentation experiments were carried out in 250 ml Erlenmeyer flasks with working volume of 100 ml and agitation rate 200 rpm.). Multiple regression analysis of the observed responses in terms of the coded factors resulted in the quadratic model below (Equation (1)) .....

$$Y=+8.49-0.057*A-0.021*B+1.46*C-0.086*A^2-0.174*B^2-0.048*C^2-0.087*A*B-0.081A*C-0.064*B*C$$

A, B and C represents variables (coded values) of pH, temperature and harvesting time respectively (Table 1).

**Table 1: Factors Of RSM Experimental Design**

| Factor | Indicator | Low level | High level |
|--------|-----------|-----------|------------|
| pH     | A         | 4.5       | 6.0        |

|                  |   |    |     |
|------------------|---|----|-----|
| Temperature (°C) | B | 30 | 45  |
| Inc. time (hrs)  | C | 24 | 120 |

**Table 2:** RSM Experimental Design for Bioethanol production from microalgae biomass.

| Exp. Runs | pH   | Temperature (°C) | Incubation Time (hrs) |
|-----------|------|------------------|-----------------------|
| 1         | 4.5  | 30               | 120                   |
| 2         | 5.25 | 37.5             | 8.72                  |
| 3         | 5.25 | 37.5             | 72                    |
| 4         | 5.25 | 50               | 72                    |
| 5         | 6    | 45               | 24                    |
| 6         | 5.25 | 37.5             | 72                    |
| 7         | 5.25 | 37.5             | 72                    |
| 8         | 4.5  | 45               | 24                    |
| 9         | 4.5  | 30               | 24                    |
| 10        | 6    | 30               | 24                    |
| 11        | 5.25 | 37.5             | 152                   |
| 12        | 3.99 | 37.5             | 72                    |
| 13        | 5.25 | 37.5             | 72                    |
| 14        | 6.51 | 37.5             | 72                    |
| 15        | 5.25 | 24.9             | 72                    |
| 16        | 5.25 | 37.5             | 72                    |
| 17        | 6    | 30               | 120                   |
| 18        | 6    | 45               | 120                   |
| 19        | 5.25 | 37.5             | 72                    |
| 20        | 4.5  | 45               | 120                   |

**Validation of the second order polynomial model**

The second order polynomial model obtained from RSM was validated by conducting a series of experiments randomly selected from the design in Table 3. The experiments were done by choosing random values of parameters within the optimized levels Table 3. Also, experiments were conducted at the optimized conditions generated by the software. The experimental output was then compared to the values predicted by the second order model obtained from CCD, to estimate the goodness of fit of the model.

**Table: 3.** Experimental set up for model validation of bioethanol production from microalgae biomass (*Spirogyra spp*)

| Exp. Run | pH   | Temp. (°C) | Inc. Time(hr.) |
|----------|------|------------|----------------|
|          | A    | B          | C              |
| 1        | 5.3  | 37.5       | 152            |
| 2        | 5.25 | 37.5       | 72             |
| 3        | 4.5  | 30         | 120            |

|   |      |      |    |
|---|------|------|----|
| 4 | 3.99 | 37.5 | 72 |
| 5 | 3.9  | 37.5 | 72 |
| 6 | 6.0  | 45   | 24 |

### iii. Results and Discussion

#### Isolation of micro algae

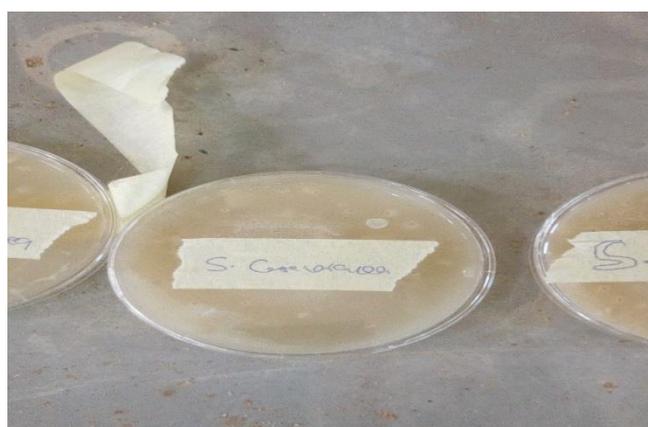
Table 4. show the results of micro algae species isolated from water sample collected from Ajiwa Dam. *Spirogyra spp.* cells was found to appears 72 times from the water sample followed by *Chlorella vulgaris* with a total of 12 cells while least number of cells was recorded in *Snesdesmus spp.* *Spirogyra spp.* being the most dominant specie was subjected to culture for bioethanol production.

**Table 4:** Isolated micro algal specie from studied water sample

| SN | Microalgal Specie             | Number of cell |
|----|-------------------------------|----------------|
| 1  | <i>Spirogyra spp</i>          | 72             |
| 3  | <i>Chlorella vulgaris and</i> | 12             |
| 3  | <i>Snesdesmus spp</i>         | 8              |

#### Isolation of fermentative Yeast (*Saccharomyces cerevisiae*)

Three *Sacchromyces spp.* isolates were identified, On the basis of colony and cell morphology including the growth of isolates in liquid medium. All three isolates were aerobes with creamish colony and spherical shaped (**plate 1**). The isolated yeast from sugarcane juice appear as unicellular, large spherical individual cells with creamish appearance and all isolates fermented glucose, fructose and sucrose, but not lactose **Table 5**. These observations were similar to those reported by Ifosu-appiah (2014) and Elijah *et al.*, (2010) who reported the isolation of *Saccharomyces cerevisiae* and other yeast from palm wine.



**Table 5:** Fermentation of some simple sugars by yeast isolate

| Isolate | Glucose | Lactose | Fructose |
|---------|---------|---------|----------|
| A       | + Gas   | -       | + Gas    |
| B       | + Gas   | -       | + Gas    |
| C       | + Gas   | -       | + Gas    |

**Optimization of bioethanol production condition**

Physical factors such as pH, temperature and incubation time are considered among most important fermentation parameters due to their effect on growth of microorganism, fermentation efficiency and by-product formation. Therefore, maintenance of these parameters is therefore of great significance in fermentation for better yield. The responses obtained for each experimental run and the predicted responses were much closer to each other. It can be observed from **Table: 6** that increased in temperature and pH results to decrease in ethanol yield. However, the yield increased positively with increased in incubation time. Maximum ethanol yield of 12% was achieved at 152 h of incubation at 37.5 °C and pH 5.2. (Run 11, Table 6) while least bioethanol yield was recorded at 72hr incubation at 50 °C and pH 5.2 (Run 4, Table 6).

**Table 6:** Actual and predicted bioethanol yield at different condition of pH, temperature and incubation time

| Exp. Runs | pH   | Temperature (°C) | Incubation Time (hrs) | Response Yield (%) | Predicted value (%) |
|-----------|------|------------------|-----------------------|--------------------|---------------------|
| 1         | 4.5  | 30               | 120                   | 8.7                | 9.43                |
| 2         | 5.25 | 37.5             | 8.72                  | 5.0                | 4.65                |
| 3         | 5.25 | 37.5             | 72                    | 9.2                | 8.49                |
| 4         | 5.25 | 50               | 72                    | 3.1                | 3.19                |
| 5         | 6    | 45               | 24                    | 5.5                | 4.96                |
| 6         | 5.25 | 37.5             | 72                    | 9.2                | 8.49                |
| 7         | 5.25 | 37.5             | 72                    | 9.2                | 8.49                |
| 8         | 4.5  | 45               | 24                    | 5.0                | 4.65                |
| 9         | 4.5  | 30               | 24                    | 5.1                | 3.63                |
| 10        | 6    | 30               | 24                    | 3.2                | 3.10                |
| 11        | 5.25 | 37.5             | 152                   | 12                 | 10.80               |
| 12        | 3.99 | 37.5             | 72                    | 5.8                | 7.01                |
| 13        | 5.25 | 37.5             | 72                    | 7.6                | 8.50                |
| 14        | 6.51 | 37.5             | 72                    | 6.6                | 5.10                |
| 15        | 5.25 | 24.9             | 72                    | 4.3                | 3.92                |
| 16        | 5.25 | 37.5             | 72                    | 8.2                | 8.49                |

|    |      |      |     |     |      |
|----|------|------|-----|-----|------|
| 17 | 6    | 30   | 120 | 6.3 | 6.85 |
| 18 | 6    | 45   | 120 | 3.3 | 4.29 |
| 19 | 5.25 | 37.5 | 72  | 7.4 | 7.51 |
| 20 | 4.5  | 45   | 120 | 8.7 | 7.91 |

The decreased in bioethanol yield observed with increased in pH. This could be due to lesser enzyme activity of the fermenting organism *S. cereviacea* at pH greater than 5.5. This agrees with observation of Hwang *et al.*, (2004) who reported that the activities of bioethanol producers are slightly suppressed at pH below 4.5 and 6.0 above. Srivastava *et al.* (1997) showed that the optimum, initial pH of guava pulp medium was 5 and achieved maximum yield of 5.8 % of ethanol at that pH. Periyasamy *et al.* (2009) obtained the maximum bioethanol at pH 4.8 from sugar molasses using *S. cerevisiae*. Ado *et al.* (2009) studied bioconversion of cassava starch into ethanol and found maximum yield of ethanol at pH 5. Asli (2010) studied efficient parameters in batch fermentation of ethanol using *S. cerevisiae* in red grapes substrate, and achieved maximum concentration of bioethanol at pH 4.5.

Moreover, this study also revealed gradual increased in bioethanol concentration with increasing incubation time. This in line with the findings of Marakis and Marakis (1996) who obtained maximum ethanol concentration of 5.8 % at pH 4.5 from aqueous carob pod extract after 120 hr of incubation. Neelakandan and Usharani (2009) produced bioethanol from cashew apple juice using immobilized yeast and reported maximum bioethanol yield at 32 °C after 140 hr of incubation.

The observed values of bioethanol yield were compared with the yield values as predicted by the second order models for validation. The result indicated that there was very good correlation between experimental and predicted values and in turn proves the validity of the models.

**Table 7:** Validation runs with observed and predicted bioethanol yield from *Spirogyra* biomass.

| Exp. Run | pH   | Temp. (°C) | Inc. Time(hr.) | Observed yield (%) | Predicted yield |
|----------|------|------------|----------------|--------------------|-----------------|
|          | A    | B          | C              | ±0.05              | (%)             |
| 1        | 5.3  | 37.5       | 152            | 11.85              | 10.8            |
| 2        | 5.25 | 37.5       | 72             | 8.75               | 8.49            |
| 3        | 4.5  | 30         | 120            | 9.05               | 9.43            |
| 4        | 3.99 | 37.5       | 72             | 6.87               | 7.01            |
| 5        | 3.9  | 37.5       | 72             | 5.80               | 7.01            |
| 6        | 6.0  | 45         | 24             | 5.65               | 4.96            |

**Test for fitness of the experimental model**

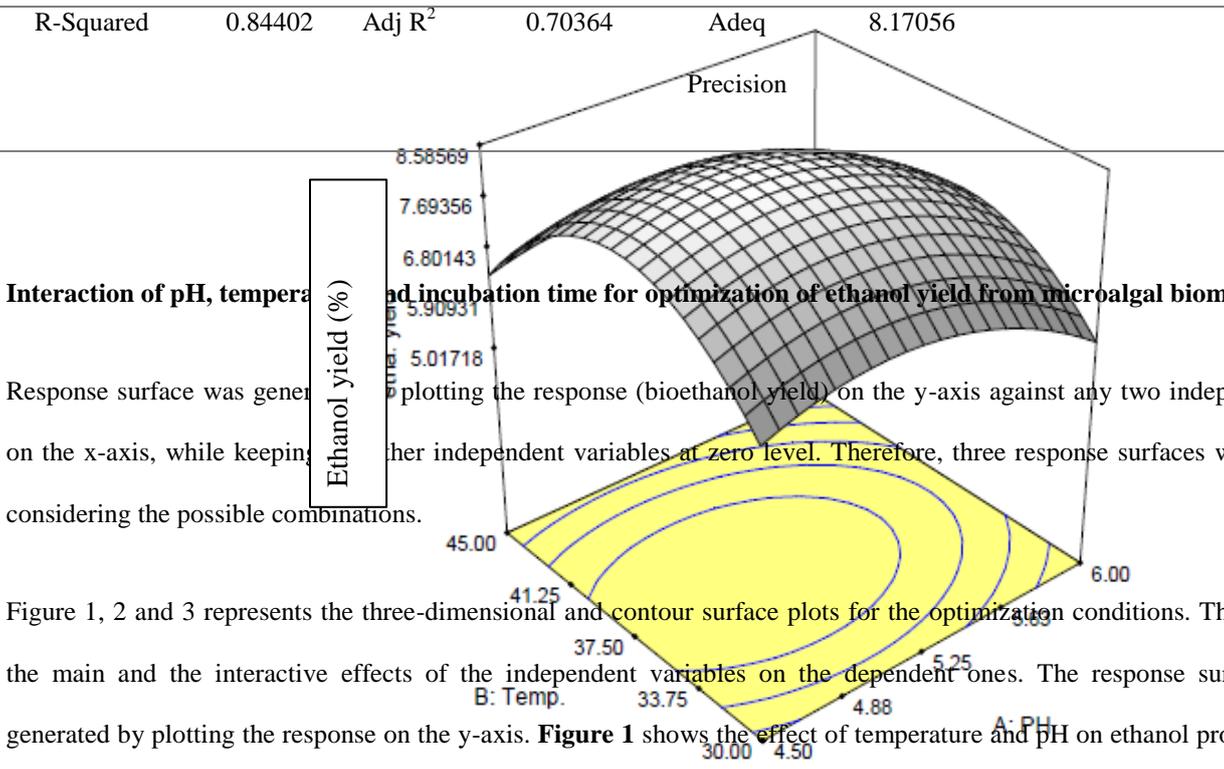
It can be deduced from **Table 8** the analysis of variance for a P-value < 0.05 indicates a significant effect on the response. Hence the Model F-value of 6.01 implies the model is significant. There is only 0.49% chance that a "Model F-Value" this large could occur due to noise. Values of "Prob > F" less than 0.0500 indicate model terms are significant. In this case C, A<sup>2</sup>, B<sup>2</sup> are significant model terms. The "Lack of Fit F-value" of 4.15 implies there is a 7.23% chance that could occur due to noise. Regression analysis produced the following second-order polynomial fit with a satisfactory coefficient of determination (R<sup>2</sup>= 0.84402).

**Ethanol. yield** = -90.92112 +17.51818\* pH +2.50683 \* inc. temp. +0.21818 \* Inc. time -1.53018 \* pH<sup>2</sup> -0.031015 \* inc. temp.<sup>2</sup> -2.06406E-005 \* Inc. Time<sup>2</sup> -0.015556 \* pH \* Temp. -0.022569 \* pH \* Inc. time-1.77083E-003 \* temp. \* Inc. time.....Equation ii.

Where, A, B and C represents pH, temperature and incubation time respectively. AB, AC and BC are the interactions, and A<sup>2</sup>, B<sup>2</sup> and C<sup>2</sup> are the quadratic terms.

**Table: 8** Analysis of variance for the regression equation of the bioethanol yield from microalgae biomass (*Spirogyra spp*).

| Source      | Squares  | DF | Square   | Value    | Prob> F |                 |
|-------------|----------|----|----------|----------|---------|-----------------|
| Model       | 0.937977 | 9  | 0.10422  | 6.012338 | 0.0049  | Significant     |
| A           | 0.044032 | 1  | 0.044032 | 2.540142 | 0.1421  |                 |
| B           | 0.006235 | 1  | 0.006235 | 0.359715 | 0.5620  |                 |
| C           | 0.289172 | 1  | 0.289172 | 16.68208 | 0.0022  |                 |
| A2          | 0.106767 | 1  | 0.106767 | 6.15927  | 0.0324  |                 |
| B2          | 0.438632 | 1  | 0.438632 | 25.30431 | 0.0005  |                 |
| C2          | 0.000326 | 1  | 0.000326 | 0.018802 | 0.8937  |                 |
| AB          | 0.000613 | 1  | 0.000613 | 0.035335 | 0.8547  |                 |
| AC          | 0.052813 | 1  | 0.052813 | 3.046705 | 0.1115  |                 |
| BC          | 0.032513 | 1  | 0.032513 | 1.875617 | 0.2008  |                 |
| Lack of Fit | 0.13966  | 5  | 0.027932 | 4.146254 | 0.0723  | not significant |

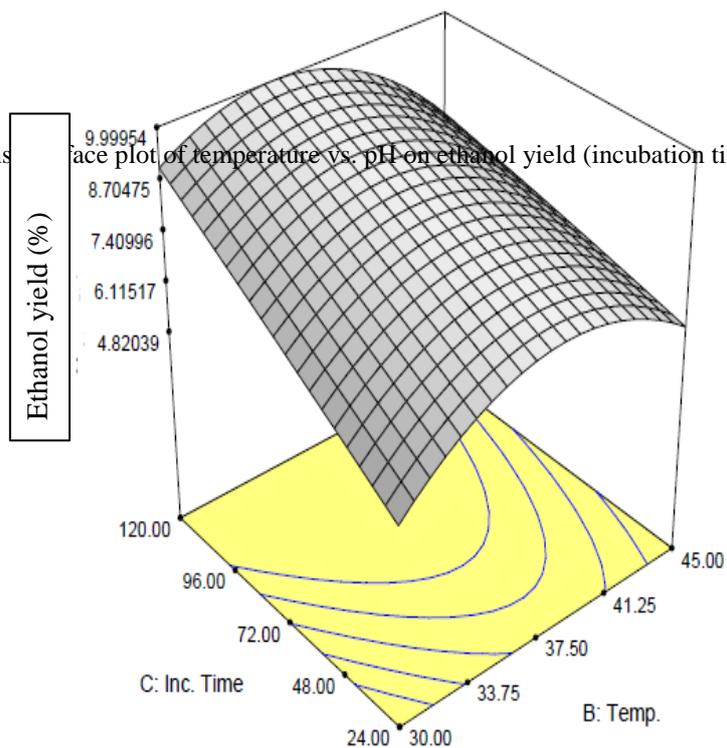


**Interaction of pH, temperature and incubation time for optimization of ethanol yield from microalgal biomass**

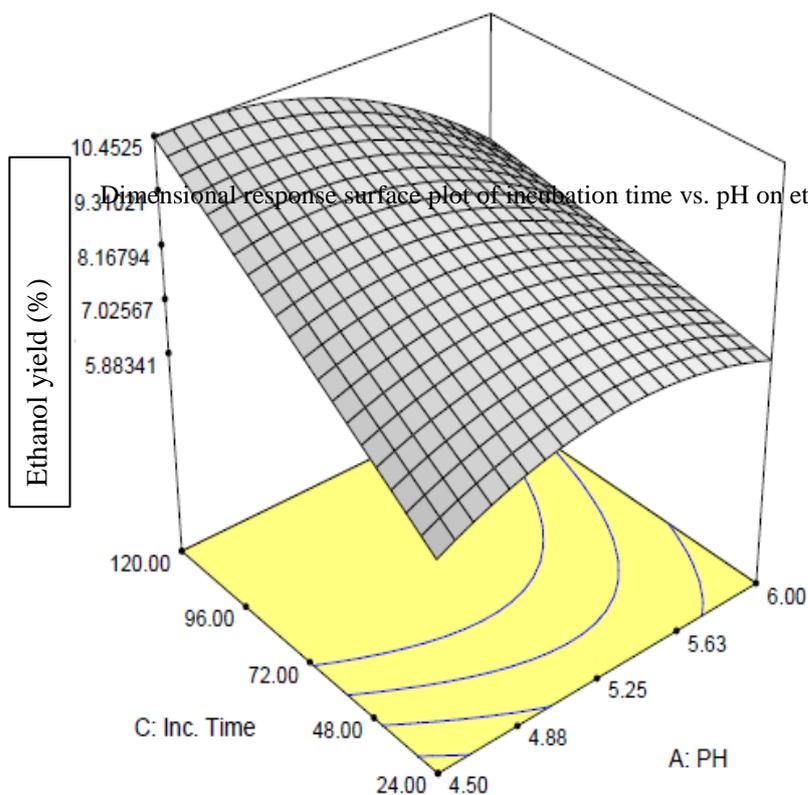
Response surface was generated by plotting the response (bioethanol yield) on the y-axis against any two independent variables on the x-axis, while keeping the other independent variables at zero level. Therefore, three response surfaces were obtained by considering the possible combinations.

Figure 1, 2 and 3 represents the three-dimensional and contour surface plots for the optimization conditions. The plot illustrates the main and the interactive effects of the independent variables on the dependent ones. The response surface plots were generated by plotting the response on the y-axis. **Figure 1** shows the effect of temperature and pH on ethanol production keeping the other variable (incubation period) constant (120hr) level. Bioethanol yield was found to increase with the increased in temperature and pH. However, the ethanol yield was more pronounced at 41°C and pH 5.6 but beyond these the yield declined and this decreased may be due to inhibition of fermenting organism activity at higher temperature. As shown in **Figure 2** and **3** harvesting time exert a positive effect on the bioethanol yield showing a linear increased significantly with time p value = 0.002 > 0.05. The linear graph of time shows, time is independent on pH, and temperature in relation bioethanol yield respectively.

**Figure 1:** 3-dimensional response surface plot of temperature vs. pH on ethanol yield (incubation time kept constant at 120 hr).



**Figure 2:** 3-dimensional response surface plot of incubation time vs. pH on ethanol yield



**Figure 3:** 3- Dimensional response surface plot of incubation time vs. temperature on ethanol yield

#### iv. Conclusion

Base on the result from this study *Spirogyra* biomass possess potential for bioethanol production. Both pH, temperature and incubation time were found to exert effect on bioethanol yield from microalgae *spirogyra* biomass. By optimizing these conditions incubation time were found to exert more positive effect on bioethanol yield compared to pH and temperature ranges used.

In conclusion by exploiting the potentials of low-cost substrate such as *spirogyra spp* as it is available abundantly in fresh water, can be easily grown on non-arable land and more importantly it has very low lignin content may open new road map for the bioethanol-production technology which is regarded to be eco-friendly and sustainable fuel.

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#### Conflict the interest

The authors declare no conflict of interest

#### Authors' Declaration

The authors hereby declare that data presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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# Investigation of the potential of *Opuntia Ficus-Indica* powder for sewage treatment

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**Abstract-** The world is facing scarcity in water resources due to various reasons. Irrigation consumes about 86% of the water withdrawal in Egypt which means less water for the domestic and other sectors usage. Thus, treatment of turbid wastewater as sewage water should be done to decrease the amount of the pure water used in irrigation. The presented project reviews a wastewater treatment technology that involves cactus of the species OFI (*Opuntia ficus-indica*). This adsorptive biomaterial is involved as coagulant/flocculent and hence collects all the pollutants, heavy metal ions and bacteria in the wastewater instead of using synthetic coagulants as Alum. The results obtained in the depollution of wastewater showed very high and promising pollutants-removal efficiency. Cactus significantly optimized many wastewater parameters (turbidity, COD, heavy metals ions, BOD, TSS etc.). The optimum dosage obtained was 1.5g/L of cactus powder. The pH was maintained near the normal level (7.5-8). The removal efficiencies for the Manganese, Iron, and Aluminum ions were 92%, 87.8%, and 83.6% respectively. The total coliform removal efficiency was 99.92%. For many special characteristics (surface composition, properties, abundance, non-toxicity, etc.), cactus powder is a useful material for wastewater treatment instead of chemical coagulants making it applicable.

**Index Terms-** cactus mucilage, polysaccharides, Bio-sorption, coagulation, Glucuronic acid, d-galactose, l-arabinose, carboxyl, hydroxyl, amino/amine, divalent ions.

## I. INTRODUCTION

Water crisis is now approaching step by step to the whole world and it is one of the fundamental grand challenges facing humanity in this era. Irrigation is consuming about 86% of the water withdrawal in Egypt and 90% of the global water usage according the International Water Management Institute [9]. In this paper, water crisis challenge is discussed stressing on the irrigational consumption. Wastewater of several sorts is disposed into rivers and seas as a final stage of its drainage. The solution discussed in this paper is to treat the wastewater, like sewage water, and try to utilize it in irrigational purposes.

This thesis presents the flocculent, bio coagulant, and bio sorbent capabilities of a cactus species common to many dry arid

climates throughout the world. *Opuntia Ficus-Indica*, the used cactus species, capabilities to remove sediments, heavy metal ions, and various types of bacteria from contaminated sewage water were investigated using different extracts: mucilage and powder. The species proved that it could be used as a bio sorbent or a bio coagulant/flocculent instead of the traditional means of water treatment by flocculation as: Alum and Ferric chloride.

Screening and sand filters are used in companion with the cactus-coagulation method to remove coagulated structures and relatively large sediments in water as well as dyes (Chlorophyll-A) introduced by the cactus. This novel treatment method presents an economic solution with minimal health hazards—compared to its counterparts. This treatment method could be applied to all the treatment stations for sewage and municipal water. To sum up, the treated water has the potential to replace a large portion of the pure water used in irrigation.

The tested water parameters are: TSS; TKN; NH<sub>3</sub>; BOD; COD; Turbidity; heavy metal ions including Al, Ba, Cu, Fe, Pb, Mn, Sr, Zn, and Cd; bacteria removal including Total Coliform, Fecal Coliform, B-cereus, and E-coli.

## II. METHODS

**Preparing the cactus (coagulant / flocculent / adsorbent / bio-sorbent):** Two types of fresh cactus were collected and processed with different ways, first way was taking the fresh viscous mucilage from sliced cactus. The second way was making cactus powder by peeling the cactus (shown in figure 1) and drying it for 10 minutes at oven's high temperature, 5 minutes at medium temperature, and finally 5 minutes at low temperature. The dried cactus was grained by mortar and pestle.



Figure 1: *Opuntia Ficus-Indica* species being peeled for drying and mucilage extraction.

**Preparation of sand filters:** The sand was collected and put in contact with water to remove the very small clay particles that stayed suspended in the water. Charcoal was brought and grained forming fine charcoal. Two filters were made, the first one had more sand content to reduce TSS. The second one had more active carbon content to filter out the “chlorophyll-A” and dyes of cactus powder.

**Collection of turbid sewage water sample:** 4 liters of non-treated sewage water samples were obtained from a village’s sewage collecting plant.

**(Coagulation/flocculation/adsorption/bio-sorbent) activity jar test:** 400 ml of high-turbidity sewage water samples were put in each of the four 1-liter beakers after the sewage was passed through sand filter. Cactus extractions were put with water in 3 beakers and were exposed to different stirring speeds: 100rpm for 1 minute and 30rpm for 10minutes; the fourth beaker was left as a control.

After rotating, the one liter beakers were allowed to settle for 20 minutes then 40ml were taken 3 cm below surface of water from each beaker and parameters like TSS, TS, TDS, PH, DO, COD, BOD, TOC, DOC, conductivity, chlorophyll-A, turbidity and Transmittance were measured. The adsorption activity in the removal of heavy metals of the cactus as a bio-sorbent and coagulant/flocculent was determined by measuring the amount of heavy metal ions after and before the treatment. Finally, the water was passed again through second sand filter to filter out the dyes.

**Investigation of cactus activity in bacterial flocs formation:** Flocs of bacteria are shown in figure 2. The flocs formed after treating the water were taken and observed under microscope targeting the B-cereus and E coli, as shown in figure 4. At the right, E coli cells were gathered by cactus. Also at the left, the pretreated water showed the flocs made by cactus. Bacterial incubation test was performed to investigate the total and fecal coliform removal efficiencies. This was done by putting sample of non- treated and treated water in incubator different times with different conditions suitable for each bacterium and the samples were compared.

### III. RESULTS

**Test 1:** A jar test was made to determine the turbidity, TSS and “chlorophyll-A” after processing it in coagulation / flocculation processes, OFI (*Opuntia ficus-indica*) showed great results removing turbidity and TSS with efficiencies 97% and 92.8% respectively; the “chlorophyll-A” content increased dramatically but it was removed later with sand filter.

**Test 2:** After water samples were collected, some parameters were determined shown in table 2 .PH results were confirmed using a pH meter and compared to Alum for each dosage added as shown in figure 3.

**Test 3:** After the water was put in contact with cactus powder, Cactus was determined to have relatively high capacity for heavy metals adsorption. The removal efficiencies are shown in table 1.

**Test 4:** Bacterial aggregation activity of cactus powder resulted in white flocs shown in figure (2) with concentration of  $10^8$  cells

per ml; figure (2) illustrates the white flocs of bacteria formed after several hours of settling. The bacterial cells were observed by microscope. The incubation test showed a total coliform removal efficiency of 99.92% and fecal coliform removal efficiency of 99.94%.

Table 1: Metal ions removal efficiencies of the OFI powder.

| Metal ion | Removal efficiency |
|-----------|--------------------|
| Aluminum  | 83.6%              |
| Barium    | 72.4%              |
| Copper    | 50.8%              |
| Iron      | 87.8%              |
| Manganese | 92%                |
| Strontium | 76.6%              |
| Cadmium   | 89.8%              |
| Zinc      | 85.2%              |
| Lead      | 69.3%              |

Table 2: various water purity parameters removal efficiencies of the OFI powder.

| Parameter       | Removal efficiency |
|-----------------|--------------------|
| TSS             | 92.8%              |
| TKN             | 66.1%              |
| NH <sub>3</sub> | 97%                |
| Turbidity       | 97%                |
| BOD             | 99.4%              |
| COD             | 99.6%              |

### IV. ANALYSIS

**Characterization of mucilage and Factors making it an eco-friendly material for treatment:** According to [7], the factor behind using cactus as a material for wastewater treatment is its biochemical composition without toxic effects. It was reported by many studies that cactus is composed of low-protein and lipid contents.

Polysaccharides are considered as the main ingredient. Interestingly, cactus species are known by the polysaccharide-rich mucilage production. The presence of minerals, such as Ca<sup>+2</sup> and K<sup>+</sup>, is necessary for the gelatinous properties of mucilage. The high flocculation/coagulation capacity of cactus is related to its polysaccharide structure that is composed of various carbohydrates, such as l-arabinose, d-galactose and galacturonic acid. Arabinose is the highest in turbidity removal. Galacturonic acid is significantly implicated as the main active coagulant agent, based on its polymeric structure as shown in figure 6. This polymeric structure provides a bridge for particles to adsorb.

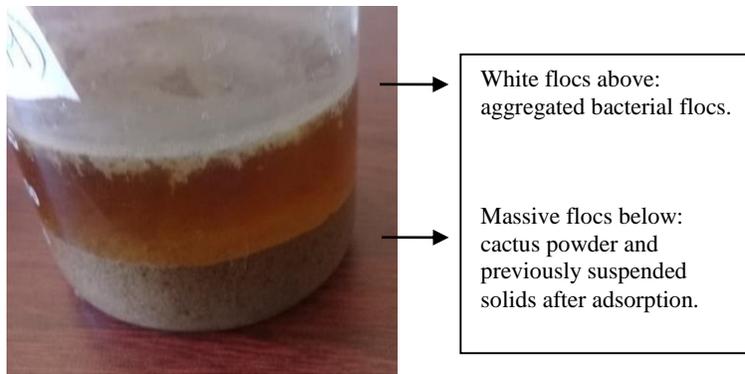


Figure 2: the collected flocs from ~3-liter sample of sewage water.

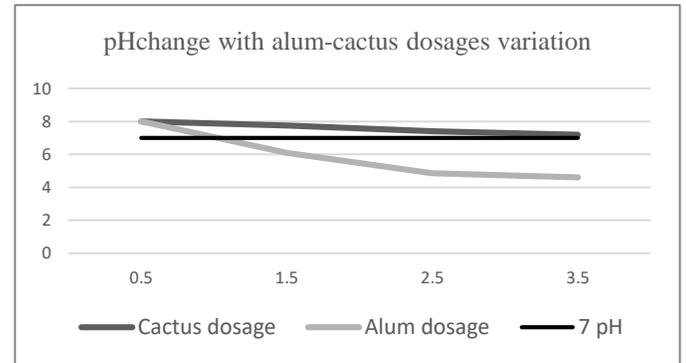


Figure 3: the effect of adding OFI powder on water pH vs

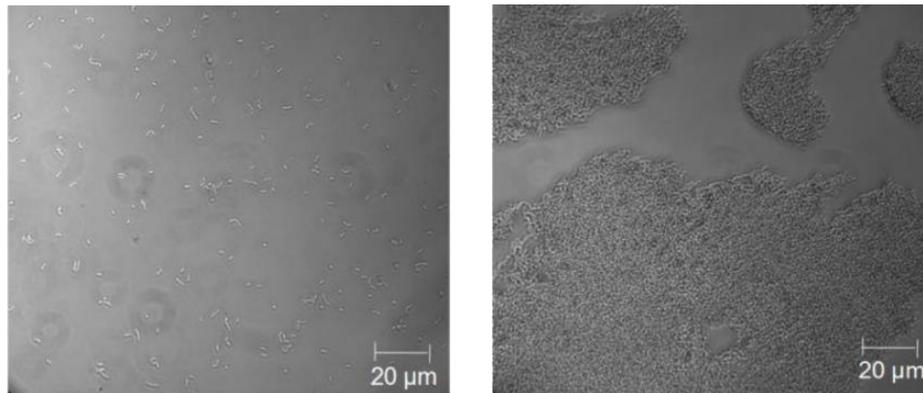


Figure 4: light microscope images of *Bacillus cereus* in control sewage water (Left) and bacterial flocs (Right).

Moreover, the functional groups of cactus polysaccharides included carboxyl (COOH—), hydroxyl (OH—) and amino or amine (NH<sub>2</sub>—) groups, as well as hydrogen bonds. These functional groups are considered as preferred groups for the flocculation process.<sup>1</sup>

**Bio-coagulant dosages effect:** The increment in removal of turbidity by the increment of the dosage is due to increment of active site of the cactus powder. As the cactus powder dosage was increased, the final pH values of the water sample were relatively unaffected. This means that the cactus powder has no significant effect on the pH with the increment of the dosage unlike alum (as illustrated by figure 3).

**Coagulation mechanism:** Most of the plant-based organic coagulants predominantly function on adsorption and inter-particle bridging mechanism of coagulation. Our results have supported the hypothesis of adsorption facilitated by inter-particle bridging mechanism where particle destabilization takes place in the adsorption of colloidal particles onto the main chain and side chains of polysaccharides of OFI and forming the bridge in terms of complexes of particle-polysaccharide-particle<sup>2</sup>. Adsorption may take place through dipole-dipole interactions and hydrogen bonding. Due to high molecular weight of polysaccharides, their

long chains may stretch into the medium and can adsorb the larger number of pollutants.

The natural electrolytes of mucilage of OFI, specifically divalent ions such as Ca<sup>+2</sup> and Mg<sup>+2</sup>, have a synergistic effect on coagulation by enhancing the complex formation. The full mechanism is illustrated in figure 5.

**Comparison between bio-coagulant and alum:** As Alum is widely used as a chemical coagulant for water treatment, it was compared with cactus coagulant for treatment of wastewater. Although alum had relatively better turbidity-removal efficiency compared to cactus coagulant, the pH of treated water was much lower in case of Alum. The flocs formed using alum were nearly spherical in shape unlike the thread structured flocs formed by bio-coagulant. The floc size was small in case of alum generating the sludge of poor settling properties whereas the sludge formed by OFI was more compact with bigger flocs. It was also observed that in case of OFI, the sludge stayed compact even after creating the disturbance in water and separated from water easily.

**Sand filters and the activated charcoal:** The sand filter is used after the water is exposed to screening to get rid of some of the relatively large suspended solids. Activated charcoal is used in the sand filter since it has a large surface area and have tendency to adsorb heavy metal ions. The treated water by cactus is passed

<sup>1</sup> Credit of this hypothesis goes to [7].

<sup>2</sup> Credit of this mechanism goes to [7].

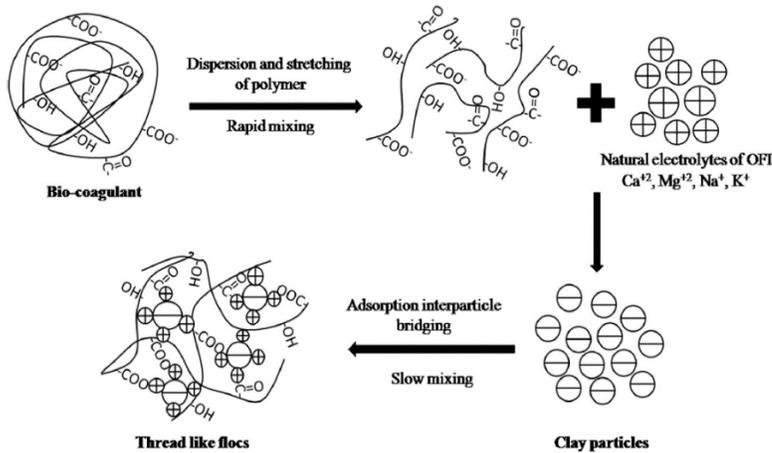


Figure 5: the supposed inter-particle bridging mechanism. Credit to [7]

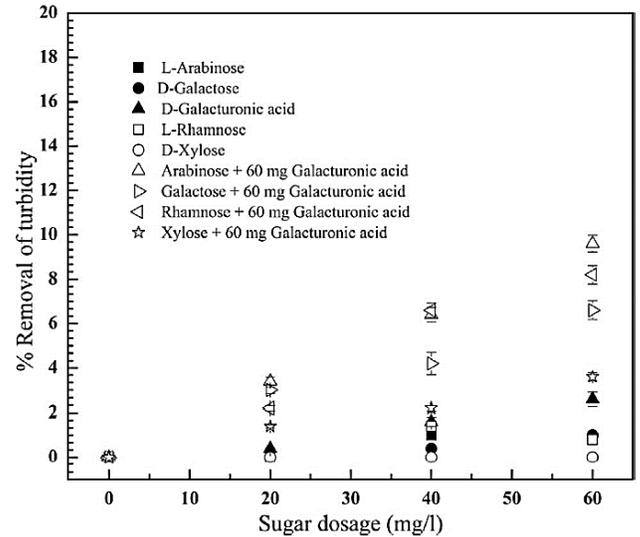


Figure 6: polysaccharides of mucilage with its anti-turbid effect. Credit to [7]

again over activated carbon to adsorb the chlorophyll-A dye present in the water.

## V. CONCLUSION

Considering the discussed investigation, it is obvious that cactus has high potential for water treatment. It has high removal efficiencies for the contaminants of wastewater. It has no unfavourable effects on water during the treatment process. It has a negligible cost compared to the cost of chemical coagulants like Alum and Ferric Chloride; additionally, these chemical coagulants do not have the same potential as natural OFI powder. The first sand filter removed relatively large-sized particles and the second sand filter reduced “Chlorophyll-A” content. The cactus optimized the pH, COD, BOD, TSS, turbidity, heavy metal ions and bacteria presence in the water. Ultimately, clean sterile water suitable for agriculture was obtained.

## VI. RECOMMENDATIONS

It is recommended for further investigation that:

- 1) Trying to combine other coagulants, instead of Alum, with cactus powder to obtain even better results in turbidity removal putting into consideration their effect on water characteristics and the pollutants removal.
- 2) When the project is applied on a large scale, it is preferred to dry the cactus to obtain the powder by subjecting the cactus (after peeling) to sunlight for about two weeks. This is much more cost-effective than drying cactus in the oven.
- 3) It is recommended to use pure cactus mucilage extracted with special type of centrifuge, the cactus will be peeled and mashed then it will be put in centrifuge machine which have very small pores that allows the mucilage liquid particles to pass without the other solid molecules, this mucilage should

give better results as it will be pure extraction of polysaccharides and ions.

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# Covid-19 Disrupts India's March towards Making Her Children Thrive and Transform

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**ABSTRACT:** When the pandemic hit the world, everyone was relieved a bit that at least, the virus seemed to have a limited direct impact on children. But no one had anticipated the indirect effect the pandemic will have on children. This paper explores the impact of Covid 19 on infant and child mortality, child nutrition, schooling and child protection issues. It draws attention to the already worrisome pre-covid statistics on these parameters in India, and why one can expect things to go worse. Some solutions for remediation are also presented.

**INDEX TERMS:** Covid-19, under5mortality, maternal mortality, child protection, child labour

## 1. INTRODUCTION

This article brings to attention the plight of children from poor households from low income countries during the covid-19 pandemic.

The right to life with dignity is an inalienable right under the Constitution of India and the International Convention on Civil and Political Rights, 1966 that India has ratified. India ratified the UNCRC in 1992 and the obligations to ensure children's rights under the UNCRC also remain [1]. Child Rights journey is to make children survive, thrive and transform. It is a journey to make sure that all children:

- Have adequate food and healthcare services which help in their survival
- Attend schools and *anganwadis* where they get opportunities to learn and to develop their faculties and skills
- Are safe and protected from violence
- Have their best interests protected
- Have a say in decisions that affect their lives [2]

When the pandemic hit the world, everyone was relieved by the fact that the virus seemed to have a limited direct impact on children. In fact, the world statistics on Corona fatality by age showed zero deaths in the 0-9 years age group. But the world had not imagined the indirect effect the pandemic will have on.

The march of nations to achieve this has been delayed and disrupted due to the Covid pandemic. It is now believed that the progress made by nations in last 5-10 years to bring down the child and maternal mortality figures and those on protection parameters like child labour and abuse, is going to be wiped out [3].

India has child population of 472 million, of which, it is estimated that 40 million from poor families have been impacted by covid lockdown [4]. Childhoods have been threatened due to covid 19 and the impact is disproportionately high on children from poor households in low income countries. The marginalized groups of children like, children of migrant workers, street children, children living in institutions, the homeless, those living in abusive conditions with high risk of violence, children from rural or far flung areas who are now out of school or have been hit by disruption of health and nutrition services offered by the government, are badly hit. Let's discuss how children have been impacted by Covid-19.

## 2. MATERNAL AND INFANT MORTALITY

Based on a study by Timothy Robertson et al in Lancet [5] it is estimated in 118 low- and middle-income countries globally, 6000 additional child deaths per day are expected, which would be an additional 1.2 million under-five deaths in just six months. This would be due to reductions in routine health service coverage levels and an increase in child wasting, malnutrition,

disruption of nutrition services, disruption of medical and food supply chains and health workers engaged in corona related work across the country.

The first comprehensive estimate of district-level trends of child mortality in India published in *The Lancet* and *EClinicalMedicine*, stated that if the trends observed up to 2017 were to continue, India would meet the SDG 2030 under-5 Mortality Rate (U5MR) target [6]. The study stated that the under-five Mortality Rate (U5MR) dropped in India since 2000 by 49 per cent. There were 1.04 million under-five deaths in India in 2017, while in 2000, there were 2.24 million under-five deaths. Now, with Covid pandemic, UNICEF estimates 440,000 children will be affected in South Asia over the next six months of which as many as 3,00,000 children would be in India alone owing to the lockdown, the pandemic continues to weaken health systems and disrupt routine services across the region," UNICEF said in a statement[7]. The gains in child mortality will be reversed due to thousands of additional child deaths.

Of 1.04 under 5 deaths in India in 2017, there were 0.57 million neonatal deaths in 2017, down from 1.02 million neonatal deaths in 2000. The NMR has dropped by 38 per cent from 2000 -2017. Now, this progress made gets negated. As per estimates of UNICEF, 20 million babies are expected to be born in India between March-December 2020 [3, 8]. In pre-covid times, pregnant women from across the country in India from poor households visited *anganwadis* and PHC to avail ante-natal check ups three times during pregnancy (more than 50% women got all ANC checkups done). During these ANC checkups, regular monitoring of weight was done, blood pressure checked and routine urine and blood test done. Pregnant women were given Iron and Folic acid tablets along with Calcium. These women also received supplementary nutrition from the AWCs along with nutrition counselling. They received two shots of tetanus toxoid vaccination. The TT injections were a big intervention in preventing neonatal tetanus and helped in reducing neonatal and maternal mortality. As is clear, the services at the *anganwadis* and MCH centres got disrupted during covid. Additionally, rather than attending to their routine health care duties at AWCs and MCH centres, health functionaries were being involved in emergency Covid duties like, taking temperature, quarantine centre management and contact tracing etc.

Furthermore, due to lockdown and transport being unavailable[3], it became a challenge for pregnant women to reach health facilities on time for child birth. As per UNICEF [9], the rate of institutional deliveries in India was 79% and Maternal Mortality ratio was 145. Covid is likely to decrease institutional deliveries further. Lowering of institutional deliveries will have a negative bearing on neonatal and infant survival. When an infant is delivered at an institution, she is weighed first and then she receives BCG, Oral polio vaccine and Hepatitis-B vaccines at birth. If the child is premature or is of low birth weight, child is kept in nursery or a NICU, if needed. There is birth registration also done, so child becomes eligible for availing government facilities and services. As per NHFS-4, the birth registration rate was 80%, which will most likely go down. It is quite obvious that a large number of newborns during covid times are going to miss on these important vaccinations, and access to many services, hence increasing mortality and morbidity.

With Covid happening, Timothy Roberts et al [5] estimate that the decline in healthcare would result in additional 39% maternal deaths due to pregnancy & child birth related causes in 6 months. With health facilities closed or offering emergency services only, the use of contraceptive is also likely to go down. So, we can expect an increase in unwanted births. We need urgent measures to contain child and maternal mortality!

### 3. NUTRITION AND HEALTH

UNICEF reports that 368 million children in 143 countries are unable to access meals from schools due to closure of schools [10]. If we look at the situation in India, with AWC closure, this regular source of daily

school closure, this too has got disrupted. This is going to directly impact the nutrition levels of children and in long term effect cognitive development, concentration and learning outcomes. As per NHFS-4 [11], in India 38% children under 5 years who are stunted (height for age), 28% wasted (weight for height) and 36% underweight (weight for age). It is not hard to understand where further malnutrition levels are going to reach in the prevailing conditions.

The Immunization status of children in India as per NHFS-4 was - 62% children (12-24 months) are fully immunized. WHO reports that covid 19 is going to lead to a spike in measles among young children as measles immunization has been suspended in 37 countries and will not be reaching 117 m children, missing out on life saving vaccination [12]. Millions of children are in danger of missing life-saving vaccines against measles [13], diphtheria and polio due to disruptions in immunization service. Polio vaccination campaigns have been suspended worldwide, setting back the decades-long effort to eliminate the virus, and to tackle recent outbreaks of the vaccine-derived virus in Africa, East Asia and the Pacific.

#### 4. POVERTY

Another factor worth getting the attention of the readers is spike in poverty. IMF expects 3% fall in global income in 2020 due to lockdown and rising unemployment. Immediate loss of income often means families are less able to afford basics [14], including food and water, are less likely to access health care or education, and are more at risk of violence, exploitation and abuse.

As per Global multidimensional poverty index reported in 2018, India had 364 million people in poverty, of whom, 154 million are children [15]. As per Unicef Policy brief [16], an estimated 42-66 million children could fall into extreme poverty as a result of the crisis this year, adding to the estimated 386 million children already in extreme poverty in 2019.

#### 5. SCHOOL CLOSURE AND DIGITAL DIVIDE

As per UNICEF Policy brief [16, 17], 188 countries have imposed countrywide school closures, affecting more than 1.5 billion children and youth. The potential losses that may accrue in learning for today's young generation, and for the development of their human capital, are hard to fathom. More than two-thirds of countries have introduced a national distance learning platform, but among low-income countries the share is only 30 percent. Before this crisis, almost one third of the world's young people were already digitally excluded.

#### 6. CHILD PROTECTION

UN warns, first rise in child labour in 2 decades globally likely. WHY? IMF indicates a rise in extreme poverty globally from 84 m to 132 m people. As per estimates, 1% increase in poverty leads to 0.7% increase in Child Labour as the number of children getting back to labour force is likely to shoot up due to poverty. Further exacerbating factors for global rise in child labour are likely illness/unemployment of parents, separation of the child from parent due to migration, death of parents, and many such reasons will necessitate children to step in as a bread winner. Another major factor is that school closure is likely to spike child labour. Even when schools start, parents may not be able to pay for it. Child labour robs children of childhood, exposes them to abuse, violence and exploitation. This is a real crisis for the children of the world.

During the lockdown everyone has been told to stay home. But what about the street children? Where do they go during the lockdown? According to one estimate, Delhi alone has more than 70,000 street children, who continue to be invisible.

Studies also show that when parents are without a job or a means of subsistence, it leads to frustration, and this is commonly vented out on the weak and meek. So, Covid has put children 'at risk' of increased violence at home. Confinement at home makes children soft targets.

Covid has also closed down child protection services or they are partially functional. Safe spaces where children participated and spoke freely, like schools, are also shut down. When children are at facility/zonal based quarantine, that context also reduces the safety net for them as they may be separated from parents or coping with misery. Limited support is available to already vulnerable groups of children like street children, those in institutions, in conflict with law, on the move and abandoned children. In India, CHILDLINE received 4.6 lakh calls in 21 days of lockdown, 9,385 interventions made, of which 20% for child marriage, child abuse, trafficking, abandonment, child labour. Childline interventions also prevented 898 child marriages during this period.

#### 7. CONCLUSION

FUTURE AND PRESTIGE OF THE COUNTRY IS AT STAKE- actions needed

This pandemic has exposed social and structural inequities and failure of the system to respond. I would like to highlight a few emergency actions that we need to take if we want to reclaim some childhoods.

DATA: An assessment of the situation of children as a result of the impact of COVID both in the short and long term and make such data available in the public domain. How many children have migrated to villages, how many are out of school, how many not receiving immunization/supplementary nutrition? Data is needed on home deliveries during this period? How many children are still in children's institutions, what is happening to the street children, trafficked children and homeless children?

**RESUME SERVICES:** Antenatal check up, nutrition and nutrition supplements services through anganwadis and MCH centres for pregnant mothers should be resumed immediately. Institutional deliveries and attended births are absolutely to be restored to bring back some stability in neonatal deaths.

**UTILIZE FUNDS:** Funding for children is not cut, existing resources are effectively utilized and augmented where there is a shortfall, and flexibility in utilization of Central Government funding [1].

**STATUTORY ENTITLEMENTS:** Children and families receive their statutory entitlements to livelihood for adults, food, and supplementary nutrition, health, education, care and protection, and efforts are intensified to cover those currently outside the net of social protection [1].

**START SCHOOLS:** States should come with staggered opening of schools so that mid-day meals as well as learning opportunities for children are restored. Children, especially girls, children with disabilities and transgender children, are not pushed out of education, children of migrant families are enrolled and supported to continue their education wherever they are.

**CHILD PROTECTION SERVICES:** Local authorities and bodies ensure children are not exploited, physically/ sexually/ emotionally abused, trafficked for labour/ sexual exploitation/ other purposes, forcibly married, or discriminated against, or separated from their families. Core child protection services, service providers and authorities (Childline, JJBs, CWCs, DCPUs, SJPU and police, Child Care Institutions, lawyers, frontline workers in CSOs/NGOs, counsellors) and Anganwadi workers are declared as 'essential' during any lockdown or declared emergency [1]. Systems for reporting violence against children are strengthened and accessible to all children, including children with disabilities, children living in CCIs, and children in police custody[1].

This is a clarion call for the children of India.

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# Factors influencing Accounting Students' Career Paths in Trincomalee Campus, Eastern University, Sri Lanka.

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**Abstract-** The purpose of this paper is to investigate factors that influence accounting students' preference toward career paths. Career path refers to the choices of jobs and occupational positions an individual may choose to hold. Accounting students may choose to advance their career into one of the following areas: financial accounting, management accounting, taxation, auditing, finance, etc. According to past literature, choices of career path are influenced by intrinsic motivation, extrinsic motivation, third parties, and career exposure. Therefore, the objective of this study is to measure which factors influencing accounting student's career paths in Trincomalee Campus, Eastern University, Sri Lanka. A simple random sampling method is used to select participants for this study. A quantitative approach is used in this study. Accordingly, data are collected using a questionnaire, designed in a Likert's scale method. This study is limited to students who are in Trincomalee Campus, Eastern University, Sri Lanka. In this study, four variables are used to measure the factors influencing accounting student's career paths in Trincomalee Campus, Eastern University, Sri Lanka.

To attain the objectives, the quantitative method is used and data are collected through questionnaires. A total of 100 questionnaires are distributed to students who were in Trincomalee Campus, Eastern University, Sri Lanka for further analysis. The data are analyzed using statistics. The findings exhibited that, Intrinsic motivation, Extrinsic motivation influences of third parties and career exposure accounting student's career path in Trincomalee Campus, Eastern University, Sri Lanka.

Professional accounting bodies may benefit from the findings of this study as it may provide a basis in designing member recruitment strategies and this paper fulfills an identified need to study how shortage of certain career path for accounting students could be resolved.

**Index Terms-** Career development, Career planning, Career management, Career interest, Career path

## I. INTRODUCTION

The number of members recruited by the Association of Chartered Certified Accountants (ACCA) and the Chartered Institute of Management Accountants (CIMA) indicates a slanted preference by accounting students. In year 2013, ACCA recruited 10,361 new members, while CIMA only recruited 5,527 new members. The low number of member recruitment in CIMA may be an indicator of accounting students' preference toward their

career paths. Hutaibat (2005), as cited in Hutaibat (2012), explained Journal of Management Development Vol. 36 No. 3, 2017 pp. 319-329 © Emerald Publishing Limited 0262-1711 DOI 10.1108/JMD-11-2015-0169 Received 28 November 2015 Revised 6 May 2016 22 July 2016 Accepted 31 July 2016 The current issue and full text archive of this journal is available on Emerald Insight at: [www.emeraldinsight.com/0262-1711.htm](http://www.emeraldinsight.com/0262-1711.htm) 319 Accounting students' career paths that the lack of preference for management accounting could be due to the lack of formal education in management accounting. Past literature revealed that other influencing factors using the social cognitive career theory (SCCT) include intrinsic motivation, extrinsic motivation, third parties influence, and career exposure.

The objective of this study is to identify factors which influence accounting students in choosing their career paths upon graduation. Basically, accounting students have many choices in terms of career advancement upon their graduation. For instance, they may advance into areas of financial accounting, taxation, management accounting, auditing, finance, etc. This study includes new variables in the model to ascertain which factors are significant in influencing accounting students' preference toward their career paths. Besides that, educational institutions may benefit from this study as subject teachers or academic counselors may use the findings of this study to assist students in their career choices. Moreover, professional accounting bodies may also benefit as the findings could provide a basis for them to design their member recruitment strategies.

## II. LITERATURE REVIEW

The Social cognitive career theory (SCCT), which was developed by Lent et al. (1994), is used to explain variables that influence a person's career choices. According to Lent et al. (1994), the SCCT refers to the process of an individual developing his or her career choices, vocational interests, and persistence of his or her career. As explained by Wang et al. (2007), SCCT posits that an individual's career choices and goals are influenced by the person's self-efficacy beliefs and career expectations. The concept of SCCT is regularly used in past literature in the examination of career choices and career development. There are three major variables involved in the career choice process, which are personal, contextual, and behavioral variables (Flores et al., 2010). A past study conducted by James and Hill (2009) had used SCCT as a framework in analyzing the phenomenon, whereby a majority of African-American students are uninterested to advance in accounting as their career option.

As explained by Chantara et al. (2011), SCCT comprises three primary tenets, namely, self-efficacy, outcome expectations, and goals. Self-efficacy refers to an individual's faith about his or her capabilities to achieve a course of action which is related to career achievement (Mandzik, 2011). Humans with strong sense of self-efficacy will usually place great effort in accomplishing tasks despite of the obstacles they encounter. Outcome expectations, on the other hand, refer to the beliefs on the future consequence after a certain behavior is performed (Mandzik, 2011; Chantara et al., 2011). Lastly, goals are defined as a person's determination to decide on specific outcomes of learning or performance. The composition of goals represents a critical mechanism which involves the method with which a person exercises his or her self-empowerment.

Career path is defined by Yusoff et al. (2011) as a lifelong journey which should be planned at the beginning of a person's career. On the other hand, Joseph et al. (2012) defined career path as an occupational position held by an individual for his or her entire lifetime. A person could advance into a career of business, law, academics, entertainment, etc. Career path and career choice could be used interchangeably. In this study, career path refers to the career choice which an accounting student makes upon his or her graduation. An accounting student's career choice includes advancing into areas of audit, tax, management accounting, financial accounting, finance, etc. According to Dalton et al. (2014), accounting students frequently enter into the audit and tax career paths.

As commented by Byrne et al. (2012), identifying the factors that influence graduates' career choices would be helpful to the accountancy profession for its promotional and 320 JMD 36,3 recruitment campaign. As discussed earlier, it is observed that Malaysian accounting graduates have a slanted preference toward ACCA instead of CIMA. Thus, the identification of factors influencing career choices (i.e. career path) for the accounting graduates would aid CIMA in its recruitment campaign. According to Joseph et al. (2012), a person's career path could also be influenced by the personal attributes of the individuals. Career path may also refer to work experience instead of progress in terms of career, personal growth, job status, and job satisfaction (Jennifer, 2010 as cited in Yusoff et al., 2011). Similar to past literatures, this study adopts the concept of SCCT in the examination of accounting students' career paths in a reputable higher learning institution which recruits a huge number of accounting students annually for its accounting program.

Generally, motivation is divided into intrinsic motivation and extrinsic motivation. Intrinsic motivation refers to something or an activity which brings personal satisfaction (Ryan and Deci, 2000). Ryan and Deci (2000) further explained that intrinsic motivation is a positive experience a person has when he acts out of his own interest or challenge. It is not influenced by external factors such as pressures, rewards, or enforcement. On the other hand, Jackling and Keneley (2009) defined intrinsic motivation as a personal contentment achieved from chasing and searching for some activity. Intrinsic motivation includes two components, namely, personal interest and personal choice.

A past study conducted by Odia and Ogiedu (2013) inspected factors affect accounting students' career choice decisions in Nigerian universities. All 300 questionnaires were collected from undergraduates in three different universities. The

t-test analysis showed that intrinsic motivation was an important factor for accounting students. Findings found that intrinsic motivation can positively affect students' career paths. Students prefer accounting simply because accounting is interesting. The students are also confident in getting good results and are addicted to numbers and figures. These factors had intrinsically motivated students to study accounting.

Another past study conducted by Mbawuni and Nimako (2015) examined job-related and personality factors that influence career decisions for accounting students from the University of Education, Winneba. Altogether, 516 questionnaires were collected from undergraduate accounting students. Findings from this study showed feelings and perception toward the accounting profession have positive and significant influence on career decision among accounting students. On the other hand, according to Adeleke et al. (2013), personality factors which included aptitude and attitude are shown as significant factors of personality in the progress of career interest. Respondents of that study comprised secondary school leavers from both urban and rural areas.

As explained by Ryan and Deci (2000), extrinsic motivation is different from intrinsic motivation. A person may be extrinsically motivated to perform some tasks even though they do not enjoy the task, as he may be working for expected rewards (Bainbridge, 2015). As such, Bainbridge (2015) defined extrinsic motivation as a motivation factor that comes from the outside of an individual.

A study carried out by Hejazi and Bazrafshan (2013) consisting of 75 questionnaires was used to survey the perception of graduate accounting students in universities of Iran regarding their interest in management accounting. The result showed that management accounting is less preferred to than financial accounting and auditing among the accounting 321 Accounting students' career paths students because financial accounting could provide them with better extrinsic motivation in terms of higher pay and better benefits. The findings of the study concluded that extrinsic motivation could influence career paths. Apart from that, there are also other past studies which have found that extrinsic motivation is positively associated with career path ( Jackling and Keneley, 2009; James and Hill, 2009; Demagalhaes et al., 2011). Based on these past studies, the common extrinsic motivation factors found to influence career paths are salary and availability of job opportunities.

However, Porter and Woolley (2014) found that the effect of extrinsic motivation is smaller in comparison to intrinsic motivation in terms of career choice. The study was conducted in a single university with a total of 278 questionnaires being collected and analyzed. Even though Porter and Woolley (2014) agreed that the accounting career does provide extrinsic benefits such as better pay and career stability, intrinsic motivation is a greater factor in influencing career path.

Career choice can also be affected by an individual or a group of people which includes family members, friends, career guidance teachers, and career consultants. Numerous past studies have found that third parties' influence is one of the important factors that influence the career paths of accounting students. According to these past studies, students are influenced by parents (Byrne et al., 2012; Myburgh, 2005; Porter and Woolley, 2014; Tan and Laswad, 2006; Umar, 2014), subject teachers ( Byrne et

al., 2012; Myburgh, 2005), relatives (Myburgh, 2005), and friends (Porter and Woolley, 2014). However, one of the past studies conducted by Wally (2013) examined factors which influence accounting students and concluded that influence by third parties is less significant. Wally (2013) conducted the study in the University of Botswana with a collection of 51 questionnaires from final-year accounting students. The findings of the study suggested influence from parents, peers, and secondary teachers is unimportant. Conversely, the availability of career advancement, personal interest toward the subject, job opportunities available, and higher earnings are more important factors in influencing the accounting students' career paths.

In this study, career exposure refers to students' exposure to career-related information. According to Ghani et al. (2008), most accounting students gain career exposure through professional accounting bodies. Ghani and Said (2009) commented that it is important for students to be exposed to the nature of an accountant's job and what type of career it offers. With greater exposure on career-related information, one can make better decision in their career choice.

Past studies have indicated that career exposure given by professional practitioners has influenced students' career choice (Ghani et al., 2008; Sugahara and Boland, 2006; Hutaibat, 2012). A study conducted by Ghani et al. (2008) in one of the universities in Malaysia had collected a total of 802 questionnaires from first-

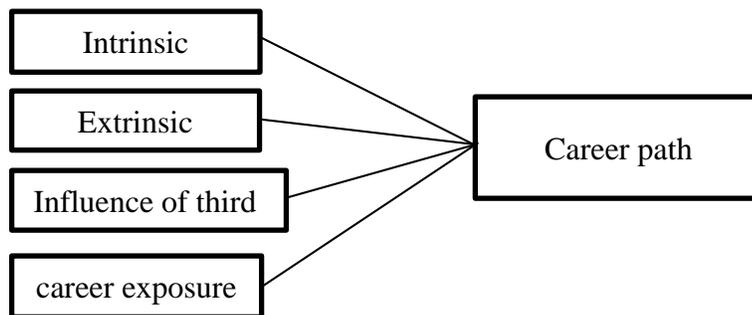
and final-year students. The result showed that slightly more than half of the students had obtained some form of exposure during their university life. The exposure was obtained from lecturers as well as through career talks provided by professional accounting bodies and counseling sessions.

On the other hand, a study which investigated factors influencing students to be interested in pursuing management accounting careers conducted by Hutaibat (2012) found that accounting students prefer public accounting as their career choice compared to management accounting area due to lack of seminars, workshops, and tutorials organized by their universities. As a result, students lack detailed information and sufficient knowledge with regards to career options in the management accounting area. Through this study, it suggests the importance of career exposure toward students' preference in their career paths.

### III. CONCEPTUAL FRAMEWORK

In this model a causal relationship is assumed between the factors influencing Accounting Students' Career path. Intrinsic Motivation, Extrinsic Motivation, Influence of third parties and Career Exposure have been identified as independent variable, and Career Path has been identified as dependent variable in the study.

Figure- Conceptual Framework



(Source: Developed for the research Purpose from Theoretical Framework of the study)

#### Research Questions:

- ✓ Does the factor of the intrinsic motivation that influences accounting students' toward Career path in Trincomalee Campus, Eastern University, Sri Lanka.
- ✓ Does the factor of the extrinsic motivation that influences accounting students' toward Career path in Trincomalee Campus.
- ✓ Does the factor of the influence of third parties that influences accounting students' toward Career path in Trincomalee Campus, Eastern University, Sri Lanka.
- ✓ Does the factor of the career Exposure that influences accounting students' toward career path in Trincomalee Campus, Eastern University, Sri Lanka.

- ✓ To examine whether extrinsic motivation can influence accounting students' toward Career path in Trincomalee Campus, Eastern University, Sri Lanka.
- ✓ To examine whether influence of third parties can influence accounting students' toward Career path in Trincomalee Campus, Eastern University, Sri Lanka.
- ✓ To examine whether career exposure can influence accounting students' toward Career path in Trincomalee Campus, Eastern University, Sri Lanka.

#### Objectives of the Research:

- ✓ To examine whether intrinsic motivation can influence accounting students' toward Career path in Trincomalee Campus, Eastern University, Sri Lanka.

### IV. RESEARCH METHODOLOGY

The sampling method that will be used in this study is simple random sampling. The group of population in this study is students in (Specialization in Accounting and Financial Management) Trincomalee campus. The populations of the study consist of 155 students but the researcher collect data only from 100 students in the order of the list.

The numbers of students selected to the sample from Specialization in Accounting and Financial Management is depended on the total number of students. The following table show the number of students size of the sample.

**Table 1: Sample Size**

| Year                 | Students | Sample |
|----------------------|----------|--------|
| 2 <sup>nd</sup> Year | 50       | 32     |
| 3 <sup>rd</sup> Year | 81       | 52     |
| 4 <sup>th</sup> Year | 24       | 16     |
| Total                | 155      | 100    |

**Data Analysis**

Univariate and Bivariate were used for data analysis, specially SPSS package is SPSS latest version is used.

Questioners prepared based on the five-point liker scale.

| Scale             | Points |
|-------------------|--------|
| Strongly disagree | 1      |
| Disagree          | 2      |
| Moderate          | 3      |
| Agree             | 4      |
| Strongly agree    | 5      |

**Decision rules and method of interpretations**

The mean value of these five point scales was 3, i.e.,  $(1+2+3+4+5)/5=3$ , hence, this mean value was taken as deciding factor, which determined whether the respondents are in favor to the particular variable or not. However, the degree of the results of the measurement of these variables, i.e. the average score, was interpreted with the decision rules in the following way for each and every variable.

**Intrinsic motivation**

Let average score of the respondent for intrinsic motivation questionnaire

If  $IM < 3$ , then intrinsic motivation influence on low level to career path

If  $IM = 3$ , then intrinsic motivation influence on moderate level to career path

If  $IM > 3$ , then intrinsic motivation influence on high level to career path

**Extrinsic motivation**

A similar scale was used to measure the extrinsic motivation

Let EM be the average score of the respondent

If  $EM < 3$ , then extrinsic motivation influence on low level to career path

If  $EM = 3$ , then extrinsic motivation influence on moderate level to career path

If  $EM > 3$ , then extrinsic motivation influence on high level to career path

**Influences of third parties**

A similar scale was used to measure the influences of third parties

Let IP be the average score of the respondent

If  $IP < 3$ , then influences of third parties influence on low level to career path

If  $IP = 3$ , then influences of third parties influence on moderate level to career path

If  $IP > 3$ , then influences of third parties influence on high level to career path

**Career Exposure**

A similar scale was used to measure the career exposure

Let CE be the average score of the respondent

If  $CE < 3$ , then career exposure influence on low level to career path  
If  $CE = 3$ , then career exposure influence on moderate level to career path

If  $CE > 3$ , then career exposure influence on high level to career path

**Hypothesis development**

H1: There is a relationship between intrinsic motivation and career path.

H2: There is a relationship between extrinsic motivation and career path.

H3: There is a relationship between influences of third parties and career path.

H4: There is a relationship between career exposure and career path.

V. ANALYSIS

**Table 2: Descriptions analysis**

| Statistics            |         | intrinsic    | extrinsic    | influence    | career       | career path  |
|-----------------------|---------|--------------|--------------|--------------|--------------|--------------|
| N                     | Valid   | 100          | 100          | 100          | 100          | 100          |
|                       | Missing | 0            | 0            | 0            | 0            | 0            |
| <b>Mean</b>           |         | <b>2.63</b>  | <b>2.58</b>  | <b>2.80</b>  | <b>2.67</b>  | <b>3.10</b>  |
| <b>Std. Deviation</b> |         | <b>1.036</b> | <b>1.129</b> | <b>1.047</b> | <b>1.015</b> | <b>1.070</b> |

Source – Survey data

According to the above table all the variables show the moderate level influence towards their career path. All the

independent variables having the positive relationship with career path.

## VI. DISCUSSION

Considering the conceptual variables, students intrinsic motivation influencing their career path. In the Trincomalee Campus, the Department of Business & Management Studies offers the specialization in Accounting, Marketing, Human Resource Management and Information Management. Most of the students are choosing the accounting stream with their own interest of choice among the above areas.

Taking into consideration of another variable extrinsic motivation, department of BMS conducted number of workshops related to future career path. They invited the following academic people to conduct the workshop, such as CIMA, Chartered, Stock Exchange, SLIM & etc. Therefore extrinsic variable also influence the students' career path.

Influence of third-party variable also moderately influence. Checked with the passed records of accounting stream, in every batch accounting students' numbers increases step by step. It shows that, definitely third party interfere their career path. Passed out students, seniors, parents, lecturers and etc., encourage them to move into accounting career path.

Based on the current scenario, the department revised the curriculum to meet the current needs of the job market. In our syllabus having these subjects, such as financial auditing, taxation, Management Accounting, Auditing, finance & etc.

When students go for an internship, it is a first career exposure for our students. Accounting students choose the internship related to accounting theme, specially audit firm, bank, finance company and etc.

In order to their performance some of the organization gives the chances to permanent recruitment. In the meantime most of the private organization welcomes the young graduates to these organizations. This is a good opportunity for students to work in the reputed organization with well remuneration.

Therefore career exposure variable also influence the students' career path.

### Recommendation

Consider to this career path, institution creates the opportunity to the students. Conduct the job fair within the organizations, before they go for a graduation, and send them to outside institution too. Therefore, they can get the job. Invite all island service people as a resource person to this exposure and guidance will help to the standard to choose the best career path. Example: SLAS, SLPS, Accounting service. If the campus makes a MOU with professional bodies, they will give the discount of course fee and exceptional subject too. Therefore, most of the students can join this course during their under-graduation period (Example – ACCA, CIMA, CIM, Chartered). This is a good exposure to them to compete the other university students in the job market.

### Conclusion

Education is a weapon to create the good path to their life. Higher education plays the major role to produce the qualified graduate to the society. In this research intrinsic motivation, extrinsic motivation, influence of third parties and career exposure leads to the career path. In the univariate analysis all the variables are moderately support to the system.

Trincomalee Campus provides all the facilities to students to enhance their performance. They will make the MOU & Link

with the professional bodies will help for the students to choose their career path in a better way.

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# Corporate Social Irresponsibility, A New Area To Focus

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**Abstract-** This paper is an in-depth study of emergence of Corporate Social Irresponsibility (CSI) as an area that got academicians' and researchers' attention when a seminal work published in "Social Responsibility Journal" by Brian Jones et. al in the year 2009 titled "Corporate irresponsibility and corporate social responsibility: competing realities". In this paper the researcher has come out with an idea to find how the corporate social irresponsibility became prominent area of research that might bring out possible strategies the corporates may follow to enhance their corporate governance practices. This paper is an in-depth study that highlights eight factors like Contractual Perspective (CP), Corporate Governance (CG), Importance of Human-Asset for Corporate Stakeholders (IHCS), Stakeholders are the Basis for Capitalism (SBC), Behavioral aspects of Economics (BAE), stakeholders' value creation (STVC), principal–agency relationship (PAR), and shareholder value creation (SHVC) are responsible that highlights how Corporate Social Irresponsibility has grabbed the attention of many to conduct research to find plausible solution to this issue. The researcher took the response of 113 respondents and used single factor ANOVA method to test the hypothesis, "CSI factors are responsible for its emergence as a study for researchers and academicians".

**Index Terms-** Corporate Social Irresponsibility, Corporate Governance, Contractual Perspective, Corporate Stakeholders, principal–agency relationship

## I. INTRODUCTION

Despite several government and central bank initiatives to curb unemployment in the countries like US, Britain and Germany, economic growth has taken a negative form in France and elsewhere in the world. The so-called credit crunch and its consequences have been heard and felt in businesses and in society in general. Credit crunch, as well as toxic debt issues all increase fear and confidence among general people. Bank of England on several occasions provided Emergency funding to banks in England, and instead of sating and reassuring markets, the overall market panicked. Central banks around the world have integrated and launched several policy initiatives including lowering interest rates and financing and printing. In the wake of such an integrated central bank initiative, one Guardian letter writer (Jones, 2007) stated that, "If 20 billion US dollar fails to save one bank, what hope is there of 50 billion US dollar saving the world economy? We're doomed". Sentiments of doom, financial meltdown and market panic spread, and bank collapse reports; Central bank and bank acquisitions dominated media coverage. At the onset of the

crisis, the political response of officials was measured. As The crisis intensified, with officials responding to the policy. Financial armaments and suffering were avoided, but not by accident. Stock markets have collapsed and house prices have fallen. The Icelandic economy suffered a downturn and the country went bankrupt. It was almost as if a Hollywood script had come true. The impact on the lives of communities, businesses and people is immense.

While neoliberalism emerged as a pre-existing ideology, at the same time CSR became important as an area that needed and was involved in business and management. Whether there is a connection between these two events is an open question. There is certainly some embarrassment for this, because when neoliberalism was in favor of government intervention, many CSR advocates called for greater government intervention and control. Many CSR books and research papers portray events where things "failed", did not work, or simply "went wrong" or should not happen, and the 2007–2010 financial crisis is a clear and true example of this. The extent to which it has destroyed property is evidence that CSR is responsible for this is not CSI. Franklin (2006) stated that "socially conscious but bankrupt businesses are not good for anyone". Where much has been written on CSR (Blowfield & Murray, 2008; Smith & Lenssen, 2009), but not in the case of CSI, which, is an emergent and topical subject area.

## II. LITERATURE AND HYPOTHESIS DEVELOPMENT

Corporate governance is a broad field in which business and legal practitioners, policy makers and all social sciences contribute. Amidst this heavy hum, this flourishing illusion, where is the essence? How do we select sheep from goats? Describing himself as a certified Methodologist as a Civic informant, Robert Sloan (2001), "terse description of what one economist thinks he is doing", took three forms: keep it simple; get it right; make it plausible. It is carried away improperly, keeping it simple, allowing the focus of first-order effects - as was the case in the original - and then the introduction of skills, refinement, and elaboration. Solow (2001) has of opinion that "doing the right thing involves logical work and making it a commendable means to prevent imaginary constructions. To fix this the concept of economics needs to be transformed into correct mathematics and to ensure that more logical operations are performed and verified correctly." One of these more logical activities, particularly in the field of public policy, is to determine whether a reasonable "ineffective" of comparative institutional surveys remains. Since any expression of simultaneous inefficiency represents an opportunity for mutual benefit, there is an incentive on behalf of

the parties to such transactions to relieve the incapacity. This is what is the biggest obstacle for every organisation to face.

While most contract theories of economic organizations focus on pre-induced alignment, the contract / administration prism primarily focuses on the outdated administration of ongoing contractual relationships. Three conceptual features are perceptible in this regard. First, the prism of the contractual approach to economic institutions agrees with James Buchanan's assertion that "mutuality of advantage from voluntary exchange ... is the most fundamental of all understanding in economics" (2001). The lens of contract / administration is before John R. Commons who wanted to implement this by joining the reform of the problem of developed economic institutions: "The ultimate unity of action ... it should be - three principles of conflict, mutuality and order. The prism of agreement / administration not only accepts transactions as the main unit of analysis, but also sees governance as a means of reducing conflict, helping to reduce conflict and achieve outcomes. Second, and applies to this emphasis of governance, adaptation is seen as the main problem of economic organization, of which two types are recognized: autonomous adaptations in the market that are elicited by changes in relative prices (Hayek, 1945) and coordinated adaptations of a 'conscious, deliberate, purposeful kind' accomplished with the support of hierarchy (Barnard, 1938). Subject to the nature of the transaction, both types of adaptation are important - namely, the joint study of markets and hierarchies (Rather than the old conceptual division into markets or classifications) results. Frank Knight's (1941) observations The key point in the spirit is that: to waste money and to behave normally and within limits to make his activities and his organization "efficient" without wasting time. This fact deserves supreme importance; And an adequate definition of economics can make it clear that the main relevance of the discussion is in relation to social policy, assuming that signaling will be oriented towards increasing economic efficiency and reducing waste.

The economics of transaction costs react by explicitly providing for the characteristics of human actors in the contract. In particular, all complex contracts are incomplete, some contracts are subject to disciplinary risks and parties are given "potential foresight", which increases potential risks and risks for the future. In addition, the details of business and market organization are scanned through the lens of the desired configuration, and when viewed through the lens of the contract, both the administrative structure and the transactions are subject to scrutiny and there is the requirement of microanalytic. Thus, the company and the market are described as alternative methods of administration that vary according to individual structural modalities. More specifically, each common mode of administration is defined as a syndrome of different characteristics that gives rise to different adaptive strengths and weaknesses. In particular, where market contract law is valid and compatible with transactions in both law and economics, so that both parties can easily break up transactions on behalf of alternative suppliers and buyers, hybrid transactions and, in particular, classified transactions for which continuity is assessed. Legal rules thus give way to the more elastic concept of 'contract as framework' for hybrid transactions, where the framework 'never accurately indicates real working relations, but affords rough indication around which such relations

vary, an occasional guide in cases of doubt, and a norm of ultimate appeal when the relations cease in fact to work' (Llewellyn, 1931).

The conscious, deliberate and firm adaptations noted by Bernard were made by the administration. They transact outside the market and organize them internally, which enforces the contract law of the internal organization. Courts have a good idea to refuse to hear disputes arising between companies, unless they are presented as 'fraud, illegality or conflict of interest, such as compliance, pricing, Overhead, accounting, transfer inclusion costs - delays, quality failures, etc. In practice, the internal body has contract law tolerance, making the company its court of final appeal (Williamson, 1991). After the transaction is designated as the basic unit of analysis, the important features of the transaction are: (1) the condition of asset specificity, in that such assets cannot be redeployed to alternative uses and users without loss of productive value; (2) the disturbances (uncertainty) to which contracts are subject; and (3) the frequency with which transactions recur. Discriminatory contractual contingencies are primarily identified as the value of continuity, which varies directly with the specificity of the asset, where collaborative customization is required for disruption.

Heal, (2005) raises various questions about the reasons why companies engage in various economic activities to fulfill social requirements such as environmental protection outside of their legal obligations. In other words, why are companies "highly compliant" to social demands? Does this benefit companies, their shareholders and perhaps others? With common sense, an answer may seem obvious. However, it is not necessary for economists to have a larger framework of thinking since businesses are not required to do anything outside of legal liability to serve the interests of traders. Heal, (2005) has of opinion that companies and their shareholders and other stakeholders are not only economic games, but also actors of formerly integrated social exchange games. It analyzes how the social capital of companies involved through CSR can compensate for the abandonment of economic resources, how the former can indirectly supplement the latter's transfers and the latter how institutional changes in the environmental rights system Can be adapted against. From this point of view, the company is not only the community in which it is integrated and should also be the beneficiary of the company, but the company itself also benefits from social interaction with the community.

The standard approach to business organizations in economics is a graded series of principal – agency relationships. The architecture of an internal organization is seen as a nested hierarchical structure composed of a co-chief supervisor and a co-subordinate agent, in which decision-making power lies only from the first to the second boundary of the contract. Senior executives of in-house firms are seen as agents of investors who control through the financial markets (and the board of directors) in the class of the legal framework. In short, corporate governance is seen as an agreement only with the means by which "companies assure suppliers a return on their investment" (Shleifer and Vishny, 1997). However, there are different models between the mechanisms of corporate governance (CG) and organizational architecture (OA) as non-market information systems, whose functions and implications are not properly understood in terms of standards is, where the organisations provide a simple framework

to classify the basic conditions for each conservative pattern of relation between CG and OA to be effective.

One possible idea and analytical approach to linking CG and OA is to see the corporate entity as a playground between directors, workers and investors (different types) and to consider a stable link between specific types of CG and of organizational architecture (OA) among these actors. As an example of the balancing result of strategic contradiction. Multiple equilibria can also be created from a game with a common structure, in which choice can be conditioned by the value of institutional parameters surrounding the game's domain (external rules of the game). Formal legal rules, institutional organization of market procedures, trade relations, government relations and customary social customs can be seen as constituting these criteria. This approach can be seen as an attempt to implement the so-called CG stakeholder society approach within a limited framework, by involving employees as investors and managers as well as explicit actors in the game (Aoki 1984, 2001). On the other hand, he also expects traditional control of organizational stratification based on property rights, providing a special balance among others, which is possible under certain conditions. This particular equilibrium solution is similar to the standard "corporation-as-property-as-property". Thus, the game theory approach can be seen as a more general approach that takes traditional theoretical debates to a higher level in both opinion and reconstructs the normative approach.

The bare mechanics of stakeholder theory, as it has evolved over the last 25 years that agrees to the arguments of Milton Freedman, Michael Jensen, and Oliver Williamson, often calling them counterparties to stakeholder theory, and suggesting that all stakeholder theories conform to the core concept. These theorists highlight the main differences that can be made with this great economic approach to trade. they suggest that if these approaches are consistent with stakeholder theory, then it makes more sense to go back to the roots of capitalism, entrepreneurial theory and they suggest that stakeholders' theories should be viewed as theories about how companies can operate in practice. We have come out with several policies that form the basis of stakeholder capitalism. There are several accounts of the history of stakeholder theory (Freeman, 1984; Donaldson and Preston, 1995; Phipps, 1997; Slinger, 1999; Freeman, 2005). However, there is little analysis of the underlying basis of the theory. Freeman (1994) suggests that most business theories are based on the difference between "business" decisions and "ethical" decisions. It is effective to assume, for example, it is said that has no inherent moral content or ethical viewpoint in a business decision. And, it is effective to believe that to achieve what is most believed is of value and has no inherent content or vision for the business. Wicks (1996) and others explain how this lie affects our understanding of business and other areas of society. Isolation is two things to disprove lies. The first is that almost all business decisions have ethical content. To see if this is true, just ask if the following questions really matter for a business decision: (1) If this decision is made for whom is value created and destroyed? (2) Who is harmed and/or benefited by this decision? (3) Whose rights are enabled and whose values are realized by this decision (and whose are not)? Most business decisions, or phrases about business, have ethical content or an underlying ethical perspective. Most moral judgment, or phrase related to ethics, is an implicit view of some

business or commercial content. (1) There is no point in talking about business without talking about politics. (2) There is no point in talking about politics without talking about business. (3) There is no point in talking about business or morality without talking about people. One of the biggest challenges facing business experts is mandatory speech. At its heart are the stories that have integrated research. It is essentially the work that researchers have done over the last 25 years on behalf of this "reader's theorist": (1) "economics and useless science to question a lot of work done in the name of"; (2) about the many works done by philosophers who have little knowledge of economics or business; And (3) challenges a number of tasks in all business disciplines that are "anthropology" or "humanities" or more strongly stated that most people are quite complex. The stakeholder theory was initially developed around (1). Its future development and utility depend on how it treats (2) and (3). (1) To begin the speech, we need to proceed to the basic principles of ethics, and we suggest that some principles should be included in the most rational moral approach. Most people, most of the time, want to identify the impact of their actions on others and take responsibility for them. Clearly, the principle of responsibility is not compatible with the lie of isolation. While business is different from ethics, there is no question of moral responsibility in making business decisions; Therefore, the joke is that business ethics is an oxymoron. More clearly still, it is difficult to see how morality comes to earth without something like "principles of responsibility". "Responsibility" can be quite a difficult and versatile concept. There are different ways to understand this. But if we do not accept to take responsibility for our own actions (because it is limited to reason and complex issues such as this), then how do we include reason together in ethics so that we can all develop bad faith. One answer to the responsibility policy is that some people do not really want to be responsible or ethical. All they want is to remove as much hatred of others as possible. People sometimes act "opportunistic and cunning". Despite some truth in this approach, the question is a starting point. Start with an accountability policy and you still have to deal with the problem of opportunism, but it does not become a fundamental consideration in defining organizational design. Start with opportunism and it is possible that human dignity, collaborative effort, creative consciousness is likely to let go of such critical ideas that we provide, the whole core of capitalism. Both our accounts require a deep understanding of liability policy, its origins and implications.

It is now easy to see that the origins of the "stakeholder theory" are the thesis of integration and the principle of accountability. Leave the error of separation in part due to open question logic and there is no option. Individuals involved in value creation and business are "particularly accountable to groups and individuals who may be affected or harmed by their activities", that is, to stakeholders. For most businesses, as we now understand, this means focusing on customers, employees, suppliers, communities and financiers. The "stakeholder doctrine" does not mean that representatives of this group should sit on the board of directors of the company, nor that shareholders (we prefer "financier" as more inclusive terms) have no rights. This means that the interests of these groups are interdependent and to create value, attention has to be paid to how value is created for each partner. The way values are created for stakeholders is how each is influenced by the activities of managers as well as the other.

"Stakeholder theory" is basically a theory of how a business is efficient, optimistic and how it can be efficient. It is descriptive, managerial, and useful at the same time, and as Donaldson and Preston (1995) argued, it is operational. Stakeholder theory is about businesses and how to effectively run a business. "Creating more and more values" is considered "effective". Most stakeholder theory authors have taken an approach that considers existing large companies as appropriate. He tried to use this concept to solve anti-social problems such as "corporate social responsibility", "corporate legitimacy", "company theory" and even "building a good society". With a few exceptions, many of the most important questions were not considered important: how to understand production and trade at simple prices? How can entrepreneurs build and maintain standards? Price across and between multiple state regimes. How does manufacturing and business take place? While these questions may seem ineffective at first glance, we would like to suggest that we take a stakeholder approach to gain interesting insights and make assumptions about business and political philosophy, which we want to do. There are many competing "standard accounts" related to quality creation and business. They all revolve around the idea that shareholders or owners or investors are entitled to ongoing benefits that come from value creation and commerce. The Stakeholders' theory states that problems are more complex, meaning they have relationships with stakeholders and are more complex.

In a series of questions posed to stakeholder advocates, the author sows: (1) How should a manager identify key stakeholders and classify other fundamentals as insignificant? (2) Who set the criteria separating important and unimportant stakeholders? And (3) what key values should be represented in making such decisions? (Sundaram and Inkpen, 2004). The answer to this question, explains Sundaram and Inkpen, 2004, is the need for discriminatory economic theory. Unfortunately, the stakeholder response provided by Freeman, Vicks, and Parmar (2004) is beautiful and is consistent with Inkpen's stereotype. Rejecting the economic theory for free man, Weeks and Parmar asserted that it came from a self-destructive destructive academic community rather than an empirical exploration of "how they work." After researchers begin this investigation, Freeman, Vicks, Parmar points out that values become linguistic / behavioral mediums through which managers enter professional associations. And, once established on this basis, stakeholder theory provides a way to answer the question of beauty and inefficiency: stakeholder theorists distinguish ideological stakeholders who can achieve an ethical position by contributing to the firm and derivative Stakeholders, despite their organization, did not contribute (Phillips, 2003; Mitchell, Agle, and Wood, 1997). The board of directors has the legal power to differentiate between these stakeholder groups and to allocate rights and obligations between these stakeholder groups (Phillips, Freeman and Wicks, 2003). Of course, this stakeholder formula is based on the voluntary and collaborative nature of the company. However, the components of the enterprise contribute to the assets and take risks to participate in the economic activities of the market. And, as such, the "stakeholders" of the company must share incomplete language to help them make two key business decisions: (1) who are legitimate and who are stakeholders; And (2) who should be on the board? Nonetheless, stakeholders' theorists have many reasons to be skeptical about neoclassical economics. His belief is that everyone

works opportunistically, and that everyone can rationally and fully adapt to enterprise coordination management experience studies. However, advances in behavioral and economic law now provide an immediate economic rationale that easily adapts to a stakeholder model (Jolls, Sunstein & Thaler, 1998; Blair & Stout, 1999; Kaufman & Englander, 2005). We in most cases argue: (1) the firm's economic purpose designates legitimacy to core stakeholders, to those who add value, assume unique risk, and can incur harm; (2) the board serves as the principal who coordinates these core stakeholders to sustain competitive advantage and new wealth creation; and (3) state incorporation law, Delaware in particular, reinforces the board's function.

This research focus on the integration of concepts from behavioral law and economics with stakeholder theory (Harrison and Freeman, 1999; Jones and Wick, 1999; Merens and Wicks, 1999). Arguably, a resource-based economy extends the structure of team management to effective management tools. The section begins with behavioral economics from Homo sapiens. The new "rational actor" provides team production with "raw materials" to classify (describe) the business as a collaborative game so that business leaders share the broker's surplus allocation and adjustments Consider stakeholders fair (Aoki, 1984). Mutual benefit sets the basic standard of "fairness" in the market. Partition has no purpose, no neutral values just the thematic notion of parties that cooperate (Pareto and Caldor / Hicks competence) trample non-cooperation. Thus, mutual justice has the intrinsic moral value of "justice" (economic efficiency), not harm. However, its evaluation depends entirely on the voluntary agreement of each group.

This formula contains rules of ethics (distribution) and strategic measures. Nevertheless, we do not agree with general stakeholder representations that allow the board to choose between the principles of mutual benefit and the initial distribution of neutrality (Freeman and Evan, 1990); Phillips, Freeman and Weeks, 2003; Donaldson and Dunfee, 1999). Competition in commodities and financial markets is preventing American boards from deviating from the Pareto / Caldor / Hicks standard. Thus, we agree with economists that administrators cannot choose between neutral values i.e. utilitarianism and mutual benefit (methodology interaction / decision) (Barry, 1989; Fahr&Gacheter, 2000; Bowles). 2004). Instead, the consequences of public policies in "unfair" markets become sites of treatment. Here it is reasonable to criticize Freeman and Evan, 1990 for local justice and (global) public policy justice (Elster, 1992; Rolls, 1999, Phillips, 1997; Phillips, 2003; and Child and Marcus, 1999). Kaufman & Englander, (2005); Prahalad, (1993) are of opinion that Regulated markets reproduce the advantages of trade. Its liquidity gives "enough power to money market managers". A particular corporate control group is the most powerful - which can formulate division / allocation rules for the convenience of shareholders and managers; Or control groups may enter into deals that distribute benefits to consolidated stakeholders in a new asset generation team. In addition, team production concepts (details, content) create value creation, unique risk and strategic insights that business leaders can assemble a board that is demographically aligned to build economic strategy and business acumen. These views are clearly in line with the strong contribution of strategic practice to resource-based economies (Barney, 1991; Grant, 1996). Both of these theories suggest that the board serves as the

creator of team trust (s) rather than senior executives by the vault. since the various components participate in the organization's surplus value and the creation of new assets after a period of extended capital allocation, there is total possibility to maximize the total value as a business goal. The perceived relationship between transactions and modes of administration stems from the application of discriminatory alignment assumptions - intelligence, transactions combined in their characteristics, administrative structures, which differ in terms of corporate social irresponsibility. The researcher in this research paper tried to find out the answer for the following hypothesis i.e.

**Hypothesis:** All influential factors of CSI i.e. Contractual Perspective, Corporate Governance, Importance of Human-Asset for Corporate Stakeholders, Stakeholders are the Basis for Capitalism, Behavioral aspects of Economics, stakeholders' value creation, principal–agency relationship, and shareholder value creation are responsible for the emergence of CSI as a new area of research among the researchers and practitioners.

### III. OBJECTIVES

The literature mentioned above have failed to find out the causes that triggered the academicians and the researchers even the corporate representatives to consider CSI is an emerging topic that needs the in-depth study. The basic objective of this research paper is to find out what are factors responsible for greater involvement of the scholars and intellectuals to study CSI as a subject matter to bring in best of the corporate practices, so that it can meaningfully influence millions of lives.

The outcome of this paper is based on the following eight factors, that has triggered the researcher to conduct in-depth study in the area of Corporate Social Irresponsibility.

- Contractual Perspective
- Corporate Governance
- Importance of Human-Asset for Corporate Stakeholders
- Stakeholders are the Basis for Capitalism
- Behavioral aspects of Economics
- stakeholders' value creation
- principal–agency relationship
- and shareholder value creation

### IV. RESEARCH METHODOLOGY

#### Research design

This study is exploratory in nature. Here some factors which are explored from literature and perceived by the author are combined into find some categorical variable like Contractual Perspective, Corporate Governance, Importance of Human-Asset for Corporate Stakeholders, Stakeholders are the Basis for Capitalism, Behavioral aspects of Economics, stakeholders' value creation, principal–agency relationship, and shareholder value creation.

Data collected from some Corporate employees, HR professionals, PhD Research scholars, Academicians and corporate consultants using a structured questionnaire and analyzed by test of significance by using ANOVA. Apart from this the percentage and bar charts are used to interpret data.

#### Research Hypothesis:

**H<sub>0</sub>:** CSI factors are responsible for its emergence as a study for researchers and academicians.

**H<sub>1</sub>:** CSI factors are not responsible for its emergence as a study for researchers and academicians.

#### Questionnaire and Data collection

In this research the researcher has tried to find out the importance of the following factors like Contractual Perspective, Corporate Governance, Importance of Human-Asset for Corporate Stakeholders, Stakeholders are the Basis for Capitalism, Behavioral aspects of Economics, stakeholders' value creation, principal–agency relationship, and shareholder value creation responsible for the researchers to take up the topic CSI so seriously that took the lime light in recent past. For this the researcher tried to investigate the importance of these factors in the study of CSI. For this the researcher conducted primary data collection to test how responsible these factors are in dealing with CSI as a subject matter. The researcher used the following parameters of response i.e. very responsible (1), mild responsible (2), responsible (3), not responsible (4), less not responsible (5), strongly not responsible (6). In this research paper the researcher conducted research on five group of respondents like Corporate employees, HR professionals, PhD Research scholars, Academicians and corporate consultants and the information received from these respondents became the basis for further research to test how far the factors like Contractual Perspective, Corporate Governance, Importance of Human-Asset for Corporate Stakeholders, Stakeholders are the Basis for Capitalism, Behavioral aspects of Economics, stakeholders' value creation, principal–agency relationship, and shareholder value creation are responsible for CSI to take the center stage among the CSR researchers.

#### Questionnaire:

For this current study a questionnaire framed with 8 questions to identify respondent's personal and behavioral information towards why CSI is an area that demands more in-depth research. For collection of data the researcher used six parameters to test the importance of the factors responsible for studying CSI as a new subject matter to enhance the corporate governance practices. The researcher used the following parameters of response i.e. very responsible (1), mild responsible (2), responsible (3), not responsible (4), less not responsible (5), strongly not responsible (6) for collection of data. The researcher collected the information from the five group of respondents via e-mail and in some cases used WhatsApp.

#### Sample profile:

The researcher used convenience stratified random sampling for the collection of data amongst the five group of respondents like Corporate employees, HR professionals, PhD Research scholars, Academicians and corporate consultants. For this the researcher took the responses of 113 individuals. Further the researcher tested the hypothesis based on the data collected from these respondents.

#### Data collection and Analysis

The data collected from 113 respondents were further grouped and mean values were collected to conduct the research.

**Table-1: Responses received on Factors Responsible for Emergency of Study of CSI**

| TYPE OF RESPONDENTS  | Mean Values of Factors Responsible for Emergency of Study of CSI |    |      |     |     |      |     |      | Total |
|--|--|----|------|-----|-----|------|-----|------|-------|
|  | CP   | CG | IHCS | SBC | BAE | STVC | PAR | SHVC |       |
| Corporate employees  | 3  | 4  | 2    | 4   | 3   | 2    | 1   | 2    | 21    |
| HR professionals   | 2  | 2  | 3    | 3   | 3   | 2    | 5   | 3    | 23    |
| PhD Research scholars  | 3  | 3  | 3    | 1   | 2   | 4    | 3   | 4    | 23    |
| Academics  | 4  | 1  | 4    | 3   | 4   | 3    | 4   | 2    | 25    |
| corporate consultants  | 5  | 3  | 2    | 2   | 3   | 1    | 2   | 3    | 21    |
| <b>Contractual Perspective (CP), Corporate Governance (CG), Importance of Human-Asset for Corporate Stakeholders (IHCS), Stakeholders are the Basis for Capitalism (SBC), Behavioral aspects of Economics (BAE), stakeholders' value creation (STVC), principal–agency relationship (PAR), and shareholder value creation (SHVC)</b> |  |    |      |     |     |      |     |      |       |
| <b>PARAMETERS OF RESPONSE: very responsible (1), mild responsible (2), responsible (3), not responsible (4), less not responsible (5), strongly not responsible (6)</b>  |  |    |      |     |     |      |     |      |       |

Source: Researcher's own source

From the above table-1 it is observed that out of total 113 respondents' Corporate employees, HR professionals, PhD Research scholars, Academics, and corporate consultants constituted 21, 23, 23, 25 and 21 respondents respectively. From the following table-2 it is observed that the average response from the Corporate employees, HR professionals, PhD Research scholars, Academics, and corporate consultants are 2.625, 2.875, 2.875, 3.125 and 2.625 respectively.

**Table-2: Summary Table**

| Groups                | Count | Sum | Average | Variance |
|-----------------------|-------|-----|---------|----------|
| Corporate employees   | 8     | 21  | 2.625   | 1.125    |
| HR professionals      | 8     | 23  | 2.875   | 0.982    |
| PhD Research scholars | 8     | 23  | 2.875   | 0.982    |
| Academics             | 8     | 25  | 3.125   | 1.268    |
| corporate consultants | 8     | 21  | 2.625   | 1.411    |

Source: Researcher's own source

Taking into consideration of the requirement of the research from the following table-3 it is observed that the researcher has

used single factor ANOVA for the statistical inference of the data gathered from 113 respondents. From the following table it is observed that there is no reason to reject the Null Hypothesis (H0) because the calculated 'F' value is less than the critical value of 'F' i.e. (0.303 < 2.641). Since the calculated 'F' value i.e. 0.303 is less than the F critical value 2.641 the researcher considers that the null hypothesis i.e. "CSI factors are responsible for its emergence as a study for researchers and academicians" is accepted.

**Table -3: Single Factor ANOVA**

| Source of Variation | SS     | df | MS     | F     | P-value | F crit |
|---------------------|--------|----|--------|-------|---------|--------|
| Between Groups      | 1.4    | 4  | 0.35   | 0.303 | 0.874   | 2.641  |
| Within Groups       | 40.375 | 35 | 1.1535 |       |         |        |
| Total               | 41.775 | 39 |        |       |         |        |

Source: Researcher's own calculation derived from the table-1

V. SCOPE FOR FURTHER RESEARCH:

This research opens pandora's box that talks about the factors like Contractual Perspective (CP), Corporate Governance (CG), Importance of Human-Asset for Corporate Stakeholders (IHCS), Stakeholders are the Basis for Capitalism (SBC), Behavioral aspects of Economics (BAE), stakeholders' value creation (STVC), principal–agency relationship (PAR), and shareholder value creation (SHVC) are responsible for the development of another area of study parallel to CSR that talk about the Corporate Social Irresponsibility and its implication in the modern business organisations when taking any decision to build strategy. The future research can be carried out individually how these factors of CSI are correlated to each other and what other possible external factors are responsible for if any deviation found in their relationship.

VI. CONCLUSION

This research is an attempt to draw an attention from the research scholar who are considering the importance of CSR in corporate decision making. This research draws an attention that there are various factors like Contractual Perspective (CP), Corporate Governance (CG), Importance of Human-Asset for Corporate Stakeholders (IHCS), Stakeholders are the Basis for Capitalism (SBC), Behavioral aspects of Economics (BAE), stakeholders' value creation (STVC), principal–agency relationship (PAR), and shareholder value creation (SHVC) are responsible for the irresponsible activity shown by many corporates from time to time. For this the research used the responses from different section of society who are directly associated with the CSI subject in various ways. Corporate employees, HR professionals, PhD Research scholars, Academics, and corporate consultants are the prominent section of the society who categorically pointed out that Contractual Perspective, Corporate Governance, Importance of

Human-Asset for Corporate Stakeholders, Stakeholders are the Basis for Capitalism, Behavioral aspects of Economics, stakeholders' value creation, principal–agency relationship, and shareholder value creation are the important factors that are responsible for the emergence of CSI as a new area of research in parallel to the study of CSR and CG. The ANOVA result shows that Since the calculated 'F' value i.e. 0.303 is less than the F critical value 2.641, therefore the researcher agreed to the fact that CSI factors i.e. Contractual Perspective, Corporate Governance, Importance of Human-Asset for Corporate Stakeholders, Stakeholders are the Basis for Capitalism, Behavioral aspects of Economics, stakeholders' value creation, principal–agency relationship, and shareholder value creation are responsible for its emergence as a study for researchers and academicians.

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# Perception of Search and Rescue Crew of Malaysian Police Air Wing towards General Issues of Search and Rescue

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**Abstract-** Search and Rescue (SAR) is a process of searching for individuals and rescuing those that are in danger. In Malaysia, several agencies are involved in SAR. One of them is the Malaysian Police Air Wing. We had posed several SAR issues to the crew of SAR of the Malaysian Police Air Wing and we had given them leverage whether to agree, disagree, or remain neutral pursuant to these issues. The results were analyzed and a majority of the crew agreed that SAR had save lives while other issues showed mixed responses.

**Index Terms-** Aviation Search and Rescue, Search and Rescue Training and Operations

## I. INTRODUCTION

Search and Rescue (SAR) can be actuated through several modes whether it is via land, sea, or air. In Malaysia, the Police Air Wing is equipped with several aeroplane and helicopters to perform aerial SAR. The crew of the Police Air Wing were trained to be proficient in the usage of aerial equipment and vehicles.

The American Society for Testing and Materials (ASTM) had laid out several procedures and management systems to be used by personnel when performing or actuating SAR [1]. ASTM had also developed standards for equipment or vehicles to be utilized for SAR operations, whether it is for land, sea, or air [1]. The activities of ASTM is in pursuant to our research as we had touched upon the issue of SAR management in our analyses.

Bezgodov had introduced a method to efficiently perform searches at seas or oceans. Bezgodov used Complex Network Model to represent the pattern or characteristics of objects, such as crashed airplanes or humans, that drifted in lieu with the oceanic waves, current, and wind [2]. Such advances are welcomes as it would ease the burden of SAR personnel.

According to Statheropoulos, one of the issues affecting SAR is the approach or the management of SAR operations. Statheropoulos confided that if the management of SAR operations is efficient, SAR could be concluded swiftly and without unwanted wastage of resources [3]. Statheropoulos had indicated that future development of a rigid and concrete management approach is within grasp [3].

Shabani had indicated that clues or information regarding location of objects, vehicles, or humans to be searched and rescued are sometimes incomplete and without pertinent details [4]. This poses an encumbrance to the SAR efforts and delays the effort to save precious lives. Shabani had proposed a new optimization algorithm to counter this predicament and he noted that this new algorithm is somehow competitive when compared to other existing algorithms [4].

Joshi had argued that variations of Likert Scale existed because certain researchers were inclined to measure certain sentiments of the respondents [5]. Joshi further stated that the Likert Scale gives opportunities to the researchers to capture perceptions of the respondents in lieu with the issues that are being investigated [5]. This augur well with our research where our research was implemented for the purpose of capturing the attitudes of the SAR crew with respect to certain SAR issues. We had used the 3 Point Likert Scale for our research.

Lehmann mentioned that the 3 Point Likert Scale had been validated by various researchers and is suitable to be used in numerous occasions [6]. He gave examples where researchers had utilized the 3 Point Likert Scale due to it's convenience and the scale has passed certain reliability tests [6].

## II. LITERATURE REVIEW

According to McMurdo, one of the prominent issues in SAR is the predicament of identifying the smallest possible location of victims within a short period of time [7]. To effectively perform this identification, SAR crew should be well trained in order to correctly and accurately interpret the data or information received. This hence would ensure swift SAR operation and action. We dealt with this issue of training in our research and in this paper.

Reid stated that one of the criteria to perform an efficient SAR is the availability of well trained crews [8]. He gave examples of SAR missions that were performed from the year 2013 till 2017 where data collected during this 5 year span were analyzed to show contrasting features of SAR conducted by civilian and military agencies [8]. We in fact had touched upon and analyzed the issue of training in our research and the results were shown in the results section of this paper.

One of the issues in SAR is the optimization of rest for the SAR crew where this is part of SAR human resource management. Jenkins pointed out that during SAR operations, most crew were deprived of sleep and this had decreased the performance of the crew [9]. Jenkins had studied the sleeping pattern of a set of crew and suggested that the resting period of the crew be optimized or the crew's schedule be properly utilized as this would enhance the productivity and performance of the crew [9].

Another aspect which is vital for SAR crew is the demanding fitness level that is required of each crew member. SAR crew would usually undergo professional fitness training to increase or retain their fitness. We had this issue parlayed to the respondents of our research and this is inline with the study conducted by Silk where he commented that physical fitness is utterly important for individuals involved in SAR [10]. He further analyzed tasks performed by SAR crew and deduced that most of the tasks requires high amount of muscle strength. This thus further cemented the correctness of our approach in conveying to the respondents the issue of professional training.

One issue which is grave in SAR is the risk factor. Several risks are inherent during an SAR operation. We were particularly interested in the experiences of each individual in the SAR team where we had posed the issue of experiences to our respondents. Inexperience individual would endanger an SAR operation and thus increasing it's risk. Our concern was also shared by Cokorilo where she had raised the issue of risk in her paper. She indicated that there ought to be a statistical assessment upon the SAR operations in order to gain a comprehensive risk evaluation [11]. Cokorilo had developed a method to predict the inherent

risk of SAR operations and our research was somehow guided by it.

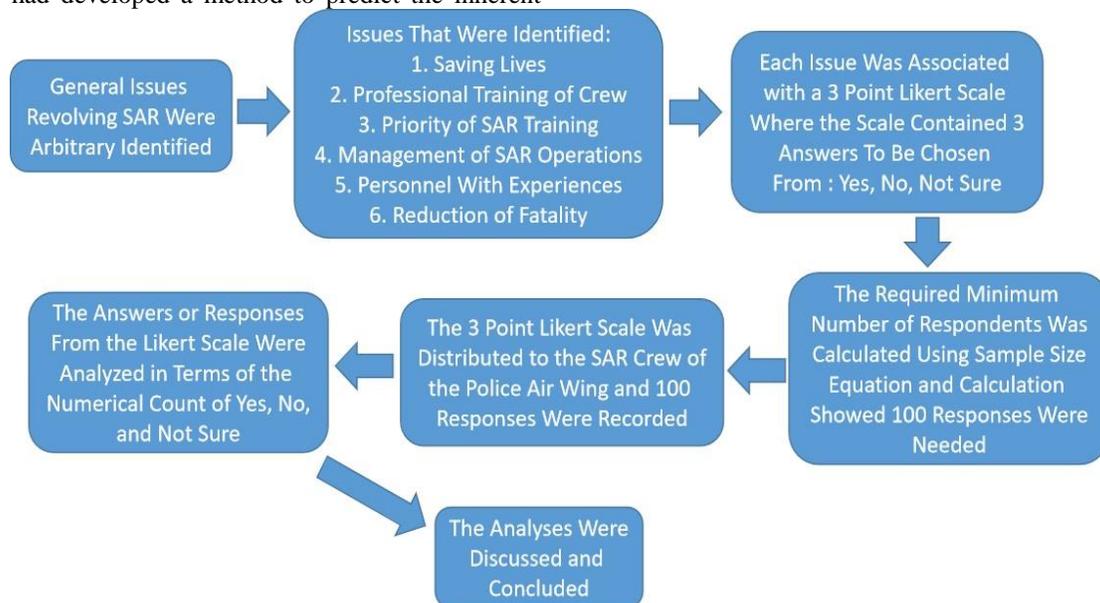
Likert Scale had shown prominent in the academic world where numerous researchers had used the scale for various and numerous studies and researches. Ferrari had utilized the scale to study procrastination among college students [12]. He had developed several statements and questions and had integrated the Likert Scale to those statements and questions where the students had chosen the appropriate answers from the scale [12]. We had followed suit and our approach was similar.

Albaum had also utilized college students in his research but his study was upon the Likert Scale itself. Albaum had analyzed the appropriate usage of the scale and he deduced that the usage was appropriate for most situations and the scale was able to represent the perception of the intended subjects in an optimum manner [13].

Jauch had measured the professional commitment of academicians by using the Likert Scale and the usage of the scale had allowed him to comprehend the correlation between performance and commitment [14]. This showed that the Likert Scale is robust and the variety of usage of the scale is noticeable where the scale is acceptable among social scientists and researchers.

### III. METHODOLOGY

The methodology of our research is shown in Figure 1.



**Figure 1. The Methodology to Obtain the Perception of the Crew**

The general issues pertaining to SAR were arbitrary identified where the decision was based upon heuristics. We had listed 5 issues that were posed to the respondents. Those 5 issues were Saving Lives, Professional Training of Crew, Priority of SAR Training, Management of SAR Operations, Personnel with Experiences, and Reduction of Fatality. Some of these issues were somehow related to human physical fitness and risk where

we had earlier outlined the correlation in the Literature Review section.

Each of these issues were associated with a 3 Point Likert Scale where the respondents were given choices for their answers. Those choices were Yes, No, and Not Sure. We had calculated the required minimum number of respondents by using the Sample Size Equation. We had inserted these values

into the equation : Population Size = 253 , Confidence Level = 80% , and Margin of Error = 5% . The population size is the total number of individuals from the Malaysian Police Air Wing that were involved in SAR.

The calculation showed that we need a minimum of 100 respondents. The issues along with the Likert Scale were then

distributed to the crew of SAR and we had obtained 100 responses which thus met our minimum requirement. The responses were then analyzed where the number of Yes, No, and Not Sure was quantified, counted and represented in graphical forms. These were then discussed and conclusions were made.

#### IV. RESULTS

Figures 2, 3, 4, 5, 6, and 7 show the results in graphical form.

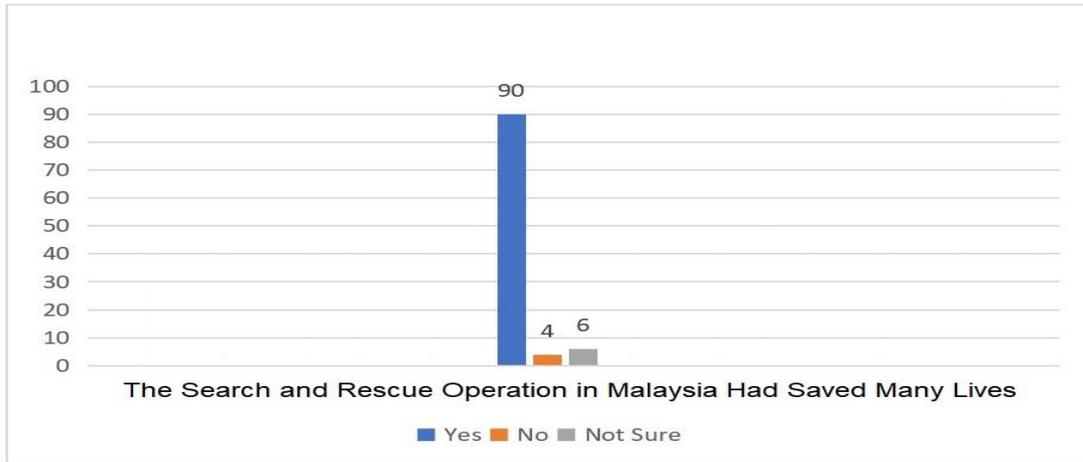
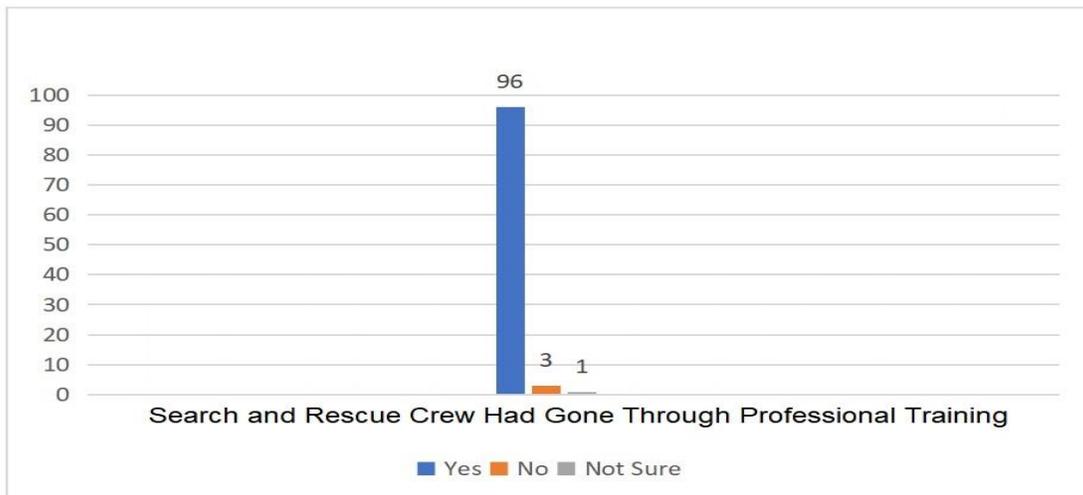
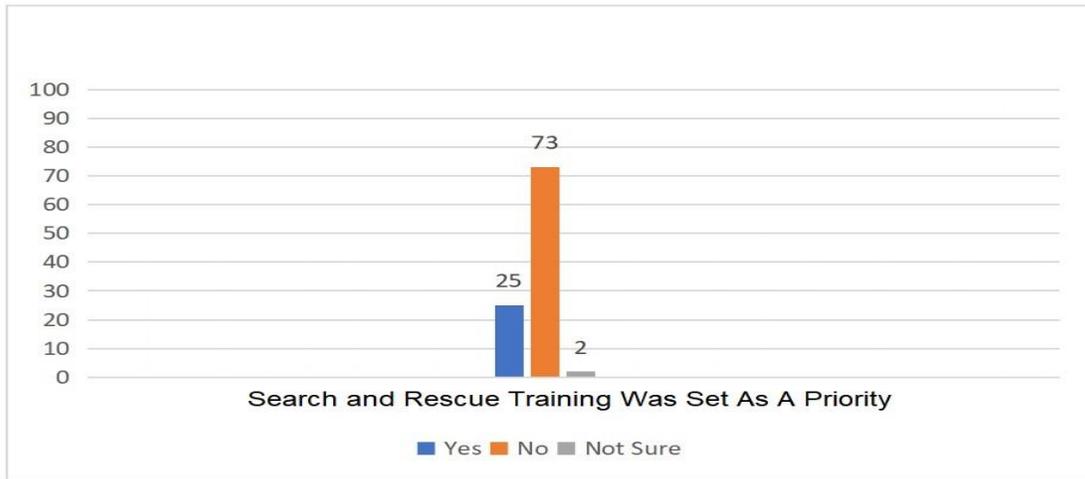


Figure 2. Saving Lives



**Figure 3. Professional Training**



**Figure 4. Priority of SAR Training**



**Figure 5. Management of SAR Operations**

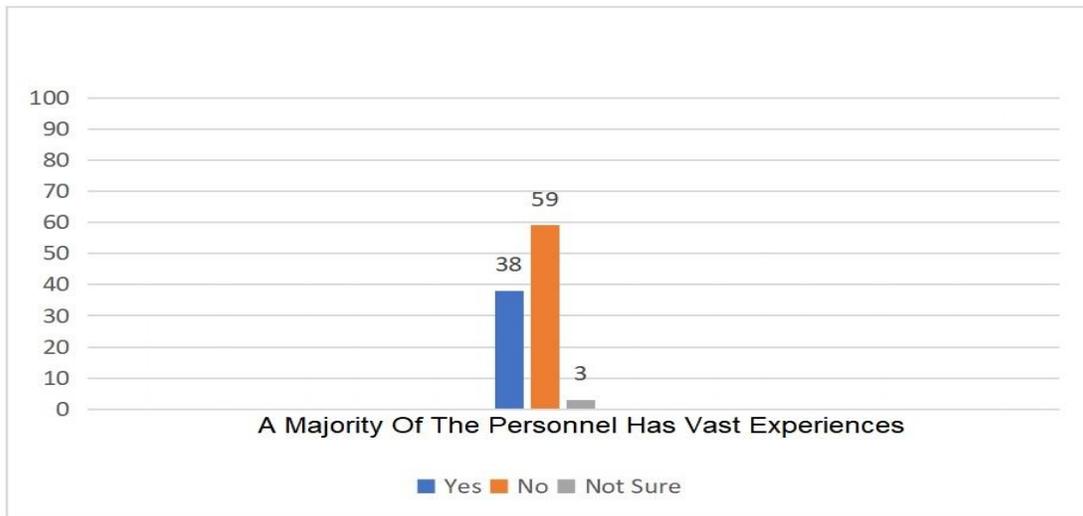


Figure 6. Personnel with Experiences

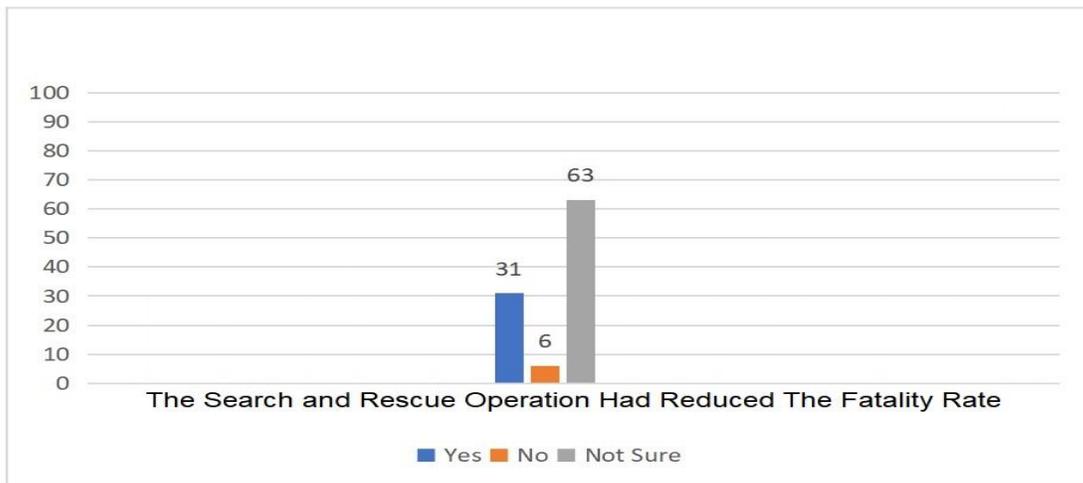


Figure 7. Reduction of Fatality

## V. DISCUSSION

From Figure 2, it can be seen that 90 individuals from the SAR crew had agreed that the SAR operations in Malaysia had saved numerous lives. This number represents 90% of the total respondents. We were clearly delighted that a majority of the crew felt that they had contributed to the life saving process and perhaps their perceptions were based upon operational experiences where various lives were indeed saved.

Figure 3 showed the issue concerning professional training. Professional training here encompassed training in several fields such as physical fitness, methodology of SAR, management of SAR, maintenance of equipment, resources planning, and more. Only 3% of the respondents perceived the crew had not gone through adequate professional training while 96% perceived otherwise. We can take note that almost all of the respondents had undergone, in some way, sufficient amount of training pursuant to SAR.

Based upon Figure 4, it seems that 73% of the respondents felt that the SAR training was not set as a priority by certain quarters. This is quite alarming and perhaps most of the training were focused upon certain non SAR entities. This issue requires more investigation in order to unearth the real picture of the situation. There is a possibility that the allocation of training was actuated in stages and there were groups of individuals that had not gone through several training as the waiting list was extensive.

Figure 5 indicated that 97% of the respondents agreed to the notion of improving the management of SAR operations. Not all operations went smoothly as indicated by the literature in the Literature Review Section. In fact, we had pointed out in the Literature Review Section that this was a global predicament, not only constricted in Malaysia. The perceptions of our respondents showed that they were willing to improve themselves and learn from their previous operations. This is a good trait and should be applauded.

By looking at Figure 6, only 38% of the respondents acknowledged that a majority of the crew members had extensive experiences. This could be an indication that most of the individuals in the SAR crew were young and had not matured yet. While this number (38%) may be low, we felt that there was progression in the team where young individuals were roped in and were led by members who were much more experienced. Young individuals were much more fitter and employing this strategy is reasonable as most SAR tasks were arduous and gruesome.

In Figure 7, 63% of the respondents were unsure whether the SAR operations had reduced the fatality level during incidents or catastrophes. It might be because the crew were responsible for the SAR portion only and victims that were saved were subsequently passed to other agencies for treatment and care. Thus this explain the crew's ignorance upon the status of the saved victims.

## VI. CONCLUSIONS

The result that we obtained showed that the SAR crew were seemingly critical of the issues that existed in the SAR operations and structure. However a majority perceived and felt that the professional training they received were adequate and sufficient. High portion of the crew stated that there should be improvement with regards to the management of SAR operations. A majority of the crew also stipulated that SAR training should be given uttermost priority. However the SAR crew also indicated that their profession had saved precious lives and had made a significant impact during unwanted events.

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# The intervention of mindfulness on behavioral change for achieving goals

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**Abstract-** With different methods and theoretical models, numerous researchers have explored the approaches to achieving life goals. On the other hand, mindfulness is increasingly being used as a method for achieving personal growth development as well as organizational progress. And while mindfulness was based on spiritual origin, it has also become a business practice nowadays. A conceptual model was constructed for goal achievement through mindfulness by using the secondary data available, such as journals, books, and scientific articles, and research papers. In this theoretical framework, it is explained through the default network and direct network of the human brain contribute our thoughts and daily functions and how mindfulness co-related on both system positively for habit formation process which has been explained through the habit loop. It is observed that mindfulness helps to reduce the stress, pain, and fear which come as negative consequences of default network usage and how mindfulness can improve the positive outcome such as relaxation, concentration, and awareness which come from the direct network. The conceptual framework shows the positive relationship between goal achievement and habit loop via breaking existing bad habits and growing new good habits. Hence it can be perceived the certain track of goal setting through the intervention of the mindfulness process.

**Index Terms-** Mindfulness, Goal achievement, Default and Direct network, Habit loop, Neuroscience

## I. INTRODUCTION

People always attempt to follow goals and dreams in their life by expecting a better outcome. In the 21st century in our busy schedule and the complexity of need and want, we naturally create many goals to achieve instantly. Hence, they bend to follow many diverse techniques to accomplish objectives without having proper awareness of it. For example, a businessman may hard work too much with dedicating his or her private life, but who gets the same results and no improvement as expected. There, it is necessary to identify the actual reason for not gaining the advanced result even we strive for success. The real cause is about changing our habits. Changing habits is not just changing our activity in a short time, it relies on a combination of a certain mental and physical process. (Ajzen, 1987) says that in the behavioral change theories clearly show that physical changes happen due to the mental transformation and in other words, our actions are controlled by our thoughts (p1, p67). So that we need to address a technique or

tool or strategy to differ our thoughts or attitudes to change our habits for getting the desired outcome. Mindfulness comes as a certain practice in modern society a few decades ago, but it has mainly been established in the eastern region especially in Buddhism as life-long practice for experiencing success and happiness in a spiritual framework. Hence, this study investigates how mindfulness acts a vital role in growing new habits and scientifically weaken our bad habits. There, the close relationship between our brain functions and the role of mindfulness to have a positive relationship with goal setting will be evaluated in neuroscientifically.

## II. MINDFULNESS:

In the last two decades, mindfulness has become a powerful tool in large communities such as clinicians, a lesser extent, and empirical psychology (Bishop *et al.*, 2004). Recently, the psychological and business construct mindfulness has received a great deal of attention, present awareness, and non-judgmental thinking. Mindfulness has its roots in Eastern contemplative traditions and is most often associated with the formal practice of mindfulness meditation. However, mindfulness has been called the “heart” of Buddhist meditation Mindfulness, however, is more than meditation and which is “inherently a state of consciousness (Grabovac and Brandilyn, 2015). According to Buddhism, there are mainly three levels of mindfulness. Momentary mindfulness (Informal meditation) is used during the day when we are active mode. When we talk to someone, we should be mindful of what we say and when we are about to cross the street, we should be aware of the traffic (Fronsdal, 1998). Access concentration (Informal meditation) is more focused. While reading an exciting book, one gets absorbed in it. One cannot be thinking about other things while reading (Pemaratanana, 2012). Absorption in mindfulness (formal meditation) can be achieved with the practice. Here one needs to find a quiet place and need to close one’s eyes (Dhammadharo, 1992). In the modern organizational context, people attempt to practice all levels of mindfulness for achieving their goals by using different strategies such as MBSR programs (Chiesa and Malinowski, 2011).

### 1.1 MINDFULNESS AND TWO NETWORKS OF THE BRAIN:

The default network of the brain consists of the medial [prefrontal cortex](#), posterior [cingulate cortex](#), and the [inferior parietal lobule](#) that are important for our

survival(Spreng *et al.*, 2010). A 2007 research called at the University of Toronto, "[Mindfulness meditation reveals distinct neural modes of self-reference](#)" by Norman Farb, which was in the [understanding](#) of mindfulness from a neuroscience perspective. There, Scientists have figured out a way to investigate how human beings experience their research, and they discovered that people have two distinct ways of interacting with the world, using two different sets of networks. They found that humans had two distinct ways to communicate with the environment, using two separate network sets. (Rock, 2009).

In the region of the medial prefrontal cortex of our brain, along with our memory region like the hippocampus which is networked with our experience which is called the "default network" or "narrative network"(Fransson and Marrelec, 2008; Rock, 2009). When not much else is happening, and when we think about ourselves self then this network becomes active. Especially this will be helpful for goal setting, planning, and strategizing(Spreng *et al.*, 2010). We also able to experience the world more straightly, which allows more sensory information to be perceived. In the process of default networking, our brain holds huge stores of information about our self, other people's history, and the future of all the people we know, including ourselves. For example when thinking about what to cook for dinner tonight, or whether we will be embarrassed by making a mess of the meal. It is meant the default network is active when we are in planning, daydreaming, and also ruminating. When we experience the world by utilizing a narrative network we take information from the outside environment and then process it via a filter of what everything means and also we add our interpretations (Andrews-Hanna, Smallwood and Spreng, 2014).

Even though default network has a positive impact on goal setting or future planning, it also has a negative influence to our self as a negative consequence of highly activating our default networks, such as stress, fear, and pain with a high level of activation of the default network (Camerer, Loewenstein and Prelec, 2005). At the present, research shows that people think most of their past or future with a doubtful or stressful mental condition based on a quarter of a million queries posed of about 5000 people from 83 different countries in the world. But, fortunately, another study says that after practicing mindfulness, then the grey matter in our brain's amygdala can become smaller –which the region is known for its role in stress (McGilchrist,2019). Another study says that mindfulness can have an impact on producing chemicals that change our mood. Other research states that when we are mindful, then connections between different regions of the brain change cause for creating happiness (Kringelbach and Berridge,2010). One study showed that experts in mindfulness experienced less pain than those who did not practice mindfulness (Taylor *et al.*, 2011). Interestingly, the regions of the brain associated with pain did not diminish in those individuals. The brain areas linked with emotion and memory were less involved, instead. Mindfulness may have minimized the connection between these two brain regions (Brewer *et al.*, 2011a).

There is also another way of experiencing experience which is through "*direct experience network*". When this network is operating several different brain regions become more active. One is the insula, a region that refers to perceiving bodily sensations(Brewer *et al.*, 2011b). Another brain region is the

anterior cingulate cortex which is a region central to switching our attention. In the process of direct networking, it allows us to get closer to the present moment which is the reality of any event, and able to perceive more accurate and real-time information about events occurring around us(Smallwood and Schooler, 2015). It is meant when this is active we are less banded with past, future, our habits, expectation, or assumption. We are indeed experiencing data coming into our five senses in real-time such as a cold drink in our hand, the warmth of the sun on our skin, or the cool breeze in our hair. Concerning mindfulness, our direct experience network is more active when we are thinking in mindfully(Rock, 2009). Moving on to further explanation, mindfulness experience such as meditation help to get rid of distractions like mind-wandering and self-referential thinking through minimizing the brain activities in the default mode network(DMN)(Garrison *et al.*, 2015).

It is important to observe how both networks work in different situations.Researchers have found that two circuits are inversely correlated. Lets' explain that from two examples. First, when we think about an upcoming meeting while washing dishes, we are more likely to fail to detect a broken glass and cut our hand, because the visual perception brain map is less efficient when the story map is turned on. We don't see as much (or hear as much, or see too much, or see something like that) while we are lost in thought. Sadly we don't taste even a cold (Rock, 2009; Verhaeghen, 2017). In terms of the second example, it reduces the activation of the narrative circuitry when we concentrate our attention on incoming data, such as feeling the water on our hands as you wash up. This explains why it helps to take a deep breath and reflect on the present moment if, for example, your narrative circuitry is going nuts thinking about an upcoming stressful event. At that moment all the senses "come alive"(Arden, 2010). Furthermore, mindfulness can effectively be functioning the creativity for problem-solving, and controlling our emotions via the pre-frontal cortex is the area of our brain (Berkovich-Ohana *et al.*, 2017).

### III. HABIT LOOP:

Habit is a behavioral pattern that is constantly replicated and appears to occur unconsciously. From the psychologists' point of view, habit is known as "a more or less fixed way of thinking, ability or feeling acquired via repeated repetition of mental experience"(Andrews,1903, p.121). Creating a good habit is a fundamental problem for human life as our conduct is primarily influenced by our customs. Good study habits are good assets for learners because they help students gain mastery in the areas of specialization and ultimately excellent results, while the opposite is a restriction on learning and achievement that leads to failure. The learning habit influences not only the academic successes of the students but also their potential success (Chen *et al.*, 2020a). According to Duhigg, there is a loop that entails a cue, routine, and reward for every habit. This habit loop consists of three components, namely: *cutting* (arrangement the environment such as place, time, incidents, or people), *routine* (a repetitive pattern of activities), and *reward* (the result of activating the habit) (Duhigg, 2012). In terms of routing, it acts as a habit trigger for automatic behavior (Clear, 2018). Habits are built once actions are tied to a trigger by consistent repetition. When a habit is activated,

individuals have an unconscious urge to take the action; people do it without conscious mind or present awareness. For an instant, go to the bathroom once we wake up is a habit, we do it without asking ourselves whether they want to do so in that morning. Psychologists show that habits are cued by context (Wood and Neal, 2007) and there are two types of contextual 'cues', namely; direct and motivated cues. When the routine and environment are associated repeatedly, it refers directly to cue. It is meant that habits can be developed by serving a constant environment. Then the brain to go into automatic mode. There a cue could be visual, thought sequences, or an emotion something like a particular time of day. For illustration, reading a book in the same room at the same time. When we have a successful experience that may become a stored motive to do the same thing or having a rewarding experience, it is called a motivated cue (Daw, Niv, and Dayan, 2005). 'Routing' is the next level and it is generally considered as behavioral patterns that we repeat usually, literally etched into our neural pathways and the routine could be simple or complex. For an example of simple routing; putting toothpaste on our toothbrush, brushing our teeth, and rinsing. On the other hand, going to our car will be more complex; getting in, adjusting things like the seat and mirrors, starting the car, getting out of the parking place, looking on the road for the correct track, observing traffic signals and road signals, and watching out for other drivers and pedestrians (Hill Jr, 2018).

Goal-driven acts are learned rapidly and are controlled by their outcome. Habitual behaviors are reflexive, elicited rather than their effects by previous stimuli. They can become repetitive when people participate in goal-directed activities daily. A habit can initially be activated by a target, but it becomes less important over time and the habit becomes more automatic. The third component of the habit loop is called 'reward': the result of habit activation. The rewards can be physical or emotional reinforcement — "clean teeth" and "safely reaching our destination". Via routine behavior, people may feel that their needs and wants to get accomplished, and they receive inner rewards (Phillips *et al.*, 2016). This rewards cause us to continue the habit as a psychological outcome. It is proposed that one should first set up a challenging life goal, and then, try to fix or resolve it. We gain a coherent psychological experience during the processes of achieving life objectively. As a result, this psychological experience in the new habit may increase positive feedback that will help to replicate the new behavior in the future (Chen *et al.*, 2020b).

Our brain equips with a lot of work so it uses habits because it wants to minimize some of its efforts. Therefore, our brain seeks to create any routine into a habit. But here is a trouble, the habit can be good or bad, and the brain does not judge this and it only wants to minimize its thinking attempts. We can also generate new habits as we wish by finding the right cue and routine that brings the desired reward. The thing is more we do a routine the very strong is designed and it never goes away, but it can be changed or modified by changing the routine. But, some habits are really hard to change and it is needed for hard work such as refrain from smoking and lose weight from overweight(Hill Jr, 2018).

## 2.1 MINDFULNESS AND HABIT LOOP

A signal that triggers the brain to pick a routine from its stored routine database, for an instant as we arrive home from that

hard day at work we switch the TV on (Foster, Gore, and West, 2006). There, mindfulness will assist us to discover and dig deep the real cue behind our habit. It brings our awareness and consciousness to something that remains the same each time we have the urge to begin that habit which is the cue(Orbell and Verplanken, 2010). When it comes to routing then mindfulness helps to identify another routing for the observed cue. There, we can change our bad habits via route changing through mindful way with giving rewards(Carden and Wood, 2018). Let's discuss an example of that. We attempt to work out what craving our habit is satisfying. If it is a smoking break, substitute it mindfully for something else i.e. taking a walk. If the craving is satisfied, yes, then the craving was for a break. If our craving is still there? Then we can experiment with rewards, try a coffee or fruit juice instead and see if that works. Often we have to dig around for a while with the rewards before we can effectively shorten our old habits with something different that will fulfill the urge. Generally, mindful people determine and observe their behavior consciously and decide whether it is worthy of repetition. As an example, when we get home after a hard-working day then we turn the TV on and put our feet up. At that time our brain comes to a decision it feels good to rest(Brewer, 2017). This is the positive reinforcement delivered by our brain. When we are going to rest for too long then we link with more kinds of habits such as bite our nails(Williams, Rose, and Chisholm, 2007). Being mindful would be a great asset to break down all unnecessary and ineffective habits that the default network of the brain do not realize(Burrell, 2016). Hence, once we have successfully identified the cue and the reward then it is easy to work on designing a new routine(Chen *et al.*, 2020a). There, researches have shown that the quickest way to change our habit is to have a proper plan with a conscious mind(Ayobi *et al.*, 2018).

## IV. HABIT CHANGING AND GOAL ACHIEVEMENT:

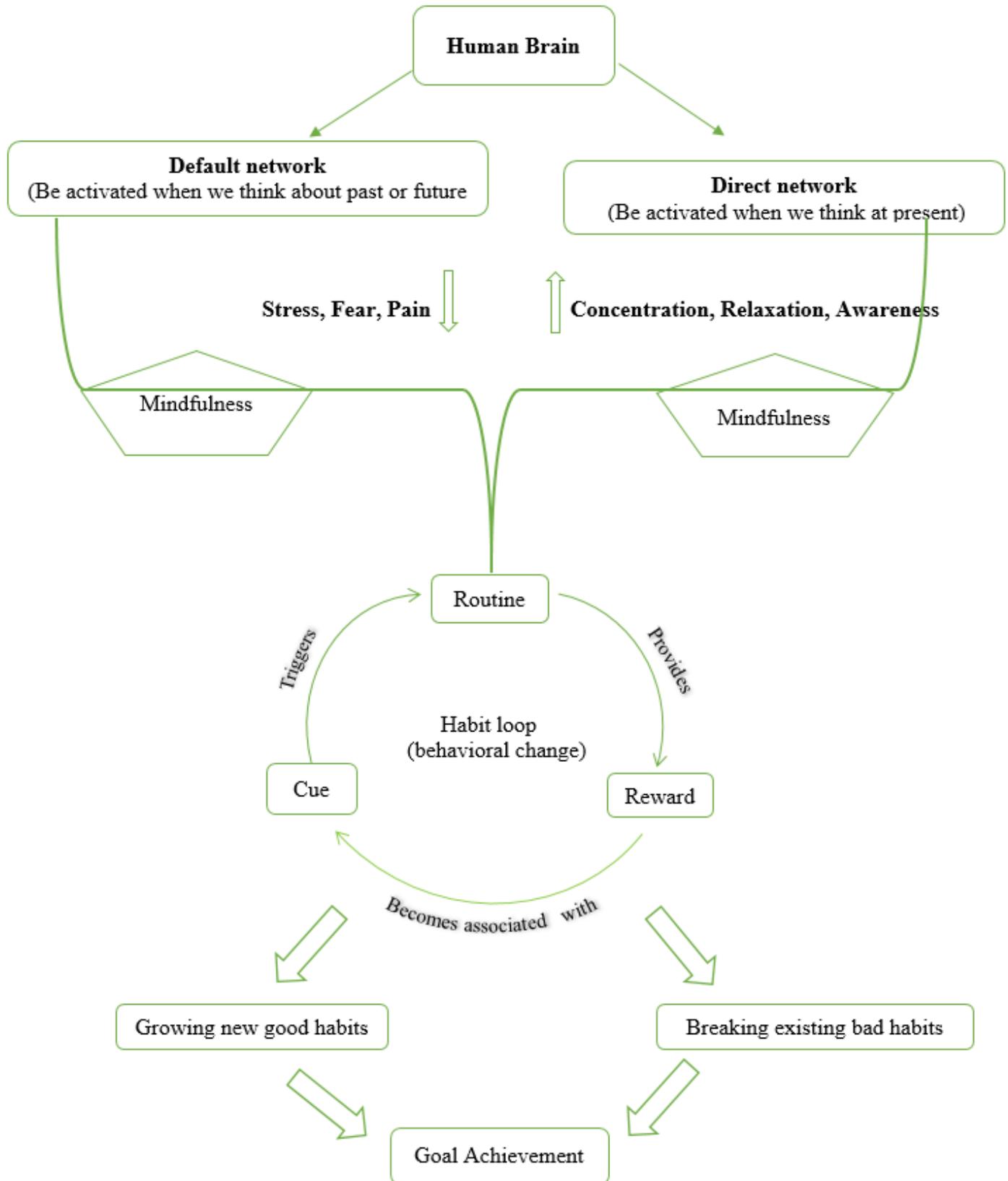
It is well acknowledged that goal achievement is a cognitive concept. The goal is what the person wants to accomplish, the object or intent of an action. In the context, it is close to the concepts of purpose and intent (Locke *et al.*, 1981). Goal achievement is commonly elaborated via the SMART framework in which a goal is included five main components, namely; specific, measurable, achievable, realistic, and time-based and it is more associated in business and management contexts (Day and Tosey, 2011). Moreover, it is explained that goal setting has two major main attributes which are content and intensity; the content of a goal consists of the results which are being sought, and the main angle of goal content which is clarity. When it comes to behavioral approaches regarding the goal achievement, the linkage theory of intention has declared that "intention, will and need" are the foundation for achieving the desired goal and which model suggests that intentions affect people's behaviors in the same way as need do since need can be satisfied by several types of behaviors(Gollwitzer, 1993). In the behavioristic tradition, habit and habit formation have been core elements too. (Verplanken and Aarts, 1999). With regard, to habit changing towards goal achieving, there are mainly two functions namely, establishing new good habits and breaking existing bad habits(Verplanken and Wood, 2006). Which kind of techniques for breaking bad repetitive habits and developing 'wanted' habits will be successful? First is changing the situation, because it is well-known that habits

are called situational target-driven behaviors and therefore behavioral responses are automatically created when the situation occurs (Gollwitzer, 1993; Verplanken and Wood, 2006) and when the situation is changed then new situation facilitates alternative responses too. For example, the very same person who has a habit of instead of recycling it throwing his old paperwork in a regular dustbin by using a special recycling box. Then, it can breakdown existing bad habit and initiate new good habit (Zimbardo and Leippe, 1991)

Another strategy is well planning of our objectives with visualizing. Gollwitzer says it is important to specify, where, when, and how these goals are acted upon and it is better to write down and visualize the objective and then it is hugely influenced do the necessary changes in our habits (Gollwitzer, 1993). In the neuroscience, it is explained via neuroplasticity. Neuroplasticity is

the brain's ability to alter its physical structure and function based on input from our experiences, behaviors, emotions, and maybe even thoughts (Schwartz and Begley, 2009). Our brain develops neuronal links based on what we do in our lives repeatedly-both good and bad (Møller, 2008). For establishing a strong new habit, it is needed to start our actions or thoughts with small steps, which is meant gradually increasing the time that we involve with the new habit. Neuroscientists show when we start to think differently then what happens is the current which produces from our thoughts are flown in different neuron paths and then a new path is become stronger and bigger since flowing more current (Fukushima, 1975). It takes some time and time is depended on the power and conscious level of our thoughts (Wood, Quinn and Kashy, 2002). Based on the above argument a conceptual model is presented below:

## V. .CONCEPTUAL FRAMEWORK:



## VI. DISCUSSION:

Even different approaches to achieving goals in modern society have been tested, people face many obstacles when implementing those strategies in a practical scenario. This paper explores simple actions we have implemented on our own to reach the desired destination, which is an approach to mindfulness. Even mindfulness is considered a spiritual tool, to understand the reality of the practical aspect of this conceptual framework is explained to the reader via modern scientific evidence. Here is shown that achieving a goal is not just a sudden action or miracle it is a progressively increasing process that can be achieved effectively via mindfulness intervention.

## VII. CONCLUSION:

This conceptual paper finds the possible solution by using the interference in mindfulness to achieve our life goals by stimulating them. It is shown that through the intervention of mindfulness our habit loop can have a profound effect and that as an outcome it is possible to change our actions to achieve goals. In that process of breaking existing bad habits and growing new habits are observed as challenging tasks, but with the interference of mindfulness, it is proven that it becomes more easier and reliable activity.

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# Capacity Building for Women in Disaster Management: Lessons from Super Cyclone, Odisha

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**Abstract-** The most effective way to mitigate the effects of natural disasters is to be prepared for them. Women, who “are key economic actors throughout the disaster cycle of preparedness, mitigation, relief, and reconstruction”, should be provided with capacity building training to reduce the impact of disasters. In this paper I attempt to put forth some of the training that has been provided to women as part of the disaster preparedness programme in the aftermath of the Super Cyclone.

**Index Terms-** capacity building, disaster management, super cyclone, Odisha

## I. INTRODUCTION

The most effective way to mitigate the effects of natural disasters is to be prepared for them. Numerous studies have pointed out that empowering the traditionally marginalized groups who experience greater vulnerability to disasters has the potential to mitigate their overall effects (Neumayer and Plumper, 2007). Women, who “are key economic actors throughout the disaster cycle of preparedness, mitigation, relief, and reconstruction”, should be provided with capacity building training to reduce the impact of disasters. In accordance with the provisions of the Disaster Management Act 2005, there is a need for well structured capacity building arrangement at different levels in the Government machinery and other stakeholders. Capacity building is an important attribute for the effective management of disasters. Since women constitute 50 per cent of the population and are the hardest hit in times of disaster, it is important to enable women to build their capacity through training to resist the threats caused by disasters. For the successful implementation of the disaster management plans at the state, district and block level, it is essential to impart training to women at different levels according to the needs, requirement and the different roles played by women in the various phases of disaster management, while at the same time having an intimate knowledge and understanding of the local reality.

## II. CAPACITY - BUILDING TRAINING FOR WOMEN

In this paper I attempt to put forth some of the training that has been provided to women as part of the disaster preparedness programme in the aftermath of the 1999 Super Cyclone.

Proceeding on the conviction that women are more likely than men to respond to disaster warnings with protective actions

(Drabek, 1969 cited in Fothergill 1998: 17), a number of programmes have been designed keeping women at the centre of action both for preparedness and provision of relief during the event. The study reveals that women were more patient, keen to learn, be trained and were more amenable to being taught than men. Drawing from experience of the super cyclone and tapping on women’s nurturing role, by virtue of the gender-based division of labour, Action Aid and Red Cross two prominent relief agencies came up with a comprehensive programme to train women in disaster preparedness. To begin with, women are advised to keep certain items ready to meet any emergency situation. This includes storage of food such as fried rice (*mudhi* which remains edible for 15 days), puffed rice (*chuda*), parched rice, biscuits etc, which can stay for long in a jar and other essential items like candles, match sticks, kerosene, oil, medicine, needle and thread, and clothes. During the super cyclone several women could not take clothes with them and hence had to wear the same garment for several days. In some cases their sarees got caught in trees and were torn and in the absence of any replacements women had to continue to wear these torn sarees.

Women must be alert and quick to act. Once they hear the siren signaling, the advent of a cyclone they should move to higher ground, to a concrete house and not stay in their house (if they are residing in a kutch house), but to be in a place where all the villagers have gathered. They should take the provisions and all the members of the family together, especially children and elderly members of households and if someone sees old age persons on the way, they should be escorted to safer places. Emphasis was laid on the importance of saving lives over material possessions. The elders of the researched village claimed that they have seen many cyclones but never one like the super cyclone, where people had to leave their homes and had to take shelter in concrete houses. Today the endangered population of the study area are aware of the ‘do’s and don’ts in the cyclone’ and of the immediate responses to be made in the event of a similar instance.

Through different NGOs, training has been provided to the women and task forces have been formed to rescue people stuck in different situation in disasters, for instance, how to rescue people if the sea water level rises, and in every panchayat task forces have been formed with the help of OSDMA. The women in the field area have been trained to swim (for those women who are unable to swim it is necessary to keep with them tyre tubes, a big tin jar, rope and a drum. One can tie the rope to the drum as with its help one can save oneself and others because the drum would not drown in the water, as swimming as a skill is socially not encouraged for women), to climb trees, rescue people stuck in

trees, to make knots in ropes and how to tie ropes fast in such a way so that the knots can be removed quickly and rescue the people from drowning.

The people from coastal areas possess some indigenous knowledge which helps them to safeguard themselves against disasters. As most inhabitants of the coastal area are accustomed to swimming from a young age, several of them can swim as much as half a kilometer even in turbulent cyclonic currents. Many can carry bamboo, big wooden plates and a jar of 20 litres to cross the water. Women too traditionally possess these skills. Interestingly, today the skills are mostly confined to the aged groups, and not their children.

To overcome this lacuna, first-aid trainings are imparted to women with the emphasis that they pass the training on to their children. For example, if a person is suffers from diarrhea, they should first provide ORS to them and then send them to the doctor or if a victim gets drowned in water and has gulped water, how to remove water from the person body, or if a victim's leg or hand is broken, what are the things to be done before taking the victim to the hospital.

Through Red Cross, women have been trained how to save someone who is drowning in water during disasters even if they don't have a rope they can throw their saree or any clothes and they should not themselves go inside the water as they can be drowned. Women have also been trained to ride a boat and help in rescue operations by wearing specific clothes. Women have been given clothes with caps that are water resistant to wear during natural disasters to rescue the people who are drowned.

Olarah village, the focal point of this study, was severely affected by the super cyclone had no means of communication (i.e. TV), so the warning of the cyclone had been transmitted through the Radio. The endangered population did not take the warnings of the super cyclone seriously and had no idea that the wind speed would be so high and would be accompanied by water which resulted in severe losses to both lives and property. The affected population believed that if the warning would have specifically mentioned that the wind speed of the cyclone would be accompanied with water then they would have taken precautions and would have moved to higher areas before the occurrence of the super cyclone and would have also kept their possessions in safer places. The people thought that water of the super cyclone would only rise till their waists, but the water level was so high that even coconut trees were submerged in it.

The level of preparedness can play a crucial role in diminishing the impact of any disaster on a community. But for a community to be prepared for any type of disaster, it is imperative that the community realizes that they are at risk. In the pre-disaster phase and during the super cyclone the people in the researched village had no awareness of the risk they faced, but after the training provided by Red Cross, the people have become more aware and today whenever there is a warning about a disaster the threatened population start storing food items. The vulnerable population of the village is aware that before the cyclone they have to be alert and prepared. To ensure that everyone is made aware of the approaching cyclone, information is relayed through a Public Announcement System or mike by telling the *mukia* to bring together all the women along with their children. It is important to bring the endangered population together to one place to understand that the cyclone is coming and to be prepared.

Ensuring that people congregate at one location is important as it becomes easier to tell them to go to higher land and people should be ready along with their family and children to face the cyclone. When the weather forecast informs that cyclone is coming, youth should form groups and take people to higher land before the onset of the cyclone, specifically those who live in low lying areas should be informed by making mike announcement in those areas. Effort should also be made to move animals to higher ground and to see if the houses i.e. the pucca houses are strong enough to withstand the cyclone, keep medicines, food, agricultural land documents and, drinking water in a proper place. Water will be polluted after the cyclone so it is important to dig water pumps instead of wells.

Today vehicles are available in the researched village (which was not the case during the super cyclone) which can be used to take people to safer places like cyclone shelters and take older people who cannot walk in their arms to safer places. Some roads and vehicles cannot reach all places; the youth are trained to go to places where roads do not exist and take the people to safety.

The formation of the SHG facilitated (adaptive) livelihood strategies that helped to minimize the vulnerability among women. Through the SHG women are trained to earn their living through different income generating activities like growing food in their kitchen gardens and rearing of poultry, cows, goats and pigs for home consumption and the market. The money women save are kept in the SHG and loan is taken from the group. In this way the SHGs are helping to strengthen the livelihood security of women. Before the cyclone many women were members of the SHG and had formed groups of 24 members through Red Cross. But, these groups broke off after the super cyclone as the number was too high to be manageable instead small groups of 12 members was formed.

The group leaders of the SHG have been constantly encouraging the members to do different kinds of work as the women in higher lands such as Erasama, Goda and Jaba are engaged in many kinds of activities like making toys and other articles for fairs and melas, which are generally supplied by women SHGs of upper land areas. The women of the lower land areas, although they are in a group (i.e. SHG,) do their work individually and according to their convenience. It is because their husbands have migrated to cities for work, the women are living alone with their children and all the responsibility of the household and children falls on them. There are no employment opportunities in the village whereas in higher land villages, both the husband and wife are present in the house allowing women the opportunity to leave their house and to work as a group. The women of the SHG are taken to different places outside the village to understand how fish cultivation is carried out in Bhubaneswar. Unfortunately the women of the researched village could not avail the opportunity provided, with their husband away in the city, they are saddled with the household responsibility.

The women who worked as anganwadi workers were trained to educate the village women about health issues and campaign on health issues. The anganwadi women made slogans on health issues (e.g. on breast feeding, use of ORS in case of diarrhea, to drink boiled water) and campaigned it along with the village women and organized meeting and discussed it with other women. The women and men were taught to sign their names instead of using fingerprints by the anganwadi workers. In the post

cyclone period, anganwadi workers also organize programmes for disaster preparedness. The anganwadi that played an important role in the training of the women in the researched village in the post disaster is Integrated Child Development Scheme (ICDS). Women were told to leave their kutcha houses and move to a pucca house after hearing the cyclone warning or of the low pressure created in the Bay of the Bengal from Radio and TV. Women were made aware about the importance of trees and encouraged to plant more trees (like mangrove) and not to cut them as this is one of the major cause of disasters. There are many people who are cutting the trees for profit and because of their poverty. The anganwadi workers through their awareness programme meetings educate the people not to cut trees for their survival, as it will lead to more disasters and cause damage and destruction in the long term.

Training has also been provided to unite the educated youth to persuade the people to move to higher places, for e.g. if the youths agree to save the possessions (like dry food, kerosene, clothes, important documents) of the affected people then they can be easily persuaded to move to a safer place. If such support is provided to the people then they will leave their houses and come to the cyclone shelter. A *trust worthy person* of the village should persuade the people to move to a safer place before the disaster. Close observation reveals that people in the villages trust the anganwadi worker, and their advice usually heeded by the villagers.

Several basic life-saving techniques are imparted by the anganwadi workers to the villagers, for instance how to deal with the incidence of fever, vomiting, and diarrhea etc. Women are taught simple home-remedies to save the lives of people. What precautions should be taken for infants during disasters: for example, if an infant is placed in the arms of the mother then it can get the warmth through the mother's body heat and won't be affected by cold and can survive for two hours without food. Another example is that if any person collapses in the cyclone the survivors can provide mouth-to-mouth respiration or put a cotton cloth by making a ball and placed inside the mouth of the collapsed person who can thereby be saved.

Today, even if there is rain people go to concrete houses. The respondents believed that if government could have provided them with concrete houses they would have been saved. Even after several years of the super cyclone many of the respondents are still living in thatched houses.

In Olarah village there is no cyclone shelter and only the school building which is two-storied structure created by the Paradeep Trust serves as the cyclone shelter. In this panchayat as a whole there are four to five cyclone shelters. This includes the Red Cross building which serves as a cyclone shelter in times of disaster. The government and NGOs have made some pucca houses under the IAY for individual families, after the cyclone. However concrete housing has not been found to reduce social vulnerability (Ray, 2006).

### III. CONCLUSION

Community preparedness can be very useful in reducing the adverse impacts of disasters to a considerable extent. The capacity building trainings should incorporate skill upgradation in the use of the latest know-how for effective response and sustainable recovery in disaster situations. Women are pivotal to a society's

social fabric and hence it is important to understand their capacity for resilience which is critical for risk prevention and response efforts. Most of the studies on gender and disaster management report that women are not included in the formal disaster preparedness trainings (Nehnevajsa, 1989 cited in Fothergill 1998, p.16). Women should be engaged effectively in disaster management, as there is a huge disconnect between their work and equitable integration into all stages of decision-making processes, policies and programs. If women are continued to be excluded from effective engagement at such levels, gender inequities will be persistent, and countries will not recover from the impacts that disasters engender.

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#### Endnotes

This paper is an outcome of my fieldwork undertaken in the super cyclone affected coastal village of Olarah in Erasama Block in Jagatsinghpur district, Odisha, as part of my doctoral research in Jawaharlal Nehru University, New Delhi.

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# Perceptions, Attitudes, Awareness, Beliefs and Islamic Religiosity Toward Organ Donation Among Moros in Davao city, Philippines

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**Abstract- Background:** To determine the factors relevant in understanding the behavior, perceptions and practices as well as religious attitude regarding organ donation of Moros residing in Davao City, Philippines. **Material/Methods:** A self-administered questionnaire was conducted between August to September 2017. A total of 469 questionnaires were distributed to different public communities and private institutions. 369 surveys were collected successfully and used for analysis. **Results:** Two most important independent variables as independent indicators of organ donation approval included high level of Islamic ethical principles and lesser score on Punishment of Allah appraisal. This study further validates that belief in divine entity entails intention to donate an organ. Contributing factors of affirmation to the act of donation include female gender, belonging to same religion, higher educational level and the role of Imam. However, majority of the respondents believe donating an organ is not compatible with Islam. It is of great emphasis that Faith leaders such as the Imams and mosques have important roles in promulgating public awareness as well as authority in clarifying the context of Islam with regards to organ donation. Many of the respondents have faith on Imam teachings. Adequacy of public campaigns is vital to educate the Muslim communities especially in relation to medical reservations. **Conclusion:** Islamic Religious sect and leaders should be encouraged to actively participate in policy making to arrive in enhanced knowledge that may ultimately lead to better understanding of organ donation socially, ethically and religiously. Trust in health system and medical professionals are important in delivering transparency of the process in donating an organ. Information drive thru ad campaigns, forums and lectures to educate Filipino Muslims may aid in solving shortage of organ donors.

**Index Terms-** Attitudes, Culture, Islam, Moros, Organ donation

## I. INTRODUCTION

In the present millennial age, Organ donation and transplantation is still immensely a controversy in the world of Muslims, globally. Nonetheless, some of the ASEAN region, Middle east countries and Western countries with minority population practicing Islam have adopted and publicly produced Fatwa or guidelines used at present in signifying the relevance of organ donation and transplantation in end-of-life death among

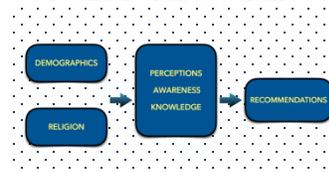
Muslims respectively. As read in Saheeh hadith, Prophet Muhammad (s.a.w) said that “For every disease there is a medicine, and if that medicine is applied to the disease, he will recover by Allah’s Leave.” He even further said: “Allah has not sent down any disease but He has also sent down the cure; the one who knows it, knows it and the one who does not know it, does not know it”<sup>1</sup> Indeed, at present local setting; the disparity on moral ethics, religious views, political issues on perceptions and misconceptions on this phenomenon is astounding and has a substantial bearing among Muslims in pledging as organ donors. Raising awareness and expanding the judgment among Filipino Muslim people is a critical step in promoting acceptance and essentially invigorate the practice of such deed in saving life. Possession of willingness to donate an organ can be either convenient or ponderous to a Muslim family even to a large extent among Muslim communities functioning in entirety.

## II. IDENTIFY, RESEARCH AND COLLECT IDEA

The research question that this study tried to go through was “What were the factors relevant in understanding the behaviour, perceptions and practices as well as religious attitude of Moros (Filipino Muslims) residing in Davao City, Philippines in terms of organ donation?”

The study goals were as follows: 1. To describe the socio demographic profile of Muslim participants in the study. 2. To determine the level of perceptions, attitudes, awareness, beliefs and Islamic religiosity toward Organ Donation. 3. To determine the significant factors of Organ Donation in terms of perceptions, attitudes, awareness, beliefs and Islamic religiosity.

## CONCEPTUAL FRAMEWORK



This study explored the different elements that may influence decision-making of Moros; observations and assessments arising from the data gathered have given better understanding on nature of organ donation among respondents.

The strength of this study relies on being a pilot study in assessing variables that may predict willingness of a Moro to donate an organ.

### ***Study Design and Study Setting***

This study was a descriptive correlational research approach conducted within August to September of year 2017. Using purposive technique, voluntarily selected respondents were surveyed using a written questionnaire. The entire procedure was compensation-free. This study was limited to only one urban area, it does not claim to be comprehensive since other urban and rural areas with Muslim residents were excluded.

### ***Participants***

The study provided complete confidentiality to all respondents. Selected respondents were eligible males and females. They were structured according to the following specifications:

#### **Inclusion Criteria**

The participant is a native Moro.

He/She is a Filipino by citizenship.

The participant is of Islam by religion at birth and at present.

A resident of Davao city, Philippines.

He /She must be or more than 18 years old of age.

An individual who has intact psychosocial support/sound mind.

He is a recognized Imam of mosque within Davao City (male only).

#### **Exclusion criteria**

Those individuals who are balik-Islam..

Individuals ageing less than 18 years old.

The person is not of residence of Davao City.

He/she has unstable psychosocial support/capacity.

### ***Sample Size and Sampling Method***

The sample size was calculated based on the 2010 household population released from Philippine Statistics Authority; the totality of Muslim residents was sum up comprising 45,788 residents. This numerical value then generated a calculation of an appropriate sample size of 369 using Cochran's formula with 50% probability that a respondent will act or not act in donating an organ. An important note is the fact that 2015 household population has not yet been dissected according to religion.

### ***Method of data Collection***

Actual visitation of the said areas was conveyed. Subsequently, rationale of this research was clearly expounded prior to obtaining both oral and written consent. These respondents were informed about the shortage of local data. All participants completed the survey on their own pace of time. As to participants who were illiterate, a legal representative requested per participants' discretion of choice assisted them in answering the survey.

### ***Questionnaire***

The self-administered questionnaire originally written in English was translated in Filipino by a certified linguist. They were lifted from two separate published studies whom the authors gave full permission to use them. It is divided in two parts. The first part was extracted from the study entitled "A Quantitative Survey of

western Muslim Attitudes to Solid Organ Donation" published last November 2011 through Clinical and Translational Research journal. It consists of 41 questions divided into four sections: demographic details, religious and cultural beliefs, opinion on organ donation and awareness of organ donation issues. It was pretested and approved by the institutional review board at Queen Elizabeth Hospital Birmingham, United Kingdom.

The second part pertains to impartial measurement of Islamic Religiosity from a validated Psychological Measure of Islamic Religiousness (PMIR). This is a scientific tool validated in 2005 for two times and lastly in 2008 (Research Gate publication) by Hisham Abu Raiya of Graduate College of Bowling Green State University, Ohio of USA.

### ***Statistical Analysis***

The sociodemographic profile of respondents were analyzed in descriptive statistics such as mean and standard deviation of quantitative analysis while the qualitative data were interpreted by frequency and percent. The level of perceptions, attitudes, awareness, beliefs and Islamic religiosity toward Organ Donation had been calculated by median while the factors associated to the likelihood of organ donation were identified by use of logistic regression analysis.

### ***Related research***

As of this writing, there have been no documented studies or articles that incite active participation of Filipino Muslims ever produced, in contrast to other ASEAN countries such as Malaysia, Singapore and Kingdom of Saudi Arabia (KSA) having "fatwa" or decree endorsed as law enforced to Guide and encourage its enactment in accordance to Islamic faith thru holy Koran. Sadly, such called fatwa is absent in the Philippines.

As of 2015, the Philippine population is said to be almost 100 million(100,000,00)<sup>2</sup>, with multi-ethnicity in different archipelago and about 5.57% of the total population practices Islam ( 5,127,084 population) <sup>2</sup>; even so, a published headline in 2014 on a campaign embarking sign up donor program only generated 3,548 individuals in metro manila <sup>3</sup>, which is a disproportionate to those in need of transplant as recently raised by National Kidney Transplant Institute (NKTI) that as of September 2016, around more than seven thousand (7,000) end-stage renal disease patients are presently on the waiting list<sup>4</sup>. This scarcity of donors cannot be neglected in the forefront of treating a person with in dire need of new organ, nationwide.

To extrapolate scarcity of organ donation in this archipelago, summaries of worldwide registry on organ donation have showed that as of 2015, the Philippines had only successfully performed 444 (4.41) per million of inhabitants (pmp) of transplants exclusively from kidney. This figure is very low compare to west pacific and global figures of 18,585 (10.4) pmp and 126,670 (20.64) pmp, respectively. No available Philippine data retrieved in relation to other solid organ transplantation<sup>5</sup>. The International Registry in organ Donation and Transplantation or IRODaT had released September 2016 report on preliminary reports of fifty (50) countries worldwide involved in donation/transplantation activity 2015. Important to note on these reports are the few numbers of Muslim countries with active programs such as the Iran, Turkey, Saudi Arabia,

Kuwait, Lebanon and Malaysia only <sup>6</sup>. In regard to 2010 population in Davao region, it has about four million and four hundred seventy thousand (4.47) of people with 2.3% population growth rate. While Muslim population within the urban area is about forty-five thousand and seven hundred eighty-eight (45,788) only as documented by Philippine Statistics Authority (PSA). Nonetheless, if growth of population by global scale is to be considered in relation to Islam as religion, The Asia-pacific which includes Philippine archipelago had about 986,420,000 Muslim population (61.7%) by 2010 <sup>7</sup>. These figures are expected to increase as predicted in one study published in Pew Research Centre with astounding surge of Muslims rising fastest by 2050 of 2.76 billion (29.7%) making up almost in equal shares with Christians (31.4%) in global projections and that Asia will continue to host majority of World's Muslim populations <sup>8</sup>. Summarized populations of people needing solid organ are also stupendously growing but the donors are disappointingly low. In year 2016, Prasad et al (A study to assess the knowledge, attitude, and misconceptions regarding organ donation after brain death among common people in rural areas) cited that 2,000,000 people are on waiting lists for kidneys worldwide and that Asia lags far behind the rest of the world. Indeed, organ shortage is a global problem that needs hasty resolutions <sup>9</sup>.

For the past decades, there have been several studies on Muslims perceptions on this act of donating an organ but neither a global perspective nor Southeast Asian projections have documented as far a large scale studies on Muslims are concerned. Shahid Athar, MD <sup>10</sup> stated on his review article that Muslims by generality are reluctant in to sign up as donor while they are willing to be recipient when need arise. This is one of the ethical-cultural issues that need to be addressed. And yet, since the beginning of Islamic history making, AD 570-632- Prophet Muhammad (PBUH) have been doing re-plantation during battle era. More than a thousand years have gone since Muslim surgeons did bone and teeth transplants either from a corpse or another person<sup>11</sup>. Furthermore, since 1972 Arab world<sup>12</sup> have successfully commenced the transplantation program up to this day. It is unfortunate that it's revolution on knowledge and practice among Filipino Muslims have not moved onward. Active participation of Imams in convincing Filipino Muslims on the appropriateness of such life-saving treatment medium as reflected suitably in the holy Koran is an obstacle that needs to be recognized. This problem was studied by Makmor Tumin <sup>13</sup> (2015) concluding that Mosques play an important role in conveying knowledge on such organ donation. Joshua D. Newton made a meta-synthesis of 27 qualitative articles from 24 studies worldwide concluding that religious leaders are indeed trustworthy source for elucidating religious concepts on becoming a donor (Biomed Central; 2011) <sup>14</sup>. In Turkey, attitudes of Muslim clergy revealed that Islam allows organ donation as it is also asserted in one study on 40 religious officials conducted in Istanbul asserting positive viewpoint of Islam on organ donation and transplant. (Brain Death and Transplant in Islamic Countries; 2016) <sup>15</sup>. However, an important publication released last 2009 by Rady et al <sup>16</sup>(Islam and End-of-Life practices in organ Donation for Transplantation: New questions and Serious Sociocultural Consequences) emphasizes antagonistic views between sanctity of human life and organ donation. It reverberates what Sarhiil et al (2001) statement that dying

Muslims should be allowed peacefully and comfortably without attempts of sustaining life artificially as one's death is inevitable. According to this study, donating an organ interrupts Islamic end-of-life rituals by several means such that it intrudes temporal course of dying; resuscitative procedures by medications are used even after death has been declared; palliative care to a dying patient is disturbed by either medical and/or surgical interventions, and lastly; preservative fluids may have replaced the blood of the dying patient. Furthermore, traumatic memories among family members as well as moral distress in health-care providers may arise when practices of end-of-life rituals are sacrificed for organ donation. It also pointed out that some families may sense surgical interventions on a deceased person as violations and desecrations of the body at the same time prolonging patient's suffering and destroying the deceased actual appearance. It further explained then that these will complicate family's bereavement which might include depression, post-traumatic stress, poor physical health, and inability to cope with daily activities. Hence, organ donation conflicts Islamic principles of care for the dying and their families.

On the contrary, three recent studies have shown that Islam as religion has no significant influence <sup>17</sup>(Jabri et al; Awareness, beliefs, and Barriers of Organ Donation among Saudis in Madinah City, Saudi Arabia; 2016) and not a deterring to organ donation <sup>18</sup>(Tumin et al, Organ donation in Muslim countries: The case of Malaysia; 2013). They did found out that campaigns needs to maximize positive beliefs and in pledging their organs for donation. The third study was by Soubhanneyaz et al <sup>19</sup>(Survey of Public attitude, awareness and beliefs of Organ donation in Western region of Saudi Arabia; January 2016) revealed more than 70% of their population study were willing to donate, emphasis on religion, money, and age having no role in determining willingness of Saudis; it also acknowledged that legislation and regulations entail efforts to spread awareness. It is also important to note, that it found out government incentives by monetary and health treatment of those who will donate can be effective in its propagation.

Altruism, an act of selflessness, is an important principle of Islam. Chapter 5:32 of Qur'an states "Whosoever saves the life of one person it would be as if he saved the life of all mankind". This principle was the rationale behind approval of porcine bone grafts and pork insulin usage for medical treatment up to this present. As Michael Oliver et al<sup>20</sup> concluded, it is vital in educating targeted individuals who are most influential in the community and that Ramadan with its forcibleness on altruism is a good opportunity to strengthen organ donation campaign within the community (organ donation, transplantation and religion; 2010). Several studies have gained enlightenment on Muslims attitudes toward donation of an organ. In 2008, Alashek et al <sup>21</sup> surveyed Libyans in four Libyan cities with findings that willingness was significantly associated with being male, having younger age and college or graduate degree as well as for being single. They have discovered that lack of knowledge and religious concern emanating from inadequacy of a fatwa permitting cadaveric donation within the community (Reasons for unwillingness of Libyans to donate organs after death). Around 2010, Wong LP <sup>22</sup> of University of Malaya, gauged that Muslim Malaysians have general concerns on mistreatment of the deceased's' body in procurement of organs. Therefore, Cultural

sensitivity on public educational messages are necessary to address sociocultural barriers (Singapore Med J; Information needs, preferred educational messages and Channel of delivery, and opinion on strategies to promote organ donation: a multicultural perspective). The Qataris were also studied by Verjee et al<sup>23</sup> (Organ donation and transplantation: A gender perspective and awareness survey in Qatar; 2014) showing females have greater tendency to believe that Islam supports organ donation. It is of critical issue that religious beliefs have determined value in their attitudes towards donating an organ. Although, in late 2005, another study done among Qataris by El-Shoubaki et al<sup>24</sup> resulted to knowing majority of the 1305 samples preferred donating organ(s) to their close relatives or close friends only although those respondents did believe that health education was the best method to increase donors (Public knowledge and attitudes toward organ donation and transplantation: A cross cultural study, 2005). This behavior of wanting to donate to relatives only was also perceived among Kuwaiti as manifested by Bosakhar et al<sup>25</sup> in a recent 2016 study entitled "Predictors of knowledge and attitude regarding organ donation in Kuwait". In Pakistan, 440 adults were interviewed by Salem et al<sup>26</sup> (Knowledge, attitudes and practices survey on organ donation among selected adult population of Pakistan; 2009) who identified that allowance for incentive in religion was associated with significant motivation to donate an organ; higher education and socioeconomic status are of positive predictor of organ donation. It also showed that persons believing their religion have forbid organ donations are without motivation to donate in future life. A concluded 2015 study by Al-Harthi et al<sup>27</sup> highlighted that fear of complications and lack of post-donation care which includes incentives are the main reasons why people of Taif, Saudi Arabia are unwilling to donate (Perceptions and attitudes of Saudi adult population board organ donation, Taif, Saudi Arabia; 2015).

Among arabs of UAE, Dr. Eveline Kayasseh<sup>28</sup> have cited importance of extended family in obtaining consent for organs to be donated may it be from a living or deceased person. These several studies have indeed contributed in clearing some apprehensions and strongly seized understanding Muslim views despite its limits on geography. The Islamic Jurisprudence's Assembly Council of Saudi Arabia had long been affirmed since 1988 the fatwa in organ donation and permit proxy consent if necessary (Ethical and Legal aspects of organ transplantation in Iran; 2004)<sup>29</sup>.

Certainly, educating Muslims as part of functioning society in general may arise to several measurements that will gauge need of full attention on multi-aspects of every Muslim in its wholeness as a human being.

### III. WRITE DOWN YOUR STUDIES AND FINDINGS

469 individuals were approached for survey participation, 369 respondents successfully answered the questionnaire while the remaining 100 were not returned.

This study showed higher prevalence of participants (n=160) not agreeing to donate an organ in relation to Islam. It cannot be paralleled to any local figures since there has been no earlier local study that can be compared with, 125 (34%) agreed in donating an organ while the remaining participants were unsure

whether to agree with it (n=74) and and had no answer (n=10) [figure 1]. Many of these respondents belong to Maranao (54%) tribe followed by the Kaagan people (23.3%) [figure 2]. By descriptive analysis, majority of the respondents were females, citizens by birth, unemployed, having no kidney problems and have shown no significant difference among those who agreed and did not agree on donating. Age and marital status don't seem to be predictive variables as well with majority of them aged 18-28 years old having mean deviation at age 30 for those who do not agree in donating and age 33 to those saying yes.

As to educational attainment, higher degree of educational attainment of college degree seemed to sway affirmatively toward organ donation of 51.2% versus 46.9% of respondents disagreeing to it who had high school learning. This slight higher prevalence on educational level is supported by Saleem et al<sup>26</sup> findings among selected adult population of Pakistan in 2009 wherein higher educational level was seen as an independent predictor of knowledge on process of donating an organ. Although it should be noted that among respondents who answered no, level of education is not statistically different having high school level of 46.9% versus college level of 36.9%.

As previously mentioned in the literature, several studies<sup>17, 18, 19</sup> in Muslim countries have found out that Islam has no bearing on willingness to donate an organ. But sadly, this finding does not hold true to this study as reflected only about 21% out of all respondents believed organ donation is allowed in Islam. Majority of those who said no (n=107) believed that it is not compatible in Islam faith [table 2]. Diminishing this ambiguousness relies heavily on initiation of educating them by sermons/forums with community Imam and other religious sect.

Cited reasons by some respondents in disagreeing organ donation included the following: a donor may get sick in turn even years after the procedure or die during the operation; violation of one's body with mutilation should be avoided for once dead their body should return in its wholeness even in the after life. These judgments were resonated in the 2009 study by Rady et al<sup>16</sup>. Such hesitations should be tackled by best methods available in the health system and community to arrive with effective measures of addressing this wariness. Interestingly, majority of all the respondents do believe that it is still an individual's choice to make when asked on who should have the over-all authority in deciding on it on both No (n=59) and yes (65) to donating groups; respectively [table 2]. When the No respondents were given situational events of the possibility of intending to donate, 31.1% said they preferred doing it while alive and for a loved one as receiving endpoint; this is also parallel to findings among Qataris and Kuwaiti mentioned the related studies<sup>24, 25</sup>.

However, 108 (67.5%) of them will not do it if it is against Imam and 118 (73.8%) of them wont disobey their family if it was against their view. It is also agreeably noted that among them about 73(45.6%) would only give their organ to fellow Muslims in comparison to those respondents willing to donate an organ to non-Muslim person (n=40 or 25%). Even further differed from the Yes group (n=71 or 56.8%) who expressed willingness towards potential recipient of different religion. Indeed, religion seem to have a solid impact on process of donation as 73(45.6%) respondents from this group conveyed even acceptance of an organ from a person of same religion is preferred.

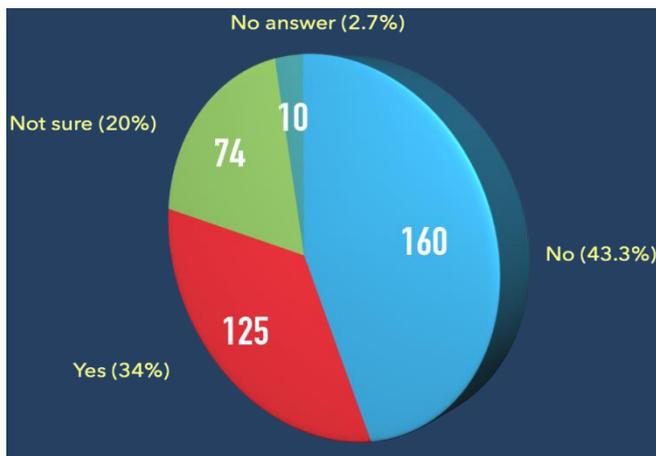


Figure 1 Distribution of response among study population



Figure 2 Distribution of respondents according to Ethnic tribe

| Answer | N   | Mean  | Std deviation |
|--------|-----|-------|---------------|
| Yes    | 119 | 33.19 | 13.84         |
| No     | 130 | 30.10 | 12.80         |

This is largely in contrast to 90.4% rate among Malaysians who are willing to accept from those people belonging to another kind of religion as emphasized by S. Sugathan et al<sup>33</sup> although their survey was on national level rather than singular urban area as what this study accomplished. If given a comparison to non-Muslim religious view, a 2012 study of 213 Malaysians of different religion (Knowledge, Religious Beliefs and Perception towards Organ Donation from Death Row Prisoners from the Perspective of Patients and Non-

| Variables                  | No to donating (n=160) | Yes to donating (n=125) | Not sure (n=74) |
|----------------------------|------------------------|-------------------------|-----------------|
| Gender                     |                        |                         |                 |
| Male                       | 59(36.9%)              | 44(35.2%)               | 23(31.1%)       |
| Female                     | 101(63.1%)             | 81(64.8%)               | 51(68.9%)       |
| Age bracket                |                        |                         |                 |
| 18-28                      | 71(44.4%)              | 66(52.8%)               | 39(52.7%)       |
| 29-38                      | 28(17.5%)              | 16(12.8%)               | 9(12.2%)        |
| 39-48                      | 19(11.9%)              | 11(8.8%)                | 7(9.5%)         |
| 49-58                      | 14(8.8%)               | 11(8.8%)                | 2(2.7%)         |
| >58                        | 6(3.8%)                | 9(7.2%)                 | 2(2.7%)         |
| Marital status             |                        |                         |                 |
| Single                     | 72(45%)                | 60(48%)                 | 37(50%)         |
| Married                    | 78(48.8%)              | 60(48%)                 | 28(37.8%)       |
| Divorced                   | 4(2.5%)                | 3(2.4%)                 | 1(1.4%)         |
| Widowed                    | 5(3.1%)                | 2(1.6%)                 | 6(8.1%)         |
| Residential status         |                        |                         |                 |
| Citizen by birth           | 87(54.4%)              | 77(61.6%)               | 37(50%)         |
| Resident                   | 66(41.3%)              | 45(36%)                 | 36(48.6%)       |
| Educational Attainment     |                        |                         |                 |
| Elementary                 | 9(5.6%)                | 9(7.2%)                 | 5(6.8%)         |
| High school                | 75(46.9%)              | 37(29.6%)               | 24(32.4%)       |
| College                    | 59(36.9%)              | 64(51.2%)               | 29(39.2%)       |
| Post graduate              | 4(2.5%)                | 11(8.8%)                | 8(10.8%)        |
| Islamic theology           | 6(3.8%)                | 2(1.6%)                 |                 |
| No formal education        | 4(2.5%)                | 1(0.8%)                 | 7(9.5%)         |
| Occupation                 |                        |                         |                 |
| Not employed               | 87(54.4%)              | 65(52%)                 | 40(54.1%)       |
| white collar               | 12(7.1%)               | 22(17.6%)               | 12(16.2%)       |
| Blue collar                | 56(35%)                | 32(25.6%)               | 21(28.4%)       |
| Category you fall in       |                        |                         |                 |
| I'm on dialysis            | 1(0.6%)                | 1(0.8%)                 |                 |
| I have a kidney transplant |                        | 2(1.6%)                 | 1(1.35%)        |
| I have a chronic disease   | 4(2.5%)                | 3(2.4%)                 | 2(2.7%)         |
| I have no kidney problems  | 137(85.6%)             | 113(90.4%)              | 65(52%)         |

**Table 2. Attitudes/belief variables toward organ donation**

| Variables                               | No to donating (n=160) | Yes to donating (n=125) | Not sure (n=74) |
|---|------------------------|-------------------------|-----------------|
| Organ donation is compatible with Islam |                        |                         |                 |
| Yes                                     | 15(9.4%)               | 57(45.6%)               | 6(8.1%)         |
| No                                      | 107(66.9%)             | 17(13.6%)               | 11(14.8%)       |
| Not sure                                | 34(21.3%)              | 51(40.8%)               | 57(70.2%)       |
| Intent to donate                        |                        |                         |                 |
| Against imam/mosque                     |                        |                         |                 |
| Yes                                     | 15(9.4%)               | 51(40.8%)               | 7(9.4%)         |
| No                                      | 108(67.5%)             | 37(29.6%)               | 26(29.6%)       |
| I don't know                            | 24(15%)                | 33(26.4%)               | 34(45.9%)       |
| Against Family                          |                        |                         |                 |
| Yes                                     | 13(8.1%)               | 40(32%)                 | 7(9.4%)         |
| No                                      | 118(73.8%)             | 51(40.8%)               | 21(28.3%)       |
| I don't know                            | 20(12.5%)              | 30(24%)                 | 40(54%)         |
| Intent to receive an organ              |                        |                         |                 |
| Yes                                     | 46(28.8%)              | 73(58.4%)               | 17(22.9%)       |
| No                                      | 52(32.5%)              | 10(8%)                  | 6(8.1%)         |
| Maybe                                   | 46(28.8%)              | 38(51.3%)               | 26(35.1%)       |
| I don't know                            | 8(5%)                  | 3(2.4%)                 | 24(32.4%)       |

**Table 2. Attitudes/belief variables toward organ donation**

| Variables   | No to donating (n=160) | Yes to donating (n=125) | Not sure (n=74) |
|---|------------------------|-------------------------|-----------------|
| Acceptance of organ from Muslim                                       |                        |                         |                 |
| Yes- Muslim only  | 73(45.6%)              | 45(36%)                 | 43(58.1%)       |
| No-anyone   | 40(25%)                | 60(48%)                 | 10(13.5%)       |
| I don't know  | 24(15%)                | 17(13.6%)               | 20(27%)         |
| Donation of organ to Muslim   |                        |                         |                 |
| Yes- Muslim only  | 73(45.6%)              | 40(32%)                 | 37(50%)         |
| No-anyone   | 40(25%)                | 71(56.8%)               | 18(24.3%)       |
| I don't know  | 24(15%)                | 9(7.2%)                 | 13(17.5%)       |
| Principle of presumed consent (after death)                           |                        |                         |                 |
| Yes   | 16(10%)                | 49(39.2%)               | 10(13.5%)       |
| No  | 97(61%)                | 34(27.2%)               | 12(16.2%)       |
| I don't know  | 36(23%)                | 37(29.6%)               | 46(62.1%)       |
| Overall authority to decide on organ donation in the context of Islam |                        |                         |                 |
| Family  |                        |                         |                 |
| Individual  | 19(11.9%)              | 22(17.6%)               | 9(12.1%)        |
| Imam/mosque   | 59(36.9%)              | 65(52%)                 | 29(39.1%)       |
| Islamic scholar/seat of learn   | 28(17.5%)              | 11(8.8%)                | 7(9.45%)        |
| Muslim organisations  | 22(13.8%)              | 15(12%)                 | 16(21.6%)       |
| Health authorities  | 11(6.9%)               | 5(4%)                   | 4(5.4%)         |
| Situation when organ donation is allowed                              |                        |                         |                 |
| A.Donation after death to save a life (loved one)                     | 37(23.1%)              | 35(28%)                 | 22(29.7%)       |
| B.Donation after death to save life (stranger)                        | 8(5%)                  | 3(2.4%)                 | 1(1.35%)        |
| C.Donation after death to improve somebody's life (loved one)         | 4(2.5%)                | 9(7.2%)                 | 2(2.7%)         |
| D.Donation after death to Improve somebody's life (stranger)          |                        | 1(0.8%)                 |                 |
| E.Donation while alive to save a life (loved one)                     | 50(31.3%)              | 56(44.8%)               | 25(33.7%)       |
| F.Donation while alive to save life(stranger)                         | 1(0.6%)                | 5(4%)                   |                 |
| G.Donation while alive to improve somebody's life (loved one)         | 8(5%)                  | 4(3.2%)                 | 4(5.4%)         |
| H.Donation while alive to improve somebody's life (stranger)          | 1(0.6%)                | 3(2.4)                  | 1(1.35%)        |
| I.No answer   | 51(31.9%)              | 9(7.2%)                 | 19(25.6%)       |

Patients in Malaysia: A Preliminary Study) by N. Badrolhisam and Z. Zakaria<sup>31</sup> found out that majority of their Christian participants believed that donating an organ is a good deed and around 73.3% of them will still do it even if it is against their religion. Seemingly, those respondents who are not agreeing in donating an organ are said to be extremely (n=47) to moderately (n= 41) religious by self-rate but it is of important note that the influence of Islam in making personal decisions in life were substantially weighty on both No (120) and Yes (100) group which further reflects and supported by related studies emphasizing Islam as religion is not a hindrance on it<sup>15, 17, 18, 19</sup>. Parents (20%) do seem have authority in swaying authority over any religious opinion to those respondents who do not agree to donating [table 3]. This finding can be supported thru recent 2017 study done by A. Ralph and A. Alyami et al<sup>30</sup> which projected family cohesiveness describing importance of parental authority in guiding and persuading the act of donating among younger generations.

Imams have an important role in promoting organ donation as their valuable contribution is proven by this study since they are of source personnel chosen by majority of No (55%) and Yes (68%) group respondents in correlating Islamic view on organ donation to morally being acceptable means of saving an ill person [ table 3,4,5].

**Table 3. Religious beliefs and practices**

| Variables                                    | No to donating (n=160) | Yes to donating (n=125) | Not sure (n=74) |
|--|------------------------|-------------------------|-----------------|
| Self rate of Religiousness                   |                        |                         |                 |
| Extremely religious                          | 47(29.4%)              | 41(32.8%)               | 18(24.3%)       |
| Moderately religious                         | 41(25.6%)              | 35(28%)                 | 14(18.9%)       |
| slightly religious                           | 17(10.6%)              | 16(12.8%)               | 4 (5.4%)        |
| Religious                                    | 43(26.9%)              | 31(24.8%)               | 33(44.5%)       |
| Not religious/liberal                        | 3(1.9%)                | 1(0.8%)                 |                 |
| Non-believer                                 | 1(0.6%)                |                         |                 |
| Islamic Faith influence on personal decision |                        |                         |                 |
| Always                                       | 120(75%)               | 100(80%)                | 58(78.3%)       |
| Sometimes                                    | 24(15%)                | 22(17.6%)               | 12(16.2%)       |
| Rarely                                       | 1(0.6%)                | 1(0.8%)                 | 1(1.3%)         |
| Never  | 3(1.9%)                |                         |                 |
| Sources of religious query                   |                        |                         |                 |
| friends                                      | 3(2%)                  | 1(0.8%)                 | 3(4%)           |
| Imam/mosque                                  | 88(55%)                | 85(68%)                 | 35(47%)         |
| Other family member                          | 4(3%)                  | 2(1.6%)                 | 2(2.7%)         |
| Parents                                      | 32(20%)                | 18(14.4%)               | 14(18.9%)       |
| Scholar                                      | 15(9%)                 | 15(12%)                 | 11(14.8%)       |
| Self-directed research                       | 5(3%)                  | 2(1.6%)                 | 6(8.1%)         |
| Website/internet                             | 2(1%)                  |                         | 1(1.36%)        |

As faith leaders, they have direct contact among people of interest thru daily encounters and in mosque and should play a role in enlightening them on its context in Islam. This is supported by Tumin et al<sup>13</sup> 2015 study of Malaysian Muslims affirming that Mosques have imparting value in campaigning process as well educational dialogues.

As to the role of doctors and health system, both No and Yes group have expressed opinion that they have an important reputation in educating them on the value of organ donation as well as its process. Distrust in health system as well is a factor in driving away potential donors [table 4,5]. In response to awareness thru public campaign, majority of the respondents have poor personal knowledge and unaware of shortage in solid organ supply as manifested among 74.4% of those who disagree and 68% to those who otherwise agree in donating an organ. This could be attributed to poor advertisement (46.9%) and (44.8%) among No and Yes group, respectively [table 6].

**Table 4. Sources of information regarding organ donation**

| Variables                                      | No to donating (n=160) | Yes to donating (n=125) | Not Sure (n=74)      |
|--|------------------------|-------------------------|----------------------|
| A. Quran                                       | Very important         | Very important          | Very important       |
| B. Hadith                                      | Very important         | Very important          | Very important       |
| C. Imam/Mosque                                 | Very important         | Very important          | Very important       |
| D. Muslim council/parliament /other group      | Moderately important   | Moderately important    | Moderately important |
| E. Family                                      | Very Important         | Very important          | Very important       |
| F. Friends                                     | Very important         | Moderately important    | Moderately important |
| G. Doctors                                     | Very important         | Very important          | Very important       |
| H. HealthHealth organizations/groups /leaflets | Moderately important   | Moderately important    | Moderately important |

**Table 5. Rate of variables on reasons Muslims may not be keen to donate an organ**

| Variables                         | No to donating (n=160) | Yes to donating (n=125) | Not Sure (n=74)      |
|-----------------------------------|------------------------|-------------------------|----------------------|
| a. Interpretation of Quran/Hadith | Very important         | Very important          | Very important       |
| b. Advice from Imam/mosque        | Very important         | Moderately important    | Very important       |
| c. Cultural reasons               | Moderately important   | Somewhat important      | Moderately important |
| d. Family pressure                | Very important         | Very important          | Moderately important |
| e. Distrust on health system      | Moderately important   | Moderately important    | Moderately important |
| f. Poor publicity                 | Moderately important   | Moderately important    | Somewhat important   |

**Table 6. Donation characteristics and registration Status**

|   | No to donating (n=160) | Yes to donating (n=125) | Not sure (n=74) |
|---|------------------------|-------------------------|-----------------|
| Registration Status                                 |                        |                         |                 |
| Yes   | 2(1.3%)                | 5(4%)                   |                 |
| No  | 154(96.3%)             | 117(93.6%)              | 62(83.7)        |
| Can't remember                                      | 3(1.9%)                | 3(2.4%)                 | 10(13.5%)       |
| Family member as organ donor                        |                        |                         |                 |
| Yes   | 8(5%)                  | 1(0.8%)                 | 2(2.7%)         |
| No  | 133(83.1%)             | 101(80.8)               | 46(62.1%)       |
| I don't know  | 11(6.9%)               | 21(16.8)                | 3(4%)           |
| Awareness on shortage of organs for transplantation |                        |                         |                 |
| Yes   | 35(21.9%)              | 39(31.2%)               | 24(32.4%)       |
| No  | 119(74.4%)             | 85(68%)                 | 48(64.8%)       |
| Advertisement rate of organ donation issues         |                        |                         |                 |
| Excellent   | 22(13.8%)              | 5(6.8%)                 | 7(9.45%)        |
| Good  | 30(18.8%)              | 32(25.6%)               | 14(18.9%)       |
| Average   | 25(15.6%)              | 32(25.6%)               | 20(27%)         |
| Poor  | 75(46.9%)              | 56(44.8%)               | 29(39.1%)       |

Indeed, poor publicity has a high regard of importance on those who are keen not to donate an organ as seen on table 5. This finding is also reflected in a national online survey among Malaysians (81%) with secondary and higher level of education performed last December to January 2015 by S. Sugathan et al<sup>33</sup> revealing that lack of awareness was the reason for a remarkably low rate among these subjects. Inventive ad campaign should be proposed in order to intensify its publicity as further concluded by Hye-Jin Sun<sup>32</sup> on her 2014 study on public campaign emotional ad campaign producing higher intention to donate thru emotionally driven ad campaigns and boosting positive attitudes towards organ donation by positive ad campaigns. This poor advertisement and educational campaign can also be supported by the findings of having very high percentage of respondents not registered as a donor, 96.3% and 93.6% on No and Yes group respectively.

**Regression analysis**

Using the PMIR for objective determination of religiosity, the summative interpretation by regression analysis identified the two most independent significant factor for predicting approval of donating an organ. These are the subscale on Islamic Ethical Principles (IEPS) and Punishing Allah Reappraisal Subscale (PARS). The former revealed that the stronger the concept of believing to a divine entity and better Islamic ethical principles, the higher the chances of intending to donate. The latter subscale entails that those respondents who feel willing and agreeing on donating an organ have lesser tendency to feel punished by Allah (S.W.T).Furthermore, as you can see in[table7], the coefficient (B) for IEPS is positive denoting that the higher the religiousness the higher the chance of donation and the PARS revealed a negative Coefficient denoting that the lesser the feeling of being punished by Allah, the more likely he will donate. The model further explains that these coefficients have p-values less than 0.05 suggesting that the two factors do exist in the model and that it is able to explain r<sup>2</sup>=0.056 or 5.6% of the likelihood of donation can be attributed by these two factors.

**Table 7. regression analysis result**

| Model    | Unstandardized coefficients |           | Standardized Coefficients | t      | P-value      |
|----------|-----------------------------|-----------|---------------------------|--------|--------------|
|          | B                           | Std Error | Beta                      |        |              |
| Constant | 0.056                       | 0.147     |                           | 0.3379 | 0.705        |
| IEPS     | 0.01                        | 0.003     | 0.186                     | 3.424  | <b>0.001</b> |
| PARS     | -0.019                      | 0.008     | -0.13                     | -2.382 | <b>0.018</b> |

**Strength and Limitations**

This is the first known qualitative study to elicit Moros' perspective on organ donation as well first to correlate Islamic religiosity and willingness to donate an organ voluntarily.

At This point of heightened global practice towards act of solid organ donation, the Philippines still lag far behind worldwide setting. Henceforth, this research is timely relevant in hopes of increasing numbers of potential volunteers to donate for either a loved one or a stranger. Certain limitations did occur in this study. The results do not however reflect the entire country where Filipino Muslim are an ethnic minority. Two major tribes became major respondents, possibly not giving full recognition and representation of possible distinct and different perspectives among several tribes. The reason for this is that communities' population have linear and higher tribal territorial associations.

#### IV GET PEER REVIEWED

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#### V. CONCLUSION

The variables seen as important predictors of approval to donate an organ are the following: higher religiousness based on PMIR – IEPS and lesser appraisal of punishment by Allah thru PMIR-PARS. Contributing factors in making an affirmative stand on donating an organ were as follows: higher educational attainment, female gender, belonging to same religion and the role of Imam. The investigators have found out that Religion is a powerful medium in defining moral and social perspective among Moros. However, it did not prevent majority of the participants to conclude that it should be every individuals' personal choice of selflessness. Imams are important vehicle to expound on organ donation in relation to Islamic faith. Unsure and guilt feeling can cease to occur only if a consolidative affirmation among Islamic scholars/Imams is conceded.

Doctors along with adequate publicity are seen as efficient means of promulgating community awareness among Moros on organ donation as well as making them knowledgeable in order to understand the essence of it as well as realize possible apprehensions and undesired consequences that people wish to comprehend. Government should include religious sect in making policies to attain promising outcome that are beneficial to entire community.

#### RECOMMENDATIONS

The investigators recommend constructing further study on this matter through a multi-site correlation study using the only two independent factors determined by this research: IEPS-PMIR. Also, active participation of Muslim religious sect in policy making should be encouraged and be expand to Mosques. Imams should be part of enlightening the value of organ donation in relation to Islam thru Quran and Hadith readings as they are means of promulgating the values in Islam. And of course, Health system should examine present ad campaign ways around Muslim communities to better empowerment.

#### APPENDIX

See attached separate appendix

#### ACKNOWLEDGMENT

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# The Effectiveness of Stretching Exercise and Yoga Asana in Treatment of Primary Dysmenorrhea in Young Females.

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**Abstract-** Menstruation is the regular intrauterine bleeding of female after puberty. There are various physical and mental pain by menstruation is called dysmenorrhea. Few studies on the yogic exercise shows that certain yoga poses control the stress and pain of dysmenorrhea and has a positive effect if practiced regularly. The stretching also has a reducing effect on pain as stretching is associated with increased endorphin production. **Aim of the study:** To determine the effect of stretching exercise and yoga asana in relief of pain and improving quality of life. **Study design:** A Research with experimental design was performed in 2 group's. **Methodology:** 8 weeks comparative study to evaluate the effectiveness of stretching exercise versus yoga asana for primary dysmenorrhea. One group was given active stretching exercise and other group was given yoga asana actively. 10 repetitions of every stretching exercise and yoga asana done with 5 second hold. NPRS, QOL and WALLID score was taken for pain scale before starting the treatment and after the menstruation to compare the effectiveness of treatment. **Result:** A significant decrease was found in pain and quality of life in both the groups ( $p < 0.005$ ). The result showed statistical improvement in quality of life and wallid score. But there was no any significant difference found between stretching group and yoga group for NPRS score. **Conclusion:** Both stretching and yoga technique are shown to have effect on improving PAIN, QOL scale and WALIDD score. The stretching technique was found clinically more effective in improving QOL and WALIDD score than yoga asana in subjects with primary dysmenorrhea. However there is no significant difference found in improving pain between both the groups stretching and yoga group.

**Key words:** - Primary Dysmenorrhea, Young girls, Active Stretching, yoga.

## INTRODUCTION

Menstruation is the regular intrauterine bleeding of female after puberty<sup>(1)</sup>. There are various physical and mental pain by menstruation is called dysmenorrhea<sup>(1)</sup>. Dysmenorrhea comes from Greek word describes painful menstruation<sup>(2)</sup>. It also define as the presence of painful cramp of uterine origin during menstruation<sup>(3)</sup>. Dysmenorrhea is cyclical lower abdominal or pelvic pain which may also radiate to the back and thighs (It occurs before or during menstruation or both<sup>(1,4)</sup>). It is a common symptom of various gynaecological disorder, but it also occur in most women as a primary form of disease<sup>(3)</sup>. The statement was given by the World Health Organization that dysmenorrhea is the most important cause of chronic pelvic pain<sup>(5)</sup>. Hyper secretion of

prostaglandins and increased uterine contractility may cause the pain associated with dysmenorrhea<sup>(1)</sup>

Some women (3 % to 33%) have very severe pain that they can't able to work in normal way for 1 to 3 days each menstrual cycle, which restricts the activity and increase absence from school or work. It also leads to a lower academic performance in adolescents, and poor quality of sleep, and affect the mood, causing anxiety and depression. Dysmenorrhea also effect on quality of life, more than half of the girls have reported poor QOL<sup>(6)</sup>. Dysmenorrhea is also associated with Premenstrual Symptoms (PMS). PMS were divided into physical and psychological symptoms<sup>(6,7)</sup>. Nausea, leg cramps, dizziness, fatigue, abdominal pain and breast pain were considered as physical symptoms, whereas anxiety, irritability and emotional instability were considered<sup>(6,8,9)</sup>. Dysmenorrhea is more in the first day and rarely continues to next day. Primary dysmenorrhea stops spontaneously after 1-3 years; but sometimes it is possible to continue until childbirth<sup>(10)</sup>. The primary dysmenorrhea is so common in young women and the prognosis of it is good. The cause of primary dysmenorrhea is not well found still some responsible cause has been identified that the hyper-production of uterine prostaglandins, particularly of PGF2a and PGF2, which is associated which increased uterine tone and high-amplitude contractions Which highest secreted during the first two days of menstruation<sup>(3, 11)</sup>. Progesterone control the production of the prostaglandin: when progesterone level drop, immediately prior to menstruation, prostaglandin level increase.<sup>(12)</sup>

Different type of medical treatment physiotherapy treatment and other treatment are used to relieve dysmenorrhea<sup>(1,12)</sup>. The side effects of the medications are nausea, breast tenderness, and intermenstrual bleeding, dizziness, drowsiness, hearing and visual disturbances<sup>(9,10)</sup>. Non pharmacological treatment includes physical therapy, yoga, heating-pad, massage, taping, aerobics and Swiss ball exercises are used which effectively reduce pain and discomfort<sup>(1)</sup>. There is also some evidence of a dose-response relationship between exposure to environmental tobacco smoke and increased incidence of dysmenorrhea<sup>(13)</sup>. Few studies on the yogic exercise shows that certain yoga poses control the stress and pain of dysmenorrhea. Yoga has a positive effect if practiced regularly<sup>(14)</sup>. Mechanical explanation for the effect of yoga on mental and physical health is reduction in sympathetic nervous system tone and increases in vagal activity<sup>(15)</sup>.

The stretching helps in reducing effect of pain due to stretching is associated with increased endorphin production<sup>(16)</sup>. Stretching exercise increased elasticity and strengthen the spine and pelvic muscle, the diaphragm becomes more elastic and strong, oxygenation and other fluid are circulated properly to uterus,

decrease pain of joints and backache, stimulate the appetite and bowel action, anemia decrease and free flow during menstruation, and maintain the hormone balance<sup>(17)</sup>. As there is various treatments available for the dysmenorrhea, there is a need for a standard treatment protocol, which will have good result of reduction in pain and improving the quality of life<sup>(1)</sup>. This study designed to compare two type of treatment technique stretching and yoga asana to treat female with primary dysmenorrhea.

## METHODOLOGY

**Study Design**-Experimental pre-test – post-test study design

**Study Population** - Primary dysmenorrhea Sampling Technique-Convenient Sampling, **Sample size** was calculated on G\* power software on the basis of mean of pain intensity of the previously reported study from a similar population of patients with primary dysmenorrhea effect size 0.5025 and significance level of 0.05 and 0.80 power was selected. These criteria led to an estimated sample size of 23 participants in each group and to take into account a probable no drop out, the sample size is enhanced to 23 in each group so total 46 patients were included in this study.

**Study Duration**- 6 month, **Source of Data Collection**-S.S. Agrawal Institute of Physiotherapy, Navarra. **Inclusion Criteria** - Age (18-22) years, Primary Dysmenorrhea, Unmarried, Pain intensity 6-8, Non-Athletes, Willingness to participate **Exclusion Criteria** Psychiatric Disorder, Secondary Dysmenorrhea, Yoga Practice, Pharmacological method, Disease in genital organ, Systemic disease **Tools And Materials** Pen, Informed consent form Data, recording sheet Yoga mat Questionnaire - NPRS scale WALIDD Score QUALITY OF LIFE score sheet.

### Procedure:

The purpose of this study was explained and a written informed consent was obtained from all the subjects. The study procedure was conducted through assessing patients, initial recording, treatment and final recording. Forty six participants volunteered to be a part of this study based on the inclusion and exclusion criteria were allocated into two groups, group A (stretching group) and group B (yoga group) by using quasi-randomization procedure as follows. First subject was allocated to Group A, second visiting subject to Group B once they fulfilled the inclusion and exclusion criteria. The same sequence of procedure was followed Throughout for consecutive subjects.

• Descriptions of groups were as follows:

• Group A (stretching group): patients were administered stretching technique actively.

• Group B (yoga group): patients were administered yoga actively. All the patients completed demographic details and physical examination performed by the researcher. On the first day of the study all subjects underwent a baseline assessment prior to any intervention using Questionnaire like QOL Scale, NPRS and WALIDD Score. All the measurements were taken by the researcher of the study.

Sequence of Stretching exercise Group A (stretching group)

All the 23 patients had received active stretching for 5 days a week, up to 8 weeks.

Procedure: Information was given to participants of group (A) to do 6 stretching exercises for 8 weeks (5 days per week and 1 times per day for 10-15 minutes). They were asked to avoid performing stretching exercises during the period cycle. They were given a

questionnaire prior to the stretching exercises and completed it after 8 weeks of stretching exercises.

The information about the active stretching exercises were given to the subjects prior to starting the exercise followed by warm-up exercises.

The prescribed exercises were as follows:

### The first stretching exercise:



(Figure: 1)

Procedure:

The starting positions of the subjects were stranding.

The subjects were asked to stand and bend trunk forward from the hip joint. In that the shoulders and back were positioned on a straight line so that the upper body was placed parallel to the floor. The subjects were asked to hold this position for 5 seconds and 10 repetitions were done.

### The second stretching exercise



(Figure: 2)

Procedure:

The starting positions of the subjects were stranding.

The subjects were requested to stand then raise 1 heel off the floor, hold this position for 5 seconds then raise the alternate heel and again hold it for 5 second. The subjects were asked to repeat the exercise 10 times.

### The third stretching exercise



(Figure: 3)

Procedure:

The starting positions of the subjects were stranding.

The subjects were asked to spread their feet shoulder width, place trunk and hands in forward stretching mode. Then subjects were

asked to completely bend their knees and maintain a squatting position. The subjects were asked to hold this position for 5 second. Then raised their body and repeated the same movements 10 times.

#### The fourth stretching exercise:



(Figure: 4)

#### Procedure:

The starting positions of the subjects were standing. The subjects were asked to spread her feet wider than shoulder width. Then the subjects were asked to bend and touch left ankle with their right hand while putting their left hand in a stretched position above their head so that the head was in the middle and their head was turned and looked for their left hand. The subjects were asked to maintain this position for 5 seconds. This exercise was repeated for the opposite foot with the same method. The exercises were repeated alternatively 10 times for each side of the body.

#### The fifth stretching exercise:



(Figure: 5)

#### Procedure:

The starting positions of the subjects were supine. The subjects were asked to lie down in supine position so that the shoulder, back, and feet were kept on the floor. Then the subjects were asked to bend the knees with the help of their hands and reach to their chin. The subjects have to hold this position for the 5 seconds and repeat this exercise for 10 times.

#### The sixth stretching exercise:



(Figure: 6)

#### Procedure:

The starting positions of the subjects were standing. The subjects were asked to stand against a wall and put their hands behind their head and elbows pointed forward in the direction of the eyes then without bending the vertebral column, the abdominal muscle wall was contracted for 5 seconds. This exercise was repeated 10 times.

#### Sequence of Yoga

##### Group B (yoga group):

Information was given to participants of group (B) to do 6 yoga asana for 8 weeks (5 days per week and 1 times per day for 10-15 minutes). They were asked to avoid performing yoga asana during the period cycle. They were given a questionnaire prior to the stretching exercises and completed it after 8 weeks of stretching exercises.

The prescribed exercises were as follows:

#### Vajarasana :



(Figure: 7)

#### Procedure:

The starting position of the subjects were to sit on the heels with the calves beneath the thighs. A four finger gap was kept between the kneecaps and the first toe of both the feet touch each other and sit erect. This position was maintained for 5 seconds, returned back to the starting position and repeated for 10 times.

### Utrasana :



(Figure: 8)

#### Procedure:

The starting position of the subjects were kneeling. It is a deep backward bend from a kneeling position; the completed pose has the hands on the heels. The backs of the feet may be flat on the floor or the toes may be tucked under for a slightly less strong backbend. This position was maintained for 5 seconds, returned back to the starting position and repeated for 10 times.

### Matsayasana :



(Figure: 9)

#### Procedure:

The starting position of the subjects were supine. The asana was a backbend, where the subjects lie on their back and lift the chest by rising up on the elbows and drawing the shoulders back. The neck was lengthened and the crown of the head was pointed towards the floor where they were lying down. The position was maintained for 5 seconds, returned back to the starting position and repeated for 10 times.

### Janusirsasana



(Figure: 10)

#### Procedure:

The starting position of the subjects were long sitting. In a seated position one leg was extended from the knee with toes pointing upward, and the other leg is bent with the knee pointing away from the straight leg and the sole of the foot in by the groin. The torso turns and folds over the extended leg. This position was maintained for 5 seconds, returned back to the starting position and repeated for 10 times.

### Dhanurasana :



(Figure: 11)

#### Procedure:

The starting position of the subjects were prone. From a prone position, the feet are grasped to lift the legs and chest to form the shape of a bow with the body, the arms representing the bowstring. This position was maintained for 5 seconds, returned back to the starting position and repeated for 10 times.

### Bhujangasana



(Figure: 12)

#### Procedure:

The starting position of the subjects were prone. The subjects were requested to prone position on the floor with the palms placed under the shoulders, pushing down until the hips slightly. The backs of the feet rest on the ground outstretched; the gaze was directed forward, giving the preparatory pose. This position was maintained for 5 seconds, returned back to the starting position and repeated for 10 times.

### Suryanamashkar :

#### Procedure:

The starting position of the subjects were prone. Step-1 (prayer pose): The subjects were requested to stand on the floor with feet together and palms together in front of the chest in prayer position. Step-2 (raised arm pose) In prayer position, breathing in lift the arms up and back, keeping the biceps close to the ears.

Step-3 (hand to foot pose) Breathing out bend forward from the waist, keeping the spine erect. As you exhale completely, brings the hands down to the floor, beside the feet.

Step-4 (equestrian pose) Breathing in, push your right leg back, as far back as possible. Bring the right knee to the floor and look up.

Step-5 (stick pose) as your breath in, take the left leg back and bring the whole body in a straight line and keep your arms perpendicular to the floor.

Step-6 (saluting with eight points or parts) lower the chest towards the ground bending both arms at the elbows. The following eight organs should touch the ground, forehead, chest, both palms, both knees and both toes. (Because eight body parts touch the ground it is called Ashtangasan).

Step-7(Cobra pose) Slide forward and raise the chest up into the cobra posture. You may keep your elbows bent in this pose, the shoulders away from the ears. Look up. As you inhale, make a gentle effort to push the chest forward; as you exhale, make a gentle effort to push the navel down. Tuck the toes under. Ensure you're stretching just as much as you can; do not force.

Step-8(Mountain pose) Breathing out, lift the hips and the tail bone up, chest downwards in an 'inverted V' ( $\wedge$ ) posture. If Possible, try and keep the heels on the ground and make a gentle effort to lift the tailbone up, going deeper into the stretch.

Step-9 (Equestrian pose) Breathing in, bring the right foot forward in between the two hands, left knee down to the floor, press the hips down and look up and place the right foot exactly between the two hands and the right calf perpendicular to the floor. In this position, make a gentle effort to push the hips down towards the floor, to deepen the stretch.

Step-10 (hand to foot pose) Breathing out, bring the left foot forward. Keep the palms on the on the floor. You may bend the Knees, if necessary. Gently straighten the knees and if you can, try and touch your nose to the knees. Keep breathing.

Step-11 (raised down pose) Breathing in, roll the spine up, hands go up and bend backwards a little bit, pushing the hips slightly outward. Ensure that your biceps are besides yours. The idea is to stretch up more rather than stretching backwards.

Step-12 As you excel, first straighten the body and then bring the arms down. Relax in this position; observe the sensation in your body.

**RESULTS**

The statistical analysis for the present study was done for Group-A, based on the readings taken on Day-1 when the patients had approached the researcher for the treatment and then on the last day of the 8<sup>th</sup>week after the treatment with active stretching. The statistical analysis was done for Group-B based on readings taken on Day 1 when the patients had approached the researcher and then on the last day of the 8<sup>th</sup>week after the treatment of yoga asana and conventional therapy. For better understanding the readings that were taken for statistical analysis were given the terms pre for 1st day for both the Groups and post for last day of 8<sup>th</sup>week for Group A (active stretching) and Group B (yoga).

Normality of the data was checked. Since the outcome measures were measured within group pre-test and post-test values. Descriptive statistics including mean and standard deviation were analysed and Between-group differences at follow-up period were compared. Statistical significance was set at  $p < 0.05$  for all

statistical analyses and confidence interval was set at 95 %. All the data analysis was done in IBM SPSS version 20.0.

**Table 1 shows the demographic data of the both groups including number of patients and age and weight**

| Variable | STRETCHING Group | YOGA Group    |
|----------|------------------|---------------|
| Subjects | 23               | 23            |
| Age      | 18.22 ± 49.70    | 20.22 ± 1.04  |
| Weight   | 49.70 ± 6.657    | 54.48 ± 12.28 |

**Table2: Wilcoxon Signed Rank test for within group comparison of WALLID SCORE, QOL and NPRS in Group A (n=23)**

| Variables    | Level                | Mean ± SD   | Mean rank | Z Value | P Value |
|--------------|----------------------|-------------|-----------|---------|---------|
| Walidd score | Baseline             | 6.91 ± 1.44 | 11.00     | -4.045  | 0.000   |
|              | 8 <sup>TH</sup> Week | 4.17 ± 1.43 |           |         |         |
| QOL Scale    | Baseline             | 7.70 ± 2.20 | 11.50     | -4.128  | 0.000   |
|              | 8 <sup>TH</sup> Week | 3.39 ± 1.90 |           |         |         |
| NPRS         | Baseline             | 7.70 ± 1.39 | 12.00     | -4.244  | 0.000   |
|              | 8 <sup>TH</sup> Week | 4.22 ± 1.59 |           |         |         |

**Table 3: Wilcoxon Signed Rank test for within group comparison of WALIDD SCORE, QOL and NPRS in Group B (n=23)**

| Variables    | Level                | Mean ± SD   | Mean rank | Z Value | P Value |
|--------------|----------------------|-------------|-----------|---------|---------|
| WALIDD SCORE | Baseline             | 7.04 ± 1.36 | 12.00     | -4.220  | 0.000   |
|              | 8 <sup>TH</sup> Week | 2.70 ± 1.71 |           |         |         |
| QOL          | Baseline             | 7.35 ± 3.06 | 12.00     | -4.206  | 0.000   |
|              | 8 <sup>TH</sup> Week | 1.48 ± 1.64 |           |         |         |
| NPRS         | Baseline             | 6.57 ± 1.80 | 12.00     | -4.215  | 0.000   |
|              | 8 <sup>TH</sup> Week | 2.83 ± 1.37 |           |         |         |

**Table4: Non parametric (independent sample t-test) for between group comparison of WALIDD SCORE, QOL and NPRS in Group A (n=23) and Group B (n=23)**

| Variable          | STRETCHING Group | YOGA Group | Z Value | P Value |
|-------------------|------------------|------------|---------|---------|
|                   | MEAN RANK        | MEAN RANK  |         |         |
| Walidd score      | 28.93            | 18.07      | -2.793  | 0.005   |
| QOL               | 31.15            | 15.85      | -3.952  | 0.000   |
| NPRS (DIFFERENCE) | 24.78            | 22.22      | -667    | 0.505   |

**DISCUSSION:**

The purpose of the study was to compare the effects of yoga asana and stretching exercises in treatment of primary dysmenorrhea. In this study 46 patients were randomly allocated to any one of the two treatment groups such that there were 23 subjects in each treatment groups.

Group A received stretching exercises and group B received yoga asanas. WALIDD Score, Quality Of Life Scale and NPRS were measured both before and after 8 weeks of treatment.

For group A WALIDD Score, Quality Of Life Scale and NPRS pre and post treatment values were measured using Wilcoxon signed rank test, showed extremely statistically significant changes giving a p- value < 0.000. Thus stating that stretching that exercise has beneficial effects on improving quality of life, reducing symptoms of dysmenorrhea and reducing pain. Similarly, for group B WALIDD Score, Quality Of Life Scale and NPRS pre and post treatment values were measured using Wilcoxon signed rank test, showed extremely statistically significant changes giving a p- value < 0.000. Thus stating that stretching that exercise has beneficial effects on improving quality of life, reducing symptoms of dysmenorrhea and reducing pain. When compared between groups ( group A and group B), post treatment values were measured using Man Whitney U Test, P-value for WALIDD score was 0.005, which is considered to be statistically significantly and p-value for QOL scale was 0.000, which is considered to be extremely statistically significant. The baseline value of NPRS for both the groups were significant, therefore pre-post NPRS difference of both the groups (group A and group B) were been taken and average score was obtained, using this average score further analysis using Man Whitney U Test was performed, according to this test p-value for NPRS was 0.505. Which is considered to be not statistically significant. Hence the present study concluded that there was no difference in post values.

Similar studies from the evidence databases showed that the results are in line with the present study for WALIDD Score, QOL SCALE and NPRS. The results of the study are discussed in and Also compared with the previous studies. The possible explanations for the results are also discussed below according to supporting literature.

Veena Kirthika S, et al conducted a study on Efficacy of Yoga Asana and Gym Ball stretching Exercises in the Management of Primary Dysmenorrhea with 30 subjects and concluded that

Twelve-week gym ball exercises have the sufficient potential to decrease level of menstrual distress and related pain among female with PD when compared to yoga asana. The present study supports this literature as the presence study also shows the decrease in level of pain and improving quality of life in primary Dysmenorrhea.

Hyun-Nam Ko et al conducted a study on Effects of Yoga on Dysmenorrhea: A Systematic Review of Randomized Controlled Trials it was an research study that was conducted using CINAHL, the Cochrane library, Embase, PsycINFO, PubMed, and Korea Med electronic databases to identify randomized controlled trials (RCTs) reported effects of yogic intervention on dysmenorrhea, papers retrieved by the search were (n=1,120) potentially relevant papers retrieved for evaluation of full text (n=5) .after screening of full text the total number of studies included in the review were (n= 2) and concluded from the evidence of two RCTs that yoga interventions may be favorable effective for dysmenorrhea. The present study was the Experimental pre-test–post-test comparative study on primary dysmenorrhea , it included two groups stretching and yoga (n=23) in each group, total (n=46) and concluded that yoga is effective for dysmenorrhea in improving pain and quality of life ,when yoga group was compared with stretching group in primary dysmenorrhea, stretching group showed more significant effect in improving quality of life and WALIDD score in primary dysmenorrhea.

While there was no significant difference seen in post NPRS score between stretching and yoga groups.

Salvi Shah, Neha Verma et al conducted a study on Effect of exercises on primary dysmenorrhea in young females with subjects of 40 participants equally divided into two groups

Group A: Stretching exercise group, Group B: Control group. Active stretching exercises in the abdominal, pelvic, and groin regions for 8 weeks (4 days per week twice for 10 min.) and concluded that Stretching exercises are effective in reducing pain (P=0.002) in young females with primary dysmenorrhea. In the present study (group A) consisted of active stretching exercises that include abdominal, pelvic, and groin regions and for 8 weeks (5 days per week, 10 repetitions with 10 sec hold .) and group B consisted of 6 yoga asana and both the techniques were performed for 8 weeks (10 repetition with 5 sec hold for 5days per week) and concluded that both the techniques were highly significant in improving pain (p=0.00) , while stretching group also showed there was improvement in quality of life (p=0.00) and WALIDD score (p=0.00) post intervention in primary dysmenorrhea. The present study shows increases effect in primary dysmenorrhea then previous study. This can be due to increases in repetition performed regularly 5 days per week.

The present study was in favor of the study conducted by Sandeep Kaur which included 105 girls of age 19-25 years with primary dysmenorrhea the subjects were divided into 3 groups, Intervention introduced to the subjects were active stretching and core strengthening protocol for 8 weeks (4 days per week, 2 times a day, 10 min) at home and concluded that regular exercise as a helpful means in this age group. On the other hand exercises can be done in every place that do not need to any cost. When the present study was compared with this study it also concluded that regular exercises is helpful in primary dysmenorrhea when stretching and yoga given regularly (ie.10 repetition with 5 sec hold, 5days per week for 8 weeks) helps in improving pain, quality

of life and WALIDD score, while stretching group showed more statistically significant improvement in quality of life and WALIDD score. The mechanism behind yoga effectiveness for dysmenorrhea is still unclear the mechanism in which an abnormal increase in vasoactive prostanoids in the endometrium and menstrual fluid may induce myometrium hyperactivity and tissue ischemia subsequently, a yoga intervention improves blood flow at the pelvic level as well as stimulating the release of B endorphin acting as nonspecific analgesics [4]. However, in spite of both groups (stretching and yoga) showing improvement in pain, quality of life and WALIDD score these results support stretching exercises as a positive manager of primary dysmenorrhea symptoms.

According to present study there may be no significant difference in the post value of NPRS score between stretching and yoga group but stretching shows significant improvement in the increasing improvement in quality of life of young females and reducing the symptoms of primary dysmenorrhea according to WALIDD score.

Izzo and Labriola proposed that the increase in the blood flow and metabolism of the uterus during exercise may be effective in the reduction of dysmenorrheal symptoms. In another words, improved metabolism is a factor in the reduction of symptoms. It is also suggested that increased menstrual pain by uterine muscle contraction is derived from a nervous system that is innervated by the sympathetic nerve hence; stress through hyperactivity of sympathetic nerve System via the increase contractibility of uterine muscles may lead to menstruation symptoms.

Consequently, it might be possible to reduce dysmenorrheal symptoms by decreased Sympathetic over-activity through exercise. Another hypothesis suggests that therapeutic Exercise can increase the secretion of endorphins from the brain, and these materials in turn raise the pain threshold of the body. Daley AJ believed that contracted Ligamentous bands in the abdominal region were the causative factor for physical compression of nerve pathways and their irritation, so the proposed series of stretching exercise was considered very effective<sup>(15)</sup>

#### Further Recommendations:

The long term benefits of this treatment protocol could be established.

#### CONCLUSION

The present study concluded that both stretching and yoga technique are shown to have effect on improving PAIN, QOL SCALE and WALIDD SCORE. The stretching technique was found clinically more effective in improving QOL SCALE and reducing the symptoms of dysmenorrhea by WALIDD SCORE than yoga asana in subjects with primary dysmenorrhea. However there is no significant difference found in improving pain between both the groups stretching and yoga group.

#### LIMITATIONS

It is a short duration study in which follow up was not done, therefore long term effects were not known. Randomized controlled trial is needed to find long term effects of both therapeutic exercises. There is lack of control group. Future research is required.

**CONFLICT OF INTEREST:** NONE DECLARED

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# Synthesis of Bio – Polyurethane from Palm Kernel Oil and Characterization Using FTIR and NMR

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**Abstract-** Polyurethane (PU) becomes one of the bio-based polymers and produced by pre-polymerization method. In this study, polyurethane (PU) was synthesised using aromatic isocyanate (4,4'-diphenylmethane diisocyanate) as a hard segment and palm kernel-based monoester polyol (PKO-p) as a soft segment by using prepolymerization method with polyethylene glycol (PEG) 400 as a chain extender. Urea added into polyurethane in order to show the characteristic of polyurethane urea. Polyurethane – urea films with various concentration were studied and showing different tensile properties with polyurethane film. The tensile strains of PU – Urea films decreased owing to the addition of urea. The carbonyl peak (C=O) were detected using FTIR in polyurethane and polyurethane – urea around 1727 cm<sup>-1</sup> and 1725 cm<sup>-1</sup>, respectively. Meanwhile, thermal properties of the PU – urea films were determined using thermogravimetry (TGA) method and indicated satisfactory result.

**Index Terms-** Polyurethane, pre-polymerization, urea, FTIR, TGA

## I. INTRODUCTION

Various organic polymer materials nowadays are very popular among industry polymer. Polyurethane is one of the polymer materials considered to substitute materials originated from petroleum and can be applied as bio-based materials (Kizuka & Inoue 2015). Polyurethane (PU) is the largest volume commodity polymer that cannot be characterized by a simple structure. Instead, PU represents a class of polymers and any polymer with a urethane repeat unit is classified as a PU regardless of the other functional or polymer structures incorporated. As commodity products, PU have obtain acknowledgement by academic sciences and showed significant activity in PU science owing to its high potential for design and innovation (Sonnenschein & Koonce 2012; Szycher 2013; Priscariu 2011).

Polyurethane (PU) can be produced by various techniques such as quasipolymer, single-step polymerization and prepolymerization. Quasipolymer technique is a reaction between diisocyanate reacted with polyol. Furthermore, the higher content of free isocyanate at 15 – 30% in urethane prepolymer and called semiprepolymer or isocyanate quasiprepolymer owing to half of diisocyanate molecules are reacted with polyol (Wong & Badri 2012), whereas for single-step polymerization takes place when polyol, diisocyanate and catalyst are mixed simultaneously with the extend of chain takes place simultaneously (Clemitson 2008).

On the other hand, prepolymerization technique divided into several steps, the initial step is a formation of urethane polymer where the reaction between polyol and diisocyanate occurred. The final step is the chain of urethane prepolymer extended using water or diol to produce PU.

This study used palm kernel oil (PKO) as a monoester polyol. Production of PU in this study went prepolymerization technique which specifically designed by structoset prepolymers. Structoset prepolymers are polymerized in the final step by catalyst addition as shown in **Figure 1**. Here, this study report a synthesis of polyurethane using the aromatic isocyanate (4,4'-diphenyl-methane diisocyanate (MDI)) as a hard segment, whereas for soft segment is polyol based on palm kernel oil (PKO) used and PEG 400 as a chain-extender.

## II. EXPERIMENTAL PROCEDURE

### 2.1 Materials

The palm kernel oil – based monoester polyol (PKO-p) was prepared as described by Badri et al. (2000). 2,4-diphenylmethane diisocyanate (MDI) was acquired from Cosmopolyurethane (M) Sdn. Bhd., Klang, Malaysia. Benzene, hexane, acetone, tetrahydrofuran (THF), dimethylformamide (DMF), dimethylsulfoxide (DMSO) and polyethylene glycol (PEG) 400 were purchased from UKM laboratory.

### 2.2 Synthesis of Polyurethane film

The PKO-p and PEG 400 were put into the vessel A and dissolved with acetone in order to form a polyol prepolymer solution. Afterward, the solution mixed using centrifuge in 100 rpm for 5 min to obtain homogenized solution. Diisocyanate prepolymer produced with 4,4-diphenyl-methane diisocyanate (MDI) dissolved with acetone in vessel B, mixed for 20 sec in order to acquire a homogenized solution. Then, 10 g of diisocyanate prepolymer solution poured slowly into vessel B that containing 10 g of polyol prepolymer solution, mixed using stirrer for 10 sec to obtain a homogenized prepolyurethane solution. Afterward, the solution poured into mold and dried at room temperature. The recipe and urea content for each polyurethane are listed in **Table 1**.

### 2.3 Characterization

In this research, characterizations applied were tensile test, surface analysis using FESEM, thermal properties using TGA and DSC, NMR and FTIR spectroscopy applied to identify the

chemical structures. All analyses and tests were performed at room temperature ( $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ) unless otherwise indicated.

### 2.3.1 Chemical Properties

Solubility tests were performed using 10 x 10 mm test pieces. Each test piece was soaked in a solvent (benzene, hexane, acetone, tetrahydrofuran (THF), dimethylformamide (DMF), dimethylsulfoxide (DMSO); 10 mL) at room temperature ( $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ) for 24 h.

### 2.3.2 Cross-Section Determination

Soxhlet extraction method used in order to determine the percent of cross-section. 1 cm x 1 cm of PU film weighed and put into the soxhlet and used toluene and poured into flask. This method was carried out for 24 hours. Mass of PU film weighed before and after reflux done.

### 2.3.3 Mechanical Properties

Tensile tests were performed on an Instron 5566 model. The value of tensile stress, strain and modulus recorded.

### 2.3.4 Thermal Properties

Thermogravimetric analyses (TGA) were performed on a Perkin Elmer Pyris 1 thermal at a heating rate of  $10^{\circ}\text{C}/\text{min}$  from  $30^{\circ}\text{C}$  to  $600^{\circ}\text{C}$  under an  $\text{N}_2$  atmosphere.

Different scanning calorimetry (DSC) measurements were performed on a Perkin Elmer Pyris 1 thermal at a heating rate of  $10^{\circ}\text{C}/\text{min}$  from  $30^{\circ}\text{C}$  to  $250^{\circ}\text{C}$  and at 20 Hz under a  $\text{N}_2$  atmosphere. Approximately 5 - 10 mg of PU was weighed and sealed in an aluminium pan. The samples were heated from  $30^{\circ}\text{C}$  to  $150^{\circ}\text{C}$  for 1 min then rapidly cooled from  $150^{\circ}\text{C}$  to  $-100^{\circ}\text{C}$  for 1 min and then heated to  $250^{\circ}\text{C}$  at a rate of  $10^{\circ}\text{C}/\text{min}$ .

### 2.3.5 Surface Analysis

The field emission scanning electron microscope (FESEM) uses a focused beam of high-energy electrons to generate a variety of signals at the samples surface. The electron/sample interactions release signals that unveil information about the sample such as external morphology (texture) which forms the image observed. FESEM analyses were performed on dried sheets at room temperature in air using a Zeiss Gemini SEM 500-70-22. All the images presented here were reproduced from images acquired from at least three points on each sample surface.

### 2.3.6 Fourier Transform Infrared (FTIR) Spectroscopy

FTIR spectroscopy was performed on a Perkin-Elmer Spectrum BX using the Diamond Attenuation Total Reflectance (DATR) in order to identify several important functional groups in PU such as urethane carbonyl ( $\text{C}=\text{O}$ ) group, carbamate ( $-\text{CN}$ ), hydroxyl ( $-\text{OH}$ ) and amide ( $-\text{NH}$ ).

### 2.3.7 Nuclear Magnetic Resonance (NMR) Spectroscopy

The NMR spectroscopy  $^1\text{H}$  NMR and  $^{13}\text{C}$  NMR 600 MHz spectra of PU were performed on an ECP spectrometer in dimethyl sulfoxide- $d_6$  (DMSO- $d_6$ ) with tetramethylsilane ( $\text{Me}_4\text{Si}$ , TMS) as an internal standard at room temperature.

## III. RESULTS AND DISCUSSION

### 3.3.1 Chemical Properties

The solvent resistances of polyurethane films containing urea were tested by immersing polyurethane film sheet in various solvents such as hexane, benzene, acetone, THF, DMF and DMSO. The results are presented in **Table 2**.

All the PU films containing urea were resistant to benzene, hexane and acetone and slightly dissolved in THF, DMF and

DMSO at room temperature ( $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ) for 24 h. It shows the chemical bonds of PU are very strong are not easy to be separated.

### 3.3.2 Crosslinking determination, Tensile and Thermal Properties

All results are reported in **Table 3**. Soxhlet extraction method was applied in order to determine the percentage of crosslinking part in polyurethane. Percentage different of PU mass before and after reflux process acquire the percentage of the sample crosslink. The content of crosslinked portion determined by the percentage of gel content (Rogulska et al. 2007). Gel content of each sample was calculated using the following equation below:

$$\text{Gel content (\%)} = \frac{(W_i - W_f), \text{g}}{W_f, \text{g}} \times 100\%$$

Where

$W_i$  was initial mass of the sample before reflux (g)

$W_f$  was final mass of the sample after reflux (g)

The tensile strength of PU, PU1, PU2 and PU3 films show how much elongating stress the film will endure before failure. The tensile properties of the PU films containing urea are reported below. The tensile stress, strain and modulus for polyurethane showed satisfactory result compared to polyurethane that containing urea. It can be concluded that urea has capacity to reduce the tensile properties of polyurethane film. Furthermore, the results of DSC and TGA are presented in **Table 3**.

Apart from different IR absorption, polymers also having variety in their thermal stability. TGA and DSC have been used in order to verify the purity of the synthetic materials, detect thermal degradation or phase transitions (Majewsky et al. 2016). During DSC analysis, a sample heats using a controlled temperature gradient with a defined heating rate, e.g.  $10^{\circ}\text{C}/\text{min}$ . The heat flow is interpreted by comparing the sample with a reference (Menczel & Prime 2008).

TGA analysis was applied to analyse the material degradation behaviour through the change in mass of the sample function of temperature and time in a controlled environment. This measurement was applied to determine the thermal stability and disintegrate the material composition. The thermal stabilities of the polyurethane films containing urea were analysed using TGA under a  $\text{N}_2$  atmosphere. **Table 3** presents four types of polyurethane films with and without urea with different urea concentration. Polyurethane films with and without urea were began degrading at above  $170^{\circ}\text{C}$ . Martel – Estrada et al. (2010) stated that polymer can be justified as a good polymer and mixed well when only one peak resulting in DTG thermogram. Nevertheless, this study showed the appearance more than one peak in DTG thermogram indicated that the PU prepolymer was likely to have residues.

DSC is a method with objective to analyse the changes of physical properties of the sample based on the glass transition temperature ( $T_g$ ) from the thermogram. DSC and TGA curves were measured for all polyurethane with and without urea to analyse characteristic endothermic reactions. DSC analyses of the polyurethane film containing urea were performed over  $30^{\circ}\text{C}$  to  $250^{\circ}\text{C}$  under a  $\text{N}_2$  atmosphere. From the data in **Table 3**, one main transition appeared in polyurethane films containing urea. The values for the glass transition temperatures ( $T_g$ ), detected as the

peak temperature in the  $E'$  curves of the corresponding polyurethane with and without urea content were 78.1°C, 117.6°C, 130.2°C and 132.2°C for PU, PU1, PU2 and PU3, respectively.  $T_g$  values of polyurethane films containing urea increased. It is because the composition of urea inside the polyurethane have influenced the  $T_g$  value of each sample.

### 3.3.4 Surface Analysis

FESEM images of the polyurethane films are presented in **Figure 3**. The surfaces of the polyurethane film were compared to polyurethane film that containing urea with various concentrations. The concentration, viscosity and conductivity of the solutions as well as the applied voltage and distance between the charged electrode and the grounded target (Kaur et al. 2016). FESEM images of polyurethane films containing urea revealed that all investigated samples were organic layer with a roughness less than the sheet thickness. The urea incorporation into the polyurethane film surface was visible. Furthermore, the surface of polyurethane films containing urea were not satisfactory uniform owing to the presence of urea.

### 3.3.5 Fourier Transform Infrared (FTIR) Spectroscopy

**Figure 4** showed the FTIR spectra of polyurethane, polyurethane containing urea and urea. The PKO-p reacted with diisocyanate to form urethane polymer in order to remove the free diisocyanate of MDI. Furthermore, there are no traces of NCO namely C-N (ester amide) at 1611  $\text{cm}^{-1}$  detected in the FTIR spectrum of the PU formed via addition polymerization. This indicates the diisocyanate group has completely reacted with PKO-p to form polyurethane.

The presence of the amide (-NH), carbonyl urethane group (-C=O), carbamate group (CN-H and -C-O-C indicated the urethane linkages in the PU. The carbonyl peak (C=O) were detected in polyurethane and polyurethane – urea around 1727  $\text{cm}^{-1}$  and 1725  $\text{cm}^{-1}$ , respectively which means a hydrogen bonded carbonyl urethane group. The identification peak around 1730  $\text{cm}^{-1}$  known as a non-hydrogen bonded carbonyl urethane group according to Clemitson (2008). Furthermore, there is no possibility of forming urea as the by product since the peak of C=O urea is no exist in polyurethane at 1690  $\text{cm}^{-1}$  (Clemitson 2008). Nevertheless, FTIR spectrum of polyurethane-urea and urea having the peak of C=O at 1660  $\text{cm}^{-1}$  and 1674  $\text{cm}^{-1}$ , respectively. It indicates there are no reaction between polyurethane and urea owing to the peak of C=O presence in FTIR spectrum of polyurethane-urea. The free NH band, hydrogen – bonded NH with oxygen (ether) and hydrogen – bonded NH with oxygen (carbonyl) in the urethane are observed at 3301  $\text{cm}^{-1}$  and 3326  $\text{cm}^{-1}$  – 3428  $\text{cm}^{-1}$  (Lampman et al. 2010; Mutsuhisa et al. 2007). The urethane groups in the hard segment (MDI) have electrostatic charges at oxygen, hydrogen and nitrogen atoms and these charged atoms form dipoles which attract another atom of opposite charge (Boyd 1983). In this study, the hydrogen bond formed by C=O acts as proton acceptor whereas NH acts as proton donor.

The reaction mechanism in the formation of the urethane linkage via prepolymerization method is by nucleophilic substitution reactions (Yong et al. 2009) where in this research amine as the nucleophile. Amine attacks the carbonyl of the isocyanate (MDI) to form two resonance structures of the intermediate complexes A and B. The intermediate complex B has a greater tendency to react with polyol owing to the carbonyl bond (C=O) is stronger than the C=N bond the intermediate complex A.

Thus, intermediate complex B is more stable than intermediate complex A (Wong & Badri 2012). Furthermore, nitrogen is more electropositive than oxygen, which -CN bond is more attracted to the cation ( $\text{H}^+$ ) compared to -CO (Lampman et al. 2010).

The other reaction appeared in this study with PEG where the oxygen of PEG nucleophile attacks diisocyanate of MDI to form two intermediate complexes A and B. Nevertheless, nucleophilic substitution reaction has greater tendency to polyol compared to PEG owing to the nitrogen atom presence in polyol which is more electropositive than oxygen atom in PEG. Amine has higher possibility to react with isocyanate compared to hydroxyl (Herrington & Hock 1997). The other study stated that amine with a stronger alkalinity has more ability to react with carbon atom of the isocyanate (Wong & Badri 2012). Polyol contains a very long carbon chain that it can easily stabilize the alkyl ion when an intermediate complex is formed. Thus, the polyol is more reactive than PEG to react with MDI. Nevertheless, the use of PEG will increase the chain length of PU and prevent side reaction to occur such as the formation of urea between the reaction of NCO group in urethane prepolymer and water molecules from surrounding.

### 3.3.6 Nuclear Magnetic Resonance (NMR) Spectroscopy

NMR spectra are applied to analysed the structure of the polymeric chains. The  $^{13}\text{C}$  NMR spectrum of the polyurethane and polyurethane containing urea are shown in **Figure 5** and depicted as follows:

$^{13}\text{C}$  NMR for polyurethane:  $\delta$  (ppm) = 153.9 (C(O)ONH), 129.3 – 130.1 (C = C), 118.8 (C=CN(H)), 72.8 ( $\text{CH}_2\text{O}$ ), 69.2 – 69.8 ( $\text{CH}_2\text{C}(\text{O})\text{OC}$ ), 60.7 – 63.9 (C(O)OCNH), 59.3 – 59.6 (C – OH), 22.5 – 33.9 ( $\text{CH}_2$ ), 14.4 ( $\text{CH}_3$ ).

$^{13}\text{C}$  NMR for polyurethane – urea:  $\delta$  (ppm) = 129.3 (C = C), 118.9 (C=CN(H)), 72.8 ( $\text{CH}_2\text{O}$ ), 69.2 – 70.2 ( $\text{CH}_2\text{C}(\text{O})\text{OC}$ ), 60.7 – 63.6 (C(O)OCNH), 39.61 – 40.6 (C – N), 22.5 – 33.9 ( $\text{CH}_2$ ), 14.4 ( $\text{CH}_3$ ).

The presence of peak at 153.9 ppm and the disappearance of NCO peak of MDI at 125.7 ppm concluded that the diisocyanate of MDI reacted to -OH of polyol completely to form urethane polymeric chains (Wong & Badri 2012). Furthermore, the C-OH peak in polyurethane was detected around 59.3 – 59.4 ppm indicating an excess of polyol and PEG. Whereas, the C-N peak in polyurethane – urea was detected owing to the presence of urea. The  $\text{CH}_2$  peaks in both spectrums also showing varieties around 22.5 – 33.9 ppm owing to numerous fatty acid contents in PKO such as linoleic acid, linolenic acid, palmitic acid, lauric acid and so on.

## IV. CONCLUSIONS

In summary, this study achieved the synthesis of polyurethane containing urea using the prepolymerization method. The use of urea showing that urea was entrapped inside the polyurethane films owing to the properties of polyurethane film has pores on the surface. The film of polyurethane is transparent whereas polyurethane films containing various concentrations of urea are opaque owing to polyol and MDI have no ability to dissolve urea. The FTIR spectra also indicated the progress of the prepolymerization of polyurethane based on palm kernel oil – based polyol. The presence of C-N peak in FTIR spectra of polyurethane – urea also indicated no reaction between

polyurethane and urea. The experiment results showed that the tensile properties of polyurethane containing higher concentration of urea decrease and their flexibility are also unsatisfactory and the films containing urea are brittle.

Regarding its applications, the polyurethane – urea film is expected for use in chemical sensors. This study needs to be further extended by studying the capability of polyurethane – urea as a chemical sensor.

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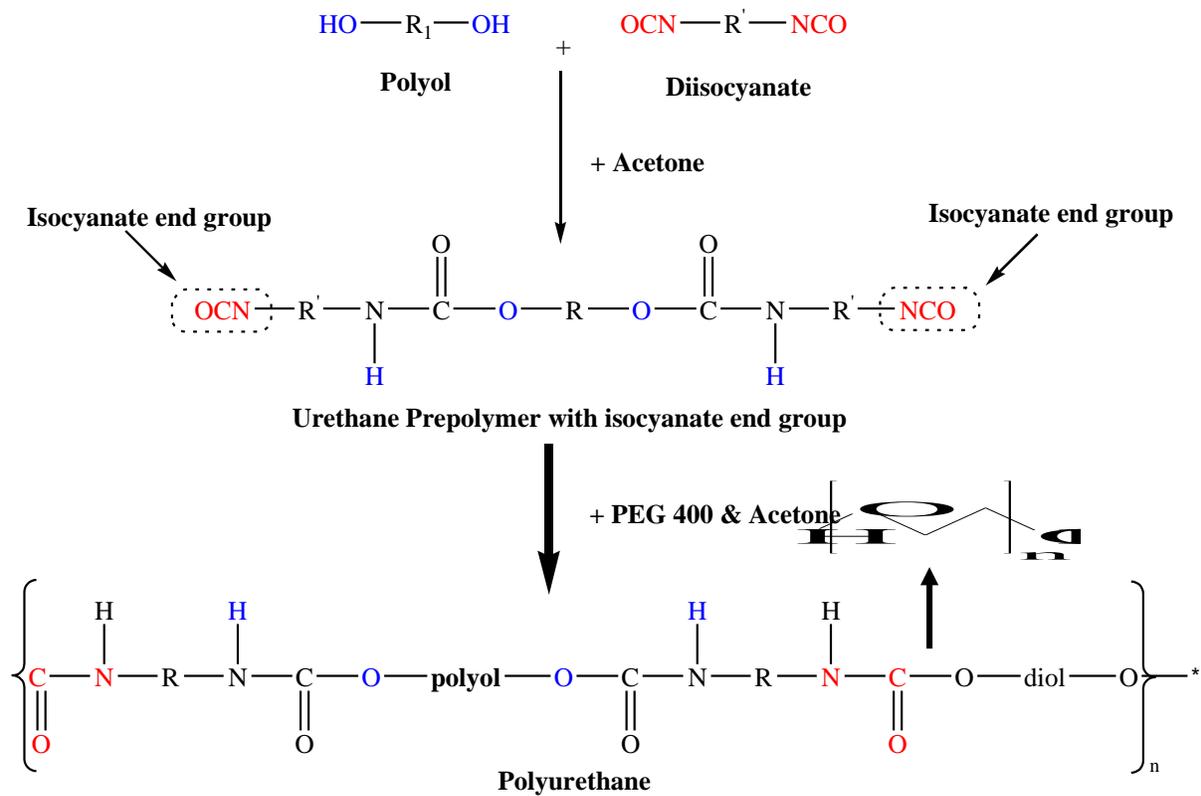


Figure 1. The chemical route of producing polyurethane via prepolymerization method (Wong & Badri 2012).

Table 1. Synthesis of polyurethane films containing urea.

| Sample           | MDI (g) | Polyol (g) | Urea (%) |
|------------------|---------|------------|----------|
| Polyurethane     | 1.5     | 2.1        | 0        |
| Polyurethane – 1 | 1.5     | 2.1        | 1        |
| Polyurethane – 2 | 1.5     | 2.1        | 3        |
| Polyurethane – 3 | 1.5     | 2.1        | 5        |

Table 2. Solubilities of polyurethane films containing urea.

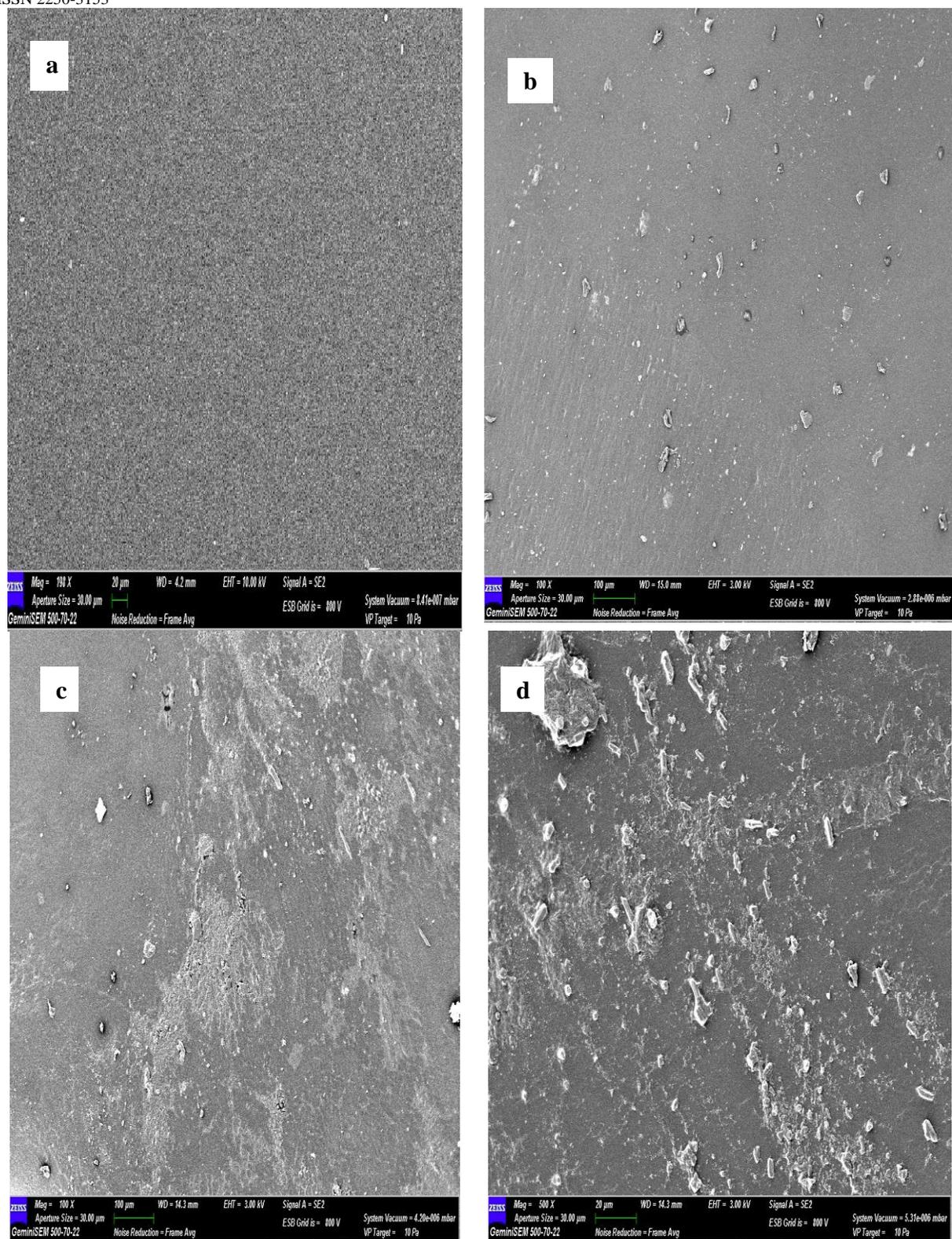
| Sample | Benzene | Hexane | Acetone | THF | DMF | DMSO |
|--------|---------|--------|---------|-----|-----|------|
| PU     | -       | -      | -       | x   | x   | x    |
| PU1    | -       | -      | -       | x   | x   | x    |
| PU2    | -       | -      | -       | x   | x   | x    |
| PU3    | -       | -      | -       | x   | x   | x    |

-: undissolved, x: slightly dissolved.

**Table 3. Physical properties of polyurethane films.**

| <b>Sample</b>                     | <b>Stress<sup>a</sup><br/>(Mpa)</b> | <b>Strain<sup>a</sup><br/>(%)</b> | <b>Modulus<sup>a</sup><br/>(Mpa)</b> | <b>(100)</b> | <b>T<sub>g</sub><sup>b</sup></b> | <b>T<sup>c</sup></b> | <b>Cross-section<br/>(%)</b> |
|-----------------------------------|-------------------------------------|-----------------------------------|--------------------------------------|--------------|----------------------------------|----------------------|------------------------------|
| <b>Polyurethane</b>               | 8.53                                | 43.34                             | 222.10                               |              | 78.1°C                           | 171.8°C              | 99.36                        |
| <b>Polyurethane –<br/>urea 1%</b> | 6.73                                | 26.27                             | 163.67                               |              | 117.6°C                          | ≥190°C               | 90.12                        |
| <b>Polyurethane –<br/>urea 3%</b> | 4.93                                | 16.79                             | 117.79                               |              | 130.2°C                          | ≥190°C               | 88.27                        |
| <b>Polyurethane –<br/>urea 5%</b> | 2.95                                | 10.47                             | 87.11                                |              | 132.2°C                          | ≥190°C               | 85.31                        |

<sup>a</sup>Measurement conditions: using tensile instruments, total thickness = 1 mm, room temperature (23°C ± 2°C). <sup>b</sup>Differential scanning calorimetry was performed at a heating rate of 10°C/min from -100°C to 200°C under a N<sub>2</sub> atmosphere. <sup>c</sup>Thermogravimetric analysis was performed at a heating rate of 10°C/min from 30°C to 300°C under an N<sub>2</sub> atmosphere.



**Figure 3. FESEM images of polyurethane with and without urea. (a) polyurethane, (b) polyurethane – urea 1%, (c) polyurethane – urea 3%, (d) polyurethane – urea 5%.**

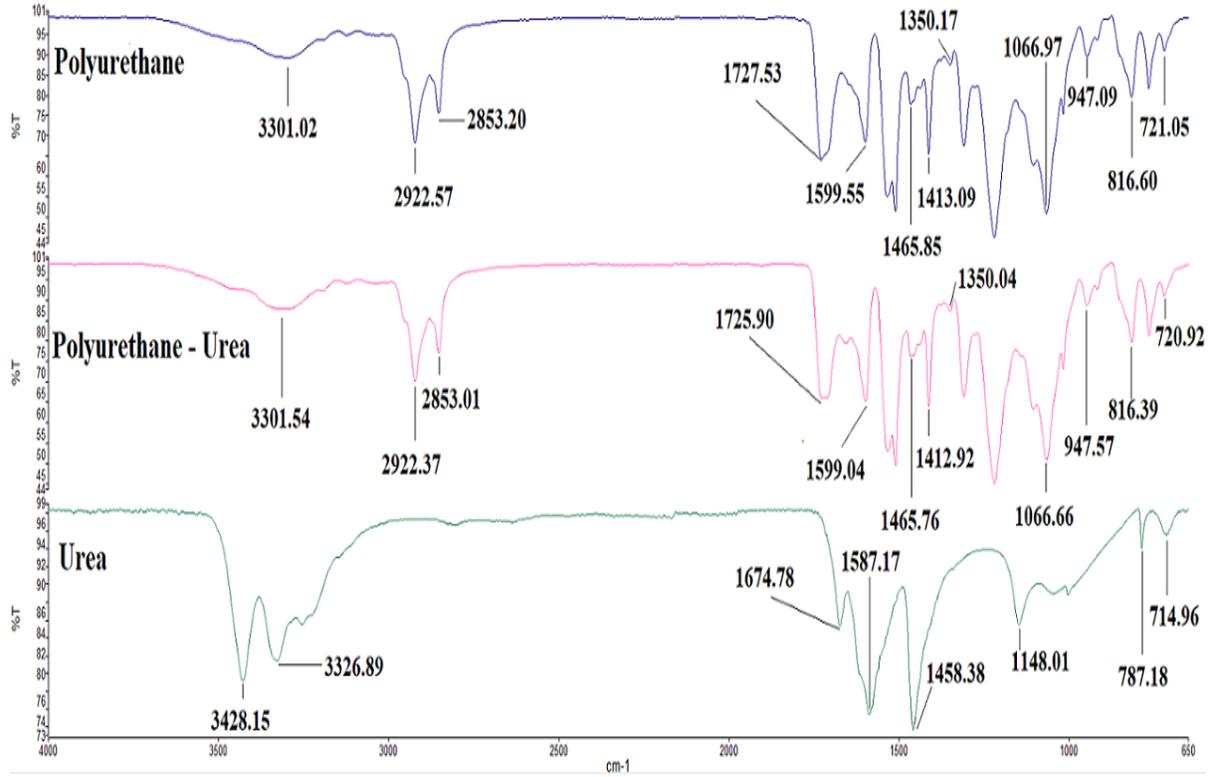
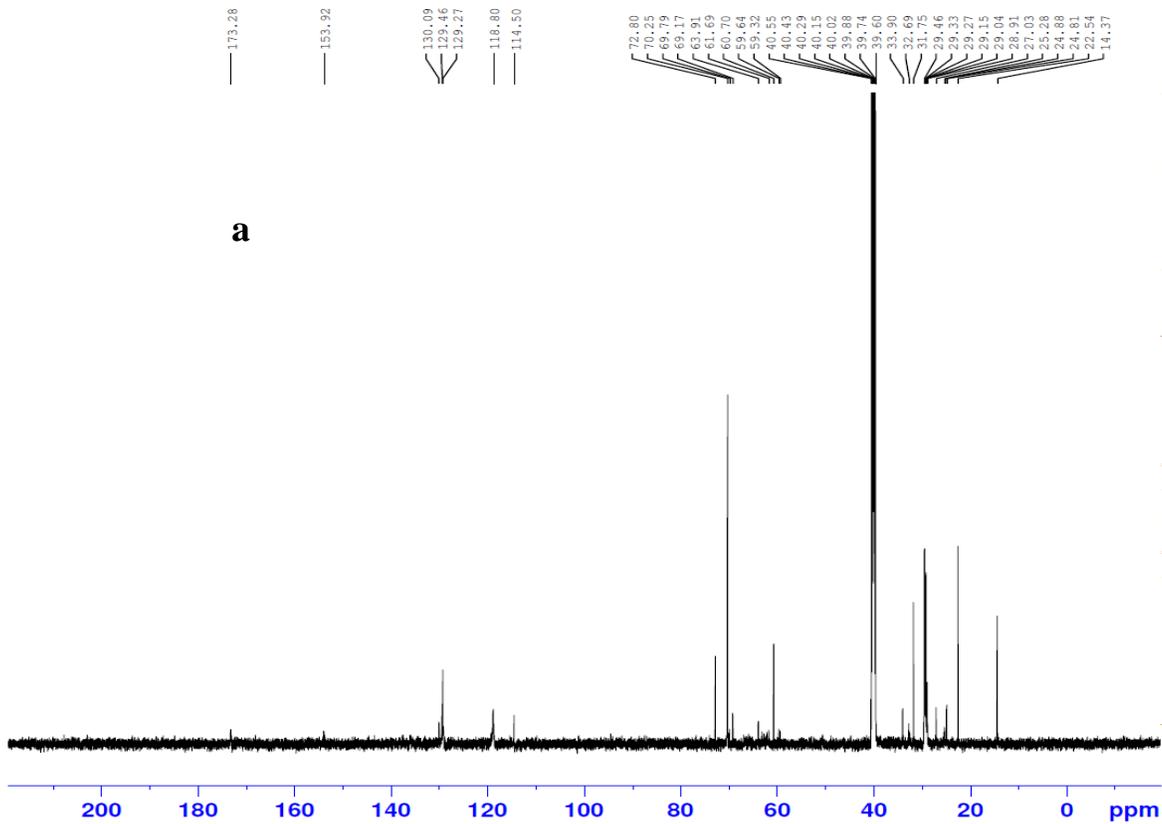


Figure 4. FTIR spectrum of polyurethane, polyurethane - urea and urea.



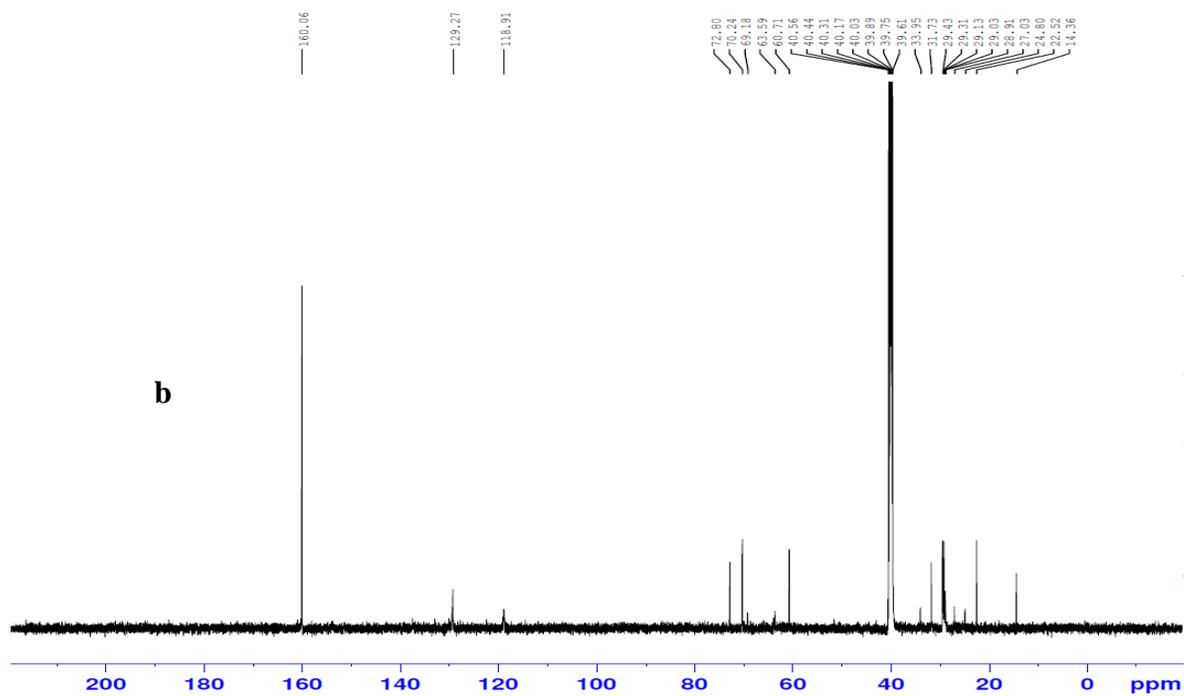


Figure 5.  $^{13}\text{C}$  NMR spectrum: (a) the polyurethane and (b) the polyurethane – urea.

# Sustainability Analysis of Settlement Area on Cikapundung Riverside, Bandung City, Indonesia

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**Abstract-** Existing condition of settlement area on Cikapundung riverside is dense population, mostly illegal status, low quality of infrastructure, and ecological function decrease. The aim of this study was to analyze sustainability status and sensitive attributes affecting settlement area sustainability. This study used qualitative-quantitative method and its data type was ordinal data. Data analysis method used was statistical method with Multi Dimensional Scalling (MDS) with Rapid appraisal (Rap) – riverside settlement analysis. The result of settlement area sustainability status on Cikapundung riverside was included in less sustainable category by index of 48.65. The result showed analysis of 42 attributes from 5 sustainable dimensions in settlement area was undergone 16 sensitive attributes were obtained consisting of ecological (4 attributes), economical (3 attributes), social (3 attributes), institutional (3 attributes), and technological dimension (3 attributes). Those 16 leverage attributes sensitively affect settlement area sustainability on Cikapundung riverside.

**Index Terms-** leverage attribute, dimension, settlement, sustainability

## I. INTRODUCTION

The Sustainable Development Goals (SDGs) program's 11th goal related to urban and settlement problems is to build inclusive, safe, resilient, and sustainable cities and settlements. One of the targets (point 11.1) is to guarantee societies' access to settlement and feasible, safe, affordable basic service, including slum settlement area arrangement in 2030 (UNESCO 2017). This goal positions cities in sustainable development core amid rapid urbanization conducting to increasing total population. McGee (1955) predicted that more than 56 % population in Southeast Asia (ASEAN) dwells in urban area.

Urbanization has influenced total population increase of Bandung City. Total population increase average of Bandung city (2014–2019 period) annually was 7,417 people (0.3 %), while recorded low income total population in 2019 was 84,670 people (3.38 %) (Bandung City Central Bureau of Statistics 2020). This phenomenon will inflict on existing of irregular settlement clusters if it is not anticipated by avoiding low price houses for low income population (Ooi and Phua 2007). Turner and Fitcher (1972) postulated that house was a complete part of settlement, not

merely physical result, but it was a progressive process. In this context, house had sustainability meaning.

Most of low-income population do not afford to feasible legal buy house or land. They look for low price house and land (infeasible) or even they dwell in illegal land whose it does not have insecurity of tenure, such as riverside informal settlement. Doxiadis (1968) postulated that settlements meant settlements for humans. Settlement has larger meaning than housing. Recently, Cikapundung riverside settlement area has irregular spatial use, high population density, illegal status, low qualified infrastructure and ecological function decrease (Rusdiyanto et al. 2020). This condition might inflict on settlement area sustainability decrease. Principally, sustainability could be defined as effort of need fulfillment for recent generation without decreasing capability of upcoming generation to fulfill their needs (WCED 1987).

Base on regulation, we could do condemnation by relocating illegal population to overcome Cikapundung riverside settlement area problem, while legal population might be offered to choose land consolidation program alternative (Law and Human Rights Ministry 2011). Since this condition has been existing and it relates on human right and nation responsibility to care low income population, this solution should be undergone carefully by humanistic persuasive approach to avoid conflict. By considering this condition, the urgent short term solution is to increase the settlement area sustainability, by examining the actual condition of sustainability status and sensitive attribute which could increase the settlement area sustainability.

Based on previous researches (Wihadanto et al. 2017; Wijaya et al. 2017; Rahayu et al. 2018), it was known that the research done in Cikapundung riverside was undergone partially, from both functional aspect (either upstream or downstream) and administrative area. In conclusion, research examining settlement area sustainability by taking locations in 3 areas (upper, middle, lower area) simultaneously hadn't been undergone. This research was undergone to analyze sustainability status and important factors (sensitive attributes) affecting on Cikapundung riverside settlement area, Bandung City.

## II. TIME AND LOCATION OF THE STUDY

This research had been undergone for 9 months started from March until December 2019. Generally, it had been undergone in Bandung City (Indonesia) in 3 settlement area passed by

Cikapundung river consisting of Kampung Pelangi 200 (Dago Subdistrict), Kampung Cimaung (Tamansari Sudistrict), and

Kampung Mengger Tengah (Mengger Subdistrict). Specifically, the study location could be seen in Picture 1.



Picture 1. Research Location

### III. DATA COLLECTION

Data collection method consists of reference study, indepth interview, and expert judgment. The data is categorized as primary and secondary data. Primary data was collected from respondents including common populations, experts and other stakeholders and direct observation. Sampling determination was undergone by purposive sampling. Secondary data was obtained from previous studies result and other publications.

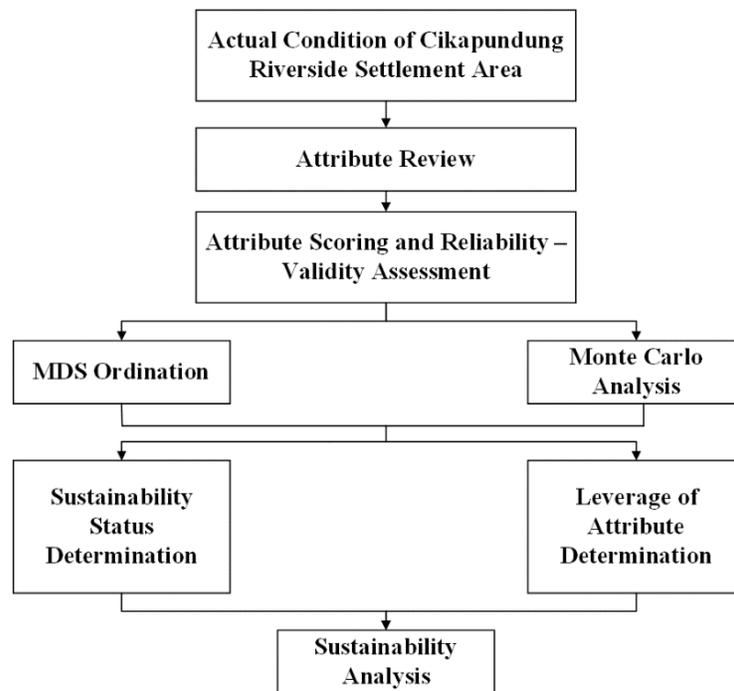
### IV. STATISTICAL ANALYSIS

Data analysis method was processed by Multidimensional Scalling (MDS) by using software Rap-riverside settlement as adjustment of RAPFISH (Rapid Appraisal for Fisheries). MDS is a statistical analysis technique that attempts to carry out multidimensional transformations into simpler dimensions (Kavanagh and Pitcher 2004). Sustainability status assessment used 5 (five) dimension approaches consisting of ecology, economy, social, institutional and technology. Dimensional attribute arrangement and assessment to attributes in each

dimension were undergone based on literature study or previous study result, actual condition, valid legality, and consultation to experts.

Overall, there were 42 sustainability attributes consisting of ecology dimension (9 attributes), economy dimension (8 attributes), social dimension (10 attributes), institutional dimension (8 attributes), and technology dimension (7 attributes). Index arrangement and sustainability status of each dimension and their attributes followed concept developed by Pitcher and Preikshot (2001). Assesment score of each dimension was asserted from bad scale 0% until good scale 100%. Assessment score was underlied in existing condition analysis result and obtained secondary data. Index score >50 % could be asserted that examined dimensions had been sustainable. In another hand, <50 % of those dimensions had not been sustainable. Sustainability index category is shown in Table 1. The stages of sustainability analysis using Rap-riverside settlement are presented in Picture 2.

Picture 2. The stages of sustainability analysis using Rap-riverside settlement



Picture 2. The stages of sustainability analysis using Rap-riverside settlement  
 Source: Modification of Kusmana et al. (2020)

Table 1. Sustainability Index Category  
 Source: Pitcher dan Preikshot (2001)

| Index Score | Sustainability Category         |
|-------------|---------------------------------|
| 0 – 25      | Worse (Unsustainable)           |
| > 25 – 50   | Bad (Less Sustainable)          |
| > 50 – 75   | Moderate (Moderate Sustainable) |
| > 75 – 100  | Good (Sustainable)              |

V. RESULT AND DISCUSSION

SETTLEMENT AREA SUSTAINABILITY STATUS

The sustainability index assessment result on Cikapundung riverside settlement area is shown in Table 2.

Table 2. Settlement Area Sustainability Status

| Cikapundung River | Ecology | Economy | Social | Institution | Technology | Multi dimension |
|-------------------|---------|---------|--------|-------------|------------|-----------------|
| Upper Part        | 50.59   | 61.19   | 51.78  | 41.94       | 39.78      | 49.06           |
| Middle Part       | 56.01   | 63.02   | 53.91  | 39.12       | 48.00      | 52.01           |
| Lower Part        | 46.94   | 45.54   | 47.06  | 38.15       | 46.77      | 44.89           |
| Average           | 51.18   | 56.59   | 50.92  | 39.74       | 44.85      | 48.65           |

Sustainability index assessment result was 48.65 for settlement area sustainability score categorized as less sustainable. Lower part of Cikapundung riverside settlement area was placed in the lowest sustainability level by score of 44.89 (less sustainable) continued by upper part by score of 49.06 (less

sustainable), while middle part had the highest sustainability level by score 52.01 (moderate sustainable). Based on sustainability dimension assessment it could be obtained that institution dimension was the lowest dimension by score of 39.74 (less

sustainable) and economy dimension was the highest dimension by score of 56.59 (moderate sustainable).

Assessment result by using Rap -riverside settlement method, we got stress score (S) and determination coefficient score (R<sup>2</sup>) as shown in Table 3.

Table 3. Rap-riverside settlement assessment result

| Dimension   | Index Score | Stress (S) | Coefficient (R <sup>2</sup> ) |
|-------------|-------------|------------|-------------------------------|
| Ecology     | 51.18       | 0.16       | 0.93                          |
| Economy     | 56.59       | 0.14       | 0.92                          |
| Social      | 50.92       | 0.16       | 0.93                          |
| Institution | 39.74       | 0.13       | 0.94                          |
| Technology  | 44.85       | 0.15       | 0.93                          |

Based on the S and R<sup>2</sup> score, according to analysis guideline of statistical model feasibility, a good model will occur if S score < 0.25 and R<sup>2</sup> approaches 1 (Kavanagh and Pitcher 2004). It is concluded that the examined model in this study is good of fit observed by ecology, economy, social, institution, and

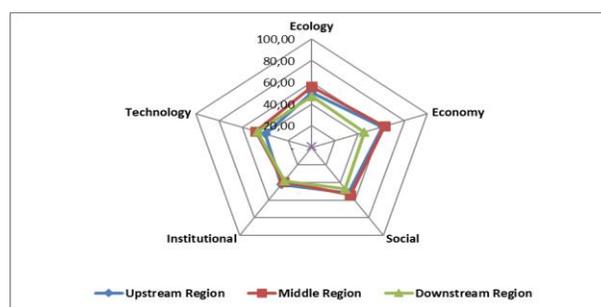
technology dimension. It shows that all attributes for each dimension describe the actual Cikapundung riverside settlement area condition which means it does not need to get addition or dimension of attribute total. Monte Carlo analysis result is shown in Table 4.

Table 4. Comparison between MDS index score and Monte Carlo analysis

| Dimension   | Index Score (a) | Monte Carlo (b) | Deviation (a – b) |
|-------------|-----------------|-----------------|-------------------|
| Ecology     | 51.18           | 49.16           | 2.02              |
| Economy     | 56.59           | 55.88           | 0.71              |
| Social      | 50.92           | 49.57           | 1.35              |
| Institution | 39.74           | 38.66           | 1.08              |
| Technology  | 44.85           | 43.32           | 1.53              |

Analysis result in Table 4 shows that deviation of index score and Monte Carlo analysis score for every dimension is no more than 5 %, therefore it could be interpreted that sustainability index score of Cikapundung riverside settlement area has relatively small random error (Hardjomidjojo et al. 2016).

For getting clearer description, sustainability index score of each dimension could be visualized in kite diagram shown in Picture 3.

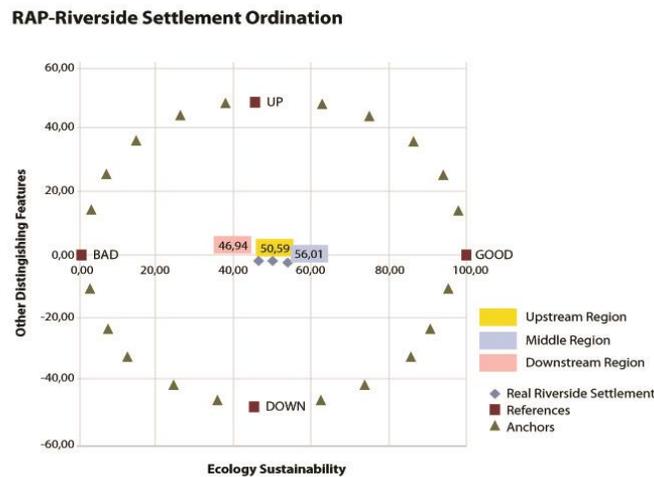


Picture 3. Settlement area sustainability kite diagram

Hereby researcher show sustainability status index and leverage of attributes consisting of 5 (five) dimensions of Cikapundung riverside settlement area sustainability.

1. Ecology Dimension Sustainability Index

Ecology dimension sustainability describes ecological functions existing condition on Cikapundung riverside settlement area described in 9 (nine) attributes. Picture 4 shows Rap-Riverside Settlement ordination analysis result in ecology dimension resulting in sustainability index score average of 51.18 (moderate sustainable) in details of upper part, middle part, and lower part by score of 50.59, 56.01, and 46.94 respectively.



Picture 4. Ecology Dimension Ordination Chart

Based on leverage analysis result shown in Figure 1, there are 4 of 9 analyzed attributes sensitive to affect on value of ecology dimension sustainability index score consisting of (1) land

conversion into built land by score of 2.11, (2) settlement arrangement by score of 2.07, (3) green open space availability by score of 1.54 and (4) waste management by score of 1.07.

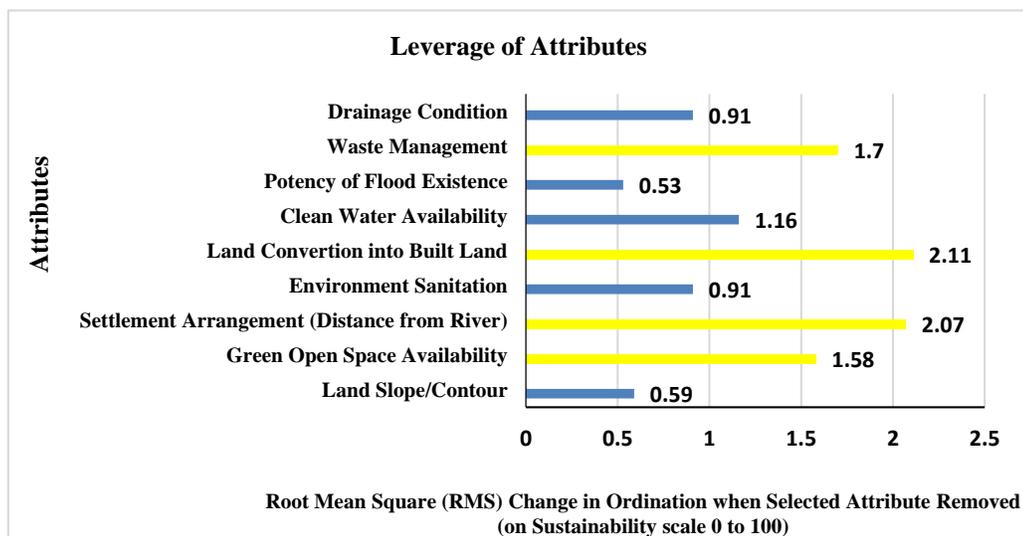
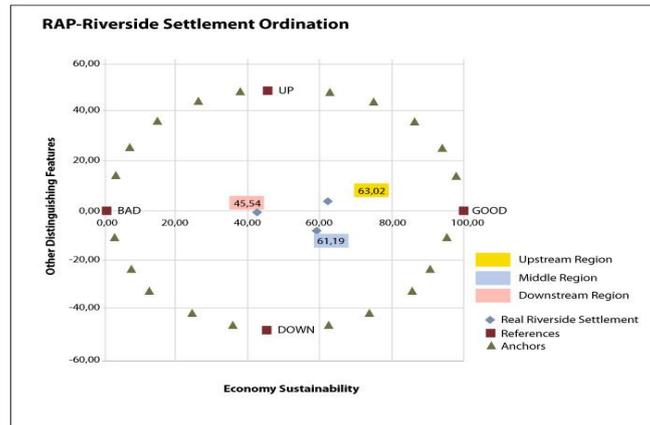


Figure 1 Ecology Dimension Leverage Attribute

## 2. Economy Dimension Sustainability Index

Economy dimension sustain-ability depicts area and society economical condition in Cikapundung riverside settlement area and its impact to long term sustainability described in 8 attributes. Picture 5 shows Rap-Riverside Settlement ordination

analysis result in economy dimension resulting in sustainability index score average of 56.59 (moderate sustainability) in details of upper part, middle part, and lower part by score of 61.19, 63.02, and 45.54 respectively.



Picture 5. Economy Dimension Ordination Chart

Based on leverage analysis result shown in Figure 2, there are 3 of 8 analyzed attributes sensitive to affect on value of economy dimension sustainability index score consisting of (1) settlement restoration fund availability by score of 7.74, (2) population prosperity improvement by score of 6.73 and (3) population income by score of 6.02.

## 3. Social Dimension Sustainability Index

Social dimension sustainability describes social aspect in settlement area arrangement directly affecting on long term environment and resource sustainability depicted in 10 (ten)

attributes. Picture 6 shows Rap-Riverside Settlement ordination analysis result in social dimension resulting in sustainability index score average of 50.92 (moderate sustainable) in details of upper part, middle part, and lower part by score of 51.78, 53.91, and 47.06 respectively.

Based on leverage analysis result shown in Figure 3, there are 3 of 10 attributes sensitive to affect on social dimension sustainability index consisting of (1) population density by score 1.78, (2) low income total population by score of 1.42 and (3) population participation in environment management by score of 0.80.

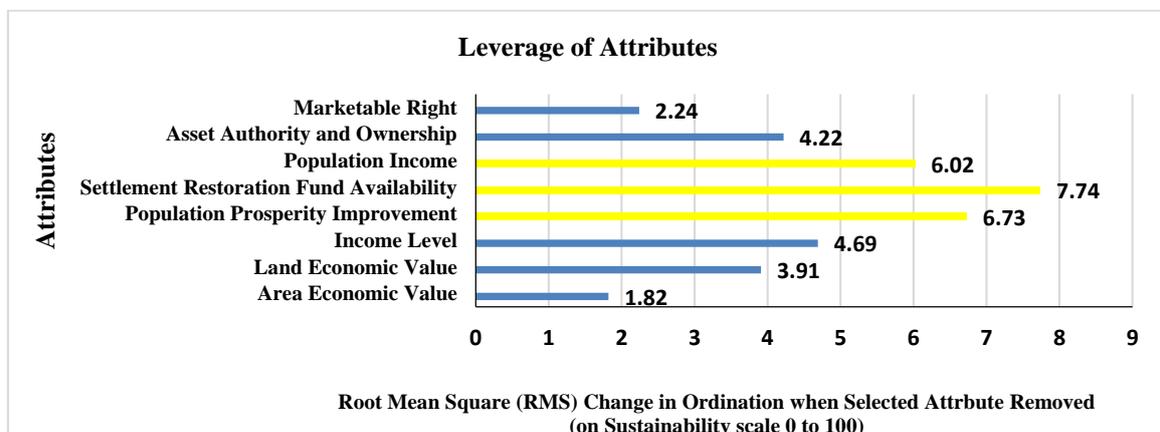
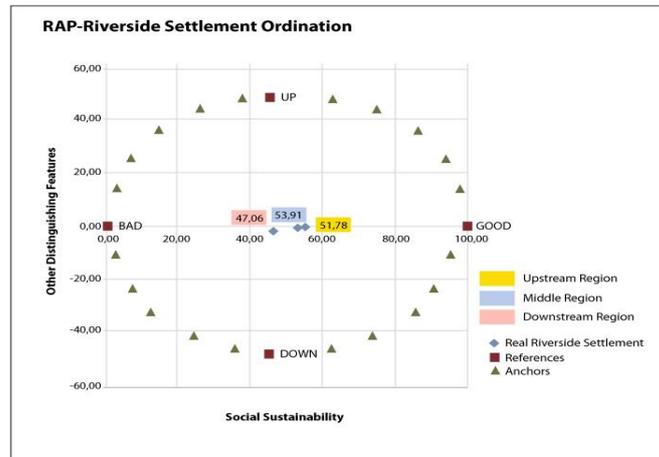


Figure 2. Economy Dimension Leverage Attribute



Picture 6. Social Dimension Ordination Chart

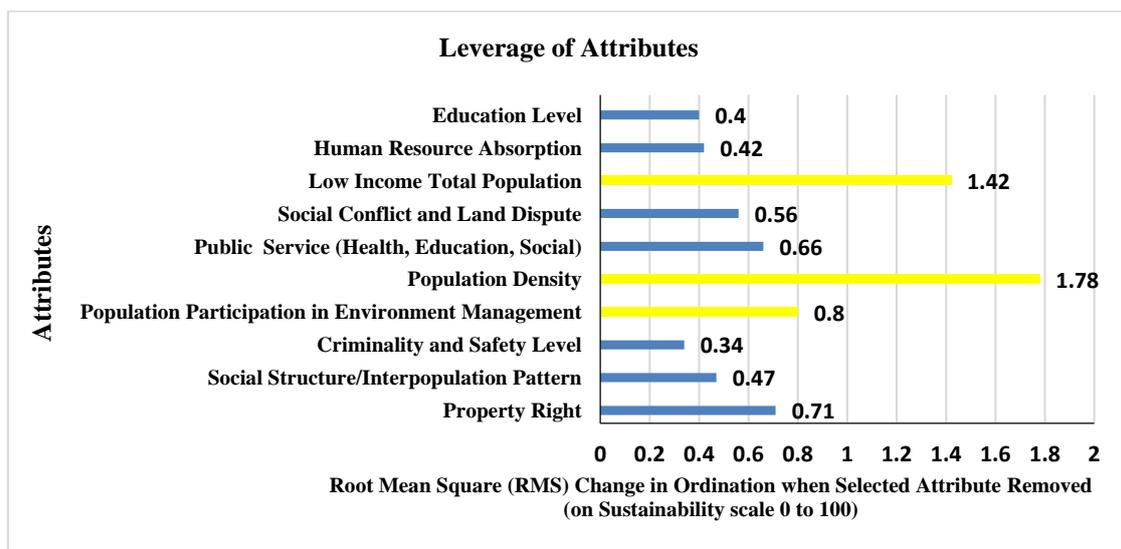
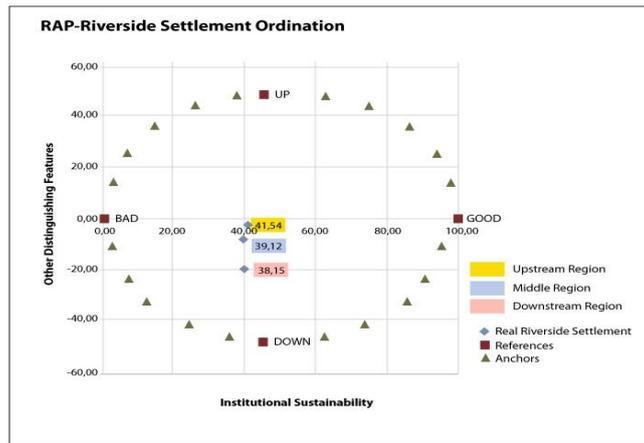


Figure 3. Social Dimension Leverage Attribute

#### 4. Institution Dimension Sustainability Index

Institution dimension sustainability describes institution role in Cikapundug riverside settlement area sustainability depicted in 8 (eight) attributes. Picture 7 shows Rap-Riverside Settlement ordination analysis result in institution dimension resulting in sustainability index score average of 39.74 (less sustainable) in details of upper part, middle part, and lower part by score of 41.94, 39.12, and 38.15 respectively.

Based on leverage analysis result shown in Figure 4, there are 3 of 10 attributes sensitive to affect on value of institution dimension sustainability index score consisting of (1) mechanism simplicity of development permission by score of 4.27, (2) interarea cooperation by score of 4.21 and (3) coordination in infrastructure restoration by score of 4.14.



Picture 7. Institution Dimension Ordination Chart

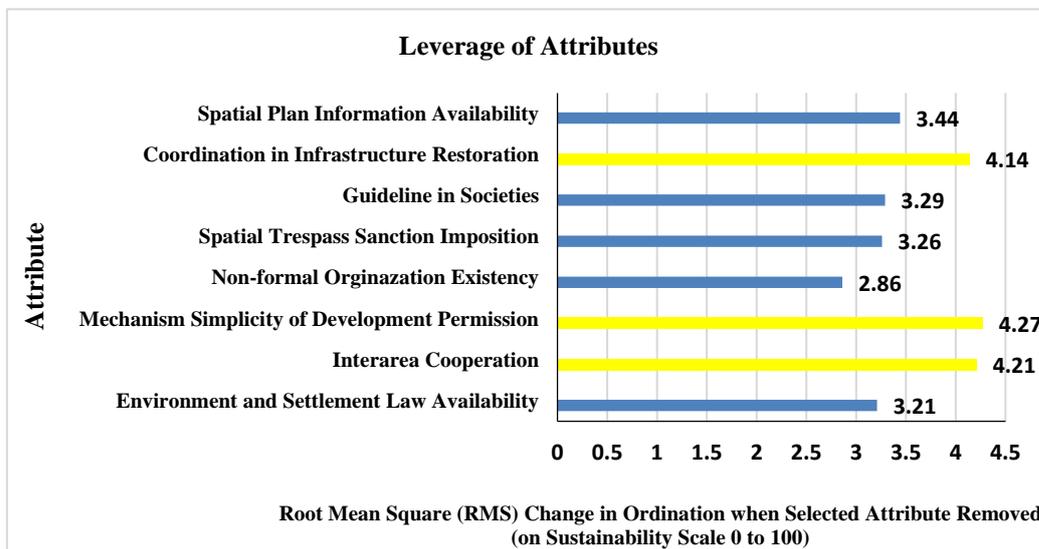
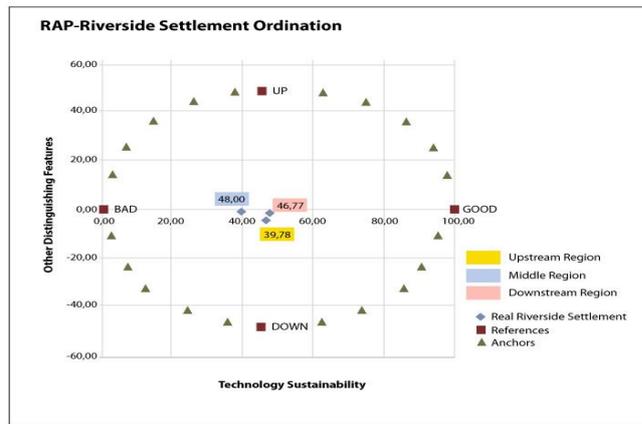


Figure 4. Institution Leverage Attribute

5. Technology Dimension Sustainability Index  
 Technology dimension sustainability describes technological role in Cikapundung riverside settlement area sustainability depicted in 7 (seven) attributes. Figure 8 shows Rap-Riverside

Settlement ordination analysis result in technology dimension resulting in sustainability index score average of 44.85 (less sustainable) in details of upper part, middle part, and lower part by score of 39.78, 48.00, and 46.77 respectively.



Picture 8. Technology Dimension Ordination Chart

Based on leverage analysis result shown in Figure 5, there are 3 of 7 attributes sensitive to affect on technology dimension sustainability index score consisting of (1) dense waste management

technology availability by score of 6.59, (2) land conservation technology availability by score of 6.46 and (3) wastewater management installation availability by score of 6.11.

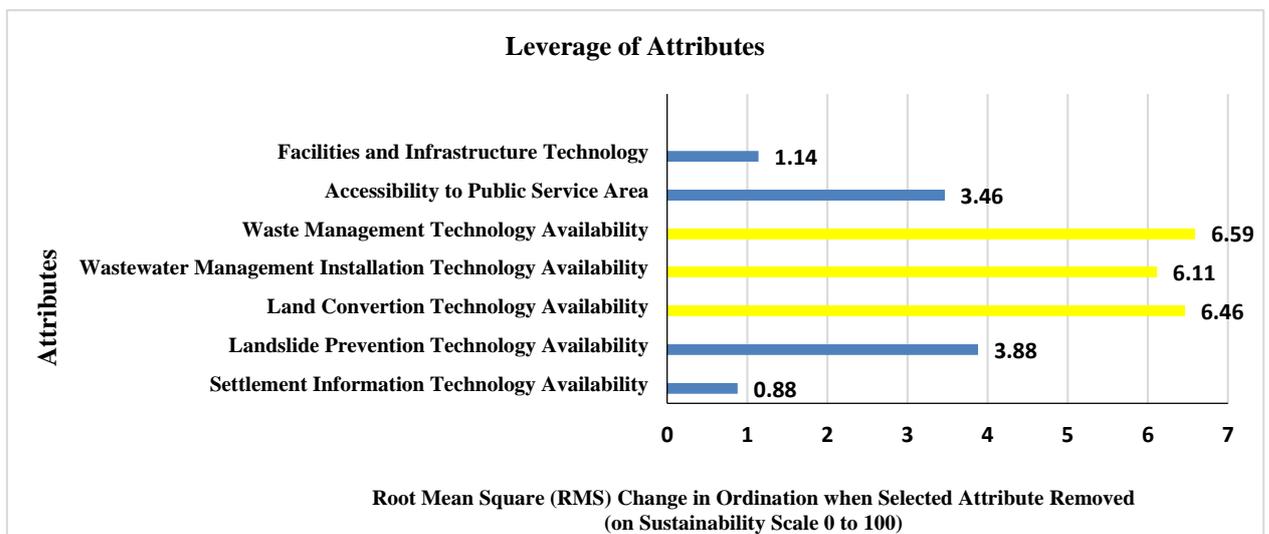


Figure 5. Technology Dimension Leverage Attribute

Furthermore, there are 16 leverage of attributes derived from analysis of 42 attributes for those 5 dimensions (ecology, economy, social, institution, and technology) shown in Table 5.

Table 5. Sustainability Settlement Leverage of Attribute

| No  | Dimension  | Leverage of Attribute  | RMS  |
|-----|------------|--|------|
| I   | Ecology    | 1. Land conversion into built land                                 | 2.11 |
|     |            | 2. Settlement Arrangement (distance from river)                    | 2.07 |
|     |            | 3. Waste Management  | 1.70 |
|     |            | 4. Green open space availability                                   | 1.58 |
| II  | Economy    | 5. Settlement restoration fund availability                        | 7.74 |
|     |            | 6. Population prosperity improvement                               | 6.73 |
|     |            | 7. Population income   | 6.02 |
| III | Social     | 8. Population density  | 1.78 |
|     |            | 9. Low income total population                                     | 1.42 |
|     |            | 10. Population participation in environment management             | 0.80 |
| IV  | Instituion | 11. Mechanism simplicity of development permission                 | 4.27 |
|     |            | 12. Interarea cooperation  | 4.21 |
|     |            | 13. Coordination in infrasctructure restoration of settlement area | 4.14 |
| V   | Technology | 14. Dense waste management technology availability                 | 6.59 |
|     |            | 15. Land conversion techonology availability                       | 6.46 |
|     |            | 16. Wastewater management installation technology availability     | 6.11 |

## VI. CONCLUSION

Sustainability status of Cikapundung riverside settlement area is in less sustainable category by score of 48.65. Sustainability status ranking of each dimension is economy by the highest score of 56.59 (moderate sustainable), social by score of 50.92 (moderate sustainable), technology by score of 44.85 (less sustainable), and institution dimension by the lowest score of 39.74 (less sustainable). There are 16 of 42 attributes sensitive to affect on increasing sustainability index of Cikapundung riverside settlement area. Those attributes are 4 attributes in ecology dimension, 3 attributes in economy dimension, 3 attributes in social dimension, 3 attributes in institution dimension, and 3 attributes in technology dimension.

## VII. Suggestions for Settlement Area Arrangement and Future Research

For increasing sustainability status of Cikapundung riverside settlement area, we suggest to prioritize attributes improvement focusing on sensitive attributes improvement. These sustainability index scores only represent condition in 2019, therefore the dynamic could not be described. Hence, attributes choosing and their dimension will be underlied on attribute

progressivity in study period if there is upcoming research about sustainability status score.

## ACKNOWLEDGMENT

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# Extent of Protection of Lives and Properties of Community Members by the Vigilante Security Group in Abia State, Nigeria.

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**Abstract:** *The study examined the extent vigilante security group protects lives and properties in Abia State. A research question and a null hypothesis guided the study. Using purposive sampling technique, 726 respondents comprising of 648 Town Union Executives (TUEs) and 78 policemen in 10 local government areas with registered vigilante units were selected for the study. Questionnaire was the tool used for data collection. Data were analyzed using mean and t-test statistics. The results revealed that the vigilante protects lives and properties of community members to a high extent in the war against crime. Based on the findings, it was recommended among others that the government should establish vigilante units at the local government areas where the units are nonexistent. This is because the vigilante security group has been found to be serving a useful function and complimentary to the police in protecting lives and properties as well as reducing the fear of crime among community members.*

**Index Terms:** *Protection, Lives and Properties, Community members and the Vigilante.*

## Introduction

Protection of lives, properties and welfare of citizens is a crucial matter in every society because it plays a critical role in the overall wellbeing and development of any society. It is considered as foremost in the developmental strides in any progressive society because a country which is devoid of security and safety will eventually be doomed and may go into extinction. For existence to be meaningful, lives and properties have to be valued and secured. As enshrined in the fundamental human right, every individual has the right to life and property. Right to life should be guaranteed to citizens by providing social welfare and security for the common good of the people. In pursuant of the fundamental human right, the Nigerian constitution (1999, Section 33 as amended) states that welfare and security of the citizens shall be the primary responsibility of the government. It is therefore a constitutional duty of the government to protect lives and properties of the citizens irrespective of their religion, ethnic or political affiliations (Louis-Udeh, 2018).

Protection of lives and properties in this paper implies shielding someone from danger, pain, discomfort, harm, threat or disease. It further implies providing devices or approaches which could guard a person or community members against a broad range of hazards which may include crime, violence and other emergency situations such as the present covid-19 pandemic, Cattle herdsmen, bandits, armed robbers and kidnappers.

Protection of lives and properties in any nation is paramount because a peaceful and secured society provides peace of mind, attracts investment, economic growth and development while insecurity causes stress, poverty, diseases, hazards, unemployment and poor investment which seems to be the case in Nigeria at the present time. Obodoechina (2017) stressing on the importance of security noted that any nation which does not pay attention to the overall well-being of life and properties of her citizens does not deserve to exist. In line with the notion of Obodoechina, it is the view of this paper that every government should take appropriate measures to safeguard lives and properties of her citizens.

In Nigeria, in pursuant to the objective of safety of lives and properties, the Nigerian police force was set up in the year 1889 by the British colonial administration (Okeke as cited in Elekwa, 2019). This was done not to undermine the efforts of ‘ndinche’ community guards or neighbourhood watch existing in the Southeast Nigeria at that time (Ajayi, 2007). However, unfortunately, the colonial police were neither used as an agent for promoting the rule of law, human rights, community safety nor delivering social services, rather, it was used more as an instrument for riot control, oppression and suppression of community members (Chukwuma 2000; Garba, 2012; Nwanze, 2014;). The body also serves personal interests of the elites and politicians (Yahaya, 2019). This development alienated the police from the people and caused disconnect, suspicion and distrust by the people for the police. This led

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to rising wave of insecurity which threatened the corporate existence of the country (Ewetan 2011). This level of insecurity caused enormous loss of lives and properties and created an atmosphere of fear and tension in the country (Obidiegwu & Elekwa, 2019) which compelled many states in Nigeria to start taking up their security responsibilities in their own hands by setting up vigilante security groups. Vigilante security group can be defined in this study as an informal security group which works at the grass-root to complement and supplement the efforts of the police in different societies in fighting crime. As noted by Alemika and Chukwuma (2004) and Yahaya (2019) the emergence of the Vigilante Security Group is in response to the community members' quest for safety and security of lives and properties which may be seen as a welcome development in different societies. However, Silke (2001) observed among other issues that sometimes vigilantes embark on unlawful punishment of alleged wrong-doers and oftentimes their perception of what constitute deviant behavior is not shared by the legal system.

In order to actualize the dire need for safety of lives and properties of members, Abia State of Nigeria set up vigilante security group in the year 2002 in order to supplement and compliment the efforts of the police and abate crime. In the light of the continuing critical situation of distrust and suspicion between community members and police, some agencies (Everbridge, 2020; National Institute of Justice, 2020) observed that a good rapport between community members and police would promote partnership and provide problem solving techniques to proactively and intelligibly abate insecurity for public safety. This agrees with Travis (2005) who noted that increase in police and vigilante surveillance and partnership allows the police and the vigilante to gain knowledge about the issues or problems plaguing a community or increased synergy. According to Obidiegwu and Elekwa (2019), protection of lives and properties in any country is actualized when it involves inclusive and participatory strategies involving the formal and informal policing. This implies that if the government is not meeting the expectations of the people by providing security for them, citizens could share such responsibility for their common good which involves taking care of their security and other emergency situations which may threaten their existence through community policing. Furthermore, community policing emphasizes collaboration and proactive efforts by the citizens in order to nip crime at the bud and reduce criminal activities to its lowest ebb. In consonant to this view, Obeagu (2014) pointed out that community policing offers invaluable services towards protecting lives and properties of residents from armed robbers and thieves. Nevertheless, Musa (2016) expressed concern that in spite of the fact that Vigilante Security Group is charged with the responsibility of rendering lawful assistance to the Police in times of emergencies and threats, there are still incidences of crimes such as menace of cattle herdsman, house breaking and car theft which often occur during the daytime, perpetrated mainly by criminals who are residents and have knowledge of the security loopholes of their environment.

Presently in Nigeria and Abia state in particular, the rate of crime, violence and killings increases each day. The loss of lives is enormous and quite worrisome. Mutual suspicion among ethnic groups breeds antagonism and general mistrust among different ethnic groups (Folami, 2017). In Southern Kaduna and in different parts of Nigeria, killings by Boko-haram insurgents, bandits, cattle herdsman, kidnapping, armed robbery, rape occurs on regular basis. This situation, in addition to the global Covid-19 pandemic throws the nation into pandemonium and reveals more of the security and socio-economic gaps cutting across the entire nation. This unsatisfactory situation calls for continuous reinforcement of the vigilante security group and further determination of the extent the group protects the lives and properties of community members in order to fill necessary gaps in their performance for safety in the society.

In Abia State, the vigilante group was registered as a voluntary entity under the Abia state Nigeria law No.8 of 2002 and was officially known as Abia State Vigilante Group (ASVG). Since 2002, the ASVG has performed her function for 18 years and needs to undergo regular assessment following the opinion and perspective of different stakeholders so that any gap identified in her performance will be filled for a better society.

The respondents to this study comprised of town union executives, who represented the interest of the community members living in rural and urban areas as well as policemen working in different locations (Rural & urban communities) in Abia state. In order to enhance effective security of lives and properties of community members in Abia state, many efforts have been made to achieve effective security services and crime-free environment. However, the researchers still deemed it quite germane to embark on this study in order to determine the extent vigilante security group protects lives and properties of community members in Abia state so as to unravel the areas of their strengths and weaknesses which need improvement for greater effectiveness, decision making, action plan, policy making and implementation for public safety.

#### Statement of the Problem

Any progressive society is expected to exist with minimal incidences of crime and violence for peace of mind, increased investment and productivity among citizens. Presently in Nigeria, the volume of different kinds of crime has been quite overwhelming. The boko-haram militant group and herdsman continue to terrorize farmers and communities. Armed bandits parade as cattle herdsman. Kidnapping, raping and different kinds of crime is prevalent causing untold security challenges, poverty and unemployment to people. The situation is worsened by the ravaging covid-19 pandemic. As it presently stands high level of distrust and disconnect exist among community members and the police. Vigilante security group seems more reliable and trustworthy public security outfit as perceived by Yaqub and Olaniyi (2005); Onwuegbusi (2017); and Akin-Samuel (2018). It is therefore quite expedient that constant assessment of the vigilante security group be carried out for improvement of the group for sustainable protection of lives and properties by filling

identified gaps to enable the citizens have peace of mind and be productive. Hence, this paper seeks to determine the extent vigilante security group protects lives and properties of community members in the rural and urban communities of Abia state.

**Research Question**

The following research question guided the study:

To what extent does the vigilante security group protect lives and properties of community members in Abia State?

**Null Hypothesis**

The following null hypothesis was tested at 0.05 level of significance:

Town Union Executives and Policemen in both the rural and urban areas do not differ significantly in their mean ratings on the extent to which the vigilante security group protect lives and properties of community members in Abia State.

**Method**

The study adopted a descriptive survey research design. Purposive sampling technique was used to select 726 respondents comprising of 648 Town Union Executives and 78 Policemen. Two sets of instrument (For the TUES & Policemen) titled Vigilante Group Protection of Lives and Properties Scale (VGPLPS) was used for the study. Four point rating scale with the following response categories: Very High Extent (VHE 4 points, High Extent (HE) 3 points, Low Extent (LE) 2 points and Not at All (NAA) 1 point was used for data collection. The instrument was subjected to face and content validity. The reliability coefficient of the instrument was determined using the Cronbach alpha reliability coefficient. For testing the hypothesis, t-test was used. The reliability of the sections of the instrument was found to be high 0.72 and 0.70 for TUE and police respectively. Thus, the instrument was highly reliable. The data collected was analyzed using weighted mean. Decision rule was based on the true limit of the four point rating scale. Thus, any mean score that is up to 2.50 and above was seen as high extent of protection while mean scores below 2.50 was seen as low extent of protection. Null hypothesis was rejected if the t-cal was greater than the t-crit- at 0.05 level of significance, otherwise it was not rejected.

**Results**

The data collected were presented and interpreted in Table 1:

**Research Question:** To what extent does the vigilante protect lives and properties of community members living in rural and urban areas in Abia State?

**Table 1: Mean Ratings of the Respondents on the Extent Vigilante Security Group Protects Lives and Properties of community members**

| S/No | Items  | Tue<br>(N=648) | Police<br>(N=78) | Mean | Remark      |
|------|--|----------------|------------------|------|-------------|
| 1    | House breaking has been reduced since the inception of the vigilante in your community                         | 2.46           | 2.31             | 2.39 | Low Extent  |
| 2    | Killing of innocent people by criminals has been tackled by the vigilante in your community.                   | 2.47           | 2.68             | 2.58 | High Extent |
| 3.   | Early morning robbery of commuters has reduced in your community since the inception of the vigilante          | 2.49           | 2.96             | 2.73 | High Extent |
| 4.   | Frequent harassment of people by criminals has reduced in your community due to the presence of the vigilante. | 2.49           | 2.85             | 2.67 | High Extent |
| 5.   | Destruction of crops by herdsmen has reduced in your community due to the presence of the vigilante            | 2.48           | 1.83             | 2.16 | Low Extent  |
| 6.   | Human trafficking has reduced in your community due to the presence of the vigilante                           |                |                  |      |             |

|             |  |      |      |             |                    |
|-------------|--|------|------|-------------|--------------------|
| 7.          | Kidnapping has been combated by the vigilante in your community.         | 2.49 | 2.42 | 2.46        | Low Extent         |
|             |  | 2.43 | 2.99 | 2.71        | High Extent        |
| 8.          | Car theft has reduced since the inception of vigilante in your community |      |      |             |                    |
|             |  | 2.50 | 2.04 | 2.27        | Low Extent         |
| <b>Mean</b> |  |      |      | <b>2.50</b> | <b>High Extent</b> |

Table 1 shows that the mean scores of the respondents (TUE & the Policemen) ranged from 2.16 to 2.73 with a grand mean of 2.50 which is at the border line (With reference to the decision rule). This implies that the vigilante protects lives and properties of community members to a high extent in Abia State.

The analysis of the null hypothesis was presented as follows:

### Hypothesis

Town Union Executives and Policemen in both the rural and urban areas do not differ significantly in their mean ratings on the extent to which vigilante security group protects lives and properties of the community members in Abia State.

**Table 2:** t-test comparison on the extent to which the Vigilante Security Group Protects Lives and Properties of Community Members in Abia State

| Variable | N   | X    | SD   | DF | t.cal | t.crit | LS   | Decision |
|----------|-----|------|------|----|-------|--------|------|----------|
| TUE      | 648 | 2.47 | 0.04 |    |       |        |      |          |
|          |     |      |      | 76 | -0.16 | 1.96   | 0.05 | Not sig  |
| POLICE   | 78  | 2.51 | 0.02 |    |       |        |      |          |

Table 2 shows that at 0.05 level of significance and 76 degree of freedom, the calculated t-value (-0.16) is less than the critical t-value (1.96). Therefore, the hypothesis which states that the Town Union Executives and Policemen in both the rural and urban areas do not differ significantly in their mean ratings on the extent of protection of lives and properties of community members in Abia State was not rejected.

### Discussion of Results

The findings of the study revealed that the Vigilante Security Group in Abia State protects lives and properties of community members to a high extent, however, information provided in Table 1 shows that critical attention need to be paid to areas such as housebreaking, crop and human destruction by cattle herders, human trafficking and car theft. This implies that the presence and activities of the vigilante has helped in curbing criminal activities across the communities in the ten local government areas covered by the study. This finding of satisfactory performance by the Vigilante is in consonant with the findings of Yahaya (2019) which revealed that Vigilante took responsibility for crime control in Gezawa local government area of Kano State. The study by Yahaya further found that the Police in the State performed poorly which led to the formation of the Vigilante in the local government area. The emergence of the Vigilante Security Group is in response to the community members' quest for safety and security of their lives and properties (Alemika & Chukwuma, 2004).

In a similar finding, Onwuegbusi (2017) equally shows that the people of Anambra State were at home with the Vigilante though as the researcher noted, the Vigilante has their areas of weaknesses such as poor training and undue loyalty to political stalwarts because of monetary and selfish gains. Another study by Obidiegwu and Elekwa (2018) shows that community members perceive the Vigilante's performance as satisfactory and effective in curbing crime in Abia State which abates crime in the area. However, Silke (2001) noted that sometimes vigilantes embark on unlawful punishment of alleged wrong-doers and oftentimes their perception of what constitute deviant behavior is not shared by the legal system.

In addition, the view of this study on the benefit of partnership in community policing is in consonant with Obeagu (2014) who pointed out that in ensuring a more secured environment, community policing offers invaluable services in protecting lives and properties of residents from armed robbers and thieves. Community policing reinforces the safety of citizens because the vigilante and the police rely on community members for useful information or intelligence reports on emergency situations and difficult terrains. The test of the null hypothesis showed that there was no significant difference in the mean ratings of town union executives and policemen in both the rural and urban areas on the extent to which the Vigilante Security Group protect lives and properties of community members in Abia State. Thus, town union executives who represent the interest of community members and policemen

serving in the rural and urban areas agreed that the vigilante security group protects lives and properties of community members in Abia State. This implies consistency in their responses. This further implies that true dialoguing; liaison and partnership among the stakeholders in community policing could promote quality of discussion, negotiation, and collaboration. Furthermore, synergy of thoughts, sense of belonging and relationships could be fostered among the stakeholders who can come together to pursue a common course for sustainable safety and security in their communities.

### Conclusion

The Vigilante Security Group protects lives and properties of community members to a high extent in Abia State. Substantial efforts have been made by the vigilante and police in crime prevention and control in the rural and urban communities in Abia State, however, there is need to reinforce and re-strategize the group in some areas of safety need for sustainable state and national security.

### Recommendations

1. Community members should mobilize action for establishing vigilante units at the local government areas where the units do not presently exist. This is because the Vigilante Security Group has been found to play indispensable role in complimenting the efforts of the Police and protecting lives and properties in communities in Abia State.
2. The government should reinforce the functioning of the vigilante security group by providing state of the arts equipment, communication gadgets, patrol vehicles, motor bikes and other logistics for them, in order to meet international best practices; boost morals of the Vigilante and facilitate their efforts in combating crime. There should be some measure of reward and welfare packages to the members which could serve as incentive and motivation to enhance their services.
3. Government through the National Orientation Agency should embark on constant awareness campaign, public enlightenment and training to orient and reorient community members on issues of community policing and neighbourhood watch using sensitization and advocacy strategies such as jingles, fliers and bulk SMS. Train the trainer programme is also quite necessary for sustainable security to be achieved. Such training programmes for traditional leaders, president generals, leaders of market associations, youths and age grades will go a long way to reinforce Vigilante Security Group and the Police on crime prevention and control in communities in Abia State.
4. A co-coordinating platform for training vigilante and community leaders on criminal justice code, deviant behaviour and their penalties should be set up and maintained. This will foster fairness and justice in crime control mechanisms and equally help to promote the confidence of the community members on the vigilante in the rural and urban communities to the lowest level.
5. Traditional leaders, president generals and town union executives should permanently reside in their communities as chief security officers of their communities for easy liaison with the vigilante, police and state government on monitoring and dealing with security issues facing their communities.
6. Anti – criminal laws should be enforced. Those caught in criminal activities should face the wrath of the law. Members of the society who compromise criminal activities should be prosecuted and send to jail. Boko-haram insurgents should be prosecuted and issue of their rehabilitation jettisoned. Extortion of community members by the police or the vigilante should be duly punished for meaningful security to be achieved.

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# Statistical Downscaling Modeling with Kernel Ridge Regression for Rainfall Prediction in West Java

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**Abstract-** The Statistical downscaling (SD) is a technique of analysis using statistical model which can be used to predict local scale as response based on global scale data as predictors. The problem in SD is that the predictors are usually multicollinearity which can be overcome by ridge regression. Rainfall data are generally nonlinear, non-stationary and non-normal. A method that can be used to model the rainfall data is the kernel method. This study aims to apply SD using kernel ridge regression (RKR) for rainfall prediction and to compare the RKR and ridge regression (RR). The data used in this study are the monthly GCM (General Circulation Model) precipitation data with a 5×8 grid (2.5°×2.5° each grid) domain in 1981-2009 as predictor variables and the rainfall data at West Java in 1981-2009 as the response variable. The RKR model was better than RR model for rainfall prediction in West Java at one, two, and three years ahead. This fact was based on the RMSEP value of RKR was smaller than that of RR and the correlation of RKR was higher than that of RR.

**Index Terms-** statistical downscaling, kernel ridge regression, GCM, rainfall

## I. INTRODUCTION

Rainfall greatly affects the activities of human life. The diversity is quite large and characterizes the climate in Indonesia. Global climate change can increase the incidence of extreme rainfall. Analysis is needed to obtain rainfall prediction information that is very useful to reduce the impact of possible extreme rain events.

Statistical downscaling (SD) is an analytical technique with a statistical model that can be used to predict local scale rainfall based on global scale data. Local scale data is used as response variable (rainfall data) with global scale data as predictor variable (Global Circulation Model (GCM) output precipitation data). In general, the basic idea of SD is to estimate the parameters of the relationship between global scale climate variables and local scale climate variables, which are then used for local scale climate predictions.

The problem that commonly occurs in SD is the GCM domain grid, which is a predictor variable containing multicollinearity. This problem can be overcome, among others, by ridge regression (RR). Ridge regression is used to overcome multicollinearity problems through modification of the least squares method (Neter, Wasserman and Kutner 1990 in Herwindiati 1997).

Rainfall data as a response variable is generally nonlinear, non-stationary and non-normal, so a method that does not require these conditions is needed. In overcoming this problem, the kernel method is often used because the kernel density estimator is flexible, mathematically easy to work with and has a relatively fast convergence rate (Wahba 1975)

Several studies related to SD include Hadijanti (2016) which examined daily rainfall in Sembalun Station by modeling the kernel nonparametric regression with the reduction method using the classification and Regression Tree (CART) algorithm. The result of his research shows that the statistical downscaling model of the monthly rainfall of Sembalun Station with the resulting Kernel nonparametric regression has consistency in prediction.

Predictions of extreme rainfall have been carried out by Santri (2016) and Mulyati (2018). The result of the research by Santri is SD modeling with quantile regression using the Least Absolute Shrinkage and Selection Operator (LASSO) for rainfall data in Indramayu Regency which result in a predictive value that is more consistent with changes in time when compared to the main component regression model based on the RMSEP criteria. The result of Mulyati's research is that SD modeling using kernel quantile regression model with GCM-lag predictor and kernel quantile regression model using the main components of GCM-lag produce relatively the same and consistent predictions in predicting extreme rainfall.

Based on the consideration that ridge regression can overcome multicollinearity and the kernel method is a method that does not require linear, stationary and normal data properties, in this study, SD modeling with kernel ridge regression (RKR) is carried out in this study. RKR modeling in this study uses the Gaussian Radial Basis Function (RBF) kernel. This study aims to apply SD modeling with kernel ridge regression to predict rainfall in West Java province and to compare the kernel ridge regression model with the ridge regression model.

## II. METHOD

### A. Data

Data used in this study is the GCM monthly precipitation data released by the Climate Forecast System Reanalysis (CFSR) with GCM domains measuring 5×8 grids (2.5°×2.5° for each grid) in 1981-2009. Local rainfall data in West Java province is used as a response variable that was issued by the Meteorology, Climatology and Geophysics Agency (BMKG) in 1981-2009. Local rainfall data in West Java province is divided into 2 parts based on plain elevation, namely lowlands (0-200 masl) and highlands (> 200 masl).

### B. Procedure of Analysis

Data analysis is performed using python 3 software. The stages in this study are as follows.

#### 1. Data preparation stage

- a. Identifying predictor variables obtained from the GCM output data and response variables obtained from the BMKG website.
- b. Combining the predictor variables and response variables into new data.
- c. Grouping the data into 2 parts, namely the lowlands (0-200 masl) and the highlands (more than 200 masl).
- d. Dividing lowlands data and highlands data into 2 parts, namely modeling data (rainfall data in 1981-2008, 1981-2007, and 1981-2006) and validating data (rainfall data in 2009, 2008-2009, 2007-2009).

#### 2. Ridge regression modeling stage

The RR model is as follows:

$$\hat{y} = X(X^T X + \lambda I)^{-1} X^T y$$

Ridge regression modeling is carried out on lowlands data and upland data with the following stages:

- a. Choose the optimum lambda value with the smallest cross validation value.
- b. Ridge regression modeling on modeling data based on selecting the optimum lambda and sigma values..

#### 3. The kernel ridge regression modeling stage (RKR)

The RKR model is as follows:

$$\hat{y} = Z Z^T (Z Z^T + \lambda I)^{-1} y$$

Ridge regression modeling is carried out on lowlands data and highlands data with the following stages:

- a. Transforming GCM output data by mapping  $\phi : \mathbb{R}^p \rightarrow \mathbb{R}^q$
- b. Using the kernel method (Gaussian kernel radius basis function) to solve vector multiplication
- c. Choosing the optimum lambda value and sigma value with the smallest cross validation value.
- d. Kernel ridge regression modeling on modeling data based on selecting the optimum lambda and sigma values.

#### 4. The model comparison stage

Comparing kernel ridge regression and ridge regression based on the root mean squared error prediction (RMSEP) value with the formula

$$RMSEP = \sqrt{\frac{1}{n} \sum_{i=1}^n (y_i - \hat{y}_i)^2}$$

and the correlation value between actual rainfall and predicted rainfall with formula

$$r_{y_i, \hat{y}_i} = \frac{n \sum_{i=1}^n y_i \hat{y}_i - (\sum_{i=1}^n y_i) (\sum_{i=1}^n \hat{y}_i)}{\sqrt{[n \sum_{i=1}^n y_i^2 - (\sum_{i=1}^n y_i)^2][n \sum_{i=1}^n \hat{y}_i^2 - (\sum_{i=1}^n \hat{y}_i)^2]}}$$

#### 5. Model consistency test stage

Test consistency of the model using RMSEP and Correlation

## III. RESULT

### A. Data Exploration

The highest average rainfall in the lowlands occurs in January, which is 274.56 mm/month with a minimum value of 118.58 and a maximum value of 415.67 and a standard deviation of 88.87. In the highlands, the highest average rainfall also occurs in January at 401.11 with a minimum value of 166.03 and a maximum value of 591.75 and a standard deviation of 108.62. This shows that January is the peak of the rainy season in the lowlands and highlands. This is inversely proportional to August, which has the lowest average rainfall on both plains.

Figure 2 shows that the box-line diagram forms the letter U. This shows that West Java province has a monsoon rain pattern. The monsoon rain pattern is a rain pattern that occurs in areas that have a clear difference between the rainy season and the dry season. Pribadi (2012) states that the rainy season has an average monthly rainfall intensity of greater than 150 mm/month. Therefore, November to April is the rainy season in the lowlands, and October to May is the rainy season in the highlands. The two plains have clear differences between the seasons.

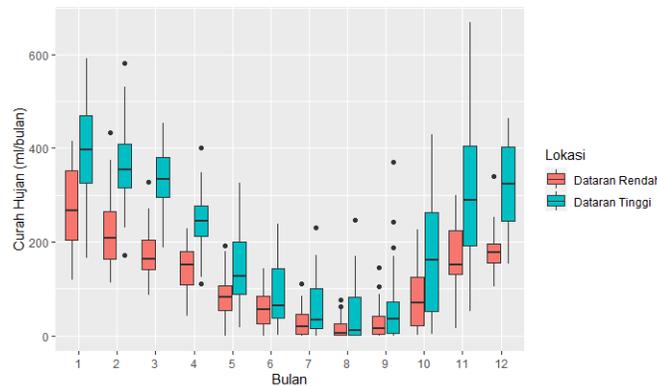


Figure 2 Box diagram of West Java rainfall

**B. Kernel Ridge Regression**

Kernel ridge regression is a combination of kernel method and ridge regression. The kernel function used in this study is the Gaussian Radius Basis Function (RBF) kernel function. The formation of the RKR model in the low and highlands uses the optimum  $\lambda$  and  $\sigma$  values. Determination of the optimum  $\lambda$  and  $\sigma$  is by selecting the minimum value from cross validation.

The optimum  $\lambda$  and  $\sigma$  values in the lowlands are 0.0001 and 150 for modeling data in 1981-2008, 0.0001 and 200 for modeling data in 1981-2007, 0.0001 and 150 for modeling in 1981-2006. The optimum  $\lambda$  and  $\sigma$  values are used to predict rainfall. Based on the prediction results, the obtained RMSEP value is quite small which is 25.08 for validating data in 2009, 40.86 for validating data in 2008-2009, and 45.71 for validating data in 2007-2009.. Moreover, correlation value obtained is very high which is 0.99 for validating data in 2009, 0.96 for validating data in 2008-2009, 0.95 for validating data in 2007-2009.

The optimum  $\lambda$  and  $\sigma$  values in the lowlands are 0.0001 and 100 for modeling data in 1981-2008, 0.0001 and 150 for modeling data in 1981-2007, 0.0001 and 200 for modeling data in 1981-2006. The optimum  $\lambda$  and  $\sigma$  values are used to predict rainfall. Based on the prediction results, the obtained RMSEP value is quite small which is 38.36 for validating data in 2009, 54.64 for validating data in 2008-2009, and 66.81 for validating data in 2007-2009.. Moreover, correlation value obtained is very high which is 0.98 for validating data in 2009, 0.96 for validating in 2008-2009, 0.93 for validating in 2007-2009. The small RMSEP value indicates that the predicted rainfall value of the RKR model has a small difference with the actual rainfall value, while the high correlation value indicates that the predicted rainfall pattern of the RKR model follows the actual rainfall pattern.

**C. Comparison of RKR and RR**

Rainfall prediction obtained by RKR will be compared with rainfall prediction obtained by RR. This comparison is done to see the prediction of a better model in terms of the smallest RMSEP value and the largest correlation. Table 1 shows the comparison of RKR and RR on the prediction of rainfall in the lowlands of West Java with validating data in 2009, 2008-2009, and 2007-2009.

Based on Table 1, it can be seen that the RMSEP value of the RKR model is smaller than the RR model. The RMSEP value of the RKR model is 25.08 for validating data in 2009, 40.86 for validating data in 2008-2009, and 45.71 for validating data in 2007-2009. The correlation value of the RKR model is greater than the RR model. This shows that for different validation data, the RKR model is better than the RR model for predicting rainfall in the lowlands of West Java.

Table 1 Comparison of RKR and RR models in lowlands

| Modeling Data | Validating Data | RKR   |             | RR    |             |
|---------------|-----------------|-------|-------------|-------|-------------|
|               |                 | RMSEP | Correlation | RMSEP | Correlation |
| 1981-2008     | 2009            | 84.29 | 0.97        | 25.08 | 0.99        |
| 1981-2007     | 2008-2009       | 84.71 | 0.88        | 40.86 | 0.96        |
| 1981-2006     | 2007-2009       | 93.39 | 0.93        | 45.71 | 0.95        |

Table 2 shows the comparison of RKR and RR in the prediction of rainfall in the West Java highlands with the validating data in 2009, 2008-2009, and 2007-2009. The RMSEP value of the RKR model is smaller than the RR model. The RMSEP value of the RKR model is 38.36 for valudating data in 2009, 54.64 for validating in 2008-2009, and 66.81 for validating data in 2007-2009. The correlation value of the average RKR model is greater than the RR model. This shows that in different validation data, the RKR model is better than the RR model for predicting rainfall in the highlands of West Java.

Table 2 Comparison of RKR and RR models in highlands

| Modeling Data | Validating Data | RKR    |             | RR    |             |
|---------------|-----------------|--------|-------------|-------|-------------|
|               |                 | RMSEP  | Correlation | RMSEP | Correlation |
| 1981-2008     | 2009            | 121.65 | 0.98        | 38.36 | 0.98        |
| 1981-2007     | 2008-2009       | 133.62 | 0.96        | 54.64 | 0.96        |
| 1981-2006     | 2007-2009       | 137.29 | 0.85        | 66.81 | 0.93        |

*D. Model Validation and Consistency*

The RKR model and RR model will determine which model is better in predicting rainfall. Figure 3 and Figure 4 show the RMSEP value and correlation for the RKR and RR models for prediction within one-year in the lowlands and highlands of West Java. Based on Figure 3 and Figure 4, the RMSEP value obtained by RKR is consistently smaller than the RR model in different validating data. Based on Figure 3, it shows that the correlation obtained by the RKR model is consistently greater than the RR model. Figure 4 shows that the correlation values obtained by the RKR and RR models are not significantly different. This shows that the RKR model is consistently better than the RR model for predicting rainfall within 1 year in West Java.

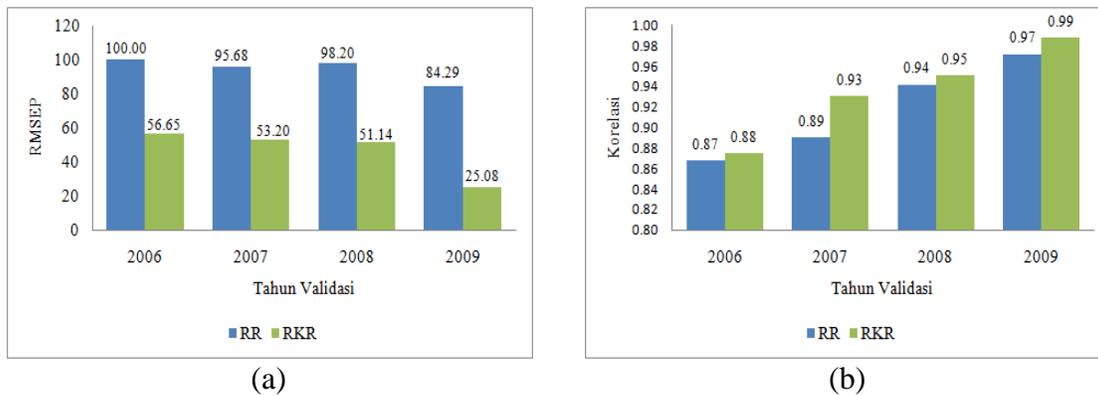


Figure 3 Bar charts of (a) RMSEP and (b) Correlations for the RKR and RR models in the lowlands of West Java for one-year prediction

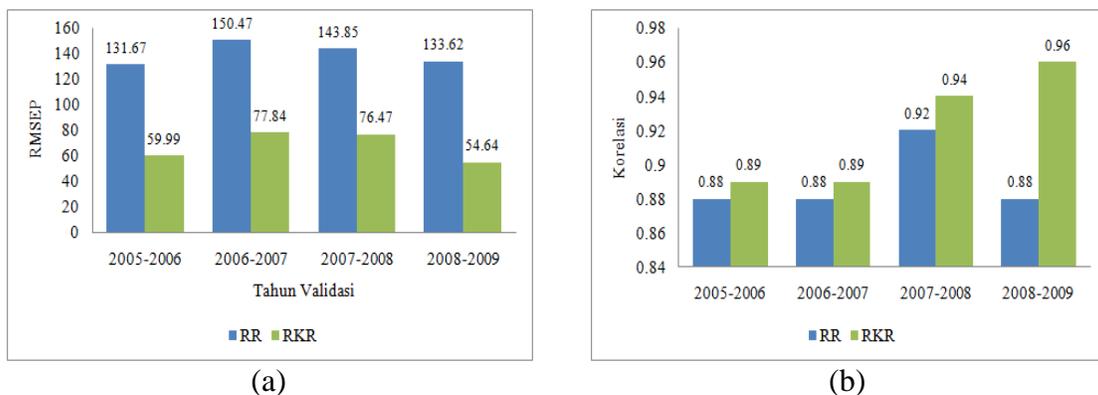


Figure 4 Bar charts of (a) RMSEP and (b) Correlations for the RKR and RR models in the highlands of West Java for one-year prediction

Figure 5 and Figure 6 show the RMSEP values and correlations for the RKR and RR Models for predictions over a two-year period in the lowlands and highlands of West Java. Based on Figure 5 and Figure 6, the RMSEP value obtained by RKR is consistently smaller than the RR model on different validation data. Figure 5 shows that the correlation obtained by the average RKR model is greater than that of the RR model. Figure 6 shows that the correlation values obtained by the RKR model and RR model are not significantly different. This shows that the RKR model is consistently better than the RR model for predicting rainfall within 2 years in West Java.

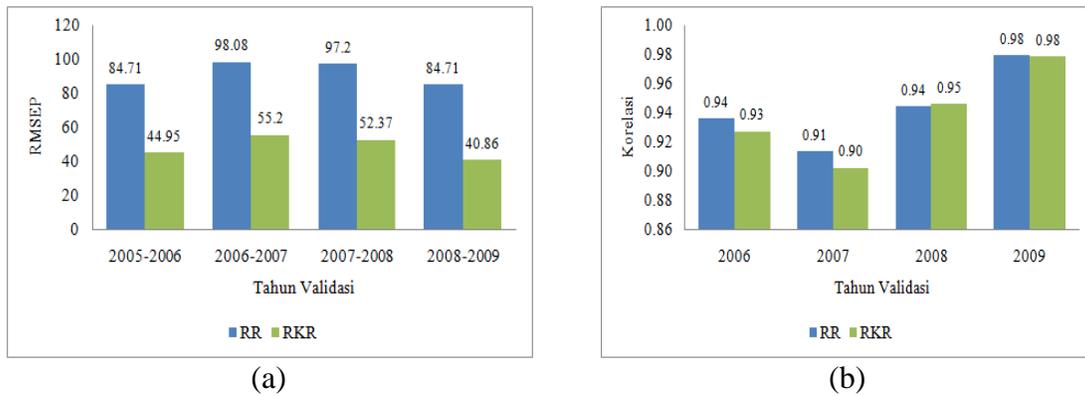


Figure 5 Bar charts of (a) RMSEP and (b) Correlations for the RKR and RR models in the lowlands of West Java for two-year prediction

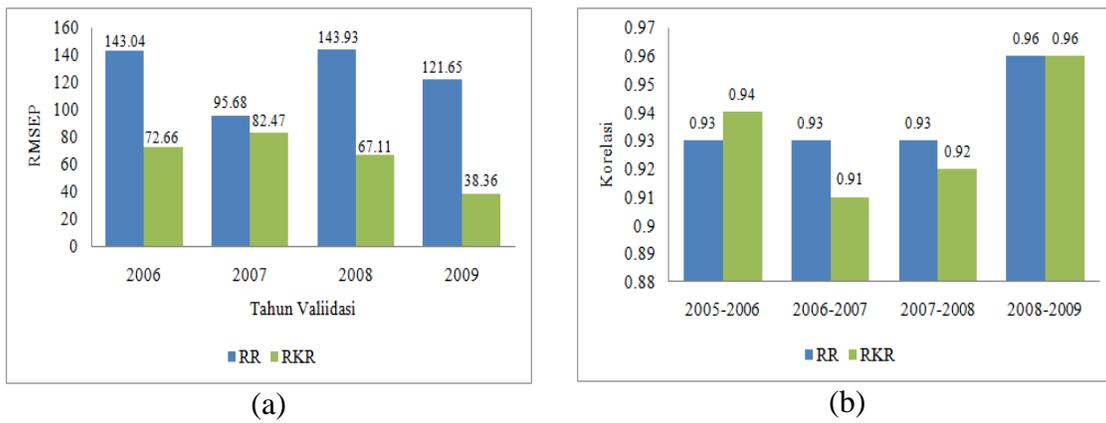


Figure 5 Bar charts of (a) RMSEP and (b) Correlations for the RKR and RR models in the highlands of West Java for two-year prediction

Figure 7 and Figure 8 show the RMSEP values and correlations for the RKR and RR Models for predictions over a period of 3 years in the lowlands and highlands of West Java. Based on Figure 7 and Figure 8, the RMSEP value obtained by RKR is consistently smaller than the RR model on different validation data. Based on Figure 7, it shows that the correlation obtained by the RKR model is consistently greater than the RR model. Figure 8 shows that the correlation value obtained by the average RKR model is greater than the RR model. This shows that the RKR model is consistently better than the RR model for predicting rainfall within 3 years in West Java.

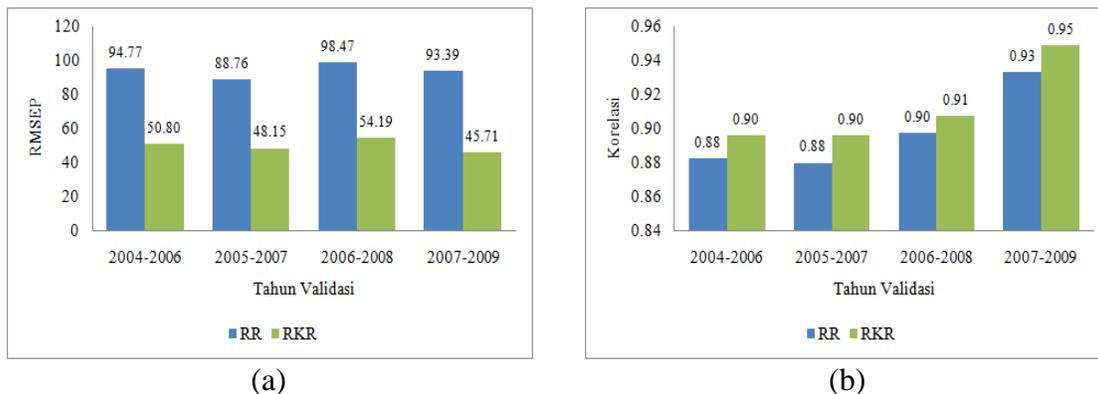


Figure 7 Bar chart of (a) RMSEP and (b) Correlation for the RKR and RR models in the lowlands of West Java for three-year prediction

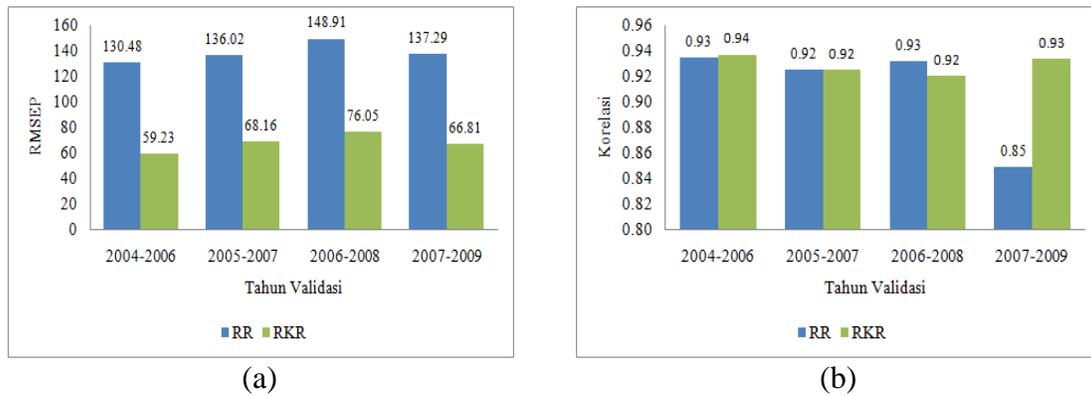


Figure 8 Bar chart of (a) RMSEP and (b) Correlation for the RKR and RR models in the highlands of West Java for three-year prediction

The consistency of the RKR model can also be measured from the standard deviation of the correlation value in the modeling data and validation data at different times. The smaller the standard deviation, the more consistent the model is (Wigena 2006). The standard deviation obtained by the RKR model for one-year predictions is 0.05 in the lowlands and 0.03 in the highlands. The standard deviation obtained by the RKR model for the two-year prediction is 0.02 in the lowlands and 0.02 in the highlands. The standard deviation obtained by the RKR model for the three-year prediction is 0.02 in the lowlands and 0.04 in the highlands. The standard deviation value obtained is very small. This indicates that the RKR model is quite consistent in predicting rainfall in West Java for the next one year, two years and three years.

#### IV. CONCLUSION

The RKR model is better than the RR model for predicting rainfall in West Java for the next one, two, and three years. This is based on the RMSEP value of the RKR model which is smaller than the RMSEP model of the RR and the correlation value of the RKR model which is greater than the correlation of the RR model.

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# Using Ensemble Learning for Diagnostics of Eye Diseases

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**Abstract-** Deep learning is the most widely used image recognition technology today, and it provides more insight into how computers can understand and learn from data. In deep learning, artificial neural networks analyze a large set of data to automatically detect patterns. In this article, we'll introduce some of these techniques to see how we can use deep learning to create our own model for diagnosing eye disease. When we talk about determining a diagnosis by medical imaging, we mean that we are going to explain some of the main areas of computer vision and how we can classify images data using convolutional neural networks, one of most important idea is the evaluation of model performance using ensemble learning. In this study, CNN, Vgg16 and Inceptionv3 networks will be compared in detail using ensemble learning. In our work, a convolutional neural network based on Keras and TensorFlow is implemented using python. 1692 images were used for classification, which contained four types of eye diseases (diabetic retinopathy, glaucoma, myopia and normal), including 1,200 for training, 246 for validation and 246 for testing. CNN, VGG16 and InceptionV3 networks are trained in Colab GPU processors with three different combinations of classifiers using bagging, boosting and stacking. All types of ensemble learning have been implemented and the result is obtained. We found that through ensemble learning we could achieve higher performance than we could achieve from any of learning algorithms alone. On the other hand, we used the confusion matrix in our experiments to show us where our classifier is confused when it makes predictions.

**Keywords.** Vgg16, eye diseases, ensemble learning, Diabetic retinopathy, Glaucoma, Myopia, bagging, boosting, stacking.

## III. Ensemble learning

Ensemble learning is a combining of a set of models in order to improve the model accuracy. Ensemble learning divided into simple ensemble techniques and advanced ensemble techniques.

## I. INTRODUCTION

In this part, we will review the concepts relating to eye diseases such as glaucoma, myopia and diabetic retinopathy and its detection. These diseases are the most common eye diseases, and leads to blindness if it is not detected early. In recent years, due to the development of information technology and artificial intelligence, the diagnosis of diseases of the human visual system has made significant progress. Considering the complexity and variety of functions, where the number of diagnostic equipment, tools, algorithms and methods are developed. Sometimes a doctor can detect a specific condition after the analysis of visual images. However, in some number of cases, a diagnosis unsuccessful, due to many reasons, for example, low experience, fatigue, various forms of similarity, poor image quality, etc. In these cases, We must use intelligent image analysis systems in order to diagnose eye diseases [1], [18].

Ensemble learning is a collection of machine learning models combined to produce better results. In our study, we will use ensemble learning to improve model performance and make better learners. It is not a new algorithm, but assembling together several different algorithms or several different models to create an ensemble learning to improve the model accuracy. over all, ensemble learning helps to reduce noise, bias and variance. As it shown in fig.1 ensemble learning used a set of learner algorithms to improve predictive performance. [2], [19].

## II. Problem statement

Eye diseases come in a variety of forms and are sometimes difficult for an optometrist to recognize and recognize. Therefore, information technology and artificial intelligent must be used to improve the existing system.

In our work, we will use ensemble learning to evaluate accuracy of three different CNN structures to determine eye diseases.

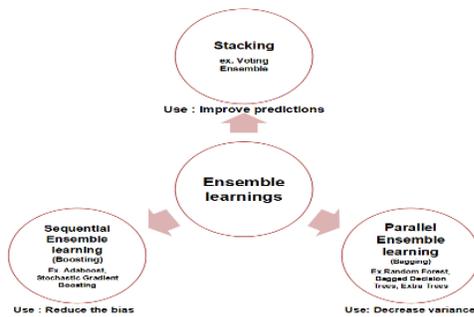


Fig. 1. Ensemble learning technique [5], [18]

A. Simple ensemble Techniques [3], [18], [19]

In this technique we use three different ways to predict:

- a. Max Voting: the idea of this techniques is all models makes prediction and the voting will be for each sample. The final predictive class will be highest votes.
- b. Averaging: It is creating and combining a set of models to produce a desired output. The output will be better performance than a given single model alone.

$$\tilde{y}(\mathbf{x}; \alpha) = \sum_{j=1}^p \alpha_j y_j(\mathbf{x}) \quad (1)$$

- c. Weighted Averaging: In this way, each member contribution to the final evaluated is weighted by the performance of the model. the formula of weighted average takes the form:

$$\bar{A} = \frac{\sum_i A_i e^{-\beta E_i}}{\sum_i e^{-\beta E_i}} \quad (2)$$

B. Advanced ensemble techniques [4], [15], [18], [19]:

- a. Bagging: This technique relies on a number of sub-datasets that we create, called bagging. Each bag containing a subset of the original dataset and a set of instances of random data with replacement. We use all bagging of our data to train all the models, obtain all results and implement the average or voting value as it shown in Fig. 2.

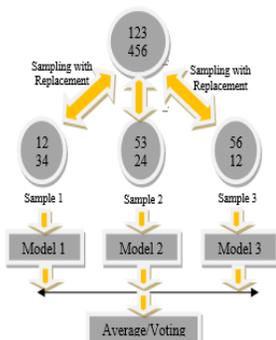


Fig. 2. Bagging example

- b. Boosting: in this technique attempts to improve the learners by focusing on areas where the system is not performing correctly. We train a sequence of models where more weight is given to examples that were misclassified by earlier iterations. Classification tasks are solved through a weighted majority vote and regression tasks are solved with a weighted sum to produce the final prediction as it shown in Fig.3. in boosting, each subsequent model try to correct the errors of the previous model.

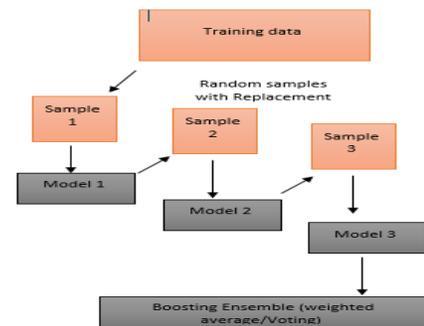


Fig. 3. Boosting example

- c. Stacking: As Fig.4. shows all models are trained in stacking based on all data set, and the output used as input features to train ensemble function. In our experiment we used logistic regression as a classifier.

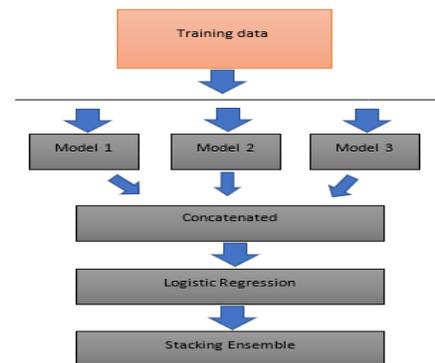


Fig. 4. Stacking example

Ensemble learning models are divided into three main category bases on their use, Table.1 shows the details.

Table 1. Types of ensemble learning based on the use [5]:

|  |         |          |          |
|--|---------|----------|----------|
|  | Bagging | Boosting | Stacking |
|--|---------|----------|----------|

|   |                    |                              |                     |
|---|--------------------|------------------------------|---------------------|
| Divide the data into subsets                | Random             | Prefer misclassified samples | Various             |
| The goal to be achieved                     | Minimize variance  | Increased predictive power   | Both                |
| The methods in which it is used             | Random subspace    | Gradient descent             | Blending            |
| The function of combining individual models | (weighted) average | Weighted majority vote       | Logistic regression |

#### IV. RELATED WORK

Ensemble learning has been used in many works using neural networks.

For example, Ju, Cheng, Aurélien Bibaut and Mark van der Laan. in their paper [6], they compared the empirical performance for some of the ensemble methods, such as, Neural network, VGG, GoogleNet and ResNet, including: Unweighted Averaging, Majority Voting, Bayes Optimal Classifier, Super Learner. The authors trained their models based on Same Network with Different Training Checkpoints, Ensemble of Same Network Trained Multiple Times, Ensemble of Networks with Different architectures, Learning from Weak Learner and Prediction with All Candidates. The results are obtained and achieved the best performance on testing set. All learners based on the CIFAR 10 data set. The unweighted averaging proved the best result when the performance of the base learners is comparable.

Huang, Jonathan, et al. [7] the authors used four different deep neural networks: Vgg12, ResNet50, AclNet, and AclSincNet in order to improve the accuracy of the models. All these models were pre-trained with Audio set data. The ensemble learning has been achieved in all these models and the experiment results were obtained over the validation set. The best result was achieved when all models combined together 83.01% through ensemble averaging.

Mo, Weilong, et al. [8] proposed image recognition algorithm based on ensemble learning algorithm and CNN structure (ELA-CNN) to solve the problem that single model cannot correctly predict. Bagging model has been used to train their different learners. The network structure used are combinations of ResNet, DenseNet, DenseNet-BC and Inception-Resnet-v2 architecture. In their work they used cifar-10 as a dataset. Among them, there are 60,000 color images. These images were divided into 50000 as a training set and 10000 as testing set. They used the average probability in their final result.

Kumar, Ashnil, et al. [9] An Ensemble of Fine-Tuned CNN for Medical Image Classification has been used to classification-based diagnosis, teaching, and biomedical research. The authors used 6776 as a training images and 4166 as test images. They used two different architectures of CNN, AlexNet and GoogleNet to images classification. The experiments have been obtained using individual models and ensemble methods. Finally,

the method achieved an accuracy that was consistent with the best accuracy among the other methods in ensemble method 96.59%.

Beluch, William H., et al. [10] investigate some recently proposed methods for active learning with high-dimensional data and CNN classifiers. They were compared ensemble methods against Monte-Carlo Dropout and geometric approaches. They found that the best result was obtained from ensembles, which are the basis for many learning algorithms of CNN such as, S-CNN, K-CNN, DenseNet, InceptionV3 and ResNet-50 for Diabetic Retinopathy classification. The dataset was used from MNIST, CIFAR and ImageNet. And they found that ensembles which are based on many active learning algorithms were the best result, and achieve a test set accuracy around 90% with 12,200 labeled images.

Minetto, Rodrigo, Maurício Pamplona Segundo, and Sudeep Sarkar. [11] Hydra: An Ensemble of Convolutional Neural Networks for Geospatial Land Classification in satellite image. Hydra is an initial CNN that is coarsely optimized, which will serve as the Hydra's body. In this article, authors created ensembles for their experiments using two state-of-the-art CNN architectures, ResNet and DenseNet. They demonstrated their application of the Hydra framework in two datasets, FMOW and NWPU-RESISC45. The final result ensemble achieved accuracy around 94.51%.

#### V. DATA DESCRIPTION

Kaggle is a data science site that contains a different of interesting datasets. You can find all kinds of datasets in its list [11].

I used my data from competition in kaggle Diabetic Retinopathy Detection and from iChallenge-GON Comprehension which is a very big dataset of large number of annotated retinal fundus images from both non-glaucoma and glaucoma patients.

Inside the dataset more than 35 types of eye diseases. We will reduce the dataset with the four types. The dataset is consisting of images of Diabetic retinopathy, Glaucoma, Myopia, and Normal eyes which provided as a subset of images from a dataset of 1692 Retinal Image as it shown in table.2. All the images were collected in total from Kaggle dataset and iChallenge-GON Comprehension, in high resolution images [17], [18], [19].



Fig. 5. Normal Fundus, Glaucoma, Diabetic retinopathy and Myopia All our images have been used as the input of CNNs structure. We split our dataset into training, validation and testing data; each type of images has an individual folder and each image has a filename that is its unique id. Python language were used to achieve the goal with Google colab.

Table 2. images of eye diseases

### VI. RESEARCH METHODOLOGY

The block diagram of our proposed methodologies is shown in Fig.6 and Fig.7. Each block is labeled and represents the processing steps. In our work we compared three different structures of CNN, VGG16 and InceptionV3 in order to evaluate individually and using ensemble learning in order to determine eye diseases.

Firstly, we need to analyze and preprocess data we have. Here are 4 folders which contain 1692 images of Diabetic retinopathy, Glaucoma, Myopia and Normal where 1200 images used for training, 246 images used for testing and 246 images used for validation. Next steps include choosing the right model architectures, training chosen models and then measure model performance with accuracy metric. With obtained results we can compare performance of different approaches: individual training and ensemble learning. In this paper we have used three methods to study to evaluate performance of our classifier: CNN model which consists of three hidden layers and pooling layers as it shown in Fig 6A, Pre-trained CNN based on VGG 16 algorithms using the last block layer training as it shown in Fig 6B, and Pre-trained CNN based Inception v3 algorithms using the last block

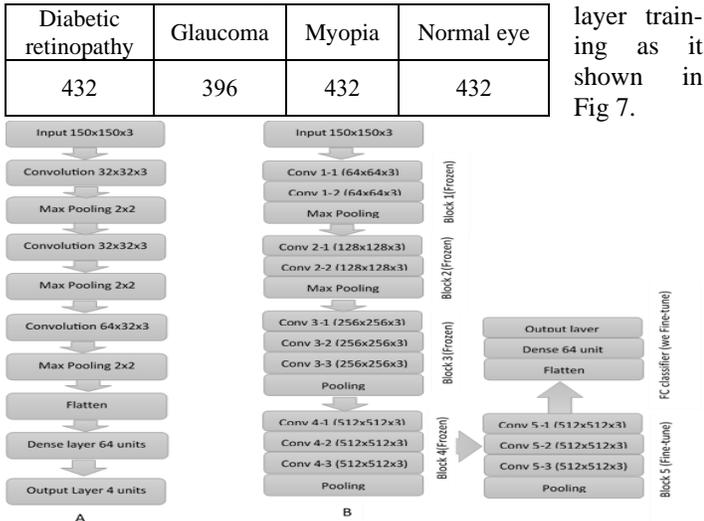


Fig. 6. CNN and VGG16 block diagram [18], [19]

#### A. Convolution Neural Network

Fig.6A shows convolutional layers, 150\*150 pixels has been chosen as the size of input image (RGB). We used 32 filter of size 3\*3 pixels to extract the features. The next layer is pooling layer, the size of windows we have used is 2\*2 pixels to minimize the size of images. Another convolution layer we have used is 32 filters with size 3\*3 and then max pooling size 2\*2 pixels. We used 64 filter of size 3\*3 pixels as the last convolution layers with pooling layer 2\*2 pixels. Finally, fully connected layer 64 units and output layer 4 unit to prediction. After the forward pass and adjust its filter weights through backpropagation, the network is able to calculate the loss function and update the weights [18].

| Function        | Formula                          | Derivative   |
|-----------------|----------------------------------|--|
| Weighted input  | $Z = XW$                         | $Z'(X) = W$<br>$Z'(W) = X$                                     |
| ReLU activation | $R = \max(0, Z)$                 | $R'(Z) = \begin{cases} 0 & Z < 0 \\ 1 & Z > 0 \end{cases}$ (3) |
| Cost function   | $C = \frac{1}{2}(\hat{y} - y)^2$ | $C'(\hat{y}) = (\hat{y} - y)$                                  |

$$*W_x = W_x - \alpha \left( \frac{\partial \text{Error}}{\partial W_x} \right)$$

↑ Old weight      ↓ Derivative of Error with respect to weight  
↑ New weight      ↑ Learning rate

#### B. VGG 16.

Is CNN architecture developed by Visual Geometry Group from oxford university in 2014. This model using a 16-layers, 224\*224 with three channels were used as the input images. The input images are passed through five blocks of convolutional layers. The five blocks layers were followed by three fully connected layers. The last layer is the output layer used for prediction. Fig.4B shows the block diagram of vgg16 [12], [18], [19].

#### C. Inception V3 [13],[14].

It is famous models consisting of 48 deep layers, one of the models that can be used for transfer learning and the ability of retrain the last layers of the model. As the fig.5 shown the inception layer is a comprised of set of layers [18], [19]:

- 1\*1 Convolutional layer.
- 3\*3 Convolutional layer.
- 5\*5 Convolutional layer.
- 1\*1 Convolutional layer before applying another layer used for dimensionality reduction.
- Max-Pooling layer.

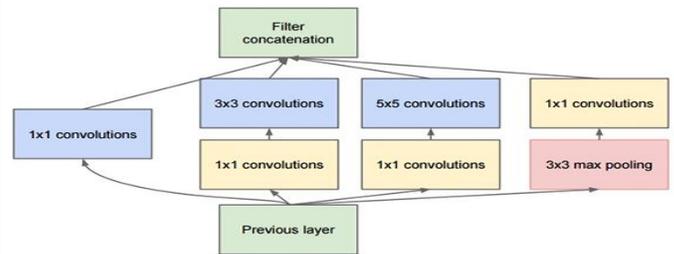


Fig. 7. Inception V3 block diagram

#### D. Confusion matrix.

It contains information about actual and predicted classifications which obtained from classification system. The performance of the systems is usually evaluated by the data in confusion matrix. It is the most common measures used to compare

the classifiers. In our work, we will use this matrix to compare the model's accuracy.

Accuracy: A measure of how much we predicted the classes correctly [18], [19].

$$\text{Accuracy} = \frac{TP}{TP+FP+FN+TN} \quad (5)$$

### VII. EXPERIMENTS AND RESULTS.

In our experiments, all the ensemble methods mentioned above have been deployed and the result obtained. The performance of all the ensemble methods were addressed including: bagging, boosting and stacking.

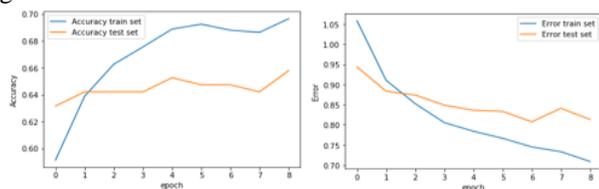
#### A. Results on models individually:

All the models mentioned before, namely CNN, VGG16 and InceptionV3 have been applied to eye diseases dataset as ensemble using bagging, boosting and stacking approaches. The result addressed in table.

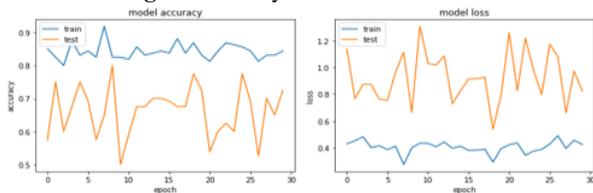
**Table 3.** Individual models accuracy

| Model              | Epochs         | Accuracy |
|--------------------|----------------|----------|
| CNN model          | Early stopping | 64.5%    |
| VGG-16 model       | 30             | 68.39%   |
| Inception-V3 model | 30             | 74.17    |

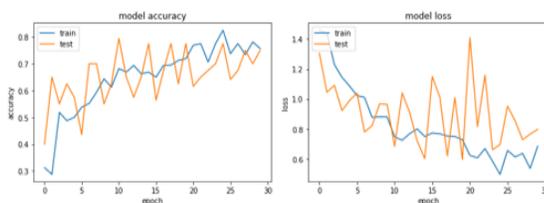
Table.3. shows the results we have obtained from the three individual models. These results were graphically represented in fig.8.



**Fig. 8.** Accuracy in CNN architecture



**Fig. 9.** Accuracy in VGG architecture



**Fig. 10.** Accuracy in InceptionV3 architecture

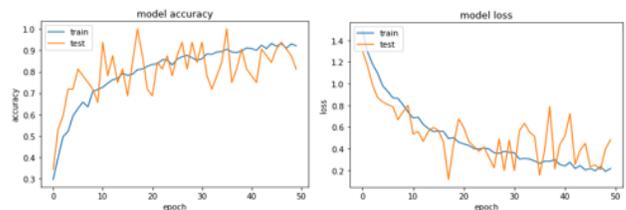
#### B. Results on three models using ensemble learning:

Ensemble learning of all the three models with different and the same structures have been applied, and the results obtained used bagging, boosting and then stacking. The performance was compared, and the results presented in Table.4 of each model.

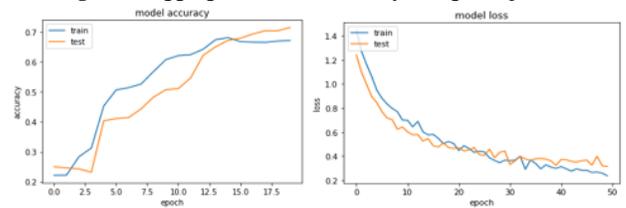
**Table 4.** Models accuracy using ensemble learning

| Model                             | Ensemble Types | Accuracy |
|-----------------------------------|----------------|----------|
| Three CNN models                  | Bagging        | 66.73%   |
|                                   | Boosting       | 60.45    |
| Three VGG16 models                | Bagging        | 69.19%   |
|                                   | Boosting       | 62.78    |
| Three InceptionV3 models          | Bagging        | 83.76%   |
|                                   | Boosting       | 67.45%   |
| CNN, VGG16 and InceptionV3 models | Bagging        | 73.22%   |
|                                   | Stacking       | 76.60%   |

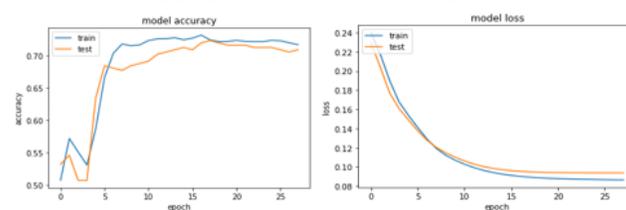
Table 4, shows the accuracy of ensemble learning networks according to the types of ensemble, bagging, boosting and stacking. These accuracies are graphically represented in the graphs below, where each structure of the model is represented with epochs and accuracies.



**Fig. 11.** Bagging ensemble accuracy using InceptionV3



**Fig. 12.** Bagging ensemble accuracy using three models



**Fig. 13.** Stacking ensemble models accuracy using three models

The graphs above have been compared according on accuracy, and we conclude that combining all different structure as a bagging ensemble gives the best accuracy 86.43 % as shown in Fig.12. in addition, using of confusion matrix in Fig.14. shows that all models are confused with Glaucoma and Normal when it makes predictions. Therefore, in order to optimize the classification, this problem needs to be solved.

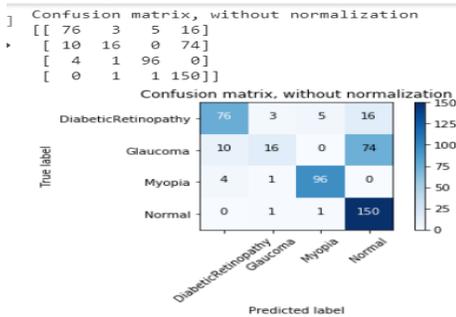


Fig. 14. Confusion matrix results

### VIII. CONCLUSION

Deep learning is becoming very popular these days for solving image classification problems. In this work, we applied three models for classifying multiple classes using ensemble learning. we found that ensemble learning with convolutional neural network models can outperform traditional methods based on learning algorithms alone.

The comparative has been applied between three models, CNN, VGG16 and InceptionV3 in order to measure the model's accuracy using two ways, individual and ensemble techniques, and to know the effects of model's assembly on classification compared with learning algorithms alone. We implemented the fine-tuning and data augmentation to increase the accuracy of experiments in the test set. Python language with google colab have been used to compare these models. The results were obtained for each combination and observed that ensemble learning gives better results relying on the problem in your own learner. Bagging is used if your learner suffers from variance, boosting is used to reduces bias and stacking minimizes both variance and bias. Fig.12 shows the best results we obtained in bagging ensemble when we combine three different architectures. That means ensemble learning with multiple learner algorithms obtains better predictive performance than could be obtained from constituent learning algorithms alone.

We used CNN consisting of 3 hidden layers which has poor accuracy compared to the other models. Therefore, the authors recommend to use deep learning networks such as AlexNet or ResNet with Inception V3 to obtain better accuracy. Due to the lack of precision in our experiments, we used the confusion matrix to know in which class our models were confused. The confusion matrix shows us that all classification models in varying proportions are confused with Glaucoma, as it shown in Fig.14. There-

fore, this problem needs to be corrected in order to optimize the classification.

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# Solid Waste Management Scenario in ULBs of Dakshina Kannada District and Recommendations

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## ABSTRACT:

The increase in population and the improved lifestyle of people around the globe are resulting in over exploitation of resources and also generating huge amount of wastes in terms of solid and liquid waste. As per the World Bank data available in 2016, global municipal waste generation is 2.01 billion tons per year. Dakshina Kannada district is the coastal district in the state of Karnataka, India with Mangaluru as its administration headquarters. The district has one of the highest literacy rates in Karnataka state. The 8 ULBs of the district generates around 410 Tonnes per day of municipal solid waste, around 58% of this waste organic or biodegradable in nature. Per capita waste generation ranges from 0.26 to 0.6 Kg per day. Solid waste collection efficiency is between 78-95%. This study aims at providing the existing scenario of solid waste management in Dakshina Kannada district, challenges being faced, financial analysis, recommendations and specific recommendations for waste management in Covid and Post Covid situation.

**Keywords:** Solid Waste Management, Dakshina Kannada, Mangaluru, Processing and Disposal, Covid.

## INTRODUCTION:

Solid waste management in India is a major problem for most of the Urban Local Bodies (ULBs) irrespective of the population and size due to increasing environmental pollution concerns, aesthetic concerns and resource crunch. The amount of solid waste generation is increasing day by day, by increasing urbanization and consumption patterns. There are no complete data or reports on quantity of municipal solid waste generated in India per day, the CPCB annual reports on status of implementation of MSW Rules for the years 2015-16, 2016-17 and 2017-18 are having incomplete with data from some states are missing. However, for a Lok Sabha question in 2018, it is stated that the total waste quantity generation in Urban areas is 1,45,626 TPD from 35 states and union territories. India is the third largest generator of municipal solid waste behind USA and China (What a Waste 2.0, World Bank Report, 2018).

Due to the land constraint and unscientific solid waste processing and disposal resulting in environmental issues, municipal solid waste management is becoming a major problem for the ULBs as well as the state and federal Governments. In this paper, the existing Solid Waste Management (SWM) Practices, Challenges faced in the ULBs of Dakshina Kannada District is highlighted along with the recommendation for improvement of SWM and action plans to be adopted in Covid situation. Solid Waste Management would be of prime objective in coming days for public hygiene. This is in line with the Government of India initiative under Swachh Bharat Mission. The ULB map of Dakshina Kannada District is given in Figure 1.

**Table 1: Salient Details of Dakshina Kannada District**

|                             |   |
|-----------------------------|---|
| Population                  | 20,89,649<br>9,96,086 (Urban Population around 47.67%)  |
| Literacy Rate               | 88.57%  |
| Urban Local Bodies          | City Corporation -1 nos.<br>City Municipal Corporations (CMC) -2 nos.<br>Town Municipal Corporations (TMC) -2 nos.<br>Town Panchayats (TP) – 3 nos. |
| Rainfall                    | 4000 mm average   |
| Per Capita income (2013-14) | Rs. 2,18,580  |

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**Source:** 1. District Census Handbook, Dakshina Kannada and 2. Economic Survey of Karnataka 2015-16.



**Figure 1: Study area of Dakshina Kannada District Map with ULBs**

**SOLID WASTE GENERATION:**

Total estimated solid waste generation of Dakshina Kannada district ULBs’ is around 410 Tonnes per day (as on the year 2016<sup>1</sup>). Highest solid waste generation in Dakshina Kannada district is accounted by Mangaluru City Corporation (MCC) with generation of around 331 TPD. The ULBs’ per capita solid waste generation ranges from 0.26 Kg per capita (Ullal ULB) to 0.60 Kg per capita per day (MCC) in the ULBs. The highest per capita generation in MCC may be attributed to its higher hostel population since it is an education hub and due to improved lifestyle and economic status of citizens (Vijay Kumar et al. 2013 and Economic Survey of Karnataka 2015-16) and urbanization of Mangaluru City. Remaining ULBs have the per capita generation rate as per the CPCB assessed national average for medium towns and cities which is in the range of 0.3-0.4 kg per capita per day. The details of waste generation of all 8 ULBs are given in Table 2.

**Table 2: Waste Generation of ULBs**

| Sr. No. | Name of ULB    | Population (2011) | Solid Waste Generation (TPD) (2017) | Per capita waste generation (in Kg per person per day) |
|---------|----------------|-------------------|-------------------------------------|--|
| 1       | Bantwal TMC    | 40155             | 14.5                                | 0.33   |
| 2       | Belthangady TP | 7746              | 3.2                                 | 0.35   |
| 3       | Mangaluru CC   | 499487            | 331                                 | 0.60   |
| 4       | Moodbidri TMC  | 29431             | 11                                  | 0.34   |
| 5       | Mulki TP       | 17286             | 6.6                                 | 0.35   |
| 6       | Puttur CMC     | 53061             | 18                                  | 0.33   |
| 7       | Sullia TP      | 19956             | 7                                   | 0.32   |
| 8       | Ullal CMC      | 53061             | 16                                  | 0.26   |
|         | <b>TOTAL</b>   | <b>720183</b>     | <b>409.3</b>                        | <b>Min: 0.26, Max: 0.6, Avg: 0.36</b>                  |

**SEGREGATION:**

Solid waste segregation is one of the important activities which need to be done at the source. Unfortunately, this is not happening 100% in any of the ULBs in Dakshina Kannada District. Moodbidri and Mulki being the highest with around 90% of Segregation,

<sup>1</sup> The solid waste management study was conducted by TATA Consulting Engineers Limited in the year 2015-16, the non-disclosure agreement with Dakshina Kannada District Urban Development Cell (DUDC) was completed in March 2020.

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Belthangady and Puttur have segregation of around 35%, Mangaluru has around 27% of Segregation and Sullia, Ullal and Bantwal have the least around 20-25% segregation.

### COLLECTION AND TRANSPORTATION:

Solid waste collection efficiency in Dakshina Kannada ULBs ranges from lowest 78 % in Belthangady TP to highest 95 % in MCC. Both the wet waste and dry waste are being collected on daily basis by the ULBs.

As per the Government orders, workers are being directly appointed from the ULBs and being utilized for sanitation activities like Street Sweeping, Collection, Transportation and Processing of waste. Mangaluru City Corporation has outsourced to private agencies through tenders to manage the solid waste activities. Solid Waste Collection efficiency is shown in Figure 2.

Transportation of solid waste is done by using Auto tippers, Mini Tippers and Tipplers in all the ULBs, the collection vehicles picture is depicted in Figure 3. The waste is transported daily to the processing and disposal site from the ULBs.

It is seen from the graph that the waste is being collected and transported efficiently and is more than the average collection efficiency for MSW in Indian cities and states which is about 70% (Shikha Saxena et al. 2010).

Though the ULBs are making all the efforts to cover solid waste collection in the entire city or town, due to resource constraints like number of vehicles, manpower, solid waste collection is not completely covered. Dakshina Kannada District being in Western Ghat region, the ULBs have many places which are inaccessible to vehicles which are situated on hillocks or places where access is very narrow, this can be attributed as one of the reasons for not covering 100% waste collection. Many of the places in outskirts of the ULBs use their biodegradable/ organic waste in the gardens or plantation areas.

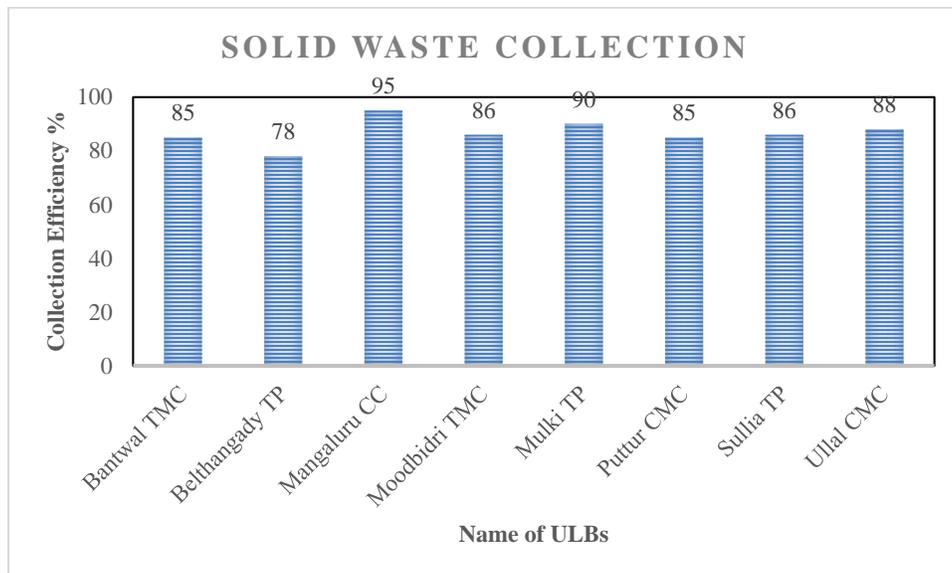


Figure 2: Solid Waste Collection Percentage



(a)



(b)

Figure 3: Solid Waste Collection by Vehicles a) Mangaluru City Corporation

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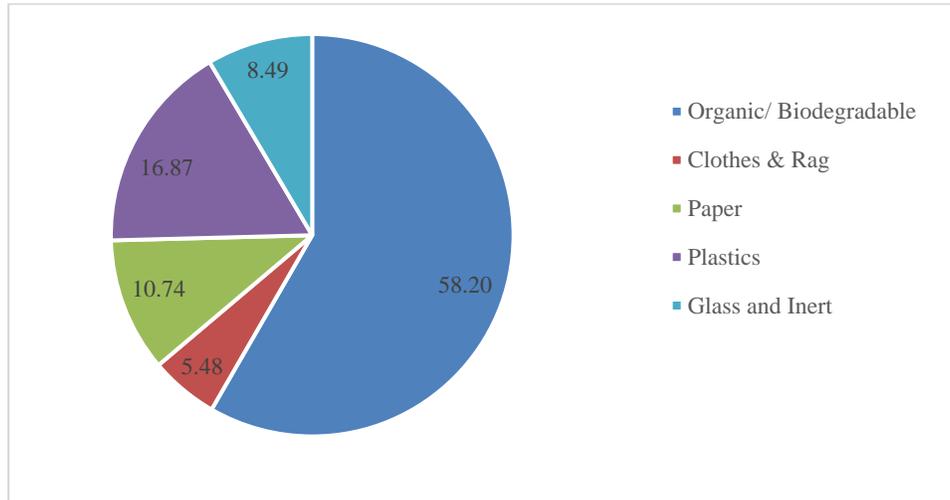
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**b) Sullia Town Panchayat**

**PHYSICAL COMPOSITION OF WASTE:**

The waste has been categorized as Organic waste, Cloths/ rag, Paper, Plastic and Inert wastes. Average composition of waste of Dakshina Kannada District ULBs includes 58.2% organic/ bio-degradable waste, 5.48% cloths and rags, 10.74% paper, 16.87% plastics and 8.49% Inerts. The waste composition is given in Figure 4. This shows that more than half of the waste is biodegradable and around 27% of the waste is recyclable. The physical composition of the waste is in line with the various similar studies carried out (Kapil Dev Sharma et al. 2018), 40%-60% organic waste and 10-25% recyclables in the studies by NEERI and similar study carried out from IISc Bangalore for Bengaluru City (Ramachandra T.V et al. 2014).



**Figure 4: Solid Waste Composition**

**PROCESSING AND DISPOSAL:**

Since Karnataka state was one of the early states to implement as per MSW Rules 2000 and had its own Solid Waste Management Policy, majority of the ULBs were identified with Solid Waste Processing Site/ Landfill site and required civil and mechanical infrastructures at Processing site. All the 8 ULBs except Ullal CMC have their own Processing and Disposal (P&D) sites in the ULB limits and they dispose the waste in the P&D site. Ullal CMC sends solid waste to MCC P&D site for processing and disposal. Bantwal TMC also sends solid waste to MCC P&D site for processing and disposal due to the litigation of its processing and disposal site. Both the Ullal CMC and Bantwal TMC pay tipping fee to MCC on tonnage basis for disposal.

ULBs have solid waste processing sheds for Windrow Composting and Vermi-compost pits for processing bio-degradable wastes and sanitary landfills for waste dumping. The details of ULBs’ P&D sites and available existing facilities are given in Table 3 below.

**Table 3: Details of Existing Processing and Disposal Sites**

| Sr. No. | Name of ULB    | Area of P & D Site (in Acres) | Facilities at P&D Site   |
|---------|----------------|-------------------------------|--|
| 1.      | Bantwal TMC    | 8.55                          | i.Sanitary Landfill  |
| 2.      | Belthangady TP | 3                             | ii.Waste receiving platform<br>iii.Vermi Compost pits<br>iv.Sanitary landfill  |
| 3.      | Mangaluru CC   | 77.93                         | i.Waste receiving platform<br>ii.Vermi Compost pits<br>iii.Windrow Platform<br>iv.Weighbridge<br>v.Sanitary landfill<br>vi.Leachate treatment plant<br>vii.Bio-methanation plant |
| 4.      | Moodbidri TMC  | 4.25                          | i. Waste receiving platform<br>ii. Windrow Platform<br>iii. Bio-methanation plant  |

| Sr. No. | Name of ULB | Area of P & D Site (in Acres) | Facilities at P&D Site  |
|---------|-------------|-------------------------------|---|
| 5.      | Mulki TP    | 2.46                          | i. Waste receiving platform<br>ii. Vermi Compost pits<br>iii. Sanitary landfill |
| 6.      | Puttur CMC  | 7.15                          | i. Waste receiving platform<br>ii. Vermi Compost pits                           |
| 7.      | Sullia TP   | 3                             | i. Waste receiving platform<br>ii. Vermi Compost pits                           |
| 8.      | Ullal CMC   | No Site                       | --  |

Moodbidri, Mulki and Mangaluru ULBs are practicing waste processing at the processing sites. The bio-degradable wastes are processed by windrow and vermi composting.



(a)



(b)

**Figure 5: Solid Waste Collection by Vehicles a) Vermi Composting at Mangaluru City Corporation  
 b) Screening of Vermi-Compost at Mangaluru City Corporation**

Since 2017, Moodbidri ULB is processing hotel waste and organic waste from vegetable and fruit market to Bio-methanation plant of 2.0 TPD capacity at the Processing and Disposal Site, Karinje.

Mangaluru City Corporation also has a 2 TPD Bio- methanation plant near Urva Market, the kitchen waste from the nearby hotels and hostels is being feed to the bio-gas plant.

Apart from these, most of the waste is being dumped in open in other ULBs without any substantial processing.

**FINANCIAL ANALYSIS:**

Based on the solid waste generation, existing available infrastructure in the ULBs, solid waste collection and processing facilities have been proposed including the Vehicles for Solid Waste Collection, Transportation and Processing, Equipment for Collection and Processing engaged in the SWM activities, Financial details are given in Table 4 . The vehicles and equipment are proposed as per Karnataka Solid Waste Normative Standards. The solid waste management proposals are made for design year of 2022.

Except for Mangaluru and Ullal, the cost per ton for the processing and disposal involving Conventional Aerobic Composting of solid waste are above the limits specified (Rs. 5 crores per 100 tons) by ‘Report of the Task Force on Waste to Energy, 2014’. This can be attributed to lesser waste generation in the ULBs, requiring all the resources for processing and disposal. Mangaluru CC has higher waste generation and also Mangaluru CC has completely outsourced the entire activities like street sweeping, collection and transportation for duration of 7 years and processing and disposal through outsourcing. Hence, the capital cost (capex) required is lesser. Since, Ullal is not having processing and disposal site and sending organic waste to MCC P&D site, the capital cost is less.

The cost of processing and disposal is higher for smaller ULBs, this shows that the centralized waste processing is ideal for cost efficient operation. However, the modalities of the centralized waste processing are to be developed and it is not practiced extensively in India.

Operation cost (Opex) is inclusive of the amount required for Collection, Transportation, Processing and Disposal including payment of salary, wages, vehicle and equipment maintenance, fuel required, electricity required

**Table 4: Financial Analysis of Capital and Operational Cost**

| Sr. | ULBs | Capex in Rs. Lakhs | Design | Per ton cost | Opex in |
|-----|------|--------------------|--------|--------------|---------|
|-----|------|--------------------|--------|--------------|---------|

| No. (1) | (2)            | Collection & Transportation (3) | Processing & Disposal (4) | Total (5) | Capacity in tons per day (6) | for Processing & Disposal in Rs. Lakhs (7)=4/6 | Rs. Lakhs (8) |
|---------|----------------|---------------------------------|---------------------------|-----------|------------------------------|--|---------------|
| 1.      | Bantwal TMC    | 63.27                           | 248.34                    | 311.61    | 17.20                        | 14.44  | 183.16        |
| 2.      | Belthangady TP | 22.14                           | 33.57                     | 55.86     | 3.48                         | 9.65   | 35.27         |
| 3.      | Mangaluru CC   | 0*                              | 1256.00                   | 1256.00   | 422.00                       | 2.98   | 4556.57       |
| 4.      | Moodbidri TMC  | 59.36                           | 148.45                    | 207.81    | 13.50                        | 11.00  | 153.82        |
| 5.      | Mulki TP       | 27.67                           | 106.61                    | 134.28    | 7.74                         | 13.77  | 82.50         |
| 6.      | Puttur CMC     | 119.13                          | 330.25                    | 449.38    | 22.00                        | 15.01  | 263.91        |
| 7.      | Sullia TP      | 20.07                           | 203.99                    | 224.06    | 8.62                         | 23.66  | 95.04         |
| 8.      | Ullal CMC      | 60.47                           | 27.75                     | 87.72     | 22.00                        | 1.26   | 165.27        |

Note: \* Mangaluru City Corporation has existing collection and transportation set-up from third party agency, hence, only up-gradation of the processing and disposal facility is proposed..

#### CHALLENGES BEING FACED:

1. Non-Segregation of waste at source by the public.
2. Unavailability of sufficient manpower and equipment for processing.
3. Less awareness of processing and disposal.
4. Lack of strong will power from political bodies.
5. Being a coastal district, there is good amount of fish, chicken and meat consumption. This also generates huge quantity of meat waste. In Mangaluru City Corporation alone, there is generation of around 30-40 TPD meat waste, which needs to be processed separately.
6. Dakshina Kannada district ULBs being rapidly developing due to economic improvement generates C&D waste. Mangaluru city generates around 20-30 TPD of Construction and Demolition waste, which is not processed or recycled at present.

#### RECOMMENDATIONS:

Recommendations for overall improvement in Solid Waste Management with various components of SWM are given in Table 5.

**Table 5: Recommendations for Improvement in SWM**

| Sr. No. | SWM Component                 | Existing Condition   | Recommendations   |
|---------|-------------------------------|--|---|
| 1.      | Collection and Transportation | <ul style="list-style-type: none"> <li>• Lack of source segregation in households.</li> <li>• No system of tracking Collection and Transportation vehicles.</li> <li>• No separate collection system for household Hazardous waste, Bio-medical waste and E-wastes.</li> </ul> | <ul style="list-style-type: none"> <li>• The source segregation of waste is to be encouraged and enforced more and more for the ease in waste processing.</li> <li>• GPS tracking to be provided for Collection and Transportation vehicles of ULBs.</li> <li>• Households and apartment complexes shall be asked to segregate the waste as Hazardous waste, Bio-medical waste and E-waste apart from the existing biodegradable and non-biodegradable wastes.</li> </ul> |
| 2.      | Processing and Disposal       | <ul style="list-style-type: none"> <li>• ULBs are practicing conventional Windrow and Vermi-Composting, requiring huge area and time consumption.</li> </ul>   | <ul style="list-style-type: none"> <li>• The conventional processing needs to be replaced with technologies like Waste to Energy (WtE), Incineration Refuse Derived Fuel (RDF) and Bio-CNG through wet waste produced. This requires policy intervention from State Government.</li> </ul>  |

| Sr. No. | SWM Component       | Existing Condition  | Recommendations  |
|---------|---------------------|---|--|
|         |                     |   | <ul style="list-style-type: none"> <li>MCC being a city with waste generation of around 350 TPD at present can opt for these technologies in PPP mode.</li> <li>Only dry wastes like paper, plastics, cloths etc., will increase the efficiency of WtE, Incineration and RDF processes.</li> </ul>   |
| 3.      | Policy Intervention | <ul style="list-style-type: none"> <li>There are no policies at present to incentivize the public/ residential or commercial complexes that are practicing organic waste processing on their own.</li> </ul>        | <ul style="list-style-type: none"> <li>Based on solid waste composition of the waste, it is seen that more than 50% of the waste is organic/ compostable in nature and people should be encouraged to process the organic waste in their premises using methods like pipe composting, pot composting, kitchen bin composting and usage of organic waste for garden areas.</li> <li>Individual households, Apartment Complexes and Housing societies practicing organic waste processing in their premises shall be exempted or given concession in SWM cess/ fee.</li> </ul>   |
| 4.      | Capacity Building   | <ul style="list-style-type: none"> <li>Lack of training and awareness.</li> <li>Effective IEC for source segregation.</li> <li>Lack of manpower, resources, will power and management of SWM facilities.</li> </ul> | <ul style="list-style-type: none"> <li>It was observed that most of the ULBs' officials/ engineers responsible or deputed for solid waste management are not trained on aspects of waste collection, transportation and processing strategies and their implementation.</li> <li>Citizens and municipal waste collection staff shall be trained and made aware on the segregation and its effect on waste processing.</li> <li>ULBs shall be provided with enough manpower and resources for municipal solid waste management.</li> <li>Periodic encouragement to efficient ULBs, officials and solid waste management staff is to be happened.</li> </ul> |

**RECOMMENDATION FOR THE STEPS TO BE TAKEN IN COVID AND POST COVID SITUATION:**

In the Covid era, the Solid Waste Management will require an overhaul from its traditional practices in terms of Solid Waste Collection and Processing.

**Table 6: Recommendations for Improvement in SWM**

| Sr. No. | SWM Component                 | Recommendations  |
|---------|-------------------------------|--|
| 1.      | Solid Waste Generation        | <ul style="list-style-type: none"> <li>There will be additional generation of Face masks, Gloves and Covid PPE kit used by people in residential and commercial areas, these wastes shall be sent to authorized Bio-medical waste incineration plants.</li> </ul>  |
| 2.      | Collection and Transportation | <ul style="list-style-type: none"> <li>Workers involved in collection and transportation shall be strictly asked to be equipped with required PPEs during solid waste handling.</li> <li>Waste generated from household with persons affected by Covid shall be handled with proper precautions using all PPEs and it shall be incinerated.</li> <li>Requirement of mechanical handling of solid waste avoiding human touch.</li> <li>Discontinue the practice of hand segregation of wastes, the segregation</li> </ul> |

| Sr. No. | SWM Component           | Recommendations   |
|---------|-------------------------|---|
|         |                         | and sorting shall be done by mechanical means.<br>• Provide hand sanitizers to the waste collection and transportation workers.   |
| 3.      | Processing and Disposal | • Workers engaged in processing site shall be routinely screened for Covid test.<br>• Workers shall be provided with and ensured to use required PPEs.<br>• Manual segregation of waste shall be discontinued at waste receiving and segregation platforms.<br>• Provide hand sanitizers and washing facilities to the workers. |

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# Determinants Of Inventory Management Practices On Service Delivery In Trans Nzoia County Level Four County Hospital, Kenya

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## Abstract

The purpose of the study was to establish the Determinants of Inventory Management on Service Delivery in Trans Nzoia County Level Four Hospital, Kenya. The analysis was focused on the respondents of the target population of the study. The specific objectives of the study were: Lead Time, Staff Competence, Records Management Practices and ICT Practices on Service Delivery in Trans Nzoia County Level Four Hospital. The study was anchored on the following theories; The EOQ theory, Transaction Cost Theory, Resource Based View Theory (RBV) and The Theory of Change. A descriptive research design was adopted. The target population was 200 respondents who comprised of employees from the following departments in Trans Nzoia Level four hospital; procurement, finance, pharmacist and administration department resource respectively. The researcher did a census survey. A sample and sampling technique was purposive, because the respondents had similar experience, skills and exposure. 10% pilot test was done to confirm the validity and reliability of the research instrument. Research instrument of this study were both structured and semi- structured. Data was collected with the assistance of two researchers assistant who were conversant with the problem under study. The collect data was analyzed with the help of Statistical Package for Social Science Version 24 and now its presented in a form of tables, pie charts, frequency and figures. The findings from the results conclude that Record management practices had the strongest correlation to service delivery ( $r = 0.357$ ), while the weakest relationship among the variables was found between information and communication technology and service delivery ( $r = 0.386$ ). Staff competence and record management practices were strongly and positively correlating with service delivery at correlation coefficient of 0.357 and 0.386 respectively. Service delivery significantly influences effort of respondents, most notably through the JIT shortening of lead time, staff competence, record management practices and the up-take of information and communication technology in all level four hospital in Kenya.

**Key Words:** *Inventory Management, Service Delivery, Staff Competence, Information and Communication Technology*

## INTRODUCTION

### Background of the Study

Procurement performance is an on-going, never-ending, integrated process requiring continuous reassessment and reformation. Procurement is the nerve center of performance in every institution, whether public or private and thus needs a tight system to be followed and adopted. Procurement performance measurement is the process by which procurement establishes criteria, based on strategic planning goals, for determining the results and quality of its activities. It involves creating a simple, effective system for determining whether the procurement is meeting its objectives (Wanyonyi & Muturi, 2015). This includes monitoring results, comparing to benchmarks and best practices, evaluating the efficacy and efficiency of the process, controlling for variances, and making adjustments to the process as necessary (Kerzner & Kerzner, 2017)

According to Ali *et al.*, (2007) County Governments, being service providers to the public, are not immune from pressure that drives organizations to be successful with the quality service that satisfy the customers and stakeholders. The last ten years saw an increased pressure on governments around the world to demonstrate efficient and effective use of the assets under their care. Inventory being one of the main assets owned by the county governments. County governments are the primary providers of services at the local level and communities judge their performance by the level of service provided.

The government of Kenya is initiating and developing its public service reform program through the introduction and institutionalizing of result based management in the public service. Result based management was adopted as a means by which the public service would begin to deliver targeted and timely results for Kenyans (Odette, 2014). Performance contracting has become a very important initiative to support the efforts of institutionalizing result based management. This tool has played an important role in improving service delivery. Service delivery is an indicator of performance entrenched in the performance contract.

Quality customer service is a touchstone of Government quality service initiative. Kumar (2018) stated that inventory management software in Indian hospitals has been important in ensuring that hospital or medical stores in India are kept precise

and updated. The well managed pharmaceuticals and surgical equipment, for example, has ensured that medical care is of high quality and appealing all over the world. Kumar (2018) further hold that inventory management and quality service are the most significant jobs for any health organization. Medicines and other hospital equipment are costly and hence important for healthcare hospital department to keep track of all the stock/inventory items. He however notes that hospitals face a number of challenges including; Shortage of pharmaceuticals, theft of surgical equipment, among other challenges.

According to Mensah (2015), Ghanaian hospitals have a high daily hospital attendance of patients which makes it necessary for the hospitals to buy and store both medical and non-medical materials for proper service delivery. She further states that this is however not the case always, thereby affecting service delivery to the patients. Ghanaian hospitals majorly suffer from shortages of items, overstocking non-medical stocks, huge amounts of obsolete stocks, and stock losses. Due to this, public Ghanaian hospitals have greatly lost reputation in the eyes of the public who seek services from these hospitals.

In recent years, major improvements in the way services were provided in Kenya had been put in place by defunct Local Authorities as part of renewed focus on customer services. The principles underlying customer service are courtesy, accessibility and fairness in how services are provided. Inventory consists of all goods owned and held for customer satisfaction. According to Yatundu et al (2016), Inventory is a necessary evil to any organization although there are various costs that accrue as a result of keeping inventory. Yatundu et al (2016) goes ahead to state that Inventories represent a sizeable investment and a potential source of waste that needs to be carefully controlled. Inventory Control is a means by which an organization's resources are put to economic use. Inventories require huge financial investments and hence need for contemporary financial controls and well-functioning financial audit systems meant to deliver key assurance to all stakeholders against corruption, waste and inefficiencies. When controls are found to contain weaknesses, management must choose among the following alternatives; increase supervision and monitoring and institute risk, inherent with the control weakness. County Governments in Kenya are created by an act of parliament, (CG Act. 2012.). There are 47 county Government in Kenya with Trans Nzoia being county number 026.

### **Statement of the Problem**

The need for devolved County Government to focus on service delivery in the health sector has been a subject of discussion all around the country by various researchers and government officials. In spite of the legal, policy and institutional reforms undertaken so far in the public health procurement sector in Kenya, county governments still find it hard to effectively manage the inventory (Koross *et al.*, 2016). United Nations (2013) indicated that over 65 percent of key government health projects in Kenya are being affected due to poor inventory management practices. This implies that only 35% of major health projects are successful due to effective inventory management in this country. This implies that despite efforts so far undertaken in the health project sector in Kenya, health projects are still unable to effectively deliver health services. The

inability to effectively manage inventory affect health project in the country consuming about 20% of the GDP and up to 60% of the annual budget (RoK, 2013) it is a serious problem given that health persons are the engine of a healthy nation, economic growth and development needed to move the country to a middle level economy as envisaged in the development blue print of Vision 2030 (ACEPD, 2011). According to World Bank report (2014) on the effective delivery of health project services in Kenya, it was established that 60% of the health projects were not performing well due to poor inventory management. This information is as reported by Koross *et al.*, (2016) in their project titled "Determinants of effective inventory management in health projects in Kenya: a case of Homa-Bay County." The issues included Lead time, Staff Competence, Records management Practices and ICT Application Practices. It is on this premise that the study seeks to find out if the determinants of inventory management have an effect on service delivery in Trans Nzoia County, specifically the level four county hospitals of the health sector in Trans Nzoia County.

### **Objectives of the Study**

#### **General Objective**

The general objective of this study was to establish the determinants of inventory management practices on service delivery in Trans Nzoia level four county hospital, Kenya

#### **Specific Objectives**

The specific objectives of the study were:

1. To assess the effect of Lead Time on Service Delivery in Trans Nzoia County level four hospital in Kenya.
2. To determine the effect of Staff Competence on Service Delivery in Trans Nzoia County level four hospital in Kenya.
3. To examine the effect of Record Management Practices on Service Delivery in Trans Nzoia County level four hospital in Kenya.
4. To assess the effect of Information and Communication Technology on Service Delivery in Trans Nzoia County level four hospital in Kenya.

### **Theoretical Framework**

#### **Agency Theory**

Agency theory is thought to be relevant for this study in understanding the effect of lead time on Service Delivery in Trans Nzoia County level four hospital in Kenya, hence it gives a theoretical background for this study. According to Jensen and Mackling (1976), an agency relationship is a contract under which one or more persons (principals) engages another person (the agent) to perform some service on their behalf, which involves delegating some decision-making authority to the Agent. Agency theory is concerned with agency relationships. The two parties have an agency relationship when they cooperate and engage in an association wherein one party (the principal) delegates decisions and/or work to another (an agent) to act on its behalf (Eisenhardt, 2009). The important assumptions underlying agency theory is that; potential goal conflicts exist between principals and agents; each party acts in its own self-interest; information asymmetry frequently exists between principals and agents; agents are more risk averse than the principal, and efficiency is the effectiveness criterion. Two potential problems stemming from these assumptions may arise in agency

relationships: an agency problem and a risk-sharing problem (Xingxing, 2012).

An agency problem appears when agents' goals differ from the principals' and it is difficult or expensive to verify whether agents have appropriately performed the delegated work (i.e. moral hazard). A risk-sharing problem arises when principals and agents have different attitudes towards risk that cause disagreements about actions to be taken (Xingxing, 2012). By their nature, buyers expect suppliers to provide good quality and to improve the quality of supplied products and/or services, but suppliers may be reluctant to invest substantially especially if they perceive that buyers are reaping all the benefits. The difference between buyers and suppliers will result in the two parties concerning themselves only with their self-interests (Xingxing, 2012).

The agency theory is widely used in procurement, Cliff Macure and Eric Prier did a study on using agency theory to model cooperative public purchasing and the operational linkages between government organizations, their purchasers, and their suppliers are vied as important contributors to the success of government policy and decision-making. Although cooperative purchasing has been a topic of study for many years (Wooten, 2003), researchers revisited issues related to cooperative public purchasing (CPP) in search of more clarification on with respect to its theoretical underpinnings (Aylesworth, 2003). Dixit (2002) consider that although the procurement official might believe that the actual purchase is an outcome, the purchase is merely considered an action from the viewpoint of the stakeholder for whom the purchase was made. In other words, the level of analysis is important in determining what behavior is an action as opposed to an outcome. Another reason why agency theory is a fruitful method for modeling public purchasing performance is that it helps to identify the various incentives of the stakeholders. By clarifying the opportunities and constraints they face, there is hope that efficiency, effectiveness, and accountability will be increased. This theory explains that procurement managers in the public sector play a relationship role. According to this theory, procurement managers including all civil servants concerned with public procurement must play the agent role. Therefore, procurement managers take on the role of agent for elected representatives. This theory holds that shirking is likely to occur when there is some disagreement between policymakers and the bureaucracy.

### **Theory of Reasoned Actions (TRA)**

Theory of Reasoned Actions (TRA) is considered to be relevant for this study in order to understand the effect staff competence on service delivery in Trans Nzoia level four hospital, Kenya, hence it gives a theoretical background for this study. The second most cited theory was the Theory of Reasoned Actions (TRA). The theory originates from social psychology, and it is a special case of the Theory of Planned Behavior (TPB) (Ajzen, 2010). Fishbein and Ajzen (1975) developed TRA to define the links between the beliefs, attitudes, norms, intentions, and behaviors of individuals. The theory assumes that a person's behavior is determined by the person's behavioral intention to perform it, and the intention itself is determined by the person's attitudes and his or her subjective norms towards the behavior. The subjective norm refers to "the person's perception that most people who are important to him think he should or should not

perform the behavior in question" (Fishbein and Ajzen, 1975, 302). Ajzen and Fishbein's (1980) book is focused on the prediction and understanding of human behavior to help in solving applied problems and making policy decisions. The authors state that TRA is applicable, for example, when studying consumer behavior, women's occupational orientations, or family planning behaviors. In these studies TRA was used to compare it with TAM (Davis et al., 1989, see above), or in combination with DOI (Karahanna et al., 1999). For example, Karahanna et al. (1999) examined users' pre-adoption and post-adoption beliefs and attitudes by combining aspects of TRA and DOI.

### **Theoretical Contexts of Records Management Theory.**

Theoretical contexts of records management theory is considered to be relevant for this study in order to understand the effect information and communication technology on service delivery in Trans Nzoia level four hospital, Kenya, hence it gives a theoretical background for this study. By "theoretical context" we mean a broader area of theory into which records management theory fits. There can be many such theoretical contexts. We will mention just three. Functional context; Records management serves a firm or other organization. Therefore, the *mission* of a records management service needs to be related to and supportive of the mission of the organization as a whole. The *role* of the records management program needs to be articulated with the roles of other parts of the organization: the roles, needs, and activities of employees needing access to records; the roles of other information-related programs such as Management Information Systems, data processing, the library, and the archives. In other words, records management theory is likely to be sterile or incomplete unless it is related to a view of the organization as a whole. More than academic curiosity is involved. If we are to assert that the role of records management is important, then we need to have views on how a good records management program contributes to and supports the effectiveness of the organization.

Professional context; Records management can be seen as one member of a family of retrieval-based information systems. An Italian is not the same as a Briton, but they are both Europeans and share some things in common as Europeans. Archives, libraries, records management programs, and corporate databases are not the same, but they are all retrieval-based information services and so have some features in common as well as differences that make them uniquely different (Buckland 1982, 1991). Seeing records management as a member of a family of retrieval-based information systems is not new. This view was adopted in the "Documentation" movement early this century, especially in the writings of the Paul Otlet (1868-1944) (Rayward 1976, 1986). What we now call records management, Otlet called "administrative documentation" and he saw it as an important specialty in administration. He also included what we now call Management Information Systems as part of administrative documentation. Otlet wrote a number of papers on the subject and his ideas were implemented to a limited extent in Europe (Otlet 1923, 1930, 1934, 350-55; Rayward 1976, 160, 184)..Otlet viewed archives, bibliography, libraries, museums, and records management as parts of the broad field of "Documentation" or "General Documentation", or, as we might say now-a-days, information resource management. In 1923 he

wrote, somewhat prematurely, that administrative documentation was a branch of "general documentation," which was born from the convergence and then the fusion of bibliography, archive administration, and even museology (Otlet 1923, 13). Otlet was a major figure in his time but is now little known. His writings are only now beginning to appear in English (Otlet 1990).

However, the idea that there might be theoretical and practical benefit in seeing records management (and other sorts of information services) as part of a family of related information professions and of adopting a comparative approach has received attention recently in North America (Seibell 1987; Pemberton & Prentice 1990; Buckland, 1991). Intellectual context;. Another kind of context is what could be called the "intellectual context". Where did ideas in records management ideas come from and where have records management ideas gone to? Two examples can illustrate this point. One source of records management ideas is archival theory. Posner (1940) teased archivists for their penchant for tracing their roots to ancient Assyria. Perhaps that ancient archival activity is more accurately described as ancient records management (Walker 1989). Professor Duranti has recently summarized that aspect of the intellectual ancestry of records managers (Duranti 1989).

### Technology Acceptance Model (TAM)

Technology Acceptance Model is thought to be relevant for this study in understanding the effect of information and communication technology on Service Delivery in Trans Nzoia County Level Four Hospital, Kenya; hence it gives a theoretical background for this study. The most cited theory was the Technology Acceptance Model (TAM). Davis (1989) presented a theoretical model aiming to predict and explain ICT usage behavior, that is, what causes potential adopters to accept or reject the use of information technology. Theoretically, TAM is based on the Theory of Reasoned Action (TRA). In TAM, two theoretical constructs, perceived usefulness and perceived ease of use, are the fundamental determinants of system use, and predict attitudes toward the use of the system, that is, the user's willingness to use the system.

Perceived usefulness refers to "the degree to which a person believes that using a particular System would enhance his or her job performance", and perceived ease of use refers to "the

Degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, 320). In these articles TAM was used in three different ways, namely to compare different adoption models, develop extensions of TAM, or replicate the model. For example, Davis et al. (1989) empirically compared the ability of TRA and TAM to predict and explain the acceptance and rejection by users of the voluntary usage of computer-based technology; Venkatesh and Davis (2000) developed and tested a theoretical extension of TAM, referred to as TAM2, which explains perceived usefulness and usage intentions with the help of social influence and cognitive instrumental processes, and Adams et al. (1992) replicated Davis' (1989) study.

### Conceptual Framework

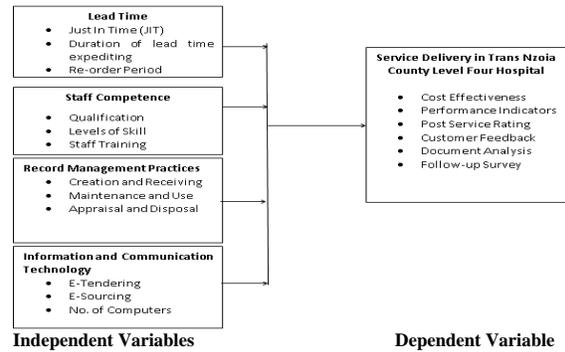


Figure 2.1: Conceptual Framework

### Lead Time Management

In the recent times, service providers have focused on speed as the basis of competitive advantage to gain customer satisfaction. The lead time is the measure of speed for delivering services. Lead time may be defined as the time elapsed between the initiation and execution of a process (Okyere, Annan & Anning, 2015). A more conventional definition of lead time in the realm of a service industry is the time from the moment the customer demands a service to the moment it is received by the customer. Lead time management is not a new concept in service delivery. The opportunity to reduce lead time in service delivery lies in the service process itself. The time it takes to provide a particular service to a customer is very significant. The service lead time is subjected to various constraints such as excessive and unstipulated demand, and geographic limitations.

For an organization to be able to reduce lead time, it should include lead time reduction as a company strategy. This will enable the company to address lead time issues more efficiently. Therefore, effective management practices play a major role in minimizing lead time for service providers (Kritchachai & Meesamut, 2015). The significance of lead time management is unquestionably a very important aspect in any business environment, and everyone involved must have in-depth understanding as to why it is important. The following are the important to understand lead time management; It provides competitive edge for Product and Services; Customer Lead time plays a significant part in Demand forecast; Direct influence on customer Satisfaction and Provides an alternative overview of Business Performance (Okyere et al., 2015).

Time is a fundamental unit of measurement. It measures an event or process in seconds, minutes, hours, days, weeks, months or years. Time is therefore a basic and a key measurement of efficiency in almost every organization. The understanding of time by mankind makes it a common unit of measurement and a key performance indicator for every organization. The above attributes of time is believed to be behind Harrison and Van Hoek (2008) suggestion of time as a key performance indicator in an organization before cost and quality. This consequently signifies the significance of lead time or the total order cycle time in organizations nowadays. Total order cycle time often known as order to delivery cycle time has been explained by various authors to mean the time existed from when a customer order is received until the delivery of such customer order. The

customer order in question can be a service, raw material, finished goods, or works.

### **Staff Competence.**

Business Dictionary defines competence as the sufficiency of related abilities, commitments, knowledge, and skills that enable an employee (or an organization) to act effectively in a particular job. The realizations of objective by organizations, private or public, greatly depend on the skill, caliber, competence and experience of its work force. The point of emphasis here is that the success or failure of organization is not unconnected with the manpower it recruits, maintains and develops in the course of its operational life. Ensuring the availability of a skilled workforce with the right competence is a critical task for every human resource professional in every organization. As consumer behavior and technological developments change over time, the demand for certain competencies and skills also changes. Performance reviews and career development are an important means of ensuring that competence development objectives are met. In addition to hiring competent workers, it also essential to place equal importance on individual development plan that includes actions for development of existing workers through training, assignments and work experience. Proper planning and training measures are required to address the existing and evolving needs. Every organization must have a measure to analyze the organization's current competence status and future needs, process competency gaps, and define either the need for recruitment or the development of existing employees. (Inthiyaz, 2017).

### **Record Management Practices.**

Records management refers to the whole range of activities which an organization should perform to properly manage its records. The key activities include setting records management policy, assigning responsibilities, establishing and promulgating procedures and guidelines, as well as designing, implementing and administering recordkeeping systems (Musembe, 2015). In the Government, "records management" includes the planning, directing, organizing, controlling, reviewing, training and other managerial activities involved with respect to the creation, classification and indexing, distribution, handling, use, tracking, storage, retrieval, protection and disposal of records to achieve adequate and proper documentation of government policies, decisions and transactions as well as efficient and cost-effective operation of government bureaux and departments (B/Ds).

All organizations need to identify the regulatory environment that affects their records management (Pinheiro & Macedoa, 2009). The regulatory environment may comprise such elements as laws and regulations, codes of best practices, code of conduct etc. For instance, the retention period of a particular type of records before they can be destroyed may be governed by a law or a code of practice. The purpose of a recordkeeping system is to manage records throughout their life cycle, i.e. from the creation or receipt of a record, through its useful life to its final disposal.

### **Information and Communication Technology.**

Information is a very critical guide in Service delivery, especially its availability, access speed, reliability, timeliness and accuracy that actually facilitates admirable service delivery through informed decision making (Kithinji, 2015). According to Riley (2012), how easily the information is understood; cost worth and

ability to meet user's needs are the three important elements of critical information within an environment where the objectives seeking the information are defined in advance.

The integration of IT in Procurement/ inventory management and improves information sharing potentially unlocks the efficacy of inventory management by improving information sharing, predictability increase, value chain waste reduction, better product demand monitoring and order placement to prevent stock-outs which eventually reduces bullwhip lead time effects (Haag and Cunnings, 2016). Effective SCM continues to be best enabled by Information Technology (IT) (Kodama, 2017) while improving supply chain agility, reducing cycle time, achieving required efficiency and timely customer/patient service/product delivery in expectable manner (Radjou, 2016).

### **Service Delivery**

According to Michael (2007), from the beginning of the "customer service revolution" almost 20 years ago, a body of business research has focused on service delivery. Business consultants, corporations and others have worked to identify the characteristics of organizations that consistently please their customers, to develop tools for monitoring service delivery, and build continuous, quality improvement system that respond to consumer feedback. Service delivery survey is considered critical in understanding consumer behavior, needs, wants, attitudes, perceptions, expectations and trends in an organization service and how to influence the customers to the advantage of organization. Calking *et al.*, (2004) advised that the key to successful service delivery and hence relationship management follow through and actually improve performance in areas that need greater public attention. This *et al.*, (2008), insisted that government have to be more responsive to society's needs and demands. He added that public-sector organizations are being reformed in order to provide better, faster and more services. However, quality quantity and speed are not the only new competences that society requires from its government. Since the pace of social change is accelerating, government should equally be able to respond to changing demands by offering new solutions. Secondly, government reforms with the purpose of re-establishing trust in government. Government needs to provide more choice, democracy and transparency by interacting with citizens/customers at all stages of the policy and service delivery process.

### **RESEARCH METHODOLOGY**

A descriptive research design was adopted for this study. The target population was 200 respondents drawn from different departments; 50 finance officers, 60 Procurement officers, 50 pharmacist officers and 40 administration officers' respectively. as officers from sub county hospital were also inclusive. The study adopted a purposive random sampling technique, since the respondents had similar experience, skills and knowledge for this study. The study used both structured and semi-structured questionnaires for primary data collection. The researcher employed the drop and pick approach for the questionnaire which was picked after a week, where there was need, an extension was granted, so as to give humble time to the respondents to fill in without stress (Wekesa, 2016). The study also employed documentary sources of data collection for

purposes of obtaining secondary data to validate same with primary data.

In line with Hassan (2016) assertion, both descriptive and inferential analysis was used to analyze data to establish the relationship between variables using the Statistical Package for Social Sciences (SPSS version 24). This relationship was described in the multiple regression model at 95% confidence level.

## RESEARCH RESULTS

### Lead Time

The variables were lead time, staff competence, record management practices and information and communication technology on service delivery at Trans Nzoia level four hospital in Kenya. This section examined the specific variable called Lead Time using the Likert scale of five points where; Strongly Disagree =SD, Disagree =D, Neutral =N, Agree =A, and Strongly Agree =SA

### Influence of JIT on Service Delivery

The study also sought to determine the effect of just in time on service delivery to Trans Nzoia level four hospital in Kenya. The respondents were required to indicate whether they agree with just in time on service delivery. Majority 79.2% (111) of the respondents indicated that they strongly agreed that the just in time can enhance their service delivery. A bout 14.3% (20) of the respondents indicated they disagree and the remaining 6.5% (9) agreed. The study therefore successfully captured of electronic data interchange which influence performance.

### Effect of Duration on Service Delivery

The study sought to find from the respondent whether the duration of lead time was on time for goods and service when supplier gets orders to delivery to Trans Nzoia level four hospital. Therefore the respondents were asked to indicate their level of agreement as to whether duration to deliver goods is always on time. A majority 59%, (83) of the respondents strongly agreed that their institutions can perform through duration is preserved. A bout 30.2% (42) of the respondents indicated that they were neutral with the duration taken on service delivery at Trans Nzoia level four hospital and (15)10.5% of the respondents disagreed . A further 32% (44) of the respondents strongly disagree duration taken is too long before the delivery to Trans Nzoia level four hospital, also 40.3 % (56) of the respondents Agreed, another 18.3% (26) of the respondents agreed that reorder period was too long, hence the need to improve for better service delivery in Trans Nzoia hospital a few 2% (3) of the respondents disagree lead time was the cause of poor service delivery. A similar result was replicated when the respondents were asked to state how they thought overall lead time affects service delivery to Trans Nzoia level four hospital in Kenya.

Respondents were further asked whether order period affects service delivery at Trans Nzoia level four hospital. The majority of respondents stated that there was need to embrace shorten the lead time period for better service delivery at the hospital. Then they explained why it is important because it had an impact on customer satisfaction with a mean of (3.915) with standard deviation of 1.37318; followed by active management of all aspects of order processing with a mean of (3.752) and standard deviation of 1.0094; then collaborative inventory control flow of all types of products such as medicine and drugs in time a mean of (3.832) and standard deviation of 0.8318. Further, a mean of

(3.592) and standard deviation of 1.1604. the respondents indicated that lead-time effectiveness had impact to order period; direct response to delivery minimises complains mean of (3.401) and standard deviation of 0.9912; influence of service delivery to both internal and external clients such as patients and staffs Mean of 3.394) and standard deviation of 1.093; From the foregoing, it can be deduced that a majority of employees explored embraced quick order delivery as an aspects of good service delivery at Trans Nzoia level four hospital in Kenya.

These results are in line with findings of Ochiri and Nyakeri (2017), who revealed that about 78% of work-related service delivery can be influenced by expediting lead time and that it must be enhanced by quick response. Similarly, Nyongesa and Osoro, (2019) identified concept of JIT which includes stockless and accuracy towards delivery and minimizing time cost of manual processing. Moreover, some unreliable evidence showed that substantial JIT leads to modern confidence.

### Effect of Re-order

Majority 86% (146) of the respondents strongly agreed with their reorder period at Trans Nzoia level four hospital in Kenya. A bout 48% (67) of the respondents agreed their reorder period of two weeks, similarly, 26% (36) of the respondents indicated strongly disagree, another 12% (17) of the respondents disagreed with the reorder period, and additionally an average 11% (15) of the respondents were neutral with the existing reorder period. This finding was replicated when the respondents were asked to state how they thought service delivery at Trans Nzoia County hospital in Kenya.

Separately, the study sought to find whether reorder period can affect service delivery at Trans Nzoia County level four hospital in Kenya. From figure 4.5 below, majority 56% (146), of the respondents agreed when properly instituted can minimize delay service delivery at Trans Nzoia County level four hospital in Kenya A bout 18% ( 130), of the respondents were neutral, then 6% (129) of the respondents strongly disagreed at 20% (105) of the respondents indicated the importance of service delivery at Trans Nzoia level four hospital in Kenya. This is in line with the findings of Wabuge and Osoro (2020), who pointed out that service delivery at the hospital was essential, as would ultimately enhanced both performance and efficient service delivery to their clients.

### Effect of Staff Competence

When also, asked to state if there was effective staff qualification on service delivery at Trans Nzoia county level four hospital in Kenya. a majority of respondents indicated that disagreed with a mean of (3.891 and standard deviation 1.4011); of the respondent were neutral with a mean of (3.763) and 1.3317; then extent to which qualification affect service at a Trans Nzoia level four hospital in Kenya with a mean of (3.672) and standard deviation of 1.11713 of the respondents agreed. A further a mean of (3.519) standard deviation of 1.2092 of the respondents strongly agreed; about a mean of (3.507) and standard deviation of 0.9912 of the respondents indicated they strongly disagreed. All indicators were engaged to establish the level of qualification at Trans Nzoia county Level four hospital in Kenya.

### Record Management Practices

The respondents were requested to respond to record management practices at Trans Nzoia county level four hospital in Kenya. Majority 68.8% (89) of the respondents strongly

disagree that level of respond to record management practices was not good, while 14.1% (18) of the respondents disagreed; only 12.4% (19) of the respondents agreed. A small number 4.7% (8) of the respondents strongly disagree that respond to record management practices has service delivery, while a high majority 76.5% (78) of the respondents were neutral, another 8 of the respondents agree and the remaining 16.3% (29) of the respondents strongly agree. This echoes the finding of David & Asamoah (2011), who observed that about 23.5% (40) of the respondents disagree level of respond to record management practices at Trans Nzoia county level four hospital in Kenya was low, hence affecting service deliver, while 35.3% (50) of the respondents disagree that it cannot have any effect at Trans Nzoia county level four hospital in Kenya, 32.9% (69) of the respondents were neutral and on 2.9% (8) of the respondents agreed felt that there was need to improve service delivery through respond to record management practices at the county level four hospital, hence 4.1% (7) of the respondents strongly agreed and the remaining of the respondents were neutral.

The study sought to find out from the respondents opinion on the effect of respond to record management practices on service delivery at Trans Nzoia County level four hospital in Kenya. Majority 58 % (81) of the respondents agreed on service delivery at Trans Nzoia County level four hospital in Kenya. Bearing in mind, that respond to record management practices on how to retrieve, maintain and receive the records once they are established at Trans Nzoia county level four hospital with the revolution of technology changing year in year out, also business must embrace new training of going for further studies oftenly. From the foregoing, majority of respondents affirmed that their respond to record management practices was a good achievement towards improvement by mean of (6.971) and standard deviation 1.224 who disagreed for the types of maintenance most of the respondents therefore strongly disagreed by a mean of (3.873) and standard deviation 1.007 of the respondents who were neutral on how record management practices, followed by mean of (3.546) and standard deviation 1.821 of the respondents who were in agreement, and then mean of (5.197) and standard deviation 1.933 of the respondents who strongly agreed finally others (3.527) and standard deviation 1.684 of the respondents agreed. Supply chain performance in public institutions as was well centric to the needs and wants of the whole structure in the organization.

### **Information and Communication Technology**

The respondents were requested to state whether the hospital staff like procurement officers use e-tendering as the do their work, a few 3% (4) of the respondents strongly disagreed that the hospital personnel don't use e-tendering method to manage the their customer, 2% (3) of the respondents disagreed, with none of the respondents remaining neutral. 45% (63) of the respondents agreed that the hospital procurement personnel use e-tendering method and 50% (70) of the respondents strongly agreed to the same statement. On whether the hospital personnel responds apply e-sourcing for quick service delivery at Trans Nzoia County level four hospital, 7% (10) of the respondents strongly disagreed, 9% (13) of the respondents disagreed, with 11% (15) of the respondents remaining neutral. 33% (46) of the respondents agreed while 40% (64) of the respondents strongly agreed that the hospital has enough computers to responds

quickly and accurately to easy working procedures. The respondents were requested to indicate their acceptance to the application of information and communication technology at Trans Nzoia county level four hospital on service delivery, the respondents' numbers were; 2% (3) of the respondents strongly disagreed, another 2% (3) of the respondents disagreed, and 4% (6) of the respondents stated that they neutral. 46% (64) of the respondents agreed that indeed the number of computers were enough to all staff and they network was excellent and finally majority 46% (64) of the respondents strongly agreed.

The results indicated that, 65% (91) of the respondents were positive on whether the hospital has embraced ICT training to all departments at the Trans Nzoia County level four hospitals. On whether the hospital management responds quickly and accurately with the help of Information and communication technology when leading with their working on daily basis, 13% (18) of the respondents agreed/strongly agreed while 11% (15) of the respondents either disagreed or strongly disagreed, on the statement, however 11% (15) of the respondents remained neutral. The researcher therefore concluded that the hospital management responds when leading with their working procedures. As in the other analyses above, the descriptive statistical measures, mean and standard deviation were used to analyze the data. On whether the hospital has allocated and assigned qualified ICT personnel to manage the ICT department, the responses generated a 4.621 mean with a 1.5412 standard deviation. The findings on whether the hospital management responds timely and accurately as ICT is used leading to easy working procedures indicated a mean of 3.902 with a standard deviation of 1.852 that; the hospital management responds timely and accurately as ICT is used leading to easy working procedures. The third and last statement/question on this variable was that ICT facilitates easier, faster and cheaper communication that offers increased convenience and reduced service delivery time was backed with a mean of 4.463 and a standard deviation of 1.6171.

### **Service Delivery**

From results below, majority of respondents affirmed that service delivery at Trans Nzoia county level four hospital in Kenya was good with a mean of (3.971) and standard deviation 1.7001 of the respondents who disagreed, with a mean of (3.873) and standard deviation 1.462 of the respondents who were neutral, followed with a mean of (3.546) and standard deviation 1.6031 of the respondents who were in agreement, and then with a mean of (3.197) and standard deviation 1.3713 of the respondents who strongly agreed. Service delivery can be improved with mean of (3.651) and standard deviation 1.0721 was in agreement for efficiency, then with a mean of (2.007) 1.3215 of the respondents indicated they were in disagreement. Such the three levels namely; individual needs, groups wants and the organization's objectives being made proactively for the whole growth. Majority with a mean of (3.456) and standard deviation 1.0932 of the respondents indicated were strongly disagreed, while a few with a mean of (4.001) and standard deviation 1.6312 customer satisfaction and return on investment with a mean of (5.641) and standard deviation 0.9863 high service delivery indicated they were neutral, finally with a mean of (4.033) and standard deviation 1.0985 of the respondents indicated they strongly disagree with timely delivery.

**Model Correlations of all Variables**

The study further conducted inferential statistics entailing both Pearson and regression analysis with a view to determine both the nature and respective strengths of associations between the conceptualized predictors (independent variables) lead time, staff competence, record management practices and information and communication technology and (dependent variable) service delivery at Trans Nzoia County level four hospital.

**Table 4.15: Results of Pearson Correlation**

|                 |                        | Staff<br>Lead<br>t | RecordICT | Service Del. |
|-----------------|------------------------|--------------------|-----------|--------------|
| Lead<br>time    | Pearson<br>Correlation | 1                  | .         | .            |
|                 | Sig. (2-<br>tailed)    | .                  | .         | .            |
|                 | N                      | 140                |           |              |
| Staff<br>Comp.  | Pearson<br>Correlation | .269               | 1         | .            |
|                 | Sig. (2-<br>tailed)    | .409               |           |              |
|                 | N                      | 140                |           |              |
| Record<br>mgt   | Pearson<br>Correlation | .172               | .258      | 1            |
|                 | Sig. (2-<br>tailed)    | 1.000              | .438      |              |
|                 | N                      | 140                | 140       | 140          |
| ICT             | Pearson<br>Correlation | .357**             | -.249     | .1           |
|                 | Sig. (2-<br>tailed)    | .200               | .418      |              |
|                 | N                      | 140                | 140       | 140          |
| Service<br>Del. | Pearson<br>Correlation | .350               | .588      | .377         |
|                 | Sig. (2-<br>tailed)    | .097               | .356      | .436         |
|                 | N                      | 140                | 140       | 140          |

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

From the findings, a positive correlation is seen between each supply chain and performance. The strongest correlation was established between independent variables and service delivery (r = 0.386), and the weaker relationship found lead time and service delivery (r = 0.269). ICT and record management practices were found to be strongly and positively correlating with Information technology on service delivery Trans Nzoia County level hospital correlation coefficient of 0.350 and 0.357 respectively. This is tandem with the findings of Kothari (2011), who observed that all the independent variables were found to have a statistically significant association with the dependent variable at over 0.05 level of confidence.

**Regression Analysis**

To establish the degree of effect on service delivery, a regression analysis was conducted, with the assumption that: variables are normally distributed to avoid distortion of associations and significance tests, which was achieved as outliers were not identified; a linear relationship between the independent variables and dependent variable for accuracy of estimation, which was achieved as the standardized coefficients were used in interpretation. The regression model was as follows:

(record management practices) +  $\beta_4$  (information and communication technology) + error term. Regression analysis produced the coefficient of determination and analysis of variance (ANOVA). Analysis of variance was done to show whether there is a significant mean difference between dependent and independent variables. The ANOVA was conducted at 95% confidence level.

**Model Goodness of Fit**

Regression analysis was used to establish the strengths of relationship between service delivery (dependent variable) and the predicting variables; Lead time, staff competence, record management practices, and (information and communication technology (independent variables). The results showed a correlation value (R) of 0.871 which depicts that there is a good linear dependence between the independent and dependent variables.

**Model Goodness of Fit**

| R     | R <sup>2</sup> | Adjusted R <sup>2</sup> | Std. Error of the Estimate |
|-------|----------------|-------------------------|----------------------------|
| 0.871 | 0.712          | 0.794                   | 0.056                      |

a. Predictors: (Constants), Lead time, staff competence, record management practices, and information and communication technology

b. Dependent Variable: service delivery

With an adjusted R-squared of 0.794, the model shows that Lead time, staff competence, record management practices, and information and communication technology explain 79.4% of the variations in supply chain performance while 20.6% is explained by other indicators which are not inclusive in study or model. A

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon$$

$$\text{Lead time on service delivery} = \beta_0 + \beta_1 (\text{lead time}) + \beta_2 (\text{staff competence}) + \beta_3$$

measure of goodness of fit synopsis the discrepancy between observed values and the values anticipated under the model in question (Capelli, 2010).

**Analysis of Variance (ANOVA)**

Analysis of variance statistics was conducted to determine the differences in the means of the dependent and independent variables to show whether a relationship exists between the two. The P-value of 0.05 implies that service delivery has an effect at Trans Nzoia County level four hospital has a significant relationship Lead time, staff competence, record management practices, and information and communication technology which is significant at 5 % level of significance. This is in line with the findings of Nyongesa and osoro (2020), who observed that this also depicted the significance of the regression analysis done at 95% confidence level. This implies that the regression model is significant and can thus be used to evaluate the association

between the dependent and independent variables. This is in line with the findings of Kothari (2011) who observed that analysis of variance statistics examines the differences between group means and their associated procedures.

**ANOVA Test**

|              | <b>Sum of Squares</b> | <b>df</b>  | <b>Mean Square</b> | <b>F</b> | <b>Sig.</b> |
|--------------|-----------------------|------------|--------------------|----------|-------------|
| Regression   | 4.647                 | 1          | 1.309              | .514     | .002        |
| Residual     | 5.432                 | 139        | .483               |          |             |
| <b>Total</b> | <b>10.089</b>         | <b>140</b> |                    |          |             |

**Regression Coefficients of Determination**

To determine the relationship between the independent variables and the dependent variable and the respective strengths, the regression analysis produced coefficients of determination revealed a positive relationship between role of procurement in service delivery and all the independent variables. Taking the multiple regression models:

**SUMMARY, CONCLUSIONS AND ECOMMENDATIONS**

**Conclusion of the Findings**

From the results presented in this section, it was concluded that inventory management practices on service delivery indeed affect the level four hospital in Kenya. There is a high correlation between the inventory management practices on service delivery. The results are in agreement with the findings of other studies carried out relating inventory management practices on service delivery. These resulted in larger savings and improvement in the public hospital in counties in Kenya Hanover. The authors suggested that inventory management practices on service delivery by embracing lead time, reorder level, training staff, encouraging modern skills through further studies. However, they asserted that these relationships are moderated or mediated by inventory management practices on service delivery. The research therefore concludes that there is a relationship between determinants inventory management practices on service delivery in all county level four hospitals in Kenya in future.

**Recommendations**

The Researcher recommends that all the specific variables, e lead time, staff competence, record management practices and the up-take of information and communication technology on service delivery in Kenya, hence the need to embrace the same now and in future endeavors.

**Lead Time**

The researcher recommends that devolved system of government in Kenya need to incorporate components inventory management practices into the system to improve on service delivery for the

patients with and their customers. This can enable the county governments to realize the empowerment of their people health wise and enhance e- on service delivery to devolved system of Government as have enough medicine and drugs in their inventory. The impact of on service delivery on service delivery systems can also be used to co-ordinate the procurement by ensuring better sharing of information related to inventory management practices and encourage e-sourcing for goods and services online.

**Staff Competence**

This study recommends that there is need to have competent staff who can do things first time and be proactive to expedite the lead time process in all the county level four hospitals in Kenya. The Government of Kenya has the responsibility of advising the county level hospitals through the Ministry of Health the best practice embraced by development counties from other pioneers countries. Staff competence lead to error and paper work and increased transparency when competed officer are involved to excuse their daily duties on any available tenders on online platforms. Though flexible information and communication technology practices, and through proper networking with the help of computers, websites and modern research of effective and efficient inventory management practices, hence heading to bearing fruits in the county level four hospitals in Kenya.

**Record Management Practices**

The results recommend that record management practices can minimize paper work during the ordering of goods and services to county devolved level four hospitals in Kenya. And at the same time minimizes double filing. Most procurement activities are can now be handled electronically with the help of flash disk, hard disk, online and online archiving. There is need for devolved system of government in level four hospitals in Kenya. Actors supporting Treasury full automation of records of suppliers and keep update profile of online portals and websites. An entity that embraces healthy record management practices outshine those that do not and in fact the disparity continues to widen as such firms go on to creatively explore new ideas aiming faster and additional creation of value given vast competition and high expectations from customers. Record management practices can minimize unnecessary expenditure to level four county hospitals in Kenya.

**Information and communication Technology**

The study recommends the need for real time dissemination of information to all interested parties, it is the recommendation of this research that county governments should gather and appropriate information and communication technology through e- information. The websites of county governments need to be regularly updated with the latest information concerning procurement activities. Suppliers should be encouraged to communicate their needs online and even download others from a procuring entities portal/websites. Also to acquire the most recent software be applied, with tech-savvy, hence more resources towards further trainings where there is need. Getting input and sharing through e- information from all level four county hospitals in Kenya.

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# Assessment Of Drinking Water System: A Case Study Of Juba City South Sudan

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**Abstract-** A sustainable drinking water system increasingly becomes a problem with an increase in population density. The purpose of this study is to assess the drinking water system in Juba city and compare its water quality parameters with the WHO standard. The systematic review method is applied to identify relevant information and the gray literature data collected from the Ministry of Water Resources on the treated water quality parameters such as water temperature, pH, water conductivity, TDS, and residual chlorine for January, March, June, and August 2018. The results of the study show that the temperature 25.9, 30.0, 27.3, 29.5°C were above the WHO guideline value 25°C has increased the taste and color in the water. The water conductivity 1420, 1331 ms/m is above the WHO guideline value 400 mS/m due to the anthropogenic factors that have been throw into the River Nile. While for 132, 138 mS/m were below the WHO guideline value 400ms/m its shows the less discharge of waste into the River Nile. The residual chlorine 1.6, 1.5, 1.5, 1.8 mg/L were above the WHO guideline value 0.2 mg/L, which means the treated water quality is not well disinfected. The pH of 7.9, 7.3, 7.3, 7.9 mg/L was found normal in range with the WHO guideline value 6.5, 8.5 mg/L. The TDS of 482,590,572 mg/L, were found to be Normal with the WHO guideline value 600 mg/L, it shows the treated water quality is safe for drinking and the TDS for August 719 mg/L is above the WHO guideline value 600 mg/L. It's due to the exposure of the waste into the River Nile. The result reveals that the under-investment in drinking water system infrastructure in Juba city has seriously impacted the drinking water system availability and water quality. Therefore, this study has recommended the development of a drinking water system and the treatment of water quality to meet the WHO permissible level.

**Index Terms-** Drinking water system, surface water, water quality treatment, parameters, Juba city

## I. INTRODUCTION

Safe and adequate drinking waters are the most essentials requirement of life and a determinant of the living standard and health of the people in a nation. Improving drinking water quality is the concern of many governments worldwide to protect human health<sup>1</sup>. The drinking water systems have been described commonly as supply chains built up by three main sub-systems raw water, treatment, and distribution. Together these sub-systems

cover the entire supply chain, from the source of the water through the treatment plant and distribution network to the customers tap<sup>2</sup>. However, given the complexity of processes occurring during the water transport through distribution systems, the drinking water quality may deteriorate, leading to the growth of pathogens, taste, odor, and operational issues corrosion and discoloration<sup>3</sup>.

Natural water is an essential material for both lives of animals, plants, and human beings, on the earth. Safe access to drinking water is essentials for health and the basis for a human right that is integral to the United Nations Resolution 64/292 of 2010<sup>4</sup>. Reports indicated that around 1 billion people faced safe access to drinking water, and more than 5 million people die each year from water-related diseases. According to WHO and UNICEF joined report. Almost 1.8 billion people use drinking water sources contaminated with feces that put them at the risk of contracting cholera, typhoid, dysentery, Polio, and hepatitis A<sup>5</sup>.

In South Sudan mostly depended on aid organizations for water help, this has not been enough, and water becomes increasingly expensive and unaffordable. Without available clean water, the population has no alternative but to settle for dirty water. That increases the likelihood of catching disease and infections. Because of this, the country South Sudan still host to 98% of the world's remaining Guinea worm cases, and a third of children under the age of 5 suffer from diarrhea. Making improvements to water access be crucial in South Sudan for the country's future. That is why the (DROP4DROP Organization) has established a role within South Sudan, repairing broken bore-wells and providing wash initiatives and training<sup>6</sup>. The majority is vulnerable to several life-threatening diseases. The under-investment in the water infrastructure has seriously affected the drinking water system availability. South Sudan is now facing challenges to meet the 2030 Sustainable Development Goals formulated in 2015 as the 2030 Agenda through the water as key to Sustainable Development<sup>7,8</sup>.

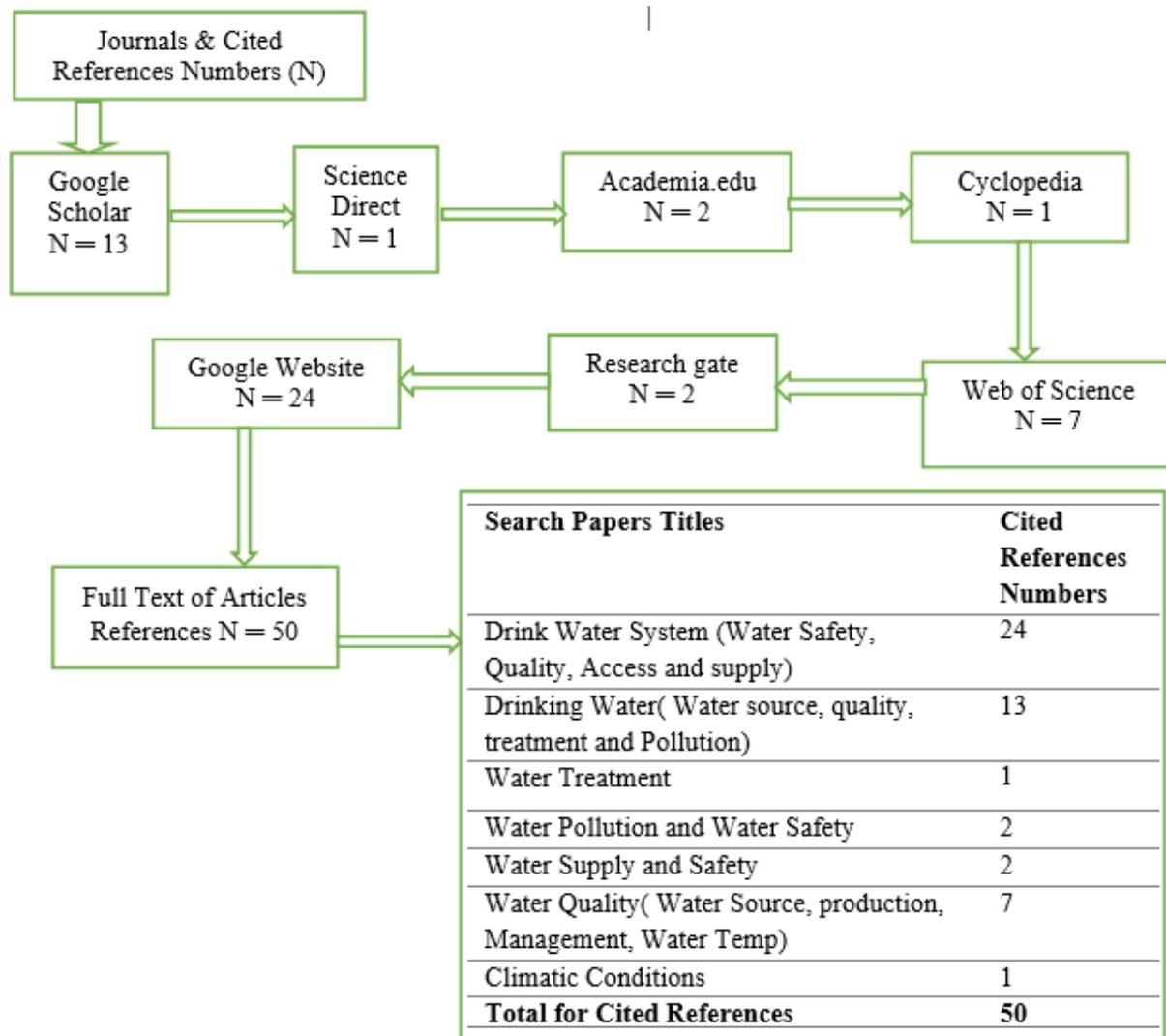
There were always problems with the communities' drinking water in Juba city. People often used to get sick and suffer from diarrhea, and then cholera broke out. "The Population of the people used to get their drinking water from various places, never making sure whether it was safe or not? They usually used to collect it from the river that was dirty and polluted," According to UNICEF, 32 percent of the South Sudanese population doesn't have access to clean drinking water. Due to limited access to safe water, a third of the children under the age of five suffer from

diarrhea<sup>9</sup>. Most of the Juba city populations rely on water tankers of which often distributed raw river water that is not suitable for human consumption. The primary cause of the Waterborne disease is microbiological contamination, associated with the ingestion of fecally contaminated water, according to the WHO 2011<sup>10</sup>. The Juba city 2005-2006 cholera outbreak was the clear manifestation of such microbiological pollution<sup>11</sup>. Therefore, the mains purpose of this study is to assess the conditions of the drinking water system in Juba city and compare its water quality parameters with the WHO guideline value.

## II. MATERIALS AND METHODS

The systematic review method is applied to identify the relevant literature topics and published papers in some of these

journals and electronic databases<sup>12</sup>, Such as Web of Science, Research gate, Science direct, Google Scholar, Academia, Cyclopedia, and Google website. The title of the search engine entered is as follows the water quality, drinking water, water management, water supply, and water distribution. The information was from the journals and websites. The gray literature data such as water temperature, pH, water conductivity, total dissolved solids, and residual chlorine of January, March, June, and August 2018, were collected from the ministry of water resources & irrigation (MWRI) Juba-South Sudan. The publication information searched from the five scientific Journals websites and the other information from the google website. Therefore, **Fig.1** is showing the detailed process of the schematic diagram of the search engine strategy of the websites and journals.



**Fig.1. Showing Schematic Diagram of the Search Engine Strategy and Cited References Number**

## III. STUDY AREA

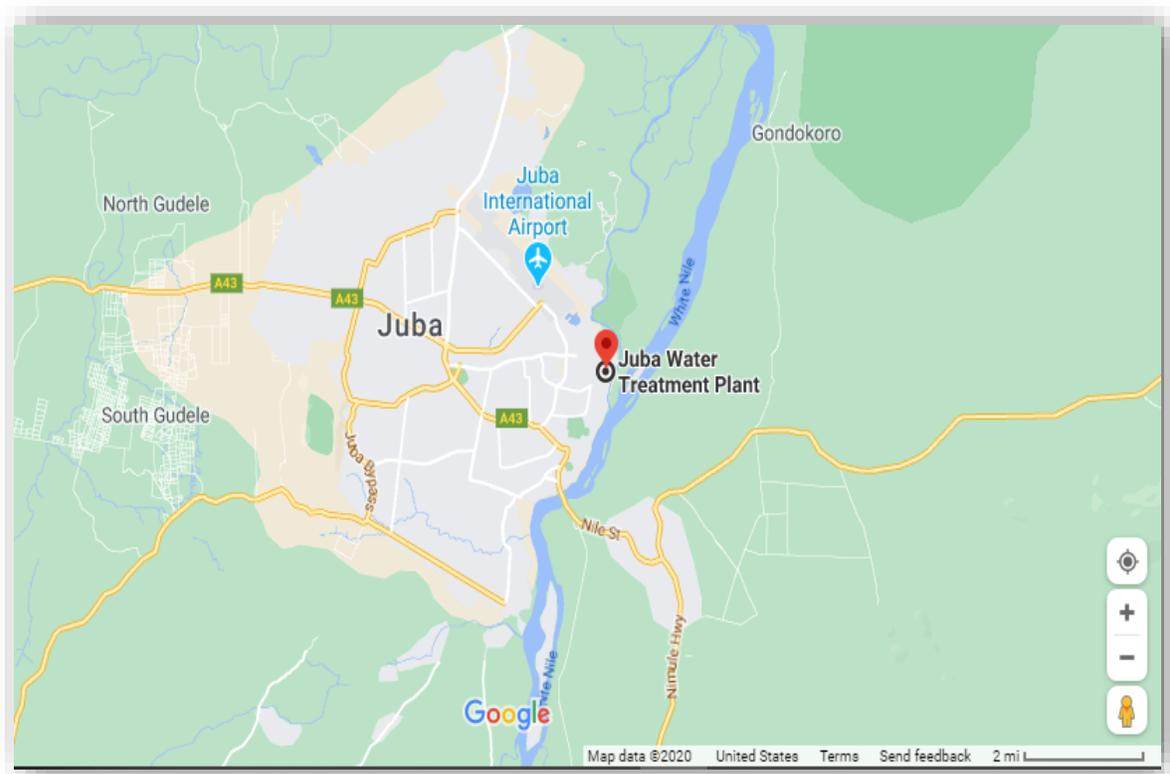
Juba city is within the Southern part of South Sudan in Central Equatoria State. Juba is perhaps currently among the fastest

developing places in the world, particularly the growth in its population is noticeable. In 2019, its estimated population in **Table 1**. The city has been characterizing by rapid development, urban sprawl, and inadequate services provision in **Fig.2**. Its geographical coordinates are 4° 51' 0" North and 31° 37' 0" East at

the western bank of the River Nile. It is estimated to occupy a 12-kilometer area in diameter from the center of town included surrounding rural lands, which encompasses roughly 100 kilometers in diameter<sup>13</sup>.

**Table 1 Population growth in Juba from 1972-2019.**

| Years      | 1973   | 1993    | 2005    | 2010    | 2019      |
|------------|--------|---------|---------|---------|-----------|
| Population | 56,737 | 114,980 | 250,000 | 548,953 | 1,577,902 |



**Fig.2. Juba city water treatment plant**

**3.1.1 Overview of Juba City Climatic Conditions**

Juba city has a tropical wet and dry climate, and as it lies near the equator, temperatures are hot year-round. And little rain falls from November to March, which is also the time of the year

with the hottest maximum temperatures reaching 38°C in February and more than 100 millimeters of rain falls per month from April to October as shown in Fig. (a) and (b)<sup>14</sup>.



#### IV. RESULTS

##### 4.1.1 Drinking Water Sources in Juba city

The mains sources of water available for use by municipal water systems and the adequacy and reliability of each. Many municipal water systems use more than one type of water source as Impounding Reservoirs, Fresh-Water Lakes, Wells, Oceans, and Bays<sup>15</sup>. Water is an essential precious natural resource without which no form of livelihood is possible. Therefore, the quantity and quality of accessible water must be studied to make possible the concept of sustainable development<sup>16</sup>.

South Sudan is rich with its surface water resources source gives a broad picture of its major surface water resources components<sup>17</sup>. An estimated approximately between 50-60

percent of the population has access to an improved water source, such as hand pumps shown in **Fig. (c)**, a protected well, or piped water supply that only benefits a minority. However, though the sections of the population with access to improve water sources often do not receive safe water. While those without access to an improved water source often fetch water from rivers, ponds, or open wells. Some buy water from vendors who use trucks to supply water to their customers. Only 13 percent of Juba city residents can access municipal water supplied mostly through a small piped network shown in **Fig. (a)**, boreholes, and a single public water filling station on the river bank. Generally, the water system for the public has been complementing by the patchwork of small private water suppliers, which end up delivering relatively expensive and low-quality water in **Fig. (b)**. The residents of Juba city depend on unpurified water indicated<sup>18</sup>. There are about 300 registered trucks supplying water throughout Juba city<sup>19</sup>.



(a)



(b)



(c)

#### 4.1.2 Drinking Water Supply System in Juba

The drinking water supply system on a tributary of the River Nile in Juba city, The screened feedwater drawn from the Juba channel River Nile with the help of a floating type intake supported by a bridge through which a flexible pipeline mounted by two pumps, each with a design capacity of 158 m<sup>3</sup>/s and the third pump being on standby mode, the transported water to the raw water tank. The gravity water flows to the receiving raws water chamber, where aluminum sulfate is added and mixed by high energy dissipated, and the falling water through a weir facilitate the coagulation/flocculation process before entering the Sedimentation Tank. Then settled water is filtered through the rapid sand filtration technology, and the flocs are release to a maintenance hole where it finds its way for disposal into the river. At this treatment stage, chlorine is injected into the free gravity flowing water and finally stored in four underground tanks. Treated water has been lifted with the help of booster pumps to elevate tanks located in different areas. Then treated water is distributed to users as in **Fig. (a)** by a network of pipes or supplied by tankers to the unconnected regions<sup>1</sup>.

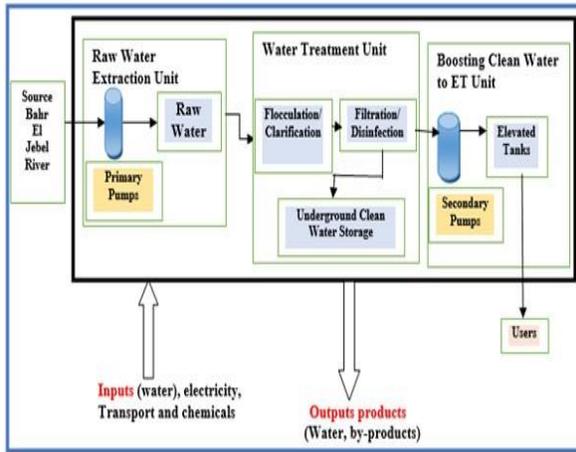
Juba City is the national capital, the state capital of South Sudan, and a majority of the international, diplomatic, and regional hub. However, its water infrastructure is inadequate and requires urgent improvement. The water access coverage in the city is only about 20%<sup>20</sup>. And about 30-50 percent of water facilities are non-functional at any point due to weak water sector governance, limited funding and funding absorption capacity, human resource constraints<sup>21</sup>. Improving water supply, sanitation, hygiene, and management of water resources could prevent almost one-tenth of the global disease burden. In low-income countries, estimated that 80% of all illnesses are related to water. The

primary cause of the waterborne disease is microbiological contamination<sup>10</sup>. The people in Juba obtain water through house connection or public tap of urban water corporation (UWC), public wells equipped with hand pumps, private vendors by water tanker or jerrycan vendors, and private wells. However, most of the people still use untreated river water or high salinity groundwater that has to be unhygienic and inadequate quality for human consumption<sup>22</sup>. The Juba city drinking water systems predominantly from surface water, boreholes, and public-wells not safe for drinking<sup>23</sup>. The vendors selling water to households or at collection points are common in many parts of the world where scarcity of water or fault in or lack of infrastructure limits access to suitable quantities of drinking water. Water vendors use a range of modes of transport to carry drinking-water for sale directly to the consumers, including tanker trucks and wheelbarrows or trolleys. There are several health concerns associated with water supplied to consumers by water vendors. These include access to adequate volumes and concern regarding inadequate treatment or transport in inappropriate containers, which can result in contamination<sup>24</sup>.

In Juba city, most of the facilities have deteriorated and in an urgent need of rehabilitation or reconstruction to bring them to their normal condition of operation. However, there still exists a large gap between the current water demands and the water supply capacity. Besides, the water distribution network mostly composed of aged pipes asbestos causes high leakage. The water tankers truck of Juba is a daily feature of the city but at a higher cost, as overheads continue to rise, pushing up consumer charges. The lack of safe water shows residents at risk of the spread of sicknesses such as diarrhea and cholera, making children especially vulnerable to Water-Bornes disease. A water crisis, aggravated by political conflict, and a weakening economy, this is

one of the more challenges in Juba city that families are facing daily. In 2015 estimated about 20% of Juba residents had municipal water access operated by South Sudan urban water corporation (SSUWC), the public water utility, mainly through a small piped network shown in fig.8 and boreholes. That likely has dropped the number further nationwide, for people without access to municipal drinking water. The water is given by the private

water trucking operators shown in Fig. (b) and Fig. (c). Often, water from these vendors is untreated, yet expensive, and the most source of hygiene-related diseases<sup>25</sup>. Water must undergo satisfactory treatment or disinfection that guarantees appropriate water quality<sup>26</sup>.



(a)



(b)



(c)

#### 4.1.3 The Specification of Drinking Water Quality Parameters.

The assessment of water quality mainly needs parameter identification. For every parameter, a standard being recognize. It encourages the understanding of water quality problems by

integrating complex data and creating a score that defines water quality<sup>27</sup>. The drinking water quality guidelines for the tested parameters, which were proposed for Southern Sudan by UNICEF in October 2008, are summarized in Table 2<sup>11</sup>.

Table 2 Southern Sudan draft proposal for water quality guideline (UNICEF, October 2008)<sup>11</sup>.

| Items                          | WHO value | Guideline | S. Sudan value | Guideline |
|--------------------------------|-----------|-----------|----------------|-----------|
| pH                             | 6.5 – 8.0 |           | 6 – 8.5        |           |
| Electrical Conductivity (mS/m) | 400       |           | 150            |           |

|                                |     |       |
|--------------------------------|-----|-------|
| <b>TDS (mg/L)</b>              | 600 | 1,000 |
| <b>Residual Chlorine(mg/L)</b> | 0.2 | -     |

**4.1.4 Drinking Water Treatment Process**

Drinking water treatment typically includes coagulation, sedimentation, filtration, and disinfection. Coagulation is a critical step in water treatment processes, not only because it removes particles but because it also removes the microorganisms that are often attached to the particles<sup>28</sup>. In Juba city, the treated water is supply to only a small fraction of government offices and households. Most of the households rely on wells and water tankers. Since groundwater in most of the wells in Juba is high in salinity, and some wells are polluted, the use of groundwater becomes difficult for an urban water supply source. Also, the water tankers selling water to people are mainly raw river water that is not suitable for human consumption<sup>29</sup>. Water suppliers require information on the microbiological quality of their source water information on the contamination level of the source water is the basis for the design of an adequate treatment system. A water supplier also needs to know the efficiency of the treatment processes in eliminating microorganisms, initially in the designed phased to be able to design an adequate treatment system and subsequently in the production phase, to ensure its adequate operation. In the latter phase, detailed information on the microorganisms during the different operational phases may help to optimize the efficiency of treatment processes<sup>30</sup>.

The two water clusters point taps install by UNICEF in Juba City, where water fetches from River Nile were treated with the aluminum sulfate and chlorine. Some 50,000 liters daily pumped out for private and commercial use. This small oasis offers a potable water source in a city where access to safe water isn't readily available. About 15 percent of Juba city residents only can access municipal water. A lot of the population is left vulnerable to waterborne diseases such as dysentery and cholera disease. According to an African Development Bank report, access to water supply service is among the lowest in Africa. And water scarcity affects more than 40 percent of the global population, according to the United Nations, and 1.8 billion people worldwide drinking water that is fecally contaminated. Some 1,000 children each day were dying from preventable water and sanitation-related diseases<sup>31</sup>. Despite available ground and surface water resources, evidence suggests that two in three people in the country South Sudan don't have safe access and potable water supply services. More than six million people lack access to improve water supply services. Besides, 1,000 schools representing 50% of the total number of schools in South Sudan don't have access to water supply<sup>32, 31</sup>.

The majority of the people in Juba city treat their water by using chlorine because chlorine tablets are the simple way of drinking water treatment and households trained in the areas on how to do filtration and sterilization of water since the cholera outbreak in Juba<sup>23</sup>. Chlorine is the most widely used disinfectant for the inactivation of waterborne pathogens in drinking water supplies historically has arguably contributed to the public health protection of the consumers. The post-treatment, primary disinfectant, and the level of the residual remain in the distribution water systems to ensure microbiological compliance can be a

quality assured to consumer's taps in safeguarding against recontamination to the distributions system<sup>33</sup>.

**4.1.5 Biological Quality parameters**

Biological parameters are the basics quality parameters for the control of diseases caused by pathogenic organisms, which have humans an origin. Pathogenic organisms found in surface water include bacteria, fungi, algae, protozoa, plants, animals, and viruses. These diseases, some caused organisms (algae, protozoa, bacteria, fungi, and viruses ) were so difficult to identify and be observed microscopically only and may also be important in the changing of physical and chemical characteristics of water. The drinking water for cooking aims must be free from pathogens, greatly microbial risks connected with the consumption of contaminated water with human or animal feces<sup>34</sup>.

Pollution by animal and human waste is the main factor for the majority of the microbiological degradation of surface water<sup>35</sup>. Unfortunately and regrettably, The Poor population of Juba city still directly depends on the River Nile water for drinking and all other domestic needs. The high fecal coliform presence concentration in the river water is a clear indication of the seriously municipal solids waste pollution in Juba. Also, it signifies the high percentage of both animal excreta and humans in the waste stream. Another majors source of this contamination is the discharge of direct illegal untreated sewage into the River Nile from the hotels along with it. Therefore, water contaminated with pathogens cause various waterborne diseases. It has being explains by the highest incidence of diseases such as typhoid, diarrhea, hepatitis A, and gastrointestinal infections in the city. Thus, the river water wasn't fit used for domestics purposes, except otherwise if treated: but it can use for recreational purposes, for example, swimming<sup>36</sup>.

**Table 3 Distribution of Coliform along the River Nile on the selected sample points<sup>37</sup>.**

| <b>Coliforms</b>                  | <b>Juba city (CFU/mL)</b> | <b>WHO Level (CFU/mL)</b> |
|-----------------------------------|---------------------------|---------------------------|
| <b>Total coliforms</b>            | 20 x 10 <sup>4</sup>      | 100                       |
| <b>Fecal coliforms</b>            | 20 x 10 <sup>3</sup>      | 100                       |
| <b>Escherichia coli (E. coli)</b> | Is Present                | 100                       |

**4.1.6 Drinking Water quality in Juba city**

Water quality is an important parameter, particularly in areas of severe water shortage, for urban development and ecological environment<sup>38</sup>. Water quality deterioration is the greatest challenge for the tradition of drinking water purification processes in achieving adequate removal of trace organic matters, toxic microbes such as Giardia lamblia and Cryptosporidium tyzzer, and the toxic organic halides produced chlorination<sup>39</sup>. Most developing and other developed countries use the WHO standards for drinking water quality measurement involves chemical, physical, and bacteriological analysis that determines

the goodness of water for a particular aim. WHO guidelines reported that water quality effluents to test determinations for giving information concerning the water health and water qualities changing by applying water parameters such as temperature, pH, turbidity, salinity, nitrates, and phosphates, color, taste, odor, conductivity, chlorine, and the total dissolved solids. If the water is filtered to remove the suspended solids, the remaining solids in the water indicate TDS. If the dissolved solids in water exceed 300 mg/L, it adversely affects living organisms as well as industrial products<sup>34, 40</sup>.

The Juba city four traditional water treatment plants haven't regularly monitored to the ascertain level. And the water quality trends have presented a high risk to increase water-related diseases connected with bad environmental sanitation practices exercised in most Southern Sudan parts, and the water supply facilities have been install over the years. Existing water supply facilities do not cater to the needs of entire towns and, this leads to the purchase of water from water tanks by the users. Most of these water tanks privately are owned, and these tanks filled up using water from the Rivers directly. While filling up the tanks, Liquid chlorine added to the tanks. However, no agency monitors the water quality supplied by these tanks. Water quality from these tanks should be monitor to avoid any outbreak of diseases<sup>35</sup>.

**4.1.7 Providing a Safe Drinking Water System in Juba city**

Accessibility to safe drinking water always needs long, arduous hours of walking to the nearest borehole. Frequently many individuals resort to drinking dirty from surface water that has been used for bathing, washing clothes, and cleaning kitchen utensils<sup>41</sup>. Because of the lack of plans and policies for water resources management, both the water quantity and quality in these streams and River Nile has reached a terrible situation that doesn't allow its instant use<sup>23</sup>. The South Sudan water policy developed in 2009, and it represents a comprehensive framework for the sector. The keys principles are improved access to be a prioritized over-improved quality of water and water supply the requirement to provide technological options. The policy sees water as a human right and actively encourages community participation as well as through the involvement of the private sector in water service delivery<sup>42</sup>.

Juba city residents have no clean and safe drinking water access. And since then, they have no other choices beyond the River Nile. They have to continue to consume raw water from the river. That has been saturating with the disease-causing microorganisms, inorganic and organic impurities that find themselves into the river either from domestic wastes or industrial wastes. As the population of Juba continues to grow, the water crisis in the city will continue to worsen, and if no appreciable measures have been taken and expeditiously so, the public health implications of this water crisis will soon become apparent to the government of South Sudan and the residents of Juba<sup>43</sup>.

**4.1.8 Drinking Water Quality Management in Juba city**

The quality of water is a crucial issue to an assured safe consumption by the population. Water availability in sufficient quantity and quality is one of the mains focuses of the water resources management authorities<sup>44</sup>. Drinking water management must be able to satisfy the requirements of consumers regarding

quantity and quality. The water has been transporting from the source to point distribution in a chain composed of six main links: adduction, storage, resource, capture, production, and distribution. The treatment link depends on the quality of the source water<sup>45</sup>. In Juba city, Water quality management and water distribution management focused on the maintenances and operations of the water supply system as the core value of water supply services. Also, strengthening customer services is primarily emphasized as the number of customers was planning to increase drastically toward the year 2015<sup>29</sup>.

The communities in Juba city are thus eager for solutions to chronic issues such as dilapidated infrastructure, lack of investment, and unfair pricing. Ongoing safe access to potable water amid South Sudan's protracted crisis is fundamental to people's survival. It represents a step towards developing a situation of normality and the ultimate one in which the people can thrive. Partnership with the private sector has, however, demonstrated to communities that water treatment and distribution services can be better managed and has the potential to provide an extras source of income<sup>46</sup>.

**4.1.9 Drinking Water Responsibility in Juba city**

The mandate of the South Sudan urban water corporation (SSUWC) is to provide the citizens with the drinking water. But the constraints of the resources-both financial and human continue to struggle to maintain services across the city. And cannot extend the service to underserved areas without external support. These have contributed to the dilapidation of existing service delivery systems, as well as due to a lack of clarity of sectoral roles and responsibilities leading to fragmentation and duplication exacerbated by weak accountability and oversight systems support<sup>46</sup>.

**Table 4 South Sudan Highlights based on Country Reported GLAAS 2016/2017 data<sup>33</sup>.**

| SUSTAINABILITY MEASURES   | EXISTENCE AND LEVEL OF IMPLEMENTATION                            | RESPONSIBILITY ASSIGNED TO   |
|---|--|--|
| <b>Improve reliability and continuity of urban water supply</b> | Plans exist, but only moderate levels of implementation          | South Sudan Urban Water Corporation (SSUWC), Local Government and Partners                 |
| <b>Rehabilitate disused drinking-water hand Pumps</b>           | The planning exists, but only moderates levels of implementation | Local Water Departments, Water Users Committees  |
| <b>Ensure environmentally sustainability of water services</b>  | No plan or low levels of implementation                          | Ministry of Environment and Forestry (MEF), MWRI Directorate of Water Resources Management |

**Ensure drinking-water quality meets national standards** Planning exists, but only moderate levels of implementation Ministry of Health (MOH) Ministry of Water Resources and Irrigation (MWRI)

The Juba city drinking water system predominantly from the Surface water and boreholes and public wells, which is not safe for drinking, unhygienic, and inadequate quality for human consumption. The water access coverage in the city is only about 20%. The water infrastructure under-investment has seriously impacted the drinking water system availability in Juba. The drinking water supply system is inadequate and requires urgent improvement. People used to source their drinking water from various places, never making sure whether it was safe or not? The vendor's water is untreated yet expensive and is the mains source of hygiene-related diseases.

V. DISCUSSION

5.1 Drinking Water System

5.2. Drinking-Water Supply

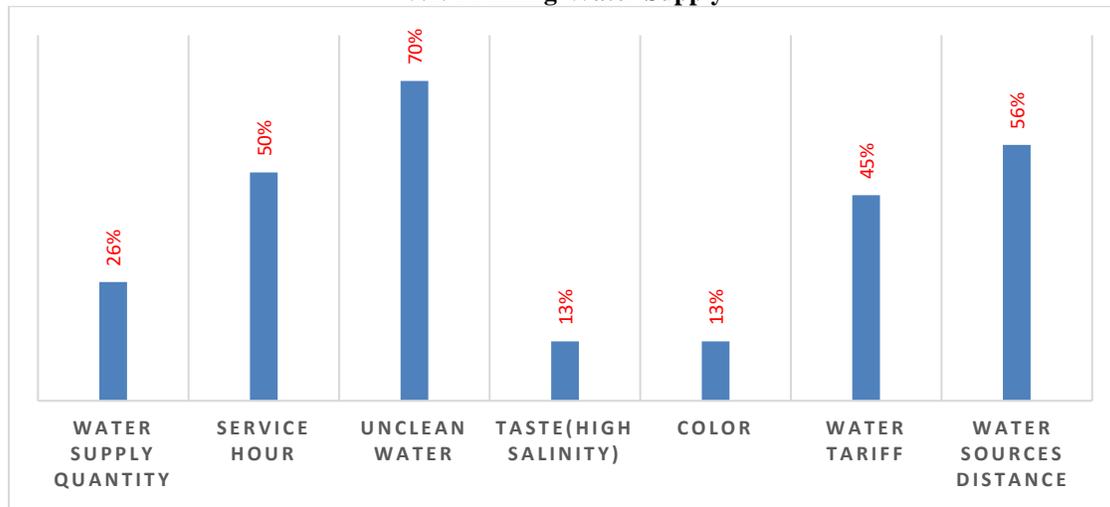


Fig.3. Showing the drinking water parameters in Juba city<sup>29</sup>.

From Fig.3, the result shows that Juba city water supply quantity is 26%, the water doesn't cover the whole city, and the water supply quantity has just ended in a few areas. The majority of the people was relying on the water vendors or water tank truck to get water supply. Service hours are 50%, it's mainly due to the power issues, the electricity cannot operate the whole day, that's why it affects the service hours, and the water tariff is 45% due to the unavailability of the water supply quantity in the whole Juba city. However, 70% of the households have expressed their mains water sources are unclean because most of the Juba population used to obtain their drinking water from the Vendors and water tank truck, its water quality is not well treated. The water quality problems which the customer identified are color 13% and taste 13%. The watercolor and the taste appeared because of the less concentration on the water quality treatment. Over 90% of the households expressed dissatisfaction with the current water supply conditions of both mains and supplemental. And the distance for getting water source is 56%. The water source points are very far from some residents and, it will take a half-hour to obtain drinking water and sometimes beyond this time.

The average time of the household's using urban water corporation UWC supplied water is 7 hours. The service hours of public tap and borehole with hand pumps are also restricted depending on the community. The average distance to water sources from the household is 281 minutes, and the average fetching time is 66 minutes. The water tanker's selling hour is also

unscheduled, and the purchase of water may not be possible sometimes<sup>29</sup>.

5.3. Treated Water Quality Parameters in Juba city 2018

The below table 5 are the results for the treated water quality parameters, the data composed of the following parameters such as water temperature, pH, conductivity, total dissolved solids (TDS), and residual chlorine.

Table 5 Treated Water Quality Parameters Results for Four Monthly Chemical Parameters in Juba city 2018

| Parameters             | Juba city, South Sudan |       |      |      | Specifications |           |
|------------------------|------------------------|-------|------|------|----------------|-----------|
|                        | Jan                    | March | June | Aug  | South Sudan GV | WHO GV    |
| Water Temperature (°C) | 25.9                   | 30.0  | 27.3 | 29.5 | -              | 25        |
| pH                     | 7.9                    | 7.3   | 7.3  | 7.9  | 6- 8.5         | 6.5 – 8.5 |
| Conductivity (mS/m)    | 1420                   | 132   | 138  | 131  | 150            | 400       |
| TDS (mg/L)             | 719                    | 482   | 590  | 572  | 1000           | 600       |

|                          |     |     |     |     |   |     |
|--------------------------|-----|-----|-----|-----|---|-----|
| <b>Residual Chlorine</b> | 1.6 | 1.5 | 1.5 | 1.8 | - | 0.2 |
|--------------------------|-----|-----|-----|-----|---|-----|

From the indicated Table 5, results show that water temperature for January, March, June, and August 25.9, 30.0, 27.3, 29.5 °C was above the WHO guideline value 25 °C. The water temperature could be higher due to the seasonal variation of temperatures, and the highest water temperature enhances the growth of microorganisms. And it may increase taste, odor, color, and corrosion problems<sup>47</sup>. The pH for January, March, June, and August 7.9, 7.3, 7.3, 7.9 was found to be normals in range with WHO recommended value (see Table 5). Therefore, pH was a measure of how acidic/basic water is-with the 7, beings neutral<sup>48</sup>. The water conductivity for January and August is 1420, 1331 mS/m is above the WHO guideline value 400 mS/m. It's because of the anthropogenic factors are thrown into the River Nile. However, for March and June 132,138, mS/m is below the WHO guideline value 400 mS/m. There was a significant change in the water conductivity in these mentioned four months January, March, June, and August. It could then be an indicator that less discharge or some other source of water pollution has entered River Nile during June, and August is the raining season in Juba city<sup>49</sup>. The TDS for January 719 mg/L is beyond the WHO guideline value 600 mg/L. that means the River Nile was exposures to some of the pollution substances. So the treated water quality for January is not well safe for drinking. The TDS for March, June, and August 482,590,572 mg/L found to be normals and in range with the WHO guideline value for the TDS 600 mg/L. Therefore, the treated water quality for March, June, and August is safe for drinking. The Residual chlorine for January, March, June, and August 1.6, 1.5, 1.5, 1.8 mg/L has a significant variation and above the WHO guideline standard 0.2 mg/L. The residual chlorine of 1.5 mg/L indicated that water is not well disinfected. Therefore, the water requires is 2.0 mg/L of recommended residual chlorine levels to destroy all organisms<sup>50</sup>.

## VI. CONCLUSION

The Juba city drinking water source is mostly from surface water, boreholes, water tank truck, and public-wells. That is not safe for drinking. The access to drinking water system coverage in Juba city is only about 20%. It has put the communities' drinking water in Juba city to source their drinking water from various places such as the River Nile that is dirty. The study results show the water temperature for January, June, March, August 25.9, 30.0, 27.3, 29.5 °C were above the WHO guideline value 25 °C. The highest water temperature has increase taste and color problems. Water conductivity for January, March, June, August 1420, 132, 138, 1331 mS/m were not in range with the WHO guideline 400 mS/cm. So the changing of water conductivity indicates that River Nile has received the discharge of pollution, especially in June and August are the raining seasons in Juba city. The residual chlorine 1.6, 1.5, 1.5, 1.8 mg/L were above the WHO guideline standard 0.2 mg/L. the residual chlorine of 1.5 mg/L indicated that water is not well disinfected. The pH for January, March, June, August 7.9, 7.3, 7.3, 7.9 mg/L was found to be normals with the WHO guideline value 6.5, 8.5 mg/L. And the TDS for January, March, June, 482,590, 572, mg/L were also found to be normals in range with the WHO guideline value 600 mg/L. Therefore, the treated

water quality for March, June, and August is safe for drinking. While the TDS for August 719 mg/L is not in range with the WHO guideline value, it's due to the exposure of the waste into River Nile.

Therefore, the study has concluded that the under-investment in drinking water system infrastructure in Juba city has seriously affected the availability of the drinking water system. The treated water quality parameters for January are not well safe for the drinking, while for March, June and August were safe for drinking. Therefore, the study has recommended that Juba city should improve the development of the infrastructures for the drinking water systems and treat the water quality parameters in accordance to the WHO permissible level to meet the 2030 Sustainable Development Goals formulated in 2015 as the 2030 Agenda through the water as key to Sustainable Development.

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# Sustainable production of medicinal plants in Serbia

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**Abstract-** In recent years, the sector of medicinal, aromatic and spice plants (MASP) in Serbia is experiencing new growth, developing new technologies, standards and markets. Today, unfortunately, despite the extremely rich biofund of this group of plants, production, processing and export of medicinal plants is below the levels of the late eighties. The closure of several large public companies, together with the lack of a sufficiently favorable political situation, has led to the discovery of raw materials and products in some other markets.

Therefore, in order for this to return to the place it deserves, it must act vertically and horizontally: vertically towards the institutions that directly or indirectly determine the state of the sector (ministries, chambers, associations, etc.), and horizontally towards participants in production and processing.<sup>1</sup>

**Index Terms-** Natural resources, crops of medicinal plants, ecological-genetic research and selection, organic production

## I. INTRODUCTION

Medicinal herbs, production and marketing are often unknown to many people. By growing medicinal plants, a larger amount of plant raw materials is obtained, uniform quality is achieved, and the pressure on natural resources is significantly reduced. On the Serbian market, the supply of seeds of medicinal plant species as well as planting material is not adequate. On the other hand, our country is a large exporter of unprocessed medicinal herbs and aromatic herbs. We often state that Serbia, thanks to its geographical position, ie climate and soil, as well as its rich tradition, is extremely suitable for collecting and growing medicinal, aromatic and spicy plants. However, we must also state that these potential opportunities are not used adequately.

## II. PRODUCTION OF MEDICINE PLANTS

The production of medicinal plants has so far been accompanied by many problems (insufficient organization, fragmentation of programs, insufficient equipment, both human and technical, incoherence of science and practice, limited number of cultivated species, unsuitable varieties, small and fluctuating yields, unsatisfactory quality, underdeveloped market). Today the

situation is gradually changing. Many problems have been overcome, the structure of medicinal plant production has been significantly improved. New species and new varieties are being introduced and the results of scientific research are being used more and more. The number of commodity producers is increasing, both in the social and individual sectors, and the cultivation of medicinal plants is becoming their only or main occupation.

Production specializes or concentrates in certain farms, where it takes on the character of a basic economic activity. The expansive development of this production begins, and thus the increased interest of breeders to learn new methods and ways to improve production. In our country, little work has been done on the issue of growing medicinal herbs. The lack of literature is also one of the reasons for the insufficient cultivation of medicinal plants in our country. Since in our country the cultivation of medicinal plants in culture, as agricultural production, has not been sufficiently researched, given the importance of medicinal plants, in organizing scientific work, attention should be paid to developing a methodology for introducing certain plant species into culture. It is necessary to take into account the climatic conditions and soil types of a certain area, which enable the appropriate type, and even a variety of medicinal and aromatic plants to be grown on a specific type of soil. It is necessary to analyze the possibilities of collecting medicinal plant species. We should not neglect what nature already provides.

In addition to several types of medicinal and aromatic plants that have been cultivated since ancient times, there is a great need for those medicinal plants that are primarily collected from the wild: linden, callus, nettle, etc. The task of science would be to choose from numerous plant species those behind which there is interest on the domestic and foreign markets and for which there are growing conditions. The problems of studying medicinal plants must be considered from the point of view of the general conditions of agricultural production, primarily the farming system which characterizes other agricultural crops. Therefore, it is often not possible to apply solutions from foreign literature, no matter how modern and based on new knowledge.

Growing medicinal herbs, as well as aromatic and spicy herbs in a protected area is becoming an increasingly lucrative hobby, and there are those for whom it is becoming one of the main types of income. The Resava region and the municipality of

<sup>1</sup> Filipović, V. and V. Popović (2014): State of the production and the collecting of medicinal plants in the Republic of Serbia. International Scientific Conference „Sustainable agriculture and rural development in terms of the Republic of Serbia strategic goals realization within the Danube region - rural development

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Svilajnac are especially known for growing these plant species. Interest in plantation cultivation of medicinal and aromatic plants was initiated by the demand of the processing industry whose end products are based on medicinal and aromatic plants, as well as the need for raw materials of uniform quality and quantity. More intensive plantation cultivation dates back to the 50s of the last century, and since the 70s some medicinal and aromatic species are fully introduced into the culture, which means that their origin on the market is exclusively from plantation production (mint, thyme, resist, chamomile, čubar, melisa, borač, marigold). The global trend of recent years is a great demand for medicinal and aromatic herbs. It is estimated that the same trend will continue in the coming years.

Thanks to the favorable climate, soil and unpolluted environment, Serbia is very suitable for intensive cultivation of medicinal plants. In terms of biodiversity, Serbia is ranked among the 158 best centers in the world; more than 700 plant species with medicinal properties have been identified in the rich flora, while 400 species of medicinal plants have been registered (of which 280 species are traded as industrial raw materials which are used for further production of medicines, cosmetics and hygiene preparations, spices, various extracts). ...).

In relation to the collection of plants from nature, plantation cultivation of medicinal plants has several advantages:

1. cultivation yields raw materials of standard quality, especially when larger quantities of uniform drugs are needed for the needs of the pharmaceutical and related industries (quality depends on genotype, chemotype, ecotype - habitat, climate, age, etc.);
2. it is easier to use the advantages of already existing agricultural techniques, ie. mechanization, sowing structures, protection measures, processing and processing of medicinal plants;
3. agricultural land resources are used more rationally, because poorer quality lands are also used; the engagement of labor needed for collection is canceled;
4. economic effects are greater compared to growing standard crops;
5. quality of the raw material can be more easily complied with pharmacological standards; rare, endemic, endangered species are protected from extinction, especially those whose collection is prohibited or strictly limited;
6. unused resources, unsuitable for other economic and agricultural activities (lands of hilly and mountainous areas, floodplains, lands prone to erosion, territories of national parks and nature reserves) are being revived.

In Serbia, crops of medicinal plants are grown on average over 3500 ha, mostly in the area of Vojvodina. Chamomile (*Matricaria chamomilla*), lemon balm (*Melissa officinalis*), valerian (*Valeriana officinalis*), hybrid mint (*Mentha h piperita*), myrrh (*Hyssopus officinalis*), thyme (*Thymus vulgaris*), coriander (*Coriandrum sativum*), cumin are mostly grown. carvi), selenium (*Levisticum officinale*), artichoke (*Cynara scolymus*), anise (*Pimpinella anisum*), marshmallow (*Althaea officinalis*), Echinacea and others. Directed cultivation of medicinal and aromatic plants would reduce the uncontrolled harvest of wild plants and thus prevent its extinction. It is equally important to point out that the production of medicinal plants brings higher,

faster and easier profit than other agricultural productions. Those few who are engaged in plantation cultivation of medicinal plants in our country claim that significant profits can be made by growing medicinal plants.

For example, according to the data of the Group of Producers and Growers of Medicinal Herbs, in 2016, for the production of chamomile, for example, the costs per hectare were around 600 euros, while the profit was around 900 euros. About 700 euros were needed to invest in the production of anise per hectare of land, and the positive difference was about 450 euros. For the production of marshmallow root, the costs were 2000, and the profit was 1,250 euros, while in basil, about 850 euros had to be invested in order to get 1,100. For the cultivation of coriander, which does not require much work, last year it took 530, and the positive difference was 70 euros. The production of marigold on one hectare cost 1,700, and the profit was 1,200 euros, while for mint in the first year of production, about 800 euros are needed, and in the next two years, half as much.

In the first year, about 600 euros are earned on nana, and in the second and third year, about a thousand euros. By growing and processing medicinal plants, significant amounts of waste material are obtained, which can be used as a natural fertilizer in organic agriculture (compost and various biodynamic fertilizers) or as fodder. Considering the needs of the world market, and especially the developed western market, the production of biologically pure medicinal herbs for buyers of organic food has started, that is. products obtained by applying the so-called technology. organic production. Production of medicinal and aromatic herbs according to the principles of the so-called Organic farming (application of organic fertilizers, weed control through alternative control measures, including mulching, crop rotation and other measures) has its future, especially in hilly and mountainous areas, which are fully environmentally friendly for this type of activity and, on the other hand, include key autochthonous habitats of the largest number of medicinal and aromatic species. In a word, the cultivation of medicinal and aromatic plants is completely in accordance with the principles of organic agriculture and sustainable rural development.

The constant use of plants in an area requires appropriate ecological-genetic research and selection procedures with the aim of obtaining new varieties, introducing them into culture and starting cultivation. Plantation cultivation can also produce species that do not originate from our area, which reduces the import of these raw materials. Properly applied nutrition and protection of medicinal and aromatic plants is acceptable for humans, and at the same time it ensures a good yield and economical production. Crop care is the next agro-technical work and it refers to rolling after sowing, thinning, cultivating, fertilizing, protection from weeds and pests, irrigation, mulching and pruning. When it comes time to harvest, it is done manually or mechanically, single-phase and two-phase. Two-phase is recommended for plants that mature unevenly, which easily scatter seeds. We need to know which plant will thrive best on a particular plot, and that there is demand again and that it has an economically viable price. The next condition is whether it is possible to procure quality planting or seed material. We don't need to produce even if we can't negotiate the sale. Previous cooperatives did not exist for no reason. I remember that the cooperative in MZ Ušće na Ibru contracted and sold medicinal herbs from Golija throughout the

year. The current production of medicinal, aromatic and spicy herbs cannot meet the needs of the market for products such as basil, anise, borac, chamomile, coriander, spice, mustard.

### III. TYPES OF MEDICINAL PLANTS GROWN IN SERBIA

Serbia used to be the leading country in the region in this area and could very easily return to the very top, with the support of state bodies. Favorable geographical and climatic factors and diversity of land types are prerequisites for large and diverse production. The economic factor should not discourage a potential grower - for the cultivation of medicinal plants, the initial investment is not large. The engagement of human potential is much more important than capital. The choice of species for cultivation is influenced by the characteristics of the plant itself, geographical location, type of land, as well as the demand and price of individual species, which should be reported in detail to the buyer. For optimal yield, it is certainly necessary to apply appropriate agro-technical measures, with the use of appropriate mechanization, appropriate soil configuration and size of plantations. Crops whose market demand is lower generally achieve a higher price for yield per unit of arable land, and small areas also require smaller monetary investments, so small-scale production can have significant advantages. This is exactly the case with the cultivation of medicinal, aromatic and spice plants. A good selection of crops for cultivation, taking into account the biological specifics of the selected species, can ensure continuous production during most of the year, and at the same time the optimal filling of drying and finishing capacities.

It is important, especially at the beginning, to make the costs as low as possible. Hiring additional labor requires additional investment and reduces one's own earnings. Small areas can be served by labor within a single household, which makes this production an extremely promising family business. In order to achieve better yield and quality, it is important to sow or plant in a timely manner, hoeing, weeding, thinning, fertilizing ... This is always easier to achieve on smaller areas. On large areas, due to the application of mechanization, plants are planted in a rarer group than required by their shape and size. Production on small areas is done manually, which makes it possible to grow a larger number of plants per unit area, and filling the missing plants is far easier. At the very beginning, large investments in drying capacities are not necessary. The problem of drying can be solved, with a significant increase in production capacity, with less investment in existing facilities. At the same time, maximum use should be made of solar energy and other cheap alternative sources, which certainly reduces production costs. Organic production is a system of sustainable agriculture based on high respect for ecological principles:

1. rational use of natural resources,
2. use of renewable energy sources,
3. conservation of natural diversity and
4. environmental protection.

Organic production in Serbia is becoming increasingly popular and economically important, and thanks to the potentials, primarily fragmented land and land that is not polluted with harmful substances, this type of agriculture can significantly contribute to the development of rural areas and agriculture in general. Therefore, organic production is set as one of the priorities of agricultural development and is an integral part of the strategy for the development of agriculture and rural areas of Serbia.<sup>2</sup> Below we will list some of the plants that are grown in Serbia with more or less success. The following six species are grown on the largest areas in Serbia:

1. sage (*Salvia officinalis* L),
2. lavender (*Lavandula officinalis* Chaix),
3. chamomile (*Chamomila recutita* (L) Rauch)
4. thyme (*Thymus vulgaris* L),
5. coastal immortelle (*Helichrysum italicum* (Roth) G. Don)
6. rosemary (*Rosmarinus officinalis* L).
7. Marigold (*Calendula officinalis*)
8. Fennel or sea buckthorn (*Foeniculum vulgare*)

### IV. AGROECOLOGICAL AND SOIL CONDITIONS IN THE REPUBLIC OF SERBIA

The analysis of agroecological and soil conditions in the Republic of Serbia in the past 30 years shows that global climate change is affecting the wider region of Southeast Europe and our agro-ecological area. This is observed by an increase in air temperature during the vegetation period of spring sowing crops by about 2 ° C. In the summer months, the relative humidity has less and less values, it is often accompanied by dry winds and air temperatures above 35 ° C. Such weather conditions in the long run cause great damage to all arable plants. Uneven precipitation distribution with a deficit of up to 300 mm during the summer months significantly affects the yields of most crops. All available agro-technical measures that have a preventive character should be included in the fight against drought. These are cultivation adapted to the storage of water in the soil, plant nutrition, selection of genotypes, sowing, care and protection of crops during the vegetation period. When cultivating the soil, preference should be given to conservation and reduced tillage, with as little machine passage and drying of the surface layer as possible. Varieties with a shorter vegetation period and hybrids more tolerant to drought should be chosen.

In areas with low summer rainfall and high air temperatures, winter crops or drought-tolerant crops should be grown more. These drought control measures should be started as soon as possible in areas with limited crop irrigation. Respect and adequate application of agrotechnical measures increases seed germination and significantly helps in the fight against weeds, which leads to savings on plant protection products. It is the right time to apply contemporary knowledge and find out what of the agro-technical measures is recommended before spring sowing in order to achieve maximum yields.

<sup>2</sup> Law on Organic Production, [www.mpt.gov.rs/introduced/123/3920-09.pdf](http://www.mpt.gov.rs/introduced/123/3920-09.pdf)- Zakon o organskoj proizvodnji, [www.mpt.gov.rs/postavljen/123/3920-09.pdf](http://www.mpt.gov.rs/postavljen/123/3920-09.pdf)

## V. SOIL PREPARATION, CARE MEASURES AND FERTILIZATION

Basic processing is performed in the fall to a depth of 30 cm. Before the basic processing, 30-40 t / ha of well-burned manure and 500 kg / ha of NPK 15:15:15 are evenly distributed on the plot surface. It can be sown in the same place after at least 3-4 years. There are 200-300 of them in a gram of seeds. If a precision seed drill is used for fine seed, 3-4 kg / ha goes, while manual sowing should use 6-10 kg / ha of seed. 1-2 g per square meter is consumed in the funnels. In early spring, when the machines can enter the plots, it starts in well-prepared soil with sowing. The row spacing is 60-70 cm, and 20 cm in a row. Depth of sowing is 1-2 cm. Seedlings are transplanted when the height is 10-15 cm. They are transplanted to the same depth as they were in the bed. Before transplanting, the leaves are shortened. The head is formed above the ground.

Analysis of agroecosystem dynamics implies complex interactions between plants, animals, humans and the environment and agroecological impacts.<sup>3 4 5</sup> Agroecological studies from the statistical perspective of the research take into account spatial scales that are larger than the plot, or from the agricultural area because the effects of agricultural practice on the environment and the impact of environmental conditions on agricultural areas cannot represent local phenomena from an agroecological point of view. they could be well analyzed at the regional level.<sup>6</sup> Additionally, even if a relatively small system was analyzed, crop and animal production in such a small system would be influenced by both local and regional environmental conditions; that is, even a small area of agricultural land can be viewed as a complex ecosystem from an agroecological perspective. Thus, multivariate and multifactorial statistical approaches may be necessary to model and describe small systems accurately.

## VI. CONCLUSION

Serbia is suitable for growing medicinal and aromatic plants. Since demand for medicinal plants in recent years has

shown growth in the world market. Works in spices, aromatic and medicinal herbs do not coincide with other works in the countryside. Production can also be organized on land of lower credit rating classes. Earnings are achieved with a certain risk in the initial phase, and later it becomes much safer when experience is gained. The cultivation of medicinal plants achieves a uniform quality and a safe amount of raw materials and enables compliance with deadlines, which is a great advantage in relation to the collection of raw materials from nature. By growing medicinal plants, it is possible to protect a large number of wild, endangered species whose collection is prohibited or restricted, which contributes to the preservation of the natural resources of our country.

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# A Sociological Analysis on Max Weber's Methodology

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**Abstract-** It is during the classical period of sociology that a strong foundation was laid on its theoretical progress. During this particular period of time, Max Weber, an outstanding classical sociologist became an exception in introducing a sociological methodology, which can enhance the prospects of sociological studies. Following the evolution of the European society into the scientific stage, having based on two *Paradigms*, researches have been conducted by the scholars who have directed themselves for the supplantation of scientific knowledge for the functionality of the materialistic and socio-cultural worlds. Those two *Paradigms*, are known as 'Nomothetic Approach' and 'Idiographic Approach'. Most importantly, Max Weber, the above mentioned German classical sociologist could be considered as an exception, since the sociological methodology, introduced by him directly belongs to neither 'Nomothetic Approach' nor 'Idiographic Approach'. As such, this specific methodology, introduced by Weber for the realistic understanding of the human society is known as the Weberian sociological methodology.

Max Weber, having demonstrated his methodology has combined the techniques relevant to both 'Nomothetic Approach' and 'Idiographic Approach'. Most importantly, having based on the disciplines of 'history' and 'sociology', Weber has presented his own methodology of analyzing the society. This paper discussed as to how Weber has based on history and sociology in investigating the society as well as that of his way of investigation on the social phenomena. The analysis on this specific methodology is based on the facts derived through the academic secondary sources which include the analysis of classical theories of sociology. The explanation on Max Weber's methodology on the titles of 'Understand/Meaningful', 'Causality', 'Ideal Types' and 'Value-free – Judgment in Sociology' and as to how those titles could be used in understanding the social phenomena were also taken into account.

**Index Terms-** Paradigm, Causality, Ideal Types, Value Free – Judgment

## I. INTRODUCTION

During the classical era, Max Weber is considered as a reputed German classical sociologist who gave a pioneer contribution for the theoretical and methodological development of sociology. Max Weber was born to a middle class family in 'Erfurt', Germany, on the 21<sup>st</sup> of April 1864, in the nineteenth century, during the 'Bismarck' administration. He expired on the

14<sup>th</sup> of June 1920. It is understood that the system of attitudes corresponding to the capitalist socio-economic system which is a unique feature of Weber's sociological thinking is a result of the socialization, gained through his elite family background.

Weber's elite family background has influenced on the creation of his sociological vision being different from that of the visions of the other classical sociologists. By the time Weber lived in Germany, two basic paradigms which were needed to be addressed in the sociological studies, conducted in order to generate the scientific knowledge in understanding the real form of society were getting popular in Europe. 'Nomothetic Approach', based on the vision that the reality of socio cultural phenomena is decided according to a certain natural law which remains externally from the man is the first of them. This has been used on the basis of causality corresponding to the natural sciences. The creation of the reality of social phenomena takes place with the people's contribution and interference and as such it is able to build up a scientific knowledge by accurately understanding the meaning, given by the people to social phenomena is the second approach. This is introduced as the 'Idiographic Approach' which is considered to be used in investigating the empirical reality of social phenomena. It is clear that Weber's sociological methodology has directly inclined with none of these two specific *paradigms*. According to that having combined the above 'Objectivistic' and 'Subjectivist', the two *paradigms*, Weber has introduced a unique methodology for the investigation of social phenomena. Weberian sociological methodology, introduced by Weber which should be followed by the sociologist in the scientific study of social cultural phenomena is known as an 'Intermediate Approach'. Due to the presence of intermediary characteristics of the 'Nomothetic' and 'Ideographic' methodologies, it is introduced as an intermediate methodology. This paper is expected to review the Weber's sociological methodology which should be applied with the scientific interpretation of the society.

## II. HISTORY AND SOCIOLOGY

It is required to inquire briefly the opinion of Max Weber on the relationship between history and sociology in order to understand his sociological methodology which was the basis for his sociological idealism. History was his most sought after subject even when Weber was a student and a young lawyer. Weber obtained his PhD from the University of Berlin, Germany, and his doctoral thesis on 'Medieval trade law significant for the

study on Roman agricultural law and logical history' being an analysis based on law and history is a testimony even for his initial interest in history. However, it is clear that he got mostly concerned with sociology towards the middle age of his academic life. 'Economy and society', the best master piece, authored by Weber in 1909, being based on an entirely sociological foundation demonstrates the considerable academic contributions done by him on the field of sociology. Towards the contemporary period of during which Weber lived, he had directed himself towards a new direction of 'sociology' which was established as a novel discipline in the Western European society. Weber has taken efforts to inquire deeply the relationship that sociology has got for the stability of the field history.

As per Weber, every field of study is indispensable for the other field of studies whereas an interrelationship with each other is also being visible. Therefore, he has emphasized that the role of sociology is the supply of essential service to the field of history. As noted by Weber, sociology performs a basic, moderate and perfect work for the society. Weber has also shown the difference between sociology and history. In that light it has been demonstrated that actions are taken by sociology for the formulation of models and concepts, associated with the practical process corresponding to social integration. It has been demonstrated that due to the inclination of sociology towards the causality analysis of the actions of people with different cultural significance and that of their structural circumstances. Even though, there involves a slight difference between these two specific subject disciplines, Weber has combined both these disciplines in his academic discussions. Likewise, Max Weber in all his sociological discussions has developed and presented the concepts which involve the causality analysis on historical socio-cultural phenomena. Under such circumstances, Max Weber is considered as a 'Historical Sociologist'. The intellectual arguments, erupted in Germany during the contemporary period of his life have had a direct impact on upliftment of his comprehensive sociological idealism. In this aspect, the intellectual arguments arose regarding the relationship between History and Science were the most significant.

Most importantly, according to the positivists, this specific intellectual argument prevailed between the concept which considers that even history could be considered as a natural science and the concept, upheld, by subjectivists where it is considered that history and natural sciences are two different disciplines of subjects. Having rejected both these two intellectual extremes, Weber developed a specific novel concept on history which has links with sociology. As per this particular novel concept of Weber, history is created as a consequence of the impact of specific empirical phenomena which cannot be generalized on an empirical level. Hence, Weber points out that the sociologists should conduct the studies by differentiating their *Heuristic Tools* from empirical world. Weber has emphasized that the concepts are not entirely able to grasp the empirical world and its activities but it is able to understand the actual reality of the empirical world by using heuristic tools. Accordingly, the sociologists are able to logically develop these concepts by generalizing them into the empirical reality. Weber further declares that history is not capable of this particular generalization but it should not be contradicted with the empirical reality.

While being significantly impressed by generalization, Weber refused the efforts taken by historians in narrowing history according to a simple rule of law. As such, Weber refuses the concept which involves in the fact that the historians comment that as per the general notion of law, the man and the human civilization go through several stages in sequence. Weber believes in the fact that the general notion of law which is used to mitigate the empirical reality is meaningless. Weber's this particular sociological concept is reflected in most of his historical studies. For instance, in his study on ancient civilizations, it has been demonstrated that it is not able to identify either a closed circular path or liner progression within a long and persistent medieval European history. Weber has defined that the entirely dormant phenomena related with ancient civilization may at times re-emerge in a new context.

Having shunned the traditional academic concepts on history, prevailed in Germany, Weber presented a two-dimensional model perspective which is unique to him. And these two dimensions, which should be taken into account with regard to Weber's sociological prospective on history, are known as 'Individuality' and 'Generality'. Weber shows that one particular specific conclusion is able to be reached, through the study of specific social or human activities by practically using the general concepts. Weber emphasis that these general concepts can be used in identifying the individualism relevant to all the novel social status while being able to interpret the same as well and by means of those characteristics it is able to arrive at a one single conclusion on the way of the difference of one social status from that of another. Weber shows that this process assists in getting the reasons, affecting with the differences of different social stages in history revealed. Weber, having done a causality analysis on history, Weber eventually refuses the conscientious idea where history is investigated with a single reason. In lieu of that, Weber has used his conceptual model for the categorization of different facts involving specific reasons unique to a certain historical phenomenon. As Weber's concept is declared in nutshell, history is created, as believed by Weber in an unending sequence of specific phenomena. He emphasizes for the study of different concepts, planned and developed to be used in a way where the realistic world can be investigated are necessary. Weber has mentioned that the enhancement of these concepts is the aim of sociology and the role of history should be the causality of analysis of its specific historical phenomena. It is clear that Weber has taken efforts to for develop a science which is able to investigate the nature of the complex social life by combining both 'specific' and 'general' two directions.

### III. VESTEHEEN: UNDERSTANDING

Weber's 'Understand/Meaningful' is another methodology, which could be taken into consideration for the study of human activities. Weber used the word '*Vestehen*' in order to introduce this sociological methodology. '*Vestehen*' is the word used in the German language which replaces the English word of '*understanding*'.

Weber's introduction of his sociological methodology as '*Vestehen*' shows that the sociologist should study the social activities in accordance with '*understanding*' methodology (Allen, 2004, p.72/ Ringer, 1997, p.92). Weber defines that

'understanding methodology' is an approach unique to sociology and due to that the advantage, given to the sociologist is relatively greater than that of the natural scientists in the research accomplishments. This shows the fact that Weber has declared that the sociologist has the ability of meaning full understanding of social phenomena and their activities in the social researches. However, Weber has shown that natural scientists do not have the ability of understanding the behavioral patterns of natural materialistic components, atomic particles or the chemical composition during the process of experimentation. The sociologist attempts to understand the reality of social phenomena by studying the behaviors and interactions of the people who dwell in a socio-cultural environment who have got feelings, emotions and perceptions which are similar to that of them. Weber mentions that the person whose activities and behaviors are studied by the sociologists has got a certain meaning on those activities which he does. But, the natural scientists study through the 'experiment' methodology about the behaviors and activities of the materialistic phenomena of the natural world which do not have emotions, feelings and perceptions. Therefore, it is not able to derive a meaning through these specific materialistic phenomena studied by the sociologists which do not have an ability of thinking. In order to understand the activities and realistic nature of the materialistic phenomena which do not have emotions, Weber suggests that research methodology, followed by natural scientists could be more suitable. Under these circumstances, Weber argues that the research methodology of the social sciences is not certainly reliable for the studies, conducted in order to accurately understand the activities and behaviors of the people who have emotions, feelings and perceptions, living in a socio-cultural environment.

Within the above discussed situation, Weber emphasizes that the sociologists, conducting the research in order to accurately understand the activities of the socio-cultural phenomena should use a specific methodology unique to them which is not involved with the methodology of natural sciences. Therefore Weber highlights that the sociologist is able to understand the human activities and behaviors which he studies by understanding the meaning of those activities, given by the studied actor in association with his sensitiveness Weber named and introduced this sociological methodology as 'Verstehen' or 'understanding'. Weber has used the term 'sympathetic introspection' in interpreting the central meaning of the sociological methodology. Weber has explained in 'sympathetic introspection' that in order to justify the accuracy of the interpretation of a meaning of a sociological phenomenon, it would be more beneficial to accurately understand the meaning given by the relevant actor himself according to his subjective imagination on the activity which he does. It is the method of understanding his activities and behaviors with the actor's meaning through a subjective approach is introduced as 'Subjectist Approach' which is used to study the sociological phenomena of the principals of social research.

#### IV. CAUSALITY

Max Weber's causality analysis is another identified approach of his sociological methodology. It is clear that Weber has given his major concern on the investigation of causality analysis of social phenomena, associated with history, more than

the sociological point of view. However, a considerable difference cannot be seen among those subjects in Weber's analysis, as sociology and history cannot be distanced from each other. This specific causality analysis is significant, since it reflects another aspect of Weber's theoretical point of view. This reveals a methodology which Weber followed in investigating social phenomena in which both 'Nomothetic Approach' and 'Idiographic Approach' which are combined together.

In interpreting the vision of causality analysis, an activity can be introduced as understanding of a phenomenon which initiates its actions with the influence of another activity. It is understood that Weber's point of view is different from many historians who get satisfied that the understanding of the repetition of certain actions, the clear comparison of them with each other and the simultaneous happening of actions is sufficient for the historical authenticity. For that matter Weber defines that as a researcher investigates a social activity or a phenomenon, the affected reasons for that as well as the meaningful significance of its historical changes should be investigated. Weber has identified 'Dialectical Model', presented by Karl Marx based on contradiction as a 'One-way Causal Model'. Weber was mostly into the investigation of economy, society, states, organization, religion, social strata and some more within sociology. Therefore, Weber directed his investigations in analyzing the influence, created by an interrelationship involving a large number of reasons through the investigation of 'Multicausal Approach'.

However, it is understood that some of Weber's sociological analysis are different from the above approach. The concept, presented by Weber on his study of 'Protestant Ethics and the Spirit of Capitalism' clearly questions his causality analysis. The easiest argument leading to the questioning of Weber is the fact that protestant ethics are only one of the other casual factors contributed towards the modern capitalist development in Europe. But the argument, brought out by Weber's analysis is the fact that the influence of the reforms of Protestants was the only reason for the European capitalistic renaissance. But Weber does not argue in the fact that European capitalistic renaissance took place due to the influence of many other casual factors. Not only in this particular study but also in most of his theoretical analysis, this specific contradiction in causality analysis is seen.

However, it is clear that Weber was hugely influenced by 'Multicausal Approach' in understanding the social phenomena while leaving away the 'One-way Causal Model'. According to Weber's above declared idea on 'Understanding' the knowledge, presented through the causality analysis by social sciences on social phenomena is different from the knowledge developed through the causality analysis of natural sciences. Weber declares that by the valuation of the meaning and the value of the social activities which could be meaningfully interpreted by social sciences, it creates an easy platform in accurately understanding them. Due to this specific reason, Weber emphasizes that there involves a considerable uniqueness in the criteria taken for the causality analysis in social sciences of the historical prevalence of human activities. Therefore, Weber has further defined that the knowledge, developed through causality analysis in natural sciences differs from that of the same developed through the causality analysis of social sciences. Weber's idea on the causality analysis is considered as a pattern of thinking which can thoroughly grasp the conflict between nomothetic and idiographic

knowledge on social phenomena. Nomothetic point of view persuades for the argument on a necessary relationship among social phenomena, while subjectivist pattern of thinking giving prominence on the analysis of random relationships among social phenomena. But Weber has declared that the analysis on social phenomena should be done while remaining in a middle position of these two analytical thinking patterns and this specific analytical concept is considered as 'Adequate Causality'. Weber has shown that a better 'Probabilistic Statement' which is unique to social sciences on the relationships developing within social phenomena through this specific 'Adequate Causality' analysis.

## V. IDEAL TYPES

'Ideal types' could be introduced as a concept which came to the limelight with the combination of the philosophical thoughts of 'Platonism' of Plato, 'Historicism' of Wilhelm Dilthey and 'Kantian Metaphysics' of Immanuel Kant and also as a significant theoretical approach which got introduced to the sociological theory by the contribution of Max Weber. Weber has given a detailed description in his academic documents about the 'Ideal types', since he understood that by developing the methodological approach on the 'Ideal types', it was able to justify the productivity of his sociological analysis. Weber's initial detailed description on the methodological approach about ideal types was appeared in 'Objectivity', his academic essay, published in 1904 (Ringer, 2004, p. 101), where examples are available on the concept of synthetic construction as the most highlighted idea about the historical phenomena in the existing economic theory. It gives an ideal picture on the activities of a commodity market in an organized society based on an extremely logical administration where there involve independent competitive or exchange principals.

Through this conceptual framework, an imaginary harmonious system which includes the whole of relationships and activities within the historical way of life is established. Weber has demonstrated that it is able to reach at an analytical conclusion on the principals happening in the reality in accordance with the concept of 'Utopia' (Ebrahim and Moragn, 1985, p.176). Likewise, Weber defines that in studying and understanding the social phenomena and social activities happening within the actual realistic society, the sociologist should have a psychological imaginative ideal framework, initially built up on such activities. The sociologist should build up an 'imaginative ideal framework' on the best superior sequence in which the relevant social activity should happen by his understanding on the historical activities in the society or investigating the existing practical social activities. And this is introduced as the 'Ideal Types'. Likewise, Weber declares that it is able to analyse the social activities happening in the realistic society while being based on the 'Ideal Type' which the sociologist have got on a certain phenomenon. At that juncture, the sociologist attends to reach at a conclusion on the realistic framework of the society by measuring the degree of deviation of the practical reality from the 'superior framework of ideals'.

Weber in his analysis on 'Ideal Types' declares that Ideal Types could be considered as conceptual idea which could unanimously generate one or several ideas surrounded by conversations happening separately on the personalized phenomena which can be either rarely ignorant or more or less

scientific. Weber notes that even though 'Ideal Types', an integrated analytical structure designed with an unanimous emphasis on different visions is a psychological, logical and clean concept, it cannot be identified in its actual form through empirical social reality. The specialty in ideal types is the fact that it could be used as a self-investigating Heuristic Device which is quite useful in the empirical studies, done in order to understand a significant cross section of the social world. Therefore, as declared by Weber, the duty of the 'Ideal Types' should be the understanding of causality relationship of the actual social reality by analyzing the divergences or similarities between empirical reality and ideals in the comparison of empirical social reality with the superior psychological conceptual structure (Ringer, 2004, p. 102).

The use of 'Ideal Types' as a Heuristic Device, used in the study of the reality of the historical activities of the social phenomena as an example is given below. Initially a sociologist is able to build up an ideal model of the bureaucracy by being heavily concerned with the historical information on official governing system. Secondly, these ideal types are compared with the activities of the actual bureaucracy. Later on, the sociologist should analyse the degree of deviation and similarity between the bureaucracy and the ideal-typical bureaucracy involved with exaggeration while inquiring the reasons behind the deviations and the gaps.

The expected causes which may affect with the difference between the ideals of the officials systems and the practical reality may be as given below.

1. Utilizing the bureaucratic activities, enhanced by wrong information.
2. The wrong strategies practiced by the leaders of legal.
3. Getting the activities of leaders of legal and their followers mislead.
4. Formulating of legal policies based on emotions.
5. Dysfunction of the activities of leaders of legal and their followers.

In this way it is clear that a sociologist comparatively analyzes the present actual empirical reality of the social phenomena with the ideal involving with the best sequence of activity of the relevant phenomena, based on his conceptual interest associated with the information of an historical social phenomenon. In this aspect the superior sequence involved with ideals, used by the sociologist cannot be seen as it is in the actual social activity. Not been able to make a conceptual ideal as practical as it should be is the reason behind its mismatch. Hence, Weber declares that the sociologist, based on ideals in conducting his studies on social phenomena should reach at an accurate conclusion on the existing social reality by analyzing the difference between the ideals and the practicality as well as the types of causality affecting with such a difference.

However, Weber has defined that although ideals are in accordance with the conceptual interest of the sociologist, they may go in line with the practicality other than entirely getting deviated from the practical reality. The reason is the fact that ideals are build up through the logical imagination of the sociologist more than the whims or fancies perceived in the mind of the

sociologist. As per Weber's vision on ideal types, no overview theory, raised from the inferior deductively, based on the carefully interpreted concepts within an ideal is involved.

In lieu of that, it has been emphasis that there involved a structure consisting of logical concepts which derive from inductivity taken place through the reality of the historical social world. As Weber emphasis that ideal type is neither generalized concept, nor it is a specific approach, his sociological methodology is introduced as an 'intermediate approach' which has got the in-between characteristics both nomothetic and ideographic methodologies. Weber has identified that ideal types have been initially divided into different forms within the logical concept on ideal types, presented relevant to the social happenings (Ritzer & Goodman, 2004, p.206; Abraham & Morgan, 1985, p.176). The different forms of those ideal types have been given below;

1. Historical Ideal Types: The ideal types, related to the phenomena relevant to a specific period time in history are included in this type. (For instance: Protestant ethics, Capitalist Market )
2. General Sociological Ideal Types: The ideal types related to the phenomena identified for several historical periods of time. (For instance: bureaucracy)
3. Action Ideal Types: The ideal types, built based on the impressions of the person who does an activity. (For instance: affectual/emotional action)
4. Structural Ideal Types: The ideal types related with the casual analysis of the social activity. (For instance: The system of tradition dominance)

#### VI. VALUE FREE - JUDGMENT IN SOCIOLOGY

As per the sociological methodology of Max Weber, it is required to evaluate in nutshell the way in which the sociologist should act within the socio-cultural environment as he studies the human activities in the society. Weber has defined the way of approach of the sociologist who does scientific studies on the society with his introduction of 'value free Judgment in sociology'.

According to the academics who are bound by positivistic approach, the values which can logically interpret the meaning of human activities are known to be obstructing the achievement of their targeted goal. And also, as per the academics who depend on idealistic approach, values erode the scientific ability of a science which talk about human activities. But according to Weber it has been emphasized that the scientific authenticity of a study on human activities is ensured by the values.

But, according to Weber's meaning given to the 'value-free approach in sociology' which is used by him to introduce the methodological approach of sociology with regard to his vision, it is emphasis that the sociologist should conduct his studies deviating from the value analysis of the values which are bound by all of his deeply rooted cultural values, whenever he is involved with the studies about social activities. On the other hand, it is noted that '*Vestehen: Understanding/Meaningful*' or

'Sympathotic Introspection' which include Weber's sociological methodology emphasizes that there involves a certain meaning of any of activity which any person in the society does. Weber has shown that as a person gives a meaning through himself from an activity which he does, this specific meaning is generated, subjected to the values rooted in him while being in accordance with his socio-cultural environment. Accordingly, ideal values directly affect in giving an accurate and logical meaning to a human activity. There involves a dichotomous appearance in value free judgment in sociology and '*Vestehen: Understanding/Meaningful*'. According to the idea that the scientific ability of a study about human activities is eroded by values, it has been identified that since the sociologist is also a person who lives in the society, values are considered as an inalienable part and parcel of him. Therefore, it is demonstrated that the conclusions given by a sociologist following his study on human activities, may get influenced by the values by which he is bound. In that light Weber emphasis that the sociologist should be more logical in conducting his studies where as he is required to deviate temporary from the values by which he is deeply bound. It is also highlighted that the sociologist should declare his conclusions while deviating himself from his own value analysis, but by understanding the human activities in the spirit of the meaning, given to them by doers of the activities.

However, as argued by Weber, that among a vast of social facts and fields, the sociologist should select a specific social activity, phenomenon or a field, in conducting studies on the society. The sociologist is required to be in accordance with his social values in selecting a research proposition. As such, Weber highlights that an exact empirical analysis cannot be done on social phenomena or culture. Under the above circumstances, in Weber's methodology, the relationship between the sociologist and the values has been explained with reference to the relationship between 'value freedom' and 'value relevance'. As the sociologist does his studies on social phenomena called 'value free', he should be able to do his analysis while being free from his deeply rooted values. It is meant that as a sociologist selects a specific research proposition called the 'relevance to values' that specific selection is done according to his own system of values.

Weber has shown in his methodology that a clear and scientific guide is given to the empirical studies by this specific dichotomous relationship of the values within the process of socio-cultural studies. Another idea derived through this particular situation is the fact that the researcher should not be misled by approaching an illogical research proposition based on his values, but should be guided towards a clear path where the selected problem could be well addressed. A very good example taken from his another study bears testimony to this specific fact. The question 'How did Western Capitalism Begin?' on Weber's study on the raise of capitalism and protestant values is a research proposition which he selected in accordance with his values. In addition to that, it could also be highlighted that it is 'The Role of Protestantism' which is in accordance with weber's cultural background is the correct direction in order to approach with the study of this specific question (Allen, 2004, p. 75).

Weber's vision on 'value free sociological methodology' could be summarized as given below. Weber emphasizes that the sociologist who does studies on human activities and behaviors should be able to study and understand the social activities not

being bias by his own value analysis, but by being entirely deviated himself from those values. It is vehemently emphasized that the sociologist should temporary put aside his own values in his attempt of understanding the meanings given by the other people who are quite like him in the society about their behaviors and activities in order to reach at an accurate conclusion (Allen, 2004, p. 73). In that context, Weber believes in the fact that the sociologist is able to have an exact specific and realistic approach on the human activities.

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# Working Capital Management Impact on Economic Value Addition of the Poultry Industry in Nigeria.

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**Abstract:** The poultry industry as a key player under the category of Small and Medium-Sized Enterprises (SMEs) in the Agricultural sector makes critical use of the component of working capital and their contribution to the economy of the country is a direct variable of the value addition generated. The efficiency and judicious utilisation of the key components of the working capital components combined with the peculiarity and uncertainties associated with the Nigerian business environment can make or mar the success of such SMEs operating in the poultry industry and this is a focus of this study. The study employed survey design with cluster sampling approach. The study population is made up of Poultry farmers in 162 farms as registered with the Poultry Association of Nigeria-Ogun State Chapter with the total of 200 farm managers, this number exclude farm attendants and other non-managerial staff as they are task staff. The Cochran formula was used to obtain a sample size of 150. The owners/managers and other participants in these farms were selected through a multi-stage sampling technique which involves the stratified, proportionate, and simple random sampling method. The instrument validity was done through scrutiny and evaluation by the research supervisors and experts in the study area, and reliability was determined via Cronbach's alpha coefficient computed from pilot study responses. By the use of instrument codes, responses were processed into quantitative data for descriptive and empirical analysis. The analysis revealed that all proxies of working capital management practices such as cash management, accounts receivable management, accounts payable management and inventory management have a significant positive effect on economic value addition of the poultry industry (Adjusted R<sup>2</sup>= 0.057, F-statistics = 2.485.: p= 0.035<0.05). Thus, the study concluded that working capital management proxies, of cash management, accounts receivable management, accounts payable management and inventory management, has a significant positive effect on the economic value added of poultry industry in Ogun State, Nigeria.

**Keywords:** accounts payable management, accounts receivable management, cash management, economic value added(EVA), inventory management and Working Capital Management.

## 1.1 Introduction

For SMEs operating in a global dynamic competitive market to achieve growth, development and profitability, working capital management are often a condition for survival (Namusonge, Muturi & Olawoye, 2016). Poultry farms as a sub-set of the Livestock industry are farms that raise chickens (layers, broilers, cockerels and noilers), ducks, turkeys, and other birds for meat and egg production. In the past, poultry farming involved raising chickens mainly in the agrarian farms or in the back yard for daily egg production and family consumption. However, poultry farming today is a huge business that is split into several operations including hatcheries, poultry services and veterinary services, other inputs suppliers, pullet farms for meat and egg production (Adegbe & Alawode 2020 ; Fadeyi 2018; NPS 2018).

Chickens originated from Jungle Fowl in South Eastern Asia around 3200 BC (Olorunwa, 2015). Chickens were domesticated and spread to all the continents including China, India, Africa, Pacific Island, and Europe. Table eggs provide rich proteins and vitamins, especially the good fat-soluble vitamins (A, D, E, and K). As a fast-paced cycled operations, poultry farms can fulfil constantly the basic demand for meat and eggs, and can be grown into meeting an ever-growing need of the universe. Chickens are fast growing animal which in the past will take about 4 months to produce a two- kilogram chicken but today a four-kilogram broiler can be produced in 42 days (Olorunwa, 2015). And this positive development of 42 days, a better understanding of livestock husbandry practices aided by technological innovations have made poultry farms to be profitable ventures.

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In Nigeria, with SMEs constitute 97.2% of the companies in Nigeria and the poultry industry is not an exception (Ministry of Trade and Investment, 2011). However, the SMEs performances have fallen short of expectations in Nigeria (Eniola, Entebang 2014). The country is still characterized with alarming unemployment rate of 19.7% in 2010 and 43.67% in 2016 (Aminu & Shariff, 2015), as well as, high level of poverty for more than half of the population still live below the poverty line (Gbandi & Amissah, 2014). This shows that SMEs are not effective in this part Nigeria. Quite a good number of SMEs go into extinction shortly after their establishment and few that survive hardly make to the end of second and at most third-generational farms.

Farms profitability could be damaged because of inefficient working capital management. The Poultry farms have often failed due to the lack of knowledge of efficient working capital management (Kehinde, 2011). Additionally, the environmental uncertainties as applicable to businesses makes the predominantly SME farms to rely excessively on equity and maintain high liquidity and these financial characteristics affect profitability and consequently economic value added. Working capital management in SMEs is noticed by these researchers (Afrifa & Padachi(2015) ; Baños-Caballero, García-Teruel, & Solano(2010); Kehinde(2011).; Wali Ullah, Zahid, Khan, & Islam (2018)). However, in many previous studies about working capital management there are still some limitations and more so little or no research work has been carried on working capital management with regard to economic value added or capital maintenance of the poultry industry especially in a developing country like Nigeria. Performance and value addition is one of the most concerned goal of enterprise owners, therefore studying about relations between working capital management and Poultry industry value addition will have more belief in the effectiveness of working capital management and to be more helpful in understanding the working capital management of not only the poultry industry but other related and associated businesses in Ogun State, Nigeria.

## 1.2 Statement of the Problem

In Nigeria, defining the research problem of the SMEs and specifically the poultry industry may begin with a consideration of the typical characteristics of management staff and structure. Most SMEs do not have any organizational structure and this can consequently be narrowed down to SMEs not having a structured approach to dealing with suppliers (payables and inventory) and customers (receivables) set ups. And most owner-managers and farm managers have no formal training in managing these specific components of the working capital and thus may experience mix-up in definitions of concepts and realities.

The SMEs in Nigeria have not been surviving as most SMEs collapse with the economic meltdown of between 2005 and 2009. The Poultry industry also have its own share of the downturn as the competition for poultry inputs climaxed since 2016 when the Federal Government of Nigeria stopped financing the importation of grains which is about 50% single cost in poultry production and thus survival becomes a function of efficiency measurement where the Break-Even analysis became relevant more than ever before. (Oduntan, 2017)

Lack of knowledge of financial management, specifically working capital management, combined with the uncertainties of the business environment often lead SMEs to serious crisis regarding value addition and thus ability or inability to meet creditors obligations. Regardless of whether it is owner-manager or hired-manager, for as long as the key inputs of working capital are wrongly placed, ability to add value and meet the requirements of equityholders and creditors of the company will be adversely affected. Consequently, SME profitability could be damaged because of inefficient combination of working capital components.

Available empirical studies in Nigeria on management issues associated with poultry health checks(drugs management and vaccination) and performance are mostly descriptive analysis on assessment of established prevalent diseases and mortality in chicken layers, noilers and broilers; evaluation of biosecurity status of poultry farms; assessment of biosecurity measures and practices.. Also, literature is vast with the economic analysis of poultry production in Nigeria (Kalla ,Barrier, Haruna, Abubakar,

Hamidu, & Murtala(2007), Akintunde, Adeoti, Okoruwa, Omonona,& Abu(2015); Obi, Olubukola & Maina, 2008; Fasina, Ali, Yilma, Thieme & Anker, 2012; Ajetomobi & Adepoju, 2010). However, none of these studies has considered the assessment of working capital management and its effect on economic value added of the poultry farms in Nigeria. Based on this identified gap, this study will examine the effect of working capital management on performance of selected Poultry farms in Ogun State, Nigeria. and then, to analyse measures for improving SME profitability in Nigeria by using efficient financial management tools and utilization of such tools.

### **1.3 Objective of the Study**

The main objective of this study is to evaluate the effect of working capital management on economic value added of SMEs in the Poultry industry of Ogun State.

### **1.4 Research Questions**

The question that formed the direction of the conduct of enquiry in this paper is “In what way does Working capital management affect the Economic Value-Added position of selected Poultry industry in Ogun State, Nigeria? “

### **1.5 Hypotheses**

The hypothesis tested in this study is :

H<sub>0</sub>: There is no significant effect Working capital management on the Economic Value-Added(EVA) position of SMEs in the Poultry industry of Ogun State, Nigeria.

### **1.6 Justification for the Study**

In terms of working capital management, most previous researchers have focused on examining, investigating and describing the behaviour of SMEs in practicing financial management. The specific areas of working capital management including financial reporting and analysis, working capital management, fixed asset management, annual budgeting process, accounting information system and capital structure management have long attracted the attention of researchers (Banik & Bhaumik, 2006). Their findings are mainly related to exploring and describing the behaviour of SMEs towards working capital management. Although they provided such descriptive statistical data and empirical evidence on SME working capital management in manufacturing industry but failed to consider SMEs farming industry, it appears that there are still gaps in the literature, which is the focus of this paper.

Firstly, most empirical evidence comes from the developed economies such as the United States of America (USA), the United Kingdom (UK), Canada and Australia (King & McGrath, 2002). And the developed economies can be further latched onto for expanding the frontier of studies relating to working capital management and SMEs performance in farming poultry industry in Nigeria. Secondly, most previous researchers focus on investigating and describing working capital management whereas there has been little research examining the impact of working capital management on SMEs performance in Nigeria (Alabi 2014).

These are major gaps and it is difficult to convince business financial management practitioners of the need for changes in practices until empirical evidence of the effects of working capital management on the profitability of SME is provided and the

relationship between the two variables are discovered. Based on previous research findings and recognition of these gaps, a study of the impact of working capital management on SMEs performance of poultry farms in Ogun State, Nigeria is justified and a model of the impacts of working capital management and its effect on SMEs performance should be developed and tested by using the empirical data from Nigeria. However, studies on the effect of working capital management on Poultry industry in Ogun State are scanty considering individual constructs of working capital management majorly like annual budget process, financial reporting and analysis, capital structure management, working capital management and accounting information system. Based on this identified gap, this study focused on the effect of working capital management on performance of selected Poultry farms in Ogun State, Nigeria.

## 2.0. REVIEW OF LITERATURE

### 2.1 Poultry Industry as a Small and Medium Scale Enterprises (SMEs)

A small and medium enterprise (SME) was introduced as far back as the late 1940s with the primary aim of improving trade and industrialization in the developed nations. (OECD, 2004). The definitions of SME are usually associated with each country definition based on the role of SME in the economy, policies and programmes designed by relevant development agencies and institutions empowered to develop SME. The concept of delimitation of small or medium scaled business varies across continents and even countries within the same continent. also varies overtime from agencies or developing institutions to another, depending on their policy focus.

**Table 2.1. Definition of Small, Medium and Large-Scale Companies**

| Category     | UK (1975 Companies Act) |               | European Union (EU) 1995 | Nigeria (2003) National Council of Industry |   |
|--------------|-------------------------|---------------|--------------------------|---|---|
|              | Turnover                | WorkForce     | WorkForce                | WorkForce                                   | Total Cost Including Working Capital But Excluding Land |
|              | <i>million£</i>         | <i>Number</i> | <i>Number</i>            | <i>Number</i>                               | <i>m/Naira</i>  |
| Small Scale  | <1.4                    | <50           | 10 - 49                  | 11 - 35                                     | 1 - 40  |
| Medium Scale | 1.4 - 5.7               | 50 - 250      | 50 - 250                 | 36 - 100                                    | 40 - 199  |
| Large Scale  | >5.7                    | >250          | >250                     | ≥ 101                                       | ≥ 200   |

**Source: Researcher’s Field Survey (2019). National Council of Industry (2003). CBN Guideline on Small and Medium Enterprise Investment Scheme (SMEEIS, 2005). IFC(2006)**

In most economies, smaller enterprises are much greater in number. In Nigeria, the Poultry Industry is almost 100% SMEs. In many sectors, SMEs are also responsible for driving innovation and competition. Globally SMEs account for 99% of business numbers and 40% to 50% of GDP.

The development of viable SMEs in Nigeria has over the years been challenged by a number of harsh economic conditions which characterise the Nigerian business environment. Some of these challenges have been outlined to include erratic informal sources of finance still remain the major source of funding for SMEs in Nigeria including personal saving and borrowing from friends, extended families and various credit bodies like the cooperative societies (Alawode & Adegbe, 2020). Next is the fact of huge dependence on owners entrepreneurial skills. Thirdly, there is the challenge of inadequate (or outright lack of) infrastructural and institutional support, this includes electricity, portable water, feeder roads and security networks while the judiciary is still weak at protecting SME growth and development in Nigeria. And incessant political conflicts, ethno-religious conflicts, as well as poor governance and accountability in public service, have all functioned to make the Nigerian business environment very shaky and unreliable. (Etuk, Etuk & Baghebo, 2014; Falope & Ajilore, 2009).

### **2.1.6. Working Capital Management**

Raheman and Nasr (2007) defined working capital management as one that is concerned with the problems emanating from attempts to manage the current asset, current liabilities and the interrelationship that exists between them. Whereas, Soyemi and Olawale (2014) noted that working capital management is the administration of the whole aspects of both current assets and current liabilities, which makes working capital the life blood of a company. Working capital management ensures that a company has sufficient cash flow in addition to the operating profit induced cashflow in order to meet its short-term debt obligations after settling operating expenses. Implementing an effective working capital management system is an excellent way for many companies to improve their earnings and increase their short-run survival tendencies. All the working capital management components have specific measurement indicators and these help the management to identify areas of focus, such as inventory management, cash management, accounts receivable and payables management.

Working capital management in view of Raheman and Nasr (2007) is based on the purpose of holding working capital as it ensures the effective and efficient utilization of the business investment in fixed assets. Sharma and Kumar (2011), viewed working capital management from efficiency perspective and can be measured and achieved through the cash conversion efficiency, days operating cycle and days working capital. Working capital management is also the management of investment in current assets and the financing of the current assets, and involves setting working capital management policy and carrying out that policy in a business's daily operations, to achieve its goals and objectives, such as shareholder wealth maximization compared to alternative investment return, competitive advantage and growth. (Ewubare & Ozar, 2018)

Working capital management is very crucial in this hydra-headed period of global financial crisis and this is because liquidity crisis is the order of the day particularly for SMEs necessitating that effective and efficient management of any available cash will be needed to ensure that company breaks even and survives this distressed time since credit is scarce. Uremade, Egbide. & Enyi (2012).

Working capital management involves, the process of managing the activities and processes related to working capital (Saad & Edi, 2010) and the aim is to ensure that there are checks and balances to ensure sufficiency in cash inflow to sustain the company's operations. This must be an on-going process that must be evaluated using the current level of assets and liabilities. Working capital management may involve implementing short-term decisions that may or may not carry over from one financial period to the next one and can be defined as the administration of current assets in the name of cash and cashlike items like marketable securities, receivables including staff advances, payables including deposit for sales and inventories. Adina (2010) demonstrated that good working capital management is when there is an acceptable relationship between the different components of a firm's working capital so as to make an efficient mix, which will guarantee capital adequacy. Therefore, working

capital management should make sure that the desirable quantities of each component of the working capital are available for management (Soyemi & Olawale,2014).

Working capital management consists of managing working capital components; including cash, receivable, and payable and inventory management in SMEs and working capital policy used to maintain level of investment in current assets for attaining their targeted Raheman & Nasr (2007). In order to understand the importance of working capital one has to understand the details of working capital cycle and cash conversion cycle which is described as the core for working capital management. Adina (2010) said that working capital cycle includes all the major dimensions of business operations. It is quite clear that a bad management of a single component of the accounts in this cycle might cause a big trouble for the non-living entity which might leads to its death, like mis-managing deferred tax components leading to huge cash outflow. Therefore, the management of working capital and balance between components of working capital particularly with key indicators like DPO, DSO, Inventory turnover is extremely important for the smooth running of businesses. Similarly, the basic aim of financial management is to maximize the wealth of the shareholders and in order to achieve this; it is necessary to generate sufficient sales and profit.

However, as most organisations cannot but get involved in credit sales, sales do not convert in to cash instantly. The time between purchase of inputs which are largely inventory items (raw material or merchandise) for the production and their conversion into cash is known as operating cycle or working capital cycle. Therefore, working capital management deals with the act of planning, acquisition, organizing and controlling the components of working capital (current asset and liability) like cash, bank balance, inventory, receivables (trade and others), payables(trade and others), overdraft and short-term loans (Shubita, 2013).

#### **2.1.6.1 Cash Management**

This is simply the treasury management of the bank balances and the cash at hand including imprest management. The main factor to be managed here is the banking relationship to cover for overdraft and other short-term facilities in periods of cash deficit and to invest the surplus cash inflow at an optimum and non-disruptive manner.

#### **2.1.6.2 Accounts Receivable Management**

Accounts receivable are incomes and sales receipts due but not yet paid by the customers and other receiver of dispended/sold services. Accounts receivable, which can be resulting directly from trade/production or from other activities are listed as assets on a company's balance sheet, but they are really not actually assets until they are collected as there exists risk elements of non-collection. A common metric that is used to assess a company's handling of accounts receivable is days sales outstanding, which interprets to be the average number of days a company takes to collect sales proceeds (Raheman & Nasr, 2007).

#### **2.1.6.3 Accounts Payable Management**

Accounts payable, the money that a company is obligated to pay out over the short term of one accounting year. We also have Trade payables resulting directly from procurement of direct factors of production/services and Other payables resulting from other obligations like tax, interest expense not settled. Companies seek to strike a balance between maintaining maximum cash flow by delaying/optimising payments as long as is reasonably possible without soiling the integrity of the business which can impact on the credit ratings. Usually measured by the Days Payable Outstanding- the number of days of financing provided by the short-term creditors. Ideally, a company's average time to collect receivables should be significantly shorter than its average time to settle payables (Obara & Eyo, 2002).

#### **2.1.6.4 Inventory Management**

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Inventory is a company's primary asset acquired with the intention of further processing/packaging and converts into sales revenues. The inventory turnover rate which measures the rate at which a company sells and replenishes its inventory is an important measure of its success and is an indication of the strength of sales and as a measure of how efficient the company is in its purchasing and manufacturing process. In the poultry industry, there are three broad inventory items as inputs apart from the birds itself, these are energy inputs like maize, wheat, sorghum and oat. Protein inputs like soya bean meal (SBM), fishmeal, groundnut cake(GNC) and soya/vegetable oil. The third category are the macro-nutrients and other additives. The last two categories are largely imported and if not properly managed and gets too low puts the company in danger of losing out on production/sales, but excessively high inventory levels represent wasteful, inefficient use of working capital. There are also many sub-categorisations of inventory depending on the industry, for example in the poultry industry, we can have Finished Feed, Feed materials, Feed Additives and other constituents like drugs (Afrifa & Padachi (2015); Kier ,2015; Lihandah , Bogonko & Ong'iyoy (2018 )).

**Table 2.2. Inventory and Cash Levels and Impacts**

| <b>Inventory</b>   |   |
|--|---|
| <b>High Levels</b>   | <b>Low Levels</b>   |
| <b>Benefit:</b> <ul style="list-style-type: none"> <li>■ Happy customers</li> <li>■ Few production delays (always have needed parts on hand)</li> </ul> <b>Cost:</b> <ul style="list-style-type: none"> <li>■ Expensive</li> <li>■ High storage costs</li> <li>■ Risk of obsolescence</li> </ul> | <b>Cost:</b> <ul style="list-style-type: none"> <li>■ Shortages</li> <li>■ Dissatisfied customers</li> </ul> <b>Benefit:</b> <ul style="list-style-type: none"> <li>■ Low storage costs</li> <li>■ Less risk of obsolescence</li> </ul> |
| <b>Cash</b>  |   |
| <b>High Levels</b>   | <b>Low Levels</b>   |
| <b>Benefit:</b> <ul style="list-style-type: none"> <li>■ Reduces risk</li> </ul> <b>Cost:</b> <ul style="list-style-type: none"> <li>■ Increases financing costs</li> </ul>  | <b>Benefit:</b> <ul style="list-style-type: none"> <li>■ Reduces financing costs</li> </ul> <b>Cost:</b> <ul style="list-style-type: none"> <li>■ Increases risk</li> </ul>   |

| <b>Accounts Receivable</b>   |   |
|--|---|
| High Levels (favorable credit terms)   | Low Levels (unfavorable terms)  |
| <b>Benefit:</b> <ul style="list-style-type: none"> <li>■ Happy customers</li> <li>■ High sales</li> </ul> <b>Cost:</b> <ul style="list-style-type: none"> <li>■ Expensive</li> <li>■ High collection costs</li> <li>■ Increases financing costs</li> </ul> | <b>Cost:</b> <ul style="list-style-type: none"> <li>■ Dissatisfied customers</li> <li>■ Lower Sales</li> </ul> <b>Benefit:</b> <ul style="list-style-type: none"> <li>■ Less expensive</li> </ul>       |
| <b>Payables and Accruals</b>   |   |
| High Levels  | Low Levels  |
| <b>Benefit:</b> <ul style="list-style-type: none"> <li>■ Reduces need for external finance—using a spontaneous financing source</li> </ul> <b>Cost:</b> <ul style="list-style-type: none"> <li>■ Unhappy suppliers</li> </ul>                              | <b>Benefit:</b> <ul style="list-style-type: none"> <li>■ Happy suppliers/employees</li> </ul> <b>Cost:</b> <ul style="list-style-type: none"> <li>■ Not using a spontaneous financing source</li> </ul> |

Source: Knight (2016) and Kier (2015)

## 2.2 Theoretical Review

This section of the review provides the basic theoretical assumptions for the study. It will focus on relevant theories that can be applied to the study variables and concepts in order to come up with a logical linkage between the variables. The theories reviewed are; The Theory of Residual Equity, The Contingency Theory, Shareholder Theory, Liquidity Trade off Theory and Pecking Order Theory.

### 2.2.3. The Contingency Theory

The contingency theory of leadership was proposed by the Austrian psychologist Fred Edward Fiedler in his 1964 article, "A Contingency Model of Leadership Effectiveness" (Fiedler, 1964(as cited in Omoluabi, 2016).The contingency theory emphasizes the importance of both the leader's personality and the situation in which that leader operates. The theory holds that there are various contextual factors that determine how an organization operates such as the technology and external environment. As described by Chenhall (2003), that these factors will affect the organizational structure, which will then influence the design of the financial system.

The second feature of firms environmental uncertainty as identified by Pike (1986) argued that the more mutable and random the context of operation is, the less suitable will be the highly bureaucratic, mechanistic capital budgeting arrangements. According to Pike(1986), businesses working in highly indeterminate environments are assumed to benefit from complex investment approaches, mainly in appraising risk. Finally, Pike was also concerned with the behaviour characteristics of firms and recognises three characteristics, namely degree of professionalism, the history of the organisation and the management style. Contingency theories that postulates that effective leadership will depend not only on the leadership style but such style will be influenced by how to be in control over situations. Good leader-member relations, task with clear goals and procedures, and the ability for the

leader to serve out rewards and punishments are the three key ingredients of contingency theory and lacking these three in the right mix and context is surely a recipe for leadership failure.

## **2.2.4 Cash Management Theory**

Cash Management theory was determined by Morton Miller and Daniel Orr in 2009 in attempting to create a better way to deal with finance management over Baumol's model.

The Miller & Orr model of cash management is developed for businesses with uncertain cash inflows and outflows. It is a model that allows lower and upper limits of cash balances to be set and the return point determined (target cash balance). The model figures out how to achieve a reasonable level of authenticity while not being excessively detailed. It states that the aggregate cash flows are constantly distributed with very low levels of the mean and standard deviation. This is a probabilistic or stochastic model which accepts instability in financial management by accepting that the day by day cash flows are unverifiable and, in this manner, take after a trendless random walk. This theory thus sets bounds inside which money ought to be managed. These cut-off points are: A furthest breaking point, which is the most extreme value of money to be held, Lower restrict, which is the base value of money to be held (thought to be zero), and Return point, which is the target amount of money considered optimal.

According to Gadome and Thaeer (2008), an endeavour ought to keep up satisfactory liquidity for its smooth working. In the event that materials are heedlessly bought, it will bring about dormant moderate moving and outright stock. And at any rate, deficient stock value will result to stock outs and negative interference in operations (Gadome & Thaeer, 2008). Money should likewise be kept up at a perfect level. It might likewise result to expanded cost because of misusing, waste and theft. Namusonge (2008) notes that excessively or deficient level of money equalizations mean money is not appropriately used. Insufficient level of finance balance for instance can prompt stoppage in business operations. An organization might be beneficial however with no liquid finance which can result to operations intrusions. The organization can likewise be constrained into ending up by its creditors.

## **2.3 Empirical Review**

### **2.3.3. Working capital management and Economic Value Added**

This is a registered trademark of Stern Stewart and Company and is an estimate of a firm's economic profit being the value created in excess of the required return of the company's investors (i.e. shareholders and debt holders)

EVA is based upon an age-long concept and that is the concept of profit left to service equity, and is completely apart from accounting profit at all. A company is at a loss if its business returns in terms of profit is less than its cost of capital. And this is mindless of the business paying taxes as if it had a genuine profit. The enterprise still returns less to the economy than it devours in resources... Until then it does not create wealth; it destroys it.(Sharma & Kurma 2010)

Proponents of EVA claim that EVA is highly correlated with stock returns, return on investment. EVA derives stock prices (Stewart, 1995; Sharma & Kurmar, 2010) is better than other accounting-based performance indicators particularly accounting profit.. Various Studies are also conducted on Incremental information content tests of EVA and provide evidences that it adds significant explanatory power to Earnings Per Share in explaining stock returns. Worthington and West (2001) provided

Australian evidences regarding the information content of EVA and concluded that stock returns to be more closely associated with EVA than residual income, earnings and net cash flow.

EVA as a measure of residual income is normally utilized for assessing the performance of organisations as a divisions, multi-divisions or departmentalized operations, in which a finance charge (cost of capital) is deducted from the accounting profits of the entity. The finance charge is calculated as the net assets of the company, factored with applicable interest rate which is normally the company's weighted average cost of capital or the prevailing ruling interest rate of commercial credit (usually banking interest rate). (Daraban 2017; Butt, Huniar & Rehman 2010; Geysler & Liebenberg, 2003)

EVA as a residual income can be mathematically expressed as

$$EVA = NOPAT - (k * \text{capital})$$

Where:

NOPAT = Net Operating Profits After Tax.

(r \*capital) is the finance charge,

where r = the firms weighted average cost of capital

capital = equity plus long-term debt of the company at the start of the period including shareholders loan whether short-term or long-term.

EVA is useful in explaining the market value of a company as the profit rate can easily be compared with the prevailing market cost of capital and it allows dissecting a company's market value into known and unknown (expected) components. The present value of future stream of EVAs actually has two components, present value of current EVA (known component) and present value of expected EVA improvements over the current level (unknown component). The first component coupled with current book value of equity is called Current Operational Value (COV) and the second component is called Future Growth Value (FGV). As market value of a firm is essentially futuristic and it depends to a large extent on Future Growth Value (FGV) of a firm and FGV depends on EVA improvement. If a company maintains EVA (without any improvement), its NOPAT will provide a cost of capital return on current operational value(COV) and no return on FGV. Hence, EVA improvement is a precondition for growth in market value

EVA is different from other traditional performance measuring tools because most measures mostly depend strictly on accounting information but EVA incorporates market cost of capital. According to Sabol, Andrija; Sverer, Filip (2017), the problem with these kinds of tools is that accounting earnings fail to measure changes in the economic value of the firm, and some of the reasons include

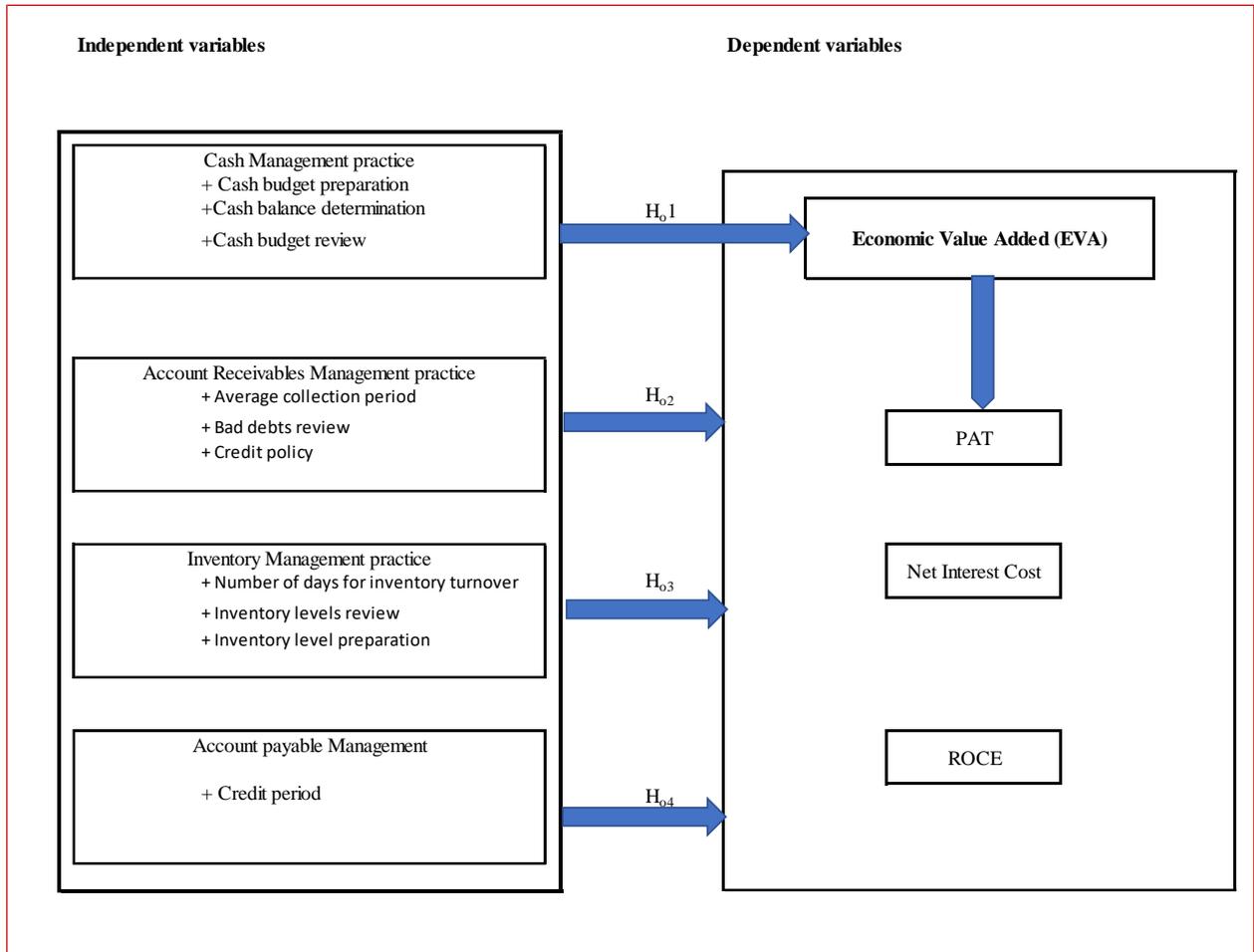
- (1) Alternative accounting methods may be employed: different methods for depreciation, inventory valuation, goodwill amortization, and so on
- (2) Both business risk (as determined by the nature of the firm's operations), and financial risk (largely determined by the relative proportions of debt and equity used to finance assets) are excluded.
- (3) Accrual based accounting numbers differ from cash flows from operations, particularly in working capital components.

(4) Dividend policy is not considered

(5) The time value of money is ignored.

### 2.6 Researcher’s Conceptual Model

This study will be guided by the following conceptual framework as adopted from financial management for small business (McMahon, 1995).



The independent and dependent variable for this research is financial management (X) and Poultry Farms performance (Y) respectively. The independent variable working capital management (X) is measured using the following dimensions: cash management, accounts receivable management, accounts payable management and inventory management while the dependent variable is measured by the key variable of Economic Value Added (EVA).

### 3. METHODOLOGY

150 structured questionnaires were administered and 122 responses in a combination of direct interview, online questionnaires and paper copies were filled and returned from across the six zones in Ogun State as mapped out by the Poultry Association of Nigeria, Ogun State chapter. This represents a response rate of 81.3%. According to Marske(2019) , a response rate of 60% is the minimum response rate, The “Gold Standard” by the Federal Statistic s is 85% (AAPOR 2015). Babbie (2004) also asserted that survey return rates of 50% is acceptable for analysis and publication, 60% is good and 70% is very good. Based on these views from renowned researchers, the responses rate for this study of 81.3% is considered sufficient for making inferences and drawing

conclusions. Table 2 below illustrates the rate of responses from the SMEs poultry farms as contained in the Farm Registration list as obtained from the Poultry Association of Nigeria, Ogun State chapter.(Adegbe & Alawode, 2020 ; PANOG).

Data analysis for this study was done in two stages: the descriptive and inferential analysis. The first stage (the descriptive analysis) features descriptions of the properties of the data to show the variations in responses of the study’s participants using such tools as frequencies and percentage distribution tables, bar charts, means and standard deviations. It will also provide the views and opinions of the respondents on working capital management and Poultry farms performance.

The second stage (the inferential analysis) is the analysis of the responses on the quantitative data and the relationships. This was carried out using statistical tools of multiple regression method of analysis using SPSS (Statistical Package for Social Sciences) software version 22.0 to test the effect link between the independent variables on the dependent variable.

The variables for this study operationalized thus:

$$Y = f(X)$$

Where Y = Economic Value Added (EVA, and

X = Working Capital Management (WCM)

Hypothesis

$$Y = f(x_1)$$

$$y_1 = \beta_0 + \beta_1x_1 + \varepsilon_i$$

$$EVA = \beta_0 + \beta_3WCM + \varepsilon_i$$

#### 4. Results and Discussion of Findings

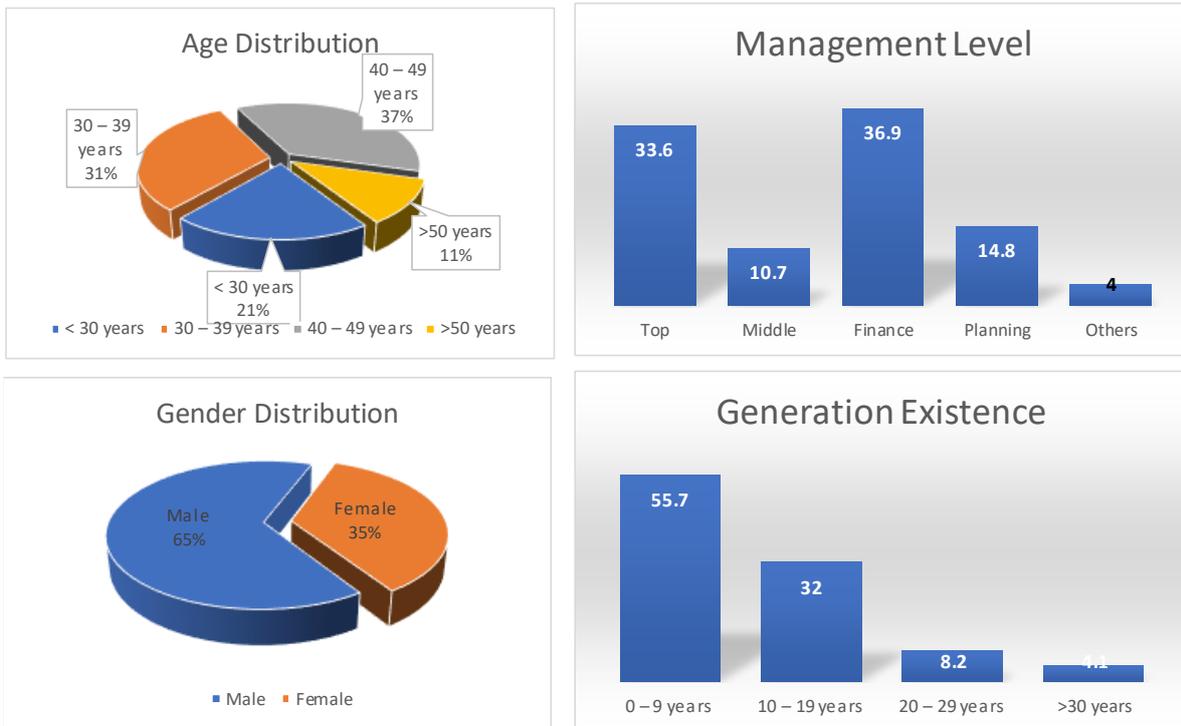
##### 4.1. Data Analysis

*Table 2. Distribution of Questionnaire/ Response Rate.*

| Categories                                  | Frequency | Percentage% |
|---|-----------|-------------|
| Copies of questionnaire administered        | 150       | 100         |
| Copies of questionnaire filled and returned | 122       | 81.3        |
| Copies questionnaire not returned           | 28        | 18.7        |

Source: Researcher’s Field Survey, 2019

*Figure 2. Demographic Characteristics of Respondent.*



Source: Field Survey, 2019

#### 4.2. Test of Hypothesis

**Research Objective :** evaluate the effect of working capital management on economic value added of SMEs in poultry industry of Ogun State.

**Research Question:** in what way does working capital management affect the economic value added of selected poultry industry in Ogun State, Nigeria?

**Research Hypothesis (H<sub>0</sub>):** there is no significant effect of working capital management on the economic value added of SMEs in the poultry industry of Ogun State, Nigeria.

**Table 4.13 Regression Estimate**

| Variable       | The Model   |                |         |       |
|----------------|-------------|----------------|---------|-------|
|                | Coefficient | Standard Error | t- stat | Prob. |
| Constant       | 3.6011      | .560           | 6.426   | .000  |
| IM             | .107        | .064           | 1.674   | .096  |
| APM            | .150        | .078           | 1.931   | .055  |
| ARM            | .156        | .087           | 1.785   | .076  |
| CM             | .183        | .097           | 1.881   | .062  |
| R <sup>2</sup> | .097        |                |         |       |

|                          |               |
|--------------------------|---------------|
| Adjusted $R^2$ : Overall | 0.058         |
| F-Stat                   | 2.485 (0.035) |

**Dependent Variable: EVA**

**\*significant at 5%**

### Model

$$WCM = \beta_0 + \beta_1IM + \beta_2APM + \beta_3ARM + \beta_4CM + \varepsilon_i$$

$$WCM = 3.6011 + 0.107IM + 0.150APM + 0.156ARM + 0.183CM$$

The regression estimates of model 3 shows that working capital management measured by cash management, accounts receivable management, accounts payable management and inventory management positively affects performance measured by economic value added (EVA). This is indicated by the signs of the coefficient.  $(\beta_0 = 3.601; \beta_1 = 0.107; \beta_2 = 0.150; \beta_3 = 0.156; \beta_4 = 0.183$  and  $\beta_5 = 0.143)$ . Also, from Table 4.13, inventory management has a positive insignificant effect on economic value added ( $\beta = 0.107, t = 1.674, p = .096$ ), accounts payable management has a positive insignificant effect on economic value added ( $\beta = 0.150, t = 1.931, p = .055$ ), accounts receivable management has a positive insignificant effect on economic value added ( $\beta = 0.156, t = 1.785, p = .076$ ), cash management has a positive insignificant effect on economic value added ( $\beta = 0.183, t = 1.881, p = .062$ ).

The Adjusted  $R^2$  of the model showed that 5.8% of the variations in economic value added of selected poultry businesses can be attributed to working capital management proxies used in this study, while the remaining 94.2% of the variations in profitability of selected poultry farms are caused by other factors not included in this model. The overall F-Statistics is 2.485, while the P-value of the F-Statistics is 0.000 which is less than 0.05 adopted for this work. Implying that working capital management does exert a significant effect on Economic-Value-Added of SME poultry industry in Nigeria. Hence, the null hypothesis may not be accepted and the objective is achieved.

Rago (2008) concluded in its study that economic value added even though unconventional by traditional standards of financial performance, it appears to be the very useful in measuring corporate performance because it emphasizes efficiency and wise management as factors that produce wealth. Also, Haller and Staden (2014) in their study highlighted that EVA can be used to enhance future earnings predictions. They also investigated the degree of correlation between different performance measures and stock market returns. The results indicate that EVA is more correlated a measure with stock returns (alternate investment return).

### 5.1 Summary

The main thrust of this study was to examine the relationship between working capital management and economic value addition as a proxy of performance in selected poultry farms in Ogun State, Nigeria. To achieve this,

The methodology adopted for this study covered such areas as the research design that was used for the study, study location, sampling, data collection method, data processing and data analysis with primary data obtained through questionnaire from one hundred and fifty (150) owners and/or managers of the one hundred and ten (110) selected poultry farms in Ogun State. One hundred and twenty-two (122) respondents were taken. Purposive sampling was used and the retrieved questionnaire was coded and analysed using simple frequency distribution and simple percentage and ordinary least square regression technique. This chapter gives the summary of the study as well as the summary of the findings and their implications. Conclusions were drawn

and recommendations made. Finally, the chapter highlighted the limitations of the study, the study's contributions to knowledge and suggestions for further research.

## 5.2 Conclusion and Recommendations

The study examined the effect of working capital management on selected poultry industry farms in Ogun State, Nigeria. The regression estimates show the effect of working capital management on economic value added and indicates that the working capital management have a positive significant effect on economic value added as a proxy of performance of poultry industry in Ogun State, Nigeria.

SMEs should ensure enhance and regularly update their accounting information system from where the various components of working capital can be analysed as the responses, showed that majority of the respondents do have an accounting information system in place but like hardwares too, accounting softwares are being developed regularly and inclusive of other multi-dimensional farm.management softwares.

SMEs should expand the coverage of working capital management components such as used in this study with special focus on credit management, cash management and asset management in their operations in order to boost their capability in competing and growing like the big farms.

A key component that need to be closely monitored is the inventory level due to the insecurity level and corruption as an environmental factor, most of these inputs are imported with attention to be paid to expiry date and moisture level of the premixes while the aflatoxin level of maize, soya and other protein materials should always be tested for the micro-biological integrity.

Usually, farms sell on cash and carry basis but the established customers enjoy average of one week unsecured credit making it imperative for close and unconventional credit management avoiding credit roll-overs. Also, the credit terms have to such that will be lower than the trade credit available to the farms so that the net of receivables and payables will remain positive.

It is also very necessary to obtain knowledge about basic financial concepts by the owners of these SMEs in order to help manage their finances in case they do not have a financial expert in their farms. The lower level in the industry need to be particularly upgraded as this study was limited to top and middle level management of these farms. A healthy business is one that all the cadres of the business strata can understand and apply various working capital management as proxied in this study.

## 5.3 Contribution to Knowledge

This study has the following contributions to knowledge:

**Contribution to Literature:** The study's conceptual work has extended the frontiers of knowledge on the effect working capital management on performance of poultry industry farms in Ogun State, Nigeria by introducing the issue economic value addition (EVA) which is a step further down the accounting profit line.with which the growth and survival of any business is guaranteed as a thriving entity in Nigeria.

**Contribution to Theory:** This study contributed to knowledge; most works done on this research topic were hinged on both contingency theory and cash management theory. The localisation of these theories serve as a confirmation of their efficacy.This study contributed to existing literature by the findings that have been examined; implications of the findings, and the recommendations that have been made.

**Contribution to Practice:** The study investigated the effect of working capital management on economic value added which is simply performance of poultry industry in Ogun State, Nigeria. To the best of the researcher's knowledge, this study is one of the studies considering the issue of working capital management in the poultry industry and can be generalised to the small and medium scale enterprises. Since the industry and SMEs usually suffer from sharp fluctuations in components of the working capital, particularly with short-supply in the inputs, a mastery of the key performance indicators comes handy to help the industry.

**Contribution to Model:** This study contributed to knowledge through the model developed which shows the effect of working capital management proxies on economic value added. Most of the previous studies are focusing on profitability but the economic value-added perspective considers the cost of capital impact in the industry and make it market funding oriented.

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# A Comparative Study of *Abrus Precatorius* by Three Different Methods of *Shodhana*

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**Abstract** - *Gunja* (*Abrus precatorius* linn.) described under the category of *upavisha*, a sub-poisonous drug in *Ayurveda*. Seeds of *gunja* have active principle Abrin, which is said to have toxic properties, which can cause severe nausea, vomiting, convulsions, liver failure, severe purgation and death. Also no antidote exists for abrin, the most important factor is avoiding abrin. There are many *Ayurvedic* medicines which contain *gunja* as a key ingredient. *Gunja* seeds are used only after processing in certain medias, known as *shodhana* process. In the present study, *rakta gunja* seeds were processed in three medias *godugdha*, *kanji* and water at same temperature and evaluated against the raw sample for its abrin content. The study was conducted to evaluate which media reduces abrin to its maximum. Abrin is a protein, which is denatured when subjected to high temperature and removes its toxicity.

**Index Terms** - *Abrus precatorius*, Abrin, *Shodhana*, *godugdha*, *kanji* and water.

## I. INTRODUCTION

*Ayurveda* is an Indian traditional system of medicine. Some *Ayurvedic* medicine contains *visha dravya* as key ingredients. Though *visha dravya* are toxic in nature, but they are used in medicine. Because they have properties like *ushna*, *teekshna*, *vyavayi*, *vikashi*, *ashukaritwa*, they spreads and act all over the body quickly.<sup>[1]</sup> So, the demand of using such medicines are increased. Before using these *visha dravya*, they should undergoes into some procedures which denatures the toxic effects and enhances the efficacy of drugs. This procedure is called as *shodhana*. The concept of *shodhana* is not a purification or detoxification (removing toxic substances), but it reduces the toxic effects and enhances the therapeutics benefits of drugs ( in relation to *visha dravya shodhana*). *Shodhana* procedures includes *nirvapana* (cooling), *dhalana* (melting and dipping into liquid media), *bharjana* (roasting), *swedana* (steaming), etc. <sup>[2]</sup> The term *visha* is named from *vishada*.

Substances that enters and vitiates the healthy *dhatu* (structural components, tissues) of the body and may or may not manifest with lethal signs and symptoms, is termed as *visha*.<sup>[3]</sup> Major classification of *visha dravya* are into two, (based on their strength) *visha (mahavisha)* and *upvisha*.<sup>[4]</sup> Other classification include *akritim* (nature) and *kritim* (artificial) or *sthavara visha*, *jangam visha* and *samyojana visha*. Author of *Rasatarangini* has enumerated and considered *gunja* (*Abrus precatorius*) as one of the *upvisha* or sub-poisonous drugs.<sup>[5]</sup> Fruits, roots and seeds are the parts which are used in the medicines. Only seeds are toxic in nature.

*Abrus precatorius* is a slender, perennial climbers that twines around trees, shrubs and hedges. It is a legume with long, pinnate-leafleted leaves. *Gunja* seeds are commonly used as cattle poison, arrow poison or sometimes used as birth control pills.<sup>[6]</sup> The major active principle of *gunja* seeds is Abrin, a toxalbumin (or protein). Ingestion of raw crushed seeds ( or improper *shodhita*) causes severe purgation and vomiting leading to toxic symptoms in the body <sup>[7]</sup> also GI irritation, nausea, abdominal pain. Therefore *shodhana* of *gunja* seeds were done. *Swedana* process is described for the *shodhana* of *gunja* seeds by *dolayantra* method.<sup>[8]</sup> Present study deals with comparative study, by *shodhana* process of *rakta gunja* seeds in three different medias.

## II. AIM

To study and compare the level of Abrin content in *gunja* seeds at before and after *shodhana* process in three different medias i.e. *godugdha*, *kanji* and water by analytical techniques.

## III. OBJECTIVES

- 1) To perform the *shodhana* of *gunja* seeds in three different medias.
- 2) Analyse the *shuddha gunja* seeds with their respective medias.

3) Evaluate and compare the Abrin content of *ashuddha gunja* seeds and *shodhita gunja* seeds with their respective medias by using analytical tools.

#### IV. METHODOLOGY

##### A. Type of study

Experimental study.

##### B. Materials

Raw material : *Ashuddha rakta gunja* seeds ( *Abrus Precatorius* Linn.)

Other materials : *Gudugdha* (cow milk), *Kanji* (sour gruel), water.

Equipments : Weighing machine, measuring cylinder, muslin cloth, vessel, spatula, rod, gas stove, match stick, cotton thread.

##### C. Method

Collection : The raw *gunja* seeds were procured from local market.

Identification : *Gunja* seeds were identified by dravyaguna department of our institute.

Standardisation : Raw *gunja* seeds were powdered and analysed. The findings were compared with monographs mentioned in API.

*Shodhana* procedure :

1. Required quantity of raw *gunja* seeds were weighed with the help of weighing machine.

2. Raw *gunja* seeds were placed in muslin cloth and all four corners were tied with thread in such a way that it form a *pottali*.

3. This *pottali* was hanged upon a rod in a vessel containing *Gudugdha* in such a way that it completely immersed in it. (like *Dolayantra*) (image no.3)

4. This vessel is kept upon gas stove and turned on with matchstick.

5. Six hours of continuous heat was given to it. During process, stirring was done with spatula so that liquid doesn't comes out from vessel while boiling.

6. When level of the liquid media decreases, liquid were poured into it, so that *pottali* is completely immersed in the media.

7. After self cooling, *pottali* was removed and *shodhita gunja* seeds was washed with luke warm water and kept for drying.

8. Likewise, *shodhana* of *gunja* seeds were done in *kanji* media and water media for 3 hours.

| Liquid media for <i>shodhana</i> | <i>Godugdha</i>              | <i>Kanji</i>                 | Water                        |
|----------------------------------|------------------------------|------------------------------|------------------------------|
| Method used for <i>shodhana</i>  | <i>Swedana in Dolayantra</i> | <i>Swedana in Dolayantra</i> | <i>Swedana in Dolayantra</i> |
| Heat given in hrs                | 6 hrs (2 <i>yaam</i> )       | 3 hrs (1 <i>yaam</i> )       | 3 hrs (1 <i>yaam</i> )       |

Table no. 1 showing *shodhana* process.

Precautions :

*Pottali* was not touched at base of the vessel during the procedure. *Pottali* was completely and continuously immersed in the media. *Mandagni* was given throughout the procedure. ( About temperature of 100 degree was maintained throughout the process) (image no.4)

Analytical study :

Organoleptic characteristics, physico-chemical analysis and TLC of *ashuddha gunja*, *shuddha gunja* and media in which *shodhana* has done.

Method applied for TLC analysis :

Methanolic extract of *gunja* seeds and liquid media were used.

Mobile phase – Tolnene : Ethyl acetate : Glacial acetic acid = ( 6 : 3.5 : 0.5 ) v/v/v

Reagent – Spray with vanilline (  $H_2SO_4$  )

#### V. RESULTS

| Parame ter     | A.G.                         | G.S.G.                           | K.S.G.                           | W.S.G.                                     |
|----------------|------------------------------|----------------------------------|----------------------------------|--|
| <i>Shabdha</i> | NA                           | NA                               | NA                               | NA   |
| <i>Sparsha</i> | Smooth                       | Smooth                           | Smooth                           | Smooth                                     |
| <i>Roopa</i>   | Black spot on reddish colour | Black spot on dull yellow colour | Black spot on dull yellow colour | Black spot on light creamish yellow colour |
| <i>Rasa</i>    | -                            | -                                | -                                | -  |
| <i>Gandha</i>  | Not specific                 | characte rstics                  | characte rstics                  | Not specific                               |
| Wight          | 100 gm                       | 95 gm                            | 94 gm                            | 96gm                                       |

Table no.2 showing organoleptic characteristics of *ashuddha* and *shuddha gunja* seeds.

A.G. – *Ashuddha Gunja* seeds, G.S.G. – *Godugdha Shodhita Gunja* seeds.

K.S.G. – *Kanji Shodhita Gunja* seeds, W.S.G. – *Water Shodhita Gunja* seeds.

| Parameter | Godugdha media  | Kanji media  | Water media  |
|-----------|-----------------|--------------|--------------|
| Shabdha   | NA              | NA           | NA           |
| Sparsha   | Semisolid       | Semisolid    | watery       |
| Roopa     | Creamish yellow | Light yellow | Blackish     |
| Rasa      | -               | -            | -            |
| Gandha    | Not specific    | Not specific | Not specific |

Table no.3 showing organoleptic characteristics of liquid media in which *shodhana* has done.

| Parameter               | Normal range | A.G.    | G.S.G.  | K.S.G.  | W.S.G.  |
|-------------------------|--------------|---------|---------|---------|---------|
| Foreign matter          | NMT 2%       | Nil     | Nil     | Nil     | Nil     |
| Ash value               | NMT 3%       | 2.92 %  | 2.48 %  | 2.32 %  | 2.84 %  |
| Acid insoluble ash      | NMT 0.5%     | 0.47 %  | 0.27 %  | 0.35 %  | 0.41 %  |
| Alcohol soluble extract | NLT 3%       | 3.29 %  | 3.86 %  | 3.16 %  | 3.12 %  |
| Water soluble extract   | NLT 15%      | 17.75 % | 17.11 % | 16.97 % | 16.05 % |

Table no.4 showing physico-chemical of *ashuddha* and *shuddha gunja* seeds.

|                         | A.G.        | G.S.G.      | K.S.G. | W.S.G.      |
|-------------------------|-------------|-------------|--------|-------------|
| Rf value of abrin       | 0.30        | 0.25        | 0.25   | 0.30        |
| Rf value of abrusogenin | 0.60 & 0.70 | 0.40 & 0.70 | 0.70   | 0.50 & 0.70 |

Table no.5 showing TLC of *gunja* seeds before and after *shodhana*.

|                   | Godugdha media | Kanji media | Water media |
|-------------------|----------------|-------------|-------------|
| Rf value of abrin | 0.30           | 0.40        | 0.40        |

Table no.6 showing TLC of liquid media

## VI. DISCUSSION

The concept of *shodhana* is to denature the toxicity and enhance the therapeutic effects. In this study, three media were used to do *shodhana* of *rakta gunja* seeds. *Godugdha* and *kanji* are the medias described in text for the *shodhana* of *gunja*. A new media was used to verify whether it can alter or reduces the toxic

effects. The reason behind this is that, if water soluble extract causes toxicity then it can replace the *godugdha* or *kanji* media for *shodhana* process. On analysing the raw *gunja* seeds, it found that the values were in the limit as mentioned in the monographs in API. On comparing all *shodhita gunja* seeds, it found that water soluble extract and alcohol soluble extract was found higher in *godugdha shodhita gunja* seeds and lesser in water *shodhita gunja* seeds. This may be due the presence of protein content in *gunja* seeds are more soluble in milk than *kanji* and water and also milk has higher affinity to dissolve the protein content. Ash value and acid insoluble ash was found lesser in *godugdha shodhita gunja* seeds than *kanji* and water *shodhita gunja* seeds. Colour and weight of *gunja* seeds were changed after *shodhana* process. TLC of *ashuddha gunja* seeds shows presence of Abrin content with rf value 0.30 and abrusogenin with rf value 0.60 and 0.70. On comparing TLC of all *shodhita gunja* seeds, rf values of Abrin was found different in *godugdha* and *kanji shodhita gunja* seeds ( conversion of 0.30 into 0.25 ) whereas rf value remain same in water *shodhita gunja* seeds and also rf values of abrusogenin was found different in *godugdha* and water *shodhita gunja* seeds ( conversion of 0.60 and 0.70 into 0.40 and 0.70, 0.50 and 0.70 respectively ) with disappearance of one of rf value in *kanji shodhita gunja* seeds. Reason behind may be that structure of Abrin content containing rf value is converted into some other component of Abrin having different rf value which may shows less toxicity. On analysing the TLC of all liquid medias in which *shodhana* was performed, it found that media show same rf value of Abrin ( 0.30 ) which was seen in *ashuddha gunja* seeds. Reason may be that some of Abrin content having rf value from *ashuddha gunja* seeds was dissolve or transferred into liquid *godugdha* media thereby reducing the toxic effects of *gunja* seeds. Also found that *kanji* media and water media shows different rf value of Abrin content ( conversion of 0.30 into 0.40 ). This may be due to commencement of chemical reaction between media and *gunja* seeds in heating process thereby leading to formation of new component or structure of Abrin.

## VII. CONCLUSION

On performing the *shodhana* of *gunja* seeds in all three different medias, there was increase in alcohol soluble extract and water soluble extract, and also decrease in ash value and acid insoluble ash of all *shodhita gunja* when compared to *ashuddha gunja* seeds. TLC of Abrin content was altered in *godugdha shodhita gunja* seeds after *shodhana*. TLC of Abrin content was altered in all liquid medias in which *shodhana* of *gunja* seeds has done whereas the presence of same rf value ( 0.30 ) of *ashuddha gunja* seeds in *godugdha* media indicating some of Abrin content is

transported in it. So, study concluded that *shodhana* of *gunja* seeds in *godugdha* is more effective than *kanji* and water.

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Image no.1 showing TLC of *ashuddha gunja* seeds and *shuddha gunja* seeds.

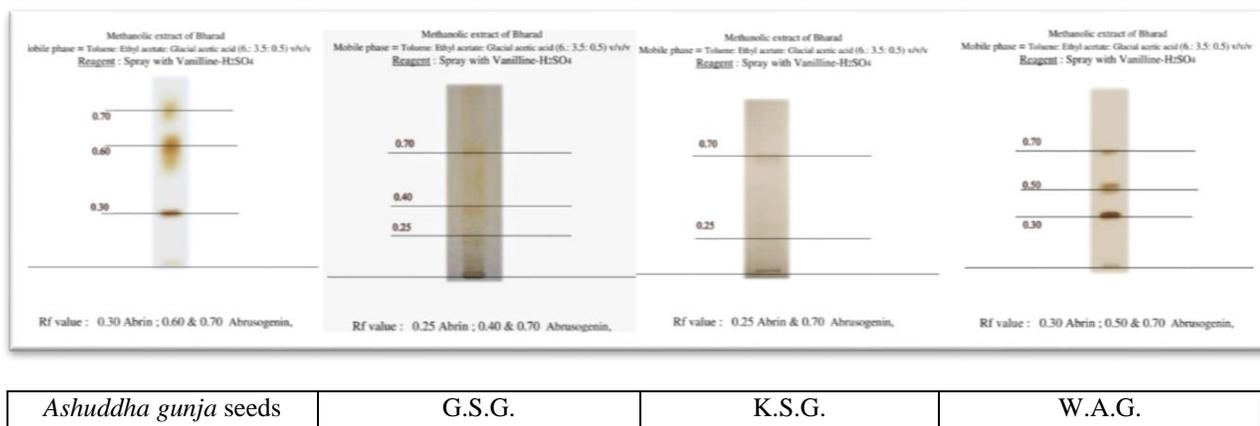


Image no.2 showing TLC of liquid media.

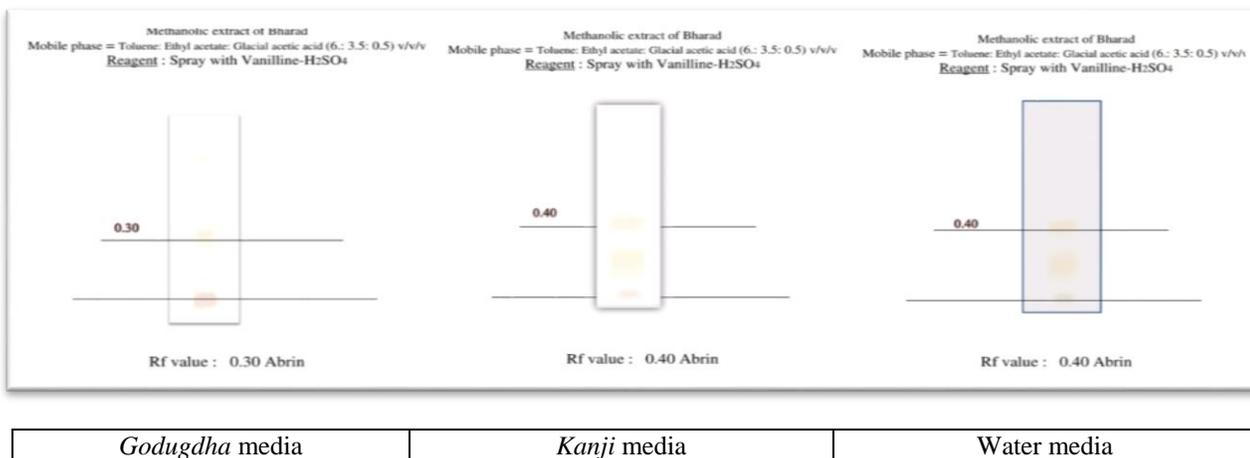


Image no.3 showing *dolayantra* method used for *shodhana* process (W.S.G.).



Image no.4 showing *agni* (heat)(low flame) used for *shodhana*.



Image no.5 showing *shodhana* of *gunja* seeds in *godugdha* media.



Image no.6 showing in-process *shodhana* of *gunja* seeds in *godugdha* media.



Image no.7 showing *shuddha gunja* seeds.



# Performance Evaluation of Algorithms for Sparse-Dense Matrix Product

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**Abstract-** In this paper we address the sparse-dense matrix product (SDMP) problem where the first (resp. second) matrix is sparse (resp. dense). We start with an initial DO loop nest structured algorithm corresponding to the most used sparse matrix compressed formats i.e. DNS, CSR and COO. Then, we derive other versions by applying optimization techniques such as scalar replacement, loop invariant motion and loop unrolling. In addition, we use different compiler optimization options such as -O0, -O1, -O2, -O3, -O4, -Os and -Funroll-loops. We particularly focus on the GXPY-Row body kernel where the matrices are accessed row-wise. A theoretical multi-fold performance study permits to establish accurate comparisons between the different versions. Our contribution is validated through a series of experiments achieved on a set of real matrices, having different sizes and densities on Grid5000 Intel Xeon Processors. Our aim is to detect the optimal version for each format as well as the best compression format giving the best performances for SDMP.

**Index Terms-** compression formats, loop unrolling technique, Intel Xeon architecture, algorithm optimization.

## I. INTRODUCTION

Sparse linear algebra concerns the study of matrix algorithms processing large size sparse matrices. These latter are very frequent in real world applications covering diverse domains such as electromagnetism, semiconductors, image processing, networks, graphs, molecular dynamics, fluid dynamics, etc [1, 2, 3, 4, 5, 6, 7]. A matrix is called sparse if it has a large (resp. small) number of zero (resp. nonzero) elements [3, 4, 5, 6, 7]. The mostly used kernels in these applications are (i) Sparse Matrix-Vector Product (SMVP) [4,5,6,7,8], (ii) Sparse-Dense Matrix Product (SDMP) [2],[4], (iii) The symmetric case of the SDMP problem, i.e. Dense-Sparse Matrix Product (DSPM) where the first matrix is dense and the second is sparse [3], and (iv) Sparse Matrix Product (SMP) where both input matrices are sparse [5,6]. We address here the case of Sparse-Dense Matrix Product (SDMP) denoted  $C=A.B$  where A (resp. B) is sparse (resp. dense). On the other hand, we underline that processing large sparse matrices requires, for reasons of space-time complexity reduction, the use of storing formats. These latter may be either general i.e. adapted to any sparse structure e.g. DNS (DeNSe), CSR (Compressed Sparse Row), CSC (Compressed Sparse Column) and COO (COOrdinate), or special i.e. convenient for a matrix structure as MSR (Modified Storage Row) for triangular structure, BND (BaND) for band structure, DIA (Diagonal) for diagonal structure [3,4,5,6,7], etc. Our aim here is (i) to determine the best optimization techniques for each version corresponding to a compressed format. (ii) to determine the best SCF for SDMP i.e. leading to the best performances. The remainder of the paper is organized as follows. In section 2, we present the related work. In section 3, we recall some useful concepts. Then in section 4, we present a theoretical study of the intra and inter algorithms optimization for the SDMP corresponding to the three chosen compression formats. Section 5 is devoted to an experimental study validating our theoretical contribution.

## II. RELATED WORK

Many works are interested in solving the problem of Matrix Product such as the Sparse Matrix-Vector Product (SMVP) [4, 5, 6, 7, 8], the Sparse-Dense Matrix Product (SDMP) [2], [4], the symmetric case of the SDMP problem, i.e. the Dense-Sparse Matrix Product (DSPM) [3] and the Sparse Matrix Product (SMP) [5,6]. Few works in the state-of-the-art concern the SDMP optimization especially for the sequential version of the algorithm. Indeed, most of the works are dealing with the parallelization of the kernel.

In [10], the authors use two different workstations with a total of eight CPU cores: one Xeon workstation that holds two quad core processors (2,66 GHz), and a Barcelona test platform that holds two AMD Opteron 2347 processors (Barcelona, quad

core, 1.9 GHz). We note that they use the respective block-oriented data structure to store sparse matrices [10]. However, our goal is to study the SDMP versions corresponding to different SCFs.

In [11], the authors study the SDMP parallelization. However, we are interested in the sequential version. Note that the present work is a continuation of the works carried out and published in [5],[16]. The used techniques are inspired from the work on the SMVP optimization presented in [7,8].

### III. GENERAL CONCEPTS

#### A. Compression Formats for Sparse Matrices

We recall that a matrix is called sparse (dense) if it has a large (resp. small) number of zero (resp. nonzero) elements [3, 4, 5, 6, 7]. Let NNZ be the number of nonzero elements. As previously mentioned, processing sparse matrices requires using special SCFs restricted to the nonzero elements. In this paper, we are especially interested in three among the most used storage formats namely DNS, CSR and COO. We underline that for storing a sparse matrix, say A of size N having NNZ nonzero elements, DNS corresponds to a 2D array where the whole  $N^2$  elements are stored. However, CSR corresponds to data structure consisting of three arrays denoted AA, JA and IA, where AA [1...NNZ] is a real array for row-wise storing the NNZ nonzero elements of A. JA [1...NNZ] is an integer array to store the column position of the elements in AA, and finally, a pointer array IA [1...N+1], where the  $i^{th}$  entry points to the beginning of the  $i^{th}$  row in arrays AA and JA [4], [7]. As to the COO format, it also consists of three arrays, each of which is of size NNZ i.e. a real array AA containing the nonzero elements, an array IA (resp. JA) of integers containing their row (resp. column) indices [4].

#### B. Sparse-Dense Matrix Product (SDMP)

The standard algorithm for multiplying two-dimensional  $N*N$  matrices, is given by Algorithm 1 below:

```

Algo-IJK (A, B, C, N)
DO i=1, N
  DO j=1, N
    DO k= 1, N
      C (i,j)+= A(i,k)* B(k,j)
    ENDDO
  ENDDO
ENDDO
END Algo-IJK
    
```

```

Algo-IKJ (A, B, C, N)
DO i=1, N
  DO k=1, N
    DO j= 1, N
      C (i,j)+= A(i,k)* B(k,j)
    ENDDO
  ENDDO
ENDDO
END Algo-IKJ
    
```

**Algorithm 1. Standard Matrix-Matrix Product (MMP)**

**Algorithm 2. Standard algorithm GAXPY-R kernel**

Let us recall that we address in this paper the case of the Sparse-Dense Matrix Product (SDMP) denoted  $C=A.B$  where the first (resp. second) matrix is sparse (resp. dense). We point out that the standard algorithm where A, B and C are stored in 2D matrices is a perfect 3-loop nest, denoted IJK (see Algorithm 1). It corresponds to the DOT-R body kernel and has a cubic complexity as mentioned above.

We can derive from algorithm 1 five other versions by permutation of the loops i, k and j. Hence, the permutations IKJ, JKI, KIJ, KJI, IJK and JIK respectively correspond to GAXPYs (GAXPY-R and GAXPY-C), AXPYs (AXPY-R and AXPY-C) and DOTs (DOT-R and DOT-C) kernels. We recall that there are two variants (Row, denoted R, and Column, denoted C) of each body kernel depending on the access mode to matrices A, B and C. We rely on the work of Zouaoui [4], who studied the different kernels and she found that the GAXPY-Row (GAXPY-R) kernel where all the matrices are accessed row-wise is the best among the other kernels since it provides the best performances, improves data locality and reduces cache misses. In Algorithm 2, we present the structure of the GAXPY-R Kernel.

### IV. A THEORETICAL STUDY OF SDMP

#### A. Application of optimization techniques

In order to optimize the SDMP loop nest structured algorithms, we have applied particular techniques such as (i) scalar replacement (SR) i.e. an array element (indirect memory access) is replaced by a scalar, (ii) loop invariant motion (LIM) where useless operations are avoided, and (iii) loop unrolling (LpU) by duplicating the loop body u times where u is an integer named LpU factor [6, 7]. In addition, we use different compiler optimization options denoted by -Oi (i=0 4, s) and Funroll-loops [7], [12].

**B. Intra- algorithm study**

In this paper, we are limited to formats storing matrices row-wise such as DNS, CSR and COO since nonzero elements may be stored and accessed row-wise. Various optimization techniques are applied to the obtained codes corresponding to these formats, namely, SR, LIM techniques (Algorithms 3, 6 and 9). In addition, in (Algorithms 4, 7 and 10) we apply the LpU technique.

For each studied format, we achieve a comparative study between different optimized versions for the SDMP. To make a comparative study in order to detect the most optimal optimization techniques, we consider (i) the number of operations (i.e. arithmetic and logic), (ii) the number of used memory words (i.e. integers and doubles), (iii) the number of indirect access (i.e. access to an array element) (iv) the number of indirect nested access (i.e. where the index of an array element is an array element) and (v) the number of reads and writes, as comparison criteria for the different SDMP versions (Tables 1, 2 and 3). Notice that unrolling optimizations have no impact on the values of these criteria. However, they have influence on the memory cache behaviour [6, 7].

- 1) SDMP-DNS versions: in Table 1, we compare the optimized version V2 (using tests, SR and LIM) to the non-optimized version (V0 version) of the SDMP-DNS algorithm.

| SDMP_DNS version   | #operations    | #memory words | #Indirect Access | #Indirect nested Access | #Memory I/O     |
|--------------------|----------------|---------------|------------------|-------------------------|-----------------|
| Non optimized (V0) | $2N^3$         | $2N^2$        | $4N^3$           | 0                       | $4N^3$          |
| optimized (V2)     | $2N*NNZ + N^2$ | $2N^2$        | $N^2 + 3N*NNZ$   | 0                       | $2N^2 + 3N*NNZ$ |

**Table 1. Comparative study of SDMP-DNS versions**

```

SDMP-DNS-V2 (A, B, C, N)
DO i=1, N
  DO k=1, N
    s = A(i,k)
    IF (s ≠ 0) THEN
      DO j= 1, N
        C(i,j)+= s * B(k,j)
      ENDDO
    ENDIF
  ENDDO
END SDMP-DNS-V2
    
```

**Algorithm 3. SDMP-DNS version (V2) optimized with logical tests, SR and LIM**

```

SDMP-DNS-u2 (A,B,C,N)
m = N mod 2, ne = N-m
DO i=1, N
  DO k=1, N
    s = A(i,k)
    IF ( s ≠ 0) THEN
      DO j= 1, ne,2
        C(i,j)+= s * B(k,j)
        C(i,(j+1))+= s * B(k,(j+1))
      ENDDO
      DO j = ne+1, N
        C(i,j)+= s * B(k,j)
      ENDDO
    ENDIF
  ENDDO
END SDMP-DNS-u2
    
```

**Algorithm 4. SDMP-DNS optimized with logical tests, SR, LIM and LpU, factor u=2**

- 2) SDMP-CSR versions: in Table 2, we present a comparative study for the SDMP-CSR algorithms (the non-optimized version V0 and the optimized version V2 (using tests, SR and LIM)).

| SDMP_CSR version   | #operations | #memory words | #Indirect Access | #Indirect Nested Access | #Memory I/O      |
|--------------------|-------------|---------------|------------------|-------------------------|------------------|
| Non optimized (V0) | $2N*NNZ$    | $2NNZ+N+N^2$  | $3N*NNZ$         | $N*NNZ$                 | $4N*NNZ$         |
| Optimized (V2)     | $2N*NNZ$    | $2NNZ+N+N^2$  | $2N+2NNZ+3N*NNZ$ | 0                       | $4N+4NNZ+3N*NNZ$ |

**Table 2. Comparative study of SDMP-CSR versions**

```

SDMP-CSR-V0 (IA, JA, A, B, C, N)
DO i=1, N
  DO k=IA(i), IA(i+1)-1
    DO j= 1, N
      C(i,j)+= A(k) *B(JA(k),j))
    ENDDO
  ENDDO
END SDMP-CSR-V0
    
```

**Algorithm 5. SDMP-CSR version (V0)**  
non optimized

```

SDMP-CSR-V2 (IA, JA, A, B, C, N)
DO i=1, N
  ia1=IA(i), ia2= IA(i+1)
  DO k= ia1, ia2-1
    s= JA(k), s1= A(k)
    DO j= 1, N
      C(i,j)+= s1 *B(s,j)
    ENDDO
  ENDDO
END SDMP-CSR-V2
    
```

**Algorithm 6. SDMP-CSR version (V2)**  
optimized with SR and LIM

```

SDMP-CSR-u2 (IA, JA, A, B, C, N)
m=N mod 2, ne=N-m
DO i=1, N
  ia1=IA(i), ia2= IA(i+1)
  DO k= ia1, ia2-1
    s= JA(k), s1= A(k)
    DO j= 1, ne-1, 2
      C(i,j)+= s1 *B(s,j)
      C(i,(j+1))+= s1 * B(s,(j+1)))
    ENDDO
  DO j= ne+1, N
    C(i,j)+= s1 *B(s,j)
  ENDDO
ENDDO
END SDMP-CSR-u2
    
```

**Algorithm 7. SDMP-CSR optimized with SR, LIM and LpU, factor u=2**

3) SDMP-COO versions: in Table 3 we present a comparative study for the SDMP-COO algorithms (Algorithm 8 and Algorithm 9).

| SDMP_COO version   | #operations | #memory words | #Indirect Access  | #Indirect Nested Access | #Memory I/O       |
|--------------------|-------------|---------------|-------------------|-------------------------|-------------------|
| Non optimized (V0) | $2N * NNZ$  | $3NNZ + N^2$  | $N * NNZ$         | $3N * NNZ$              | $4N * NNZ$        |
| optimized (V2)     | $2N * NNZ$  | $3NNZ + N^2$  | $3NNZ + 3N * NNZ$ | 0                       | $6NNZ + 3N * NNZ$ |

**Table 3. Comparative study of SDMP-COO versions**

```

SDMP-COO-V0 (IA, JA, A, B, C, N)
DO i=1, NNZ
  DO j=1, N
    C(IA(i),j)+= A(i) * B(JA(i),j)
  ENDDO
ENDDO
END SDMP-COO-V0
    
```

**Algorithm 8. SDMP-COO version (V0)**  
non optimized

```

SDMP-COO-V2 (IA, JA, A, B, C, N)
DO i=1, NNZ
  ia1= IA(i), jai=JA(i), s=A(i)
  DO j=1, N
    C(ia1,j)+= s * B(jai,j))
  ENDDO
ENDDO
END SDMP-COO-V2
    
```

**Algorithm 9. SDMP-COO version (V2)**  
optimized with SR and LIM

```

SDMP-COO-u2 (IA, JA, A, B, C, N)
m=N mod 2, ne=N-m
DO i=1, NNZ
  iai= IA(i), jai=JA(i), s=A(i)
  DO j=1, ne-1, 2
    C(iai,j)+= s * B(jai,j)
    C(iai,(j+1))+= s * B(jai,(j+1))
  ENDDO
DO j= ne+1, N
  C(iai,j)+= s * B(jai,j)
ENDDO
END SDMP-COO-u2
    
```

**Algorithm 10. SDMP-COO optimized with SR, LIM and LpU, factor u=2**

**C. Inter-algorithm study**

In this section, we compare the optimized SDMP algorithms corresponding to the formats DNS, CSR and COO in order to detect the optimal format which provides the best performances. Notice that in Table 4, we don't present the nested indirect access number because they are equal to zero for the SDMP optimized algorithms.

| Algorithm version | #operations      | #memory words    | # Indirect Access      | # Memory I/O           |
|-------------------|------------------|------------------|------------------------|------------------------|
| SDMP_DNS          | $2N * NNZ + N^2$ | $2 N^2$          | $N^2 + 3 * NNZ$        | $2N^2 + 3N * NNZ$      |
| SDMP_CSR          | $2N * NNZ$       | $2NNZ + N + N^2$ | $2N + 2NNZ + 3N * NNZ$ | $4N + 4NNZ + 3N * NNZ$ |
| SDMP_COO          | $2N * NNZ$       | $3NNZ + N^2$     | $3NNZ * (N + 1)$       | $6NNZ + 3N * NNZ$      |

**Table 4. Optimized SDMP versions corresponding to different formats**

Thus, we first compare the number of operations. In the case of equality, we compare the number of indirect access and the number of memory I/O. Indeed, we remark that the SDMP-DNS has the largest number of operations. So, it is lastly classified. Concerning SDMP-CSR and SDMP-COO, they have the same number of operations. So, we compare their numbers of indirect access. Hence, we compute the difference of the indirect access numbers (resp. memory I/O numbers). Then, we study the sign of the obtained quantity which leads to three cases:  $2N < NNZ$ ,  $2N > NNZ$  and  $2N = NNZ$ . Tables 5, 6 and 7 present the classification of the SDMP versions corresponding to DNS, CSR and COO formats.

| Algorithm version | #operations | #memory words | # Indirect Access |         | # Memory I/O | Final rank |
|-------------------|-------------|---------------|-------------------|---------|--------------|------------|
|                   |             |               | Reading           | Writing |              |            |
| SDMP DNS          | 3           | 3             | 3                 | 1       | 3            | 3          |
| SDMP CSR          | 1           | 1             | 1                 | 1       | 1            | 1          |
| SDMP COO          | 1           | 1             | 2                 | 1       | 2            | 2          |

**Table 5. Comparative SDMP study for  $2N > NNZ$**

| Algorithm version | #operations | #memory words | # Indirect Access |         | # Memory I/O | Final rank |
|-------------------|-------------|---------------|-------------------|---------|--------------|------------|
|                   |             |               | Reading           | Writing |              |            |
| SDMP DNS          | 3           | 3             | 3                 | 1       | 3            | 3          |
| SDMP CSR          | 1           | 1             | 2                 | 1       | 2            | 2          |
| SDMP COO          | 1           | 1             | 1                 | 1       | 1            | 1          |

Table 6. Comparative SDMP study for  $2N < NNZ$

| Algorithm version | #operations | #memory words | # Indirect Access |         | # Memory I/O | Final rank |
|-------------------|-------------|---------------|-------------------|---------|--------------|------------|
|                   |             |               | Reading           | Writing |              |            |
| SDMP DNS          | 3           | 3             | 3                 | 1       | 3            | 3          |
| SDMP CSR          | 1           | 1             | 1                 | 1       | 1            | 1          |
| SDMP COO          | 1           | 1             | 1                 | 1       | 1            | 1          |

Table 7. Comparative SDMP study for  $2N=NNZ$

We notice that:

- **In the case of  $2N > NNZ$ ;** SDMP-CSR and SDMP-COO have the same number of operations. However, SDMP-COO accomplishes more indirect access and memory I/O. Thus, SDMP-CSR is first classified, and SDMP-COO is second classified. the SDMP-DNS algorithm is lastly classified because it provides the worst theoretical performances.
- **In the case of  $2N < NNZ$ ;** SDMP-CSR and the SDMP-COO have the same number of operations. However, SDMP-CSR accomplishes more indirect access and memory I/O. Thus, SDMP-COO is first classified, and SDMP-CSR is second classified. The SDMP-DNS algorithm is lastly classified because it provides the worst theoretical performances
- **In the case of  $2N=NNZ$ ;** SDMP-CSR and SDMP-COO algorithms are first classified because they have the same number of operations, the same number of memory access and the same number of memory I/O. The SDMP-DNS algorithm is lastly classified because it provides the worst theoretical performances.

## V. EXPERIMENTAL WORK

| Architectural Models | CPU frequency | L3 Cache memory | RAM    | Sites    | Clusters |
|----------------------|---------------|-----------------|--------|----------|----------|
| Intel Xeon E5-2660   | 2.20GHz       | 20Mo            | 64 GB  | Nantes   | Econome  |
| Intel Xeon E5-2650   | 2.00GHz       | 20Mo            | 252 GB | Nancy    | Graphite |
| Intel Xeon X5570     | 2.93GHz       | 8Mo             | 24GB   | Rennes   | Parapide |
| Intel Xeon E5520     | 2.27GHz       | 8Mo             | 24GB   | Grenoble | Edel     |
| Intel Xeon E5520     | 2.27 GHZ      | 8Mo             | 32GB   | Sophia   | Suno     |
| Intel Xeon E5-2630   | 2.30 GHZ      | 15Mo            | 32GB   | Lyon     | Orion    |

Table 8. The characteristics of the used INTEL XEON models

In order to evaluate the performances of the SDMP versions, a series of experimentations is accomplished on Intel Xeon processors. These last belong to Grid5000 platform and have different architectures (see Table 8). To evaluate the performances of the algorithm

versions and validate our theoretical study, we use three storage formats for storing matrix A. For each format we generate eight algorithm versions relative to the different optimization techniques. In total, the number of tested algorithms is 24. For each version, we apply seven different compiler options, we test ten matrices and we use six different target machines with different characteristics to achieve the experimentations. The total number of tests is equal to 15075.

|        | Matrices        | N     | NNZ     | d     | Structures |
|--------|-----------------|-------|---------|-------|------------|
| 2N<NNZ | cry10000        | 10000 | 49 699  | 0.05  |            |
|        | FA              | 10617 | 72 176  | 0.06  |            |
|        | Trefethen_20000 | 20000 | 287 233 | 0.07  |            |
|        | mult_dcop_03    | 25187 | 193 216 | 0.03  |            |
|        | bloweybl        | 30003 | 70 001  | 0.008 |            |
|        | lhr34           | 35152 | 764 014 | 0.06  |            |
| 2N>NNZ | obstclae        | 40000 | 118 804 | 0.007 |            |
|        | bcsstm25        | 15439 | 15 439  | 0.006 |            |
|        | qpband          | 20000 | 30 000  | 0.007 |            |
|        | bcsstm37        | 25503 | 14 765  | 0.002 |            |

**Table 9. The characteristics of the real matrices**

For each compressed format (SCF) (i.e. CSR, COO and DNS) used to store the sparse matrix A, we test different versions (i) SCF V0, the non-optimized version, (ii) SCF V1, the optimized version with scalar replacement (SR), (iii) SCF V2, the optimized version with scalar replacement (SR) and loop invariant motion (LIM) (iii) SCF ui (i=2, 8, 16, 32,36,40), the version SCF V2 optimized using the loop unrolling (LpU) such that ui correspond to the unrolling factors. In the same way, we include logical tests in the SDMP-DNS algorithm which improves its performances. In addition to the manual optimizations (i.e. SR, LM, and LpU), we use at compile time different options that control various kinds of optimizations in the GNU Compiler Collection (GCC) such as the '-O' options (the allowed forms are -O0, '-O1', '-O2', '-O3', and '-Os'), and the '-funroll-loops'.

For this purpose, we use a set of matrices from real applications which belong to Tim Davis and Matrix Market collections [13][14]. The size (N) of the matrices is in the range [10000, 40000] and the density (%) is varying in  $[8.10^{-3}, 7.10^{-2}]$  (see Table 9).

**A. Intra- algorithm study**

Let Ratio be defined as:

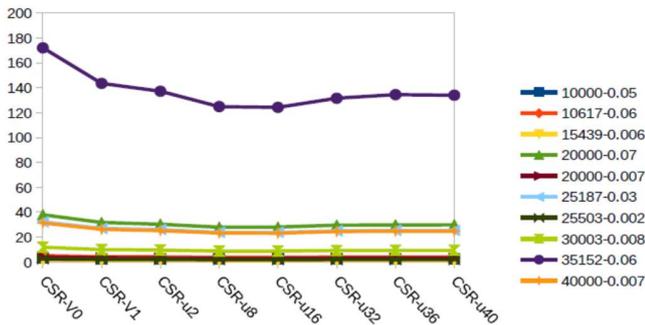
$$\text{Ratio} = (1-t_x/t_y) * 100 \quad (1)$$

Where  $t_x$  is the runtime of the SDMP version x,  $t_y$  is the runtime of the SDMP version y, with  $t_x \leq t_y$ . In this section, we validate the optimization study of the SDMP versions corresponding to the DNS, CSR and COO formats. To optimize the SDMP-DNS, SDMP-CSR and SDMP-COO algorithms, we include logical tests, SR, LIM, and LpU. The experiments are accomplished on six different machines of Grid5000, using ten matrices from real applications. For each format, we present the experimentation results we obtained when applying (i) SR and LIM optimizations, (ii) loop unrolling technique and (iii) compiler optimization options.

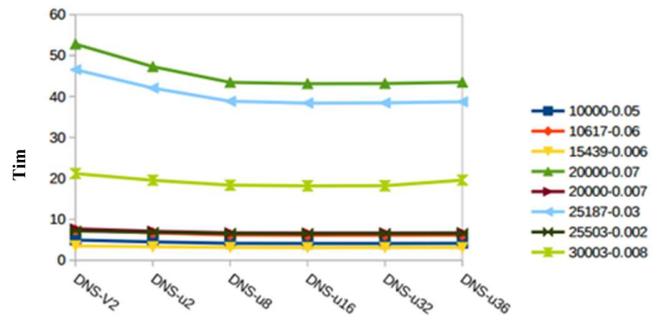
1) SR and LIM techniques: SR and LIM techniques improve the performance of the different algorithms SDMP-DNS, SDMP-CSR and SDMP-COO and this is true for all the tested matrices and on the six used architectures (see Figure 1.(a) and Figure 1.(b)). In the figures, each curve corresponds to the running time for a couple (matrix size/matrix density).

2) Loop unrolling technique: we apply the LpU technique with different factors in the range [2...40] and we obtain interesting results. Indeed, the loop unrolling technique when combined with the SR and LIM techniques increases the performances for SDMP-DNS, SDMP-CSR and SDMP-COO. We precise that the best performances are given by the unrolling factors u8, u16 and u32 for the three formats. This result is true on the six tested architectures. For lack of space reasons, we only present the results related to three architectures (Grenoble Ediel, Nantes Econome and Lyon Orion). For the mentioned unrolling factors:

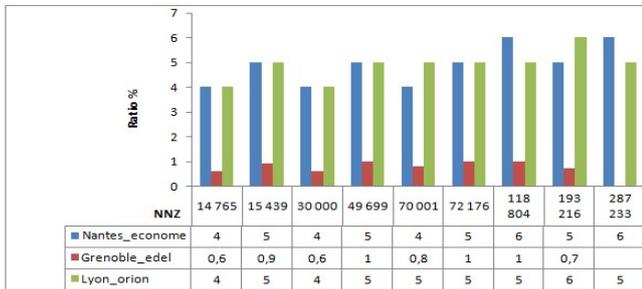
- (i) for SDMP-DNS, the performances obtained on the different machines are equivalent. Indeed, the difference does not exceed a ratio of 1% on the Grenoble Ediel processor and 6% on both Nantes Econome and Lyon Orion (see Figure 1.(c)).
- (ii) for SDMP-CSR, the performances obtained on the different machines are also equivalent. The difference does not exceed a ratio of 3% on the Grenoble Ediel processor, 6% on Nantes Econome and 5% on Lyon Orion (see Figure 1.(d)).
- (iii) for SDMP-COO, the performances obtained on the different machines are also equivalent. The difference does not exceed a ratio of 6% on Grenoble Ediel processor, 10% on Nantes Econome and 11% on Lyon Orion (see Figure 1.(e)).



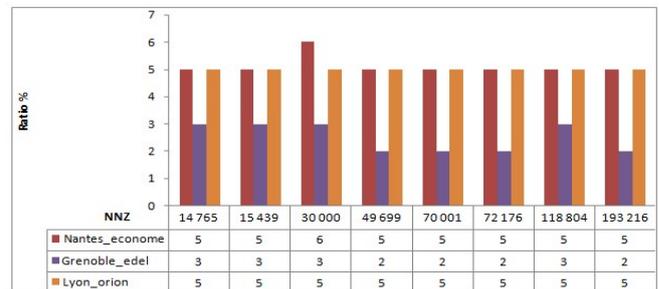
(a). Performance study of SDMP\_CSR optimized with (SR, LIM and LpU) on Grenoble\_Edel



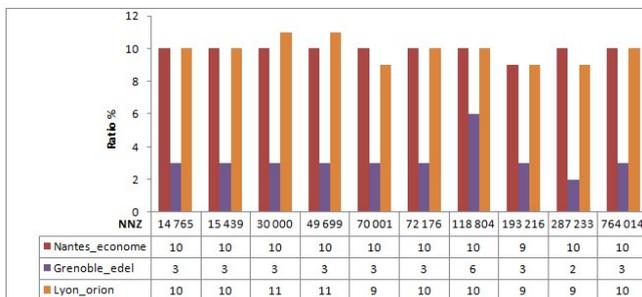
(b). Performance study of SDMP\_DNS optimized with (Test, SR, LIM and LpU) on Grenoble\_Edel



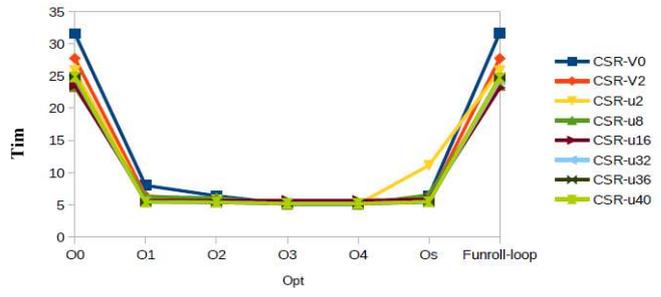
(c). Comparison for SDMP\_DNS of the performances obtained by using unrolling factors (u8 ... u32)



(d). Comparison for SDMP\_CSR of the performances obtained by using unrolling factors (u8 ... u32)



(e). Comparison for SDMP\_COO of the performances obtained by using unrolling factors (u8 ... u32)



(f). Performance study of SDMP\_CSR optimized using compiler options where N=10000 on Nantes\_Econome

Figure 1: Experimental results for intra-algorithm comparison

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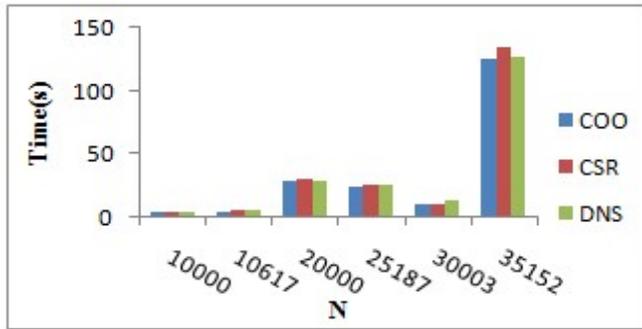
<http://dx.doi.org/10.29322/IJSRP.10.10.2020.p10647>

[www.ijsrp.org](http://www.ijsrp.org)

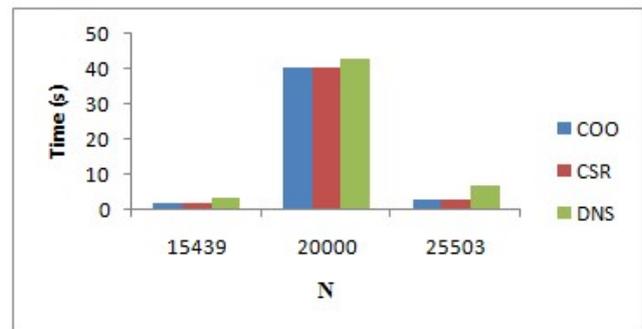
**Recapitulation:** we conclude that SDMP optimization using techniques RS, LIM, tests and LpU improves the algorithm performances with a ratio reaching 22%. These results are true for all the formats DNS, CSR and COO used for storing matrix A and are valid for the six architectures.

For the three studied formats, the best performance of the SDMP is obtained when we combine manual optimizations and compiler options.

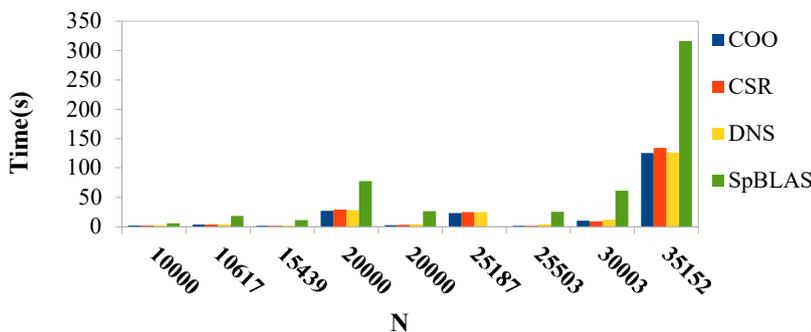
**B. Inter-algorithms study**



(a). A comparison of optimized SDMP-DNS, SDMP-COO and SDMP-CSR when  $2N < NNZ$  on Lyon\_Orion architecture



(b). A comparison of optimized SDMP-DNS, SDMP-COO and SDMP-CSR when  $2N > NNZ$  on Grenoble\_Edel architecture



(c). A comparison of the performances of SDMP optimized with LpU to the performances of Sparse BLAS on Lyon\_Orion architecture

**Figure 2: Experimental results for inter-algorithms comparison**

The experimental results validate the theoretical results. Indeed,

- **In the case of  $2N > NNZ$ ;** the SDMP-DNS algorithm is the last classified. This is true on different tested architectures. On Grenoble Edel, Rennes Parapide and Sophia Suno, the SDMP-CSR algorithm is first classified followed by SDMP-COO algorithm (see Figure 2.(b)) which is conform with the theoretical study. However, on Nantes Econome, Nancy Graphite and Lyon Orion, the SDMP-COO algorithm is first classified followed by SDMP-CSR algorithm. Nevertheless, on the six different architectures, both algorithms have close performances.
- **In the case of  $2N < NNZ$ ;** the SDMP-DNS algorithm is the last classified. This is true on the different tested architectures. On Nantes Econome, Nancy graphite and Lyon Orion, the SDMP-COO algorithm is first classified followed by the SDMP-CSR algorithm (see Figure 2.(a)). However, on Grenoble Edel, Rennes Parapide and Sophia Suno, the SDMP-CSR algorithm is first classified followed by SDMP-COO algorithm. Nevertheless, on the six different architectures, both algorithms have close performances.

- **In the case of  $2N=NNZ$** ; we don't find real matrices that respect this case.

In addition to manual optimizations, we use compiler optimization options, we notice that SDMP-COO and SDMP-CSR optimized with option O1 or O2 give the best running time on the six different architectures.

The obtained results are compared to the Sparse BLAS library, and we find that our optimized algorithms outperform the Sparse BLAS with a ratio of 13% (see Figure 2.(d)).

Recapitulation: When we compile SDMP-DNS, SDMP-COO and SDMP-CSR algorithms with compiler options O1 or O2, performances are improved, and the versions order is maintained.

## VI. CONCLUSION

In this paper, we study several algorithm versions of sparse-dense matrix product (SDMP) corresponding to three storage formats (DNS, CSR and COO) using particularly the GAXPY-R body kernel. Various optimization techniques are applied and lead to interesting improvement, namely manual optimization techniques (i.e. scalar replacement, loop invariant motion and loop unrolling) and compiler optimization options (i.e. -O1, -O2, -O3, -O4, -Os and the -Funroll-loops).

With manual optimizations, the best performances are obtained when we optimize the SDMP versions using LpU factors  $u=8$ ,  $u=16$  and  $u=32$ . On the other hand, when we add the compiler optimizations, we find that the options -O $i$  ( $i=1, 2$ ) give the best performances. This result is true for SDMP-DNS, SDMP-CSR and SDMP-COO versions and on all the tested Intel Xeon architectures. Concerning the optimal format, when the algorithms are optimized using manual optimizations, the best performances are obtained by the COO format, after applying the LpU, on Nantes Econome, Nancy

Graphite and Lyon Orion architectures. Whereas, the CSR format is the best on Rennes Parapide, Grenoble Edel and Sophia Suno architectures. When we add the compiler optimizations, the performances of the algorithms are improved, and the order of the versions is maintained. To conclude, our work arises some interesting points which may constitute a second step we intend to study soon. We may cite:

- studying the SDMP for regularly structured sparse matrices (triangular, band, ...) and the corresponding formats.
- studying the sparse-dense matrix on other architectures.
- processing very large sized matrices by parallelizing SDMP algorithms.

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# Nutritional Status and Dietary Practices among University Students in Sri Lanka

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**Abstract-** The increasing prevalence of overweight and obesity, mostly due to various behavioral and lifestyle factors are a burden on the population. Overweight and obesity are recognized as the cause of many health related complications. Unhealthy dietary practices such as high fat and salt intake lead to excess weight gain. The study aimed to assess the nutritional status and dietary practices among university students at Faculty of Health-Care Sciences, Eastern University, Sri Lanka. A sample of 384 students was selected using a systematic sampling technique. A self-administered questionnaire assessed the socio-demographic characters, and dietary practices. Weight, height and waist circumference (WC) were measured and compared with Asian anthropometric cut-offs for Body Mass Index (BMI) and WC. Chi-square test was used to find out the association between selected variables. The response rate was 87.5%. Out of 336 participants, the percentages of those overweight, obese and underweight were 35.2%, 10.7% and 8.6% respectively. Nearly one fifth of the students had the abdominal obesity; while one fourth of the female students had it, only about 10% male students had it. Males consumed significantly more ( $p < 0.05$ ) of unhealthy foods such as red meat and fast foods, had a higher prevalence of obesity compared to females. The findings of this study showed that the nearly half of the participants had excess body weight, with remarkable percentage of abdominal obesity. Moreover, the unhealthy dietary practices more common among males who had high percentages of obesity. Therefore, the appropriate awareness programme could be initiated among this target population to reduce the excess bodyweight and encourage them to follow the healthy dietary practices.

**Index Terms-** Overweight, Obesity, University Students, Dietary Practices, Sri Lanka

## I. INTRODUCTION

Overweight and obesity are defined as abnormal or excessive fat accumulation in the body, which is associated with adverse health outcomes (1). Obesity has reached epidemic proportions globally, with at least 2.8 million people dying each year as a result of being overweight or obese. Previously, it was associated with high-income countries but now, also present in low- and middle-income countries (2). In 2016, World Health Organization (WHO) estimated that the obesity prevalence has tripled compared with that in 1975 and reports that over 1.9 billion and nearly 650 million adults are overweight and obese respectively (1). Globally, the prevalence of overweight has been estimated as 39% in males and 40% in females while for obesity, the prevalence is 11% in males and 15% in females (1). The epidemic of obesity, overweight and abdominal obesity has spread rapidly through the South Asian region (3). Obesity has become an emerging public health problem in Sri Lanka as well (4). Previous studies show a clear upward trend in age-adjusted obesity (BMI  $\geq 25$  kg/m<sup>2</sup>) prevalence in Sri Lankan males and females; increasing from 14.3% (males) and 19.4% (females) in 2005 (5) to 21% and 32.7% respectively in 2011 (4). One quarter (26.2%) of Sri Lankan adult population is

suffering from central obesity (WC > 80cm for woman and >90cm for man) and is double in females (36.3%) compared to males (16.5%) (5). Overweight and obesity lead to many physical, psychological and economic consequences (6).

Global increases in overweight and obesity are attributable to a number of factors such as increased intake of energy dense foods that are high in fat, salt and sugars but low in vitamins, minerals and other micronutrients; reduced physical activities due to increasingly sedentary nature of many forms of work, changing modes of transportation from walking or cycling to motor car and increasing urbanization (7). The fundamental cause of obesity and overweight is the energy imbalance between the intake and the expenditure of calories where the intake exceeds expenditure (1). Even though the rate of literacy is higher in Sri Lanka relative to the other developing countries, the incidence of overweight and obesity have risen in recent years, probably due to changes in food habits and moving towards a more sedentary life style (4). The increasing prevalence of overweight and obesity due to various behavioral and lifestyle factors are a burden on the population. For those reasons, awareness and knowledge is thought to be essential in controlling the problems of overweight and obesity and related health complications.

The transition period from high school to university seems to be linked with a decrease in physical activities and an increase in sedentary activities (8). In a study carried out in Netherlands, it was reported that majority (68%) of students had weight gain after university entrance (9). During the transition from secondary school to university, students need to adapt to a new environment. Some authors have pointed out that when students fail to adapt adequately to the new environment, it could have negative consequences towards their health and weight status (10). Therefore, this study aimed to assess the nutritional status and dietary practices and the association between selected variables among a group of Sri Lankan university students.

## II. METHODOLOGY

A descriptive cross-sectional study was conducted for one year from May 2016. A sample of 384 students consisting females and males were selected from the students of the B.Sc. (Nursing) and the M.B.B.S. degree programmes. The maximum sample size was calculated for a given margin of error (d) 0.05 with the prevalence of any of the characteristics taken as 50% in the absence of similar studies in the local setting. A systematic sampling technique was used to select the subjects from the registration information kept at the university. Selected students were invited to participate in the study after written informed consent. After completion of data collection, 48 subjects were excluded from the analysis since the data given was incomplete. Therefore, data pertaining to 336 subjects only was analyzed. This study was approved by the Ethics Review Committee, Faculty of Health-Care Sciences, Eastern University, Sri Lanka (EUSL/FHCS/ERC/2016/09).

### **Data collection instrument**

Data were collected by investigators through a self-administered questionnaire. Pre-testing was carried out among 15 students to validate the questionnaire for accountability and accuracy. Data included socio-demographic characters, anthropometric and waist circumference measurements, and dietary practices.

A self-interviewer questionnaire was used collect the data on the study subjects' dietary practices. Names of 11 common food items were given to them and their choices were recorded. They were asked to choose between the following options, which were on the frequency of consumption. The options were 'daily', 'less than or equal three times a week', 'more than thrice a week' and 'never'.

### **Measurements**

All anthropometric measurements were performed using standard procedure. The weight was measured with a SECA 703 wireless column scale (Hamburg, Germany). Participants were weighed wearing light cloths. The height was measured in a standing position by using SECA 703 wireless column scale (Hamburg, Germany) (without shoes) and the waist circumference was measured using a non-stretchable measuring tape at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest to the nearest 1cm, at end of the normal expiration.

### Statistical analysis

Subjects were classified into four groups according to their 'Measured' BMI values as underweight:  $< 18.5\text{kg/m}^2$ ; normal weight:  $18.5\text{-}22.9\text{ kg/m}^2$ , overweight:  $23.0\text{-}25.0\text{ kg/m}^2$ ; obese  $\geq 25.0\text{ kg/m}^2$  (6). Abdominal obesity was defined as a waist circumference  $>90$  cm for males and  $>80$  cm for females (6). Collected data were transferred to SPSS 16 statistical software (SPSS Inc., Chicago, IL, USA) and analyzed based on the research problem, objectives and variables. Percentages of responses were reported according to BMI and WC level and respective weight perception. For categorical variables, Pearson's chi-square test was used to describe the association. *P* values  $< 0.05$  were considered significant.

## III. RESULTS AND FINDINGS

**Table 1: Socio-demographic Characteristics of participants**

| Variables (No=336)      | Number | Percentage (%) |
|-------------------------|--------|----------------|
| <b>Discipline</b>       |        |                |
| Nursing                 | 75     | 22.3           |
| Medicine                | 261    | 77.7           |
| <b>Gender</b>           |        |                |
| Male                    | 131    | 39.0           |
| Female                  | 205    | 61.0           |
| <b>Ethnicity</b>        |        |                |
| Tamils                  | 86     | 25.6           |
| Muslims                 | 67     | 19.9           |
| Sinhalese               | 181    | 53.9           |
| Burger                  | 02     | 0.6            |
| <b>Current Resident</b> |        |                |
| Home                    | 54     | 16.0           |
| Hostel                  | 224    | 66.7           |
| Other                   | 58     | 17.3           |
| <b>Meal Type</b>        |        |                |
| Vegetarian              | 21     | 6.2            |
| Non-Vegetarian          | 295    | 87.8           |
| Ovo-vegetarian          | 20     | 6.0            |
| <b>Sources of Food</b>  |        |                |
| Home                    | 64     | 19.0           |
| Canteen                 | 199    | 59.2           |
| Shop                    | 53     | 15.8           |
| Own made                | 20     | 6.0            |

A total of 336 students were given their consent to participate. The respondent rate was 87.5% ( $n=336/384$ ). The study sample was selected randomly from the whole 4 batches of nursing students and the 5 batches of medicine students. Among the 336 participants, majority of the participants were females 61.0 % ( $n=205$ ). Out of 336 participants, Most of the participants were Sinhalese ( $n=181$ , 54%) with resident at hostel ( $n=224$ , 67%) and were non-vegetarian ( $n=295$ , 88%). Among them, the percentage of students who studied nursing and medicine were 22.3% and 77.7% respectively. While sixty percent of students consumed their regular meal from

the canteen, a very low percentage (6.0%, n=20) had self-cooked meals. Table 1 gives the percentage distribution of participants' socio demographic characteristics.

**Table 2: Dietary intake of participants assessed by a food frequency questionnaire in gender**

| Food Category            | Males (%) | Females (%) | Chi-square | p-Value |
|--------------------------|-----------|-------------|------------|---------|
| <b>Rice</b>              |           |             | 6.015      | .111    |
| Daily                    | 96.2      | 99.0        |            |         |
| ≤3times/week             | 1.5       | 0           |            |         |
| >3times/week             | 2.3       | 0.5         |            |         |
| Never                    | 0         | 0.5         |            |         |
| <b>Red meats</b>         |           |             | 20.965     | .000    |
| Daily                    | 3.8       | 1.0         |            |         |
| ≤3times/week             | 60.3      | 55.1        |            |         |
| >3times/week             | 22.1      | 11.2        |            |         |
| Never                    | 13.8      | 32.7        |            |         |
| <b>Vegetables</b>        |           |             | 1.152      | .562    |
| Daily                    | 85.5      | 88.8        |            |         |
| ≤3times/week             | 7.6       | 4.9         |            |         |
| >3times/week             | 6.9       | 6.3         |            |         |
| Never                    | 0         | 0           |            |         |
| <b>Fruits</b>            |           |             | 12.013     | .007    |
| Daily                    | 9.9       | 2.4         |            |         |
| ≤3times/week             | 54.2      | 68.3        |            |         |
| >3times/week             | 31.3      | 25.9        |            |         |
| Never                    | 4.6       | 3.4         |            |         |
| <b>Oil in Food</b>       |           |             | 5.302      | .151    |
| Daily                    | 42.7      | 44.9        |            |         |
| ≤3times/week             | 31.3      | 39.0        |            |         |
| >3times/week             | 24.4      | 15.1        |            |         |
| Never                    | 1.5       | 1.0         |            |         |
| <b>Grains</b>            |           |             | .862       | .835    |
| Daily                    | 13.0      | 13.7        |            |         |
| ≤3times/week             | 45.0      | 45.4        |            |         |
| >3times/week             | 35.1      | 31.7        |            |         |
| Never                    | 6.9       | 9.3         |            |         |
| <b>Fish and Sea food</b> |           |             | 2.596      | .458    |
| Daily                    | 26.0      | 23.4        |            |         |
| ≤3times/week             | 29.0      | 26.8        |            |         |
| >3times/week             | 38.2      | 37.6        |            |         |
| Never                    | 6.9       | 12.2        |            |         |
| <b>Sweets</b>            |           |             | 5.451      | .142    |
| Daily                    | 9.2       | 17.6        |            |         |
| ≤3times/week             | 64.9      | 55.6        |            |         |
| >3times/week             | 23.7      | 23.4        |            |         |
| Never                    | 2.3       | 3.4         |            |         |
| <b>Hot Beverages</b>     |           |             | 9.240      | .026    |
| Daily                    | 54.2      | 62.0        |            |         |
| ≤3times/week             | 26.0      | 14.6        |            |         |
| >3times/week             | 18.3      | 18.0        |            |         |
| Never                    | 1.5       | 5.4         |            |         |
| <b>Fast food</b>         |           |             | 23.295     | .000    |
| Daily                    | 3.1       | 3.4         |            |         |
| ≤3times/week             | 58.0      | 74.1        |            |         |
| >3times/week             | 35.9      | 14.1        |            |         |
| Never                    | 3.1       | 8.3         |            |         |

**Nutritional status among participants**

Out of 336 participants, the percentages of that overweight, obese, underweight, and normal weight were 35.2%, 10.7%, 8.6%, and 46% were respectively. The prevalence of overweight and obesity in males was 33.6% (n=44) and 14.5% (n=19), and in females, 36.1% (n=74) and 8.3% (n=17), respectively. Over one third of the male and female students had overweight. However, the obesity prevalence had two fold in males compared to females.

#### **Abdominal obesity among participants**

Among the 336 participants, nearly one fifth (n=64, 19%) of the study sample had abdominal obesity which constituted 25% (n=51) females and 10% (n=13) males. There was a significant association between present of abdominal obesity and gender ( $X^2 = 11.592$ ,  $p=0.001$ ).

#### **Dietary practices of participants**

Based on the semi-quantitative food frequency questionnaire (FFQ), significant differences were observed between male and female participants with respect to their consumption of individual food categories regularly (04 out of the 11 food items or groups). Males consumed more red meats, fruits and fast foods than females ( $p < 0.05$ ). Rice, vegetables, grains, fish and sea foods, sweets, hot beverages and dry fish were equally consumed by males and females (Table 2).

### **IV. DISCUSSION**

Sri Lanka is a low-middle income country that undergoes rapid transition in economics in general and food habits (11). This study provides details regarding nutritional status and dietary practices among a single group of Sri Lankan university students. The present study highlights that nearly half of the study population (n= 154) had higher than normal BMI values; one third were overweight and 10% were obese. A study by Jayawardena et al. (4) reported a much higher percentages of obesity (29%) among Sri Lankan in comparison to the findings from our study population (10%). This difference may be related to the difference in the sampling method. The alarming finding in this study is that a significant proportion of students (35%) have potential risk to become obese in future, unless appropriate action is taken. Therefore, creating awareness about their present weight status and the potential risk in future is of utmost importance to ensure safe BMI in the future. Obesity was commoner among males (14.5%) compared to females (8%), similar to two other studies done in Pakistan and USA (12, 13). In contrast, some local (4) and global (1) data showed that obesity was more prevalent in females than male and females were more vulnerable to develop obesity related negative health outcomes in future. Percentage of central obesity in this study was less than that seen in other local studies (4, 14). This feature was more prevalent among females than males. It is commonly reported that generally, females are more conscious about their body weight and seek weight control strategies (15). It has also been noted that significant percentage of female students named media and friends as the source of pressure to maintain a certain weight (16). Fat deposition in the abdominal area carries more risk for NCDs than deposition of fat in other areas of the body (6). Sri Lankan adults are reported to be more conscious about their waist circumference compared to their body weight (17).

There are many factors contribute to the unhealthful food consumption in college students include unhealthful food availability on campus, snacking, late night eating, alcohol-related eating, eating because of stress/boredom, and food in student dorm rooms (18). The present study finds out the food consumption among male and female students. In this finding, almost all students consumed carbohydrates basis foods specially rice as their main meal in daily. This is contrast with the finding of Lebanon study which stated that nearly 12% of the students consumed rice daily basis, however majority of the students daily consumed white rice (19).

Higher fibres foods such as whole grains, legumes, fruits and vegetables have been linked to lower body weights (20). In present study, majority of the students consumed vegetables daily. It contrasts with strong et al study (21). The present study revealed that less percentages of the students consumed fruits and grains as daily basis. Both males and females consumed grains more equal amount but fruits consumption was high in males compared to females. However, in strong et al study showed that both males and

females consumed fewer amounts of these food categories in daily basis (21). This indicates that efforts need to be made to improve fruit and vegetable intake among university students. There was significant correlation between gender and fruit consumption but not with vegetables consumption in the present study but it was totally opposite the findings of the strong et al study.

Increased consumption of high-fat and high-energy foods provide extra calories that cause weight gain and intake of sugar sweetened beverages such as soda and fruit drinks has been contributing increasing obesity rate (22). The fast food and red meats consumption was very low in this study sample and there was significant correlation between gender and these food categories ( $p < 0.001$ ). The students who were overweight and obesity were consumed large amount of fast foods and red meats as daily basis. While male students consumed red meats three times more than female students, the fast food consumption was more similar in both categories. The self-preparation of food is associated with least fast food consumption which is more healthy diet (23). This finding is differ from the Salmeh et al study which stated that nearly one third of the students consumed red meats in daily meals and fast food was approximately 12%. Female students added more red meats in their dish than male students and fast food consumption was double in males than females. There was a significant association between gender and red meats and fast food consumption ( $p < 0.001$ ) (19). Eating healthful diet is a challenge for the students in their transition period from secondary school to higher institution (24). The easy access to unhealthy food on a college campus is a barrier to weight management (25). Therefore, assessing nutritional status and dietary practices among university students are crucial to bring them as a healthier population in future.

## V. CONCLUSION AND RECOMMENDATIONS

Almost half of the participants were overweight or obese. Abdominal obesity was seen in one fifth of the participants and it was common in females. If university students learned healthy behaviors early in life, this would not only have favorable health outcomes at an individual level, it would also reduce the burden on health services. Males consumed significantly more ( $p < 0.05$ ) of unhealthy foods such as red meat and fast foods, had a higher prevalence of obesity compared to females. This study highlights the importance of initiating the awareness programme among university students to maintain the healthy lifestyle in order to prevent the excess weight gain.

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# Co-Operative Or Coercive Federalism: The Way To Tackle The Health Emergency In India

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**Abstract-** The purpose of this paper is to analyse the role that centre-state 'co-operative federalism' has played in addressing the current 'health emergency' in a diverse federal system like India. How to play a more effective role against this pandemic, how centre-state cooperation can play an effective role in reviving the pandemic economy. How the various 'coercive' decisions of the centre have caused social problems in India. Is corona pandemic situation showing a new path to central state relations in India? Are states becoming more centralized? How much has it been possible in the last five years to restructure the rift between the centre and West Bengal in terms of 'meeting-cooperate' and negotiating relations? Why?

**Index Terms-** Health-emergency, co-operative federalism, coercive federalism, meeting-cooperate,

## I. INTRODUCTION

The Indian federal system is in place in the world's largest democracy, consisting of 28 states and 8 union territories. Where the power structure of the central and state is also clear. Like the union prime minister, the chief minister of the state is also accountable to the people for the past administrative work. Although the power of the central government in the Indian federal system is comparatively wider than that of the states. In fact, both the centre and states are trying their best to address the extraordinary challenges in the country. The biggest crisis in the corona start-up situation has been with the issue of hunger and migration. 'Co-operative federalism' has repeatedly dealt with crisis situation since 1970 in independence India. This is true of foreign invasions as well as of unknown pandemic

## II. 'CO-OPERATIVE FEDERALISM' OR 'COERCIVE FEDERALISM' IS THE KEY FACTOR AGAINST CORONA PANDEMIC SITUATION

Earlier this year, the global pandemic corona virus struck India (1.3 billion

Population, most of them are citizens are poor villagers), as well as the world's east-west and medically advanced countries in terms of health, socio-economic and foreign policy. The first case of corona was found in India on January 30, 2020 in Kerala.

The central government has announced a 21 days nationwide lockdown on 24 march, which was later extended to 3<sup>rd</sup> may. In the third phase it was extended to May 17, in fourth phase it extended to May 31 and in fifth phase it extended for 7 days more nationwide lockdown up to June7.

Prime Minister Narendra Modi announced a lockdown on 25 march, 2020 to prevent this infection (to break the chain). It has ensured that people from different walks of life comply with this directive. BUT this sudden lockdown across the country has called into a question to the federal structure of India is 'co-operative' or 'coercive'. The federal system is in place in the world's largest democracy, consisting of 28 states and 8 union territories. Where the power structure of the central and state is also clear. Like the union prime minister, the chief minister of the state is also accountable to the people for the past administrative work. Although the power of the central government in the Indian federal system is comparatively wider than that of the states. In fact, both the centre and states are trying their best to address the extraordinary challenges in the country. The biggest crisis in the corona start-up situation has been with the issue of hunger and migration.

The section11 (1) of the National Disaster Management Act states that, 'there shall draw up a plan for disaster management for the whole of the country to be called the nation plan.' On the basis of which the prime minister announced a nationwide lockdown on 25<sup>th</sup> March. But section 11(2) states that, "the national plan' shall be prepared by the national executive committee having regard to the national policy and in constitution with the state government and expert bodies or organizations in the field of disaster management to be approved by the National Authority." Although there is a 'co-operative' mentality in this part of the law, the central government has only imposed it on the central decision without discussing with state government about any form of 'national plan' imposition like the announcement of this lockdown on 25<sup>th</sup> March. At the same time it will hit the federal system of the country.

In the federal structure of India, according to the constitution, health is listed as a state subject, while infectious diseases are included in the concurrent list. But since the pandemic virus has not spread evenly across the country, it is noticeable in some states before and after another, or even in terms of magnitude. Again, the disease did not spread equally in all parts of a state or even a district. Therefore it can be expected that the state government is more knowledgeable and able to take action on public health

issues than the central government. While the level of the virus has been declining in Kerala, on other side Maharashtra has seen an outbreak of the disease. In West Bengal's south Bengal, Kolkata, Howrah, Hooghly and North-24-Parganas etc. districts, while the number of cases of covid-19 infections is higher. While in North Bengal's Cooch Behar and Alipurduar district the number of cases is zero. That is, states needed to be empowered to act appropriately independently on the nature and course of action against the spread of the disease and on the determination of zones. But the uniform lockdown model guideline of the central government have not been able to curb the spread of such disease on the one hand, India currently has the highest daily infection rate in the world. On the other hand, have made the economic stagnation of the states more difficult. Since the main source of income is closed, the states want to activate some economic activity in the non-containment green zones. The central government will seek to lead, allocate resources and set the right guidelines in that regard. The Indian federal system could have played a stronger role against the corona pandemic if the states had been empowered to operate independently within their constitution jurisdiction.

We can see the effort of the federalism system of the centre and state governments to take precautionary measures against Covid-19 in the state of emergency in India through the implementation of two laws. One is the Epidemic Disease Act (EDA) 1897 and another is the National Disaster Management Act (NDMA) 2005. Prior to the announcement of a nation-wide lockdown by the central government on March 25, various state government of India like Delhi, Maharashtra, Kerala, Telangana, Karnataka, Hariyana, West Bengal, Goa etc. have taken various precautionary measure to deal with the situation under section 2 of the Epidemic Disease Act 1897.

Likewise, the government ordered the closure of all types of educational institutions, public swimming pools and cinema halls till March 31, which was later gradually increased.

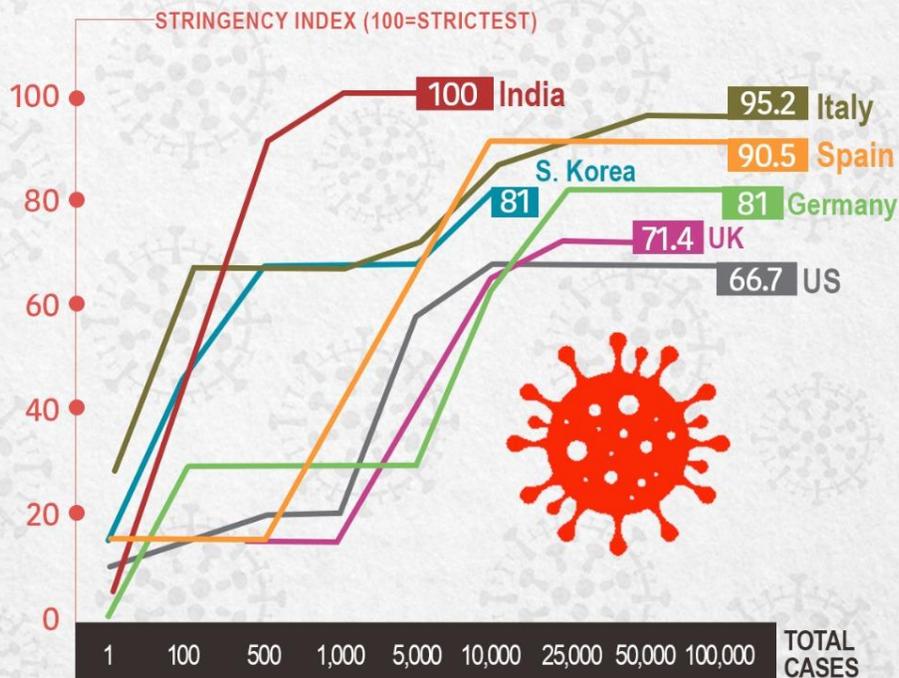
\*All hospitals should have separate concerns for screening of suspected case. In case the person has any such history of travel to affected areas in last 14 days and he/she must remain in home quarantine for 14 days from the day of exposure.

On the other hand, according to the section 2(A), central government may take measure and prescribed regulations for the inspection of any ship or vessel leaving or arriving at any port and for such detention therefor or of any person intending to sail therein or arriving thereby as may be necessary (en.wikipedia.org/wiki/Epidemic\_Disease\_Act\_1897). Although this law does not mention the airports. The Home Ministry has prohibited cruise ships, crew or passengers from coronavirus-hit nations to come to India till March 31 under this Act. In addition, the government of India has issued The Epidemic Disease (Amendment) ordinance 2020 on 22.04.2020 stipulating that anyone who attack doctors and health workers is liable to seven years imprisonment. But the law does not give the government to power to deal with a biological emergency situation. The Economic Times published on 22 March 2020, reported on 'How India is fighting corona virus with a colonial-era law on epidemics' that, this may include issue that need to be addressed in order to deal with terrorist attack, biological weapons use, cross a border issues and international spread of disease (Sharma).

According to the Oxford Covid-19 Government Tracker (OXCGRT) collected data on a scale of 13 indicators such as travel bans, closure of schools, closing public transports, restriction on internal movement, testing etc. (Oxford University Launches World's first COVID-19 government response tracker), gives 'full marks' to India government for lockdown. (@BJP4India, <https://twitter.com/BJP4India/status/1248649441193623554>). But over time, that is likely to change. India is currently leading the way in the daily rate of Covid-19 infection and OXCGRT gives 70-80 marks in the index.

# INDIA SCORES 'FULL MARKS' FOR TAKING COMPOSITE MEASURES TO COMBAT COVID-19

## COVID-19: GOVERNMENT RESPONSE STRINGENCY INDEX



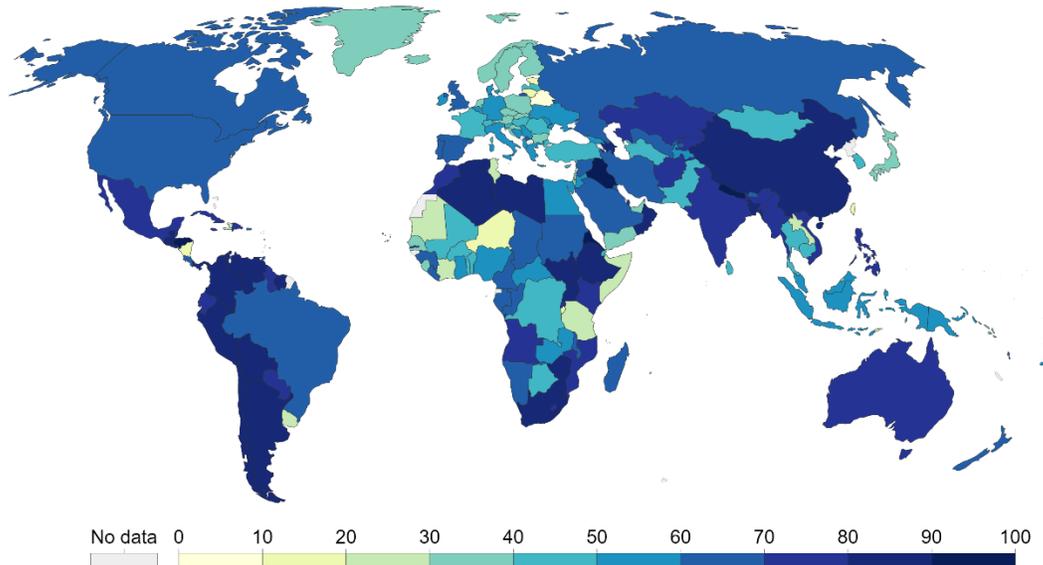
PUBLISHED ON APR 1, 2020

[f](#) [t](#) [v](#) [i](#) [p](#) /BJP4India [globe](#) www.bjp.org

Source: Blavatnik School of Government at the University of Oxford

## COVID-19: Government Response Stringency Index, Aug 14, 2020

This is a composite measure based on nine response indicators including school closures, workplace closures, and travel bans, rescaled to a value from 0 to 100 (100 = strictest). If policies vary at the subnational level, the index is shown as the response level of the strictest sub-region.



Source: Hale, Webster, Petherick, Phillips, and Kira (2020). Oxford COVID-19 Government Response Tracker – Last updated 6 September, 14:30 (London time)

Note: This index simply records the number and strictness of government policies, and should not be interpreted as 'scoring' the appropriateness or effectiveness of a country's response.

OurWorldInData.org/coronavirus • CC BY

### III. CENTRE'S FINANCIAL BLOCKED POLICY TOWARDS STATES IN PANDEMIC SITUATION:

Several state governments have enacted the Epidemic Act of 1897 before the centre declared a nationwide lockdown and has taken some limited action against this pandemic. On the other hand, the main source of the state have been shut down and similarly due to non-receipt of arrears of GST compensation by the states, there has been a severe financial crisis in the state. But the state governments have been working from the front to tackle this Covid19 pandemic. This means that a sufficient amount of central allocation is required for SDRMA. To this end, on March 14, MHA declared Covid19 as a 'notified disaster' and decided to allocate Rs29, 000 crore to SDRF in 2020-21 financial year. The central government allocated Rs11, 000 crore in the first phase. Although we do not see example of a neutral federal structure in this allocation. According to the Hindu newspaper published on 3 April that Maharashtra, where the highest number of infected people on Covid19, has been allocated RS1, 611 crore, while Kerala, which has the second highest number of Covid-19 cases, has been allocated RS157 crore. Again a relatively less affected state has been allocated Rs966 crore and Rs910 in Madhya Pradesh. IN Addition, Rs802 crore has been allocated to Odisha, Rs740 crore to Rajasthan, Rs708 crore to Bihar, Rs662 to Gujrat, Rs555 crore to Andhra Pradesh, Rs510crore to Tamil Nadu, Rs505 crore to West Bengal, Rs468 crore to Uttara khan, Rs308 crore to Assam, Rs247 crore to Punjab, Rs395 crore to Karnataka (Special Correspondent, Corona virus| Centre releases RS11, 092 crore under State Disaster Management Fund). It is felt that in the fight

against Covid-19 pandemic, there is a need for adequate funds transfer from the central government to the states.

Although the Ministry of Corporate Affairs (MCA) on 28 March has announced that the central government's public charitable trust PM Cares Fund has given exemption from CSR expenditure under seventh schedule of the Companies Act2013. But they did not bring the Chief Minister's Relief Fund or State Relief Fund for Covid19 under this exemption. In this regard, a circular was issued by the Ministry of Corporate Affairs on 10April stating that, CM Relief fund for Covid19 would not be counted as a part of company CSR obligations. The Financial Express published on 17 April, title on 'West Bengal FM writes to Nirmala Sitaraman to allow corporate funds for Covid-19 from CSR kitty' stated that, this was demanded in a video conference of the Chief Ministers with the Prime Minister on 11 April and on 16 April the Finance Minister of West Bengal made this demand in a letter to the central government (PTI). However, the MCA circular on 23 March stated that, "spending of CSR Funds for Covid19 is eligible CSR activity" (HT Correspondent, Make donation to CM relief fund part of CSR: West Bengal FM Amit Mitra).

Secondly, the states have been repeatedly asked by the central government to pay the arrears of GST soon. Meet the GST commitment of the central government during this financial crisis will further strengthen its federal relations and structure. The Kerala government has demanded Rs3000 crore pending GST compensation from the central government as well as a 50% revenue deficit grants which is Rs15, 323 crore (PTI). In this regard Punjab's Finance Minister Manpriet Singh Badal speak that dues are pending from April to all states ... the compensation has only been received up to March 2020. 4months of dues are still

pending. April, May, June and now July 2020. 4 months of pending dues is equivalent to 2 months of salary bill of all Punjab employees. In fact, all the arrears for FY19-20 have been settled by giving Rs1.65 crore. But GST compensation is due from April, 2020. Since revenue short fall has worsened due to Covid19. GST collection has reduced 41% comparatively with previous year (ENS Economic Bureau, States voice concern over pending FY 21 GST dues). On the other side, According to the Business World newspaper published on 25 Aug stated that, State governments have been loss almost 6.2 lakh crore due to loss of earning from SGST, revenue from centre and additional expenditure by states government in the pandemic situation (ET Bureau).

#### IV. APOLITICAL APPROACH OF THE CENTRAL GOVERNMENT TOWARDS STATES:

The central government announced 20 step on 13<sup>th</sup> April to tackling corona virus, notable among these are—

1. An app called 'Arogya Setu' was launched to make citizens aware of the corona virus.
2. All women registered under 'Ujjwala scheme' are given free LPG refill for next three months.
3. 6 Crore farmers who are registered under the 'PM-Kisan scheme' will be paid RS 6000.
4. The MGNREGA project offers daily wages of RS 202 and an additional RS 2,000.
5. Three thousand sixty six crore rupees financial assistance has been allocated for two crore construction workers from the Building Construction Workers Fund.
6. 1400 crore are allocated for old age persons, widows and disabled peoples under the 'National Social Assistance Programme'.
7. 20 crore women 'Jan Dhan Yojana' account holders will get RS 500 for three months.
8. RS 50 lakh per person insured for health workers who do not fight pandemic.
9. 12 million metric tons of food grains are allocated for the 'Prime Ministers poor welfare scheme' for the months of April to June. (20 days, 20 step: A look at government, Hindusthan times)

According, to the latest data, more than 9.26 crore families have received gas in the prime minister 'Ujjwala Yojana' Project most of which are in Uttar Pradesh (15 million), West Bengal (78.47 lakh), Bihar (77.51 lakh), Madhya Pradesh (63.31 lakh), Rajasthan (55.34 lakh). Financial Express published on 8 March, on the title 'Ujjwala Scheme: UP, WB, Bihar top the list of free LPG connection scheme for poor' states that, nearly, 70,000 free gas connected are being issued in this scheme, over 40% beneficiaries are SC/ST (Krishnanand Tripathi).

According to the Economic Times published on 9 April, Under the 'Pradhan Mantri Garib Kalyan' Package, 10,315 crore rupees have been credited to 20.62 crore women 'Jan Dhan' account holders by the end of April first week, as ex-gratia payment of RS. 500 would be credited for next three months. Whose maximum of account are in— Uttar Pradesh (63,691,269), West Bengal (37,509,570), Madhya Pradesh (32,894,010), Rajasthan (27,081,245), and Maharashtra (27,055,642) (PTI). Therefore, the announcement of the payment of ex-gratia to 20.62 crore women under the central government's poor welfare scheme package

states that the first-line beneficiary states, except Uttar Pradesh and Madhya Pradesh, are under the control of the opposition.

'Prime Minister's Garib Kalyan Rojgar Abhiyaan' in a situation affecting the return of migrant to India, which seek to provide livelihood opportunities to them along with other rural citizens. The Financial Express published on 20 June, under the title 'Garib Kalyan Rojgar Abhiyaan highlights' that the programme lasts for 125 days, with 25 types of work that will seek to develop rural infrastructure, at least 25,000 migrant workers in a district who returned home in the states like Bihar, Uttar Pradesh, Madhya Pradesh, Rajasthan, Jharkhand and Odisha RS.50, 000 has been allocated for the development of villagers particularly to give jobs to workers (FE Online). But this scheme is not for all migrant labourers though out India or other states of India.

The Indian Express published on 8 June states that among the state Uttar Pradesh has said 21.69 lakh workers had returned, Bihar has said 10 lakh, Maharashtra has said 11 lakh have left the state and Gujrat said 20.05 lakh had gone back to home (Chisti, Explained: How many migrant workers displaced? arrange of estimates). Although in a state like West Bengal about a few lakh workers came back from outside the states, no district of West Bengal was brought under this scheme. This is depriving the interest of migrant labours of their interest which is not desirable. The state official of West Bengal said to Hindusthan Times that, about 10,000 of the 3 lakh workers who had returned have go back to the states after taking the medical certificates (Pal, Covid-free' document in hand).

The centre has agreed to spend RS. 9460 crore and the state RS 4880 crore increase fish production. Arrangements were made to pay RS. 5763 to the fisheries. It also arranges a 60:40 ratio of centre-state micro Food Processing Enterprise Scheme (ET Bureau, Cabinet clears food processing Scheme). The Hindu published on 17 June shows that, Odisha government has launches door to door covid-19 survey by ASHA and Anganwadi workers. About five and a half lakh migrant workers have returned to the state (Special Correspondent, Odisha government launch door to door survey).

#### V. LEGALITY OF CENTRE'S INTERVENTION ON STATES

At present, the country's authoritarian populist leader are expanding their authority by taking advantage of the health emergency situation. The Economic Times published on 4 May stated that, "It is not just the USA where president Donald Trump has tried to turn residents of certain states against their own governor, In India, the ministry of Home Affairs run by Prime Minister Narendra Modi no-2 has begun sending out 'investigation team' to harass states run by the opposition, such as West Bengal" (Sharma, Corona virus is straining). Home Ministry on April 20, said in a statement that violation of lockdown and covid-19 situation is specially serious in Mumbai, Pune, Indore, Jaipur, Kolkata and a few other places in West Bengal. Similarly, 6 IMCT teams were sent to Maharashtra, West Bengal, Madhya Pradesh and Rajasthan for on-the spot inspection. Jayatri Nag reported to the Mumbai Mirror that, According to the Health Ministry rate was recorded in West Bengal at 9.57% where on 5<sup>th</sup> May, the IMCT team sent to the state had said that the morality

rate in West Bengal is 12.8%, the figure stood lower in Maharashtra, where the morality rate is 3.85%, higher than the national average.

West Bengal chief minister Mamata Banerjee tweeted on 20 April, 2020 that “we welcome all constructive support and suggestion especially from the central government in negotiating ‘the # covid-19 crisis ‘(twitter @mamata official. April20). However, In a communication between state’s chief secretary and Ministry of Home affairs states that the central government has taken step to so in the greater interest of the common general public (Singh, Inter-Ministerial central teams).

#### VI. REFLECTION OF CENTRAL-STATE RELATION ON MIGRANT WORKERS ISSUE:

According to the 2011 census, 45.6 crore peoples migrant to India, from 31% in 2001, of these, UP, Bihar has the highest number of migrants going to work in other states and Maharashtra and Delhi have the highest number of arrivals (Madhunikar Iyer, migration in India).

Although, some protections are provided for migrant workers under the Inter-state Migrant Workmen Act 1979, employers need to be licensed and migrant workers must be registered by the government. On the other hand, these inter-state migrants do not get the benefit of PDS till they get a new card from the host state by depositing their ration card in the home state.

A nationwide lockdown due to the corona pandemic situation has prompted interest migrant workers to return to their home state. Although late From 1 may to 3 June, more than 58 lakh workers returned to home by train about 41 lakh workers by bus. On March 28 and April 29 the ministry of home affairs allowed states to spend to bring in migrant workers from the State Disaster Response Fund. The Republic World published on 30 April stated that the central government on 28 march urged the state government to utilise RS 29000 crore from SDRF to help vulnerable by providing food and shelter to migrant labours Centres Continuous Efforts to.

1 April Ministry of Health and Family Affairs instructs state to provide food and medical services for migrant workers. Subsequently, on 14 may, the Ministry of Finance directed to migrants workers and to start the One Nation One Ration scheme from March 2021. The Supreme Court in 9 June ordered; directed all states to arrange for the return of willing workers to their respective states within 15 days and to arrange for registration and skills (Times of India, Huge gaps in migrant data). Section 11(3)(b) under the Disaster Management Act 2005 stated that measures to be taken for the integration of mitigation measures in the development plans’, although the development plan adopted by the government talks about integration, preparedness and capacity building among the centre and states , the government’s experience in repatriating migrants labourer to their home states can be noticed.

Another thing is noticeable that, Section 11 (3) and (4) stated that ‘appropriate provision shall be made by the central government for financing the measures to be carried out under the national plan’. Although the central government has announced a financial package in this regard, it has not taken effective action against the migrant workers and has only shifted the responsibility to the state government. The centre should have taken appropriate

action in this regard as the financial resources of the state government were less at this time. Shradha Sharma has speak in the ‘Legal Service India’ that, “In the pandemic, the state as well as central government failed to provide adequate relief to the stranded migrant workers and grossly violated their basis health and sanitation facilities to the migrant workers during the pandemic and they should be received back home in a safe and dignified manner” (Sharma, Migrant Labour Crisis in India).

#### VII. CENTRE-STATE MEETING-COOPERATISM IN PANDEMIC SITUATION

Maintaining the federal pattern in this pandemic situation is an exceptional challenge and opportunity for the central government. Balveer Arora says that the states were the frontline for this combat against covid-19 to the extent that Prime Minister Modi was obliged to consult chief ministers through video conference thrice within a short span of time something that had been missing during the last six years on other issues (Arora, Centre has chosen to assert authority).

To deal with the coronavirus pandemic, the centre and all the states came together in a discussion on March 12 to work shoulder and formulate and implement 5th policy. The chief minister of West Bengal has made it clear that this is not the time to politicize and this is not the time to highlight the differences between the states and centre. At this time, the centre and state need to work together, help to people and invest in public health. He spoke to the prime minister about the more testing centre and funding so that the states can deal with this real emergency in a fair way. In fact, through this video conference, the centre and states trying to give the right direction to the states by removing the political opposition. In fact, states and centre are currently located on the same page.

The prime minister second video conference with the chief ministers of all the states focused on the issues to combat the spread of corona virus are basically, check the spread of corona virus, movement of migrants, availability of essential and contact tracing of Tablighi Jamaat participations are likely to come up for discussion (PTI).

On 27 April prime minister’s virtual meeting with the chief ministers of various state government discussed on several issues such as lock down extension to combat further spread of covid-19, the state of economy and lifting of restriction etc. Union Home Ministry stated that around 2crore people have been given employment through the Mahatma Gandhi National Rural Employment Guarantee Act., till 27 April, 2020. (Corona virus highlights, Business Today, April27, 2020)

In the fifth meeting of the prime minister chief ministers in the corona episode situation, prime minister Narendra Modi assured the chief ministers of all states that the open up about the economy . He also said that ‘government decided to invite all chief minister to speak before a considered view is taken on the matter. The prime minister speak “ I request you all to share with me by 15<sup>th</sup> May, a broad strategy on how each one of you would want to deal with the lock down regime in your particular states”( NDTV; Prime minister modi asks states for blueprint on next phase of lockdown :10 points,12 May,2020).

In this case we can see the cooperative federalism mentality of bringing the states of the central government together. On the other hand, the states despite their difference with the centre have conveyed a message to the centre policy by participating in the meeting. The states of Maharashtra, Punjab, Assam and Telangana has voted in favour of the lockdown extension. However, Delhi chief minister who has repeatedly drawn attention to the loss of revenue for the city-state, said economic activity should resume in the capital, except in corona virus containment zones which are in strict lock down to check the spread of the virus” (Sharma and Prabhu, Prime minister Modi asks states for blue print on next phase of lock down; 10 points). Agreeing with this, the chief minister of Kerala demanded that the states be given the power to determine the boundaries of the lock down. He also said ‘ the states face different challenges and therefore should be given the freedom to make reasonable changes to the guidelines relating to the lock down(Sharma and Prabhu, Prime minister Modi asks states for blue print on next phase of lockdown;10 points). Haryana chief minister Monohar Lal Khattar has similarly called for the introduction of economic activities in the state. Originally, West Bengal chief minister Mamata Banerjee said that the central government should give equal status to all the state so that Team India could work together in this situation. She said,” this is not the time to play politics. Nobody ever asks our opinion..... don’t bulldoze the federal structure “(Relaxing lockdown restarting economy what the prime minister and chief ministers said, THE QUINT).

In the minds of migrant workers in the speeches of all states, prime minister in his opening remarks, Prime Minister Modi spoke about migrants, starting that he understands their need to go home. From May 11, limited special trains will run between Delhi and 14 states. Prime minister thanks to all chief minister for proactive role against covid-19 and their grass root level experience (FP Staff, Coronavirus out break up dates). The chief minister of Chhattisgarh demanded RS. 30,000 crore for implementing relief and welfare schemes and separate power of the states for determining green, orange and red zones.

In a large populous country like India, the death toll was 673,904 as on 05.07.2020, but the death toll was 2.86%, which is relatively low. In fact, the challenge for the government is to address the issue of coordination between ‘live and livelihood’, ‘current need and future requirement’. On the first day of the sixth virtual conference of the prime minister with the chief ministers of the states of Punjab, Kerala, Assam, Uttarakhand, Jharkhand, Chhattisgarh, Himachal Pradesh, Goa, Puducherry and six north-east states. The LT. Governor of Chandigarh, Andaman Nicobar Island, Dadra & Nagar Haveli and Lakshadweep are also attended this meeting.

On the one hand, the prime minister asked the other states to follow the strategic model of the Punjab government which has successfully tackled this pandemic. Similarly, there has been a request from the states to the centre to work together to tackle the covid-19 affected economy. On the other hand, the prime minister lauded the efforts of the Uttarakhand government to build an ‘Atma Nirbhar Bharat’ (Shrivastava, Coronavirus crisis). The prime minister has said that ‘India’s fight against corona virus will be remembered in the future for how we work together and served as an example of cooperative federalism’ (Saxena, India’s fight against covid-19 will be remembered) .

## VIII. CONCLUSION

Cooperative, flexible federalism like India has need to play an effective role in such health emergency situation. Although in many countries of the world, such as the USA, the issue was not given due importance until the president’s declaration of national emergency on March 13, although it was spread across the country. The federal system did not respond properly at first, because inadequate bio-surveillance, ‘there are not enough test to go around, a major problem for states as they begin to consider lifting stay at home orders and easing social distancing restriction (Gerstein, Epic Fail), Emergency management personnel in states and local area, chain for distributing information and supply has failed to play an effective role in tackling this crisis. Although the states of India were able to take independent action in the first phase of the covid-19, like lockdown announcement, schools and others educational institutions, cinema halls, swimming pools etc. closing. But the central government later started misusing the NDMA act on the states especially the non-BJP ruled states. Where it is stated in section 11(1) and (2) of the NDMA act that, to draw up a national plan for the whole country with consultation with state government. But the central government suddenly announced a nationwide lockdown on 25 March without any prior consent and planning with the state governments, which triggered a food crisis, unemployment and a plight of migrant workers across the country. Which was originally issued without consulting the states in dealing with the covid-19 situation, similar to the demonetization, CAA. In that case, the states did not have time to repatriate migrant workers or provide adequate resources for them. So that the life of migrant labourers ended in street death. In a country where 85% of the total workers are employed in the informal sector, who are contribute 50% to the national income of the country, economic protection should have been provided by the central government and the states.

The first step in this regard was taken by the chief minister of West Bengal, who on March26 informed the eighteen state government to rescue the migrants and to take cooperative steps. Maharashtra government announced 480 million package, Kerala government builds relief camp shelter. The important role of the central government is to lead in the right direction, to provide financial assistance as well as to increase the revenue of the states, employment, health, law and order.

While the announcement of a lockdown against covid-19 was initially easy, the uniform and rigid approach of the centre in the Indian federal system is not desirable. In the crisis situation, it is important to reconcile the two units of the federation and civil society, although this has not been largely effective.

In fact, the central control of the traditional federal system and the enigma of more states autonomous has been developed in India on the principle of cooperative federalism based on its own policy, we hope that India is active in overcoming the pandemic situation through cooperative relations. However, this crisis has largely suppressed the extreme conflict in India over the centre a few month ago. It is our hope that the level of development of the country will reach all the people at the same rate and similarly, the central government will harmonize the activism and demands of the states in this regard.

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# Development of Guided Inquiry Based Student Worksheet for First College Student

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**Abstract-** This study aims to produce a worksheet of chemical equilibrium which based on guided inquiry in order to measure the validity, practicality of the worksheet. This worksheet is structured using a guided inquiry model and is equipped with multiple representations. This research method is a research development using the Plomp model. The research subjects were students majoring in chemistry in 2019. The research instruments used were validation sheets and practicality sheets. This worksheet is validated by 4 validators consisting of chemistry lecturers and the practicality test (field test) was conducted by 45 students majoring in Chemistry, Universitas Negeri Padang. This research found that the students' worksheets have a very high level of validity ( $v=0,88$ ) and very high level of practicality by students ( $k=0,87$ ) and high by the lecturer ( $k=0,79$ ).

**Index Terms-** guided inquiry, chemical equilibrium, student worksheet, multiple representations

## I. INTRODUCTION

Chemistry is a part of natural science that requires direct observation in the learning process. Direct observation is needed because chemistry studies about the nature, structure, structure and changes in matter and energy that accompany these changes. Basically chemistry studies about topics that are mostly abstract and require understanding at the molecular or sub microscopic level [1]. People's understanding of chemistry can be seen through its ability to transfer and connect macroscopic, submicroscopic, and symbolic phenomena [2]. In addition, designate one author as the "corresponding author". The macroscopic level is a chemical representation obtained through real observations of a phenomenon that can be seen and felt by the five senses [3]. The sub-microscopic level is a chemical representation that explains and provides an understanding of the structure and processes at the particle (atom / molecular) level of the observed macroscopic phenomena [4]. Symbolic representations, namely qualitative and quantitative representations of chemistry, namely chemical formulas, diagrams, calculations and reaction equations.

Chemical equilibrium is an important material that is difficult to study because it relates to chemical reactions, where chemical equilibrium answers the question of how far a chemical reaction can go [5]. Chemical equilibrium is one of the most difficult concepts in chemistry for students to learn at various levels [6] either in middle school or in college [7]. Chemical equilibrium is a material that students must study in basic chemistry courses for first college student majoring in Chemistry.

To increase activeness in learning chemistry, namely chemical equilibrium material in class, a quality learning device is needed in the form of teaching materials that are arranged using a learning model that is in accordance with that material [8]. One of the teaching materials that can be used in helping the learning process is student worksheets (LKM). LKM is expected to increase understanding of concepts, attract interest in learning and help students actively involved in the learning process. Worksheets are arranged systematically with an emphasis on certain aspects so that the skills of students in the learning process can be obtained [9]. Worksheets are arranged with a learning model that contains activity stages that guide students to maximize understanding of the concepts being studied.

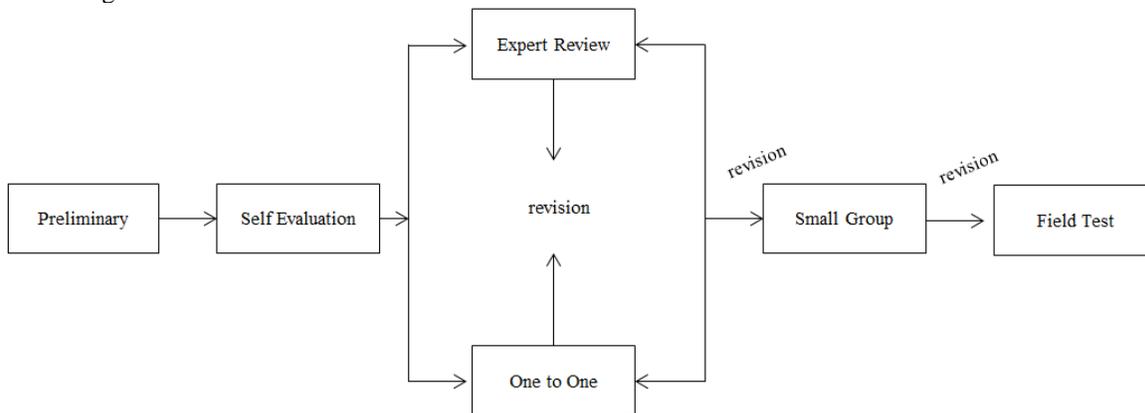
One of the learning models that can increase student activity is guided inquiry. In guided inquiry, students will be actively involved during the learning process. The guided inquiry learning cycle is divided into 5 stages, namely orientation, exploration, concept formation, application and closure [10]. Research conducted by Parappiliy et al (2013) shows that student performance increases when using the inquiry learning model so that it provides good results on learning outcomes [11]. This student worksheet that will be developed uses a guided inquiry model and is equipped with multiple representations consisting of three levels namely macroscopic, submicroscopic and symbolic This study aims to produce a guided inquiry based student worksheet of chemical equilibrium and to see the validity and practicality of the worksheet.

## II. RESEARCH METHODS

### 2.1 Research Design

This research used the type of Research and Development (R & D). The research method used in this study is Plomp model. Based on the Plomp development cycle, the Plomp model is divided into three phases, the first stage is preliminary research, the second stage is

the development or prototyping phase, and the third stage is assessment phase [12]. Formative evaluation research design use in this study can be seen in figure 1.



**Figure 1.** Formative evaluation research design

### 2.2 Research Subject

The subjects in this study were chemistry lecturers as validators of student worksheets and as practical subjects and 45 students of Universitas Negeri Padang majoring in chemistry in 2019.

### 2.3 Data Collection

#### a. Validity Analysis

The validator's assessment of each statement was analyzed using Aiken's V formula. The formula proposed by Aiken is as follows [13] :

$$V = \sum s / [n(c-1)]$$

$$S = r - lo$$

Information :

Lo = the lowest number of validity assessments (for example 1)

C = the highest number of validity assessments (eg 4)

R = number given by the assessor

N = number of evaluators

#### b. Practicality Analysis

Data analysis techniques for validity and practicality based on a questionnaire from lecturers and students using the kappa kohen (k) formula [14] :

$$k = \frac{Po - Pe}{1 - Pe}$$

Information :

k = kappa moment value

Po = realized proportion

Pe = proportion not realized

The level of validity and practicality of the guided inquiry-based student worksheet will be seen after being converted to the categories in Table 1.

**Table 1.** Validity and practicality level categories

| K value    | Category  |
|------------|-----------|
| 0,81–1,00  | Very high |
| 0,61–0,80  | High      |
| 0,41 –0,60 | Medium    |
| 0,21 –0,40 | Low       |
| 0,00 –0,20 | Very low  |
| < 0,00     | Invalid   |

## III. RESULT AND DISCUSSION

### 3.1 Preliminary Research

In this stage, the identification and analysis needed to develop research to develop a chemical equilibrium worksheet based on guided inquiry is carried out. Four analyzes were carried out, namely needs analysis, curriculum analysis, student analysis and concept analysis. Based on the analysis conducted, it can be concluded that there is no teaching material in the form of student worksheets so

that this teaching material can be developed. Furthermore, the material contained in the student worksheet to be developed has been adjusted to the syllabus of basic chemistry courses at the university. After this analysis has been completed, the next step is to design a student worksheet based on guided inquiry chemistry.

### 3.2 Prototyping Phase

In the prototyping phase of making this prototype, a formative evaluation was carried out. Formative evaluation is carried out in each prototype produced. Prototyping Phase produces prototype 1, prototype 2, and prototype 3 which is the result of formative evaluation. Formative evaluation was conducted based on Tessmer's formative evaluation. Tessmer's formative evaluation includes four stages, namely: self-evaluation; expert review and one-to-one evaluation; small group evaluation test; and field test.

#### a. Prototype 1

After formulating goals based on the Basic Chemistry syllabus, development activities were continued by designing a Student Worksheet (LKM) for Chemical Equilibrium based on Guided Inquiry. LKM components designed are cover, foreword, table of contents, list of pictures, characteristics of LKM, instructions for use of LKM, Expected Learning Outcome (ELO) for Chemistry Education Study Program, expected final abilities, study materials (teaching materials), learning objectives, concept maps, activity sheets, worksheets, and references.

#### b. Prototype 2

After producing prototype 1 in the form of an initial design, then at this stage a formative evaluation was carried out in the form of self-evaluation. Self-evaluation is carried out by means of a check list system of the important parts that must be included in student worksheets. based on the results of this evaluation, the compiled student worksheets already have components that must be included in the LKM so there is no revision in this evaluation.

#### c. Prototype 3

Prototype 3 resulted from expert review and one-to-one evaluation of prototype 2. Prototype 2 was validated by chemistry lecturers and one-one evaluation was carried out by 3 chemistry students. The validation sheet contains 26 aspects of the assessment consisting of a content component, a construction component, a language component, and a graphic component. The evaluation data for the guided inquiry-based LKM validation sheet were then analyzed using the Aiken's V formula. The results of the validation of four lecturers on this student worksheet can be seen in Figure 2

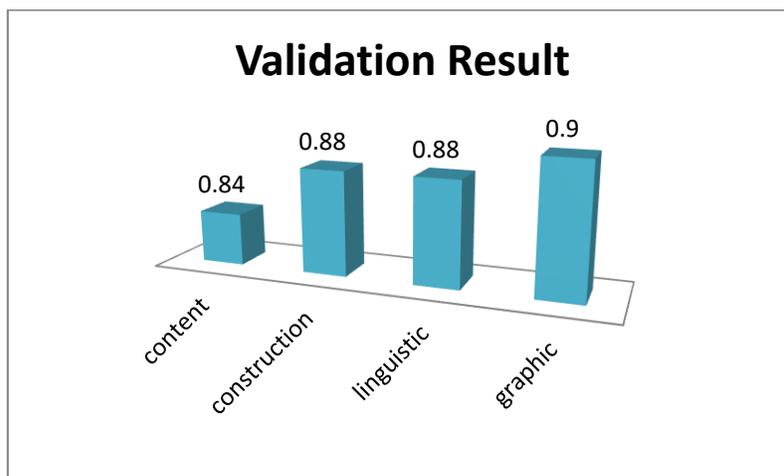


Figure 2. Average validation results of student worksheets

Overall the average validation from experts has a value of  $v = 0.88$  which is included in the very high category. The results of the LKM validation show that the LKM developed is valid. After validation then a one-to-one evaluation was carried out on chemistry students at Padang State University. This evaluation was carried out aimed at seeing student responses to the prototype 2 that had been produced. The students who were used as the test subjects consisted of three people. Data obtained from interview sheets given to students. The results of the interview found that in terms of cover design and color selection makes students interested in learning it and the use of the language is easily understood. After validating and evaluating one to one, the revision results are prototype 3.

#### d. Prototype 4

To produce prototype 4, a small group evaluation test was carried out on prototype 3. Small group evaluation was carried out on 6 students majoring in chemistry. This evaluation is obtained through a questionnaire distributed to students. The practical results of small group evaluation can be seen in table 2.

**Table 2.** Results of student response questionnaire on small group evaluation

| No      | Aspect          | k    | Category       |
|---------|-----------------|------|----------------|
| 1       | Ease of Use     | 0,86 | Very practical |
| 2       | Time efficiency | 0,80 | Very practical |
| 3       | The benefits    | 0,81 | Very practical |
| Average |                 | 0,82 | Very practical |

### 3.3 Assesment Phase

At this stage, a field test is carried out to get the practical level of the worksheets that have been produced. Field tests were carried out on 2 chemistry lecturers and 45 students. The results of the questionnaire analysis given to lecturers and students can be seen in table 3 and table 4.

**Table 3.** Results of student response questionnaires

| No      | Aspect          | k    | Category       |
|---------|-----------------|------|----------------|
| 1       | Ease of Use     | 0,87 | Very practical |
| 2       | Time efficiency | 0,85 | Very practical |
| 3       | The benefits    | 0,86 | Very practical |
| Average |                 | 0,82 | Very practical |

**Table 4.** Results of lecturer response questionnaires

| No      | Aspect          | k    | Category       |
|---------|-----------------|------|----------------|
| 1       | Ease of Use     | 0,83 | Very practical |
| 2       | Time efficiency | 0,76 | Practical      |
| 3       | The benefits    | 0,77 | Practical      |
| Average |                 | 0,79 | Practical      |

Based on table 4 the practicality of the field test obtained a kappa moment of 0.82 with a very high practicality category. This shows that the compiled worksheets are practically used by students both in terms of ease of use, time efficiency, and the benefits. This shows that practicality considerations can be seen from the aspects of ease of use, time efficiency, and benefits [15]. Based on table 5 shows that the practicality of the field test based on the lecturer response questionnaire has a kappa moment value of 0.79 in the high category. The results of practicality show that the LKM developed has been practically used in the learning process.

## IV. CONCLUSION

Based on the research results, the student worksheets that have been developed have a very high validity category with a value of 0,88. the results of the evaluation of the small group carried out have a kappa moment value of 0,82 which is very high category, while the practicality test on the field test had an average kappa moment value of 0,87 from the student response questionnaire with the very high practicality category and 0,79 from the lecturer response questionnaire with the high practicality category.

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# Continuum Regression Modeling with LASSO to Estimate Rainfall

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**Abstract-** Statistical downscaling (SDS) is a method to relate functionally global scale to local scale climate data. The global scale data are from the Global Climate Models (GCM) output while the local data are from a rainfall station. Generally, the GCM output data are available in the form of contiguous grids which commonly causes the multicollinearity problem. The problem can be overcome by a method such as principal component analysis (PCA), LASSO, forward selection. A SDS modeling can use the continuum regression with PCA. The research aims to develop SDS model using LASSO in the continuum regression to predict the local scale rainfall. The SDS model development uses the monthly GCM precipitation data at 9×9 grids as predictor variables and the local rainfall data as the response variable from January 2011 to December 2019 at West Java province. The model evaluation is based on the values of RMSEP and correlation. The results showed that the continuum regression with LASSO was better than the LASSO regression and the regression with forward selection in the case of rainfall prediction.

**Index Terms-** statistical downscaling, continuum regression, LASSO, GCM

## I. INTRODUCTION

Indonesia is located in a tropical region with high rainfall intensity, especially in the highlands. The frequency of rainfall can cause various extreme phenomenon, such as rain, flooding, and drought. These extreme phenomenon will have an impact on the quality and quantity of agricultural products. Therefore, it is very important to estimate the potential of rainfall, especially in the agricultural sector. Rainfall is one of the sources of water supply for plants. The data of Global Climate Models (GCM) is used to get some information about rainfall.

Currently, the data of GCM relates to the climate system. However, the results are inadequate because of its global scale. It means, it is difficult to obtain the local scale information to predict rainfall. One of the efforts to overcome this problem is the technique of statistical downscaling (SDS). The SDS method is a method for estimating rainfall by linking global climate elements obtained from the output data of GCM with the local-scale climatic elements through climatology stations. The output data of GCM is generally available in the form of grids which is located within the domain. The SDS model is composed of the covariate variables on a large scale, and the variables are dependent each other [1].

The problem in SDS method is determining the domain [2]. The domain is used as a predictor with many dimensions. In these dimensions, there is a possibility of the curse of dimensionality, the spatial correlation between grids in the domain, and the multicollinearity between variables [3]. These cases need to be resolved to avoid biased allegations. Currently, the SDS evolving models to cope the multicollinearity is the principal component regression (PCR), the continuum regression (CR) and the Least Absolute Shrinkage and Selection Operator (LASSO) regression. According to [4], CR is a generalization of the least squares regression, PCR, and the partial least squares regression. The results show that CR generates better predictions than least squares and partial least squares regression.

The problem in CR is the number of observations which is smaller than the number of predictor variables ( $n \ll p$ ). So that, a pre-processing method is needed in the form of reducing dimensions of the predictor variables. The pre-processing methods which are often used are the principal component analysis (PCA), the LASSO selection and the forward selection. [2] used CR with PCA pre-processing to generate multicollinearity. In addition to PCA pre-processing, LASSO pre-processing shrinks the estimator coefficient to zero in order to allow the variable selection [5]. [6] provided an alternative solution for the variable selection and the coefficients shrinkage of linear regression model by using LASSO. The results show that LASSO provides an alternative for variable selection. The LASSO method can provide excellent predictive accuracy and improve the interpretability of the model [7]. The objectives of this research are modeling the statistical downscaling by using the continuum regression with LASSO selection for estimating the rainfall and comparing the models with LASSO regression models, the continuum regression with PCA, and the continuum regression with forward selection.

## II. METHOD

### A. Data

The data used in this study is the monthly rainfall data of GCM released by the Climate Forecast System Reanalysis (CFSR) as a predictor variable. The GCM domain used is a number of 9×9 grid squares (0.5°×0.5° for each grid). The local rainfall data as a response variable issued by the Badan Meterologi, Klimatologi dan Geofisika (BMKG) for the period of January 2011 to December 2019 with the observation rain stations in West Java.

### B. Data Analysis Procedure

The data analysis is performed by using the R 3.5.1 software. The stages carried out in this study are as follows.

1. Preparing and exploring the data
2. Performing the continuum regression modeling with LASSO selection.
  - a. Selecting the predictor variables by using the LASSO method. This algorithm is available in the glmnet package. The selection of predictor variables is based on the selection of the optimum lambda value with the smallest cross validation value. The procedure of k- fold cross validation is as follows [8].
    - 1) Dividing the data randomly into k sections or folds with k=1,2,...,K, so it is formed F<sub>1</sub>,F<sub>2</sub>,...,F<sub>k</sub>.
    - 2) Using folds K-1 to build a model (training).
    - 3) The model obtained from (2) is presumed as the value of the response variable.
    - 4) Calculating the value of the mean squared error prediction (MSEP) of the fold response variable to -k ,

$$MSEP_k = \sum_{i \in N_k} \frac{(y_i - \hat{y}_i)^2}{n_k}$$

with  $\hat{y}_i$  is the estimated value of  $y$  and  $N_k$  is a data set of fold to - k.

- 5) Repeating the steps (2) to (4) as much as K, so it is obtained MSEP<sub>1</sub>,MSEP<sub>2</sub>,...,MSEP<sub>K</sub>. Each candidate model generates the measure of estimator performance,

$$CV = \sum_{k=1}^K \frac{MSEP_k}{K}$$

in which the optimal model is the model with the smallest CV value.

- 6) Modeling the rainfall data and GCM output data with the continuum regression modeling based on the LASSO method selection results. The continuum regression model is formulated in Equation (1) below:

$$y = T_h \xi + \varepsilon \tag{1}$$

with the matrix of  $T_h = XW_h$  and  $W_h = (w_1, w_2, \dots, w_h)$  contain the variable columns h with h<p and it is called a weighting matrix. [9] formulated the vector  $w_i (i=1,2,\dots,h)$  as in Equation (2) below:

$$w_i = \arg \max_w \{ \text{Cov}(x_w, y)^2 \text{Var}(x_w)^{[\delta/(1-\delta)]-1} \} \tag{2}$$

with constraints of  $\|w_i\|=1$  and  $\text{Cov}(x_{w_i}, x_{w_j})=0$  for  $i < j = 1, 2, \dots, h$ . Meanwhile, the  $\delta$  adjustment parameter are the real numbers of  $0 \leq \delta < 1$ . The Estimation of parameters  $\xi$  in Equation (1) is carried out using the least squares method and formulated as in Equation (3), and the predictive value can be calculated through Equation (4) below.

$$\hat{\xi} = (T_h^T T_h)^{-1} T_h^T Y \tag{3}$$

$$\hat{\beta} = W (T_h^T T_h)^{-1} T_h^T Y$$

$$\hat{y} = XW_h \hat{\xi} \tag{4}$$

3. Predicting and evaluating the model is conducted by calculating the model accuracy through the root mean squared error prediction (RMSEP) with the formula

$$RMSEP = \sqrt{\frac{1}{n} \sum_{i=1}^n (y_i - \hat{y}_i)^2}$$

and the correlation (r) between the actual rainfall (y) with the predicted rainfall ( $\hat{y}$ ) with formula

$$r_{y_i, \hat{y}_i} = \frac{\sum_{i=1}^n (y_i - \bar{y})(\hat{y}_i - \bar{\hat{y}})}{\sqrt{\sum_{i=1}^n (y_i - \bar{y})^2 \sum_{i=1}^n (\hat{y}_i - \bar{\hat{y}})^2}}$$

4. Comparing the results of modeling evaluation by using the LASSO regression model, the continuum regression with PCA and the continuum regression with forward selection through RMSEP values and correlation.
5. Examining the model consistency based on the RMSEP value and the correlation by carrying out the validation four times using four different validation data of the last four years, namely 2019, 2018, 2017 and 2016.

### III. RESULTS

#### A. Data Exploration

The distribution of rainfall in each region in Indonesia is diverse due to various factors. [10] divided the pattern of rainfall in Indonesia into three regions, they are: Region A (monsoonal type), Region B (equatorial type) and Region C (local type). West Java Region has monsoonal type of rainfall pattern. This region experiences the average of the highest monthly rainfall one time and the average of the lowest monthly rainfall one time. It happens because of the effects of west monsoon which is occurred on November until March and east monsoon which is occurred on May until September. The region of monsoonal rainy type normally get the maximum rainfall in the period December-January-February (DJF). However, in the transition monsoon, the monthly data of rainfall shows the second maximum value during the period of March-April-May (MAM). [11] stated that the maximum rainfall in Java island can't be defined equally occur during the period of DJF. It because some areas also have maximum rainfall during the transition monsoon in the period of MAM. The data exploration of West Java rainfall uses the monthly data in the period of 2011 to 2019 for each observation station. The data can be seen in Figure 1.

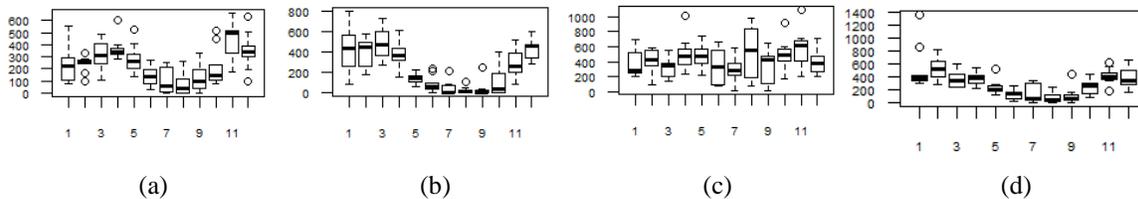


Figure 1 Boxplot of monthly rainfall station (a) Bandung, (b) Jatiwangi, (c) Bogor dan (d) Citeko

Figure 1(a) shows that the highest rainfall occurs on November until April, with an average amount of rainfall of 200 mm/month to 435 mm/month. The lowest rainfall occurs on June until October with an average amount of rainfall of 85 mm/month to 140 mm/month for Bandung station. Figure 1(b) shows the highest rainfall occurs on November until April, with an average amount of rainfall of 290 mm/month up to 485 mm/month. The lowest rainfall occurs on June until October with an average amount of rainfall ranges from 10 mm/month to 125 mm/month for Jatiwangi station. Figure 1(c) shows that the highest rainfall occurs in every month with the average amount of monthly rainfall >300 mm/month for the station Bogor. It happens because the morphological conditions of Bogor are mostly in the highlands, hills and mountains; furthermore, the climatological conditions including the very wet tropical climate. Figure 1(d) shows that the highest rainfall occurs on November until April, with an average amount of rainfall of 360 mm/month up to 530 mm/month, and the lowest rainfall is on May until September with an average amount of rainfall <300 mm/month for Citeko station.

#### B. Continuum Regression with LASSO Selection

LASSO method is a pre-processing stage which is conducted before continuum regression modeling. This method is able to reduce the coefficient estimator of zero exact, so that it can select the variables. It can improve the accuracy and interpretability of the model by eliminating predictor variables which are irrelevant to the response variables. The variables which are selected by LASSO are used in the continuum regression modeling. The model obtained is used in predicting monthly rainfall. The plot of the prediction results for the first validation or 2019 can be seen in Figure 2 below.

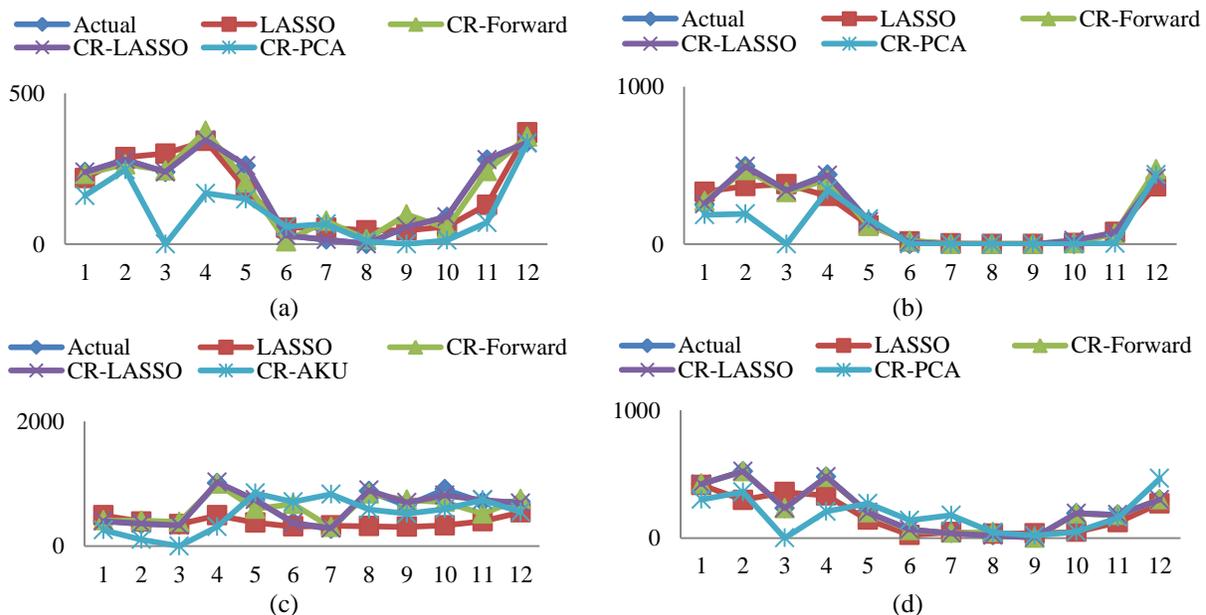


Figure 2 Actual plot and prediction model of station (a) Bandung, (b) Jatiwangi, (c) Bogor dan (d) Citeko

Figure 2 is a comparison plot of the actual rainfall value in the prediction results of the LASSO regression, the continuum regression with PCA, the continuum regression with forward selection and the continuum regression with LASSO selection for each station. The results show that the prediction value of the continuum regression model with LASSO selection and the continuum regression with forward selection tend to have patterns which are relatively the same as the pattern of actual rainfall, so the error between the actual value and the predicted rainfall is relatively small. The differences between the actual rainfall value and the predicted value will be evaluated through the value of RMSEP and its correlation.

*C. Evaluation of Regression Model*

The evaluation of regression models is performed by calculating the RMSEP value and the correlation between actual rainfall and predicted rainfall. The regression models compared are the LASSO regression model, the continuum regression with PCA, and the continuum regression with forward selection. The results of the regression model evaluation for the first validation or 2019 can be seen in Figure 3 below.

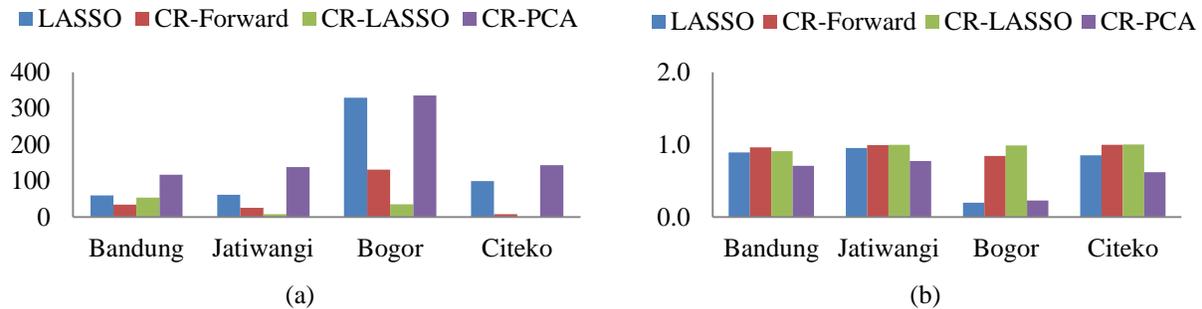


Figure 3 Regression model evaluation for 2019 (a) RMSEP and (b) Correlation

Figure 3 is the evaluation result charts of several regression models for each station. Figure 3(a) shows the value of RMSEP and Figure 3(b) shows the correlation value of RMSEP. The best model for Bandung station is the continuum regression with forward selection with a minimum RMSEP value of 33.8603 and a maximum correlation of 0.9633. The best model for Jatiwangi station is the continuum regression with LASSO selection with a minimum RMSEP value of 7.7552 and a maximum correlation of 0.9993. The best model for Bogor station is the continuum regression with LASSO selection with a minimum RMSEP value of 34.8461 and a maximum correlation of 0.9897. The best model for Citeko station is the continuum regression with LASSO selection with a minimum RMSEP value of 0.0397 and a maximum correlation of 1.000.

*D. Model Validation and Consistency*

The validation is performed by using four different validation data based on the last four years data, namely 2019, 2018, 2017 and 2016. The consistency of the model based on the value RMSEP and the correlations which can be seen in Table 1-4 below.

Table 1 Validation model of Bandung station

| Validation | Evaluation  | LASSO    | CR-Forward      | CR-LASSO | CR-PCA   |
|------------|-------------|----------|-----------------|----------|----------|
| 2019       | RMSEP       | 59.5023  | <b>33.8603</b>  | 53.0569  | 116.9794 |
|            | Correlation | 0.8901   | <b>0.9633</b>   | 0.9072   | 0.7067   |
| 2018       | RMSEP       | 81.8103  | <b>38.9886</b>  | 41.7510  | 173.0552 |
|            | Correlation | 0.9355   | <b>0.9653</b>   | 0.9607   | 0.6903   |
| 2017       | RMSEP       | 137.4381 | <b>106.1387</b> | 110.6066 | 279.9951 |
|            | Correlation | 0.5359   | <b>0.7381</b>   | 0.7120   | 0.1657   |
| 2016       | RMSEP       | 110.8518 | <b>48.9254</b>  | 88.8541  | 296.5294 |
|            | Correlation | 0.7396   | <b>0.9522</b>   | 0.8322   | 0.7933   |
| Average    | RMSEP       | 97.4006  | <b>56.9783</b>  | 73.5672  | 216.6398 |
|            | Correlation | 0.7753   | <b>0.9047</b>   | 0.8530   | 0.5890   |

Table 1 shows the RMSEP value and the correlation for each model on the four validation data in Bandung station. The consistency of the model for each validation data which provides the minimum RMSEP value and the maximum correlation value is a continuum regression model with forward selection. The results show that this model consistently has smaller RMSEP values and greater correlation than the LASSO regression model, the continuum regression with PCA and the continuum regression with LASSO selection. It shows that the average value of the smallest RMSEP and the highest correlation value is the continuum regression model with forward selection, namely 56.9783 and 0.9047.

Table 2 Validation model of Jatiwangi station

| Validation | Evaluation  | LASSO    | CR-Forward | CR-LASSO       | CR-PCA   |
|------------|-------------|----------|------------|----------------|----------|
| 2019       | RMSEP       | 61.1119  | 25.3991    | <b>7.7552</b>  | 137.8141 |
|            | Correlation | 0.9542   | 0.9909     | <b>0.9993</b>  | 0.7748   |
| 2018       | RMSEP       | 149.7064 | 94.7170    | <b>47.3918</b> | 277.0608 |
|            | Correlation | 0.7694   | 0.9142     | <b>0.9793</b>  | 0.3474   |
| 2017       | RMSEP       | 141.3708 | 57.1089    | <b>16.1061</b> | 350.1397 |
|            | Correlation | 0.8443   | 0.9736     | <b>0.9979</b>  | 0.5224   |
| 2016       | RMSEP       | 94.2279  | 50.0336    | <b>21.4112</b> | 200.4308 |
|            | Correlation | 0.8226   | 0.9524     | <b>0.9915</b>  | 0.6266   |
| Average    | RMSEP       | 111.6042 | 56.8146    | <b>23.1661</b> | 241.3614 |
|            | Correlation | 0.8476   | 0.9578     | <b>0.9920</b>  | 0.5678   |

Table 2 shows the RMSEP value and the correlation for each model on the four validation data in Jatiwangi station. The consistency of the model for each validation data which gives the minimum RMSEP value and the maximum correlation value is the continuum regression model with LASSO selection. The results show that this model consistently has a smaller RMSEP value and greater correlation than the LASSO regression model, the continuum regression with PCA and the continuum regression with forward selection. It shows that the smallest average RMSEP value and the highest correlation value is the continuum regression model with LASSO selection, namely 23.1661 and 0.9920.

Table 3 Validation model of Bogor station

| Validation | Evaluation  | LASSO    | CR-Forward | CR-LASSO        | CR-PCA   |
|------------|-------------|----------|------------|-----------------|----------|
| 2019       | RMSEP       | 329.4534 | 131.0199   | <b>34.8461</b>  | 335.3703 |
|            | Correlation | 0.1955   | 0.8425     | <b>0.9897</b>   | 0.2285   |
| 2018       | RMSEP       | 134.0708 | 62.9845    | <b>33.6528</b>  | 386.2071 |
|            | Correlation | 0.8128   | 0.9173     | <b>0.9771</b>   | -0.4714  |
| 2017       | RMSEP       | 194.3788 | 171.9880   | <b>153.4617</b> | 390.9704 |
|            | Correlation | -0.1591  | 0.4247     | <b>0.3567</b>   | 0.1242   |
| 2016       | RMSEP       | 197.4429 | 120.7508   | <b>0.0172</b>   | 460.8324 |
|            | Correlation | 0.3492   | 0.2016     | <b>1.0000</b>   | -0.3385  |
| Average    | RMSEP       | 213.8365 | 121.6858   | <b>55.4944</b>  | 393.3450 |
|            | Correlation | 0.2996   | 0.5965     | <b>0.8309</b>   | -0.1143  |

Table 3 shows the RMSEP value and the correlation for each model on the four validation data in Bogor station. The consistency of the model for each validation data which provides the minimum RMSEP value and the maximum correlation value is the continuum regression model with LASSO selection. The results show that this model consistently has a smaller RMSEP value and greater correlation than the LASSO regression model, the continuum regression with PCA and the continuum regression with forward selection. It shows that the smallest average RMSEP value and the highest correlation value is the continuum regression model with LASSO selection, namely 55.4944 and 0.8309.

Table 4 Validation model of Citeko station

| Validation | Evaluation  | LASSO    | CR-Forward     | CR-LASSO      | CR-PCA   |
|------------|-------------|----------|----------------|---------------|----------|
| 2019       | RMSEP       | 99.4824  | 7.9739         | <b>0.0397</b> | 143.5886 |
|            | Correlation | 0.8543   | 0.9990         | <b>1.0000</b> | 0.6197   |
| 2018       | RMSEP       | 141.8329 | 27.2546        | <b>8.5903</b> | 221.0699 |
|            | Correlation | 0.7615   | 0.9919         | <b>0.9992</b> | 0.6493   |
| 2017       | RMSEP       | 93.4154  | <b>16.4557</b> | 119.9355      | 290.3297 |
|            | Correlation | 0.8824   | <b>0.9959</b>  | 0.8349        | 0.4828   |
| 2016       | RMSEP       | 103.8974 | <b>17.4487</b> | 78.3643       | 232.2325 |
|            | Correlation | 0.7380   | <b>0.9937</b>  | 0.8534        | 0.5832   |
| Average    | RMSEP       | 109.6570 | <b>17.2832</b> | 51.7324       | 221.8052 |
|            | Correlation | 0.8090   | <b>0.9951</b>  | 0.9219        | 0.5837   |

Table 4 shows the RMSEP value and the correlation for each model on the four validation data in Bandung station. The consistency of the model for the validation data in 2019 and 2018 which provides the minimum RMSEP value and the maximum correlation value is the continuum regression model with LASSO selection. Meanwhile, the validation data in 2017 and 2016 is shown by the continuum regression model with forward selection. The results show that the smallest RMSEP value and the highest correlation value on average is the continuum regression model with forward selection, namely 17.2832 and 0.9951.

#### IV. CONCLUSION

The modeling of statistical downscaling using a continuum regression model with LASSO selection and a continuum regression model with forward selection can be used to predict rainfall in West Java province. The results show that the continuum regression model with LASSO selection provides fairly accurate prediction results for Jatiwangi and Bogor stations compared to the LASSO regression model, the continuum regression with PCA and the continuum regression with forward selection. The continuum regression model with forward selection also provides fairly accurate prediction results in predicting rainfall at Bandung and Citeko stations.

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# Physical Activity Plays an Important Role in Body Weight Management

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**Abstract:** Emerging literature highlights the problems in the health sector is excess weight. The excess weight is caused due to accumulation of fat under the skin and around our organs. Fat first get deposited under the skin of belly. Belly fat is directly proportional to the life style diseases. More the belly fat more lifestyle diseases a person is likely to have. Apart from the agony and pain of diseases overweight is a major blow to the self esteem and self image of people worldwide. Many such people fall prey to frauds that mislead them with their tall claim advertisements. The result will be loss of money and even the negative effects of medicines. Overweight could be practically handled with energy balance, understanding calories, metabolism and nutrition. Here the scholar is interested to find out a practical and scientific approach to overcome this menace.

**Keywords:** Physical Activity, Important Role, Body Weight, Management, Overweight.

## 1. Introduction

Regular, vigorous exercise has been necessary for survival throughout evolution. It is only during the past few decades that it has become possible for people to go through life with minimal physical activity. Many people are hitting gymnasiums and health club to reduce weight and few are going to these places to gain weight. Losing or gaining weight will be a herculean task if we don't understand the basics related to weight gain or loss. For our body to function we require energy.

We get energy through the food which we eat. The unit of energy is calorie. Our body requires calories (energy) for our day to day work. The calories we get from food is converted into physical energy or stored as fat in our body. If the calorie we receive through food is excess than the calorie we require then this excess calorie is stored as fat around our organs and under our skin. As a result our body expands and we gain weight. When the excess calories become 7700 we store 1 kg of body fat. If we take fewer calories than the required amount of by our body the deficit in calorie is made up by burning the already deposited fat in our body. We call this process ketosis. As a result our body shrinks and we lose weight. So managing body weight is all about energy input and energy output. If energy input and energy output is same then we call a state called energy balance and in this state our body weight remains constant.

## 2. Role of Nutrition in Weight Management

Nutrition plays a very vital role in managing weight. Without knowing the calorie value of different food we eat it's impossible to attain weight loss or gain. Actually nutrition should be the fundamental of any weight loss or gain program. We need to take balanced diet for proper growth and maintenance of our body. Nutrients such as carbohydrate, protein, fat, vitamins and minerals are essential for our body. Minerals and vitamins are required in smaller quantities and are known as protective nutrients as these nutrients help us to boost our immunity and protect us from diseases. The main energy sources or nutrients to our body are carbohydrate, protein and fat. Table 1 shows the calorie content of 1 gram of these nutrients.

**TABLE 1**  
**Caloric Value of Energy Giving Nutrients**

| Sl. NO | Nutrients    | Calorie    |
|--------|--------------|------------|
| 1      | 1 gm Protein | 4 Calories |

|   |                   |            |
|---|-------------------|------------|
| 2 | 1 gm Carbohydrate | 4 Calories |
| 3 | 1 gm Fat          | 9 Calories |

**Calorie Content of Food items on a Daily Basis.**

- Vegetables – All vegetables (except potato) weighing 100 gm approximately gives 20 calories. 100 gm potato gives 100 calories.
- Fruits – All fruits (except banana, mango and jackfruit) weighing 100 gm app. gives 50 calories. 100 gm banana, mango and jackfruit yields 100 calories.
- Grains – 25 grams gives 100 calories, example a single chapatti weighs 35 gm out of which 10 gm will be water and remaining 25 gm is carbohydrate so  $25 \times 4 = 100$  cal. 100 gm boiled rice is equals to 25 gm raw rice and hence gives 100 cal.
- Fried, sweets and bakery items – All 100 gm will give you approx 500 to 600 calories.
- Oil or pure fat - All oils are pure fat and 1 ml yields 9 calories so 100 ml gives you 900 calories.

The above table and statements makes us clear that the intake of raw vegetables and fruits should be more to get rid of excess fat. Grains also we should include but in moderate proportion. Oil and bakery should be out from everyone’s list if they wish to lose weight. While making food choices make such a menu which appeals to your taste. Choosing food merely on the basis of calories will not be a practical and sustainable idea. Sooner or later one will drop out from these diet plans. Our diet should be such that it fulfills our desire, low on calories, contains all the nutrients, is accessible and keeps up the quality of our life.

**3. Role of Physical Activity in Weight Management**

Physical activity or exercise also plays a vital role in weight reduction. Besides exercise is a must to all for many other beneficial reasons. Physical activity in the form of exercise and sports are many and one should choose an activity based on his /her interest, accessibility, age, gender, and fitness level. Doing physical activity in group works out for many of the people. Non adherence to physical activity is a grave matter of concern in this area. Lot of intrinsic motivation is required to make physical activity a part and parcel of one’s life. Some of the common physical activities and the amount of calories it burns is given in table -2.

**TABLE 2  
PHYSICAL ACTIVITIES – CALORIE EXPENDITURE**

| S. No. | Activity                  | Duration | Intensity   | Calories Burned |
|--------|---------------------------|----------|-------------|-----------------|
| 1      | Aerobics                  | 1 hour   | High impact | 500             |
| 2      | Body weight training      | 1 hour   | Vigorous    | 550             |
| 3      | Climbing stairs           | 1 hour   | Fast        | 600             |
| 4      | Cycling                   | 1 hour   | Moderate    | 500             |
| 5      | Gardening                 | 1 hour   | Moderate    | 250             |
| 6      | Jogging                   | 1 hour   | 10 min/km   | 400             |
| 7      | Standing and moping       | 1 hour   | Moderate    | 250             |
| 8      | Swimming                  | 1 hour   | Moderate    | 400             |
| 9      | Walking                   | 1 hour   | 10 min/km   | 300             |
| 10     | Washing clothes with hand | 1 hour   | Moderate    | 250             |
| 11     | Weight lifting            | 1 hour   | Vigorous    | 350             |

#### 4. Calorie Intake

How much food should we eat? What is the normal amount of calories required? These are some natural questions of enquiring minds. Food or calories required in a day is equivalent to the energy required in a day. We need energy for doing various types of work. The energy requirement is made up of two components.

The basal energy required for such vital functions as respiration, circulation and digestion etc. this energy is called BMR or basal metabolic rate. The basal metabolic rate is the energy used by an individual during physical, digestive and emotional rest.

The energy required for the actual physical activities of the individual. This component varies with different types of occupations. The basal requirements of calories can be calculated in relation to one's body weight. It has been found that a normal young adult expends basal energy at the rate of about 1 calorie every hour for each kilogram of body weight. If your weight is 70 kg then you require  $1 \times 24 \times 70 = 1680$  calories. Thus 1680 calories are your basal requirements of energy. If you do activity you will need another additional supply of energy. The additional calories required for various physical activities are given below.

**TABLE – 3**  
**Energy Demand**

| Activity              | Additional Calories/hour in addition to BMR Calories required |
|-----------------------|---|
| Light Work            | 70  |
| Moderately Heavy Work | 100   |
| Heavy Work            | 200   |
| Very Heavy Work       | 300   |

Minimum calories required for BMR and work in one day for a 70 kg person is -

1. Sleeping 8 hours + BMR (Whole day)=1680 calories
2. Light work for about 8 hours (college and at home)  $8 \times 70 = 560$
3. Moderately heavy work for about 8 hours  $8 \times 100 = 800$

Total = 3040 calories.

It is clear from the above example that sedentary work requires much less calories than for moderately heavy work.

If this person (70 kg) net energy (Energy consumed – Energy expended) is more than 3040 calories excess calories will be deposited as fat and his weight will increase. If his net energy is less than 3040 calories he will burn more fat and weight loss will happen.

#### 5. Tips for Reducing Calories from Eating

- Keeping Hydrated: Around 2 to 2.5 liters of water must be consumed in a day. If the person is involving in exercise he should compensate water loss through sweat above this level.
- Eating Raw Vegetables - Vegetables like cabbage, carrot, cucumber, and tomatoes could be taken raw. Nutrients loss can be avoided if we eat raw vegetables. It also gives a fullness feeling.
- Eat more fruits – fruits are dense in nutrients and low in calorie. It will help to subside hunger drive.
- Eat Complex Carbohydrate - Eat chapatti or brown rice instead of white rice.
- Proper Chewing - Chew all food for 32 times as it will extract the greatest possible amount of nutrients from your food and also decrease hunger drive as you feel fuller.
- Avoid Fried Items – All bakery and fried items are high in calories and trans fat. Try to avoid it as far as possible.
- Track your Calorie intake through Mobile applications – it will help to know the quantity of food and its caloric value.
- Never combine screen time with eating

#### 6. Yoga for weight loss

Yoga improves mindfulness of your body and increases your ability to control your diet.

- It reduces stress, which controls poor eating habits.
- Improved self discipline which adhere yourself to physical activity and balanced diet.
- It makes the body especially back healthy promoting additional exercise.

#### 7. Conclusion

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The vast majority of scientific evidence supports a important role of physical activity plays an important role in body weight management. Substantial weight loss could be achieved by the modification of our diet and choosing the right physical activity and adhering to both. Diet helps more in reducing weight but physical activity ensures that the lost weight is not regained. Weight loss with diet alone may leads to infirmity especially in older people, Physical activity in the form of aerobics and resistance training is the apt addition to diet.

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# Patterns of sexual risk behavior among men who have sex with men in major cities of Myanmar: A cross-sectional study

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## Abstract

**Introduction:** Globally, transmissions of diseases are more likely to be infected among MSM due to their sexual risk behaviors like unprotected anal sex and multiple sexual partners. Very scarce or limited studies were noted regarding alcohol consumption and sexual risk behavior among MSM in Myanmar.

**Methods:** A cross-sectional study was conducted to identify the patterns sexual risk behavior among MSM in two major cities of Myanmar. Purposive sampling was applied and sampling was made through Myanmar MSM network. Face-to-face interviews were conducted by using a structured questionnaire. Patterns of sexual risk behavior were described as frequency/percentage and mean/median as appropriate. Bivariate analysis (Chi-squared test) was also done to find out the association between condomless anal intercourse and multiple sexual partners.

**Results:** A total of 256 MSM included in the study and their mean age was  $27.33 \pm 7.7$  years. The age group was categorized into 15-24 years as young MSM and  $\geq 25$  years as adult MSM. All MSM in the study have experienced sexual intercourse with men in their lifetime. Within one month, 47.3% of young MSM and 63.9% of adult MSM had multiple sexual partners. Over 70% to 80% of MSM had multiple sexual partners within six months and one year respectively. Never/inconsistent condom use was detected among 61.3% of young MSM and 56.1% of adult MSM who had sex with their permanent sexual partners within one month. On the other hand, 33.3% of young MSM and 23.5% of adult MSM did not use condom regularly during one month. Significantly higher proportion of Apwint (open type) of MSM had more than one sexual partner than other types of MSM ( $p < 0.001$ ). Over 69% of Apwint (open type) of MSM, 51.3% of Apone (hidden type) and 26.5% of Thange (partner of MSM) had more than one sexual partner. Similar pattern of association between type of MSM and number of partners was also seen for other time periods like within three months, six months and one year ( $p < 0.001$ ).

**Conclusion:** Current study identified the alcohol consumption and sexual risk behavior among MSM in major cities of Myanmar. Intervention to reduce unsafe sexual practices like having multiple partners and condomless anal intercourse should be done since many MSM had practiced these unsafe sexual behaviors.

**Index Terms-** Sexual risk behavior, Men who have sex with men, Myanmar

## I. INTRODUCTION

Globally, transmissions of diseases are more likely to be infected among MSM due to their sexual risk behaviors like unprotected anal sex and multiple sexual partners. According to the previous studies, 40-70% of MSM had sex without using condom (Herrera et al.; Li

et al.). The prevalence of condomless anal intercourse (CAI) and their associated factors among MSM in China was documented in previous studies in China. Prevalence of CAI with male partners in the past six months was 43.7% and condomless vaginal intercourse was 21.6%. CAI was associated with earlier homosexual debut, suicidal inclinations, childhood sexual abuse and HIV testing in recent year (Li et al.). In a study conducted in Peru, condomless anal intercourse was associated with having multiple sexual partners. Similarly, having multiple sexual partners was very common and it may lead the risk of sexually transmitted infections. Previous studies documented that six to ten sexual partners were found among MSM within previous year. In addition, 50-70% of MSM had multiple sexual partners. One of the studies stated that, there was sexual relationship with ten sexual partners within last one year (Chittamuru et al.; Garcia et al.; Pines, Karris and Little).

Sexual risk behaviours among MSM have been documented in previous studies. According to a systematic review of studies done in high-income countries, increasing trend of sexual risk behavior was seen among MSM such as condomless anal sex, condomless anal sex with casual partners and main partners, condomless anal sex with partners of unknown or discordant HIV status. Similarly, sexual risk behaviors among MSM were reported in many Asian countries. A study conducted in Malaysia identified that having multiple sexual partners was common and about 60% of them had unprotected sex within six months (Koh et al.). Likewise, in Vietnam, 70% among 1695 MSM had multiple sexual multiple sexual partnerships in the last 6 months. More than half of them also reported penetrative sex with concurrent partners within last 6 months (Garcia et al.). All these sexual risk behavior were crucial for further HIV transmission among MSM population.

In Myanmar, according to “Integrated Biological and Behavioral Surveillance Survey” (IBBS) data, median age at first anal sex with male was found at 17 years of age. In addition, proportion of MSM respondents those who had first sexual partner with male was documented as 95% in Yangon and 84% in Mandalay. Then, the proportion of MSM who had anal sex with men within one year was detected as 20% in Yangon and 14% in Mandalay. IBBS conducted in 2015 found that experience of being forced to have sex sometimes in the last 12 months ranged widely from 7% to 40% among the MSM in five study sites (National\_AIDS\_Program).

According to the local terminology in Myanmar, there were three common subgroups of MSM such as Apwint or open type, Apone or hidden type and Tha Nge. Apwint or open MSM are defined as “individuals born biological male but who openly express themselves femininely by dress and/or social interactions”. Apone or hidden MSM are defined as “individuals born biological males who may also want to express themselves femininely but may not disclose this behavior to all segments of their social networks”. Tha Nge are defined as “having a masculine outward appearance but have sex with men and insertive type in nature” (National\_AIDS\_Program).

In Myanmar, HIV is concentrated among key affected population like MSM whereas HIV prevalence was over 10% among them (UNAIDS). Very little or no known study was reported sexual risk behavior among MSM. Therefore, current study was conducted to identify sexual risk behavior in terms of condomless anal intercourse and multiple sexual partners (more than one sexual partner) among MSM.

## II. METHODS

### *Study design, population and area*

A cross-sectional study was conducted among MSM those aged more than 18 years in Yangon and Mandalay, major cities of Myanmar.

### *Inclusion criteria*

- The one who identify himself as a man who have sex with man
- MSM who had engaged insertive or receptive anal sex or both

### *Sampling and sample size*

Purposive sampling was applied and MSMs were recruited through Myanmar MSM network. By considering the estimated proportion of MSM who have sex with men as 20%, 95% confidence level and an error of 5%, minimum required sample size was 246 (National\_AIDS\_Program).

### *Data collection*

One day training of the interviewers was done at Department of Medical Research and pre-test was done at a non-study township in Yangon Region. Eligible participants were invited to participate in the study and recruited at the venues where MSMs usually gather like drop-in-centers of International Non-governmental Organizations, beauty parlours and others included the hotspot places of MSM where they usually gather such as home of famous beautician, moat and office of community based organization. After getting the informed consent, data collection was done by face-to-face interview. Strict adherence to ethical principles were ensured throughout the data collection period in order to maintain the confidentiality of the information of the study participants.

### *Data management and analysis*

Data entry was carried out with EpiData version 3.1 and data analysis was done with SPSS version 21. Exploratory data analysis was done to check the errors, consistencies and missing values. Descriptive information regarding sexual risk behaviors was shown as frequency/percentage according to the age group of MSM. Bivariate analysis using chi-square statistic was also done to identify the association between number of sexual partners and types of MSM.

### *Ethical considerations*

The proposal was submitted to Institutional Review Board, Department of Medical Research, Myanmar. Informed consents were taken from the participants after thorough explanation about the objectives of the study. Confidentiality and anonymity of the information were strictly ensured. All answer sheets and data reports were kept in locked cabinet.

### *Operational definitions*

According to the local terminology in Myanmar, three groups of MSM were included in the study: Apwint or open type, Apone or hidden type and Tha Nge. Apwint or open MSM are defined as individuals born biological male but who openly express themselves femininely by dress and/or social interactions. Apone or hidden MSM are defined as individuals born biological males who may also want to express themselves femininely but may not disclose this behaviour to all segments of their social networks. Tha Nge are defined as having a masculine outward appearance but have sex with men” (National\_AIDS\_Program). Multiple sexual partners can be defined as having sex with two or more sexual partners.

## III. FINDINGS

A total of 256 MSM included in the study and mean age of MSM was  $27.33 \pm 7.7$  years. Tables were presented according to the age group that was categorized as 15-24 years as young MSM and  $\geq 25$  years as adult MSM. As shown in Table (1), 39% of young MSM and 59% of adult MSM were “apwint” (open type).

Table 1 Socio-demographic characteristics of MSM from Yangon and Mandalay (n=256)

| Characteristics                  | Age group (n=256)   |                    |
|----------------------------------|---------------------|--------------------|
|                                  | 15-24 years<br>n(%) | ≥25 years<br>n(%)  |
| Type of MSM                      |                     |                    |
| Apwint (open)                    | 43 (39.1)           | 86 (58.9)          |
| Apone (hidden)                   | 27 (24.5)           | 41 (28.1)          |
| Thange (partner of apwint/apone) | 40 (36.4)           | 19 (13.0)          |
| Income earning job               |                     |                    |
| No/ not regular                  | 59 (53.6)           | 6 (4.1)            |
| Yes, always                      | 51 (46.4)           | 97 (66.4)          |
| Monthly income (Kyats)           |                     |                    |
| Median (IQR)                     | 200,000 (166,000)   | 200,000 (187,500)  |
| Range                            | 15,000 – 900,000    | 15,000 – 2,000,000 |

All MSM in the study have experienced sexual intercourse with men in their lifetime. Mean age of first sex among them was 17.3 ± 3.1 and ranged from 11 to 27 years. The proportions of MSM who had sex with men were around 67% in both groups within one month. In addition, about 75% of young MSM and 87.7% of adult MSM had sex within six months. Similarly, 84.5% of young MSM and 91.8% of adult MSM had sex within one year (data not shown in table). Table (2) shows the number of sexual partners in different time period according to age group of MSM. Having multiple sexual partners was seen in both age groups at all time periods. Within one month, 47.3% of young MSM and 63.9% of adult MSM had multiple sexual partners. Over 70% to 80% of MSM had multiple sexual partners within six months and one year respectively. Similarly, 85.5% and 96.6% of MSM had multiple sexual partners in their life time.

Table (2) Number of sexual partners in different time period according to age group of MSM

|                                     | Age group           |                   | p-value |
|-------------------------------------|---------------------|-------------------|---------|
|                                     | 18-24 years<br>n(%) | ≥25 years<br>n(%) |         |
| Multiple partners within one month  | (n=74)              | (n=97)            | <0.05   |
| No                                  | 39 (52.7)           | 35 (36.1)         |         |
| Yes                                 | 35 (47.3)           | 62 (63.9)         |         |
| Multiple partners within six months | (n=82)              | (n=128)           | >0.05   |
| No                                  | 24 (29.3)           | 35 (27.3)         |         |
| Yes                                 | 58 (70.7)           | 93 (72.7)         |         |
| Multiple partners within one year   | (n=93)              | (n=134)           | >0.08   |
| No                                  | 24 (25.8)           | 22 (16.4)         |         |
| Yes                                 | 69 (74.2)           | 112 (83.6)        |         |
| Multiple partners within life time  | (n=110)             | (n=146)           | <0.01   |
| No                                  | 16 (14.5)           | 5 (3.4)           |         |
| Yes                                 | 94 (85.5)           | 141 (96.6)        |         |

Condom use with permanent and non-permanent sexual partners according to age group of MSM is shown in Table (3). Never/inconsistent condom use was detected among 61.3% of young MSM and 56.1% of adult MSM who had sex with their permanent sexual partners within one month. On the other hand, 33.3% of young MSM and 23.5% of adult MSM did not use condom regularly during one month.

Table (3) Condom use with permanent partners and non-permanent partners according to age group of MSM

|                                    | Age group           |                   | p-value |
|------------------------------------|---------------------|-------------------|---------|
|                                    | 18-24 years<br>n(%) | ≥25 years<br>n(%) |         |
| <b>With permanent partners</b>     |                     |                   |         |
| Condom use within one month        | (n=31)              | (n=57)            | >0.05   |
| Never/inconsistent                 | 19 (61.3)           | 32 (56.1)         |         |
| Consistent                         | 12 (38.7)           | 25 (43.9)         |         |
| Condom use within six months       | (n=41)              | (n=76)            | >0.05   |
| Never/inconsistent                 | 27 (65.9)           | 36 (47.4)         |         |
| Consistent                         | 14 (34.1)           | 40 (52.6)         |         |
| Condom use within one year         | (n=93)              | (n=134)           | >0.05   |
| Never/inconsistent                 | 24 (25.8)           | 22 (16.4)         |         |
| Consistent                         | 69 (74.2)           | 112 (83.6)        |         |
| Condom use within life time        | (n=68)              | (n=117)           | >0.05   |
| Never/inconsistent                 | 42 (61.8)           | 68 (58.1)         |         |
| Consistent                         | 26 (38.2)           | 49 (41.9)         |         |
| <b>With non-permanent partners</b> |                     |                   |         |
| Condom use within one month        | (n=54)              | (n=68)            | >0.05   |
| Never/inconsistent                 | 18 (33.3)           | 16 (23.5)         |         |
| Consistent                         | 36 (66.7)           | 52 (76.5)         |         |
| Condom use within six months       | (n=64)              | (n=101)           | <0.05   |
| Never/inconsistent                 | 25 (39.1)           | 22 (21.8)         |         |
| Consistent                         | 39 (60.9)           | 79 (78.2)         |         |
| Condom use within one year         | (n=73)              | (n=114)           | >0.05   |
| Never/inconsistent                 | 26 (35.6)           | 28 (24.6)         |         |
| Consistent                         | 47 (64.4)           | 86 (74.6)         |         |
| Condom use within life time        | (n=93)              | (n=136)           | <0.05   |
| Never/inconsistent                 | 31 (33.3)           | 23 (24.3)         |         |
| Consistent                         | 62 (66.7)           | 103 (75.7)        |         |

Number of sexual partners of MSM within different time periods according to the type of MSM is described in Table (4). Association was detected between type of MSM and number of sexual partners in one month. Significantly higher proportion of Apwint (open type) of MSM had more than one sexual partner than other types of MSM ( $p < 0.001$ ). Over 69% of Apwint (open type) of MSM, 51.3% of Apone (hidden type) and 26.5% of Thange (partner of MSM) had more than one sexual partner. Similar pattern of association between type of MSM and number of partners was also seen for other time periods like within three months, six months and one year ( $p < 0.001$ ).

Table (4) Number of sexual partners of MSM at different time periods according to the type of MSM

| Type of MSM             | No. of sexual partners within 1 month<br>n=171, n (%)  |               | p value |
|-------------------------|--|---------------|---------|
|                         | One partner  | > one partner |         |
| Type of MSM             |  |               | <0.001  |
| Apwint (Open type)      | 30 (30.6)  | 68 (69.4)     |         |
| Apone (Hidden type)     | 19 (48.7)  | 20 (51.3)     |         |
| Thange (Partner of MSM) | 25 (73.5)  | 9 (26.5)      |         |
| Type of MSM             | No. of sexual partners within 6 months<br>n=210, n (%) |               | p value |
|                         | One partner  | > one partner |         |
| Type of MSM             |  |               | <0.001  |
| Apwint (Open type)      | 18 (16.2)  | 93 (83.8)     |         |
| Apone (Hidden type)     | 20 (36.4)  | 35 (63.6)     |         |

| Thange (Partner of MSM)                                | 21 (47.7)   | 23 (52.3)     |         |
|--|-------------|---------------|---------|
| No. of sexual partners within one year<br>n=227, n (%) |             |               | p value |
|  | One partner | > one partner |         |
| Type of MSM  |             |               | 0.001   |
| Apwint (Open type)                                     | 14 (11.5)   | 108 (88.5)    |         |
| Apone (Hidden type)                                    | 17 (27.0)   | 46 (73.0)     |         |
| Thange (Partner of MSM)                                | 15 (35.7)   | 27 (64.3)     |         |
| No. of sexual partners within lifetime<br>n=, n (%)    |             |               | p value |
|  | One partner | > one partner |         |
| Type of MSM  |             |               | <0.001  |
| Apwint (Open type)                                     | 3 (2.3)     | 126 (97.7)    |         |
| Apone (Hidden type)                                    | 3 (4.4)     | 65 (95.6)     |         |
| Thange (Partner of MSM)                                | 15 (25.4)   | 44 (74.6)     |         |

#### IV. DISCUSSIONS

The current study identified the sexual risk behaviors among MSM in major cities of Myanmar. Being consistent with IBBS data in 2015, mean age at first anal sex was 17 years in present study. Moreover, proportions of MSM who had sex within one year were around 85% in young MSM and 90% in adult MSM, significantly higher than that was reported in IBBS (14% to 20%) (National\_AIDS\_Program).

Sexual risk behaviors like having multiple sexual partners and having condomless anal sex were prevalent among MSM all over the world. The present study reported that nearly half of young MSM and over 60% of adult MSM had multiple sexual partners within one month, nearly three-fourth within six months and over three-fourth within a year. Increasing proportions of MSM were having multiple partners in different time periods.

The present study highlighted that consistent condom use among MSM depended on the type of sexual partners in which it was higher with non-permanent sexual partners than with permanent partners. Around one fourth to one third of young MSM never or inconsistently used condom with permanent sexual partners at different time periods like one month, three months, six months, one year and lifetime. Similarly, nearly 16% to 60% of adult MSM never or inconsistently used condom with non-permanent sexual partners at different time periods.

Previous studies in other countries have also reported the presence of multiple partners and inconsistent condom use among MSM. In China, over 40% of MSM did not use condom within previous six months (Li et al.) whereas in Malaysia, about 60% had unprotected sex within six months (Koh et al.). Similarly, in US, 58% of MSM reported condomless anal intercourse within six months (Santos et al.). Mean number of sexual partners within six months was reported as 11 in Malaysia study while it was stated as 22 in current study. In addition, over 70% of MSM in current study had multiple sexual partners within six months. Similar findings were seen in other countries in which about 60% of MSM had multiple partners in China, about 70% had multiple partners in Vietnam (Garcia et al.) and over 90% of MSM had multiple partners in US within six months (Santos et al.). On the other hand, university students had lesser partners than MSM whereas about one-third of university students had multiple partners within one year (Choudhry et al.).

Having multiple sexual partners was very common among MSM and it may lead the risk of sexually transmitted infections. According to the past studies, over half to two-third of MSM had multiple sexual partners and had six to ten sexual partners within previous year. One of the studies stated that, there was sexual relationship with ten sexual partners within last one year (Chittamuru et al.). According to a systematic review of studies done in high income countries documented that there was an increasing trend of condomless anal

intercourse among MSM but a decreasing trend in number of partners (Hess et al.). Possible explanations for the decreasing trend of condom use included availability of other HIV prevention options and optimism about HIV treatments.

In conclusion, intervention to reduce unsafe sexual practices like having multiple partners and condomless anal intercourse should be carried out since many MSM in the current study had practiced these unsafe sexual behavior.

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# Assessment of Tolerance of *Zea mays* L. and Physico-chemical Properties of Soil at Flood Affected Site in Bayelsa State, Nigeria

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**Abstract-** Assessment of tolerance of *Zea mays* and physico-chemical properties of soil at flooded areas was conducted in Yenagoa, Bayelsa State, Nigeria. Five (5) sampling units (P1, P2, P3, P4 and P5) in an area prone to seasonal flooding were selected alongside a non-flooded terrain (control-P0). Germination studies were conducted two (2) weeks before the onset of flood in the experimental sites, while a corresponding set up was maintained at the control site. Three (3) seeds of the crop were sown in the experimental soil per planting point with five (5) replicates. The experimental set up was maintained under natural light condition for twenty eight (28) days. Physico-chemical properties of the experimental soil and the test crop growth parameters were examined. Soil pH, the contents of nitrogen and phosphorus were lower in the flooded soils relative to that of the non-flooded area. Higher contents of exchangeable calcium, and potassium were recorded at the normal soil relative to the flooded soil. The proportions of clay and silt fractions in the flooded soils were higher relative to that of the non-flooded area. The shoot length, root length, fresh weight and dry weight of the test crop were lower in the flooded soils comparable to the normal soil. This study suggests that the impacts of flooding on agricultural soils are deleterious, thus, appropriate management strategies are required to reduce the effects of this menace on plants.

**Index Terms-** *Zea mays*, Soil Properties, Flood, Bayelsa State

## INTRODUCTION

Flooding is one of the devastating environmental hazards, which results either from rainwater or by river water<sup>1;2</sup>, and is commonly found in some state of Nigeria such as Bayelsa, Cross Rivers, Akwa Ibom, Rivers, Delta, and others. This seasonal flooding of soils is considered a natural phenomenon, which occurs between May-October during the rainy season, and usually affects farmlands, forested areas as well as residential places<sup>3</sup>. The impacts of flood on soil physico-chemical properties are dependent on factors such as water balance, topography and subsurface<sup>4</sup>. Submergence of soil by flood usually causes both reversible and irreversible changes in

physico-chemical properties of such soil<sup>5</sup>. The soil is a medium of plant growth, thus alteration of its physico-chemical properties have a serious impact on root development, and consequently on plant vegetative development<sup>6</sup>. Therefore, plant grown on flooded areas are affected by stress conditions, because the diffusion of gases through soil pores is inhibited by the excess water contents, which the growing roots do not require<sup>7</sup>. The inundation of an area with water can cause hazardous chemicals to be released into the soil<sup>8;9</sup>. In rural areas, runoff from flooded areas can carry with it eroded soil containing fertilizers, herbicides and insecticides. Runoff from motorways, roads and bridges may contain heavy metals, petroleum hydrocarbons and polycyclic aromatic hydrocarbons. Runoff from inundated waste sites may contain a variety of toxic chemicals, depending on its initial source<sup>10</sup>.

This study becomes increasingly important because plant species potentials are faced with sources of strong disturbances such as destructive practices, pollution, invasive species, mass mortality outbreaks, bush fires, flooding, and poor development plans and programs leading to profound structural and functional changes<sup>11;12</sup>. The study area, Yenagoa, Bayelsa State, has a riverine and estuarine settings with many of its communities completely surrounded by water, and lies in the tropical zone in the Niger Delta region of Nigeria<sup>13</sup>. The test crop *Zea mays* (Poaceae) is cultivated as one of the staple food and economic crops in farmlands in Bayelsa State, Nigeria. It is used as a staple food crop and constitutes a major component to many important dishes, as well as a basal medium and raw material for industries<sup>14</sup>. The characteristic water terrain of Bayelsa State with its attendant's problem of flooding justifies the increasing need for this study. This present study was carried out to evaluate the tolerance of *Zea mays* at its seedling stage to flooded soil conditions as well as the physical and chemical characteristics of the experimental soil.

## I. MATERIALS AND METHODS

**Study Area:** The study was conducted in an area prone to seasonal flooding, alongside a non-flooded terrain, which served as control treatment, in Yenagoa, Bayelsa State, Nigeria. Bayelsa State has a riverine and estuarine setting with many of

its communities completely surrounded by water, and lies in the heaviest rainfall area of Nigeria, with heavy rain forest and short dry season. The research area is characterized by a mean maximum monthly temperature ranging from 26°C to 31°C. The State is geographically located within latitude 4°15' North and latitude 5°23' South. It is also within longitudes 5°22' West and 6°45' East<sup>13;15</sup>.

**Analysis of Soil Samples:** Soil samples (0-15cm depth) collected from the study sites, Yenagoa, Bayelsa State, Nigeria were analysed using standard methods for determining soil physico-chemical properties<sup>16</sup>.

### Germination Studies

Five (5) sampling units (P1, P2, P3, P4 and P5) in an area prone to seasonal flooding were selected alongside a non-flooded terrain (control-P0). Germination studies were conducted two (2) weeks before the onset of flood in the experimental sites, while a corresponding set up was maintained at the control site. Seeds of *Zea mays* obtained from local farmers in Yenagoa, Bayelsa State, Nigeria, were surface sterilized with 5% ethanol for 30 seconds and thoroughly washed several times with sterile distilled water. The seeds were air dried for few minutes. Three (3) seeds of the crop were sown in the experimental soil per planting point with five (5) replicates. The experimental set up was maintained at a mean minimum temperature of 22.42°C and a mean maximum temperature of 31.06°C, under natural light condition for twenty eight (28) days.

**Determination of shoot length and root length:** The shoot length and root length of the test crop were measured with a meter rule and expressed in centimetres.

**Determination of moisture content:** The plant materials were harvested and repeatedly washed with sterile-distilled water using a sieve to avoid loss of plant parts. Blotting papers were used to dry the seedlings and the fresh weight measured using mettler-p-165 weighing balance. The fresh plant materials were dried in a Gallen Kamp oven maintained at 65°C for 2 days to a constant weight in order to determine the dry weight.

**Statistical analysis:** Data analysis was carried out using analysis of variance (ANOVA) ( $P < 0.05$ ) using appropriate statistical method<sup>17</sup>.

## III. RESULTS AND DISCUSSION

The mean pH values ranged from 5.20 to 5.70 at the flooded soils relative to a value of 6.40 at the non-flooded soil (control) (Table 1). The low pH value of the flooded soils relative to the control soil is an indication of modification of the soil conditions at the flooded soil. This clearly shows a moderate acidic soil condition at the experimental soil, however, these values are within the range suitable for optimum growth performance of crops. In flooded soil, reduction in pH has been reported to be caused by the accumulation of carbonic acid formed from trapped carbon dioxide produced from respiration<sup>18</sup>. The presence of heavy metals in flooded soils may pose a health risk on local communities growing and consuming food crops and vegetables in contaminated sites. The sequence of contamination involves

contamination of soils by chemicals, the potential uptake by crops and the possible chronic and long term toxic effects in humans<sup>19;20</sup>. Although plant uptake of heavy metals depends significantly on the metals as well as the prevailing soil conditions, several studies have indicated that crops grown on heavy metal contaminated soils have higher concentrations of heavy metals than those grown in uncontaminated soil<sup>21;22;23</sup>.

The total organic carbon ranged from 0.34 to 0.62% at the flooded soil (P1-P5) comparable to the contents of 0.52% at the control soil (P0)-(Table 1). The contents of total nitrogen at the five sampling units of the flooded soil were 0.034, 0.050, 0.023, 0.042, and 0.020% at P1, P2, P3, P4, and P5, respectively, relative to the value of 0.063% at the control soil (P0). The phosphorus contents at the five sampling units of the flooded soil were 20.40, 12.26, 8.32, 21.30, and 20.16 mg/kg at P1, P2, P3, P4, and P5, respectively, comparable to the content of 28.07mg/kg at the control soil (P0) (Table 1). The contents of exchangeable bases varied considerably ( $P < 0.05$ ) among the five sampling units at the flooded soils, while higher contents of exchangeable calcium, and potassium were recorded at the control soil relative to the flooded soil (Table 1). The proportion of clay and silt fractions in the flooded soils increased in relation to that of the non-flooded area (Table 1). Changes in soil chemistry are usually viewed as major characteristics in soil saturated with water as indicated in this study. Water is known to decrease the mobility and availability of metal ions, and mineral nutrients due to its properties of acting as a solvent for ions and soluble compounds. This prevailing soil condition in the flooded soils has caused microbial respiration to enhance water soluble compounds such as nitrate, perchlorate, manganese, ferric iron, sulphate and carbon dioxide to act as electron acceptor<sup>24</sup>. The reduced nature of aggregate stability in flooded soil has caused organic carbon to be more soluble like metals and minerals under reducing conditions<sup>25</sup>. Nitrogen may be limited in anaerobic soil condition. The occurrence of nitrogen in soils and sediments is usually in form of complex organic substances, ammonia, molecular nitrogen, nitrite and nitrate. Organic nitrogen mineralization in flooded soil is inhibited at the ammonia stage due to oxygen deficiency, thus leading to accumulation of ammonia in anaerobic soil<sup>26;27;28</sup>.

The shoot length recorded higher values ( $P < 0.05$ ) at the control soil (P0) than those of the flooded soils (P1-P5). The root length ranged from 4.20-5.10cm at the flooded soil (P1-P5) relative to that of the control -P0 (8.20cm). Lower values of fresh weight and dry weight were recorded ( $P < 0.05$ ) at all the five (5) sampling units (P1-P5) relative to that of the control (P0) (Table 2). The reduced growth parameters of *Zea mays* at the flooded soil may be attributed to anaerobic soil conditions created in the saturated soil. The flooded soil is characterized by a decline in oxygen level, thus triggering a sequence of changes in the physical and chemical properties of the affected soil<sup>7</sup>. These changes often result in aggravated proportion of reduced metal ions, organic acids and volatile acids, which are inhibitory to root growth<sup>7;29</sup>. These changes affect the plant metabolic activities such that stomatal resistance increases, photosynthesis and root hydraulic conductivity decline and translocation of photo-assimilates is reduced. The blockage of a greater percentage of soil pores space by the presence of water inhibits root growth due to low oxygen availability<sup>30;31</sup>.

In addition, the modification of soil properties greatly affects gas diffusion coefficient in the soil, which depends on texture, structure, distribution, size and pores connectivity<sup>32</sup>. The saturation of soil pores with water also causes chemical modification in soil parameters such as pH value and accumulation of toxic products<sup>2</sup>. A reduced pore space in a flooded soil with less than 20% has been reported to affect soil properties such as texture, structure, water content, mineralogy of clays and sodium absorption, thus leading to inhibition in microbial activity and plant growth<sup>28;33;34</sup>. In general, the reduced condition of soil with its associated reduction in the capacity to extract nutrients will decrease the nitrogen and phosphorus contents of plant. Although, other mineral elements such as iron and manganese contents will increase because of their reduction in soluble forms, these changes in contents of various elements may affect plant growth due to their effects on root metabolism<sup>35</sup>.

|                |            |            |            |           |            |            |
|----------------|------------|------------|------------|-----------|------------|------------|
| Dry weight (g) | 28.07±0.60 | 20.40±0.34 | 12.26±0.42 | 8.32±0.17 | 21.30±0.64 | 20.16±0.85 |
|----------------|------------|------------|------------|-----------|------------|------------|

Mean ± standard error of 5 replicates

### CONCLUSION

The study reported a marked variation in the soil physical and chemical properties between the flooded soils and the non-flooded area. Soil pH, the contents of nitrogen and phosphorus were lower in the flooded soils relative to that of the non-flooded area. The contents of exchangeable bases varied considerably among the five sampling units at the flooded soils, while higher contents of exchangeable calcium, and potassium were recorded at the control soil relative to the flooded soil. The proportions of clay and silt fractions in the flooded soils were higher relative to that of the non-flooded area. The crop growth parameters assessed were lower in the flooded soils comparable to the normal soil. This study revealed that appropriate management strategies are required to reduce the deleterious impacts of flooding on plants and agricultural soils.

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Table 1: Physical and chemical properties of experimental soil

| Sampling sites           | Po -Control | P1         | P2         | P3         | P4         | P5         |
|--------------------------|-------------|------------|------------|------------|------------|------------|
| pH                       | 6.40±0.32   | 5.30±0.24  | 5.60±0.33  | 5.40±0.20  | 5.70±0.81  | 5.20±0.17  |
| TOC(%)                   | 0.52±0.07   | 0.62±0.03  | 0.34±0.02  | 0.17±0.05  | 0.46±0.02  | 0.38±0.03  |
| Total N (%)              | 0.063±0.01  | 0.034±0.01 | 0.050±0.02 | 0.023±0.01 | 0.042±0.02 | 0.020±0.01 |
| P (mg/kg)                | 28.07±0.47  | 20.40±0.13 | 12.26±0.20 | 8.32±0.14  | 21.30±0.52 | 20.16±0.77 |
| Ca <sup>2+</sup> (mg/kg) | 4.20±0.49   | 2.20±0.22  | 2.42±0.34  | 1.87±0.13  | 2.04±0.10  | 1.80±0.15  |
| Mg <sup>2+</sup> (mg/kg) | 0.62±0.08   | 2.27±0.32  | 3.16±0.23  | 1.30±0.18  | 1.21±0.25  | 2.06±0.33  |
| Na <sup>+</sup> (mg/kg)  | 0.28±0.04   | 0.17±0.03  | 0.24±0.06  | 0.32±0.05  | 0.20±0.02  | 0.36±0.06  |
| K <sup>+</sup> (mg/kg)   | 0.19±0.02   | 0.10±0.03  | 0.05±0.03  | 0.14±0.07  | 0.17±0.02  | 0.15±0.04  |
| H <sup>+</sup> (mg/kg)   | 0.30±0.03   | 0.60±0.04  | 0.40±0.02  | 0.20±0.02  | 0.30±0.05  | 0.50±0.02  |
| Al <sup>3+</sup> (mg/kg) | 0.10±0.02   | 1.24±0.13  | 1.07±0.18  | 0.70±0.06  | 0.20±0.04  | 1.40±0.25  |
| ECEC (mg/kg)             | 6.72±0.40   | 5.26±0.54  | 4.87±0.32  | 4.70±0.60  | 4.62±0.28  | 4.66±0.90  |
| Sand (%)                 | 90.40±0.58  | 78.55±0.31 | 82.24±0.45 | 76.74±0.72 | 70.49±0.27 | 73.30±0.69 |
| Silt (%)                 | 4.87±0.44   | 4.34±0.27  | 5.21±0.43  | 5.77±0.68  | 6.60±0.37  | 5.52±0.92  |
| Clay (%)                 | 4.73±0.63   | 17.11±0.49 | 12.55±0.46 | 17.49±0.94 | 22.91±0.53 | 21.18±0.42 |

Mean ± standard error of 5 replicates

Table 1: Physical and chemical properties of experimental soil

| Sampling sites    | Po -Control | P1         | P2         | P3         | P4         | P5         |
|-------------------|-------------|------------|------------|------------|------------|------------|
| Shoot length (cm) | 6.40±0.16   | 5.30±0.43  | 5.60±0.65  | 5.40±0.47  | 5.70±0.29  | 5.20±0.61  |
| Root length (cm)  | 0.52±0.02   | 0.62±0.09  | 0.34±0.06  | 0.17±0.05  | 0.46±0.02  | 0.38±0.05  |
| Fresh weight (g)  | 0.063±0.01  | 0.034±0.02 | 0.050±0.06 | 0.023±0.03 | 0.042±0.02 | 0.020±0.03 |

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# Characterization of Physical and Chemical Properties of Soil from Three Municipal Solid waste Dumpsites in Bayelsa State, Nigeria

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**Abstract-** Characterization of physical and chemical properties of soil from three municipal solid waste dump sites was conducted in Bayelsa State, Nigeria. Soil samples were collected from three (3) municipal solid waste dumpsites; Opolo (L1), Mechanic village (L2), and Kpansia (L3), along side natural soil (control-P0) in triplicates. Physico-chemical properties and heavy metal contents of the experimental sites were examined. This study revealed that soil pH, total nitrogen, available phosphorus, organic carbon, magnesium, potassium, calcium, and electrical conductivity recorded higher contents ( $P < 0.05$ ) at the dumpsites than the natural soil (control). Exchangeable acidity were lower at the dumpsites than the natural soil, while heavy metals contents were higher at the dumpsites than the natural soil, however, their proportions were within the permissible levels by WHO. Therefore, this study showed that the soil nutrient status and the general soil conditions at the dumpsites were adequate for optimum agricultural productivity.

**Index Terms-** Physical, Chemical, Soil, Dumpsites, Bayelsa State

## I. INTRODUCTION

Soil is regarded as a medium for plant growth and habitat for a variety of living organisms as well as an important natural resource base for mineral elements needed for plant growth and development<sup>1</sup>. Urbanization, population growth, and socioeconomic development have brought increased accumulation of municipal solid waste together with complexity in management of these wastes<sup>2</sup>. Municipal solid wastes are known to accumulate in tremendous proportion and cause unpleasant sites in some major cities in Nigeria. Further increase in the proportion of municipal solid wastes may be recorded in future due to increased population growth and economic potentials of urban centers<sup>3;4;5</sup>. Soil quality is a crucial factor to be considered for sustainable agriculture, hence, evaluation of soil properties around waste disposal sites becomes increasingly important. The factors influencing the composition of municipal solid wastes at any given time may include culture, affluence, and location<sup>6</sup>. Management of municipal solid wastes has been shown to be dependent on the solid wastes characteristics such as moisture contents, particle size, chemical composition and

density<sup>6</sup>, thus, presenting difficulty in solid waste management in terms of economic and technical aspects<sup>7</sup>.

Several open municipal wastes dumpsites are available in Yenagoa, Bayelsa State, and are centrally managed by the State Ministry of Environment. Therefore, this paper presents the evaluation of physical and chemical properties of soils within three (3) selected dumpsites and their comparison with those of the natural soil to assess the impact of pollution potential of open dumping on soil in the urban area of Yenagoa, Bayelsa State, Nigeria

## II. MATERIALS AND METHODS

**Study Area:** The study was conducted at three (3) sampling municipal solid waste dumpsite along Opolo, Kpansia, and mechanic village road, Yenagoa, Bayelsa State, Nigeria. These dumpsites are used by the inhabitants for municipal solid waste disposal as Government authorized dumping sites, and usually evacuated by the environmental sanitation authority on regular bases. The research area is in the tropical climatic zone of Nigeria with a mean maximum monthly temperature ranging from 26°C to 31°C. The state is geographically located within latitude 4°15' North and latitude 5°23' South. It is also within longitudes 5°22' West and 6°45' East<sup>8;9</sup>.

### Collection of soil samples

Soil samples were collected (0-15cm depth) from three (3) municipal solid waste dumpsites; Opolo (L1), Mechanic village (L2), and Kpansia (L3), along side natural soil, which served as Control (L0) in triplicates, giving a total of twelve (12) representative samples from both the waste dumpsite and the control soils. The samples were collected using an acid clean soil auger pack in a well labeled black polythene bag and taken to the laboratory for analysis.

### Analysis of soil samples

The soil samples were air-dried at room temperature for two (2) weeks and ground to pass through 2mm mesh sieve. The samples were then analyzed for both physical and chemical properties of the soil. Standard methods were used to analyze soil samples for physico-chemical properties<sup>10</sup>. Particle size distribution analysis

was done by the Hydrometer method<sup>11</sup>. Soil pH was measured in water at ratio 1:1 (soil: water) by glass electrode pH meter<sup>11</sup>. Organic matter was determined by wet dichromate acid oxidation method<sup>12</sup>.

The cations were extracted with 1 M ammonium acetate buffered at pH 7 to determine the cation exchange capacity (CEC). 30 ml of 1 M CH<sub>3</sub>COONH<sub>4</sub> was added to 5 g of soil. The suspension was shaken for 2 h and then centrifuged (15 min, 6000 rpm). After centrifugation and filtration, the filtrate was transferred into a 100 ml flask and two other volumes of 30 ml ammonium acetate were added successively after 30 min of agitation and centrifugation. The final filtrates were completed to 100 ml with ammonium acetate solution

Calcium (Ca) and magnesium (Mg) were determined by EDTA titration while potassium (K) and sodium (Na) were determined by flame photometry. Exchangeable acidity (EA) was determined by titration method<sup>13</sup>. The effective cation exchange capacity (ECEC) was calculated as the total exchangeable bases plus exchangeable acidity.

Available phosphorous (Av. P) was extracted with Bray solution 11 and the phosphorous determined by the molybdenum method described by<sup>14</sup>. The percent organic matter (%OM) was calculated from the percent organic carbon (OC%) measured using wet oxidation method<sup>15</sup>. Total nitrogen (TN) was determined using the modified Kjeldahl distillation methods<sup>13</sup>.

#### Determination of heavy metal contents of soil

One gram of each of the sieved soil samples was digested using the nitric/perchloric acid digestion procedure<sup>16</sup>. The concentrations of heavy metals, Pb, Cr, Zn, Fe, Mn and Cd were determined using atomic absorption spectrophotometer (Unicam Solaar 32 model) following the standard procedures<sup>17</sup>.

#### Statistical analysis

Values of mean data obtained from the replicate readings were used to calculate standard error and data were subjected to analysis of variance (ANOVA). The differences in the means were tested using Least Significant Difference (LSD) at 0.05 level of probability<sup>18</sup>.

### III. RESULTS AND DISCUSSION

Higher values of pH were recorded at L1 L2 and L3 dumpsites comparable to the control (L0). However, the pH values of L1 and L3 were slightly alkaline, while that of L2 was slightly acidic. The mean pH values of soils at dumpsites ranged from 7.43 (L1) to 7.69 (L3), and a relative lower value of 5.32 for L2, while the control (L0) had a pH value of 5.29 (Table 1). The slightly acidic nature of L2 dumpsite may be due to accumulation of used engine oil, and lubrication oil as well as other wastes usually generated from mechanic villages (vehicle repairs sites). Reduction in soil pH is one of the adverse impacts of crude oil contamination<sup>19</sup>. Contamination of soil by petroleum oil may also lead to adverse effects such as, adsorption of oil to soil particles, generation of an excess carbon that may be unavailable for microbial use and induction of a limitation in soil nitrogen

and phosphorus<sup>20;21</sup>. Reduction in pH may affects nutrient availability in soil, especially increase concentration of aluminium, copper and manganese, while depleting the nitrogen contents of soil<sup>22</sup>. Higher pH values in dumpsites of municipal solid wastes relative to natural soils have been reported<sup>23</sup>. Elevated pH at solid waste disposal sites has been attributed to liming materials and microbial activities<sup>24;25</sup>. Similarly, soil under accumulation of municipal solid wastes has been shown to be characterized by increased salinity due to accumulation of organic materials, thus leading to reduction in soil acidity<sup>26</sup>.

The values of exchangeable bases varied significantly among the three sites. Exchangeable calcium, magnesium, and sodium were higher in dumpsites than the control site (Table 1). The higher contents of exchangeable bases at the dumpsites may be attributed to high organic matter contents of soil. High contents of exchangeable bases at a given municipal solid waste dumpsite are usually an indication of high nutrient status together with increased microbial activities<sup>27</sup>. Higher contents of nitrogen and phosphorus were recorded at the three dumpsites (L1, L2 and L3) relative to the control (L0)–(Table 1). Enhanced organic matter content of solid waste dumpsites resulting from higher level of nitrogen and phosphorus has been reported<sup>28</sup>. The values of exchangeable acidity at L1 (2.31 cmol/kg), L2 (2.40 cmol/kg) and L3 (2.37 cmol/kg) dumpsites were relatively lower than that of the control –L0 (2.72 cmol/kg) site (Table 1). This disparity may be due to leaching activities of soil by rain and runoff infiltration, which cause increased acidic ion concentration in soil. Therefore, low acidic ion at the dumpsites may be due to exchangeable bases resulting from decomposing organic waste that replaced the leached cation, hence leading to alkaline nature<sup>29;30</sup>.

The values of electrical conductivity varied across the three dumpsites (L1, L2 and L3). The values for Electrical conductivity were 0.27, 0.32 and 0.23 ds/m at L1, L2 and L3 dumpsites, respectively, while that of the control (L0) was 0.07 ds/m (Table 1). This clearly shows a higher level of electrical conductivity at the dumpsites than the control site. The elevated values of electrical conductivity at the dumpsites may be due to high salt contents usually found in some municipal solid wastes<sup>31;32</sup>. Similarly, high value of electrical conductivity at dumpsites has been shown to be attributed to soluble salts often associated with disposal of metallic materials<sup>33</sup>. The soil particle size distribution at the dumpsites as well as the control site indicated a loamy sandy pattern (Table 1), which is a clear characteristic of soil of the Niger Delta region<sup>24</sup>.

There were marked variations in the contents of heavy metal across the three dumpsites as well as the control site (Table 2). Higher contents of heavy metals were recorded at L2 relative to L1 and L3 dumpsites, while the contents of heavy metals at the three dumpsites (L1, L2 and L3) were comparatively lower than that of the control (L0) sites. This variation in heavy metal content at the three dumpsites may be due to the accumulation of residential, municipal and agricultural wastes, which characterized the L1, and L2 dumpsites, while the L2 has additional wastes from vehicle repairs and mechanic shops with their associated heavy metal contents. Heavy metal accumulation

at waste dumpsites may be absorbed by plants and other soil organisms with their associated adverse effects. Waste dumpsite containing high levels of heavy metals may impose detrimental effects on soil physical and chemical properties, and upset nutrient balance, leading to reduction in plant growth and development<sup>34</sup>. Some metals are known to be harmful and can persist in the soil medium for a long period. It is important to note that some of the soils around the dumpsites are agricultural lands and are under continuous cultivation. The presence of organic matter and nutrients such as phosphorus in the soil can influence the availability of heavy metals for plant uptake, such that high contents of such nutrient can reduce heavy metals contents through processes such as chelation, adsorption and precipitation<sup>35</sup>. Although, the concentration of the heavy metals were within the permissible range, it may however be a threat to human health if ingested above optimum level for safety.

Table 1: Physical and chemical properties of experimental soil

| Sampling sites   | L <sub>0</sub> | L <sub>1</sub> | L <sub>2</sub>   | L <sub>3</sub> |
|------------------|----------------|----------------|------------------|----------------|
| Parameters       | Control        | Opolo          | Mechanic village | Kpansia        |
| pH               | 5.29±0.21      | 7.43±0.33      | 5.32±0.42        | 7.67±0.31      |
| Avail. P (mg/kg) | 6.37±0.40      | 10.48±0.35     | 8.04±0.22        | 12.33±0.60     |
| Total N (%)      | 0.24±0.02      | 3.14±0.10      | 2.62±0.20        | 3.67±0.23      |
| TOC (%)          | 1.30±0.80      | 3.67±0.21      | 5.08±0.34        | 4.02±0.28      |
| EC (ds/m)        | 0.07±0.01      | 0.27±0.03      | 0.32±0.02        | 0.23±0.04      |
| Na (Cmol/kg)     | 0.12±0.02      | 0.20±0.03      | 0.18±0.02        | 0.15±0.03      |
| Mg (Cmol/kg)     | 1.74±0.30      | 3.06±0.25      | 3.54±0.42        | 2.83±0.26      |
| K (Cmol/kg)      | 0.16±0.05      | 0.24±0.02      | 0.20±0.04        | 0.25±0.02      |
| Ca (Cmol/kg)     | 3.06±0.27      | 7.13±0.39      | 6.58±0.17        | 5.24±0.61      |
| EA (Cmol/kg)     | 2.72±0.32      | 2.31±0.18      | 2.40±0.80        | 2.37±0.22      |
| ECEC (Cmol/kg)   | 6.90±0.20      | 8.82±0.26      | 9.33±0.52        | 9.08±0.39      |
| Sand (%)         | 76.40±0.44     | 73.04±0.57     | 80.21±0.37       | 72.70±0.46     |
| Silt (%)         | 5.87±0.31      | 12.73±0.20     | 11.60±0.23       | 11.21±0.72     |
| Clay (%)         | 17.73±0.22     | 14.23±0.69     | 8.19±0.40        | 16.09±0.13     |

Mean ± standard error of 3 replicates

Table 2: Heavy metal contents of experimental soil

| Sampling sites     | L <sub>0</sub> | L <sub>1</sub> | L <sub>2</sub>   | L <sub>3</sub> |
|--------------------|----------------|----------------|------------------|----------------|
| Parameters (mg/kg) | Control        | Opolo          | Mechanic village | Kpansia        |
| Zinc               | 0.13±0.03      | 0.16±0.02      | 0.56±0.05        | 0.27±0.02      |
| Chromium           | 0.04±0.02      | 0.08±0.02      | 0.98±0.04        | 0.07±0.01      |
| Nickel             | 0.01±0.01      | 0.20±0.05      | 0.86±0.07        | 0.10±0.03      |
| Cadmium            | 0.27±0.05      | 0.40±0.02      | 0.74±0.05        | 0.31±0.04      |
| Lead               | 0.21±0.03      | 0.34±0.02      | 0.82±0.03        | 0.25±0.04      |
| Iron               | 0.10±0.04      | 0.45±0.03      | 0.77±0.05        | 0.24±0.03      |
| Copper             | 0.02±0.01      | 0.15±0.05      | 0.37±0.03        | 0.18±0.02      |
| Manganese          | 0.22±0.05      | 0.27±0.02      | 0.45±0.02        | 0.25±0.03      |

Mean ± standard error of 3 replicates

## IV. CONCLUSION

This study showed that soil characteristics such as soil pH, total nitrogen, available phosphorus, organic carbon, magnesium, potassium, calcium, and electrical conductivity recorded higher contents at the dumpsites than the natural soil (control). The contents of exchangeable acidity at the dumpsites were lower than that of the natural soil. In addition, the contents of heavy metals at the dumpsites were higher than that of the natural soil, however, their proportions were within the permissible levels by WHO. Therefore, this study clearly revealed that the soil nutrient levels as well as the general soil conditions at the dumpsites were adequate for optimum growth and development of plants.

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# Suicide in Prisons: Active Deviation Profile

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**Abstract** - The interpretative path of suicide finds its maximum expression in the theorizations of Èmile Durkheim who classifies suicide as a social pathology and as a result of a general social fragility. The more generic theme of "deaths" in prison began to arouse the interest of scholars around the mid-19th century, a period in which "suicide death" was linked to the influence of both exogenous factors, such as socio-family environmental ones and socio-relational before prisonization and suitable for suicide, which are endogenous, referable to the status of prisoner, regardless of the nature of the individual, his cognitive abilities and his adaptation skills. Often, the institution's attitude towards the "suicidal" or "attempting suicide" prisoner coincides with the labeling of a subject deemed insane and the self-suppressive conduct almost always an expression of active deviance.

**Index Terms**- Prison, suicide, deviance, prisoner, society, prevention.

## I. INTRODUCTION

With the work "Le Suicide, Etude de sociologie" by Durkheim (1897), self-suppressive conduct gradually begins to move away from the sphere of religion and morals to be addressed in the social sciences. Suicidal conduct and the person who carries it out are intertwined in a new relationship that becomes the object of research. Durkheim clarifies in the following work "Determination of the moral fact", how the individual enters society by doing violence to his nature and exceeding his individual level. The man thus described is a subject, therefore, contradictory, better identified as "homo duplex". Man moves between two opposite poles: his individual or profane nature and his social or sacred nature. As an individual, man tries to pursue his own particular purpose; as a member of society he is led to pursue general collective purposes. But this is necessary, according to Durkheim (1897), because the individual left to himself would tend towards cancellation and disintegration; To make collective behavior better than individual behavior, it is therefore necessary that the company itself actively intervenes. According to Durkheim (1897), an external, social constraint must lead the individual to the highest level and that he does not perceive this constraint as an extraneous force. Durkheim (1897) classifies suicides according to "three social modalities" from which derive three types of suicide which he defines as "selfish, altruistic and anomic". On the basis of a series of data, he comes to establish the following "general sociological law": "suicide varies in inverse reason to the degree of integration of domestic society" (family) and that "suicide varies in inverse reason to the degree of integration of political society". A classification of reasoned suicides, according to the forms and morphological characters is practically not possible due to the almost total absence of the necessary documents. In fact, in order to be able to attempt it, one should have descriptions of a large number of particular cases. It would be necessary to know in what psychic state the suicide finds himself in the moment in which he made his decision, what drives him to the implementation, how he finally put it into action, if he was depressed or agitated, calm or enthusiastic, anxious or irritated and etc. The suicide is led to deceive himself and the nature of his dispositions, for example, he believes he is acting in cold blood, while he is at the height of excitement. The social modalities of suicide classified by Durkheim (1897) are: 1) selfish suicide, considered as characteristic of modern societies. The person isolates himself by having loosened or broken the bonds that united him to other individuals. For this reason, the bond between man and his life is also weakened, thus making him fragile and at risk of killing himself in the event of even the slightest adverse circumstances. The term egoistic does not refer to "thinking only of oneself", but to what the Protestant culture claims, for which it is necessary "to allow the subject to develop his own freedom, therefore his own individual self". According to Durkheim, the subject who tends to commit suicide tends to impose his or her freedom, leading to the breakdown of relationships and leading to social disintegration. The only solution to selfish suicide is the integration of the individual with the group they belong to; 2) altruistic suicide is characteristic of "primitive" or "inferior" societies, in which there is a close bond of subordination of the individual to the group; the individual's ego loses its sense of belonging by confusing itself with something different from itself and, therefore, its action finds an explanation within a group of which it is a part. In such peoples, suicide does not represent the exercise of a right that is believed to have, but the fulfillment of a duty. According to Durkheim (1897), poor individualization and too much integration make the individual interchangeable and depersonalized. Therefore, in altruistic suicide the character of fulfillment of a duty is found, so it would be more

correct to define it as compulsory altruistic suicide. Furthermore, optional altruistic suicide can also be identified: this type of suicide has in common with the obligatory altruistic type, the type of social context tending to totally depersonalize the individual whose life is nothing of source to society. It differs from compulsory altruistic suicide in that the man, in the optional one, kills himself without being expressly kept there, often for reasons that Durkheim (1897) defines as futile or, solely, for the joy of sacrifice. In the optional altruistic suicide the individual aspires to strip himself of his individual being to annihilate himself in that other thing which he considers his true essence; 3) anomic suicide derives from social imbalances, from moments of crisis or economic disasters, before and after revolutions, in cases of sudden changes in socio-economic situations or careers. The relationship between individual and society is so strong that it pushes the subject to sacrifice. Society is not only something that attracts individuals' feelings and activities with unequal intensity, it is also a power that regulates them. There is a relationship between the way in which this regulatory action is exercised and the social rate of suicides. Anomy is, therefore, in our modern societies a regular and specific factor of suicide (called anomalous note) that does not depend on the way in which individuals are linked to society, but on the way in which it disciplines them. Anomic suicide derives from the fact that men's activity is unregulated and they suffer from it. In anomic suicide, individual passions are left without a regulatory brake. In the opposite case, if the society regulated too much, according to Durkheim (1897), the cases of "fatalistic suicide" would increase instead, that is, the one committed by individuals whose future is completely closed, predetermined and whose passions remain coerced due to an excessive discipline. In this regard, it is necessary to underline how the formulation of the Durkheimian theory was influenced by two factors of fundamental importance: the risk of disintegration of society in European countries and the need for sociology to recognize its scientific identity in the academic world. Durkheim, considering suicide as a symptom of social pathology, omits the contribution of other human sciences such as psychology. These setting limits are all the more evident when considering how suicide, perhaps more than other human action, depends on numerous psychosocial, cultural, political and biological causes and that it is not possible to try to provide an explanation that wants to be exhaustive. taking into account the results of research conducted by anthropologists, historians, psychologists, biologists.

## II. The reactions to Durkheimian theory

After the publication of Durkheim's work there were divergent reactions: Esquirol (1838) and others clearly rejected these assumptions, believing that suicide rates could be explained exclusively in terms of mental disorders and, therefore, sociology could not deal with the phenomenon as a product of psychopathological rather than social conditions. Blondel (1933) attempted to integrate the conflicting positions by arguing that although the social situation of the suicide was decisive, at the origin, however, there is always a depressive personality with tendencies towards the suicidal act, hoping for an interaction between psychiatrists and sociologists in order to study suicides more fully. For Gurvitch, (1939) unlike the clear Durkheimian opposition between society and individual, it was necessary to highlight the constant interpenetration between these two entities and, therefore, social facts could not be studied as entities external to the individual and not even consider society as a summation of individual consciences (Tarde, 2010). Halbwachs (1930) accused Durkheim of excessive generalization in exposing the motivations that lead the European individual to suicide. These argued that factors such as religion, nationality, employment, education, socio-economic status, family relationships, before being confronted with suicide, had to be analyzed in relation to both rural and urban-industrial societies, in consideration of the diversity of cultural models of the respective residence groups. Halbwachs (1930) believes that a high suicide rate represents a particularly accurate index of the amount of suffering, imbalances, disease and sadness that exist in a group.

## III. Studies and research on self-suppression

The first studies on suicide began in the Enlightenment period, in the context of criminological theories based mainly on legal aspects which, with the advent of positivism, however, gradually changed into a more "social" perspective. Consequently, a greater concentration of scholars' interest was observed on the reasons that could have led the subject to commit suicide. The need to study social phenomena therefore became pressing through empirical scientific analyzes. The first statistical studies for the analysis of social facts were conducted in the mid-nineteenth century: the ultimate aim was the attempt to explain the root causes of these events taking into account for the first time the social environment in which they took place. In the second half of the nineteenth century, Morselli (1879), an exponent of moral statistics, was the first scholar to undertake significant research on suicide. He assumed that suicide, like any other social phenomenon, is the consequence of events that occurred in previous periods and therefore responds to laws and specific influences deriving from society. The study of suicide, therefore, detached itself for the first time from the religious and superstitious perspective to take on predominantly psychological and social connotations. In this sense, the use of statistics became of fundamental importance, intended as a tool that allowed to collect social facts to present them under a common denominator. In the essay "Social structure and anomia" Merton (1938) carries out a systematic analysis of the social and cultural factors that determine the deviated behavior. Among these, he considers legitimate goals and regulatory rules of fundamental importance. The former represent legitimate objectives for each member of society regardless of the individual social positions occupied. Regulatory rules

perform a control function over legitimate methods of reaching goals. According to Merton (1938), in general, in order to pursue the culturally approved goal, individuals prefer to adopt the most effective behavior, regardless of its cultural legitimacy. Thus social instability would gradually develop, developing the phenomenon called "anomia" by Durkheim (1897). The "demoralization" would therefore be generated by the exaltation process of the end with the consequent de-institutionalization of the means with particular reference to those companies in which there is no high degree of integration between goals and regulations. Starting from Durkheim's assumption (1897), according to which the suicide rate varies inversely proportional to the degree of integration of the individual in society, Gibbs and Martin (1958) start an animated debate on suicide theories. The development of their hypothesis is inseparable from the clarification of what is meant by the term integration, without forgetting the need to formulate a quantitatively verifiable hypothesis. By broadening the definition of Durkheim, the two authors trace integration to the stability and duration of social relations within a community. However, even these two variables are not easy to measure. Therefore, starting from the assumption that all individuals occupy a status (age and sex, for example) within a wider system of status (race, occupation, marital status, etc.), the two scholars base their theory on the concept of integration of status. The anomia state theory developed by Powell (1958) presupposes, for the definition of suicide, the existence of a self, immediately highlighting the socio-psychological nature of his study. Powell's theory, in fact, arises as a reworking of the concepts of I and Me proposed by Mead (1966): according to the latter, the conjugation of the car (Io) and hetero-referentiality (Me) comes to be determined the Self, understood as the product of a social process of self-interaction in which individuals report to themselves the dynamics that guide the situations in which they act, and the resulting action is conditioned by the interpretation of those same dynamics. The theme around which Powell's theory is based is that the nature and incidence of suicide varies with social status; unlike Gibbs and Martin (1958), however, he defines status as a precise position taken by a subject within the social system, just as the role held within it is attributable to rights and status obligations : in this sense, the role of an individual held first in the family, later in the peer group, and finally as an adult within the community, is incorporated into the structure of self. Starting in the 1920s, a group of scholars, later recognized as the "School of Chicago", gave rise to a tradition of empirical research, the results of which profoundly influenced the study of many different phenomena and disciplines. One of these is that of human ecology, which applies, perhaps at times in a forced way, the behavioral characteristics of plant ecology, biotic order, to human societies, considered the foundation of the social order. Within this approach, a current develops aimed at studying the origin of deviant behaviors and suicide, being able to distinguish three different areas of thought: the first focuses on the causal relationship between social action and physical involvement of the subject, considering the action the result of the pressure exerted by the environment; the second traces the social action to the interdependence between the different social units (populations) and, finally, the third places emphasis on the meanings that the individual attributes to their own actions and those of others. Despite numerous studies, the ecological approach to suicide presents a strong weakness, that is, affirming the existence of a direct connection between social disorganization and the suicide rate without any empirical evidence to support it. An unprecedented innovation in the American suicide literature is undoubtedly represented by the work of Henry and Short (1954) who place murder and suicide on the same level, considering them both the result of aggressive social behavior in response to conditions of frustration generated by external restraint. The two phenomena differ only in the fact that in the case of suicide, violence is directed towards oneself, while in murder it is directed towards others. The main purpose of the two authors was to combine psychological and sociological variables to explain changes in suicide rates. Starting from the observation that both suicide and murder are both forms of aggression, one self-directed and the other heterodirect, Gold (1958) attempts to elaborate a theory that connects psychological theories with sociological ones. His starting hypothesis is that moving towards suicide rather than murder depends on the type of sanction used in the socialization process. Among the first to analyze the phenomenon was Esquirol (1838) who, in "Des Maladies Mentales", claimed that suicides were committed by alienated people who attempted their lives only in a delusional phase. Adler (1967) instead identifies suicide a form of communication through which others are forced to appreciate the one they have lost and what they represent. In the face of painful states of being, in which we witness a physical, moral and social devaluation of the ego, to the same thus, the way of fear, of flight, of struggle, the behavior of taking one's own life represents an extreme attempt at defense. Sullivan (1953), stressing the interpersonal component of the suicidal gesture, also considers it as a "chance fatality" in which the real goal of self-suppression is represented by an individual who in the past had a highly negative influence, destructive for the subject who decides to end it. Wahl (1957) highlights the connection between the suicidal act and the desire to reincarnate, the mystical choice of a new life and individual regression based on magical and omnipotent aspects. Hillman (1964) also focuses attention on the relationship between suicide and soul in a broader perspective that includes law, the Church and society in general. In fact, he highlights how the law has judged him a crime for a long time, religion a sin and society rejects it, tending to undermine it or to justify it with madness, as if it represented the largest of the antisocial aberrations. For the author, however, the meaning of the gesture is exclusively of a personal nature and the attempt to understand it necessarily passes through opening up to death, intimate knowledge and identification. Suicide is intended as a path to enter death, determined by the deepest fantasies of the individual soul. It represents not only a way out of life, but also a path of entry into death. The consequent regeneration of the soul means that the suicidal act can be considered not as a gesture against living, but as a satisfaction of an overwhelming need for a fuller existence. Menninger's vision of suicide appears complex (1938) who claimed that three psychic components must coexist for suicide to be achieved: 1) the death instinct, that is, the desire to kill determined by primary aggression; 2) the desire to die from guilt and as a search for atonement; 3) the desire for death to find refuge from the adverse circumstances of one's life and to end one's conflicts. Therefore, according to Menninger (1938), at least three wishes can contribute to a suicidal act: the desire to kill; the desire to be killed; the desire to die. The author therefore identified the following types of self-suppression: chronic suicide, where the subject chronicizes self-destructive behaviors, inflicting suffering that causes the gradual deterioration of their vital functions (alcoholism, masochism, anorexia-bulimia, behavioral disorders, etc.). In this way he proceeds by

"delaying" his death; localized suicide: self-destructive behavior is focused on a single part of the body (onychophagy, surgery, frigidity, impotence, etc.); organic suicide: development of organic pathologies induced by conflicting factors of psychogenic origin (oncological pathologies, and so on). Zilboorg (1936), developing some theoretical aspects of Menninger (1938), argued that in every suicidal act there is an unconscious component of hostility and a great inability to love others. He also identified the narcissistic aspect of this primitive gesture by considering it a means by which the individual tries to make his fantastic instances of immortality concrete. In the phenomenology of the suicidal act, Fornari (1967) considers the depressive anxieties caused by the loss of the love object to be of fundamental importance and, consequently, suicide would result in the desperate attempt to see his relationship with the lost object reaffirmed. Furthermore, he underlines the meta-communicative aspect of self-aggression that the suicide would represent with "a denial of death", in fact believing that the suicide desperately searches for his relationship with the world, although apparently he denies this relationship. In addition to the aggressive aspects, Stengel (1977) identifies further non-destructive motivations in suicide with particular reference to the desire to be able to affect the feelings of others. Therefore, in the suicidal gesture, it highlights a sort of appeal function, therefore an unconscious call to obtain the attention of the environment. It also highlights how in the suicidal gesture there is not always a lucid determination in ending it: this would instead often be determined by a state of confusion. The author then concludes that most suicidal people want neither to live nor die, but to do both at the same time. Deshaies, (1951) in "Psychology of suicide" considers the latter as the result of an integration of psychological, social and physical factors. He illustrates the following six types of suicide: defensive suicide against an unsustainable situation; the self-punitive one, determined by a very strong sense of guilt; self-assault suicide, through the internalization of an aggressive act; the ablative one, as a "sacrificial act"; playful suicide, by imitation or curiosity, and finally tanatological suicide, determined by the death instinct. Biswanger (1973), founder of existential analysis, focuses attention on the fragmentation of the temporal dimension of the suicidal subject, emphasizing his inability to project himself into a future dimension. Hendin (1963) argues that depressive psychopathology alone is not sufficient to push the subject to commit suicidal behavior, assuming that different psychodynamic organizations may be involved in suicide: meeting with the loved object; death as revenge on the other; suicide as self-punishment and atonement for blame; suicide as a fantasy of rebirth. Musatti (1949) considers aggression towards oneself as the constitutive essence of melancholy, which can proceed from purely psychological aspects and elaborations until it reaches its most extreme physical form represented by suicide. With regard to the etiopathogenesis of suicide, the author identifies the following two trigger mechanisms: the first is represented by the psychological imbalance caused by the impossibility of going beyond the libidinal investment for the loved and lost object, with the consequent subjective identification with this the latter and its elimination through self-suppression. The second consists in the psychologically fragile individual's inability to face external reality, with the consequent liberating reaction of transformation of his hetero-aggression into self-elimination. Baechler (1975) elaborates a theory that integrates some aspects of dynamic psychology and others of a biological nature. The basic hypothesis is that each individual, in relation to his / her learning skills and biological functions, tends to develop a reactive mode in relation to specific environmental conditions. Shneidman (1985) developed a three-dimensional integrative theory also known as "cube theory". He highlights how often suicide represents the only way out when the cognitive and reactive abilities of the individual are overwhelmed by intense psycho-physical pain, by a strong disturbance (recordable based on the intensity of the subjectively perceived stress) and by a high degree of compulsion. From the etiological point of view, the author puts forward the hypothesis that suicidal behaviors can be traced, in a schematic way, to the three dimensions of this geometric figure which would precisely coincide with: 1) pain: understood as a subjective experience of an unbearable suffering psychological; 2) disturbance: general psychological state of a disturbed person. It is intended as the relative ability of the individual to control agitation, impulses and the tendency to act compulsively. The latter aspect, for the author, would be decisive in relation to the lethality of the suicidal act; 3) compulsion: considered as the determining factor of individual psychological reactions in reference to thoughts, feelings and behaviors. This would correspond, therefore, to the resultant of the influences on the subject of both intra-subjective and social relationships. At the basis of deviant behavior there is a lack of development of cognition as stated by Walters and White (1989). Deviance is determined not by external influences but by the irrationality and inadequacy of the individual's mental patterns. Among the various deviant behaviors, suicide represents the validity of the relativistic conception of deviance.

#### IV. The types and significance of intramural suicides in the modern perspective

Aggressive suicide differs from an aggressive suicide according to the quality of the emotional behavior. This bipartition refers to the distinction between active and passive deviance elaborated by Parsons (1951). By adapting the theory of deviance to this phenomenon, suicide can be traced back to a form of passive deviance, because in the end it is an act that translates into self-death and implies the most extreme renunciation. On the other hand, it can be considered a form of active deviance, when it takes on a meaning of protest and, therefore, expresses an (active) reaction in the face of an uncomfortable situation. Different types are configured in relation to the object of aggression or not of suicidal behavior: 1) renouncing (or an aggressive) suicides, in which no form of heterodirect aggression is highlighted. These are episodes in which the subject does not react in the face of adversity at all: he does not translate his impatience into hostility, just as it does in the case of rebellious acts; 2) suicide by depression, in which the subject suffers his own pain without reacting by performing an act of passive deviance. This passivity occurs, in fact, with an act both physically and symbolically self-aggressive (unlike rebel suicides where the gesture is an act only physically, but symbolically hetero-aggressive since the subject kills himself, but in reality he would like to kill a other). Analyzing the ideal type of suicide by depression, several ideal subtypes of suicide can be distinguished: a) suicide / melancholy, defined as the self-suppressive gesture that follows the

inability to accept separation from the object of love; b) suicide / punishment, in which the punitive component of suicide in prison would perform the function of redemption of guilt; c) suicide / mourning: in this ideal type of suicide mourning causes the ego to renounce the object declaring it dead, and offering the ego, in exchange for this renunciation, the prize of remaining alive. But if in the melancholy separation and loss are now impossible, being the object introjected and identified with one's ego, then, according to Rossi (1990), suicide arises from the failure of mourning and the possibility of separation, that is, from the attack against the badly loved object that is within itself "; 3) suicide \ escape represents one of the most common manifestations of suicide in the prison environment. By giving up living, the prisoner assumes a behavior typical of passive deviance, since he tries to solve his problems through the most extreme form of abandonment and escape: death. Liebling (1992) argues that detainees, subjected to a heavy state of stress, view suicide not as an act that leads to death, but as an escape route to a "place of peace" where they can take refuge. Death then becomes self-sacrifice to move on to a better world. According to Maltbeger and Buie (1980) suicide translates into "a form of individual, magical, omnipotent regression towards the mystical choice of a new life". Unlike the interpretations of suicide \ escape in which death is seen as a passage from earthly life to another form of life, Amery (1976), argues that suicide is intended simply and bitterly as an exit from the reality of this world, without the illusion of no passage to another world. In this case, suicide involves a leap into the void, into nothingness. Ceraudo (1996) argues that suicide in prison often responds to needs for relief and rest. Not far away is the position of Sarteschi and Maggini (1990) who highlighted the aspect of relief from the worries, misfortunes and difficulties of existence that often follow the prison experience. Liebling and Ward (1994) point out that the concept of suicide as an escape from a situation of extreme constraint finds the best theoretical support in Durkheim's (1897) interpretations regarding fatalistic suicide. Fatalistic suicide expresses the sense of escape and escape from a situation of subjection and compulsion, therefore it is not difficult to imagine that a situation of compulsion, such as to lead to suicide, as Durkheim (1897) describes, could occur in prison by the rigid and inflexible discipline of Total Institutions; 4) suicide as an irrational escape represents the prisoner's attempt to escape from the rigid world of penitentiary. The subject is compressed in a claustrophobic way by the sense of compulsion and vulnerable by an acute psychological pain that leads him to meditate on killing himself. In escape \ irrational suicide, the individual does not decide and is unable to calculate the acts and consequences of his own gestures of which he remains a victim. Sarteschi and Maggini (1990) described the emotional state that many inmates have in common: "prison is a moment of vertigo; everything projects itself far away: people faces, aspirations, habits, tensions, feelings that before represented the life, suddenly splash into a past that appears far, far away, almost foreign. "Baccaro and Morelli (2009) argue that many, before and during suicide, do not reflect at all on the problem of death. He underlines the fact that in attempting his own life the subject is driven by the desire to bring about change, to flee, to seek relief and rest. Stengel (1977) tends to deny and frustrate the possibility of conceiving of suicide as a stoic manifestation of freedom, believing that for a realistic understanding of the meaning of suicide, this must be understood mainly as a release from prison; 5) Suicide as a rational escape in prison is con it mainly appears as a form of refusal in the face of a disturbing situation and, as it is conceived, it can be defined, according to Baechler's terminology, as a real rational action. Escaping from prison is a recurring theme in a prisoner's fantasy and sometimes not only in his fantasy. Sometimes, due to the degree of lucidity and the rationality with which the entire behavior is managed, this ideal subtype of suicide \ escape becomes a real rational choice; 6) the appeal / protest suicide falls into the category of rebel suicides with manifestations of active deviance. In prison the prisoner often thinks of suicide as an instrument of appeal and as an expression of protest. Adler (1967) argues that this typology should be understood as an effort aimed at individual improvement and aimed at prevailing over others (or rather over the other, more significant for him). The suicidal act can therefore be read as a request for attention and as a virile protest towards the surrounding environment; 7) suicide threat / blackmail can be defined as that self-suppressive conduct carried out in order to instill fear in the prison institution. As Bucarelli and Pintor (1991) point out, suicide in prison very often outlines blackmail, "a form of indirect aggression: I try to kill myself so I punish you, causing the blame to fall on you (judge, guardian, etc.)"; 8) crime / revenge suicide occurs when the prisoner has reached the maximum degree of aggressive charge (Gonin, 1994). In this case, in fact, self-suppression arises from a real introversion of aggression. The subject is overwhelmed by the weight of hostility that he perceives from the outside and is completely prey to the impulse to rebel through violence; however, not being able to manifest and exercise this violence towards others, he is forced to fold it and pour it on himself. The ideal type of suicide crime \ revenge presents the extremes of the act of active deviance.

Table 1  
*Suicides, disaster health care, deaths from unclear causes, overdose  
 Prisoners who died in Italy from 2000 to 2020 (September)*

| Years | Suicides | Total Deaths |
|-------|----------|--------------|
| 2020  | 3        | 6            |
| 2019  | 53       | 143          |
| 2018  | 67       | 148          |
| 2017  | 52       | 123          |
| 2016  | 45       | 115          |
| 2015  | 43       | 123          |
| 2014  | 44       | 132          |

|              |              |              |
|--------------|--------------|--------------|
| 2013         | 49           | 153          |
| 2012         | 60           | 154          |
| 2011         | 66           | 186          |
| 2010         | 66           | 185          |
| 2009         | 72           | 177          |
| 2008         | 46           | 142          |
| 2007         | 45           | 123          |
| 2006         | 50           | 134          |
| 2005         | 57           | 172          |
| 2004         | 52           | 156          |
| 2003         | 56           | 157          |
| 2002         | 52           | 160          |
| 2001         | 69           | 177          |
| 2000         | 62           | 167          |
| <b>Total</b> | <b>1.109</b> | <b>3.033</b> |

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# Yemen E-government Research Landscape: An in-depth study on the trends of published research

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**Abstract:** E-government research is receiving great attention on a global level. Some researchers tend to explore e-government research within a certain scope. The current study aimed in exploring e-government research in Yemen. The study resulted in finding 41 published studies. The study surveyed the goals and results of the published researches and discussed their progress. In addition, topics related to e-government research that were not studied in Yemen were identified. Finally, the study presented the necessary recommendations from the identified published papers, as well as the suggestions that were put forward in researches similar to the goal of current research.

**Index Terms-** Yemen, e-government, published research.

## I. INTRODUCTION

Publications on e-government have risen rapidly in recent years. The literature review provides important insights into the evolution of e-government study over time, the assessment of which serves as the basis for guidance on this global trend for future inquiry (Sarantis, 2019). With the growing usage of information and communication technology (ICT) and its applications in public administration and in the political arena, the issue of e-government is becoming more significant. Governments are keen to reach out to their people and open partnerships with businesses to boost their operations and serve their communities better. As a result, e-government work is on the rise exponentially.

Research also showed the importance of e-government in countries that have suffered from conflicts and wars in the ability to continue e-government services without disruption provided the availability of electricity and the Internet (Khan, Moon, Zo, & Rho, 2012). It also proved its importance in the continuity of the lifeline in the event of the spread of epidemics as it is the situation in 2020 (Giray, 2020 ; Olagbaju, Awosusi, & Shaib, 2020). Digitization will be a big support for SMEs in 2020 and with COVID 19 if they have a digital transformation in order to be able to compete intensively. Since SMEs are part of the digital economic environment, digital skills need to be developed and innovated so that enterprise sustainability can take place now and in the future (Winarsih, Indriastuti, Fuad, 2021). The COVID-19 pandemic is pushing governments and communities to turn to emerging technology for a short-term response to the epidemic, mid-term resolution of socio-economic consequences, and long-term reinventing of existing policies and resources (United Nations Division for Public Institutions and Digital Government, 2020).

Publications on e-government have been gained many literature reviews worldwide. Several researchers have reviewed the published work on e-government worldwide (Heeks, 2001 ; Bolívar, Muñoz, & Hernández, 2010 ; Yildiz, 2012 ; Alcaide-Muñoz, Bolívar, Cobo, & Herrera-Viedma, 2017 ; Yusuf, Adams, & Dingley, 2016 ; Dombeu, Vincent, & Nelson, 2014). Some researchers are exploring a variety of subjects to expand their expertise in this field and create a theoretical foundation for this area (Abu-Shanab & Harb, 2019). Other researchers reviewing these studies in e-government literature and categorizing the results and identifying four research areas where the research community is targeting their efforts (Sarantis, 2019).

In the current study, the research trends on the e-government of Yemen have been examined to measure the volume of researches and the domains of the studies. In addition to figuring out what has been covered and what are the proposed future research directions. The author presented a narrative thematic review of what has been published in the field of e-government in Yemen and the related services between 2007 and 2020.

The researcher in the current study searched for the published papers in the field of e-government in Yemen and determined the number of researches that were carried out starting from 2007, the year in which the first study was found in this field, to the year 2020 and in which no research was found. The number of published research, which included doctoral and master's research, was 41 research. These researches were reviewed in a survey of the goal and results, and there were categorized into four domains, under each domain number of areas of e-government topics. Finally, the issues which were not studied are identified to deserve a future study.

By realizing the importance of e-government research in Yemen, the motivation for the current research was to explore e-government research in Yemen to know what has been accomplished and what has not been studied. This research can be a guideline that will enable researchers to explore the full landscape of e-government research in Yemen and move forward to add more to the e-government research in Yemen.

The research is organized into five sections. The first section is the literature review, following that, section two, which is the research methodology that will clarify the research mechanism that was carried out in this research and how the main areas of e-government research were identified. The third section is the result and discussion where the results will be presented and discussed, the fourth section is the conclusion. The final section is the recommendations.

## II. LITERATURE REVIEW

### A. E-government

E-government (short for electronic government) is the use of modern communications devices, such as computers and the internet, to provide public services in a country to citizens and other people. E-government provides new possibilities for easy citizen access to government and the delivery of services to people directly by the government. The term consists of the digital interactions between a citizen and their government (C2G), between governments and other government agencies (G2G), between government and citizens (G2C), between government and employees (G2E), and between government and businesses/commerce (G2B) (Jeong, 2007). E-governance involves the use of information and communication technologies (ICTs) to transact the business of government. At the level of service, e-governance promises a full service available 24 hours a day and seven days a week (Prasad, & Swain, 2009).

### e-government in Yemen

The first attempt to build e-government in Yemen was announced in 2003 and its website was launched in the same year. However, the project was derailed in the absence of a change-inducing environment (ESCWA, 2007). Moreover, most of the available information systems lack technical compatibility and updated information (NIC, 2005 ; Alrewi 2007). The following e-government project was established in September 2008. The main aim in its first stage was to design the electronic information content of all the government organizations, taking into account daily updating. In this stage, the citizen would benefit from the e-government website in two different ways; the first way gets up-to-date information, the second way, enquires via e-mails (Aleryani, 2010). In 2014, the Yemen government decided to revive the E-government by 2014–2015; but many challenges stand on the way from achieving this goal (Al-Aghbari, Abu-ulbeh, Ibrahim, & Saeed, 2015). The recent research indicated that the Yemen E-government still in stage one (Catalog), Thus, e-government in Yemen needs to move to the next stage which is the transactions. Yemen still needs hard and fruitful work to reach the success that all its citizens can be touched (Atef, & Al Mutawkkil, 2019).

### Domains of e-government Research

e-government research is a multidimensional subject that further covers many domains. Many studies (Heeks, 2001 ; Yildiz, 2012 ; Bolívar, M.P., Muñoz, & Hernández, 2010) pointed to the variety of the e-government research field. In general, e-government research is characterized as activities that assist and promote government initiatives in setting strategic tasks for the use of ITC. Many studies have employed approaches to empirical mapping to examine the thematic evolution of e-government science. Alcaide–Muñoz, Bolívar, M.P., Cobo, & Herrera–Viedma, (2017) combined several bibliometric tools to analyze the dynamics of research over 16 years to discover the most noticeable and high impact topics.

Six directions for e-government research were identified in an early study by Scholl (2007) as follows: government services, government operations, citizen engagement, public policy, technology utilization, and information use.

Yusuf, Adams, & Dingley, (2016) mentioned that the e-government research's themes are interrelated to each other and the multidisciplinary field. They identified themes and trends of e-government research based on selected conferences show the top ten keywords in ICEG papers from 2007 to 2010. They identified them as follows: (1) E-Democracy, (2) E-Governance, (3) E-Commerce, (4) E-Participation, (5) Governance, (6) E-Government implementation, (7) Public Sector, (8) E-Voting, (9) Public Policy, (10) Transparency.

Abu-Shanab & Harb (2019) reviewed the 2018 articles and revealed the dominant directions of current and future research. The study used frequency and clustering analytical techniques to classify the cluster of research topics seen in the period 2013 to 2016 as follows: social media, adoption, smart cities, engagement, open government, governance, website design, public administration, commerce.

Another latest study by Sarantis (2019), the author categorized e-government research's themes into three domains and twenty subdomains as follow:

**Government:** eGovernment Strategy-Policy, Organisation Role, eGovernment Framework, eGovernment Assessment, eGovernment Legal Framework, eGovernment Research Models.

**Technology:** Electronic Services, Back Office Infrastructure, Data, Social Media, Applications, Trust and Security, Channels, Interoperability

**User:** Stakeholder Interaction, User Participation, User Needs, User Role, Digital Inclusion, Impact.

The issue addressed in Dombau, Vincent, & Nelson, (2014) study included: challenges and opportunities of e-government.

- The proposal of e-government strategies.
- e-government implementation.
- government websites.
- Models and frameworks for implementing e-government.
- The state of e-government, implication of e-government on public policy.
- Citizen roles and participation in e-government.
- The accessibility of e-government, services.
- Analysis of e-government readiness.
- The usage of ICTs in e-government implementation.

### III. RESEARCH METHODOLOGY

Al-Aghbari, Abu-ulbeh, Ibrahim, & Saeed (2015) aimed to choose related articles that studied the challenges, barriers, and issues in the context of e-government in Yemen. They reviewed e-government studies in Yemen by using a relevant set of keywords and phrases, such as electronic government, E-government, online services, information technology.

The search methods for e-government research in Yemen have been addressed to develop the best fit method for this research. Atef, & Al Mutawkkil, (2019) aimed to study the maturity of the e-government in Yemen. They searched in literature in leading journals and from international conferences about Yemen E-government. The authors made that by conduct a keyword and terms include "Yemen E-government" ,"E-government in Yemen" ,"e government in Yemen" ,"Yemen e government", "Yemen E-government adoption factors", "E-government in Yemen adoption factors". In addition, they searched for literature in a scientific database like google scholar, an Elsevier (Science Direct), ACM(Digital library), JSTOR , EBSCOhost, Wiley Online Library, Emerald , and IGI Global (IGI Global Journal & Database).

#### Search strategy

The search strategy adopted in the current study was done by searching the published works about e-government in Yemen. The search strategy was designed by combining Boolean operators and key terms in keywords and/or titles. The author extensively searched for conference proceedings, published journals articles, Master dissertations and Doctorate theses published online in English from the year 2007 to 2020. Table no. 1 shows the search strategy of the current study.

| Table no. 1: Search strategy                        |  |
|---|--|
| <b>Period: May to August 2020</b>                   |  |
| <b>First round in keywords AND/OR title</b>         | <b>Accessible web search engine</b>  |
| e-government AND Yemen                              | Google Scholar, Science Direct, an Elsevier, Scopus, IEEE Xplore, Google Chrome, Wiley Online Library, IGI Global, ResearchGate, and references in identified studies. |
| digital government AND Yemen                        |  |
| electronic government AND Yemen                     |  |
| e-governance AND Yemen                              |  |
| <b>Second round in keywords AND/OR title</b>        |  |
| Internet AND government AND Yemen                   |  |
| Information technology AND government AND Yemen     |  |
| e-services AND/OR e-business, e-commerce, AND Yemen |  |
| e-participation AND Yemen                           |  |

**Research objectives**

e-government is a very vital tool for effective services. Furthermore, it could serve as the best way to provide services during unusual times in the country including war and crises.

The current research aims first to examine the number of published works on e-government in Yemen from 2007 to 2020. It specifically aims to explore the number of publications work have done each year, in addition to the number of publications under each determined domain during this period.

The second aim is to investigate the objectives of published studies about e-government in Yemen and find out the main results that were reached by surveying abstracts, introduction, and conclusions. The survey results were organized in chronological order under each domain to give an overview of the developments in each domain.

This extensive analysis of the previously published work will result in determining the research domains that have not been tackled in the Yemen e-government compared to what was done in e-government studies in other countries (Yusuf, Adams, & Dingley, 2016) , (Abu-Shanab and Harb, 2019, Sarantis, 2019).

**Research Questions**

The current study provided an overview of e-government research in Yemen. The main questions are as follows:

1. What is the volume of published research in the field of e-government in Yemen from 2007 to 2020?
2. What are the main achievements of the published works on e-government in Yemen under each identified domain?
3. What topics are still needed to be investigated and studied?

**Contribution to the knowledge**

From reviewing and exploring the published works on e-government in Yemen, the current research is the first one for this purpose. It represents a contribution to knowledge, where it gives a clear vision of what has been accomplished and what remained unexplored and/ or needs further investigations. Moreover, determine the volume of the published works in e-government in Yemen, for the purpose of statistical studies. This research could serve as a guideline for researchers to build their new research proposals based on knowing what has been done and what needs further exploration to rich the e-government studies and avoid repetition.

**IV. RESULTS, ANALYSIS AND DISCUSSION**

The results and discussion part is divided into two parts. The first part aims to determine the volume of published studies each year from 2007 to 2020 and to list their characteristics regarding the keywords. While the second part aims to survey of publications regarding their goal, abstracts, and conclusion. Finally, the topics that still need research and study will be determined.

**The volume of published studies from 2007 to 2020**

*First step*

In the first step, the explore was based on the compound of two words (e-government + Yemen) in the title AND /OR keywords and that resulted in 17 research as shown in table no. 1.

| <b>Table no. 1: Research-based on two words (Yemen + e-government) in the title AND/OR keywords</b> |                   |  |                |   |
|---|-------------------|--|----------------|---|
| NO  | Author/s          | Title  | published Year | Keywords  |
| 1   | Alsohybe, (2007)  | The Implementation of E-Government In The Republic of Yemen: An Empirical Evaluation Of The Technical And Organizational Readiness | 2007<br>Ph.D.  | e-readiness , implementation, challenges                          |
| 2   | Al-eryani, (2009) | E-Government Services In Yemen: Success And Failure Factors  | 2009           | E-services, E-government, Failure Factors, Success Factors, Yemen |
| 3   | Al-Hagery, (2010) | Basic Criteria for the Purpose of  | 2010           | e-Government, Technological                                       |

|    |   |  |              |   |
|----|---|--|--------------|---|
|    |   | Applying E-Government in the Republic of Yemen   |              | reality and information in Yemen, Challenges of e-Government in Yemen, application criteria of e-Government   |
| 4  | Al-eryani, (2010)                                     | A Model to Measure The Impact of Culture on E-Readiness for E-Government in Yemen  | 2010 – Ph.D. | Cultural elements, e-government, e-readiness, Model, Yemen  |
| 5  | Amer, (2011).   | Requirement Identification for the Development of Information Security Readiness Indicators for the Implementation of E-government in Yemen.                         | 2011- Ph.D.  | Not found   |
| 6  | Al-eryani, & Rashed, (2012)                           | The Impact of the culture on the e-readiness for e- government in developing countries (Yemen),  | 2012         | Cultural elements, e-government, e-readiness, Yemen   |
| 7  | Al-wazir, & Zheng, (2012)                             | E-government Development in Yemen: Assessment and Solutions  | 2012         | E-Government Development Index, Human Capital Index, Least Developed Countries, Online Services Index, Telecommunication Infrastructure Index, Yemen. |
| 8  | Al-hashmi, & Suresha (2013)                           | Evaluating the Awareness of E-government in the Republic of Yemen  | 2013         | E-government, Awareness, Yemen, demographic variables   |
| 9  | Al-haimi, Dahlan, & Hujainah, (2014)                  | The Requirements Towards the Development of the E-government Service Model in Improving E-services for Ministry of Higher Education and Scientific Research in Yemen | 2014         | E-government; E-services; E-government Service Model; MoHESR, Yemen   |
| 10 | Al-wazir, and Zheng, (2014)                           | Factors Influencing E-government Implementation in Least Developed Countries: A Case Study of Yemen.   | 2014         | Adoption, external assistance, least developed countries, portal websites, Yemen  |
| 11 | Al-Aghbari, Abu-ulbeh, Ibrahim, & Saeed, (2015)       | The Readiness and Limitations of E-Government in Yemen   | 2015         | E-Government; E-Readiness; E-Government Challenges  |
| 12 | Al-Wali, (2015)                                       | E-Governance and its Impact on the Government Performance and the Reduction of Financial and Administrative Corruption in Yemen,                                     | 2015 Msc     | Yemeni e-Government, e-Governance, e-Government adoption, ICT, information society, e-Services  |
| 13 | Almutawkkil, Alsohybe, Al-shaibany, & Algabri, (2016) | The Development of Electronic Commerce Services (G2C) by the Government of Yemen: Investigating Barriers and Suggesting Solutions                                    | 2016         | E-Government, G2C, Yemen, eRial.  |
| 14 | Garad, Suyoto, & Santoso, (2017)                      | Analysis and Design of Cloud Computing for E-government in Yemen   | 2017         | Cloud Computing, e-government; Information Technology, Analysis and Design e-government, e-government of Yemen.                                       |
| 15 | Alhammadi, (2018)                                     | E-Government as an Anti-Corruption Tool in Yemen:  | 2018         | Corruption, ICT, E-government, Combating Corruption,  |

|    |                                  |  |      |   |
|----|----------------------------------|--|------|---|
|    |                                  | Citizens' Perspective  |      | economic growth, Yemen  |
| 16 | Alhammadi, and Alhadramy, (2018) | The Role of E-government in Combating Corruption in the Public Sector in Yemen | 2018 | Corruption, ICT, E-Government, Combating Corruption, Monopoly Power, Discretion, Transparency, Yemen. |
| 17 | Atef, and Al Mutawkkil, (2019)   | E-government Maturity Model: Developing Countries (Yemen)                      | 2019 | Yemen; E-government ; maturity models; stages, transaction  |

**Second step**

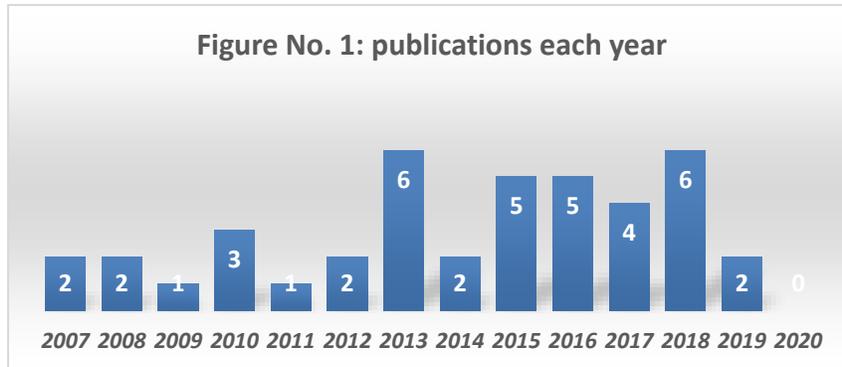
The second step of searching was based on the words (Yemen + e-service) in the title AND /OR keywords. e-service word was exchanged with the words: e-banking, e-commerce, e-learning, e-readiness. More search was on the keywords (Yemen + internet AND/ OR websites) in the title AND /OR keywords, furthermore, the investigation was done to ensure their aims are toward e-government services in Yemen. The final search was based on the keywords (Yemen + ICT) in the title AND /OR keywords, this research was also investigated to ensure their aim is toward e-government services. The result was 24 research as shown in table no. 2. That means the total of the volume of the published works is 41.

| <b>Table no. 2: published words based on the words (Yemen +( e-services AND / OR internet, websites), (Yemen + ICT)</b> |  |  |                |   |
|---|--|--|----------------|---|
| NO  | Author/s                               | Title  | Year published | Keywords  |
| 1   | Zolait, Sulaiman, & Alwi, (2007)       | Internet Banking Adoption In Yemen: An evaluation of Banks' Websites   | 2007           | Internet Banking, Bank Websites Evaluation, Yemen   |
| 2   | Al-eryani, Rashed, & Abu Shama, (2008) | The Impact of the Culture and Social Customs on the E-readiness in Yemen.  | 2008           | Culture, E-readiness, Social Customs, Yemen.  |
| 3   | Zolait, Sulaiman, & Alwi, (2008)       | Prospective and challenges of internet banking in Yemen: an analysis of bank websites                                | 2008           | Internet Banking, IB, bank websites evaluation, developing countries.                                   |
| 4   | Zolait, Ibrahim, & Farooq, (2010)      | A study on the Internet Security and its Implication for E-commerce in Yemen   | 2010           | E-Commerce, Information Technology, Internet, Internet Security, Yemen                                  |
| 5   | Al-Ajam, and Nor, (2013a)              | Adoption of Internet Banking by Yemeni Consumers: An Empirical Investigation   | 2013           | Internet banking, Technology acceptance, Innovation diffusion theory, Structural equation modelling     |
| 6   | Al-Ajam, & Nor, (2013b)                | Customers' Adoption of Internet Banking Service: An Empirical Examination of the Theory of Planned Behavior in Yemen | 2013           | Internet banking, Consumer behavior, Theory of planned behavior, Structural equation modelling.         |
| 7   | Alawi, & Nasreen, (2013)               | Impact of E-Learning and Information and Communication Technology (ICT) on Learning in Taiz University               | 2013           | E-Learning, ICT, Structural Equation Modelling, Learning  |
| 8   | Al-Ajam, & Nor, (2013c)                | Predicting Internet Banking adoption Determination in Yemen using Extended Theory of Reasoned Action                 | 2013           | Internet banking, Theory of reasoned action, behavioral intention, structural equation Modelling, norms |
| 9   | Rashed, Santos, & Al-Eryani, (2013)    | Determinants of behavioral intention to mobile banking: Case from Yemen.   | 2013           | Technology acceptance models, Mobile Banking, Arabic culture.   |

|    |   |  |             |  |
|----|---|--|-------------|--|
| 10 | Al-eryani, & Alaraki, (2015)                          | Banking e-services Requirements in Yemen   | 2015        | e-services, requirements, banking  |
| 11 | Aldowah, Ghazal, & Muniandy, (2015)                   | Issues and Challenges of using E-Learning in a Yemeni Public University  | 2015        | E-Learning, Public University, Yemen   |
| 12 | Al-Fadhli, Othman, Rashed, & Ramasamy, (2015)         | Telehealth in Yemen: An Overview and A Proposed Model  | 2015        | National dialogue conference, healthcare, ICT  |
| 13 | Abdullah, White, & Thomas, (2016a)                    | Conceptualising a New Stage Model of Electronic Business Adoption in Yemeni SMEs   | 2016        | Stage model, e-business, Yemen, SMEs   |
| 14 | Abdullah, Thomas, & Metcalfe, (2016b)                 | Measuring the e-business Activities of SMEs in YEMEN   | 2016        | e-Business, e-commerce, Measurement Evolution Model, SMEs and Yemen.   |
| 15 | Isaac, Abdullah, Ramayah, Mutahar, & Alrajawy, (2016) | Perceived Usefulness, Perceived Ease of Use, Perceived Compatibility, and Net Benefits: an empirical study of internet usage among employees in Yemen    | 2016        | Net benefits, internet usage, perceived compatibility, TAM, Yemen  |
| 16 | Alrajawy, Daud, Isaac, & Mutahar, (2016)              | Mobile Learning in Yemen Public Universities: Factors Influence student's Intention to Use   | 2016        | Mobile Learning, Subjective norms, Self-efficacy, TAM  |
| 17 | Isaac, Abdullah, & Mutahar, (2017)                    | Internet Usage within Government Institutions in Yemen: An Extended Technology Acceptance Model (Tam) with Internet Self-Efficacy and Performance Impact | 2017        | Internet usage, Performance impact, Internet self-efficacy, TAM, Yemen   |
| 18 | Al-Absi, Peneva & Yordzhev, (2017)                    | Student's Readiness for E-learning in the Universities in Yemen  | 2017        | Information technology; higher education; e-learning; questionnaire research   |
| 19 | Alragawi, & Zahary, (2017)                            | Obstacles and Opportunities for Yemeni Students to Use Mobile Learning   | 2017        | Mobile learning (M-learning), Electronic learning (E-learning), Information and Communication Technology (ICT), distance learning, Smart phone |
| 20 | Alragawi, & Zahary, (2018)                            | The acceptance of Moodle Mobile in Smartphones - Case Study – Al-Andalus University  | 2018        | Mobile learning (M-learning), Learning Manage.   |
| 21 | Aldholay, Abdullah, Ramayah, Isaac, & Mutahar, (2018) | Online learning usage and performance among students within public universities in Yemen   | 2018        | online learning, DeLone & McLean DMISM, DeLone & McLean information system success model, performance, higher education, Yemen.                |
| 22 | Isaac, Abdullah, Ramayah, & Mutahar, (2018)           | Factors determining user satisfaction of internet usage among public sector employees in Yemen   | 2018        | internet usage; user satisfaction; diffusion of innovation; DOI; Yemen.  |
| 23 | Ashbi, (2018)   | Mobile Banking adoption in Yemen- An empirical study using Unified Theory of   | 2018 Master | Mobile Banking, Yemen, Unified Theory of Acceptance and Use of Technology, Adoption of   |

|    |                                   |   |      |   |
|----|-----------------------------------|---|------|---|
|    |                                   | Acceptance and Use of Technology (UTAUT)            |      | technology  |
| 24 | Thabit, Alhomdy, & Jagtap, (2019) | Toward a model for cloud computing banking in Yemen | 2019 | cloud computing, banking management, on-demand services, scalable infrastructure, cloud computing banking, Yemeni banks |

**The number of publications per year**



According to figure no.1, the attention started to grow up since 2013. On the other hand, 2019 showed a sharp decrease. In addition, no published work has been found until September 2020. However, the number of published research was low compared with other countries (Dombeu, Vincent, & Nelson, 2014).

**Master’s dissertations and Doctorate theses**

In this study, only three Ph.D. theses have been found (Alsohybe, 2007; Al-eryani, 2010; Amer, 2011) and two Master dissertations (Ashbi, 2018 ; Al-Wali, 2015). This low number shows the lack of interest of doctoral and master's students in studying and examining the field of e-government, despite the multiplicity and importance of this field. We cannot conclude the reasons behind that, however, two main factors may be mentioned. The first factor the bad conditions that Yemen has been going through for a long time have made e-government a field far from the researchers’ interest. The second factor is the government’s failure to adopt a vision to support the existing e-government activities and try to guidance, postgraduate students, towards this field and motivate them to help the government overcome obstacles and the reasons behind the weakness of e-government applications that have been trying to exist since 2003. In addition, some of these research may not have been published through internet media, as a result, they were out of reach.

**Domains of Yemen e-government published research**

To build e-government research's domains for the current research, the author processed the keywords as follows: The keywords have been listed as a data column given a total of 170, then the data column has been sorted and the duplicated words have been removed to come up with a total of 72 unique keywords. The classification has been made to the resulted unique keywords and four homogenous domains have been created as follows:

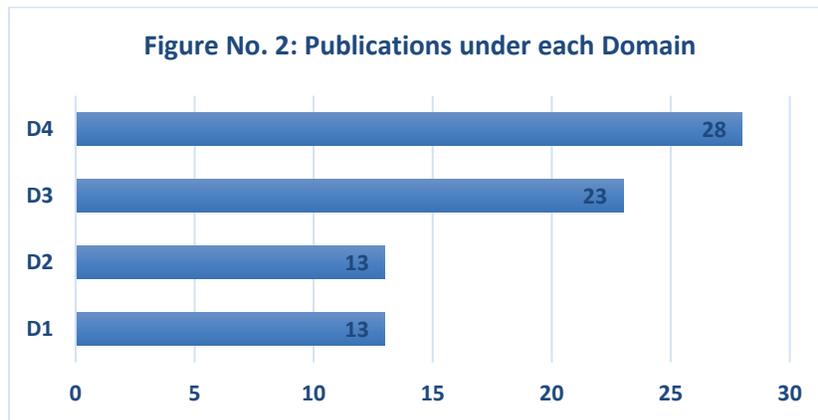
- D1: e-government model.
- D2: e-government implementation, infrastructure, and ICT.
- D3: e-government readiness, awareness, adoption, and participation.
- D4: e-government services, challenges, security, and transparency.

Finally, the publications have been distributed among the groups, taking into consideration the overlap of the interrelated objectives to each other and the multidisciplinary fields (Yusuf, Adams, & Dingley, 2016).

### Review on e-government domains

The publications have been distributed among the domains shown in table no. 3 and figure no. 2.

| <b>Table no. 3: The Publications and their Domains</b> |    |    |    |    |
|--|----|----|----|----|
| Research reference                                     | D1 | D2 | D3 | D4 |
| Alsohybe, (2007)                                       |    | ✓  | ✓  |    |
| Al-eryani (2009)                                       |    |    |    | ✓  |
| Al-Hagery, (2010)                                      |    | ✓  |    | ✓  |
| Al-eryani, (2010)                                      | ✓  |    | ✓  |    |
| Amer, (2011)   | ✓  |    | ✓  |    |
| Al-eryani, & Rashed, (2012)                            |    |    | ✓  |    |
| Al-wazir, and Zheng, (2012)                            |    | ✓  |    | ✓  |
| Al-hashmi, & Suresha (2013)                            |    |    | ✓  |    |
| Al-haimi, Dahlan, & Hujainah, (2014)                   | ✓  |    |    | ✓  |
| Al-wazir, and Zheng, (2014)                            |    | ✓  | ✓  |    |
| Al-Aghbari, Abu-ulbeh, Ibrahim, & Saeed, (2015)        |    |    | ✓  | ✓  |
| Al-Wali, A. (2015)                                     |    | ✓  | ✓  |    |
| Almutawkkil, Alsohybe, Al-shaibany, & Algabri, (2016)  |    |    |    | ✓  |
| Isaac, Abdullah, Ramayah, Mutahar, & Alrajawy, (2016)  |    |    | ✓  | ✓  |
| Garad, Suyoto, & Santoso, (2017)                       |    | ✓  |    |    |
| Alhammadi, (2018)                                      |    |    | ✓  | ✓  |
| Alhammadi, & Alhadramy, (2018)                         |    |    | ✓  | ✓  |
| Atef, & Al Mutawkkil,(2019)                            | ✓  |    |    | ✓  |
| Zolait, Sulaiman, & Alwi, (2007)                       |    | ✓  |    | ✓  |
| Al-eryani, Rashed, & Abu Shama, (2008)                 |    |    | ✓  |    |
| Zolait, Sulaiman, & Alwi, (2008)                       |    | ✓  |    | ✓  |
| Zolait, Ibrahim, & Farooq, (2010)                      |    | ✓  |    | ✓  |
| Al-Ajam, & Nor, (2013a)                                | ✓  |    | ✓  | ✓  |
| Alawi, & Nasreen, (2013)                               | ✓  | ✓  |    | ✓  |
| Al-Ajam, & Nor, (2013b)                                | ✓  |    | ✓  | ✓  |
| Al-Ajam, & Nor, (2013c)                                | ✓  |    | ✓  | ✓  |
| Rashed, Santos, & Al-Eryani, (2013)                    |    |    | ✓  | ✓  |
| Al-eryani, & Alaraki, (2015)                           |    |    | ✓  | ✓  |
| Aldowah, Ghazal, & Muniandy, (2015)                    |    |    |    | ✓  |
| Al-Fadhli, Othman, Rashed, & Ramasamy, (2015)          | ✓  | ✓  |    |    |
| Abdullah, Thomas, & Metcalfe, (2016a)                  | ✓  |    |    | ✓  |
| Abdullah, White, & Thomas, (2016b)                     |    |    |    | ✓  |
| Alrajawy, Daud, Isaac, & Mutahar, (2016)               |    |    | ✓  |    |
| Isaac, Abdullah, & Mutahar, (2017)                     |    | ✓  | ✓  |    |
| Al-Absi, Peneva & Yordzhev, (2017)                     |    |    | ✓  | ✓  |
| Alragawi, & Zahary, (2017)                             |    |    | ✓  | ✓  |
| Alragawi, & Zahary, (2018)                             |    |    |    | ✓  |
| Aldholay, Abdullah, Ramayah, Isaac, & Mutahar, (2018)  | ✓  |    |    | ✓  |
| Isaac, Abdullah, Ramayah, & Mutahar, (2018)            | ✓  |    | ✓  |    |
| Ashbi, (2018)  |    |    | ✓  | ✓  |
| Thabit, Alhomdy, & Jagtap, (2019)                      | ✓  | ✓  |    | ✓  |

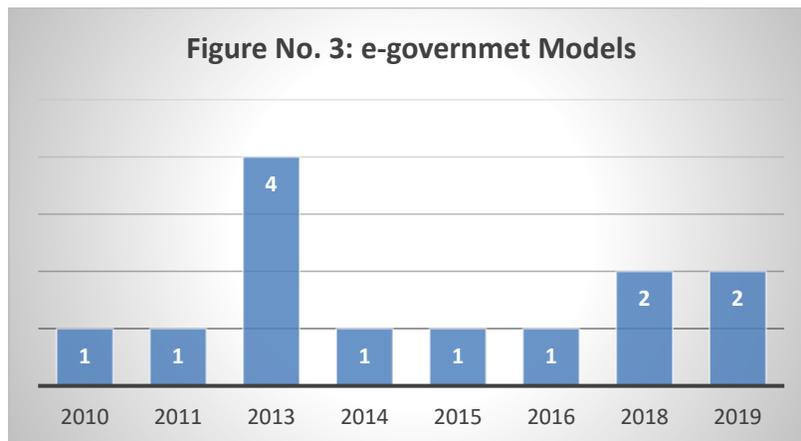


From the above figure, it can be summarized that domain No. 4 which is “e-government services, challenges, security, and transparency” was the highest studied domain. On the other hand, domain No. 3 which is “e-government readiness, awareness, adoption, and participation” got 19 published research, most of them were studying e-readiness for adopting. Moreover, domain No. 2 which is “e-government implementation, infrastructure, and ICT” is considered as one of the important domains in e-government research (Yusuf, Adams, & Dingley, 2016), however, only 13 published studies have been done based on it. Finally, domain No. 1 which is “e-government model and frameworks“ had the lowest number of publications, where only 11 published research were in this domain.

**The survey of the published works**

**1. Review on e-government models (D1)**

To ensure the successful implementation of the e-government program, it requires building a model. That could be done guided by the steps of determining and analyzing each step, in order to ensure the achievement of the objectives of the e-government project (Lusta, 2017).



From figure No. 3, it can be concluded that only 13 published research have been done based on building model during the target period as mentioned above.

Many authors conducted studies based on creating models in the field of e-government in Yemen. Al-eryani A. (2010) built a model to measure e-readiness in e-government in Yemen. Amer, (2011) developed a mathematical model that provides a new approach for assessment security readiness in Yemen.

Al-Ajam, and Nor, (2013a) proposed model includes four dimensions of Innovation Diffusion Theory (IDT), which are covering the aspects of the most important issues of Internet banking. Following that, the authors (2013b) developed a model to predict and explain customer's behavioral intentions with regard to adopting Internet banking. Finally, they (2013c) proposed a structure model to examine the relationship between attitude, subjective norm, perceived behavioral control, and customer’s intention to use internet banking service.

Alawi, and Nasreen, (2013) proposed a model, which explained the effect of ICT on e-learning. In addition, Al-haimi, Dahlan, & Hujainah, (2014) proposed an e-government service model in improving e-services for the ministry of higher education and scientific research.

Regarding e-health, only one study was found. Al-Fadhli, Othman, Rashed, & Ramasamy, (2015) proposed a high-level telehealth model that is peculiar to Yemen in terms of its existing health services, culture, geography, and ICT readiness. Abdullah, White, & Thomas, (2016a) created a conceptual model to critically evaluate the adoption of e-business activities as well as the factors that affect adoption in Yemeni SMEs.

Isaac, Abdullah, Ramayah, & Mutahar, (2018) developed an integrated conceptual model based the DeLone and McLean information systems success model (DMISM), the unified theory of acceptance and use of technology (UTAUT) and task-technology fit (TTF) to predict the user satisfaction of internet. In addition, Aldholay, Abdullah, Ramayah, Isaac, & Mutahar, (2018) extended the DeLone & McLean information system success model (DMISM) to create a comprehensive model that comprises five main antecedents.

In 2019, two models have been developed. Atef, and Al Mutawkkil, (2019) proposed a model to measure the maturity of the e-government in Yemen. Thabit, Alhomdy, & Jagtap, (2019) proposed a model for the cloud computing banking in Yemen.

## 2. Review on e-government implementation (D2)

ICT is a term used frequently by researchers to introduce the e-government umbrella, which included the coverage of communication in the form of Internet and web areas and computing. Such terms are used by researchers to cover the infrastructure supporting e-government status if offline or online (Abu-Shanab & Harb, 2019).

In early 2007, Alsohybe evaluated the technical and organizational readiness for e-government implementation. He identified the challenges facing the implementation process. In 2010 the criteria for the implementation of e-government in Yemen was studied by

The Al-Hagery' study (2010) resulted in the lack of infrastructure and disruption of the national economy's structure, limited resources, and reflection on existing information age components.

Al-wazir and Zheng (2012) studied the national project for information technology that has established the portal for e-government. They identified the main problems such as the portal contains many links to different organizations in the government, however, many links are not operational, and the contents are not up-to-date. In addition, for each ministry, there is a private website that was not linked to the portal. Due to such problems, Yemen has got a low point on the online service index.

Alawi, and Nasreen, (2013) examined the underlying relationships between e-learning and ICT promoting online higher education teaching; the findings showed that the use of e-learning and ICT techniques is becoming more common in higher education; and students make use of them mainly as a means of educational technology and research via internet.

In 2014, Al-wazir, and Zheng, studied the e-government implantation. The results showed the existence of ICT infrastructure (computers, network, database), as well as training, although that, this technology was not used in a large domain. The study showed that employees are using social networks more than using government portals or internal databases. This is due to a lack of leadership and managing technology. According to the authors, e-government implementation cannot be succeeded by providing only networks, training, software, and hardware, but government leaders should ensure using them by their employees.

The indicators of the current situation of ICT in Yemen are humbled and the efforts are concentrated to create a proper infrastructure and the formulation of policies and strategies as reported in Al-wali, (2015).

Almutawkkil, Alsohybe, Al-shaibany, & Algabri, (2016) studied the status of the electronic commerce services implemented by the public sector in Yemen. The results showed that the economy, the high illiteracy especially in rural areas, the mistrust between government agencies and citizens in using e-services, and the unavailability of appropriate legislation and policies are the main barriers to implement e-commerce.

Garad, Suyoto, & Santoso, (2017) analyzed the impact of using cloud computing in e-government and infrastructure required for it to be used in e-government in Yemen. The results showed that there are many challenges facing the implementations of using cloud computing in e-government. The main problems that face the development of e-government in Yemen are political stability, awareness of the importance of e-government, and lately, conflicts and wars. The reality of e-government in Yemen still has many problems and difficulties according to the authors.

Al-Fadhli, Othman, Rashed, & Ramasamy, (2015) attempted to find solutions to improve the quality of Yemen's healthcare services through telehealth technology. Various reforms are underway to improve the current health care indicators. ICT infrastructure needs to be assessed strategically for the successful implementation of telehealth in Yemen.

A recent study by Atef, and Al Mutawkkil, (2019) about the reality of Yemen e-government's situation and determines its maturity stage based on maturity models. Yemen e-government still in stage one (catalog). Thus, e-government in Yemen needs to move to the next stage which is the transactions. As a result, Yemen needs hard and fruitful work to reach a fruitful success that all its citizens can be touched.

## 3. Review on e-government readiness (D3)

e-readiness is one of the most important factors that has been addressing by researchers in the field of e-government. By assessing to which degree of cultural factors are present and effective in the society, that helps find a significant effect on the e-government readiness, adoption, participation, and awareness in using e-government (Sabri, 2012). From this researches, the government will be able to identify the weakness and strength points to manage the e-government projects and will help to achieve the readiness required toward a successful implementation of the e-Government systems.

e-readiness has been investigated and addressed by many Yemeni authors. In 2008, Al-eryani, Rashed, & Abu Shama, (2008) investigated the impact of the culture and social customs on the e-readiness, the results showed that Yemen still far from making its citizens e-ready for the e-government services. On the other hand, in 2012 Al-eryani, and Rashed, (2012) studied the impact of the culture on the e-readiness of e-government in Yemen. The results of the survey at this time showed that there are some positive indicators for e-readiness in Yemen, these positive indicators were due to the starting of the existence of some government websites.

In 2008, Zolait, Sulaiman, & Alwi, (2008) measured the intendency of banks in Yemen towards Internet banking adoption. This study concluded that the presence of some basic features in the Yemeni banks' web technology, which is very necessary but have still little use in the time of the research.

Rashed, Santos, & Al-Eryani, (2013) evaluated mobile banking regarding user acceptance, through the Technology Acceptance Model (TAM) in Yemen. The result showed the gap between accepts the new technology as an idea and the actual use of it.

Al-hashmi, and Suresha (2013) examined the awareness of e-government in Yemen, the results revealed a low awareness of the use of e-government in Yemen. Yemeni culture affects the participation in using e-government, especially, females, and this supported Aleryani (2010) study.

The study in 2014 showed that most of the government employees in Yemen do not sufficiently use the technology in their job (Al-wazir, and Zheng, 2014)

Al-Wali (2015) measured the impact of e-governance on the Yemeni government's performance and the reduction of corruption. He identified the readiness of Yemeni people towards the adoption of e-government. The results showed that Yemen has a combination of religious, social, economic, and political contradictions, which made the situation very complicated for adopting e-government. The study showed that the Yemeni people are not completely ready to adopt the e-Government due lacked the trust in the government.

Regarding e-learning readiness, Al-Absi, Peneva & Yordzhev, (2017) measured student's readiness for e-learning in Yemeni universities. The result showed that there are many problems such as lack of investment in physical assets; lack of qualified academic staff. This leads to reducing the student's readiness for e-learning. Alrajawy, Daud, Isaac, & Mutahar, (2016) investigated the impact of subjective norms and self-efficacy on the intention to use Mobile Learning among students in Yemen's public universities where the technology acceptance model (TAM) is used as an underpinning theory. The results recommended that the technology acceptance model (TAM) is a valid model that can be used to predict intention to use Mobile Learning among university students in Yemen. However, Yemeni students showed the ability to use the technology for learning (Alragawi, and Zahary, 2017 ; Alragawi, and Zahary, 2018).

Ashbi, 2018 studied the drivers, benefits, challenges, and the extent of using mobile-banking in Yemen. The general result showed that a big challenge faced by the bank is gaining the trust of customers and being able to provide a consistent and reliable service, especially in the current economic and political situation.

#### **4. Review on e-government services (D4)**

E-government is defined in its simplest form as the use of ICT tools and applications to provide better services to citizens and businesses (Abu-Shanab & Harb, 2019) that includes other terms that attracted more research are security, privacy, and e-service.

Many researchers stressed the importance of the quality of the e-services to influence and gain customer value (Redda, and Surujlal, 2017).

Al-eryani A. (2009) used semi-structured interviews with top management in several e-government projects to evaluate the e-government services in Yemen and understand the success and failure factors. The failure factors that were identified were the ambiguous vision of the conceptual of the e-government, the absence of the readiness and awareness among the employees and the citizens. On the other hand, the success factor was tries to reduce the gap between the citizens and technology culture and skills.

The encryption technology still unfamiliar by most companies and banks and most companies do not use firewalls to protect the information assets that they possess as reported by Zolait, Ibrahim, & Farooq, (2010). However, in 2013 Al-Ajam, and Nor, (2013a) examined empirically the factors that affect the acceptance of Internet banking and the results showed several important implications for Internet banking adoption research and practice.

Al-Aghbari, Abu-ulbeh, Ibrahim, & Saeed, (2015) surveyed the challenges that hinder the growth of e-government services by reviewing e-government studies in Yemen and summarised the challenges by grouping them into three categories: the challenges of the

organization, technique, and adoption. More studies have been addressed the e-banking, for instance, Al-eryani, and Alaraki, (2015) investigated the availability of the essential requirements for e-banking adoption in Yemen. The results showed that the infrastructure requirements are the strongest points, on the other hand, requirements related to employees and clients are the weakest points.

In 2016, Abdullah, Thomas, & Metcalfe, (2016b) measured the e-business activities of SMEs in Yemen, the results indicated that the SMEs are at the early stages of e-business adoption. They studied the factors that affect adoption in Yemeni SMEs. The results described the current state of e-business adoption in Yemen SMEs through the e-business measurement evolution model, 50% of SMEs were "not started" stage while 57% were "email" stage, 78 percent, however, have social media and are using it to promote their products and services. Many SMAs have their own website and just 39 percent use e-commerce for purposes such as obtaining orders and managing them manually and accepting payment by bank transfer or cash.

Regard e-learning Aldowah, Ghazal, & Muniandy, (2015) identified and addressed the major issues and challenges faced by a public university in Yemen in establishing e-learning as a successful medium of imparting learning process. Results showed that all the obstacles could be categorized into five dimensions, which are human constraints, administrative constraints, technical constraints, financial and physical constraints.

Alhammedi, 2018 , Alhammedi, & Alhadramy, (2018) studied the relationship of e-government and corruption. The results of the research revealed that the use of ICT in the form of e-government could make important headway to reduce corruption.

## V. RECOMMENDATIONS AND CONCLUSION

### A. Recommendations

#### **Future studies recommended by the identified studies**

The areas that need extensive studies according to the recommendations of the researchers are as follow:

Al-Aghbari, Abu-ulbeh, Ibrahim, & Saeed, (2015) recommended studying more on challenges such as Internet cost and low income and IT literacy, awareness, trust, security, complexity, website design, and website content. In addition, Abdullah, Thomas, & Metcalfe, (2016b) recommended more investigation on the barriers and drivers that deter SMEs from adopting e-business was Aldowah, Ghazal, & Muniandy, (2015) suggested many areas for the upcoming study, for instance, conduct a follow-up study on faculty members' uses of e-learning systems in learning and teaching at any public university in Yemen. Moreover, Al-Fadhli, Othman, Rashed, & Ramasamy, (2015) recommended more studies of the ICT developments in Yemen to cater for telehealth.

#### **Future studies recommended by the international literature studies**

There are some topics that researchers in the international literature have dealt with in the field of e-government that have not been studied within the e-government research in Yemen (Mahmoudzadeh, Zende, & Askarnia. 2015; Janom, and Zakaria, 2009; Aljarrah, Elrehail, & Aababneh, 2016 ; Yusuf, Adams, & Dingley, 2016, Scholl, 2007 , Abu-Shanab & Harb, 2019 , Sarantis, 2019, Cheng San, Choy Yee, Moorthy, & Lee. 2017) for instance, as follows:

- E-democracy.
- M-government.
- E-voting.
- E-government Legal Framework.
- Smart cities.
- E-payment.

#### **Author Recommendations**

For the same purpose of the current research, the author suggests a further study include the research that is written in Arabic and in foreign languages (other than English) if at least abstracts have been translated into Arabic. The author also recommends that all the researchers upload their Ph.D. and Master's theses to the proper internet location to be available to the researchers. Moreover, it is also recommended that attention be paid to future studies suggested in this study.

## B. Conclusion

To summarize that, it becomes clear the importance of e-government research and its necessity to provide the government with what are the requirements to implement more optimal and more effective e-services (Abu-Shanab and Harb, 2019 ; Sarantis, 2019 ; United Nations Division for Public Institutions and Digital Government 2020). Since the 2020 crisis has put public services under stress,

governments are urged to deploy effective digital technologies to contain the outbreak. This discovers the need for more research on e-government issues. Moreover, the crisis 2020 has exposed the need for government leadership in the development and adoption of new technologies to ensure an effective provision of public services (United Nations Division for Public Institutions and Digital Government 2020). It is responsible for the researchers to support the government in doing vital research to investigate the proper technology to be adopted.

Regarding e-government research in Yemen, the results of the research on e-government and its services are appreciated, where the 41 studies have covered important areas within e-government. The researchers reached good results that can be used and understood the reality of e-government in Yemen and its development. There is no doubt that the wars and crises that Yemen is going through have diminished interest in e-government research, and on the other hand, the lack of benefit from these research diminished the enthusiasm of the researchers to continue their research in the field of e-government.

Compare to the research landscape in other countries (Dombeu, Vincent, & Nelson, 2014) it appears that the e-government research landscape in Yemen needs more attention. In addition, the research should be linked to clear plans and targeted policies by the government to benefit from the researchers' work. It is recommended the need for researchers to work collectively to cover areas that deserve study.

## Study limitation

The published papers that are subscription-based on pricing have not been included.

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# Challenges Faced By The Media In Reportage Of Terrorism Activities In Mandera County - Kenya

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**Abstract-** The media both National and International face a myriad challenges as they grapple with the news whose subject matter is terrorism. There is a need for news stories which sell well to the population vis-à-vis the challenge of how much and in what manner should such news be broadcasted to the public. The media in one way or the other have ended up advancing the agenda being pursued by the terrorists knowingly and sometimes unknowingly. The media want profits from the news they report and so sometimes they through caution to the wind and aid the terrorists in their achieving of the agenda of sustained exposure or publicity in the media. Moreover, media in the process of news gathering face a number of challenges as it will be discussed in this paper. The objective of this study was to examine the challenges faced by media in reportage of terrorism activities in Mandera County. It was established that most of the media broadcasts relating to terrorism journalism were war or violence oriented and to a greater extent, media content opposed efforts aimed at fighting terrorism. The resultant effects included radicalization and youth recruitment into Al-Shabaab, poor infrastructural development, and increased hatred for Security Agencies. The study was motivated by the need to inform the drafting of new policies and guidelines and the re-drafting of existing policies regarding to the broadcast of terrorism activities.

**Index Terms-** Reportage of Terrorism, Challenges, Media

## I. INTRODUCTION

The media are alive to the fact that, they will encounter challenges while undertaking their duties of news gathering. These challenges vary from one set up to the other depending on how that particular community is endowed with resources which may be organic or inorganic. The Citizens usually may not be privy to the challenges the media go through to present news in time. They audience is always in need of timely, accurate and interesting news.

McQuail (1987) argues that there is evidence which postulates that the population or citizens have a tendency to think about issues they listen or watch in the media. The challenges and dilemmas that come out as a result of this are usually clear to everyone. Audiences expect the press to inform them as accurately and consistently as possible without sensationalizing the news.

Whilst analyzing the ideal situation in relation to the actual situation, one will get to an understanding that presenting terrorism in a manner that clearly rejects violence, demystifies assassins and emphasizes victims' personal tragedies is an

essential resource in any type of multi-pronged strategy that combats terror. However, a problem comes up when media gets controlled by certain ideological, cultural or religious conniving thereby beginning to look for an imagined balance between murderers and victims; when the causes being championed by certain terrorist groups are justified against others; or when a story is treated in such a way that it gives the viewer the impression that terrorist groups are political participants that deserve certain legitimacy in the competition for power. Past research studies indicate that the media is a vital component for the terrorists to perpetuate and spread fear onto large audiences than the small group of victims of a terrorist act. It is a special means of attracting and maintaining the audience's attention and consequently passing over the messages of the terrorists group.

A question arises on what the responsibility of journalists would be when they supply the oxygen of publicity to terrorists. Any form of journalism which engages itself in reporting, analyzing and commenting on terrorism is faced with a challenge of creating responsible, intelligible and accurate narratives about terrorism. Journalists also face enormous challenges which relate to the wider practices of journalism especially when it comes to matters to do with breaking news and generally conflict journalism (Rodgers, 2012).

The world stares at a challenge of sensational reporting of terrorist news in a simplistic way and in a rush thus rendering the role of professional journalism irrelevant and diminished. The news on terrorism in a click of a button are digitally available raw with no regard for professional journalistic ethics courtesy of the digital platforms. For the first time in the year 2016 the month of February, the government of the US invited social media executives to help in generating ideas on how to counter terrorists' use of the internet to broadcast their messages. A number of Executives who attended came from Facebook, Snapcht, Tumblr, and Google. Twitter, Instagram and Microsoft attended the forum (New York Times, 2016).

The world's concern is that the media are involved in the broadcast of news on terrorism in such a way that the news spread fear and confusion among the viewers or readers as well as listeners. Journalists struggle to catch up with the fast revolving wheel of terrorism. The fast revolving cycle of terrorism news is fast and often complex. This is more complicated especially when it comes to reporting on breaking news where journalists have to contend with the speed and complexity of the way information flow which is usually dictated by government authorities, the social media practitioners and even the terrorists themselves (Beckett, 2016).

## II. LITERATURE REVIEW

It should be clear to everyone concerned that in the United States of America, faith in American press has plunged to its new low. At such moment in time when the press is faced with enormous economic challenges, we must work tirelessly towards rebuilding the public's confidence in the media. The audiences have so many options to access news and so many disruptions from journalism. Terrorists know how to put to test all systems of government and public ones. Improving reportage on terrorism is vital because these extremist activities are prominent matters of concern and results into enormous challenges around the globe. The need to have in place informed, trained and skillful human resources able to report judiciously on terrorism is crucial. This is not just a moral appeal but a requirement and a necessity. It is an opportunity to showcase to the world that journalism is and it retains the central spot it occupies in the modern society (Beckett, (2016).

Omoera and Ake (2016) conducted a study on extremists' violence and how the media faces enormous challenges while undertaking the task of reporting on terrorism activities in Nigeria. Reporting terrorism or extremists' violence poses a host of difficulties and dilemmas for media experts, data managers and other state actors who are charged with the duties of delivering data objectively, responsibly, and appropriately to guarantee efficient communication of growth in society.

Similarly, insurgent or terrorist groups are spreading their excessive causes, transmitting their radicalization messages, and gaining popular assistance, recognition, and legitimacy through media channels like handbills, internet, radio, and film. Media or media experts in terror acts have accidentally become accomplices or victims or threatened species. Nevertheless, they are obliged to report the events irrespective of the consequences for the audience. Indeed, it was asserted that the sensational reporting and excessive dramatization of the media operations of extremist groups propagates further terrorist acts (Omoera & Ake, 2016).

Pressure which is often directed onto the media to broadcast news which is premised on terrorism does not necessarily mean that the terrorist organizations have taken total control on the media. However, it does indicate that there is always an obligation for the press to remain constantly seized by the moment to discern and refuse the manipulation of terrorists. As much as the audience pressures the media to reveal sensitive information, the media has to know the limits of the type of information to release to the public so as not to be part of propping the terrorists' agenda (Wilkinson, 1997).

Martin (2010) remarked that there exists in the world a commonly referenced quote that the person who has information has the power. Therefore, the audience needs the information to be in the position of being able to know what is happening around them. Terror attacks are often instigated on the innocent civilians so that the terrorists are able to attract media attention who will report on their heinous acts thereby drawing the audience's attention and sustaining it. Media are ever working hard to resonate well with their audiences. Television stations work extra hard through presenting sensational news so as to attract as many viewers as possible, newspapers work hard towards attracting their target audience and websites try to attract visitors onto their websites through presenting dramatic news.

Perspective from which a story is reported is significant to both the viewers and the terrorist organizations. Those in the media industry should prudently utilize the limited time they have at their disposal to assess and determine what kind of news stories to disseminate and in what manner it should be published. The highly sensitive news which the population might find upsetting is crucial that the editors give a sober and rational interpretation of the facts. Personal biases on terrorism matters are under the personal influence of the editor whom their cultural, political and personal biases are reflected in the news they present to their audiences (Martin, 2010).

Media has to sacrifice on providing the breaking news aspect on the basis that they have to broadcast well researched news based on facts. The media has to substitute the breaking news with factual news. Therefore the element of prompt news or immediate news has to be sacrificed at the expense of factually established news. The hurry to publish news often will elicit unnecessary fear in the public while at the same time encouraging more terrorist attacks through the sustained media coverage which the terrorists desperately crave for (Martin, 2010). The media ought to take to account the obligation they have in responsibly accurately informing citizens regarding activities on terrorism whenever they occur.

Mark Blaise is a renowned Dutch critic of the media who believes that the media have become predisposed to immense pressure from the environment and this pressure tends to suppress objective and accurate reporting. He further suggests that the main driving objective of their reporting is the creation of more profits. All the media is looking for in their quest to inform is creation of profits through mobilizing audience viewership and readership (Blaise, 1992).

Blaise (1992) once retorted that if one has enough finances, he/she will be capable of buying all the newspapers, radio stations and TV stations they want. Media concentrates its coverage on the predominant form of terrorism in that period of time. For instance, from about the 1960s to the 1980s, the news broadcasted covered mainly the extreme right and left pre-independence political movements. As much as the right and left extremists terrorism has not completely disappeared, currently though the media focuses much on religiously-inspired terrorism since it attracts bid audiences. This kind of media coverage is usually aimed at reporting on instigated by organizations claiming to follow Islam, which generates the widest media coverage.

The manner in which terrorist news are reported has immense effects on the future of terrorist actions, the way governments will react once an attack has happened and the general public's opinion. Journalists' way of reporting constitutes description of the violence as witnessed in the terror activities, how they are emphasized, how they are structured or formulated and how unique these activities indeed are. It is from this arising scenario that we can make conclusions that there is a critical relationship which the media complements between the terrorists, states/Government administrations and the public in general (Paletz & Tawney, 1992).

Global media, including the African media, is confronted with serious challenges of how to disseminate terror messages without aiding terror acts/terrorists or being victims. It is in this connection that we examine some of the challenges the African

media professionals face and some strategies to remediate them (Iqbal, (2015).

### III. METHODOLOGY

This paper adopted a descriptive research design. Descriptive research is directed at making careful observations and detailed documentation of a phenomenon of interest. These observations must be based on the scientific method and therefore, are more reliable. The study was carried out in Mandera County. Mandera County is found in the former North Eastern Province of Kenya. Its capital and largest town is Mandera town. The county has a population of about 867,457 (2019 census) and an area of 25,797.7 km<sup>2</sup>.

The study population included both residents and non-residents in Mandera County. The target population constituted Mandera County Officials, the NPS personnel, KDF personnel, media personnel (both local and international media representatives in Mandera County), NIS personnel as well as officials from NGOs, FBOs and CBOs. Simple random sampling was used to obtain respondents from within the general population of Mandera County. Purposive sampling was used to obtain key informants from the population of officials from Mandera County Government, the NPS personnel in Mandera County, KDF personnel, local and international media representatives in Mandera County, NIS personnel and officials from NGOs, FBOs as well as CBOs within Mandera County. A sample size of 384 was calculated using a formula proposed by Fisher (1998) which is:  $n = \frac{z^2 pq}{d^2}$

$$d^2$$

The study used mix method technique in data collection where both primary and secondary data were collected. The research instruments for primary data collection were questionnaires while secondary data was obtained by use of key informant interviews and FGDs. The interview schedule, FGDs and questionnaires were developed with special focus on achieving the research objective. Questionnaires with both closed and open ended questions were used in this study. The interviews conducted in this study were key informant interviews where the respondents were selected purposively. Information from key informants was obtained through inquiry and recorded by researchers. Structured interviews were performed by use of open interviews; the researcher taking notes while talking with respondents.

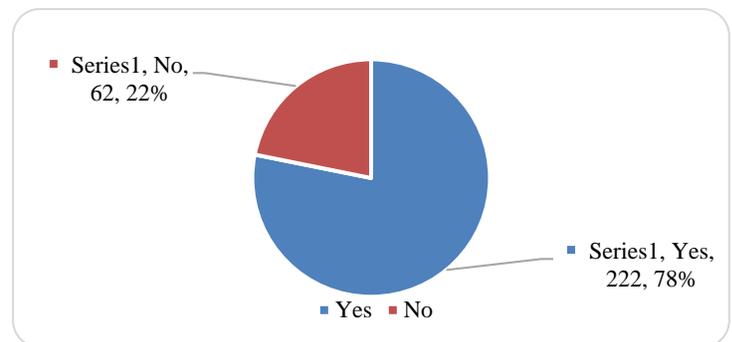
To ensure validity and reliability of the research instruments, the researcher conducted a pilot study in the following places: Elwak, Lafey, Fino and Omar Jillo prior to the actual data collection. All resulting discrepancies were corrected to ensure that the results remain the same as if the research was to be repeated under similar circumstances. The study also made use of the supervisors and MMUST Research Experts who ensured that the research instruments were valid and reliable.

The researcher used mixed (qualitative and quantitative) approaches of data analysis to provide the researcher with an ideal method needed for descriptive explanation. Quantitative data underwent the process of data management. Thereafter, the data was coded and entered into a computer software program-Statistical Packages for Social Sciences (SPSS) for analysis.

Qualitative data was analyzed using summary sheet by compiling specific phrases and key words used by respondents in description of scenarios to represent themes. The researcher used short abbreviations as descriptive codes to label data, usually a comment from key informants, under an appropriate category such as numeric codes are organized around relevant ideas, concepts, questions, or themes. Similarities and differences were sorted out then merged into larger categories then further into sub-themes. The results were presented in form of tables, charts and graphs.

### IV. STUDY FINDINGS

The study established that there were challenges faced by the media in their reportage of terrorism. This was as noted by 78% (222) of the respondents with 22% (62) noting that there were no challenges faced by the media in their reportage of terrorism.



The following were the major challenges which were noted: conflict of interest, poor communications network, myths on terrorism, lack of mutual trust, fear and intimidation, pressure and coercion and will be elaborated.

#### 4.1 Conflict of interest

Lack of balance between objectivity and accuracy against the need to make stories and reports that sell was also cited as a challenge within the media circles.

Press pundits have over time questioned if media practices objectivity in its quest to inform the public and thus, a challenge to media reportage of terrorist activities. This challenge has been exacerbated by the pressure on the media to report terror activities which suppresses objectivity and accuracy. It is usually noted that, journalists tend to pre-conclude situations and give personal opinions on issues with a view of meeting deadlines for going to press or going on air and thus, the information reported is most likely subjective. This is as a result of the pressure under which they work to deliver news promptly for a better sale. Therefore this comes into conflict with the quality of news to be presented.

Both the print and electronic media covered extensively the heinous assaults which were visited on the Westgate mall, attacks in Mandera County, assault on Mpeketoni in Lamu County and the Garissa university assault in Garissa County. Both Kenyan and international press were awash with photos exhibiting grueling pain which the survivors were going through. Others broadcasted raw photos showing physical injuries and several deaths in cold blood. It is the presence of these media outlets that hampers the strong efforts put in place by the Kenyan Government to control damage and safeguard the integrity of the rescue operations and

also coordinate on the methodology to be employed when reporting on these acts of terror. It is such type of circumstances where media inadvertently offers an opportunity for Al-Shabaab to display their attacks with little if any censorship and also exploit such circumstances to spread their propaganda. Therefore the media unknowingly grants them the oxygen to survive as well as thrive (Jacobs, 2012). This is a conflict of interest between the rights of the public to be informed vis-à-vis the national security interests.

Another instance in conflict of interest is when the public needs to know what is happening in the terrorists' world at the expense of the country's economic development. This observation is well captured in Gagalo's publication whereby it takes note that several reasons have been put forth as to why Al-Shabaab is hell bent on attacking Kenya and not other neighbours. Among the reasons given is that Al-Shabaab wants to sabotage the Kenyan economy, another reason being that Al-Shabaab wants to influence the Kenyan foreign policy by forcing the withdraw of KDF troops from Somalia. These reasons could be true but it is important to consider the bigger picture of Kenya being a tourist hub in the region and this grants the terrorists opportunity to attack these tourists. This comes about with a lot of media coverage which keeps Al-Shabaab in the visibility so as to remain relevant in the international stage. The associated media coverage and damage done to Kenya's image and economy also bleeds into Al-Shabaab's pursuit for survival and equally global and regional publicity (Gagalo, 2015).

#### **4.2 Poor communications network**

Poor facilities such as road network, transport and communication have been a painstaking limitation for journalists when gathering information in the field. Poor road networks and inadequate means of transport have made it impossible for journalists to travel and meet informants. The unreliable communication system available has made it difficult not only to obtain information but also to verify the authenticity of the information provided.

#### **4.3 Myths on Terrorism**

The myths and misconceptions surrounding the whole subject of terrorism make it difficult to obtain and verify information. Journalists who were enjoined in the study noted that because of the myths and misconceptions surrounding the issue of terrorism, it has become difficult to authenticate or verify information especially in cases where the sources of information are from different cultural and ideological backgrounds. For instance, while some myths assert that terrorism is associated with Islam and all Muslims, informants who are non-Muslims would readily give information that is biased against the Muslim community. This challenge is aggravated by the lack of means of verifying information obtained from their sources.

It is common knowledge that security officers hold classified information meaning that the information is sensitive and so it is important for them to maintain a close and warm working relationship with the media to avoid improper disclosure of information which may cause harm, injure or damage to the country's reputation. On the other hand, the journalists ought to understand the procedures for information disclosure by the security officers and whoever is authorize to give information.

Therefore, it follows that information should be utilized responsibly and with care without compromising the lives of the officers, journalists, victims, survivors or an ongoing operation (Media Council of Kenya & International Media Support, 2016).

#### **4.4 Lack of Mutual trust**

There are suspicions amongst these institutions developing, and implementing or carrying out anti-terrorism strategies. Despite this, the Kenya Defense Forces tends to be a bit more organized and robust in terms of information sharing and their relationship with the media more than the National Police Service who most times are not comfortable with the media (Media Council of Kenya & International Media Support, 2016).

It is important to be cognizant of the fact that the police and the media can co-exist while performing two similar yet so different roles – the key is to develop a strong relationship prior to critical incident. The two institutions should learn to work together in peace time such that when an incident occurs they will be able to harmoniously carry on with their tasks. Both sides have to be enlightened so that they are well versed with the policies of their counterpart and perhaps most importantly is that both sides have to respect the policies in place which they will work around (Media Council of Kenya & International Media Support, 2016). The police/military and media should endeavour to conduct regular meetings between so as to create a synergy of working together. In the process they develop rules and regulations or procedures which will assist them work together successfully without infringing on one another's rights. They should also conduct joint training classes which will also greatly help in bridging the gap of mutual suspicions between the security forces and the media. Improved media and security forces working networks and sessions are vital as they can help improve information flow and build on mutual trust. The police can also assist in bridging the relationship gap by being a bit more open with the media. Regular, consistent and credible information sharing on the process and stages of security operations can help improve or create healthy working relationships and improve access to information or volunteering of information by security forces which will translate into responsible reportage (Media Council of Kenya & International Media Support, 2016).

#### **4.5 Fear and Intimidation**

Fear of being attacked and hurt by terrorists as well as intimidation and blackmail by terrorists and sources of information was further cited as a limitation to media reportage. Serious professional journalism is difficult work at the best of times. In a society threatened by terrorism and/or violent extremism, journalists face much greater difficulties and will likely operate in a climate of fear and threats. The spread of propaganda and unverified information on social media sometimes works against facts presented by journalists. In the current times where information flows very quickly in the digital world, journalists have had the challenge of countering falsehood, propaganda and unverified information shared on social media and blogs by unverified sources. This has placed media houses at the center of confusion trying to clear the air on what are the real facts and what is unverified.

Further in understanding the challenges faced by the media in reportage of terrorists' activities, the study interrogated the

position of terrorists in the media. The study established that 67% of the respondents felt that terrorists have projected themselves better in the media than the government. The study noted that with the day-in day-out coverage of terrorist activities in the media is a depiction of terrorists projecting their presence better than the government through the media. Key informants in the study were further in agreement with these sentiments, most of who noted that terrorists have mastered the art of strategically positioning themselves well in their media to justify their acts and advance their agenda. Their resounding sentiments further paint a picture of a media that gives much airtime to terrorists and terrorism in general.

The media has on a number of occasions been seen to play an accomplice to the success of these acts of terror. This has been witnessed more so during the processes of reporting and covering these acts of terror whenever and wherever they take place. Their coverage intentionally or unintentionally gives so much publicity to the terrorist groups; a mileage they really crave to achieve.

The example of the September 11, 2001, attacks were sufficiently visual to meet the demands of the TV culture and to satisfy the public fascination for live coverage of events. By attacking cities like New York, among others, where the largest concentration of television stations and film studios and equipment exist, terrorists not only guaranteed for themselves an exhaustive coverage and a global projection of their actions, but the existence of multiple tourists and citizens who had their own film equipment. This allowed news broadcasters to utilize domestically filmed new materials in which the news did not have as much to do with the terrorist attack as with the existence of new images that allowed the viewing public to contemplate the horror and destruction from a different point of view.

Dramatic incidents, stories with emotional aspects, and negative news stories are the topics that readers find interesting. Other kinds of stories that tend to draw high levels of interest are those that are exciting and sensational, and those that directly affect the audience (Glüpkner, 2008). News stories that report on terrorists' actions or attacks are a suitable example of stories which satisfy all these characteristics.

Terrorism happen to be very brutal as well as a violent practice but it is also happens to be the global media's spectacular phenomenon which they cannot escape from covering for the sake of improving their viewership which translates to profits. News on terrorism is very juicy and vital: such kinds of news often make the public want to know more and seek for further understanding on what exactly transpired. The news is very dramatic and attractive to watch or read. This is what exactly terrorists look for, the kind of publicity the terrorists get from journalists when covering such kind of news. The media in reporting such news aids the terrorists achieve the effect of disrupting society functioning provoke fear and demonstrate that they are powerful (Beckett, 2016).

#### 4.6 Pressure and Coercion

The study further established that the media received a lot of pressure from different quarters to inform on terrorists activities including from terrorists themselves through coercion and threats. The findings of this study are in tandem with Dutch journalist Mark Blaisse who observes that the media have become predisposed to immense pressure from the environment and this

pressure tends to suppress objective and accurate reporting. He further suggests that the main driving objective of their reporting is the creation of more profits. All the media is looking for in their quest to inform is creation of profits through mobilizing audience viewership and readership (Blaisse, 1992).

## V. DISCUSSION

An analysis of the responses given in by the participants clearly depicts the fact that acts of terror have alienated the youth and even the old from leading a normal life in Mandera County just like the rest of the country. Terrorism has made the County not gain much in development due to investors being scared from investing in the County (Business Daily, 2019).

It is important to reiterate the conflicts that exist between the media and the security agencies when there is a terrorist attack kind of a situation. Due to the long standing suspicions amongst the media and the security agencies that media are out to discredit the security agencies and the security agencies are out to cover up their flaws. This has always been a bone of contention. Such incidents have been experienced in the recent past during the terrorist attacks on Westgate Mall in Nairobi, the attack on the Garissa University, in Lamu County at the border of Kenya and Somali and in Mombasa County several times (Media Council of Kenya and International Media Support, 2016).

In the recent past as experienced in the Westgate Mall attack, the Kenya Defense Forces accused the media of compromising the operation. The media while undertaking a live coverage of the operation indirectly aided the attackers. The media also did jeopardize the lives of the security officers and the victims through life coverage of the military operation revealing the military strategy towards defeating the terrorists and rescuing the victims of the attack (Media Council of Kenya and International Media Support, 2016).

While there are flaws in the way the media cover security undertakings which has contributed to lack of trust in the media from security agents, the tensions and conflicts can also be explained by the lack of understanding amongst security agencies on the role of media play in a democratic society and vice versa. If the media is not accorded the freedom to report then there is a likelihood of letting propaganda flourish. This again can lead to biased media coverage due to the lack of access to information that is provided, as well as direct threats against journalists who run the risk of imprisonment and restrictions of their rights (Media Council of Kenya and International Media Support, 2016).

For the advice of Kenyan media experts, the study would recommend a replication of the European Union Technical Assistance to Nigeria's Evolving Security Challenges (EUTANS) framework for reporting responsibly on violent extremism as part of the effective and preferred approaches to address the challenges of reporting terrorism in Kenya. Journalism involves a high degree of government confidence. To gain and retain this confidence, sticking with the greatest professional and ethical norms is morally imperative for every journalist and news medium. A journalist should always have a good public interest at heart in the practice of these responsibilities. Truth is the cornerstone of journalism, and every journalist has to work diligently to find out the reality of every evening (Okeke & Odubajo, 2018).

Gever (2015) stated that a professional journalist should be responsible for decisions on the content of news he or she presents unto the public. The public is entitled to understand the news being broadcasted. Factual, precise, balanced and fair reporting are the ultimate goal of excellent journalism and the foundation for gaining public trust and belief. A reporter should refrain from publishing information that is incorrect and misleading. Should such information be released accidentally, timely correction should be made. As a cardinal rule of practice, a journalist must have the right to answer. A journalist should seek to distinguish facts from assumptions and provide guidance in the course of his or her responsibilities.

A journalist should follow the principle of confidentiality that is widely recognized and should not reveal the source of confidential data. A journalist should not breach an agreement with an off-the-record source of information. In order to suppress or publish data, a journalist should not solicit or accept bribe, gratification or patronage. Requesting payment for news publishing is inimical to the concept of news as an event's fair, precise, unbiased and factual report. A reporter should not present violence, armed robbery, terrorist activity or vulgar wealth display in a way that glorifies such acts in the public's eyes (Bal & Baruh, 2015).

## VI. CONCLUSIONS

The study concluded that that there were challenges faced by the media in their reportage of terrorism. These challenges made it difficult for the media to gather credible, accurate and verifiable news from the ground. Therefore, media ended up framing news in the way it felt appropriate thereby propelling the terrorists' agenda. The following are the challenges which were established by the study: Conflict of interest, poor communications network, myths on terrorism, lack of mutual trust, fear and intimidation as well as pressure and coercion

## VII. RECOMMENDATION

The study recommends that, stringent measures tailored in understanding media reportage, be adopted. Additionally, the study recommends the establishment of better communication strategies to address the spilling problem of communication network.

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# The Ninth Parliamentary Election of Sri Lanka in 2020: An Analysis of the Outcomes

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**Abstract—** The Sinhala Buddhists, who are the majority in Sri Lanka, helped the Sri Lanka Podujana Peramuna (SLPP) win an absolute majority in the ninth general election of Sri Lanka. The SLPP always wishes to exceed expectations and the president, who also belongs to the SLPP, claimed that the party's performance in the general election was better than what they had anticipated. The United National Party (UNP), led by the former Prime Minister Ranil Wickremesinghe, suffered the worst electoral defeat in their history as they managed to win only one seat, that too through the national list. Ranil Wickremesinghe also recorded his first defeat in an electoral battlefield. The Samagi Jana Balawegaya (SJB), led by Sajith Premadasa, that broke away from the UNP, managed to gain 54 seats and emerged as the second-largest alliance in the island. The Tamil National Alliance (TNA), which used to enjoy the support of the majority in the North and East of Sri Lanka, suffered a huge setback as they ended up with only 10 seats, 6 less than what they had won in the previous general election. The SLPP managed to win approximately 59% of the popular vote while the SJB won almost 24% of the votes, becoming the second most popular party in the island ahead of the veteran parties like the UNP and TNA.

**Key Words—** Constitution, Election, Parliament, Women, Minorities

## I. INTRODUCTION

Even though 16 million Sri Lankans were registered to vote to elect the members of Sri Lanka's ninth parliament, the election campaign was mostly affected by the COVID-19 pandemic. According to the voters' list of 2018, nearly 84% of the registered voters polled their votes in the last November 2019 Presidential election. Considering the voters' list of 2019, total registered voters' numbers were 16,263,885. But the polled votes fell to 12,343,308 (75.89%) due to the public health issue. The Sri Lanka Podujana Peramuna (SLPP)

contested against a weakened opposition party in the parliament election. Even though the parliamentary election was delayed twice due to the COVID-19, SLPP got 2/3 majority in the parliament with the help of other supporting parties. The SLPP was expecting to get the two-thirds majority (150 seats) in the parliament without other parties' support. But they were able to gain only 145 seats in the parliament. The parliamentary elections results may be seen as an indicator of its future political direction and help to increase the potential executive president's power. With obstacles from the COVID-19 pandemic, during which the election commission tried to make sure that polling was free, fair, and safe for all. Due to the inability of foreign election monitors to travel to the country due to the COVID-19 related restrictions in place, the election was monitored by local personnel. Therefore, this research article is focused on examining the following crucial problems:

1. Did the SLPP record a historic victory by gaining a total of 6.8 million Sinhalese cast votes (59% of the valid votes) in the ninth parliamentary election?
2. Why did UNP-led United National Front for Good Governance secured 5.0 million votes in the 2015 General election but in the last parliament election, just secured only 249,435 votes?
3. How to evaluate the political status of minority parties in the ninth parliamentary election?
4. What, in the future, necessary strategies should be developed to ensure maximum security to the women's political participation?

This research paper consists of two parts. The first part of the research paper analyzes the parliament election results and SLPP's decisive victory. The second part of the research paper analyzes the minority political parties' status and women's political participation. This research was done qualitatively and involved analysis of the content of the events. The content analysis generally involved closely examining the text of documents and the words of politicians and political analysts. The data collected regarding the criticisms of the political

parties' manifesto of Sri Lanka on online literature, political leaders' speech, past election statistics, and research books have been used to write this research article.

II. THEORY

The primary norm of proportional representation (PR) is, every group of the society would secure their representation in the parliament, in proportion to their population. Different communities, who otherwise will go without representation, will get representation according to their strength in numbers. The main purpose of the PR system is to safeguard a representative assembly reflecting the statistical exactness of the various divisions in the constituency. Eminent political thinker J.S Mill supported the PR system (Agarwal, R.C, 1976). He says that a parliament must represent, all the divisions of the constituency and no minority should go without any representation in the parliament. The parliament is compared to maps. One cannot draw a map of a country ignoring any part of the area of the country. All the areas of the country should be represented in the map. Similarly, all the areas of the constituency should be represented in the parliament. The PR system has two methods. One is the Hare system and the other one is the List system. Hare systems is also known by other names such as preferential system or the single transferable vote system. The voters exercise many votes as there are several candidates and indicates their preferences of the candidates for whom they vote. In the list system candidates are grouped into lists, with each party representing a separate list. A voter casts vote for a list. Every party offers a list of its candidates up to the number of seats to be filled from each constituency. A voter cast vote for the list she/he likes. She/he may cast vote either for one candidate on the list or may distribute all his votes to the different candidates on the same list. But she/he cannot cast more than one vote to any candidates. This system gives the opportunity of representation to all parties, big or small, and confirms that the parliament mirrors the view of all the people (Agarwal, R.C, 1976). Under this system, even a minor or numerically small group of people may send a representative if they can organize themselves to cast the votes in favour of a candidate. In the same way, even a small party can get the number of its members elected with the help of constituencies of a district in which it is popular. PR satisfies its aim by giving equal chances to the minority.

The aim of the PR system allocates seats in the legislature according to the casted number of votes to the political parties or independent groups. Let's consider this scenario as an example. Based on the constituency, five seats are allowed from a certain district or area. A party polling three fifth of the total casting votes by the voters in that constituency will return three out of five seats. Another party polling two fifth of the

total cast votes will return two seats. The party composition of the legislature reflects the party preference of the electorate with a considerable degree of accuracy in the electorate. For example, hypothetical table 1 shows a legislature with five seats with 200,000 voters in an electorate.

TABLE I  
 HYPOTHETICAL TABLE

| Party | Votes        |            | Seats in the Body  |            |
|-------|--------------|------------|--------------------|------------|
|       | Casted Votes | Percentage | Number of Returned | Percentage |
| A     | 120,000      | 60%        | 3                  | 60%        |
| B     | 80,000       | 40%        | 2                  | 40%        |
| Total | 200,000      | 100%       | 5                  | 100%       |

III. DISSOLVING the PARLIAMENT and COVID -19

The President can dissolve the parliament four and a half (4-1 / 2) years after the commencement of the term of office of a parliament of Sri Lanka. The power to dissolve parliament is vested in the President by Article 70 (10) and section (2) (e) of the constitution. Therefore, following these provisions, and per the provisions of section 10 of the parliamentary elections Act No. 1 of 1981, the President of the Democratic Socialist Republic of Sri Lanka, Gotabhaya Rajapaksa, dissolved the parliament at midnight on March 2, 2020, and announced the election for a new parliament will be held on April 25. He also called on the new parliament to begin its session on May 14, 2020 (The Gazette of The Democratic Socialist Republic of Sri Lanka, Extraordinary, No. 2165/8 - Monday, March 02, 2020).

During this period, the COVID-19 pandemic began to spread in Sri Lanka. On March 19, Election Commission announced that the parliamentary elections would be postponed indefinitely, referring to instructions from the Government Medical Officers' Association (GMOA) that the country's health and medical conditions were in jeopardy. Despite the COVID-19 pandemic in Sri Lanka, the government was stubborn that elections should be held on April 25 as planned. Against the government move, the Election Commission banned political parties from holding election rallies, mass meetings, and campaigns. However, during a video conference with SAARC heads of state, Sri Lankan president Gotabhaya Rajapakse reaffirmed that the parliamentary elections would go ahead as planned.

Ignoring the president's urgency and focus on holding the parliamentary elections as planned, the Election Commission of Sri Lanka postponed the parliamentary elections until June 20, using its powers. The Election Commission also wrote a letter to the president on April 3, asking the president to seek the advice from the Supreme Court on announcing a new date

considering the constitution, and the health and medical conditions of the country.

The President's office had no intention of seeking advice from the Supreme Court on holding parliamentary elections. On April 9, the secretary to the president responded in writing that it was the duty of the Election Commission to abandon its warning of a constitutional crisis and hold parliamentary elections. Finally, the parliamentary elections were not held on April 25 amid the spreading COVID -19 pandemic. And the Election Commission decided to postpone the general election until June 20. On May 28, one of the members of the Election Commission expressed his view opposing the holding of the election under the influence of the government. This was again seen as a matter of crisis between the president and the constitution and was considered a fundamental rights issue and turned into a matter for the Supreme Court.

As a challenge to the Gazette notice, the newspaper editor Victor Ivan and seven others on 5<sup>th</sup> May 2020, Samagi Jana Balawegaya and Champika Ranawaka of Jathika Hela Urumaya on 6<sup>th</sup> May 2020, Kumara Welgama of New Sri Lanka Freedom Party on 9<sup>th</sup> May, filed a fundamental rights in the Supreme court (Colombo Page News Desk, Jun 2, 2020).

The petition stated, holding parliamentary elections on June 20 is against the provisions of the constitution. The petitioners also contended that the president's gazette notification on dissolving the parliament was invalid as the new parliament could not be convened within three months of its dissolution. Moreover, the petitioners have observed that free and fair elections cannot be held in the context of the COVID -19 crisis as the pandemic has not yet been brought under control. The health-related risk will seriously hamper the campaign efforts and they needed free and fair elections. The petitioners, therefore, asked the Supreme Court to give a verdict that the fundamental rights of the people are being violated by holding elections before the conclusion of the COVID -19-virus pandemic.

A five-member panel of the Supreme Court judges began the hearings on May 18<sup>th</sup> to determine whether all the seven petitions filed against the general election scheduled for June 20 should be taken up for the hearing or not. After a ten-days hearing, the five Supreme Court judges unanimously dismissed the case, saying the petitions would not be heard. Following this, the Election Commission announced August 5<sup>th</sup>, 2020, as the new date for holding parliamentary elections (Colombo Page News Desk, Jun 2, 2020).

#### IV. ELECTORAL SYSTEM of the PARLIAMENT ELECTION of SRI LANKA

The electoral system operates at three levels such as national, provincial, and local in Sri Lanka. For administrative purposes, the country has been divided into 25 administrative districts. Article 96 (1) says that to hold elections, the country

can be divided into not less than twenty and not more than twenty-five electoral districts. According to Article 96 (1) & (2), the country has been divided into 22 electoral districts for electoral purposes, of these 20 electoral districts have co-boundary with the 25 electoral districts. According to Article 96 (3), an electoral district namely Vanni has been formed by the Delimitation Commission who combined three administrative districts, namely, Mullaitivu, Mannar, and Vavuniya. The same way other an electoral district namely Jaffna has been formed by the Delimitation Commission who combined two administrative districts such as Jaffna and Kilinochchi. The above 22 electoral districts have been divided into 160 polling divisions. Article 94 (4) says that the electoral districts of each province shall be altogether entitled to elect four (4) members. Article 98 (1) says that the 22 electoral districts shall together be entitled to elect one hundred and ninety-six (196) members for the parliament. In this way, 160 parliament members shall be elected by 160 polling divisions from 22 electoral districts and besides based on Article 98 (2), each electoral district shall elect thirty-six (36) parliament members (The Constitution of the Democratic Socialist Republic of Sri Lanka, 2015).

Thus, the country is divided into 22 electoral districts for parliamentary elections and each of these districts becomes a constituency. According to Article 98 (4), the total number of electors whose names appear in the registers of electors of all the electoral districts shall be divided into one hundred and sixty. The whole number, resulting from dividing numbers (any fraction numbers not being considered) is hereinafter referred to as the "qualifying number".

According to the constitution, any person qualified to be a voter is qualified to be elected as a member of parliament. The parliamentary elections in Sri Lanka are held on the PR system. The number of members of parliament to be elected from each constituency is determined on a formula based on the total number of voters in the country. A political party or an independent group expecting to contest a constituency should submit a list of names of candidates. Such a list should contain three names more than the number of members to be elected. A voter is entitled to one vote which must be cast for the political party or the independent group of her/his choice. She/he is also entitled to mark up to three preferences against the names of three candidates of the political party or the independent group he votes for. The number of members elected from a political party or an independent group at an election is determined based on the votes received by the political party or group in the entire electorate.

196 candidates were elected from twenty-two electoral district in the nine electoral provinces. Each electoral district consists of different numbers of members based on the population of voters like it show below (Daily FT, Wednesday, 5 August 2020 03:43).

TABLE II  
COMPOSITION of MEMBERS in the 9<sup>TH</sup> PARLIAMENT-2020

| S. No | Electoral Provinces | Electoral District | Elected Candidates in the District Level | Elected Members in the Provincial Level | Contested Candidates |
|-------|---------------------|--------------------|--|---|----------------------|
| 1     | Western             | Colombo            | 19                                       | 47                                      | 924                  |
|       |                     | Gampaha            | 18                                       |   | 693                  |
|       |                     | Kalutara           | 10                                       |   | 312                  |
| 2     | Central             | Kandy              | 12                                       | 25                                      | 435                  |
|       |                     | Nuwara Eliya       | 08                                       |   | 275                  |
|       |                     | Matale             | 05                                       |   | 184                  |
| 3     | Southern            | Galle              | 09                                       | 23                                      | 312                  |
|       |                     | Matara             | 07                                       |   | 200                  |
|       |                     | Hambantota         | 07                                       |   | 190                  |
| 4     | North-West          | Kurunegala         | 15                                       | 23                                      | 396                  |
|       |                     | Puttalam           | 08                                       |   | 352                  |
| 5     | Sabaragamuwa        | Ratnapura          | 11                                       | 20                                      | 308                  |
|       |                     | Kegalle            | 09                                       |   | 228                  |
| 6     | Eastern             | Digamadulla        | 07                                       | 16                                      | 540                  |
|       |                     | Batticaloa         | 05                                       |   | 304                  |
|       |                     | Trincomalee        | 04                                       |   | 189                  |
| 7     | North -Central      | Anuradhapura       | 09                                       | 14                                      | 264                  |
|       |                     | Polonnaruwa        | 05                                       |   | 152                  |
| 8     | Uva                 | Badulla            | 09                                       | 15                                      | 288                  |
|       |                     | Monaragala         | 06                                       |   | 171                  |
| 9     | Northern            | Jaffna             | 07                                       | 13                                      | 330                  |
|       |                     | Vanni              | 06                                       |   | 405                  |
| Total |                     |                    | 196                                      | 196                                     | 7452                 |

Source: 5<sup>th</sup> August 2020 Sri Lankan Parliamentary Elections, Election Commission

## V. NINTH PARLIAMENT of SRI LANKA

The Election Commission announced on August 5<sup>th</sup>, 2020, as the new date for holding parliamentary elections. In the 2020 parliamentary election, almost 16 million voters casted their votes in 22 electoral districts, 7452 candidates contested from recognized political parties, and independent groups. Amongst, those 3652 candidates were from recognized political parties and 3800 candidates were from independent groups. A total of 313 independent groups contested in the 2020 parliamentary election. Among the 7452 candidates, 196 candidates were elected as parliamentarians out of 225 at the district level under the PR system. And the rest of the 29 members were nominated through the national list under the 1978 constitution (Daily FT, Wednesday, 5 August 2020 03:43). It shows in the table:3 below.

TABLE III  
9<sup>TH</sup> PARLIAMENT ELECTION ACTIVITIES- AUGUST 5, 2020

| Description                     | Amount     |
|---------------------------------|------------|
| Total Parliament MPs            | 225        |
| Elected Members                 | 196        |
| National List Members           | 29         |
| No. of Candidates               | 7,452      |
| No of Eligible Voters           | 16,263,885 |
| Electoral District              | 22         |
| Polling Stations                | 12,985     |
| Policemen on Election Duty      | 82,000     |
| Health Service on Election Duty | 8,000      |

Source: Daily FT, Wednesday, 5 August 2020

Even though in the 2015 parliamentary election more political parties and independent groups contested, only six

political parties were able to represent their members in the parliament (General Election, 2015). They are the United National Party (UNP), the United People's Freedom Alliance (UPFA), the Ilankai Tamil Arasu Kachchi (ITAK), the People's Liberation Front (JVP), the Sri Lanka Muslim Congress (SLMC) and the Eelam People's Democratic Party (EPDP)

But in the parliamentary elections held on August 5, 2020, fifteen political parties fielded their members in the parliament (General Election, 2015). The SLPP gained most of the seats at the parliamentary general election in 2020. Other political parties to obtain seats in parliament general election were the

Samagi Jana Balawegaya (SJB), Illankai Tamil Arasu Kadchi (ITAK), Jathika Jana Balawegaya (JJB), Eelam People's Democratic Party (EPDP), Ahila Ilankai Thamil Congress (AITC), Thamil Makkal Viduthalai Pulikal (TMVP), Sri Lanka Freedom Party (SLFP), Muslim National Alliance (MNA), Thamil Makkal Thesiya Kuttani (TMTK), All Ceylon Makkal Congress (ACMC), National Congress (NC), Sri Lanka Muslim Congress (SLMC), United National Party (UNP) and the Our Power of People Party (OPPP). Given below is a table showing the distribution of seats for each political party (Parliament of Sri Lanka, Monday, August 10, 2020)

TABLE IV  
VOTES, SEATS & NATIONAL LIST BY PARTY - ALL ISLAND 2020

| S.No | Party    | Votes     | %     | Elected Seats | National List | Total Seats |
|------|----------|-----------|-------|---------------|---------------|-------------|
| 1    | SLPP     | 6,853,690 | 59.09 | 128           | 17            | 145         |
| 2    | SJB      | 2,771,980 | 23.90 | 47            | 7             | 54          |
| 3    | ITAK     | 327,168   | 2.82  | 9             | 1             | 10          |
| 4    | JJB      | 445,958   | 3.84  | 2             | 1             | 3           |
| 5    | AITC     | 67,766    | 0.58  | 1             | 1             | 2           |
| 6    | EPDP     | 61,464    | 0.53  | 2             | 0             | 2           |
| 7    | UNP      | 249,435   | 2.15  | 0             | 1             | 1           |
| 8    | OPPP     | 67,758    | 0.58  | 0             | 1             | 1           |
| 9    | TMV<br>P | 67,692    | 0.58  | 1             | 0             | 1           |
| 10   | SLFP     | 66,579    | 0.57  | 1             | 0             | 1           |
| 11   | MNA      | 55,981    | 0.48  | 1             | 0             | 1           |
| 12   | TMT<br>K | 51,301    | 0.44  | 1             | 0             | 1           |
| 13   | ACM<br>C | 43,310    | 0.37  | 1             | 0             | 1           |
| 14   | NC       | 39,272    | 0.34  | 1             | 0             | 1           |
| 15   | SLM<br>C | 34,428    | 0.39  | 1             | 0             | 1           |
|      | Total    |           |       | 196           | 29            | 225         |

Source: Parliament of Sri Lanka, Monday, August 10, 2020

The SLPP recorded a historic victory with 145 seats through gaining a total of 6.8 million cast votes with 59% of the valid votes in the ninth parliamentary election. The SLPP secured 6.9 million votes in the November 2019 presidential election but in the last parliament election, just about one hundred thousand votes were lost due to various political scenarios. Like the parliamentary election victory back in 2010, after ending the civil war with LTTE, the SLPP's performance in the 2020 parliament election was very impressive in many ways.

The election results show that the SLPP's landslide victory was recorded mostly with Sinhalese votes. Except for Sathasivam Viyalendiran in the Batticaloa district, Jeevan Thondaman, and M. Rameshwaran in the Nuwara Eliya district and Kader Mastan in the Vanni district, all the other SLPP candidates were elected by the Sinhalese votes in Sri Lanka. Therefore, it can be argued that out of the 145 seats won by SLPP, 141 seats were won with Sinhala voters. SLPP has created a government of the Sinhalese without the support of the minority people, who were considered as kingmakers of the previous government. As diplomatically, SLPP succeeded in carrying out anti-minority propaganda among the majority

Sinhalese population. The SLPP then appointed three Muslim MPs and one Tamil MP as members of parliament while appointing the members of the national list. It is an attempt to provide a small relief to the mental anguish caused to the minority people during the campaign and to spread the message that a government has been established that will incorporate and rule all the people of the country.

The ninth parliament election result in Sri Lanka has once more confirmed that Mahinda Rajapaksa is the preferred Sinhala Buddhist leader by the majority of people. And 2019 Presidential election results have made Gotabaya Rajapaksa, who is the younger brother of Mahinda Rajapaksha, as the most powerful president of the country. Kusal Perera, a veteran political analyst, writer, and a strong critic of governments, said: “Yes, Sri Lanka has been gradually turning into a majoritarian country... That is what is guaranteed in these two elections - November’s Presidential victory and this Parliamentary result” (Indian Express, August 9, 2020, 10:33:48 am). The poll results indicated nothing but the fact that Sri Lankan people wanted a strongly Sinhala Buddhist leader. Mahinda Rajapaksa is the most popular leader; Gotabaya Rajapaksa is the most powerful leader. They have big challenges in front of them without provoking racism, should plan and go forward with suitable development-oriented policies, without discriminating the Sri Lankans. Gotabaya Rajapaksa has foreign exposure and knowledge, he knows that development-oriented policies alone will save the country and he is working towards that, to improve the economy.

An equally important scenario of the 2020 general election has been the downfall of the UNP. The UNP is the largest and liberal party in the history of Sri Lanka. Since the party was founded by the first prime minister of Sri Lanka’s D.S. Senanayake on 6 September 1946. It has come to power for 36 times in the 72 years of the post-independence of Sri Lanka. The UNP has a noble history as it has made six heads of government. They are, namely, D.S. Senanayake, Dudley Senanayake, Sir John Kotelawala, J.R. Jayewardene, Ranasinghe Premadasa, and D.B. Wijetunga. (Presidential Secretariat,2020). However, Ranasinghe Premadasa was the last elected head of government from the UNP, he was assassinated by the LTTE in May 1993. In the last parliament election, there was a split between the two leaders and contesting separately, with former Prime Minister Ranil Wickremasinghe led the UNP, and Sajith Premadasa led the breakaway faction, the Samagi Jana Balawegaya (SJB). UNP leader Ranil Wickremasinghe met the first historical letdown in his political career in last parliament election. UNP secured only 249,435 votes or 2.15 % of the total valid votes. They could not gain one seat in the parliament too. They gained only one national list seat in the parliament. While UNP lost all its seats, its substitute party Samagi Jana Balawegaya (SJB) alliance gained reasonable seats in the parliament. It was led by Sajith Premadasa, who is the son of the former president Premadasa who was the leader of the UNP. The SJB came in a

second winner and Sajith Premadasa secured the status of the opposition party leader in the ninth parliament. The SJB secured 24% of the popular vote and 54 parliamentary seats including seven national list seats. It is noted that in the 2010 parliamentary election, UNP’s got 29% of the popular vote and 60 parliament seats. Two SJB partner parties, the SLMC, and the ACMC secured a seat each under their flag, which made an effective opposition with 56 members of parliament.

VI. WOMEN REPRESENTATION

Women comprise over 50% of the total population in Sri Lanka. Although, when it comes to political participation at the local and national levels, the number of women politicians is at a very minimal level in the country. Sri Lanka enjoyed electing the world’s first woman prime minister who served three terms in that capacity and her daughter Chandrika Bandaranaike Kumaratunga served as a president for two consecutive terms. After that Sri Lanka has not witnessed any notable progress in women’s participation in politics.

When taking into consideration women’s representation in the 2020 parliament election, there were nearly 59 women representatives who received nominations from various political parties to contest in the parliamentary election 2020, but only eight (8) candidates won the election. Also, four (4) women selected to the parliament, as national lists members, where two representatives from SLPP, one from SJB, and one from Jathika Jana Balawegaya (JJB). Altogether, twelve (12) women were selected as a member of parliament out of 225 in the 9th parliament (News wire,14.08.2020). It shows the table:5 below.

TABLE V  
 WOMEN IN THE 9<sup>TH</sup> PARLIAMENT

| Party | District      | Name                      |
|-------|---------------|---------------------------|
| SLPP  | Ratnapura     | Pavithra Wanniarachchi    |
|       |               | Muditha Soya              |
| SJB   |               | Thalatha Athukorale       |
| SLPP  | Kegalle       | Rajika Wickremesinghe     |
| SLPP  | Gampaha       | Sudharshani Fernandopille |
|       |               | Kokila Gunawardene        |
|       | Galle         | Geetha Kumarasinghe       |
| SJB   | Matale        | Rohini Kaviratne          |
| SLPP  | National List | Seetha Arambepola         |
|       |               | Manjula Dissanayake       |
|       |               | Diana Gamage              |
| JJB   |               | Harini Amarasuriya        |

Source: The Gazette of the Democratic Socialist Republic of Sri Lanka, Extraordinary, No. 2187/26

According to the web site of the women's national parliament archive, in 2018, Pakistan secured 20.2% women representation in the lower house and 19.2% in the upper house. In 2018, Bangladesh secured 20.7% of women's representation in parliament. In 2017 Nepal secured 32.7% of women representation in the lower house and 37.3 % in the upper house. In 2014, India secured 12.6% women

representation in the lower house and 11.5% in the upper house (Women in national parliaments,2019).

While compared South Asia with Sri Lanka's experience, from 1994 to 2020, it indicated that women's participation in Sri Lanka is at a very minimal level. The below chart indicates that the reality of Sri Lanka's women's political participation in the last thirty years. The women activists' concern is that women's representation in the parliament increased only so far 5.3% in the history of Sri Lanka (Parliament of Sri Lanka, Lady Members). It is shown in the figure I below.

Source: Parliament of Sri Lanka, Lady Members

Forty-eight (48) members have been elected to the parliament on behalf of the minority people in the recent parliamentary elections in 2020. Twenty-eight of them (28) represent the Tamil people from different parts of the country on behalf of different political parties and of the twenty-eight members, twenty-five members have been elected from deferent districts. The other three members were selected through the respective political party's national list (The Gazette of the Democratic Socialist Republic of Sri Lanka, Extraordinary, No. 2187/26). It is shown in the table VI below.

FIGURE I  
 WOMEN REPRESENTATION IN THE PARLIAMENT FROM 1994 TO 2025

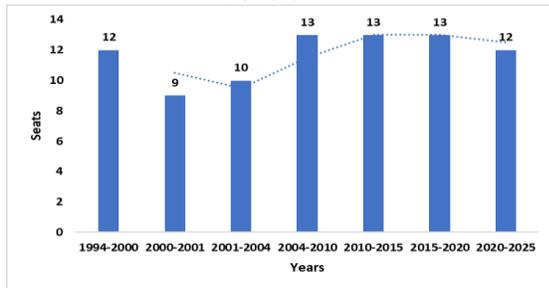


TABLE VI  
 TAMIL MEMBERS in the 9<sup>TH</sup> PARLIAMENT ELECTION 2020

| Methods       | ITAK | SJB | SLFP | EPDP | AITC | TMVP | TMTK | SLPP | Total |
|---------------|------|-----|------|------|------|------|------|------|-------|
| Elected       | 9    | 7   | 1    | 2    | 1    | 1    | 1    | 3    | 25    |
| National List | 1    |     |      |      | 1    |      |      | 1    | 03    |
| Total         |      |     |      |      |      |      |      |      | 28    |

Source: The Gazette of the Democratic Socialist Republic of Sri Lanka, Extraordinary, No. 2187/26

VII. TAMIL and MUSLIMS MEMBERS in the 9<sup>TH</sup> PARLIAMENT

In the year 2001, the Tamil United Liberation Front (TULF) prominent leaders formed a new political wing, which is named as the Tamil National Alliance (TNA), with uniting all other moderate Tamil political parties and some ex-militant groups. It contested in the parliamentary election held on 5<sup>th</sup> December 2001 under the TULF symbol and secured 3.89 % (348,164) votes won 15 seats in the North and Eastern Province.

At present, three political parties like ITAK, PLOTE, and TELO came under one umbrella in the name of TNA. In the last general election for the 9<sup>th</sup> parliament, TNA suffered a setback in the north and east, they secured only 325,168 votes and gained nine seats. Out of nine seats, ITAK won five seats including two seats from Jaffna, one seat from Vanni, Batticaloa, and Trincomalee district. In the other four seats, the TELO won two seats from Vanni and one seat from Batticaloa, and the PLOTE won the one seat from Jaffna

District and but no candidate was nominated in the Batticaloa district representing PLOTE. But the ex-candidate of the PLOTE contested for SLPP and won the seat in the Batticaloa district. Now he is a State Minister of Postal Services and Professional Development of Journalists in the SLPP Government (The Gazette of the Democratic Socialist Republic of Sri Lanka, Extraordinary, No. 2187/26).

Comparing with the previous election, we can say, that the TNA's best election period was in 2004 of the parliamentary election, they secured 6.84% of the popular votes (633,654) and secured 22 seats. Furthermore, following election periods, they secured 2.90% (233,190) votes and 14 seats in 2010, 4.62% (515,963) votes and 16 seats in 2015 and 2.82% (327,168) votes and 10 seats in 2020.

Twenty (20) represent the Muslim people from different parts of the country on behalf of different political parties and of the 20 members, sixteen members have been elected deferent district. The other four members were selected through the respective political party's national list (The Gazette

TABLE VII  
 MUSLIMS MEMBERS in the 9<sup>TH</sup> PARLIAMENT ELECTION 2020

| Methods       | SJB | SLPP | NC | ACMC | SLMC | MNA | Total |
|---------------|-----|------|----|------|------|-----|-------|
| Elected       | 11  | 1    | 1  | 1    | 1    | 1   | 16    |
| National List | 1   | 3    |    |      |      |     | 04    |
| Total         |     |      |    |      |      |     | 20    |

Source: The Gazette of the Democratic Socialist Republic of Sri Lanka, Extraordinary, No. 2187/26

### I. CONCLUSION

The outcome of the election will make a significant impact on the constitutional amendment. Gotabaya Rajapaksa was elected as president in late 2019. Following the 2019 April 21st Easter attack, he has led a national security and pro-nationalism campaign camp. Through this, he was beloved by Sinhalese ethnic majority though he could not gain the favoritism from Tamil ethnic and Muslim religious minorities. The SLPP now has sustained a strong position in the parliament. Its victory affirmed that the president's nationalist agenda and encouraged many of his policy positions. The objective of the party, to gain a two-thirds majority in the parliament. The two-third majority, which is the need for SLPP's governance to amend the country's political structure, specifically, by repealing the constitution's 19<sup>th</sup> Amendment, to increase presidential powers relative to parliament and the judiciary. The SLPP is in a clear stand in their plans to amend the 19<sup>th</sup> Amendment.

The people of Sri Lanka have strong political party affiliations. Based on that, people had voted their preferred political party in the last general election. But all of them, have a dual role in the general election, one is to give the party loyalty, and another one is to be an independent voter. But people failed to reject the candidates with the records of serious crime, financial fraud, inability, selfish and abused power while holding the public office in the last general election. In the year 2009, the 30-year armed struggle came to end. But yet, the issues that contributed to this civil war has been not resolved. For the resolving issues, the previous governments had appointed many commissions and expert committees. The previous governments supported arrangements for power-sharing and gave public assurances in this regard. On the perspective of Sri Lankan minorities, the people of Sri Lanka voted for the candidates who are yet to understand the need for diversity in the society and to the governance that promotes violence and discrimination against minority communities.

But all ethnic groups of Sri Lanka have indeed voted for a government that gives importance to the Economic Development. Even the Tamil ethnic minority have given their importance to Economy development along with their ethnic rights.

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# Prevalence and Specificities of Red Cell Alloantibodies Among Blood Recipient's in the Islamic Republic of Pakistan

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**Abstract- Objective:** To determine the prevalence of red cell antibodies in incompatible cross match cases.

**Study design:** It was a cross-section descriptive study.

**Method:** ABO (forward and reverse) and Rh D grouping of donor and recipient's and serological cross matches are performed using Indirect Antiglobulin test. All incompatible cross match cases are further evaluated in immunohematology. The samples of recipient of incompatible cross match cases are subjected to DAT. Auto control red cell antibody screening and red cell antibody identification panels as required to save the discrepancies in individual cases.

**Result:** Total 37 incompatible cross matches cases performed during the study period. ABO discrepancy was the cause of incompatible cross match in 6 of these cases. The cause of incompatible was autoantibodies in 8, compatible after fresh sample were 9, auto immune hemolytic anemia were 8, and alloantibodies in 14 cases.

**Conclusion:** The IAT cross match is an essential part of compatibility testing before blood transfusion. Antibody screening is not routinely performed on donors or recipients. The cross match incompatible is usually the first indicator of presence of allo/auto antibodies in the recipient serum. The prevalence of 0.105 % of incompatible cross match cases in this study stress the need of IAT cross match before red cell transfusion to avoid the life threatening complications. It also signifies the importance of further evaluation of cross match incompatible cases to rule out the presence of significant antibodies.

## I. INTRODUCTION

**B**lood transfusion is a life-saving treatment indicated in diverse clinical situation. Transfusion of safe and compatible blood is preliminary requirement for transfusion services.<sup>(1)</sup>

About 400 blood group antigens have been described. The clinical importance of blood group regarding transfusion line in developing antibodies against the lacking blood group antigen with a risk of transfusion reaction. The clinical importance of different blood group antigens differ but the ABO and Rh are of utmost importance.<sup>(2)</sup>

Accurate ABO grouping is one of the most important serological test required. Thus the polyclonal reagents have been largely replaced by monoclonal reagents. A and B cell are used for performing reverse grouping which is used to detect the reciprocal antibodies. To ensure that the reaction with A and B cell are not as a result of the presence of cold auto antibodies auto control may also be included. Rh D grouping is also performing simultaneously with ABO for convenience and to minimize the clerical errors which occur due to repeated handling of patient's sample.<sup>(3,4)</sup>

Red cell antibodies can be naturally occurring. If present in the plasma of subject which had never been exposed to these antigen by injection, pregnancy or transfusion and immune mediated which are produced as a response to foreign antigen.<sup>(5)</sup>

Anti A and B are the most important one which fall in the this category are of IgM type reacting at room (4 – 22 C) as well as 37 C (body temperature ) immune antibodies are produced by the individual in response to the exposure of antigen by transfusion or trans – placental passage during pregnancy of red cell. These antibodies are of IgG type generally (with few exceptions where these remain as IgM) .these antibodies react best at 37C and are also called warm antibodies. Only IgG antibodies have the capacity to cross the placenta from mother to fetus. The most important antibodies amongst this group are Rh antibodies.<sup>(2,6)</sup>

The red cell antibodies detection is crucial for safe blood transfusion.it is necessary in the investigation of suspected hemolytic transfusion reaction and immune hemolytic anemia. It is also important in detection and investigation of HDFN. Although these red cell antibodies are immune alloantibodies against red cell antigen simulated by transfusion, transplantation or pregnancy. However these can be naturally occurring produced without simulation. Naturally produced antibodies may develop through exposure to environmental antigen like pollen, fungus and bacteria having similar structure like red cell antigen. Furthermore these antibodies can be required passively through plasma products or salutation. Indirect antiglobuline test (IAT) is principle method for screening and identification of clinically significant red cell antibodies, which are of IgG type, reacting at 37 C.<sup>(7)</sup>

Presence of autoantibodies, defined as the antibodies directed against own red cell antigens may interfere in detection of clinically significant alloantibodies.<sup>(8)</sup>

The donor and the recipient sample should be typed for ABO and Rh D and screened for red cell antibodies. The presence of auto and alloantibodies together can complicate the workup making the selection of appropriate cross match compatible red cell difficult, thus resulting in reduced post transfusion red cells survival, foreign antigen are potential immunogens, and may result in production of antibodies within days, weeks or months in the recipient after transfusion. Alloantibodies can result in reduced post transfusion survival of red cells, acute or delayed hemolytic transfusion reaction (HTR) and hemolytic disease of fetus and Newborn (HDFN).<sup>(9)</sup>

In case when antibodies screening is positive, test are performed to identify the antibodies by antibodies identification panel and RBC antigen phenotyping. Screening cells are prepared from two or three individual donors having blood group O and ideally expressing D, C, E, c, e, M, N, S, s, P, Le, K, k, Fy, and jk, antigen. These cells must contain be antigens to detect the irregular clinically significant antibodies. It is also preferred to have at least one of the homozygous antigens expressing for the entire antigen for stronger reaction and ability of detection of weaker antibodies.<sup>(10, 11)</sup>

### Material and methods

This is a cross sectional descriptive study that utilized data of all patients. Patients with missing data were excluded from the study. Clotted and EDTA blood sample of all incompatible cross match cases were collected. Serum was extracted and subjected

to red cell antibody screening by using commercially available three cell panel and antibody identification by eleven cell panel. Other information sought for each patient included medical history, gender, age, and ethnic origin. The data were analyzed using the statistical package for social science (SPSS) software version 25.

### II. RESULT:

Total 37 incompatible cross matches' cases were performed during the study period. The data of investigation including antibody screening and identification was performed in immunohematology department.

Data was characterized in three variables according to blood group, Result and Allo immune specificity.

Out of 37 incompatible cross match cases 9 were compatible after repeating with fresh sample (9/37 24.32 %). ABO discrepancies were detect in 6 of these cases (16.21 %) which Bombay Rh D positive 2/6, Bombay RhD negative 1/6 , A2B with anti-A1 1/6 , week A antigen 1/6 week B antigen 1/6 (figure 1 ) . 8 of the cases were identified as auto immune hemolytic anemia( 21.62 %). 14 cases showed presence of alloantibodies ( 37.84%) showed in figure 2. Out of these 14 cases anti M was most frequent (4/14 28.57 %) followed by anti c ( 2/14 14.28 %) , anti-D ( 2/14 14.28 %) , anti-e (1/14 7.14 %) , anti-E (1/14 7.14 %) , anti Jk<sup>a</sup> (1/14 7.14 %) , anti-S (1/14 7.14 %) , anti E with K (1/14 7.14 %) , anti C with K and E (1/14 7.14 %).

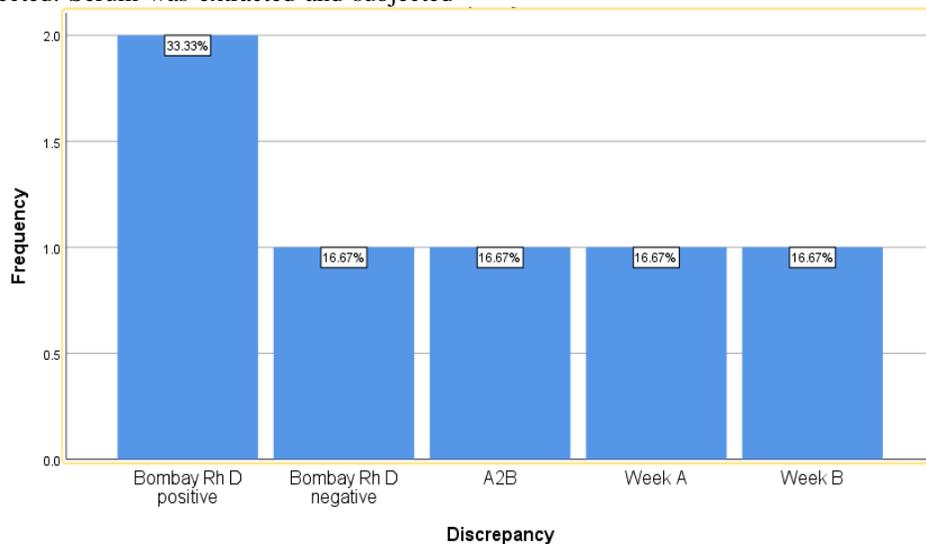
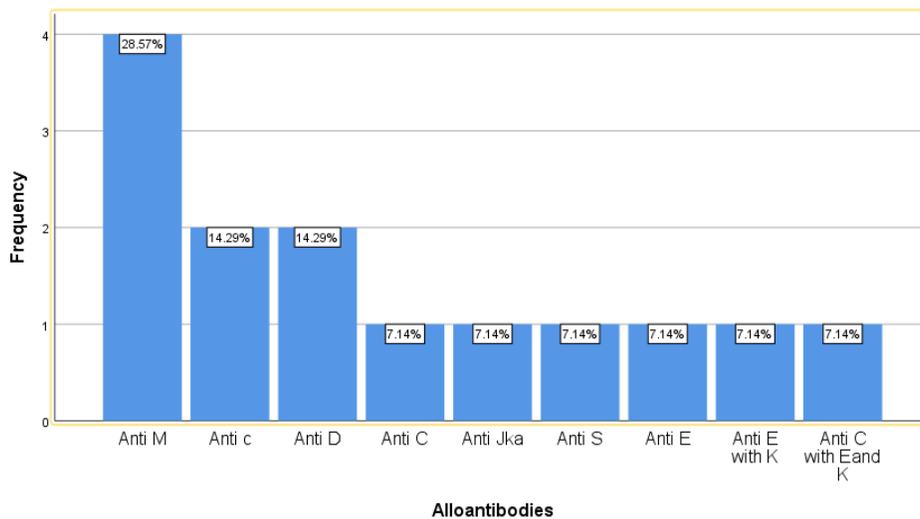
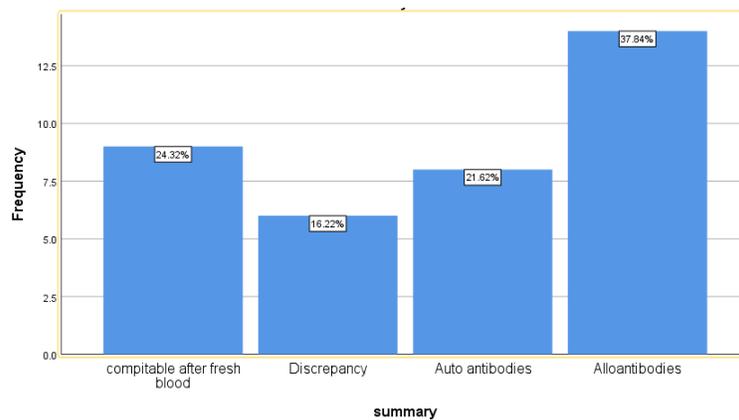


Figure – 2: Distribution of ABO discrepancy in incompatible cross matches.



**Figure – 2: Distribution of Red cell Allo Antibodies detected in Incompatible cross matches.**



**Figure – 4: summary of incomputable cross matches.**

### III. DISCUSSION:

Serological cross match is the most important part of compatibility testing in our part of world to ensure the safety of red cell transfusion. Red cell antibody screening is not performed on all donor or patient sample. However the incompatible cross match cases are subjected to further testing including red cell screening, identification ant globulin test and auto control.

The previous studies largely focused on multiply transfused patient population or antenatal women. A study at Ain Shams University Egypt, in multi transfused auto immune hemolytic anemia (AIHA) patient in 2014 revealed allo antibodies in about one fourth of these case in addition to autoantibodies. Anti E alloantibody was found to be commonest followed by anti K, anti Jk<sup>a</sup>, anti-D, anti-c, anti-M, anti-e, anti-Fy<sup>a</sup>, anti-Fy<sup>b</sup> and anti- Jk<sup>b</sup>, in decreasing order.<sup>(12)</sup>

Another study at National University of Malaysia, Kualalampure, to determine the prevalence of red cell alloantibodies among blood recipient 2008 (n-5719) showed prevalence of allo immunization 65 individuals ( 1.13 % ). The majority of these had a single alloantibody. The anti-E antibody identified as the most common allo antibody followed by the anti- Le<sup>a</sup> and anti-M antibodies.<sup>(13)</sup>

In a study performed at tertiary care hospital in Sokoto, Nigeria by Z, Isaaci, E Osarol, T,C, Adias et al on prevalence of clinically significant alloantibodies among transfusion Requiring patients in 2016 (n-229) that 14.85% of the patient had clinically significant alloantibodies in their plasma which is quite close to our studies. All the female individual were identified as anti-D and anti-c and half were identified anti-E in female followed by anti-jka, anti-Leb, anti-Fyb, anti-Pi and anti-Kp<sup>a</sup> each respectively.<sup>(14)</sup>

An Indian study determine the prevalence and specificity of red cell alloantibodies by Rahul Chaurasia et al in 2014 (n-11235), quied the incidence of red cell alloimmunization in transfused patient of 1.4% with anti-E being the most common specificity followed by anti-D, anti-e, anti-c, anti-E, anti-C + D, and anti-K respectively.<sup>(15)</sup>

Our study, taking in account all of the incompatible cross match in contrast to other study show that autoantibodies were the reason of incompatible cross match in about half of these case. About one fourth of these incompatible cases reveled presence of alloantibody. Anti M being the most frequent alloantibody followed by anti-c, anti-D, anti-e, anti-E, and anti-Jk<sup>a</sup> and anti S antibody. Only two of these cases to be found to be

having multiple antibodies (anti-E with K and anti-C with E and K ).

#### IV. CONCLUSION:

The purpose of pre-transfusion compatibility testing is to ensure the transfusion of safe blood components. It is necessary to detect the red cell antibodies to prevent hemolytic transfusion reaction during or after allogeneic transfusion. As the antibody screening is not a routine part of compatibility testing in our part of world, due to economic factor the importance of proper serological cross match cannot be overemphasized. All incompatible cross match case should be further investigation to detect clinically significant antibodies, if any, and to provide the transfusion of antigen negative blood where required. It is further suggested that the patient requiring multiple transfusion should be considered for red cell phenotype match transfusion to avoid the risk of all immunization.

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# Exploitation of Microorganisms, As tool for Sustainable Agriculture: A Review

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**Abstract-** The current rate at which population is increasing and the land which is used for agriculture shows a disbalanced relationship forcing the scientists to think of either alternative or a way to increase food production per unit of land available. Apart from the stated fact, the current agriculture practices for instance, excessive use of chemical fertilizers, contributes to land deterioration and produces a land with high acidity, low organic matter attributing to low production of crop with high percentage of health threats. This concerning situation has led to adopt the use of Plant Growth promoting Rhizobacteria “PGRPs”, which are tiny microbes with a large contribution in global processes. The present review highlights the mechanism behind PGPR activities by classifying them as direct and indirect way.

**Index Terms-** Biofertilizers, Plant Growth Promoting Rhizobacteria (PGPRs).

## I. INTRODUCTION

To satisfy the demand of uprising population, more and more chemical fertilizers basically nitrogen, potassium and phosphorous salts are dumped into soil with negligence over hazardous effects they possess, for example, chemical in soil puts out a green-house gas, Nitrous oxide into the atmosphere which accounts a portion of 74% of total U.S. N<sub>2</sub>O emission, making it the largest single source according to reports of 2013. (Draft U.S, 2016]. Apart from intensifying chemicals in soil, other adverse effect is the disturbance of biological relationship of plants, as the farmer artificially provide nitrogen in the form of ammonium nitrate, plant feels no need to establish any symbiotic relationship with microbes. Furthermore, nitrifying bacteria also take advantage of this excess ammonium and utilize it to produce nitrate which is then converted by denitrifying bacteria to produce N<sub>2</sub>O, the excess leaches into the groundwater and remaining into the atmosphere [Galloway *et al.*, 2008]. Also, many reports have suggested that chemical fertilizers are not sufficient enough for the plant growth as they lack multi-micronutrients and low content of organic matter, although one cannot neglect the lethality they possess to human and environment health. Scientists are trying to find out a solution of effective sustainable agriculture vision where input cost can be reduced and the method should be natural way. Leading on the said path, crops produced need to be equipped with disease

resistance, salt tolerance, drought tolerance, heavy metal stress tolerance and better nutritional value and all can be achieved by the use of soil micro-organisms which are small but highly efficient worker with no harm to environment (Armada *et al.*, 2014, Calvo *et al.*, 2014). They impart better nutritional and water capacity to the soil, along with other beneficial effects. The most potential organisms are bacteria and a class known as plant growth promoting rhizobacteria are doing wonders in agriculture fields. PGPRs are those bacteria which can colonize the roots of plants and a large number of free-living bacteria are able to enhance the plant growth via direct and indirect mechanisms (Lugtenberg and Kamilova, 2009).

## II. PLANT GROWTH PROMOTING RHIZOBACTERIA (PGPRs):

Rhizosphere, the area around root surface have highest activity in terms of either biological relationships or the root secretion, a continuous interaction goes on by plant with the soil components and is reported to show highest microbial activity due to a confined pool of root exudates and other nutrients (Ahmad *et al.*, 2008). So, these PGPRs, term introduced by Kloepper and Schroth [1978], paving the way for greater discoveries on PGPR, are basically the rhizobacteria which are isolated from the soil and are able to colonize the root surface to have a successful relationship with plant where microbes can fix nitrogen and can provides growth hormones to the plants. Also, it is crystal clear that microbial growth is more in rhizosphere soil, generally 10 to 100 times, as compared to bulk soil due to the presence of micro and macro nutrients (Weller and Thomashow, 1994). The type of relationship exhibited by the PGPRs towards plant include symbiotic, associative or free living (Gray and Smith, 2005), and includes protozoans, algae, fungi and bacteria, although bacteria is the most popular choice for a PGPR (Kaymak, 2010; Saharan and Nehra, 2011; Bhattacharyya and Jha, 2012). Apart from providing positive impact on plant growth by their secretions, some of the PGPRs are active against phytopathogens as well and boost the resistance of plant (Kloepper *et al.*, 1980; Son *et al.*, 2014). A wide range of free-living as well as associate and symbiotic rhizobacteria species belonging to the genus *Pseudomonas*, *Bacillus*, *Enterobacter*, *Klebsiella*, *Azotobacter*, *Azospirillum*, *Rhizobium* and *Serratia* [Saharan and Nehra, 2011].

### III. ROLE OF PLANT GROWTH PROMOTING RHIZOBACTERIA FOR PLANT GROWTH ENHANCEMENT:

A systematic relationship exists among plant and rhizobacteria, initially plant secretes certain exudates in soil to attract rhizobacteria and once they are aggregated, the latter supports the plant growth by increasing nutrient availability, nitrogen fixation and providing disease resistance to plant, stimulating the plant growth and crop yield. These kinds of relationship in which two organisms are in close proximity are usually co evolved and that's how facultative intracellular endophytes came into existence (Bulgarelli *et al.*, 2013). As stated in earlier sections there can be direct or indirect mechanisms of action, the former includes Nitrogen fixing, soil mineral solubilization, production of plant- growth-promoting substances (Auxins, Cytokinin or Gibberellins) and reduction of ethylene levels, stimulation of root growth, rhizoremediation and plant stress control while the latter includes biological control by the rhizobacteria through production of volatile organic compound, production of protection enzyme such as chitinase, glucanase and ACC-deaminase, induction of systemic resistance (Choudhary *et al.*, 2011; García-Fraile *et al.*, 2015). and competition for nutrients and niches for the prevention of plant diseases.

### IV. DIRECT PLANT GROWTH PROMOTION:

Bacterial are potential producers of plant hormones, the ability to produce Indole acetic acid (IAA) is wide spread among plant-associated bacteria (Gaudin *et al.* 1994; Patten & Glick, 1996; Glickmann *et al.* 1998) and is well known for inducing early growth of roots after germination, pathogenesis and Phyto stimulation processes (Venturi and Keel, 2016). Though, IAA regulates the expression of cAMP and amino acids (Katsy, 1997), it can also modify or degrade the tryptophan residues or analogs by methylation or halogenation producing toxic compounds which are lethal to bacterial cell (Hutcheson & Kosuge, 1985; Yamuda *et al.* 1985; Bar & Okon, 1992). IAA is a multitasker and shows effects on cell division extension and differentiation, seed and tuber germination; increases the rate of xylem and root development (Gowtham *et al.*, 2017).); vegetative growth; lateral and adventitious root formation; responses to light, gravity and floescence; photosynthesis, pigment formation, biosynthesis of various metabolites and resistance to stressful conditions (Tsavkelova *et al.* 2006; Spaepen *et al.* 2011). IAA helps in establishment of symbiotic relation by forming nodules in leguminous plants as observed for rhizobia, also it increases the root surface providing more access to nutrients (Gaudin *et al.* 1994).

### V. NITROGEN FIXATION:

Among nutrient requirement of plants, nitrogen is always a limiting one, although 78% of atmosphere is occupied with nitrogen it is often unavailable to the plants. Nitrogen is one of crucial nutrient and is transformed by biological nitrogen fixation process into ammonia which is a readily absorbed by plants (Singh *et al.*, 2015). Nitrogen fixation is carried out naturally by some of the microbes with help of an enzyme complex i.e.

nitrogenase comprised of two subunits dinitrogenase and dinitrogenase reductase each differ in metallic composition (Choudhary and Varma, 2017). The former one uses the electrons provided by reductase unit to reduce  $N_2$  to  $NH_3$  which is utilized by plants. The basic nitrogenase enzyme widespread among bacterial genera or diazotrophs is molybdenum nitrogenase while some are reported to have vanadium instead of molybdenum (Mus *et al.*, 2018). Those bacteria which are symbiotic and are capable of nitrogen fixation hosts Nif genes which are dependent on low oxygen tension which is further regulated by fix genes as observed in *Rhizobium*. Nif and fix genes are the sets of genes found in free living microbes as well (Wongdee *et al.*, 2018). Several PGPR are able to colonize plant internal tissues and thus enhance their growth-promoting effect by providing a limiting oxygen environment required for activation of  $N_2$ -fixation and more efficient transfer of the fixed nitrogen to the host plants (Nyoki and Ndakidemi, 2018). BNF represents an alternative to chemical fertilizers due to economic and environmental advantages.

### VI. ACC DEAMINASE:

Ethylene is an essential metabolite for plant normal growth and development (Van de Poel *et al.*, 2015). Besides being a growth regulator, it is a hormone generated in stress situations resulting from salinity, drought or pathogenicity (Müller and Munné-Bosch, 2015). In these conditions, endogenous ethylene level increases significantly, with negative effects since it can act as a negative plant growth regulator, leading to shorter roots (epinasty), and premature senescence (Bharti and Barnawal, 2018). Thus, high ethylene concentrations can reduce crop yields. PGPR that have ACC deaminase are able to regulate ethylene production by metabolizing ACC (an immediate precursor of ethylene biosynthesis in higher plants) in  $\alpha$ -ketobutyrate and  $NH_3$  (Dar *et al.*, 2018). In this way, PGPR facilitate plant growth and development since they are able to decrease ethylene levels. Thus, plant resistance to various stresses (e.g., presence of phytopathogenic bacteria, polyaromatic hydrocarbons, heavy metals, salinity and drought) is increased (Singh and Jha, 2016; Bharti and Barnawal, 2018).

### VII. PHOSPHATE SOLUBILIZATION:

Phosphorus is one of the inorganic nutrients, most required by all plants for the manufacture of phosphate containing nucleic acids, ATP and membrane lipids. It is essential for plant growth and development since it is involved in many important functions such as energetic metabolism, structural functions, signal transduction functions and transfer of genetic features through successive generations. Thus, this element is essential for cell division and for the generation of new tissues (Dissanayaka *et al.*, 2018). Nasralla *et al.* (1998) stated that the phosphorus element is an essential nutrient for crop growth and height with good quality. Phosphorus (P), after nitrogen is the major plant growth-limiting nutrient despite being abundant in soils in both inorganic and organic forms which is required for maximum yield of agriculturally important crops. Most agricultural soils contain large reserves of phosphorus, a considerable part of

which has accumulated as a consequence of regular applications of phosphate fertilizers. Chemical fertilizers added to the soils to circumvent the problem of P deficiency, further compound the situation by the fact that almost 75-90% of added P fertilizer is precipitated by Fe, Al and Ca complexes present in the soils (Gyaneshwar *et al.* 2002). Individual or co-inoculation of PSB (phosphate solubilizing bacteria) with other groups of microorganisms enhanced the plant growth by increasing the efficiency of biological nitrogen fixation or the availability of P along with other trace elements and by the production of plant growth promoting (PGP) substances (Poonguzhali *et al.* 2005). Bacteria of various genera such as *Bacillus*, *Pseudomonas*, *Mycobacterium*, *Azospirillum*, *Agrobacterium*, *Azotobacter*, *Rhizobium* and *Alcaligenes* are included in the PGPR group (Pathak *et al.*, 2017; Yadav *et al.*, 2018). PSB, which belong to the PGPR group, are ubiquitous and have different properties and population levels according to the physicochemical characteristics, organic matter content and P of the soil where they are found. PSB can transform different P insoluble compounds into soluble forms available for plant uptake (Pathak *et al.*, 2017). Phosphate-solubilizing mechanisms include solubilization of inorganic phosphates by the action of low molecular weight acids such as gluconic and citric acids, which are synthesized by soil bacteria. On the other hand, organic phosphate mineralization occurs through bacterial synthesis of phosphatases such as phytases and nucleases, which catalyze the hydrolysis of phosphoric esters, releasing the phosphate group (Novo *et al.*, 2018). An important fact is that inorganic P-solubilization and organic P-mineralization are capabilities that can coexist in a same bacterial strain (Hanif *et al.*, 2015).

#### VIII. PGPR AS BIOCONTROL AGENT:

In general, competition for nutrients, exclusion of niches, systemic resistance induction and antagonistic metabolite production are the main modes of action through which PGPR exert biocontrol (Fukami *et al.*, 2018). Through these mechanisms, beneficial bacteria can prevent the deleterious effect of phytopathogens on plant growth and/or development.

An indirect mechanism that was found to be involved in plant protection by beneficial bacteria is plant-mediated induced systemic resistance (ISR) that is phenotypically similar to the systemic acquired resistance (SAR) that occurs when plants activate their defence mechanisms in response to infection by a pathogenic agent (Pieterse *et al.* 2009). ISR-positive plants are said to be "primed" so that they react faster and more strongly to pathogen attack by inducing defence mechanisms. ISR does not target specific pathogens. Rather, it may be effective at controlling diseases caused by different pathogens. ISR involves jasmonate and ethylene signalling within the plant and these hormones stimulate the host plant's defence responses to a range of pathogens (Verhagen *et al.* 2004). ISR does not require any direct interaction between the resistance-inducing PGPB and the pathogen (Bakker *et al.* 2007). Besides ethylene and jasmonate, other bacterial molecules such as the O-antigenic side chain of the bacterial outer membrane protein lipopolysaccharide, flagellar proteins, pyoverdine, chitin,  $\beta\beta$ -glucans, cyclic lipopeptide surfactants, and salicylic acid have all been reported to act as signals for the induction of systemic resistance.

It was shown for a couple of bacteria that they are able to trigger the plant's defense system, thereby inducing a systemic resistance against pathogens. In analogy to pathogenic bacteria, also cell surface components of certain non-pathogenic microorganisms are recognized by the plant resulting in a mild but effective immune response (Van Wees *et al.* 2008). Such a response involves the production of pathogenesis-related (PR) proteins, the enhancement of cell wall lignification, and/or the active closing of stomata. Van Wees *et al.* (2000) showed that the application of *Pseudomonas fluorescence* strain WCS417r strain to *A. thaliana* plants stimulates a host response effective against *P. syringae*.

PGPR that indirectly enhance plant growth via suppression of phytopathogen do so by a variety of mechanism. These include: -

- The ability to produce siderophore that chelate iron, making it unavailable to pathogen.
- The capacity to synthesize anti-fungal metabolites such as antibiotics, fungal cell wall-lysing enzymes or hydrogen cyanide, which suppress the growth of fungal pathogens.
- The ability to successfully compete with pathogen for nutrient or specific niches on the roots.

#### IX. ROLE OF PLANT GROWTH PROMOTING RHIZOBACTERIA AS A BIOFERTILIZER:

Organic farming is gaining attention of lately, due to uprising demand of green synthesis. Biofertilizers are a substitute for chemical fertilizers and can be defined as tiny microorganisms which are applied to seeds, plants or soil so to enhance the plant growth by increasing the concentration of free nutrients in the soil which can be readily available to plant (Vessey, 2003). According to Mishra *et al.*, [2013], a blend of live or latent cells accelerating global processes like nitrogen fixation, phosphate solubilization, mineralization, and are applied to soil, seed, roots or composting area are termed as biofertilizers. A similar definition was given by Malusá and Vassilev [2014], stating biofertilizer as a formulated product having one or more microorganism and aimed to upgrade the nutrient status by either making them readily available to plant or by increasing access to nutrients by plants. Bacteria, algae and fungi are potential biofertilizers and are grouped in two categories one is nitrogen fixers like *Rhizobium*, *Azotobacter*, *Azospirillum*, *Acetobacter*, Blue Green Algae and *Azolla* and phosphorous solubilizers/ mobilizers like Mycorrhizae. Few more categories have been identified recently, the potash mobilizers like *Frateuria aurentia*, Zinc & Sulphur solubilizers like *Thiobacillus* species and manganese solubilizer fungal culture like *Penicillium citrinum*. These new strains would also address the issue of 'Fertilizer Use Efficiency' and would also enhance the efficacy of Bio-fertilizers (Mishra *et al.* 2013). Major benefits gained from these microbes includes increased recycling, mineralization and uptake of nutrients such as atmospheric nitrogen fixation, solubilization of phosphorus and potassium, synthesis of siderophores for iron sequestration, synthesis of vitamins, amino acids and plant growth regulating substances like auxins and gibberellins that cause elongation of root and shoot leading to improved plant growth (Glick, 1995).

Moreover, these bacteria are able to feed upon contaminants like heavy metal, pesticides and reduces their concentration by microbial degradation and uptake of pollutants by plants. Further, they reduce the number of pathogens either by competition or by producing action via antibiotics, siderophores and/or hydrolytic enzymes (Saharan & Nehra, 2011). Biofertilizer is a rapid growing industry as it is ecofriendly, cost effective, enhances crop production and soil sustainability. The functioning of biofertilizer is relatively easy to understand, they are applied as seed or soil inoculant after which they colonize and helps in nutrient cycling and crop productivity. Around, 60% to 90% of the total applied fertilizer is lost and the remaining 10% to 40% is reserved by plants. In this regard, microbial inoculants have paramount significance in integrated nutrient management systems to sustainable agricultural productivity and healthy environment (Bhardwaj *et al.* 2014).

#### X. CONCLUSION:

Plant growth promoting rhizobacteria is the most promising way for green synthesis and sustainable way of enhancing productivity, disease resistance and maintaining ecological balance.

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# Challenges and opportunities faced by informal peace committees in Peace Building in Nairobi County

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## Abstract- Background

In recent years, informal peace committees have rapidly made their mark either as precautionary or as response mechanisms to particular conflicts. The main purpose of this study was to examine the efficacy of informal peace committees in peace building in Nairobi County, Kenya since 1990

## Objective

To assess the challenges and opportunities faced by informal peace committees in peace building in Nairobi County

## Method

To accomplish this, the study population consisted of 1260 and a sample size of 509 respondents involved in peace building provided feedback on the effectiveness of informal peace committees. The study collected primary data from interviews, focus group discussions and questionnaires, while secondary data was collected from various databases. The study generated both quantitative and qualitative data. Descriptive statistics data analysis method was applied to analyze numerical data gathered using closed ended questions. Quantitative data was analyzed using descriptive statistics by use of SPSS programme

## Results

The study findings revealed that despite several challenges faced by informal peace committees, they have demonstrated their ability to prevent the eruption or escalation of nascent micro-level conflict into violent and more widespread conflicts

## Conclusion

The study concluded that informal peace committees are often small and simple initiatives, yet effective and sustainable. They are small in that they do not involve official bureaucratic structures, but are local structures that are developed from within the community. Such initiatives are usually guided by culture specific cultural norms and values and that is what makes them more local but legitimate in their host communities. The strengths of community-led initiatives are that they address the community's basic needs and challenges and can be replicated.

## I. INTRODUCTION

The study is part of a larger research project, which was designed using Descriptive statistics data analysis method was applied to analyze numerical data gathered using closed ended questions. Quantitative data was analyzed using descriptive statistics by use of SPSS programme. The central objective of this study was to examine the extent to which informal peace committees can effectively contribute to peace building in Nairobi County. The paper is structured as follows: the Background and

study locale section describes the context and study location. The Peace building theory' section reviews peace building theory. The Literature review section reviews literature on peace building and the comparative advantages of peace committees over other formations. The Research process describes the data collection procedures. The Results and discussion presents and analyses data. The Concluding remarks sums up the entire study.

## II. BACKGROUND AND STUDY LOCALE

Building lasting peace in the aftermath of a conflict is one of the biggest development challenges of our time. By most accounts, more than 50 per cent of countries emerging from civil war revert to violent conflict after a brief period of peace (Barbara Walter, 2014). This means that countries mired in war tend to find themselves in a situation known as the conflict trap. That is, societies that have experienced one civil war are more likely to experience a second or third war than are societies with no prior history of war (Hegre *et al.*, 2011). Yet, despite the virus of post-conflict relapse, a systematic analysis of the literature and empirical evidence show that there is a remarkable variation in the fates of states following civil war. While some became trapped in an intractable cycle of war and lawlessness, others have managed to sustain peace and even experience democratic consolidation after the end of conflicts.

Kenya has since the adoption of multi party politics in the early 1990s tried various peace building initiatives aimed at fostering cohesion and integration which can help reduce and prevent violence and ultimately reconcile the Kenyan people without success. The country has experienced violence especially during election cycles exposing deep rooted issues which have not been addressed in the past. The country remained polarized due to a combination of historical grievances including; unequal distribution of national resources, entrenched politics of exclusion and patronage, weak national institutions among other issues. This problem has been attributed to a cleavage between peace building processes at the local and national levels. The actors at the local level are only considered useful as victims of conflict and/or recipients of humanitarian aid, making the process of peace an activity that concerns state actors and political elites.

Nairobi has experienced all sorts of violence and conflicts associated to all manner of reasons (Mbugua, 2013). This includes social fragmentation, politicized ethnicity, and partisan politics, where political entrepreneurs use ethnic affiliation to manipulate ethnic grievances. This has been the basis for political mobilization to gain power and control over resources. Corruption

and impunity which has severely compromised the security sector, while impunity and lack of justice legitimize violence and lead to revenge attacks. Land and development projects, inequity in land ownership and access cause widespread grievances, as do development projects that are not delivered in a conflict-sensitive manner. Discrimination and marginalization of certain groups and areas have faced long-term discrimination and marginalization, which has been exploited by violent extremists. This has provided more opportunities for violence and wider insecurity and in the long run hampers the process of peace building.

There are various peace building intervention mechanisms that have been touted as the best including bottom-up approach or top-down approach (Gastrwo, 1995). Informal peace committees are intervention mechanisms at village, town or regional level which are often considered transitional mechanisms that use bottom-up approach in their peace building. These practices and policies, as internationalized as they may be, do not work. What explains this variation? In other words, how and why do some conflicts end in a peace that endures while other conflicts reignite? Although academicians and development practitioners have vigorously debated this question relying on statistical as well as qualitative methods, there is still quite limited knowledge about how to re-establish sustainable peace after a conflict. It is against this background that the study was undertaken to fill the missing knowledge gap by examining the efficacy of informal peace committee's in peace building in Nairobi County, Kenya, since 1990.

The city stands at Latitude and Longitude of 1.2833, 36.8167 respectively and GPS coordinates of 1° 16' 59.9880" S and 36° 49' 0.0120" E. The study specifically focused on the period since 1990. Kenya's capital city, Nairobi, is the most dynamic city, also known as the "green city in the sun" for many reasons. It is Kenya's largest city with a population of nearly four million. It's a city that blends people from all cultures and walks of life. As the largest center of business and trade in East Africa, Nairobi is also the regional location of and headquarters for various international companies and organizations. The central business district also houses many of Kenya's big businesses and banks, including the Nairobi Stock Exchange. Being the center of government and its organizations, Nairobi is the city where most business is transacted in Kenya

### III. PEACE BUILDING THEORY

(Michael Barnett et al. 2007), argued that peace, is creating the conditions under which individuals in society can benefit from coherent legal frameworks, public order, political stability, and economic opportunities. Building lasting peace in the aftermath of a conflict is one of the biggest development challenges of our time. By most accounts, more than 50 per cent of countries emerging from civil war revert to violent conflict after a brief period of peace (Barbara Walter, 2014). Conflict Transformation Theory by Johan Galtung (2007) was meant to order to design and reframe the way in which [peace building](#) initiatives are discussed and pursued, particularly in contexts of [ethnic conflict](#). Traditionally the emphasis has been on [conflict resolution](#) and [conflict management](#) methods, which focused on reducing or defusing outbreaks of hostility. Conflict transformation, in contrast, places a greater weight on addressing the underlying conditions which give rise to

that conflict; preferably well in advance of any hostility, but also to ensure a [sustainable](#) peace. In other terms, it attempts to make explicit and then reshape the social structures and dynamics behind the conflict, often employing analytical tools borrowed from [systems thinking](#).

(Galtung, (2013), noted that the cultural violence assembles direct and structural violence with legitimized and internalized violence. He focused on facilitation, mediation, and negotiation to attain cultural peace. The freedom from structural violence definitely assists to restore and maintain peace. It promotes positive peace to move a society toward a fair justice transforming the conflict by peaceful means. Freedom from structural violence enhances dialogue and discourse for peace to oust physical to emotional violence. Freedom from structural violence preserves peace and tranquility advocating freedom from exploitation, repression and separation. The choice of conflict transformation theory in this study was informed by several reasons: For conflict transformation to occur, tensions between parties to the conflict must be overcome – first, by ensuring all actors recognize that their respective interests are not served by resorting to violence; and second, by seeking consensus on what should be transformed and how. Conflict transformation stresses the human dimension by reminding parties of the compatible nature of their needs, instead of emphasizing their opposing interests, and by rejecting unilateral decisions and action, particularly those representing a victory for one of the parties to the conflict;

Conflict transformation does not resort to a predetermined set of approaches and actions, but respects and adapts to the particularities of a given setting; Conflict transformation looks beyond visible issues and is characterized by creative problem-solving, incorporating the perspectives a broad array of actors, including those typically marginalized from such considerations; Conflict transformation invariably involves a third, impartial party, in order to help actors alter their cognitive and emotional views on the 'Other', thereby helping to break down divisions between 'Us' and 'Them'; Conflict transformation represents an ambitious and demanding task, which is better equipped to contend with the asymmetric, complex and protracted nature of contemporary conflicts than prevailing techniques and approaches. Conflict Transformation Theory presented a systematic analysis of different schools of thought that explained why different actors choose different ways to build peace, and where they derived their underlying theories from (explicitly or implicitly). The theory also presented new and critical research thinking in peace building that might impact on practitioners work in the future. Gatling's Conflict Transformation Theory was very useful in helping the study to understand peace building. Again, the study was able to gather some very important milestone in conflict transformation meant to design and reframe the way in which [peace building](#) initiatives are discussed and pursued, particularly in contexts of political, ethnic, religious, resource-related, and gender-based violence, namely:

The aim of Conflict Transformation is to channel the energy generated by conflict in constructive and non-violent ways rather than destructive and violent directions. Thus, conflict transformation doesn't eliminate conflict but utilizes conflictual processes for generative and positive change. In this way, conflict transformation works to develop resilient personal and social

systems where security is enhanced by the quality of community relationships. Conflict transformation occurs when violence ceases and/or is expressed in nonviolent ways, and when the original structural sources of the conflict (economic, social, political, military, and cultural) are changed in some ways. The propensity for violence is diminished by democratization, demilitarization, de-alignment, socio-economic development, and expansion of human rights, humanitarian law, and socio-cultural openness. Conflict can be transformed by normal socio-political processes by the parties acting alone, by expert third-party interventions and parties acting together, or by judicious advocacy and political intervention. There needs to be multi-track involvement if good conflict transformation is sought. This means that conflict transformation can take place at any stage of the escalatory cycle. If the conflict turns violent, its transformation may depend on some kind of crisis management or intervention. Later, it may require conciliation, mediation, negotiation, arbitration, and collaborative problem-solving processes. In the end, any lasting conflict transformation involves processes of resolution, reconstruction, and reconciliation.

Although Conflict Transformation Theory was adopted in the study, one of its major weaknesses was that it has limited attention it gives to the autonomous processes of change that transpire within the political system of the conflict-affected society and it was not conclusive enough to address on what type of action or intervention mechanism is appropriate, by whom, and at what time, when conflict escalates. This means it didn't offer a contingency model on what needs to be done to stop the conflict. This therefore necessitated the need for another theory that would be able to address this shortcoming of not only offering the intervention mechanism but also offer the healing of wounds suffered by victims, offenders and the communities. This would help them to collectively resolve their differences and help them deal with the aftermath of the criminal act with an emphasis on repairing the harm from that act, hence the need for Restorative Justice Theory

#### IV. LITERATURE REVIEW

(Bar Tal, 2007.), observed that in peace building process, past rivals come to mutual recognition and acceptance, have invested interests and goals in developing peaceful relations, feel mutual trust, positive attitudes as well as sensitivity and consideration of the other party's needs and interests. This transformation of beliefs, attitudes and emotions regarding one's own group, the others and the relationship between them may take decades. He argued that reconciliation is not needed in all societies but only in those that have been subjected to protracted, intractable conflict; that is, conflicts in which the societies involved evolve a widely shared psychological repertoire that supports the adherence to the conflictive goals, maintain the conflict, delegitimize the opponent and thus negate the possibility of a peaceful resolution of the conflict and prevent the development of peaceful relations. (Gastrow, 1995), argued that reconciliation implied building or rebuilding relationships today that are not haunted by the conflicts and hatreds of yesterday. To ascertain whether a process of reconciliation is under way in a post-conflict society, suggested that three areas can be observed: how the past is integrated and spoken about between former enemies; if relationships are based

on the present or past; and if contradictory versions of the past have been reconciled not into one truth of the past but to versions not based on lies and denial from a leading scholar and practitioner of conflict resolution,

(Jacqueline *et al.* 2007), noted that in Kenya, as elsewhere, IDPs had been killed or maimed when they attempted to return to former homes in areas without adequate peace and order. Persistent insecurity linked to mobilized youth, local impunity, and the failure of the police and legal system makes resettlement and reintegration of the displaced dangerous. Some argue further that the return of the displaced to their former homes challenges gains in land that play into peace agreements. This can trigger further violence from those who currently live on the newly appropriated or vacated land unless there is careful mediation of these property disputes and reconciliation processes.

(Klopp, 2007), argued that without the healing and reconstitution of local social fabrics linked to successful return and reintegration, a country often moves toward more polarization and ethnic separation. Trauma and anger among IDPs, reinforced by the large concentration of victims with sad and horrific stories to tell means that new settlements of the displaced can easily become recruiting grounds for the next round of violence. The displacements shatter cultural cohesion and undermine traditional practices used to mediate disputes, which often depend on the aggrieved meeting face-to-face where the wrongdoing occurred. When violations of the law are left unaddressed locally as victims flee, impunity at the local level becomes entrenched. (Klopp, 2007), further stated that the process of separation produced by displacement created economic challenges. Violence often disrupts the local economy, which depends on interethnic cooperation for market access, labor, and transportation services. The loss of producer's small businesses and farmers often worsens the prospects for local economic recovery where violence occurs. Where IDPs settle, either as integrated displaced or as impoverished settlers on marginal and unproductive lands and urban slums, they generate new challenges. New ethnically homogenous and unsustainable settlements can increase the potential for violent conflicts between the displaced and host communities, even if the two groups share cultural identities, as the newcomers' needs for water, firewood, and other resources create environmental and social damages that spill over to the host community. Relief food in such new settlements can also undercut local economies.

(Kamoet, 2007), observed that IDPs needed to be integrated and recognized in economic empowerment and property restitution. They deserved to be compensated perhaps the most effective measures for remedying economic insecurity that results from an individual's displacement and loss of livelihood. He noted that internal displacement created serious challenges for Peace building, and the two are intertwined. Preventing further displacement and durable solutions to current displacement requires a peace that involves reconstruction and reform of the state and economy at both local and national levels. This includes not only resettlement but dispute resolution; adjudication of property, especially land disputes; and attack on impunity through reinforcing law and order, in not only the police force but also the courts and mediation systems. According to (Simiyu, 2008), all too often, displacement and its aftermath are viewed within a humanitarian or security lens that obscures these critical but

politically charged aspects of how peace must be built. In turn, Peace building often proceeds as if there is no significant need to restructure the local state. The failure to do so, and thus create mistrust in state institutions to deliver law fairly, often means locals rely on traditional or informal mechanisms with mixed results and contradictory effects

(Van Tongeren, 2012), argued that although informal peace committees are effective and sustainable, participants strongly stressed that they often do not have the capacity to deal directly with political level conflicts. Using their experiences in Zimbabwe, they stressed that this limitation is especially noticeable during election time when political polarization in communities takes centre stage. He observed that even peace committees formed mainly of members of different political parties are often found wanting during election times. He summed it up by saying that this paralysis is mainly due to the fact that these types of conflicts are usually instigated from outside of the community by people at a higher level within the political formations involved, such that the local political functionaries merely follow orders. Yet the lower level social conflicts that the local peace building formations often deal with contribute to the political stability or otherwise of the community as they are the fodder on which the political polarization feeds. Thus the more effective they are at the lower levels of social interaction and relationships the more relevant their work becomes at the higher levels in the community.'

(ZIMCET, 2014), identified limitations of informal peace committees and how they differ significantly from those identified by participants. In the literature, it was demonstrated that informal peace committees face collapse because of lack of funding. A classic example in Zimbabwe was the Zimbabwe Civic Education Trust (ZIMCET) peace committee programme, which survived a near collapse because of lack of funding until Oxfam America and other well-wishers rescued the organization in 2003. From this example, it was clear that peace committees that run on funded programs were at risk as some members participate based on what they will get out of the peace programme rather than what they are likely to contribute. To mitigate this limitation, support should be offered to self-initiated peace committees to ameliorate their legitimacy. (Sangqu, 2014) observed that another limitation facing informal peace committees was that they are restricted in taking part in the peace process pointed out that peace processes have been largely dominated by the elites who include political leaders and international stakeholders. She noted that, currently, informal peace committees were situated to address the softer aspects of peace process including reconciliation, forgiveness and healing related issues and concluded that such a position has ripple effects on the critical role of local peace committees in peace building. However, she contended that while peace processes cannot be left to political elites alone, and noted that local peace committees should not play a subordinate role but should actively collaborate in the peace process. Further, she recommended that attempts should be made by elites to give space to local peace committees to participate actively in the entire peace process but warned that informal peace committees should operate independent of elites, if trust, legitimacy and social cohesion are to be harnessed.

(Odendaal, 2010), observed that in addition, in some countries such as Zimbabwe, informal peace committees did not have any legal framework because their establishment followed an

informal model in which people at the grassroots were involved in setting up the initiative. In such a context, the challenge is that informal peace committees do not enjoy official recognition from the state and therefore they often suffer setbacks in terms their inclusion in mainstream peace building. Another limitation is that of power dynamics associated with peace committees in their host communities. (Adanet.al, 2006), noted that if the community is male-dominated, the composition of the peace committee will be influenced by these gender dynamics, thus posing a challenge to gender representation on the committee. He pointed out that, although peace committees drew much of their approaches from both customary and cosmopolitan norms and values, the challenge is traditional practices that have not been opening up, especially in those areas involving the inclusion of women, youth and political leaders. The exclusion of women and youth serves only to reinforce the patriarchal system in communities, which embraces tradition.

According to (Oberschall, 1973), understanding the nature of conflict, its causes and means of resolution have occupied academic disciplines for much of the 20th century. The study has provided a review of some of the literature on conflict. It aims to synthesize some of the major theoretical arguments on how conflict can be defined, how it is structured and why it develops. The study of conflict does not sit happily within any one academic discipline and in fact each discipline adopts a slightly different treatment of the issue. At a very basic level sociologists see conflict as a function of social structure and an inimical part of the way society evolves. Political science sees conflict as a function of power relations, Marxist and Gramscian thought would see class struggle as the root cause. Economists on the other hand regard conflict as the result of rational decision making by an individual seeking to maximize their personal utility given a pool of scarce resources and might even contest that conflict and competition were one and the same.

According to (Wallace, 1993), conflict is not only a complex issue, but the wide variety of views on the subject from a wide range of disciplines further complicates the picture. Much of the literature on conflict, as a result, tends to draw its support from the three major social sciences namely sociology, politics and economics. The study doesn't attempt to distinguish the correct discipline for analysis, rather to analyze the contradictory and complementary theory offered by the disciplines for the study of conflict.

## V. THE RESEARCH PROCESS

The overall objective of this study was to evaluate the strategies employed by informal peace committees in peace building in Nairobi County using descriptive methodology. This design was considered relevant in relation to the study objectives. The design helped the study achieve its research purpose of describing, explaining, and validating the findings. It was particularly important in linking research with actions that bring the social, political and economic change. The participants were observed in their natural environments without interfering with their activities and behaviors. This allowed for a multifaceted approach to data collection and analysis.

The design chosen involved measurement, classification, analysis, comparison and interpretation of data. In this method,

information was obtained using questionnaires, focus group discussions and interviews to a sample of individuals selected randomly rather than the entire population. The study population comprised of eight categories of respondents, those from the political class, professionals, business community, peace

committee members, religious leaders, government officials, civil society, and finally, the women and the marginalized groups. The tabulation of the study population is made in Table 1 sampling frame of the study population

**Table 1 Sampling frame of the study population**

| Category  | Target population |
|---|-------------------|
| peace committees members                                      | 330               |
| Political Leaders   | 244               |
| Women and the marginalized groups                             | 595               |
| Business community  | 600               |
| Professionals   | 60                |
| Religious leaders   | 95                |
| Government officials  | 156               |
| Civil society officials                                       | 80                |
| Libraries, repositories, published works, journals, databases |                   |
| <b>TOTAL</b>  | 2160              |

Given that the study population was high, the study developed a sampling frame where a list of all the respondents relevant to the study was made. To accomplish this, the study was based on a target population of 2160 respondents, and a sample size of 509. Simple random sampling was used in all the 85 wards

in Nairobi County to extract the samples in all eight categories. Simple random sampling was considered unbiased, inclusive and each unit had an equal chance of being included in the sample (Benedetti, et al, 2010).

**Table 2 Summary of the sampling method**

| Category  | Target population | Sample proportion | Sampling method        | Sample size |
|---|-------------------|-------------------|------------------------|-------------|
| peace committees members                                      | 330               | 75                | Simple random sampling | 22.7%       |
| Political Leaders   | 244               | 51                | Simple random sampling | 20.9%       |
| Women and the marginalized groups                             | 595               | 142               | Simple random sampling | 23.9%       |
| Business community  | 600               | 148               | Simple random sampling | 24.7%       |
| Professionals   | 60                | 13                | Simple random sampling | 21.7%       |
| Religious leaders   | 95                | 21                | Simple random sampling | 22.1%       |
| Government officials  | 156               | 40                | Simple random sampling | 25.6%       |
| Civil society officials                                       | 80                | 19                | Simple random sampling | 23.8%       |
| Libraries, repositories, published works, journals, databases |                   |                   |                        |             |
| <b>TOTAL</b>  | 2160              | 509               |                        | 23.6%       |

Source: Author (2018)

The sample size comprised of 51 Political leaders representing 20.9% of the target population, 75 Peace committee members representing 22.7% of the target population. 40

Government officials representing 25.6%, 19 Civil society officials representing 23.8% of the target population, 13 Professionals representing 21.7% of the target population, 21 Religious leaders representing 22.1% of the target population, 148

Members of the business community representing 24.7% of the target population, 142 Women and marginalized groups including the youth representing 23.9% of the target population. According to (Kothari, 2009), when the population is more than 10,000 participants, the formula below can be used to calculate the target population:

The sample size was computed using the formula:

$$n = \frac{z^2 pq}{e^2}$$

Where;

n= the desired sample size (if the target population is greater than 10,000)

z= the standard normal deviate at the required confidence level of 99% =2.58

p= the proportion in the target population estimated to have characteristics being measured estimated at 0.5

q= 1-p

d= the level of statistical significance set at 0.05

This gives  $n_0=666$ . Since the target population was 2160 the adjusted sample size was obtained using the formula

$$n = \frac{n_0}{1 + \frac{(n_0-1)}{N}} = \frac{666}{1 + \frac{(666-1)}{2160}} = 509$$

The study was based on a sample population of 509 respondents, out of a study population of 2160. The sample was distributed as follows;

These were the samples used in the collection of data in order to provide the information required. This represented a small portion taken from the larger population. This had sufficiently surpassed the minimum threshold sample size recommended by Gay (2005) that a sample size of the target population is regarded as adequate for small population ( $N \leq 1000$ ) Mugenda, (2008). According to Kothari, (2009), when the population is more than 10,000 participants, the formula below was used to calculate the target population. The study had therefore sufficiently surpassed the minimum threshold sample size recommended by Gay (2003)

$$n = \frac{z^2 pq}{e^2}$$

Where;

n= the desired sample size (if the target population is greater than 10,000)

z= the standard normal deviate at the required confidence level

p= the proportion in the target population estimated to have characteristics being measured

q= 1-p

d= the level of statistical significance set.

$Z^2 = 2.58$  if  $\alpha = 0.05$  level of significance

This means that the [response rate](#) may affect the number of people you send your survey to. The higher the response rate, the fewer people you need to ask to take your survey.

The study employed several data collection instruments including, questionnaires, interviews, focus group discussions as primary sources while repositories, peace and conflict journals and databases formed part of the secondary data collected. The questionnaires were administered to the women, youth and the marginalized groups, and the business community where primary

data was collected. However, the questionnaires were not conclusive in gathering the data required and therefore, the need for other methods. The study considered interviews as key qualitative data collection method for the collection of primary data. There were many reasons for the use of interviews in the collection of data as a research instrument. First, they were mainly useful in attaining highly personalized data, as well as providing the opportunities for probing to get underlying factors, and also became a viable option where there were limited respondents.

The main advantage of the interviews stemmed from their capability to offer a complete description and analysis of the research subject, without limiting the scope of the research and the nature of participant's responses. The Interviews were thus useful for gaining insight and context into the research topic. From the onset, the interviews facilitated the accurate screening for the right interviewee while seeking complete description and analysis of the subject matter. The interviewer sought the right individuals who had the desired information. While the interviews enabled the study to reach the limits of the interviewee's knowledge, it encouraged co-operation and helped to establish rapport. The interviews targeted the political leaders, government officials and the civil society officials.

Focus Group Discussion (FGD) was used a method of data collection to collect primary data. The main goal of Focus Group Discussion was to provide an opportunity for the participants to talk to one another about the study topic where the facilitator/researcher guided the discussions. The focus group discussions involved members of the informal peace committees, nyumba kumi initiative members and the local administrators mostly chiefs and assistant chiefs. The study had five focus group discussions in five different constituencies drawn across Nairobi County. The focus group discussions were mainly held in chief's office and comprised not more than twelve members in any one sitting. I collected secondary data from Libraries, repositories, published and unpublished works, journals, and databases on peace building. Secondary data provided a baseline for primary research in comparing the collected primary data results and it was also helpful in research design.

Data analysis was guided by the research objectives presented. The study generated both quantitative and qualitative data. Descriptive statistics data analysis method was applied to analyze numerical data gathered using closed ended questions. Qualitative data analysis was conducted using content analysis which classified, summarized and tabulated the data while quantitative data analysis included calculation of frequencies of variables and differences between them in order to support or reject. A model was deemed to be significant if the overall p-value was less than 0.05. Further tests on the contribution of the individual factors were concluded. The influence of a factor was concluded to be significant if the associated p-value was less than 0.05

Likert type scale items were analyzed on whether they were favorable or unfavorable. Those favoring the argument was analyzed using the order that depicted strongly agreed (SA) as having the highest weight and strongly disagreed (SD) having the least weight. For items that did not favor the argument analysis was done in reverse order where strongly disagreed (SD) had the greatest weight and strongly agreed (SA) least weight. Inferential

data such as charts and frequency tables were basically applied in the presentation of findings by use of SPSS in all objectives.

**Results and Discussions**

**Capacity to deal directly with political level conflicts**

The respondents’ opinion was sought on whether informal peace committees faced the challenge while dealing directly with political level conflicts in Nairobi County. The respondents’ opinion was .Table 1 summarizes the findings.

**Table 1 Lack capacity to deal directly with political level conflicts**

| Response      | N          | %            |
|---------------|------------|--------------|
| Less than 10% | 24         | 5            |
| 11– 25 %      | 42         | 8            |
| 26 – 50%      | 50         | 10           |
| 51– 70%       | 201        | 39           |
| 76- 100%      | 192        | 38           |
| <b>Total</b>  | <b>509</b> | <b>100.0</b> |

Source: Field Data (2018)

The findings in Table 1 showed that the majority of the respondents strongly agreed that informal peace committees faced the challenge of dealing with political level conflicts in Nairobi County. The number agreeing that informal peace committees faced the challenge in dealing with direct political level conflicts in Nairobi County was 393, representing (77 %), while those with different opinion were 116, representing (23 %). Political level conflicts was understood to mean the activity by which differing interests within a given unit of rule are conciliated by giving them a share in power in proportion to their importance to the welfare and the survival of the whole community

One informant from the FGD observed argued:

Although informal peace committees are effective and sustainable, they face serious challenges to deal with political level conflicts’. This is attested by past experience of post election violence in 2007/2008 and previous general elections in Kenya. The limitation was especially noticeable during election time when political polarization in communities took centre stage. This was due to high levels of ethnicity, informal peace committees found it very difficult to deal with polarization brought about by ethnicity.

The observation highlighted complex nature of conflict resolution while dealing with politically motivated conflicts. It emerged that although informal peace committees were able to prevent possible conflicts, to a certain extent the political leaders were able to water down their gains in peace building process. It emerged that although peace building is a long process to achieve, some politicians could destroy it in minutes especially during election times. During elections, politicians used the platform to incite their tribesmen against others with the motive of trying to win their votes. However, it also emerged that informal peace committees should not take this as a challenge but an opportunity

to blacklist politicians who were inciting the communities. It emerged that the informal peace committees could also rally the communities to shun politicians who were not conscious of the well being of the communities.

This position corroborated and differed with (Van Tongeren, 2012), argued that although informal peace committees are effective and sustainable, participants strongly stressed that they often do not have the capacity to deal directly with political level conflicts. Using their experiences in Zimbabwe, they stressed that this limitation is especially noticeable during election time when political polarization in communities takes centre stage. He observed that even peace committees formed mainly of members of different political parties are often found wanting during election times. He summed it up by saying that this paralysis is mainly due to the fact that these types of conflicts are usually instigated from outside of the community by people at a higher level within the political formations involved, such that the local political functionaries merely follow orders. Yet the lower level social conflicts that the local peace building formations often deal with contribute to the political stability or otherwise of the community as they are the fodder on which the political polarization feeds. Thus the more effective they are at the lower levels of social interaction and relationships the more relevant their work becomes at the higher levels in the community.

One informant from the professional groups observed that:

Kenya has long been considered a stable country in the East and Horn of Africa region and has since the late 1990s been making steady progress towards being a fully fledged multiparty democracy. Violence has accompanied almost every election cycle since the introduction of the multiparty political system in 1991. The violence following the December 2007 general election was the worst. . During the five year election cycles since 1991, there has been polarization in communities which has had a negative impact. The Kenyan economy has suffered while community’s ability to integrate and cohes together has seriously been affected. This has been occasioned by the political class who has been the biggest obstacle in the progress of integration and reconciliation of the Kenyan communities. Informal peace committees are unable to deal directly with political level violence as they are unable to take control by ensuring that politics did not divide the communities along tribal lines.

The observation added to the protracted academic debate on the analysis of democracy and development. It emerged that although democracy has been hailed for positive things, it was argued that democracy to a certain extent was misleading. It emerged that when there is too much freedom, some people misuse it for their own benefit. It emerged that most of the violence/conflict witnessed in Nairobi County has been witnessed since the introduction of multiparty democracy. It emerged that while democracy has opened the political space, it had its own shortcomings. Some politicians were using the freedom of speech to incite communities against other political opponent. However, some sections of the participants also felt that communities had failed in their obligation to hold politicians to account through the electoral channel just like other developed nations have done.

This position was in agreement with (Goetz and Jenkins, 2005) who argued that as analysts have found, relying on a minimalist definition of democracy cannot quite capture the

challenges besetting regimes that have undergone a transition but have yet to consolidate their incipient democratic structures. As a result, a growing number of democratization experts are turning towards a more substantive definition of democracy, one that gives greater prominence to the role and importance of accountability. Three dimensions of accountability are usually distinguished: (i) vertical accountability, which enables citizens to hold their political leaders to account through the electoral channel at specified points in time; (ii) horizontal accountability, which refers to accountability mechanisms that exist within the distinct bodies of government itself, whereby state institutions are authorized and willing to oversee, control, redress and, if need be, sanction unlawful actions by other state institutions (O'Donnell 1996); and (iii) societal accountability, which refers to the (ongoing) watchdog functions of civic associations, other NGOs and an independent mass media over the actions of the state (Schedler et al. 1999).

An informant from the FGD observed that:

The lack of patriotism among the Kenyan citizens has been the biggest challenge to political level conflicts. The informal peace committees have not succeeded in promoting patriotism among Kenyan societies. This in effect has given the political class an opportunity to exploit the gap. The only cure to this phenomenon lies in the ability for the informal peace committees to scale their peace education programs especially to the youths on patriotism. Our forefathers were able to deliver our country from the yokes of colonialism due to their patriotism on their beloved country.

It emerged from the discussions that the biggest challenge to peace building in Nairobi County was the lack of patriotism. Most communities owed their loyalty to their ethnic tag at the expense of National fabric. The lack of National patriotism where citizens valued their Nationality rather than their ethnic background was the biggest undoing to peace building in Nairobi County. It emerged that although Kenya has symbols of National unity, little attention was given to educate the citizens the benefits of National patriotism. This shortcoming was exploited the political class to divide Kenyans and in particular Nairobian along tribal lines. It emerged that both peace educators and leaders in general had failed the test of entrenching patriotism as a culture in Kenya and in particular Nairobi County.

This statement corroborated with (Korostelina 2013), who observed that as agents of peace, peace educators are expected to model interpersonal relationships and teach/impart values which uphold peace including tolerance, recognition and respect and a range of skills such as critical thinking, compromise, mediation and collaboration. Teachers are not always considered positively in terms of peace building, if anything the evidence illustrating their role in stoking conflict or preventing 'progressive' reform appears to be more plentiful than the literature advocating their positive contributions to peace building. For example the literature contains examples of teachers manipulating nation building aspects of the curriculum such as History or Geography to represent their own biases and views of history, constructing allies and enemies from their own perspective and re/producing national narratives (of teachers reproducing and normalizing unequal gender relations, and of schools as the sites of physical violence (sexual exploitation and corporal punishment)

An informant from the civil society observed that:

The informal peace committees can overcome the challenge of dealing with political level conflicts by lobbying political actors and creating a platform where politicians would be required to observe peace before and after elections. This will ensure that they don't polarize relationships between communities as they compete for political office. If the informal peace committees are able to win the hearts of the communities through outreach, they would be in a position to overcome the challenge of dealing with political level conflicts

The sentiments highlighted the complexity that is required to understand why and how to end conflict, violence, and war and to keep the peace. It emerged although informal peace committees felt the challenge of dealing with political level conflicts; they had not exploited the opportunity to hold politicians accountable for their actions. It emerged that informal peace committees could team up with civil society organizations in a movement to make politicians account for their actions. This would ensure that the political class sign peace pacts with the citizens before vying for any political office.

The sentiments corroborated with Fisher's (1969), who noted that peace occurs along many dimensions and at many levels. Recognizing this complexity is required to understand why and how to use conflict, violence, and war to keep the peace. To fight something by deliberately introducing that which one wants to avoid certainly is paradoxical, at first thought; and initially, selective burning to control forest fires, inoculation to prevent disease, and herd-thinning to prevent mass starvation were not readily accepted concepts. Fisher argued that to maintain a higher peace may entail lower-level conflict in order to make needed readjustments of expectations and power. Such conflicts through time further a process of adaptation to change. This helps avoid that large gap between the balance of powers and status quo that requires an adjustment possible only through much more extreme conflict and violence. As such, enabling such continual adjustments through nonviolent conflict is one of the values of the exchange society and libertarian political system--that is, of the just peace. And a corollary is that it is often better to let conflict take its course, for parties to negotiate their own balance, than for a third party to impose an artificial peace simply in order to avoid conflict.

The statement further corroborated with (Sen, 1999), who argued that democracy should not be expected to produce better socio-economic outcomes simply because it is a democracy. As Sen, and many others have argued, the democratic process does have intrinsic value on its own right, and it should be expected to arrive at policy decisions in a way that is inclusive, participatory, broadly representative of different societal interests, transparent, and accountable. In particular, following the Sen tradition, the importance of participation in one's development through open and non-discriminatory democratic processes is fundamental. Once the intrinsic value of democracy has been established, however, it is still very much worth asking the 'so what' question: does democracy make a difference, and if so, what kind of difference? The growing recognition of institutions as key factors in shaping (developmental) outcomes and the movement of more poor countries toward democracy have both sharpened the relevance and the stakes of this debate even further.

VI. DIFFICULTIES ENFORCING DECISIONS ARRIVED AT PEACE AGREEMENTS.

The informants were asked whether informal peace committees were challenged in enforcing decisions arrived at peace agreements. Table 3 summarizes the findings.

Table 2 Difficulties enforcing decisions arrived at peace agreements

| Response      | N          | %            |
|---------------|------------|--------------|
| Less than 10% | 30         | 6            |
| 11– 25 %      | 40         | 8            |
| 26 – 50%      | 107        | 21           |
| 51– 70%       | 155        | 30           |
| 76- 100%      | 177        | 35           |
| <b>Total</b>  | <b>509</b> | <b>100.0</b> |

Source: Field Data (2018)

The findings in Table 3 showed that the majority of the respondents strongly agreed that informal peace committees were not able to enforce decisions arrived at peace agreements. The number agreeing that informal peace committees were not able to enforce their decisions arrived at peace agreements was 332, representing (65%), while those with different opinion were 177, representing (35%).

An informant from the civil society observed:

Successful peace agreements are anchored on leaders honoring their commitments. This was the case in the South African, Namibian, and Mozambican peace processes. However, such committed leadership cannot be assumed. For example, in Lesotho, Burundi, and DRC, political leaders methodically dismantled key elements of the agreements that they saw as impediments to their pursuit of power. Regional and international partners, in turn, failed to enforce the peace processes’ provisions when these were being violated. This underscores the indispensable role that external guarantors play in the years after an agreement is signed. This is more than a perfunctory responsibility. The role of informal peace committees especially in Nairobi County to enforce agreements arrived at peace agreements is questionable. They do not have a mechanism to enforce those agreements they participated in negotiating.

The sentiments highlighted the premium attached to peace implementation process that would make it long lived. It emerged that negotiating and signing peace agreements seemed achievable, but the elephant in the room is the implementation. Most countries have negotiated and signed peace agreements but have not able to implement the same. It was argued that in most conflict cases, the warring parties will negotiate and sign a peace agreement only to disown the agreement at some point. It emerged that the disconnect was mainly from dishonest leadership that would sign the pact to favor them and disown the same when it did not favor them

The remarks corroborated with (Ayoub Mona, 2006), who noted that the failure of peace agreements has been explained by negotiated settlements tending to be used in more intractable armed conflicts; thus, making them more short-lived. Moreover, peace agreements fail due to the challenge of implementation. Peace implementation is a high-stake transition process with uncertainty, intangibles and set-backs. In these circumstances, it is difficult to maintain the commitment of belligerents and third-parties to a peace process. Belligerents are often unable to create credible commitments to disarm and demobilize. Peace implementation is also challenged by disproportionately influential groups having the resolve, opportunity and capability to spoil an agreement finally, if the conditions for rebel recruitment in a post-conflict period remain unchanged, armed conflict is likely to recur

An informant from the professional group who observed that:

Informal peace committees are not able to enforce peace decisions arrived at peace agreements. This is especially because, political elites have a tendency to challenge new norms and revert to entrenched legacies of malpractice. Institutional strengthening and robust oversight are fundamental ingredients in the success of peace agreements. Yet, nearly all countries emerging from conflict have weak institutions. Peace agreements, therefore, must be explicitly bolstered and protected against anticipated executive branch interference. In short, domestic political actors will want to test these limits. Experience shows that clear responses from guarantors to these tests are warranted to keep peace processes on track. However, informal peace committees can engage and lobby political class to honor their word in peace building processes.

The remarks emphasized on the structures that help identify, strengthen, support and solidify peace process. It emerged that for peace agreements to be implemented successfully, there is need for setting institutional reforms that will be given specific responsibilities in the implementation stage. It emerged that after the post election violence of 2007/2008 in Kenya, a National accord was negotiated and signed which later paved way for the new constitution in 2010. The promulgated new constitution had very elaborate institutional structure that ensured that the items negotiated were captured and specific institutions were set to ensure the implementation process. A good example of the institutions was the constitutional implementation commission which had a five year mandate to ensure full implementation of the constitution. The onus was therefore for the informal peace committees to partner with other players to put government on check

The observation affirmed (Schwarz Rolf, 2005), who stated that the recurrence of armed conflict underlines the importance of the relationship between peace agreements and peace building. Post-conflict peace building is a comprehensive strategy to assist areas of armed conflict in their transition from war to peace. It is defined as an “action to identify and support structures which tend to strengthen and solidify peace in order to avoid the relapse into conflict. Peace building ultimately is state-building in which the main functions of the state – security, welfare and representation – are created through external assistance and domestic ownership. Schwarz Rolf noted that the key question for the relationship between peace agreements and peace building is if the type, content and quality of peace agreements promote the sustainability

of peace building. Peace building is part of the continuum of conflict management strategies. It is preceded by a mediation process, a peace agreement, and humanitarian relief or peacekeeping operations. As peace building comes at a later stage of conflict management, it inherits flaws from previous phases. Peace building therefore looks backward to implement what has been agreed before and at the same time forward to prevent future armed conflict.

Another informant from the religious group remarked:

The informal peace committees are not entirely to blame for lack of enforcement in decisions arrived at peace agreements. Peace agreements will require strong protections of civil liberties where civil society and the media [play a critical role](#) in providing domestic oversight and upholding institutions it will never work. Restrictions on civil society and the media, therefore, should be an early warning signal to external actors of threats to the implementation of the peace process. Protections of civil liberties should be accompanied by clearly defined and [strict term limits for political leaders](#). Such limits are especially important in these early years when norms of succession have not yet been established and restraining institutions are weak. Successful consolidation of peace agreements takes time. Early progress is not a guarantee of long-term success. Sustaining the peace process relies on resilient institutions; success requires ongoing engagement by domestic, regional, and international actors. This consolidation process typically requires at least a decade. Regional enforcement through collective action may appear cumbersome. However, as the cases cited above show, inaction opens the seam for the unraveling of the rest of what may be a well-knit peace agreement. The cost of this inaction, moreover is invariably higher for the designated country and its neighbors.

The observation highlighted the challenges of not protecting peace agreements which is required to protect civil liberties where civil society and the media [play a critical role](#) in providing domestic oversight. It emerged that after setting institutional structures to ensure full implementation of the peace agreements, there was need for a vibrant civil society and trusted media house to keep the government on toes in the implementation stage. It emerged that in situations where the government gagged the media and the civil society, implementation of peace agreements was either slow or did not take off. In the same vein, the informal peace committees must join hands with the civil societies to push for full implementation of negotiated peace agreements.

The sentiments corroborated with (Westphal Florian, 2004), who observed that internal conflicts do not occur spontaneously but tend to have a history. Local media usually have a deeper understanding of the existing political structures, the participants of the conflict as well as the changes preceding the outbreak of violence. The media can therefore not only influence society before the conflict by recognizing and properly addressing the issue but also afterwards. Unlike international media covering conflicts, local media are a recognized part of society with the ability to accelerate and magnify fears or reduce them. One should not forget that journalism can play a role in escalating conflicts, which also demonstrates the potential for positive purposes. The media have the power to defuse tensions before they even reach a critical point and keep a critical eye on government, opposition

and society. By supplying credible information and reaching a large audience, the media help in managing conflicts and promote democratic principles. In the aftermath of a conflict, reconciliation and societal development can be encouraged as well.

An informant from the government official observed that:

Despite the commendable efforts accredited to informal peace committees, they have not been spared of avalanches of challenges. They lack legal and policy framework to secure their work. The biggest challenge for informal peace committees in Nairobi County has been the absence of legal and policy framework. They are thus regarded as ad hoc illegitimate arrangements to prevent communal conflicts. This challenge has been exploited by any clever criminal or person who can successfully challenge the existence and any ruling of peace committees in a court of law. Again, they have also not been spared by the government of the day because there has not been any policy framework to officially recognize their existence.

The sentiments expressed the challenges of missing or lack of policy and regulatory framework to guide the operations of the informal peace committees. It emerged that the fact informal peace committees did not have an elaborate policy and legal framework; it did not in any way stop them from being recognized by the government. This was considered as an excuse that could not hold any water, instead it emerged that they had to prove their relative worth for them to be taken seriously by other players including the government. These sentiments were echoed by (Odendaal, 2010) who noted that informal peace committees do not have any legal framework because their establishment followed an informal model in which people at the grassroots were involved in setting up the initiative. In such a context, the challenge is that informal peace committees do not enjoy official recognition from the state and therefore they often suffer setbacks in terms their inclusion in mainstream peace building

An informant from the marginalized group observed that:

The lack of legal and policy framework to straighten the operations of informal peace committees has a serious challenge. This means that they lack the authority to impose sanctions especially to the criminal networks operating in the slums of Nairobi County. Criminals have gone scot free because of this loophole. In most slums in Nairobi County, criminal gangs have forcefully occupied houses in the slums and evicted the legal owners of those houses. Informal peace committees have been unable to enforce the rules and return the houses to their original owners.

The sentiments expressed the challenges of missing or lack of policy and regulatory framework to guide the operations of the informal peace committees. This challenge did not go without being discredited. It emerged that the informal peace committees had a responsibility to prove their relative worth for other actors and player's to recognize and appreciate their work and thereby give them formal recognition. It was argued that the informal peace committees had to put their house in order before seeking formal recognition. It also emerged that, informal peace committees should strive to demand full recognition from government since the same government was aware of their existence which proved that they were operating within the legal framework. The observation affirmed the words of (Bush, 2004), who observed that the strength of informal peace committees is

the local initiative and local ownership. These are priceless ingredients of any peace building process. Bush stated: Peace building is not about the imposition of solutions, it is about the creation of opportunities'. The challenge is to identify and nurture the political, economic, and social space, within which indigenous actors can identify, develop, and employ the resources necessary to build a peaceful, prosperous, and just society. Informal peace committees rely on the initiative and commitment of local actors are clearly closer to this ideal than processes that have been designed at national level

An informant from the religious group observed:

Informal peace committees face the challenge of not being recognized formally by the state away from the national cohesion and integration commission. This can be achieved through lobbying parliamentarians to enact laws to officially recognize their existence in law. This would ensure that they are able to carry out their functions and activities without the challenge of enforcing their decisions arrived at peace agreements.

The remarks highlighted the challenges and opportunities available faced by informal peace committees through legislation to bring national peace accord. It emerged that in as much as informal peace committees would negotiate peace agreements, their resolution could be disowned for lack of *loci standi* in law. In other words, the resolutions could not be binding in law and could not be enforced. This loop hole has been used by criminals who know the legal flaws to beat justice. This affirmed (Adan & Pkalya 2006), who observed that there are two main categories of local peace committees. There is one that enjoys formal state recognition and the other that has informal status. Informal peace committees with formal state recognition are usually those created through a national peace accord, legislation or a formal statutory body as part of its mandate. Examples include informal peace committee in South Africa which was established following September 1991 terms of reference of the national peace accord, district code of conduct monitoring committee in Sierra Leone which was created by the political parties registration commission with responsibility or statutory mandate to mediate conflicts between political parties in addition to promoting pluralism, and the committees on inter-community relations in Serbia created under the terms of the law on local self-government of 2002, Act 63

## VII. CAPACITY TO RECONCILE DIVIDED COMMUNITIES

The respondents were asked whether informal peace committees faced the challenge of reconciling divided communities in Nairobi County. Table 5 summarizes the findings.

**Table 3 Capacity to reconcile divided communities**

| Response      | N   | %  |
|---------------|-----|----|
| Less than 10% | 7   | 1  |
| 11– 25 %      | 80  | 16 |
| 26 – 50%      | 97  | 19 |
| 51– 70%       | 103 | 20 |
| 76- 100%      | 222 | 44 |

| Total | 509 | 100.0 |
|-------|-----|-------|
|-------|-----|-------|

Source: Field Data (2018)

The findings in Table 6.5 showed that the majority of the respondents strongly agreed that informal peace committees faced the challenge of reconciling divided communities in Nairobi County. The number agreeing that informal peace committees faced the challenge of reconciling divided communities in Nairobi County was 325, representing (64%), while those with different opinion were 184, representing (36%). Reconciliation was understood to mean the process of restoring traumatized relationships between the victim and the offender. Reconciliation was also understood as overcoming hostility and conflict between individuals and divided ethnic communities. Reconciliation meant open and shared acknowledgement of the injuries caused and the losses experienced. It is one thing to strive to know something, but another to acknowledge it

(Hayner, 1996), defined reconciliation as being constituted by both a focus and a locus, the focus of reconciliation is upon building new and better relationships between former enemies. Relationships are both the root cause and the long term solution of conflict. The relationships must be the core focus. As a locus, He argued that reconciliation represents a space, a place or location of encounter, where parties to a conflict meet. In this place, the traumas of the past and the hopes for the future must be formulated and brought together by discussing the issues of truth, forgiveness, justice, and peace. (van der Merwe, 1998), pointed out that reconciliation must meet all initiatives which bring together, or engage, both sides in a pursuit of changing identity, values regarding interaction, attitudes, and patterns of interaction that move them to a more cooperative relationship. He investigated reconciliation from three dimensions: the spheres of relationships concerning identity, values, attitudes and behavior, the substantive components of reconciliation (justice, truth, healing and security), and the social levels of reconciliation (national, community and individual). He argued that reconciliation is a significant component in every phase of the peace-building process.

An informant from the professional group observed that:

Informal peace committees are faced with a serious challenge of reconciling communities that have had conflict before. The deep rooted enmity caused by a variety of issues relating to inequalities in social, political and economic status. The high levels of poverty have not made things any better. This has made it very difficult for the part of informal peace committees to effectively reconcile communities. However, all is not lost for them because they have a duty and responsibility to champion and advocate for equality and equity in distribution of national resources.

The remarks elaborated the challenges and weakness of lack or absence of reforms to address structural issues that led to prior violations including: individual and community reparations. It emerged that social inequality is usually associated to an unequal distribution of resources and, therefore, it is related to the gap between the rich and the poor. It also relates to an unequal access to opportunities or benefits from economic activity. In the best case scenario, this unequal distribution is associated to talent

or effort; but, in most cases, it is the result of institutional structures that create social barriers based on: sex, age, ethnicity, social status, among other variables that define individuals' initial conditions. It emerged that although the new constitution in Kenya has tried to address the imbalances, it will take several years before the impact is felt.

The statement corroborated with Morocco's long journey to transitional justice and reconciliation where after decades of abuses committed by the government, Morocco began to undertake a multi-stage political reform process in the country. This process, through which reconciliation became part of the public discourse, included granting amnesty to political prisoners and the return of the forcibly, disappeared; creating an arbitration body to grant reparations to victims; and establishing the Equity and Reconciliation Commission (IER). A number of different measures have contributed to reform, including: individual and community reparations; history and memory initiatives; addressing structural issues that led to prior violations; and the re-establishment of trust between citizens and the state. Reconciliation in Morocco at one level has involved a socio-political process, through the creation of a political community based on democratic values. Contributing to this was the acknowledgement of the country's social and cultural diversity in formal processes. At another level, reconciliation has involved reestablishing trust between citizen and state institutions, further emphasized by civil society activism.

An informant from the religious group observed that:

The informal peace committees have not been able to advocate for repentance on the part of aggressors so that the victims can reciprocate by forgiving them. While the past has refused to lie down quietly, it has an uncanny habit of returning to haunt. However painful the experience the wounds of the past must not be allowed to fester. They must be opened. They must be cleansed. And balm must be poured on them, so they can heal. This is not to be obsessed with the past. It is to take care that the past is properly dealt with for the sake of the future.

The remarks highlighted the challenges associated with forgiveness which is an element of conflict resolution. It emerged that the process of reconciliation depends on the attitude of the offender, the depth of the betrayal, and the pattern of offense. When an offended party works toward reconciliation, the first and most important step is the confirmation of genuine repentance on the part of the offender. An unrepentant offender will resent your desire to confirm the genuineness of his confession and repentance. This position was affirmed by TJRC Act (2008), which stated that unfortunately, the idea that one can 'look backwards to reach forwards' downplays the complex ways in which the past actually persists, and possible futures infringe on the present. This is problematic since it can encourage a situation where small changes dampen demands for more substantive reform. At the same time, it can facilitate a politicized assertion of closure that excludes those who do not buy into the absence of the past, the newness of the present, or the desirability of imagined futures and provides a resource to those who seek to present such 'difficult people' as untrusting, unreasonable and unpatriotic. This is not to say that truth commissions are useless and should never be considered.

On the contrary, many view speaking as better than silence, while the commission's report provides a historical overview of injustice in Kenya and a range of recommendations that [activists](#) and [politicians](#) are using to lobby for justice and reform. However, when introduced, truth commissions should be more aware of the importance of persuasive performances and how their initial reception and longer-term impact is shaped by broader socio-economic, political and historic contexts. Truth commissions also need to adopt a more complex understanding of the ways in which the past persists, and possible futures infringe on the present and avoid easy assertions of closure.

One informant from the religious group observed that:

The informal peace committees have the capacity to reconcile protagonist by having various events and forums that can be used to bury the hatchet. While communities come together, they are able to build trust amongst them. There are several activities that they can use to help communities build peace for example, sports. The overall objective is to bring confidence and trust among communities.

The observation highlighted the opportunities available for informal peace committees by use of unique tools used in promoting peace including sports, dialogue for peace, empowerment for peace, arts for peace or advocacy for peace. From the discussions, it was clear that sport for reconciliation projects can be used to promote social inclusion breaking down barriers and creating bridges between opposing groups. Sport can help the process of reconciliation building confidence and trust among diversity advancing healing process, encouraging resiliency, and giving a sense of normalcy. But Sport its self is not good or bad, it is just an empty and neutral box to be filled in and a tool to be used with values, ideas, meaning, dependent on the cultural context in which takes place and people who take part. The statement differed with earlier observations that informal peace faced challenges while reconciling communities. On the contrary, the informal peace committees have not seized opportunities available to help them reconcile communities using peace tools. According to (Hoglund, K. and R. Sundberg, (2008), who analyzed the case of South Africa and its experiences in the use of sports in promotion of social solidity as part of overcoming civil conflict especially in the apartheid era. The author discusses several processes of linking sport to reconciliation such as the utilization of symbols and symbolic acts of reconciliation like handshakes and national symbols displayed on flags and sporting uniforms. Tom Woodhouse (2009) highlights the importance of innovation and creativity in peace building and proposes the use of cultural tools, including sports, as a way to energizing the field of peace studies and conflict transformation

In another research conducted by (Hall, 2011), (Moreau et al, 2014) and (Spaaij, 2014), it was found that young people participating in sport programmers experienced strong feelings of group responsibility, care and camaraderie, enhanced inter-personal confidence, freedom to challenge social habits and boundaries, and enhanced feelings of belonging through embodied and emotional experiences associated with being actively involved in a sporting competition and part of a team environment. Furthermore, according to the Swiss Agency for Development and Cooperation, Sport programs implemented in the slums of

Medellin, Colombia have resulted in a drop in criminal behavior while in Brazil, programs such as (Segundo Tempo, 2005).are expected to show children a way out of misery and violence

One informant from the business community observed that:

Informal peace committees in Nairobi County have put in place fundamental aspect of reconciliation to address past grievances suffered by victims. They have addressed individual and community grievances well before they escalate to widespread violence and disputes. This has been very instrumental in ensuring that they respond to early warnings of conflict. This has allowed for healing and reconciliation to take place.

From the interview, it emerged that forgiveness is both a process and a choice, and may be both intrapersonal and interpersonal. It is a complex and enigmatic concept, hard to pin down because it can apply in different ways to different situations; not everyone experiences it in the same manner. For some, it may result in reducing a personal hurt that makes life easier; for others, it may mean reconciling with an enemy and being able to live side by side again. However, community leaders should also understand that if community members including both authorities and civilians adopt a forgiving attitude that can be a very useful public health and community-building tool. Forgiveness may require relinquishing something that was important to you, such as giving up your moral indignation, your desire for retaliation, or your attachment to being right. Yet forgiveness is useful to community building, because people who forgive tend to be more flexible and less certain in their expectations, both in how life will be or how others will treat them

This statement was affirmed by (Mathey, 2008), when he said that the fundamental aspect of reconciliation is the recognition of the grievances suffered and the damages experienced by the victims caused by the offender. He further said that truth telling breaks apart the past which had been hidden and allows healing and reconciliation to take place. He further asserts that shared truth, documenting the causes, nature, and the extent of severe and gross human rights abuses and collective violence under antecedent regimes, is a prerequisite for achieving accountability, meaningful reconciliation, and a foundation for a common future. Mathey noted that the process of healing and reconciling the memories within the communities in conflicts can be undertaken in a number of ways. It is important to recognize that memories of the past have to be transferred, so that pain and the harm sustained can be healed. Victims and offenders should reiterate their stories of the shared events and negotiate a mutual history as a step towards reconciliation. Retelling of the details of the stories can be therapeutic and allows those memories to be incorporated into the victim's life story. When the story is told in the presence of the offender, it can lead to acknowledgement, apology, forgiveness and reconnection with each other.

One youthful informant noted:

I doubt the ability of informal peace committees to reconcile protagonist and I do not know how one would reconcile with an enemy who did not even bother to seek forgiveness'. I remember how young innocent girls were raped by people best known to them during the 2007/2008 post election violence in Kenya. How were those children supposed to go back to their original homes after the displacement and live with the same people? In fact, instead of the offenders seeking forgiveness on

their atrocities, they were not even remorseful on their action. It is very painful seeing those perpetrators walking scot free in the slums.

From the discussions, it emerged that forgiveness and reconciliation can occur in every sphere of human experience, including individual, community, national, and trans-national levels. In any discussion about forgiveness and reconciliation, it is important to make a distinction between the two before analyzing each of them in greater detail. On the one hand, forgiveness does not necessarily mean reconciling with the wrongdoer. There may be good reasons why you do not wish to reconcile. Reconciliation is an additional choice. On the other hand, it is nearly impossible to reconcile with someone you have not gone some way to forgive. This position was affirmed by (Wabanhu, 2008), who said that forgiveness is a precondition for reconciliation and an essential part of reconciliation as well. He further defined forgiveness in two dimensions, namely; the secular and religious meanings. From the secular meaning, He argued that forgiveness contains two essential elements. The first is willingness to abandon one's right to resentment, condemnation and subtle revenge towards an offender who acts unjustly. The second is willingness to foster qualities of compassion, generosity, and even love towards the offender. Thus, for them, forgiveness consists of a decrease in negative responses, and an increase in positive responses towards a transgressor.

That position was later amplified by (May, 2010), who stated that Reconciliation which overlooks or represses the quest for justice is not reconciliation at all. However, we cannot ignore the fact that reconciliation has to do with some compromises. The compromise does not have to be one-sided since this will prevent it from resolving the conflict or providing a lasting peace. This means that we cannot confuse reconciliation with compromise. Taking responsibility for an offence creates a welcoming environment for the reconciliation process. He suggested in his acknowledgment of sharing the same understanding of reconciliation with philosopher Janna Thompson, reconciliation is achieved when the harm done by an injustice to relations of respect and trust that ought to exist between individuals and nations has been repaired or compensated for by the offenders in such a way that ensures the establishing or re-establishing of these relations. The offenders need to be responsible for the harm they have caused.

An informant from the professional bodies remarked:

Informal peace committees have faced challenges while trying to address the plight of victims to get justice while restorative justice does not demand complete consensus. While democratic reciprocity is no doubt a preferred model for addressing domestic political conflicts, the reconstruction of a society following a civil war will require not only the institutions' expressed democracy but also the cultivation of national unity. If deeply divided societies, as in the case of Kenya, are to become harmonious, they need to embark on radical programs of moral, political and legal reconstruction, such as that illuminated by the restorative justice perspective. Informal peace committees are not able to provide political, moral or legal programs.

It emerged that there are specific criticisms that have been raised regarding the appropriateness and effectiveness of restorative justice programs including failure to consult with

Indigenous communities when establishing programs, that access is a matter for police discretion, too little attention has been paid to cultural differences and the programs are seen to undermine self-determination. Once implemented, such programs in Indigenous encountered a range of issues including low referral rates, few Indigenous conference conveners, high number of youths failing to appear for conferences and a lack of awareness among the Indigenous community of the potential benefits of restorative justice.

This position differed with (Amstutz, 2006), when he stated that Restorative justice does not disregard past wrong-doing, as some of the critics allege. Rather, it seeks to confront the dire truth about the past crimes and injustices by using the truth to foment changes in values and behaviors that increase the prospects for reconciliation. From this understanding, it is important to note that justice itself is moral and ethical and not just legal. It is all about being open to discussion with the right actions to restore relationships. Restorative Justice is a demanding ethic that encourages enemies to confront their humanity and calls on offenders to disclose their accountability and victims to show empathy toward the offenders. In brief, Restorative Justice seeks to achieve idealistic personal and communal reforms so that the burdens of legal retribution are reduced or even eliminated. It does so through attitudinal and behavioral changes that increases the prospects for reconciliation.

One informant from the government actors observed that:

Informal peace committees have faced the greatest test in trying to reintegrate both the victim and the offender citing the case of Internally Displaced Persons in Kenya (IDPs). The offender and the victim probably need to be reintegrated into the community after so much condemnation, prison sentencing, or even after the punishments from the judicial system or community, citing the case of people who were arrested and later released by the courts after the violence. The role of the community in the reintegration process was vital. Each individual, therefore, needs one another for the moral solidarity of society and one cannot exist apart from the community to which one belongs. In most instances, the offender's feet alienated and cut off from society as a result of crime. However, it was the responsibility of the rest of the community to work hard to integrate them into the society despite the harm they had caused. While informal peace committees played a critical in peace building role it was almost impossible to reconcile if the society did not embrace the idea.

It emerged that civil war is commonly viewed as the result of a fracturing of society resulting in social disintegration. Civil war is not purely the disintegration of society. Instead, it is more accurate to describe it as the disintegration of the broad social community, and the social integration of certain members of the community into a new social fabric: the war family. In other words, civil war is both a destructive and constructive process; disintegrating broader social bonds, while constructing smaller more exclusive ones. Social integration is not only a positive process with a peaceful outcome, but can also provide a foundation for the formation of competing group identities. The challenge after war is not only to reintegrate combatants into society, but also to address the social bonds of the war family and combatant society. This statement corroborated with (Jennifer M, 1994), who argued that during war social disintegration takes

place on various fronts: social, economic, and political. Social disintegration, as discussed here, is the breaking of community bonds between individuals and the disassociation of the individual from community beliefs, norms, laws, structures, and goals. Social disintegration worsens with time and with higher levels of violence, especially when this violence targets civilians. Social disintegration involves the fragmentation of society, the exclusion of groups from power and access to economic goods, and the polarization of communities as individuals take sides in the war. The following briefly highlights some common patterns of social disintegration during civil war. First, there is the disintegration of community ties leading to fragmentation. There is the clear break between combatant and non-combatant groups, in terms of who belongs or is considered a member of each community. Social disintegration affects all members of a community during wartime. Community members are forced to choose which faction they support and whether they will fight or not

An informant from the religious group noted that;

The informal peace committees have not been able to achieve maximum support to advocate for a culture of dialogue and acknowledgement within the community on a day-to-day basis and to help to mobilize the community for dialogue sessions. Informal peace committees experience the challenge of advocating for a culture of dialogue and acknowledgement between the communities living in Nairobi County.

This highlighted the challenges associated with the lack of capacity to advocate for a culture of dialogue in conflicts. This contradicts with the work of (Community Social Peace model 2001), in Burundi which observed that in preparation for the community dialogue, the community identifies and delegates its representatives. It is advisable to let the communities themselves identify individuals they deem suitable for the process. The group meetings with the various communities could serve this purpose. Once the buy-in of the community has been secured, and the process explained to the members, they are encouraged to select their representatives to the dialogue sessions. It is important to ensure that during the group meetings, the voices of the various stakeholders, such as women, youth and other marginalized groups, are heard. In the process of selecting the focal points/champions, it is helpful to take into account moral credibility, commitment to dialogue and the ability of the proposed focal persons to clearly convey messages verbally and/or in writing.

Many groups will be uncertain about how the process will play out. In such situations, they may send extremists, hate-mongers or those they believe will best defend their interests to these meetings. If this happens, it is advisable not to reject these people. Since they have the confidence of their community members, rejecting them gives the impression to the community that the process contains other motives than the ones stated. The challenge is to transform their attitudes and perceptions and convert them into peace champions. Once transformed, you cannot find more committed and devoted advocates for peace. However, despite the challenges, informal peace committees have wide opportunities as (Matavire. M. 2012) noted that traditional justice mechanisms have the potential to bring out the truth about past human rights violations as the perpetrators are allowed to present

their stories and narrations in community based environments where their safety is guaranteed by the rest of the community. As much as in modern criminal prosecutions and court processes the risk of half - truths, lies and manipulation of information can never be done away with. However, the fact that a perpetrator comes seeking for community cleansing and is also aware of the need to “cleanse” his own family of social ills bedeviling his relatives facilitates a natural inclination towards bringing out the whole truth. The kind of social and community ostracism that accompanies perpetrators who are perceived to be uncooperative with the truth seeking process is enormous.

However all is not lost for the informal peace committees. (M Minnow, 1998), argued that as much as deterrence is seen to be the preserve of modern day judicial systems, informal peace committees have the potential and ability to deter future human rights violations perpetrated in communities. The avenging spirits against the perpetrator and his or her family is one mechanism that has played a huge role in ensuring that young people do not engage in criminal activities in the name of political parties or other motives. The spiritual sanction removes collective guilt that is usually abused to hide behind gross criminal acts and it individualizes the offence. This method of holding criminals accountable spiritually by the avenging spirits of the dead has helped to individually hold criminals responsible rather than communal.

#### VIII. DISCUSSIONS AND RESULTS OF THE FINDINGS

It emerged that the informal peace committees had continuously been involved in promoting dialogue, reconciliation and building peace and human communities in Nairobi County. However, it emerged that they had serious weaknesses in their structure and performance. Although informal peace committees looked inclusive in their structure, they didn't fully incorporate some local actors such as the local NGOs and civil society working for the promotion of human rights at the local level. Some of those NGOs and civil society groups in the study area had very good networks. It also emerged that informal peace committees didn't include other NGO leaders and civil society actors who had good networks and popularity among the local community. Had it included them, the informal peace committees would have definitively earned more support and increased trust from the people.

It emerged that lack of resources posed serious challenge to the functionality of the informal peace committees in Nairobi County. Due to the lack of financial and logistic resources, the informal peace committees could not act effectively in some emergency situations. This kind of situation sometimes strained the relations between them and the local authorities. This dynamic indicated a dearth of vertical and horizontal relationships among leaders. The lack of educated committee members was another big challenge faced by the informal peace committees. As a result, they could not reach their potential. Similarly, informal peace committees had not been concerned enough about research and other studies. Because of its lack of resources, they were not able to document all the issues related to conflict and peace building in the County. In addition, due to its limited relationships with other civil society organizations, they were not able to initiate

partnerships to promote peace, human rights, or harmony in the local communities.

It emerged that informal peace committees lacked cooperation from other governmental organizations. This was attributed to their temporary structure. The bureaucratic sectors usually did not seriously cooperate with the informal peace committees as with other peace actors for example the cohesion and integration commission. This lack of official recognition by the state didn't auger well with their operations despite their enormous contribution to peace building in Nairobi County. The question of legitimacy and state recognition of informal peace committees was widely raised. There was considerable debate among the respondents on how they could be integrated into state structures and seek ways to maintain them without external financial or organizational assistance. This issue raised all kinds of questions about the design of such committees. First, which and whose notions of peace, justice and societal change should they promote? Who wins by their kind of conflict mitigation and resolution, and who falls out? How do they impact on women and gender relations? How to assure that the structures remain equally accessible to everybody?

Respondents were concerned on how supporting informal peace committee would complement other interventions. In other words, what was the added value of informal peace committees if peace builders aim to contribute to Peace-Writ-Large? Even if informal peace committees had limited impact beyond the confines of their communities, to what extent did they nonetheless address more general political and social problems, and contribute to societal transformation? Again, respondents raised the issue of relationships between newly established structures and existing local institutions. Respondents were concerned that customary regulation, particularly those that favored men over women, or one social group over another? In the same breath, the legal ambiguity, a proliferation of local institutions, and unclearness about who was in charge and what rules applied came in the fore. And if informal peace committees were phased out, which of their attributes should be retained in other institutions? A key dilemma was to what extent such forms of justice and security provision might be at the disadvantage of the re-establishment of the state, and might release the state of its responsibility to take care of its citizens.

Respondents felt that informal peace committees were unable or didn't have capacity to hold people responsible for violence accountable for their deeds. They emphasized how justice may be arrived at in various ways, including through truth-finding, acknowledgement of wrongdoings and apology, or (symbolic) compensation. In the prioritization for peace it was notably motivated by observed shortcoming in the state justice system than by dislike of punitive justice. Various respondents considered that informal peace committees should play an important role after formal justice has been dispensed: in reconciling the parties and reintegration of the punished. This suggested the added value of informal peace committees even after the justice sector had been re-invigorated. They held that, an important question to consider was what local people considered as just and to what extent are such considerations promoted by informal peace committees and state justice systems. The respondents felt that informal peace committees had not exploited opportunities available for them in peace building. They felt that the committees should be able to unravel contradictions in the

sources of any conflict. They should seize the opportunity to represent the roots, the underlying causes of the incompatibilities in a conflictual relationship. These contradictions emerge along the different societal fault lines, and exist most of the time on a subconscious level. Generally, contradictions may arise when certain groups are excluded or marginalized from the political, economic and social participation, where there is a high level of unmet individual and collective needs, where poverty is endemic or where the abuse of power and corruption creates inequalities and injustice within the society. Again, the informal peace committees should be in the frontline to shape attitudes that represents subconscious pillars of the conflict, factors conflicting behavior, holding it in place. Attitudes are revealed in the perception of the conflict actors towards themselves, others, the conflict, the goals of the conflict and the strategies chosen to reach the goals. They should also address the behaviors as a conflict pillar which represents the visible, conscious element of the conflict, individual or collective manifestation of action/ inaction toward the attainment of a certain goal. Depending on the measures and tools used, the behavior may be destructive and constructive.

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# An analysis of experimental fishing traps in the coastal area of the United Arab Emirates

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**Abstract-** The fisheries of the United Arab Emirates are considered as a traditional fisheries and provide a source of income, employment and recreation. With the advancement of marine industries, fisheries are a major source of food security. The main fishing gear in the United Arab Emirates is a dome-shaped wire trap. Despite the economic important of the traps on the Arabian Gulf, scatter studies dealt with this fishing gear. The present study investigates the effect of trap size, season, trap soak time on the catch rate. Catch composition and trap loss rates were studied from March 2015 to February 2016. From 601 trap hauls weighed 2213.0kg for an average of 3.68kgs/trap/pull, catches were comprised of 47 species in which 18 were primary commercial species, 16 were secondary commercial fish species and 13 are by-catch fish species. Average catch for primary, secondary commercial species were 6.80 and 3.34kg/trap/haul respectively. On the other hand, the average of by-catch was 0.92kg/trap/haul for all trap sizes. Catch rate from the different trap sizes showed that, the trap with the diameter of 2.8m had the highest overall catch rate as well as the primary commercial species and contribute 37.04% of the catch rates for different trap sizes. Traps of 2.08m and 3.3m of diameter had the second and third highest overall catch rates and contribute 36.41% and 15.88% respectively. ANOVA results showed a significant difference ( $P < 0.01$ ) between catch rates of different size traps for primary, secondary and by-catch. In the present study, there was not relationship found between trap soak time and catch rate. It's mean meaning the catch rate not increase with increasing soak time. The present study recommended to use medium and large trap sizes and avoid using of small trap.

**Index Terms-** Trap, catch composition, species composition, Arabian Gulf, soak time.

## I. INTRODUCTION

The fisheries of the United Arab Emirates are small-scale in nature, with the vast majority taking place in the Emirate of Abu Dhabi, which is reported to comprise over 60% of the country's marine area<sup>[1]</sup>. Fishers employ two distinct fishing vessel types: fiberglass *tarrads* (speed boat) and traditional wooden *dhow*s (lanch). *Tarrads* are typically 6-8m in length and equipped with 1-2 outboard engines, allowing a crew of 1-4 people to fish for 6-8 hours at a time<sup>[2]</sup>. *Dhow*s, on the other hand, range from 12- 22 m and are equipped with inboard diesel engines and insulated cool boxes, allowing the crew of 4-6 people to fish for 3-5 days at a time. The UAE's fisheries are multi-gear and multispecies, with over 100 species occurring in the catch<sup>[3]</sup>. The main fishing gear is a dome-shaped wire trap called *gargoor*, hand lines, intertidal weirs (*hadrah*), trolling, gillnets, and encircling nets are also used<sup>[4]</sup>. Trap, *gargoor* is a traditional demersal fishing gear, which was in the past made of palm leaves woven into a semi-circular shape, where fish bait is placed inside to attract fish and changed over-time to galvanized steel wire. The diameter of the trap base varies between 1 and 3m, they are supported by tubular steel bars and have a funnel entrance. Most fish species caught by traps belong to the families Serranidae, Lethrinidae, Lutjanidae, Haemulidae, Carangidae and Mugilidae. Though fisheries are of minor importance to the UAE's economy, they are valued for the recreational opportunities they provide, for their contributions to food security, and as a part of the country's cultural heritage. The present study aims to evaluate and analyze of the experimental trap fishery in the sea area of the UAE, catch analysis (catch composition, identification and quantity), catch per unit effort (CPUE) and the impact of soak time on the fisheries.

## II. MATERIALS AND METHODS

### A. Study Area and Period

The traps were deployed in three different locations within the UAE's fishing ground, the first location with the Latitude of 25°37.303'N, Longitude of 55°34.639'E, second location with Latitude 25°36.793'N, Longitude of 55°34.281'E and third location with Latitude of 25°36.254'N, Longitude of 55°34.246'E Fig. 1. The study started from March 2015 to February 2016.

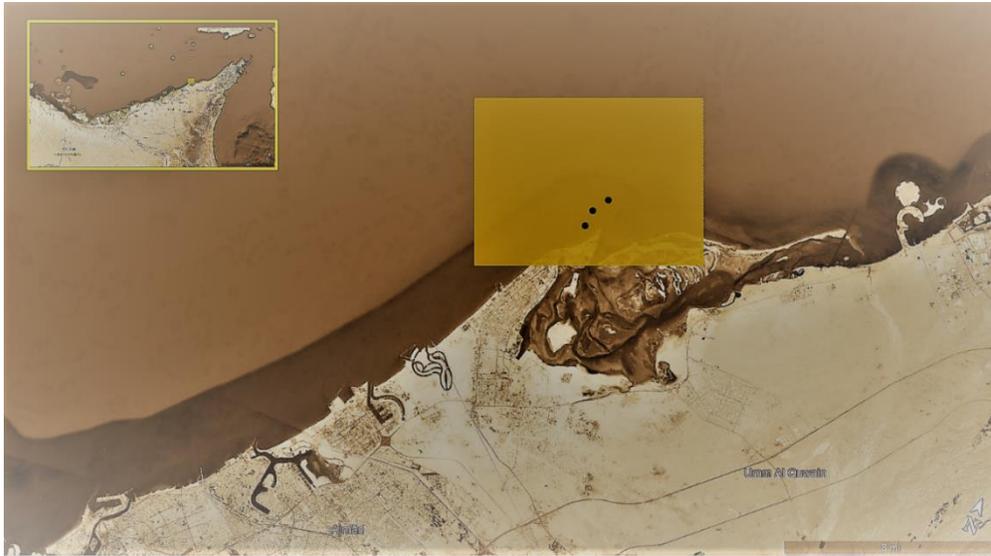


Figure 1. Map of the United Arab Emirates showing the experimental locations

### ***B. Experimental Design and deployment***

The field experiment covered at least one full year to study the seasonal variation in the catch rate and species composition of the fish trap fishery. The most common trap size in UAE's fishery is a trap with a base of 143 cm, however, the fishermen also used other sizes of traps. These trap sizes were tested to consider if different trap sizes would result different catch rates and species composition. The experimental trap used are four different sizes, Extra Large (with base length of 190cm, height of 103cm, diameter of 330cm, panel length and width of 75cm), Large (with base length of 176cm, height of 81cm, diameter of 280cm, panel length and width of 60cm), Medium (with base length of 143cm, height of 64cm, diameter of 208cm, panel length and width of 45cm), and Small (with base length of 93cm, height of 45cm, diameter of 150cm, panel length and width of 75cm). Numbered plastic plates was attached to each trap. The traps position was recorded using Global Position System (GPS) but were not marked by buoys to avoid poaching from other fishermen. Sets of four different sizes were deployed on each location.

### ***C. Sampling Procedure***

Traps were monitored twice weekly and sometimes more than two times due to weather condition and in some cases of traps lost. The trap soak time was between 2 to 4 days and during the experiment the number of soaking time reach to 15 days to check the relationships between catch rate and soak time and between trap loss and soak time. The catch from each trap was sorted, identified and subsamples were taken to measure total, forked lengths and total, gutted weights. The species identification followed the methods of Carpenter *et al.* 1997 and Forese & Pauly, 2008<sup>[5&6]</sup>.

### ***D. Data Analysis***

Catch data were analyzed and grouped by month, catch size, the pulled traps, and catches were grouped into primary commercial fish, secondary commercial fish, and by-catch. The primary commercial fish that species are popular and has high market value. Secondary commercial species are marketable but has lower value. By-catch are fishes not common and has the lowest value and sometimes returned to the sea. The catch rates for different species categories and of different sizes were obtained similarly and tested with analyses of variance ANOVA for significant difference.

## III. RESULTS AND DISCUSSION

### ***A. Traps Catch Analysis***

Table I shows the species composition from 601 trap hauls weighed 2213.0kg for an average of 3.68kgs/trap/pull, catches were comprised of 47 species in which 18 were primary commercial species, 16 were secondary commercial fish species and 13 are by-catch fish species. From the total catch, 1361.38kg (61.52%) were primary commercial species, comprised of (greatest to least order). 667.672kg (30.17%) were composed of secondary fish species and 183.96kg (8.31%) from the total catch were monitored as a by-catch. The primary commercial species was dominated by *E. coioides* and represent 10.09%, followed by *L. nebulosus* and *S. canaliculatus* by 7.60% and 6.82% respectively. The dominant catch for secondary commercial belongs to *Sepia sp.* and *Scarus persicus* and represent

4.63% and 3.82% respectively. While *Platax orbicularis* contribute 2.0% and was dominant in by-catch. The catch composition of the trap in Saudi territorial waters of the Arabian Gulf was studied and the results declared that<sup>[7]</sup>, all species caught by trap are belong to 10 major families and the dominant families were Lethrinidae, Carangidae and Serranidae (23.95%, 18.7% and 15.5% respectively. He stated also that, the catch composition was the same in both large and small boats and the only difference was in fish size and quantity. On the northern part of the Arabian Gulf, Chen *et al*, 2012<sup>[8]</sup> stated that from 1745 trap hauls weighed 7840kg, for an average 4.5Kg/trap/haul (ranging from 2.45 to 7.97kg) and the catches were comprised of 70 species, the primary commercial species (56.94%) dominated by *Argyrops spinifer*, *Epinephelus coioides* and *Plectorhinchus pictus* and contribute 13%, 12.24 and 6.83%. Secondary commercial species (34.52%), of which seven species contributed 30.25% and the *Netuma bilineatus* and *Pomadasystridens* constitute 8.83% and 7.0% respectively. The study also revealed that, the average catch rate of trap has been declining since 1991 Gulf War. The average catch rate from 1980 through 1989 was 5.8kg per trap ranging from 2.8kg to 11.0kg<sup>[9]</sup>. The average catch rate of trap was estimated by<sup>[10]</sup> as 3.57kg/trap/haul and mentioned that *Lethrinus spp* was ranked first by 15.5% and *E. coioides* accounted 14.8%.

Table I. Species composition of the total catch from the experimental traps.

| Scientific Name                          | Common name                    | Catch(kg)      | Percentage (%) |
|--|--------------------------------|----------------|----------------|
| <b>Overall</b>                           | <b>2213.00</b>                 |                |                |
| <b>Primary commercial fish species</b>   |                                | <b>1361.38</b> | <b>61.52%</b>  |
| <i>Epinephelus coioides</i>              | Orange-spotted Grouper         | 223.40         | 10.09%         |
| <i>Lethrinus nebulosus</i>               | Spangled emperor               | 168.12         | 7.60%          |
| <i>Siganus canaliculatus</i>             | White-spotted spine-foot       | 150.90         | 6.82%          |
| <i>Lethrinus lentjan</i>                 | Pink ear emperor               | 118.90         | 5.37%          |
| <i>Gerres oyena</i>                      | Common silver-biddy            | 88.60          | 4.00%          |
| <i>Rhabdosargus sarba</i>                | Gold-lined seabream            | 82.40          | 3.72%          |
| <i>Acanthopagrus bifasciatus</i>         | Two-bar seabream               | 73.60          | 3.33%          |
| <i>Portunus pelagicus</i>                | Blue swimming crab             | 70.60          | 3.19%          |
| <i>Carangoides bajad</i>                 | Orange spotted trevally        | 68.40          | 3.09%          |
| <i>Plectorhinchus sordidus</i>           | Sordid rubberlip               | 63.80          | 2.88%          |
| <i>Lutjanus argentimaculatus</i>         | Red snapper                    | 43.60          | 1.97%          |
| <i>Epinephelus areolatus</i>             | Areolate Grouper               | 42.30          | 1.91%          |
| <i>Argyrops spinifer</i>                 | King soldier bream             | 36.00          | 1.63%          |
| <i>Diagrama pictum</i>                   | Painted sweetlips              | 32.20          | 1.46%          |
| <i>Valamugil seheli</i>                  | Bluespot Mullet                | 32.16          | 1.45%          |
| <i>Lethrinus borbonicus</i>              | Snubnose emperor               | 26.70          | 1.21%          |
| <i>Lutjanus malabaricus</i>              | Malabar red snapper            | 22.90          | 1.03%          |
| <i>Plectorhinchus schotaf</i>            | Minstrel sweetlips             | 16.80          | 0.76%          |
| <b>Secondary commercial fish species</b> |                                | <b>667.67</b>  | <b>30.17</b>   |
| <i>Sepia sp.</i>                         | Cuttlefish                     | 102.40         | 4.63%          |
| <i>Scarus persicus</i>                   | Gulf parrotfish                | 84.60          | 3.82%          |
| <i>Gerres acinaces</i>                   | Whipfin silver-biddy           | 60.61          | 2.74%          |
| <i>Lutjanus quinquelineatus</i>          | Five-lined snapper             | 55.40          | 2.50%          |
| <i>Parupeneus cyclostomus</i>            | Gold-saddle goatfish           | 55.40          | 2.50%          |
| <i>Lutjanus fulviflamma</i>              | Blackspot snapper/Dory snapper | 54.30          | 2.45%          |
| <i>Nemipterus sp.</i>                    | Threadfin bream                | 42.80          | 1.93%          |
| <i>Lutjanus ehrenbergii</i>              | Blackspot snapper              | 40.30          | 1.82%          |
| <i>Siganus javus</i>                     | Streaked spinefoot             | 38.10          | 1.72%          |
| <i>Lethrinus microdon</i>                | Smalltooth emperor             | 28.40          | 1.28%          |
| <i>Cephalopholis hemistiktos</i>         | Yellowfin hind                 | 22.20          | 1.00%          |
| <i>Plectorhinchus gaterinus</i>          | Blackspotted rubberlip         | 20.90          | 0.94%          |
| <i>Gerres filamentosus</i>               | Whipfin silver-biddy           | 17.16          | 0.78%          |
| <i>Alepes sp.</i>                        | Scad                           | 16.40          | 0.74%          |
| <i>Acanthopagrus latus</i>               | Yellowfin seabream             | 15.10          | 0.68%          |
| <i>Lutjanus russellii</i>                | Russell's snapper              | 13.60          | 0.61%          |
| <b>By-catch</b>                          |                                | <b>183.96</b>  | <b>8.31</b>    |
| <i>Platax orbicularis</i>                | Orbicular batfish              | 44.34          | 2.00%          |
| <i>Abudefduf saxatilis</i>               | Indo-pacific sergeant          | 35.40          | 1.60%          |
| <i>Pomacanthus maculosus</i>             | Yellowbar angelfish            | 51.20          | 2.31%          |
| <i>Arius thalassinus</i>                 | Giant catfish                  | 7.60           | 0.34%          |
| <i>Monodactylus argenteus</i>            | Silver moony/Silver moonfish   | 9.40           | 0.42%          |
| <i>Arothron stellatus</i>                | Stellate puffer                | 10.12          | 0.46%          |
| <i>Scolopsis sp.</i>                     | Threadfin bream                | 9.60           | 0.43%          |
| <i>Chaetodon obscurus</i>                | Black-spotted butterflyfish    | 7.40           | 0.33%          |

|                                  |                                |      |       |
|----------------------------------|--------------------------------|------|-------|
| <i>Terapon jarbua</i>            | Jarbua terapon                 | 3.20 | 0.14% |
| <i>Amblygobius albimaculatus</i> | Butterfly goby                 | 0.90 | 0.04% |
| <i>Alutea monoceros</i>          | Unicorn leatherjacket filefish | 0.20 | 0.01% |
| <i>Platycephalus indicus</i>     | Bartail flathead               | 1.20 | 0.05% |
| <i>Aphanius dispar</i>           | Arabian pupfish                | 3.40 | 0.15% |

### B. Catch Per Unit Effort

The average monthly catch per unit effort as (kg/trap/haul) for different species categories was obtained and the results declared that, the average catch for primary species was 6.80kg/trap/haul, while the average catch for secondary commercial species was 3.34kg/trap/haul. On the other hand, the average of by-catch was 0.92kg/trap/haul for all trap sizes. Table II shows the catch seasonality for primary, secondary and by-catch. It is obvious that the catch per unit effort for overall species reach to maximum catch during spring (7.83, 4.26 and 1.14 kg/trap/haul respectively). In general, the mean CPUE for primary species constitute the highest rate 6.80kg/trap/haul then followed by secondary and by-catch by 3.34 and 0.92kg/trap/haul respectively. This is probably related to fish spawning, feeding behavior and change of water temperature. The period from March to May are the main spawning seasons for most of the commercial species. Fishes such as *L. nebulosus* and *E. coioides* aggregate in open water for spawning. In summer, water temperature exceeds 32°C and fishes then move to deep water to avoid the high water temperature. In the territorial Saudi waters [7] the CPUE sharply decreased for both large and small traps during Winter season (7.7 and 2.3 kg/trap, respectively). The study indicated also that, the average catch/fishing day relatively fluctuated in the large boats during the years, while it tended to increase in small boats. In addition, it can be noticed from the trips observations that the loss percentage of traps was higher in large boats (about 12%) than in small boats (about 8%), this may be due to the different ecological factors including water moving in deeper and shallow waters of the fishing areas. Chen *et al*, [8] showed seasonal changes, the monthly catch rates were high (>6kh/trap/haul) from April through July and in December, while the low catch rate (2-5kh/trap/haul) was recorded in August through October and from February through March. Shabani *et al*, [11] recorded a similar peak of catch rate (3.9kg/trap-month) in May for the trap along the East side of the Arabian Gulf.

Table II. Catch seasonality (kg/trap/haul) for the primary, secondary and by-catch caught by different trap sizes.

| Season      | Primary     | Secondary   | By-catch    | Mean |
|-------------|-------------|-------------|-------------|------|
| Winter      | 7.79        | 3.92        | 0.67        | 4.13 |
| Spring      | 7.83        | 4.26        | 1.14        | 4.41 |
| Summer      | 5.97        | 2.37        | 0.88        | 3.07 |
| Autumn      | 5.62        | 2.83        | 0.98        | 3.14 |
| <b>Mean</b> | <b>6.80</b> | <b>3.34</b> | <b>0.92</b> |      |

### C. Catch Rate by Trap Size

Catch rate from the different trap sizes showed that, the trap with the diameter of 2.8m had the highest overall catch rate as well as the primary commercial species and contribute 37.04% of the catch rates for different trap sizes. Traps of 2.08m and 3.3m of diameter had the second and third highest overall catch rates and contribute 36.41% and 15.88% respectively. ANOVA results showed a significant difference (P<0.01) between catch rates of different size traps for primary, secondary commercial catch and by-catch. On the other hand, trap size 1.5m diameter had significant lower catch rates of overall, primary, secondary commercial species and a highly significant difference in by-catch compared with the trap size 2.8m diameter. The catch rates of different trap sizes are shown in table III. Basically the traps of 2.8m and 2.05m in diameter had a significant higher overall catch rate as well as that of primary and secondary commercial fish. In Kuwait's water, Chen *et al*, [8] declared that, the highest overall catch rate as well as the primary species were not result from the largest diameter 2.25m but from the second largest size 2.15m and the study recommended the trap size 2.15m in diameter is appropriate size for Kuwait's trap fishery. The study also declared that, large size trap has more space within a trap and will be less affected by capture fish density especially when soak time is long.

Table III. Catch rate (kg) of different trap sizes

| Trap Size      | Total Trap Haul | Overall       | Primary       | Secondary    | By-catch     | Mean   | %     |
|----------------|-----------------|---------------|---------------|--------------|--------------|--------|-------|
| 3.3            | 68              | 430.70        | 98.4          | 58.9         | 27.63        | 61.64  | 15.88 |
| 2.8            | 79              | 761.70        | 229.5         | 79.4         | 11.32        | 106.74 | 37.04 |
| 2.08           | 62              | 736.80        | 225.63        | 125.32       | 43.82        | 131.59 | 36.41 |
| 1.5            | 58              | 283.80        | 66.08         | 36.2         | 45.8         | 49.36  | 10.66 |
| <b>No.</b>     | <b>267</b>      |               |               |              |              |        |       |
| <b>Overall</b> |                 | <b>2213.0</b> |               |              |              |        |       |
| <b>Mean</b>    |                 |               | <b>154.90</b> | <b>74.96</b> | <b>77.99</b> |        |       |

The average size (total length in centimeters and weight in grams) of fish caught from the different trap sizes showed that, the trap size 2.80m diameter, caught fish with an average length and weight (33.0cm and 413.0g), while the larger trap caught fish with an average length and weight (31.0cm and 388.0gm) Table IV. The study conducted by Tharwat and Al-Gaber [7] in Saudi Arabia, found that larger traps captured larger individuals due to the larger individual sizes to location (deeper waters) and larger opening of the entrance funnel. This would indicate that escape rings should be a solution to sizes election. Escape rings can be incorporated into the construction of the trap to reduce catches of undersized species. Being a multi-species gear, however, presents challenges whose solutions are not straightforward. Target species are not necessarily similar in shape, and because they mature at different ages (i.e., sizes), effort to select one size might be at the expense of other target species [10]. The study recommended that only the larger and medium sized traps be legal and the small traps with small opening funnel and mesh size have a passive effect on the reproductive cycle of many fish species, that they catch large number of immature fishes. Therefore, it could be recommended to operate the large and medium trap only while the small traps should be prohibited. The same results obtained by Chen *et al.* [8] in Kuwait's water, the 2.15m diameter captured large size fish that were only slightly smaller than those captured in the 2.25m diameter.

Table IV. Size composition of combined fish caught by different trap sizes

| Parameters          | Trap diameter (m) |       |       |       |
|---------------------|-------------------|-------|-------|-------|
|                     | 1.50              | 2.08  | 2.80  | 3.30  |
| Average length (cm) | 23.0              | 28.0  | 33.0  | 31.0  |
| Average weight (g)  | 280.0             | 350.0 | 413.0 | 388.0 |
| Number of fish      | 345               | 1503  | 1135  | 980   |

The percentage of species composition (% in weight) of the most dominant species showed that, the traps with size 2.08m and 2.8m diameter had the same dominant species: *E. coioides*, *L. nebulosus*, *L. quinquelineatus* and *G. oyena* Table V. The dominant species of trap diameter 1.5m is *P. pelagicus*. On the other hand, the dominant species of trap diameter 3.3 are *L. nebulosus*, *L. quinquelineatus*. In the territorial waters of Saudi Arabia [7] obvious that emperors, sea breams, groupers, scads/jacks/ and trevallies, rabbit fishes, snapper and others (mainly crabs, Grunt, goatfish and bartail) were the common species in the catch. The different mesh sizes were not tested in this study and the common mesh size used by the local fishermen ranged from 40 to 50mm. Meanwhile, there were reports [11 and 12] stated that larger mesh sizes (e.g. 55mm and 70mm) had resulted in much higher percentage of fish escape [8].

Table V. Species composition (% in weight) for the catch caught by different trap sizes

| Species                          | Trap diameter |       |       |      |      |
|----------------------------------|---------------|-------|-------|------|------|
|                                  | 1.5           | 2.08  | 2.8   | 3.3  | Mean |
| <i>Epinephelus coioides</i>      | 2.50          | 12.40 | 14.30 | 4.60 | 8.45 |
| <i>Lethrinus nebulosus</i>       | 4.50          | 8.60  | 7.90  | 6.30 | 6.83 |
| <i>Lutjanus quinquelineatus</i>  | 2.80          | 6.80  | 7.90  | 5.40 | 5.73 |
| <i>Gerres oyena</i>              | 4.30          | 8.90  | 5.30  | 3.20 | 5.43 |
| <i>Carangoides bajad</i>         | 3.50          | 5.40  | 6.80  | 4.90 | 5.15 |
| <i>Portunus pelagicus</i>        | 6.50          | 7.30  | 4.30  | 2.40 | 5.13 |
| <i>Siganus canaliculatus</i>     | 3.20          | 4.70  | 7.80  | 2.80 | 4.63 |
| <i>Scarus persicus</i>           | 4.50          | 6.40  | 5.20  | 2.10 | 4.55 |
| <i>Lethrinus lentjan</i>         | 1.20          | 6.70  | 5.40  | 4.80 | 4.53 |
| <i>Rhabdosargus sarba</i>        | 3.20          | 5.40  | 6.30  | 2.10 | 4.25 |
| <i>Lutjanus ehrenbergii</i>      | 3.40          | 6.50  | 3.20  | 3.00 | 4.03 |
| <i>Acanthopagrus bifasciatus</i> | 2.30          | 5.40  | 4.80  | 3.20 | 3.93 |
| <i>Plectorhinchus sordidus</i>   | 2.30          | 3.60  | 4.50  | 4.00 | 3.60 |

#### D. Effect of soaking time on the catch rate

In the present study, there was no relationship found between trap soak time and catch rate. It means the catch rate does not increase with increasing soak time. However, trap loss was positively co-related to soak time. The longest soak time in the current study is 15 days. Miller, 1983 [13] reported that, the catch rate usually increases with soak time to some asymptotic bound or increase with soak time to maximum value and thereafter decrease with longer soak time [14&15]. Pengilly and Tracy 1998 [16] stated the catch rate decreased with increasing soak time over the range of 12-72h in commercial king crab pots. After a certain soak time, mean catch rate either approach a maximum value or decreases with increased soak time. The result revealed that the trap loss increased as the soak time increased, about 35% of the trap lost with increase soak time to 10 days. However, the percentage increased to 56% with increasing soak time to 15 days. In Saudi territorial waters of the Arabian Gulf [7] found the estimated annual percentage of lost traps was higher for large boats

than of small boats. In Kuwait's water the catch rate did not increase with the increase of the soak time and this result harmonized with the current study. About 88% of the trap were lost after 100 days if the traps are not cleared during this period. While 36% of the traps were lost after 100 days if the traps were cleared at 20 days' intervals<sup>[8]</sup> and 60% of the trap lost due to lack of buoy. The present study explained the shorter soak time reduced the percentage of trap loss, although higher frequency of clearing trap will increase trap fishing effort and running cost. Mathew *et al*, 1987<sup>[17]</sup> reported the financial losses due to ghost fishing reach 3% - 13.5% of the total catch value in the trap fishery in Kuwait. In the Sea of Oman, the mortality could be as high as 78.36kg/trap in the 6-month period after a trap being deployed in water<sup>[18]</sup>. The present study recommended that to reduce loss of trap the soaking time not exceeding 7 days.

## II. CONCLUSION

The fisheries in the UAE are small-scale, with catches increasing until 1999, after which started to decline. The main fishing gear is a dome-shaped wire trap called a *gargoor*. The present study describes and evaluate the catch and species composition caught by different sizes of the traps. The present study declared that small size of the trap should be avoid because the low catch rates and smaller average sizes of the catch. Soak time less than 10 days increase the catch rate and decrease the trap lost. Therefore, it could be recommended to operate the large and medium traps only while the small traps should be prohibited.

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# Results of Comparison of Survey of Pasture and Recreation and Tourism Places with Intake for More Than 10 Years

(On the example of Gorkhi-Terelj National Park)

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**Abstract:** *The study compared and compared the changes and degradation of soil properties depending on the conditions of use of the protected area by the Pastureland, Recreation and Tourism Department. We made an incision in the Gorkhi-Terelj National Park area for pasture and recreational and tourism purposes, made morphological records, determined the physical and chemical properties of the soil, and selected the soil characteristics of the protected area for more than 10 years. compared with quality. The soil type studied is dark brown mountain soil.*

*According to the results of physical and chemical analysis of the soil, the humus content of 0-8 cm of pasture and recreational and tourist soil decreased by 2.6-2.7% from the fenced area selected for control, and became a light clay in terms of mechanical composition, which is the main indicator of soil physical properties. , sand content increased by 5.6% and physical clay content decreased by 2.6%. In addition, the content of soil nutrients such as mobile phosphorus and exchangeable potassium is lower than in the fenced area [8]. In terms of plant species composition, pastures and recreational areas decreased by 65.8%.*

*Based on the above results, there is reason to believe that the soil of Gorkhi-Terelj National Park has been affected by overgrazing and degradation..*

**Key words:** Soil degradation, soil physical and chemical properties, mechanical composition, pasture, recreation and tourism areas

## Introduction

Soil cover is deteriorating due to environmental and climate change, urbanization, recreation, tourism, and livestock growth, which is increasing the negative impact on ecosystems.

In Mongolia's protected areas, soil degradation is severe, vegetation is depleted, and the environment is adversely affected. In recent years, this situation has become more pronounced in the Gorkhi-Terelj National Park, one of the most popular places for vacationers and tourists.

The main purpose of our research is to study the changes and degradation of soil properties depending on the conditions of use of protected areas. To achieve this goal, the following objectives have been set. These include:

1. To study and identify changes in the condition and characteristics of stabilized soils in areas with high impact on pastures, recreation and tourism in comparison with the soils of fenced areas selected for more than 10 years.
2. Compare the vegetation of the area with the fenced area during the same period

## Materials and methods

Research area: 42782.9 hectares of Gorkhi-Terelj National Park, 60-70 km from Ulaanbaatar, adjacent to Khan-Khentii Strictly Protected Area.

The main method of soil field research is to make an incision in the soil and make a morphological record, and we made the incision in the soil according to a common methodology. Soil morphology records the soil color of each layer, layer thickness,

structure, density, moisture, carbonate, petrification, plant root distribution, location, and layer shift. The ingestion of soil from the pasture will depend upon the duration of the visit and to an extent on the age of the individual (Environmental Protection Agency, 1996). Van Wijnen et al. (1990) report that soil intake by children on a camp site ranges from 30 to 200 mg per 24 h, while Haas (2000) estimates ingestion per working day by agricultural workers to have a median value of approximately 10 mg. When performing chemical risk assessments, the United States Environmental Protection Agency assumes a daily soil ingestion rate of 200 mg for each 24-h period (EPA, 1996). In this study, two scenarios with different amounts of soil ingested by humans are considered. The first involves a 24-h stay including an overnight camp and uses the soil ingestion data of van Wijnen et al. (1990) and the second involves a day visit (8 h) and uses the data supplied by Haas (2000). The physical and chemical properties of the soil were performed by the following methodology. These include:

- Physical properties of the soil: The mechanical composition of the soil was determined by the Kaczynski method, the volume of the soil by the cylinder, the density of the solid part of the soil by the pycnometer method and the soil porosity by the calculation method. The pycnometer method is used for determination of specific gravity of soil particles of both fine grained and coarse grained soils. The determination of specific gravity of soil will help in the calculation of void ratio, degree of saturation and other different soil properties
- Soil chemical properties: Soil reaction environment was determined by Potentiometric method, Soil humus was determined by Turing method, Mobile phosphorus and Potassium exchange was determined by Machiginny method.

- The following methods of statistical processing of field and laboratory research materials were widely used. Mathematical modeling methods, numerical data summarization, statistical generalization, test, interval and SPSS statistics 22 software were developed.

### Results and Discussion

We determined the physical and chemical properties of the soils of pastureland and recreation and tourism areas and the composition of plant species, and compared them with the soils of the fenced area selected as the main results (Table 1-4).

| Study area                                     | Sampling depth (cm) | Soil density (g / cm <sup>3</sup> ) | Porosity (%) |
|--|---------------------|-------------------------------------|--------------|
| Intake protected<br>(Control)                  | 0-8                 | 1.08±0.08                           | 59±54.1      |
|  | 10-16               | 1.15±0.04                           | 57.2±53.9    |
| Pastureland<br>recreation and<br>tourism place | 0-8                 | 1.24±0.06                           | 53.9±52.9    |
|  | 10-16               | 1.32±0.03                           | 53.9±52.9    |

Table 1. Comparison of physical properties of soil in the study area

According to the above results, 1.24 g / cm<sup>3</sup> or 0.16 g / cm<sup>3</sup> in the 0-8 cm layer of compacted dark brown mountain soil and 0.16 g / cm<sup>3</sup> in the indoor area and 1.32 g / cm<sup>3</sup> or 0.17 g in the 10-16 cm depth. / cm<sup>3</sup>. In addition, the total porosity of 0-8 cm of soil in pasture, recreation and tourism areas was 5.1% lower than the same period, and 5.2% less in 10-16 cm. This shows that the soils of pastures and recreational areas have become denser due to human, livestock and technical degradation.

| Study Area                                     | Sampling depth (cm) |           | Mechanical particles (%) |            |             |        | Particle size (mm) |      |  |
|--|---------------------|-----------|--------------------------|------------|-------------|--------|--------------------|------|--|
|  | 1-0.25              | 0.25-0.05 | 0.05-0.01                | 0.01-0.005 | 0.005-0.001 | <0.001 | <0.01              |      |  |
| Intake<br>(Control)                            | 0-8                 | 10.9      | 32                       | 26.1       | 13.9        | 7.5    | 9.4                | 30.8 |  |
|  | 10-16               | 11.8      | 29.5                     | 26.7       | 15          | 6.1    | 10.6               | 31.7 |  |
| Pastureland<br>recreation and<br>tourism place | 0-8                 | 19.8      | 28.7                     | 27.1       | 10          | 7.6    | 6.8                | 24.4 |  |
|  | 10-16               | 19.9      | 32.1                     | 25.6       | 9.3         | 7.2    | 5.0                | 21.5 |  |

Table 2. Mechanical composition of soil in the study area

As for the mechanical composition of the soil, N. A. According to Kaczynski's classification, the content of physical clay (<0.01 mm) in the fenced area decreased by 30.8-31.8% or medium loam in the upper layers of the soil, and by 6.4-10.2% in the upper layers of pasture and recreation areas. This is a sign that the mechanical composition of the soil has deteriorated.

| Study Area                               | Sampling depth (cm) | n  | pH        | Salinity (%) | Compost content (%) |          | Nutrients ,mg /100gr          |                  |
|--|---------------------|----|-----------|--------------|---------------------|----------|-------------------------------|------------------|
|  |                     |    |           |              |                     |          | P <sub>2</sub> O <sub>5</sub> | K <sub>2</sub> O |
| Intake protected (Control )              | 0-8                 |    | 6.69±0.17 | 0.036±0.03   | 4.7±1.29            | 2.2±0.36 | 50.8±9.05                     |                  |
|  | 10-16               | 24 | 6.58±0.08 | 0.024±0.02   | 3.6±0.40            | 2.1±0.22 | 43.5±5.71                     |                  |
| Pastureland recreation and tourism place | 0-8                 |    | 6.53±0.15 | 0.073±0.04   | 2.0±0.46            | 1.9±0.25 | 38.9±6.07                     | 24               |
|  | 10-16               |    | 6.51±0.15 | 0.057±0.04   | 1.0±0.40            | 1.6±0.27 | 34.1±10.5                     |                  |

Table 3. Chemical properties of soil in the study area

From the above results, there is no significant difference in the soil reaction environment in the fenced area and the pasture, recreation and tourism area is slightly acidic, but the salt content is 0.033-0.037% higher than the fenced area in the 0-8 cm layer of the pasture, recreation and tourism area. is. This indicates that the soils of pastures and recreational and tourism areas are prone to salinization.

Fertility indicators, such as mobile phosphorus and potassium, also vary in fenced and pasture, recreational and tourism areas. The mobile phosphorus content is 0.3 mg lower and the potassium content is 11.1 mg lower than the fenced area in the 0-8 cm layer of pasture, recreation and tourism soil, which indicates a decrease in the content of these substances in the pasture and recreation area. The concentration of E. coli O157 in faeces is the most important parameter and has a positive correlation. This demonstrates that as the concentration increases, then the probability of infection also increases. The type of visit also shows an important positive correlation. For longer visits (24-h camp), the probability of infection increases due to increased ingestion of soil quantity and hence increase in numbers of pathogen ingested. The host susceptibility (the probability of infection by a single organism) defined in the dose – response model is an important parameter and is also positively correlated. This result is expected because the greater the susceptibility of the individual then the greater the probability of infection. The other positively correlated variables are less important and it is worth noting that this includes duration of time the animals are on the field. It can be seen from Fig. 2a that the build-up of pathogen on the pasture does not increase at a significant rate once the cattle have been on the field for more than 8 –9 days and hence the low correlation result was expected.

In order to determine whether there is a change in the vegetation cover of the surveyed area, we compared the plant species with a total of 6 iterations of geobotonic records in fenced and pasture, recreation and tourism areas (Table 4).

| № | Plants                 | Intake      |      |                              |      |
|---|------------------------|-------------|------|------------------------------|------|
|   |                        | Type        | Item | Type                         | Item |
|   |                        | Pastureland |      | recreation and tourism place |      |
| 1 | <i>Asteraceae</i>      | 3           | 6    | 2                            | 3    |
| 2 | <i>Crassulaceae DC</i> | -           | -    | -                            | -    |
| 3 | <i>Rosaceae</i>        | 1           | 3    | 1                            | 1    |

|    |                             |    |    |   |    |
|----|-----------------------------|----|----|---|----|
| 4  | <i>Fabaceae</i>             | 2  | 6  | - | -  |
| 5  | <i>Liliaceae</i>            | 1  | 3  | 1 | 2  |
| 6  | <i>Poaceae</i>              | 5  | 6  | 1 | 4  |
| 7  | <i>Chenopodiaceae</i>       | 1  | 1  | 1 | 1  |
| 8  | <i>Caryophyllaceae</i>      | 1  | 2  | - | -  |
| 9  | <i>Thymelaceae</i> Juss     | 1  | 1  | 1 | 1  |
| 10 | <i>Plantaginaceae</i>       | 1  | 1  | 1 | 1  |
| 11 | <i>Lamiaceae</i>            | 1  | 2  | 1 | 1  |
| 12 | <i>Scrophulariaceae</i>     | 3  | 5  | - | -  |
| 13 | <i>Rubiaceae</i>            | 1  | 1  | - | -  |
| 14 | <i>Polygonaceae</i>         | 2  | 2  | - | -  |
| 15 | <i>Brassicaceae</i> Burnett | -  | -  | - | -  |
| 16 | <i>Boraginaceae</i> Juss    | -  | -  | - | -  |
| 17 | <i>Papaveraceae</i> Juss    | -  | -  | - | -  |
| 18 | <i>Plumbaginaceae</i>       | 1  | 1  | - | -  |
| 19 | <i>Euphorbiaceae</i> Juss   | -  | -  | - | -  |
| 20 | <i>Ranunculaceae</i> Juss   | -  | -  | - | -  |
| 21 | <i>Dipsacaceae</i>          | 1  | 1  | - | -  |
|    | Total                       | 25 | 41 | 9 | 14 |

Table 4. Plant species in the study area

According to the above results, 25 species and 41 species of plants were registered in the area protected for more than 10 years, and 9 species and 14 species of plants were registered in the areas with pastures, recreation and tourism [8, 10].

Based on the results of the above study, we compared the changes in soil and vegetation in the area with the following key indicators (Table 5).

| Судалгааны талбай                        | pH          | Pulp, %     | Nutrients(mg /100 gr)         |                  |              | Volume weight (g/sm <sup>3</sup> ) | Sand (1-0.05 mm) | (<0.001 mm)  | Plant species |
|--|-------------|-------------|-------------------------------|------------------|--------------|------------------------------------|------------------|--------------|---------------|
|  |             |             | P <sub>2</sub> O <sub>5</sub> | K <sub>2</sub> O |              |                                    |                  |              |               |
| Intake (protected more than 10 years)    | 6.69        | 4.7         | 2.2                           | 50.8             | 1.08         | 42.9                               | 9.4              | 41           |               |
| Pastureland recreation and tourism place | 6.53        | 2.0         | 1.9                           | 43.5             | 1.24         | 41.3                               | 6.8              | 14           |               |
| <b>Difference (%)</b>                    | <b>-2.3</b> | <b>-2.7</b> | <b>-13.6</b>                  | <b>-23.4</b>     | <b>+14.8</b> | <b>+5.6</b>                        | <b>-2.6</b>      | <b>-65.8</b> |               |

Table 5. Changes in soil cover characteristics of pastures and recreational areas (0-8 cm)

As a result, the humus content in the 0-8 cm layer of pasture and recreation soil decreased by 2.7% compared to the fenced area, and the content of nutrients such as phosphorus and potassium decreased by 13.6-23.4%.

In terms of soil physical properties, the sand content of pastures increased by 14.8%, the sand content increased by 5.6%, the clay content decreased by 2.6% and the plant species composition decreased by 65.8% compared to the fenced areas of pastures and recreation and tourism areas. This suggests that the soil properties of pastures and recreational areas are being severely degraded and eroded.

### Conclusion

1. The sand content increased by 5.6%, the physical clay content increased by 2.6%, and the humus content, which is the main indicator of fertility, increased by 2.7%. The content of iron, phosphorus and potassium decreased by 13.6-23.4%, respectively.

2. According to the results of the vegetation survey, the vegetation of pastures, recreation and tourism areas decreased by 16 species and 27 species compared to the fenced areas. This suggests that the soil in the area has deteriorated significantly.

### Discussion

The results of the study of soil degradation in the Gorkhi-Terelj National Park are compared with the work of other researchers and the results of the study. These include:

D. Dorjgotov (1986, 2003) A detailed soil study was conducted in Mongolia to determine each soil type. According to his research, the humus content in the 0-10 cm layer of dark brown mountain soil is 3.4-5.6%, and the reaction medium is neutral to pH 6.9-7.0. In terms of particle composition, sand and light loam (<0.01 mm fraction 16-22%, <0.001 mm fraction 2-10%) have mechanical components. In our study, the humus content was 2-4.7% in the 0-8 cm layer of dark brown mountain soil, the reaction medium was weakly acidic pH 6.5-6.6, and the light clay loam in terms of particle composition (<0.01 mm percentage was 24.4-30.8%, <0.001 mm- 6.8-9.4%) of the mechanical components.

D. According to Avaadorj's researchers (1990-2000), the humus content of dark brown mountain soil is 2.07-3.24%, while in our study it is 2-4.7%.

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# Development of Livestock Feed Mixer

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**Abstract-** A livestock feed mixer was designed, constructed and evaluated for its performance using mass of shelled corn as tracer. The machine was tested using a feed composed of 12.63 kg wheat bran, 12.63 kg wheat powder, 12.63 kg faba bean bran, 10.1 kg cotton cake, 1.18 kg of salt, 0.84 kg molasses and 2 kg ungrounded corn replicated thrice at four mixing durations of 5, 10, 15 and 20 minutes and paddle shaft speed of 480, and 580 rpm. The effectiveness of mixing was assessed on the basis of mass of shelled corn, and percent of coefficient of variation (CV %) and degree of mixing of sample collected at the end of each test. The best values of coefficient of variation (13.09 %) and degree of mixing (86.91 %) were obtained at mixing paddler shaft speed of 580 rpm and mixing time of 10 minutes. Hence, it can be concluded that the machine, the prototype livestock feed mixer, should be operated at speed of 580 rpm with maximum holding/mixing time of 10 in order to make the owning and operating of the machine productive (in terms of kg/hr) and economical (in terms labour and energy cost birr/kg of mixed quality feed. The capacity of the machine is about four quintals per hour or 32 quintals per day of 8 hours of work.

**Index Terms-** Livestock, livestock feeds and feed mixer

## I. INTRODUCTION

Livestock is an integral part of the agriculture and the contribution of live animals and their products to the agricultural economy accounts for 40%, excluding the values of draught power, manure and transport of people and products (Winrock International, 1992). Ethiopia holds the largest livestock population in Africa estimated at about 43.1 million heads of cattle, 23.6 million sheep, 18.6 million goats, 4.5 million donkeys, 1.7 million horses, 0.33 million mules, 34.2 million chicken and 4.9 million beehives (CSA, 1996). Similarly, contributions of livestock to cash income of the smallholders account for up to 87% and, subsistence of some pastoral communities is entirely based on livestock and livestock products. Despite these roles, the productivity of livestock in general is low and compared to its huge resource its contribution to the national economy is below expected. Zegeye (2003) indicated that feed shortage, poor genetic potential for productive traits, poor health care and management practices are the major contributors to the low productivity.

Livestock feed is the general term for food given to farm animals. The regular supply of food to farm animals is very essential to a healthy and productive life. Feed production for livestock, poultry or aquatic life involves a range of activities,

which include grinding, mixing, pelleting and drying operations. Different types of machinery needed for the production of various types of feeds include; grinders, mixers, elevators and conveyors, mixer, extruders, cookers, driers, fat sprayers and steam boilers (New, 1987). The mixing operation in particular, is of great importance, since it is the means through which two or more ingredients that form the feed are interspersed in space with one another for the purpose of achieving a homogenous mixture capable of meeting the nutritional requirements of the target livestock, poultry or aquatic life being raised (Balami, et al., 2013).

Feed mixing can be done either manually or mechanically. The manual method of mixing feed entails the use of shovel to intersperse the feed's constituents into one another on open concrete floors. This method is generally characterized by low output, less efficient, labor intensive and may prove unsafe, hence, hazardous to the health of the intended animals.

A wide variety of mixers are available for use in mixing components, the selection of which depends mainly on the phase or phases the components exists such as solid, liquid or gaseous phases. But in Ethiopia, different organizations and research centers have imported and or developed various types of animal feed choppers and millers. But as their efforts missed mixer part of the process, the small scale farmers are forced to use the manual method of chopped/ milled feed. Therefore, this activity was initiated with objectives of developing and evaluating a mixer machine capable of mixing livestock feed constituents effectively and uniformly for small and medium scale farmers.

## II. MATERIALS AND METHODS

### 1.1. Materials

The raw materials used for production of livestock feed mixer was steel shaft having diameters of 35 and 20 mm, 2 mm and 1.5 mm sheet metal, 4 mm \* 40 mm \* 40 mm angle iron and 3 mm \* 30 mm \* 30 mm size square pipe, 5 mm x 50 mm x 50 mm angle iron, 10.5hp diesel engine, pulleys having diameters of 460 mm, 180 mm and 140 mm, UCP bearings of 204 and 6205, different sizes of bolt and nut and hinges.

### 1.1.1. Instruments

In order to measure different size and dimension of construction and testing materials measuring tape, digital balance, tachometer, caliper, small bags and others were used during construction and data collection on the field.

### 1.2. Methods

#### 1.2.1. Description of Livestock Feed Mixer

A horizontal livestock feed mixer was developed and constructed in AAERC. The mixer consists of the essential component parts like: feeding unit, mixing unit, power driving unit and feed discharging unit. The mixing section has half cylindrical shape in the lower side and rectangular shape on the upper side. The mixing chamber is provided with centrally based horizontal and vertical acting auger and paddles that operate inside a mixing chamber. Feeding unit is attached to the mixing unit on the upper left side while discharging part is attached in the lower right side. All these machine components were connected to each other with bolt and nut and welding on the main frame (Figure 1).



**Figure 1: The developed livestock feed mixer**

### 1.2.2. Working Principle of the Machine

Feed ingredients are introduced into the mixer via a feeding unit located at the upper part of the mixing compartment. Material introduction into the mixer is in order of quantity, with the bulkier material among the feed components being introduced into the machine first. The diesel engine used to drive the mixer for mixing livestock feed ingredients is on. The rotating action of the paddles located on the centrally rotating shaft and auger moves the feed ingredients front, back, down, up and sideways. After a thorough mixing was achieved, the discharge chute was opened to allow the flow of mixed feed material out of the mixer.

### 1.2.3. Part Description

The developed livestock feed mixer consisted of the following major parts: a mixing chamber, a mixing unit, frame, feeding hopper, feed outlet, engine sit, drive and driven Pulleys, screw (auger) conveyor, bearing, steel shaft, and V-belt.

#### a) Feeding hopper construction

Feeding hopper has a trapezoidal shape located at upper end of the prototype mixer. The inclination of the feeding trough from the vertical or horizontal was decided by considering the largest angle of repose of the materials which was  $60^{\circ}$ .

#### b) Mixing chamber

The mixing chamber has a half cylindrical shape in the lower and rectangular shape on the upper part by rolling and bending. This mixing chamber was made from 2 mm sheet metal which was cut, rolled and welded together with the standing frames.

#### c) Feed chute construction

An opening of 150 x 70 mm size, provided at the bottom end of the mixing chamber, is connected to the discharge chute. The chute has a shutter mechanism used for closing and opening the gate in order to facilitate discharge of the material after mixing or maintain the material within the chamber during mixing.

#### d) Frame construction

The frame was constructed from square pipe of 30 x 30 x 3 mm and 5 x 50 x 50 mm angle iron considering the rated strength and stability during service. The frame has height of 900 mm, width of 840 mm and length of 1210 mm.

#### e) Mixing unit

A horizontal axis screw and paddler were operated inside a mixing chamber to effect the mixing process. As per the recommendation of Balami *et al.* (2013), who designed, manufactured and evaluated an animal feed mixer, a screw with helix of uniform diameter of 145 mm and a pitch of 100 mm was selected and all the necessary design analyses were made on the basis of the dimensions stated above.

## 1.3. Selection of Drive and Transmission

### 1.3.1. Selection of pulley diameters

The diameters are selected based on the need to reduce the diesel engine speed to the required paddle type horizontal feed mixer shaft. It is given by the following equation

$$D_1 \times N_1 = D_2 \times N_2$$

Where: D1 = Diameter of driving pulley in (mm), D2 = Diameter of driven pulley in (mm), N1 = Speed of driving pulley in (rpm), N2 = Speed of driven pulley in (rpm)

### 1.3.2. Selection of the drive

V-belt and pulley arrangements were adopted in this work to transmit power from the Diesel engine to the shaft of the paddle type horizontal feed mixing shaft. The main reasons for adopting the v-belt drive is its flexibility, simplicity, and low maintenance costs. Additionally, the v- belt has the ability to absorb shocks there by mitigating the effect of vibratory forces (Khurmi and Gupta, 2005).

### 1.3.3. Determination of belt contact angle

The belt contact angle and angles of wrap for smaller and larger pulley is given by the following equation (Khurmi and Gupta, 2005).

$$\phi = \sin^{-1}\left(\frac{R-r}{C}\right)$$

$$\alpha_1 = 180 - 2\sin^{-1}\left(\frac{R-r}{C}\right)$$

$$\alpha_2 = 180 + 2\sin^{-1}\left(\frac{R-r}{C}\right)$$

Where: R = radius of driven pulley, mm; r = radius of driving pulley, mm;  $\phi$  = belt contact angle, deg;  $\alpha_1$  = angle of wrap for the driving pulley, deg;  $\alpha_2$  = angle of wrap for the driven pulley, deg; C = is the center distance between the two center pulleys.

### 1.3.4. Determination of belt length

The length of belt appropriate to drive the system is calculated using the equation given below by Shigley and Mischike (2001).

$$L = 2C + \frac{\pi}{2}(D_2 + D_1) + \frac{(D_2 - D_1)^2}{4C}$$

Where: L = belt length, m; C = center distance between pulleys, m; D<sub>2</sub> = pitch diameter of driven pulley, m; D<sub>1</sub> = Pitch diameter of driver pulley, m.  
Speed of the belt was calculated by using the equation as given by Khurmi and Gupta (2005).

$$v = \frac{\pi D_1 N_1}{60}$$

### 1.3.5. Bearing selection

Bearings selection was made in accordance to American Society of Mechanical Engineers (ASME) standard as given by Hall *et al.* (1988).

### 1.3.6. Determination of belt tensions

To determine tensions on the tight and slack sides of the belt the following equations is used (Khurmi and Gupta, 2005).

$$T_1 = T - T_c$$

$$T = \sigma_{\max} a$$

$$T_c = mv^2$$

Where: T<sub>c</sub> and T = the centrifugal and maximum tension of a belts (N); T<sub>1</sub> and T<sub>2</sub> = tension in the tight and slack sides (N), σ<sub>max</sub> = maximum safe normal stress (N/mm<sup>2</sup>); a = is cross sectional area of belt (mm<sup>2</sup>), m = mass per unit length of belt (kg/m); v = is speed of belt (m/s), Values of σ<sub>max</sub>, a and m are taken from standard tables.

Tensions on the tight and slack sides of the belt will be estimated using the equation given by Khurmi and Gupta, (2005):

$$\frac{T_1 - T_c}{T_2 - T_c} = e^{\mu \alpha_1 \cos \frac{\beta}{2}}$$

Where: μ = coefficient of friction between a belt and a pulley from design book 0.25, β = groove angle 40°, α<sub>1</sub> = angle of wrap on driver pulley

According to Khurmi and Gupta (2005) torsional moment (T<sub>r</sub>) due to belt tensions was determined using the following equation.

$$T_r = (T_1 - T_2) \frac{D_2}{2}$$

where: T<sub>1</sub> = tension on tight side of a belt (N), T<sub>2</sub> = tension on slack side of a belt (N), D<sub>2</sub> = is the diameter of driven pulley (mm).

### 1.3.7. Determination of Screw Shaft Diameter

According to American Society of Mechanical Engineers (ASME) code (ASME, 1995) for the design of solid transmission shafts, the maximum permissible working stresses in tension or compression may be taken as 112 MPa for shafts without allowance for keyways and 84 MPa for shafts with allowance for keyways. The maximum permissible shear stress may be taken as 56 MPa for shafts without allowance for key ways and 42 MPa for shafts with allowance for keyways. According to maximum shear stress theory, equivalent twisting moment (T<sub>e</sub>) and that of a mixer shaft diameter (d) is determined as follow:

$$T_e = \sqrt{(MK_b)^2 + (TK_t)^2}$$

According to maximum normal stress theory, equivalent bending moment is given as:

$$M_e = \frac{1}{2} \left( K_b M + \sqrt{(K_b M)^2 + (K_t T)^2} \right)$$

$$M_e = \frac{\pi \sigma_b d^3}{32 \times fs}$$

Where: where: T<sub>e</sub> = equivalent twisting moment, Nm; M = maximum bending moment, Nm; M<sub>e</sub> = equivalent bending moment, Nm; σ<sub>b</sub> = maximum allowable normal stress, 84 MPa; T = twisting moment, Nm; = maximum allowable shear stress, 42 MPa; fs = factor of safety assume 2, d = diameter of mixer shaft, m. For rotating shafts, with load suddenly applied and minor shock, combined shock and fatigue factor were applied to bending and torsional moment as recommended; the values used were K<sub>b</sub> = 1.20 to 2.00, and K<sub>t</sub> = 1.00 to 1.50, (Khurmi and Gupta (2005)). Therefore, the values of K<sub>b</sub> = 1.20 and K<sub>t</sub> = 1.00 were used in this work.

### 1.4. Performance Test

Performance testing of the mixer was targeted at evaluating its ability to mix feed components, duration of mixing and rate of discharge. At the onset of the test, 37.89 kg of wheat bran, 37.89 kg of wheat flour, 37.89 kg of faba bean bran, 30.30 kg of cotton cake, 3.54 kg of salt, 2.52 kg of molasses and 6.00 kg of ungrounded maize as tracer were divided into three equal measures of 12.63 kg of wheat bran, 12.63 kg of wheat flour, 12.63 kg of faba bean bran, 10.10 kg of cotton cake, 1.18 kg of salt, 0.84 kg of molasses and 2.00 kg of ungrounded maize, and the mixer's performance test was conducted and replicated thrice according to the standard test procedure for farm batch feed mixers developed by ASAE, (R2006) and Ibrahim and Fasasi (2004). Four mixing durations of 5 min, 10 min, 15 min and 20 min and two mixing speed 480 rpm and 580 rpm were considered in the cause of conducting the tests. At the end of each test run, ten samples of 1 kg were drawn from the mixed components and the coefficient of variation among mixed samples and mixing levels, were computed using the expressions below as given by Ibrahim and Fasasi (2004):

$$CV = \frac{SD}{\bar{y}} \times 100$$

$$\bar{y} = \frac{\sum y_i}{n}$$

$$SD = \sqrt{\frac{\sum (y_i - \bar{y})^2}{(n-1)}}$$

$$DM = 100 - \% CV$$

Where: CV = percent coefficient of variation, DM = percent degree of mixing, SD = standard deviation,  $\bar{y}$  = mean, Σ = sum, y<sub>i</sub> = individual y sample analysis results, n = total number of samples

### 1.5. Experimental Design and Statistical Analysis

The experimental design is randomized complete design with three replications. Treatments consisted of factorial combinations of two mixing speeds (480 and 580 rpm) and four mixing times (5, 10, 15 and 20 min). Data was subjected to analysis of variance following a procedure appropriate to the design. Analysis was done using GenStat 15<sup>th</sup> edition software. The treatment means that were different at 5% level of significance was separated by using LSD.

### III. RESULTS AND DISCUSSION

The necessary design parameters needed for the development of a horizontal livestock feed mixer were considered in depth. Proper shaft, paddler and auger design analysis was carried out on the machine to avoid failure on both paddler shaft and auger shaft. A prototype of the livestock feed mixer was manufactured using materials available on market, with the AAERC’s workshop technicians. Its performance tests were carried out at four mixing times and two mixing speeds (paddler shaft speeds, rpm) to evaluate the mixing performance of the prototype feed mixer.

Table 1: Technical Characteristics of the Mixing Machine

| No. | Technical characteristics  | Determined and selected values |
|-----|--|--------------------------------|
| 1   | $D_2$ = Diameter of pulley for the mixing paddler                                | 460 mm                         |
| 2   | $C_1$ = center distance between larger pulley                                    | 869 mm                         |
| 3   | $L_1$ = length of larger belt  | 2710 mm                        |
| 4   | $v$ = Speed of the belt m/s  | 13.96 m/s                      |
| 5   | $T_1$ = tension of belts on the tight side of larger pulley                      | 298.10 N                       |
| 6   | $T_2$ = tension of belts on the slag side of larger pulley                       | 165.18 N                       |
| 7   | $T_{12}$ = tension of belts on the tight side of smaller pulley                  | 166.88 N                       |
| 8   | $T_{22}$ = tension of belts on the tight side of smaller pulley                  | 88.80 N                        |
| 9   | $T_c$ and $T$ = the centrifugal and maximum tension of a belts on larger pulley  | 42.10 N and 340.20 N           |
| 10  | $T_c$ and $T$ = the centrifugal and maximum tension of a belts on smaller pulley | 3.22 N and 170.10 N            |
| 11  | $W_{ip}$ = weight of larger paddler shaft pulley                                 | 103.01 N                       |
| 12  | $W_{sp}$ = weight of smaller paddler shaft pulley                                | 23.54 N                        |
| 13  | $\rho$ = density of feed   | 621.38 kg/m <sup>3</sup>       |
| 14  | $W_p$ = weight of paddles found on shaft   | 62.59 N                        |
| 15  | $R_{VAy}$ = Vertical reaction force at bearing close to pulleys                  | 1467.67 N                      |
| 16  | $R_{VBy}$ = Vertical reaction force at bearing far from pulleys                  | 117.07 N                       |
| 17  | $R_{HAX}$ = Horizontal reaction force at   | 84.10 N                        |

|    |  |           |
|----|--|-----------|
|    | bearing close to pulleys   |           |
| 18 | $R_{HBx}$ = Horizontal reaction force at bearing far from pulleys              | 7.47 N    |
| 19 | $BM_{VCmax}$ = Vertical maximum bending at the center of mixing hopper say C   | 117.71 Nm |
| 20 | $BM_{HCmax}$ = Horizontal maximum bending at the center of mixing hopper say C | 9.32 Nm   |
| 21 | $T_r$ = torsional moment due to belt tensions                                  | 59.91 Nm  |
| 22 | $M$ = total bending moment   | 118.08 Nm |
| 23 | $T_e$ = equivalent twisting moment   | 153.43 Nm |
| 24 | $M_e$ = equivalent bending moment  | 147.56 Nm |
| 25 | $d$ = Paddler shaft diameter   | 35 mm     |

Table 2 gives the average weight of ungrounded corn recovered from each of the 10 samples drawn from the mass of mixed components after a mixing period of 5, 10, 15, and 20 min in respect of the three replicated tests at paddler shaft speed of 480 rpm.

Table 2. Prototype livestock feed mixer performance at paddler shaft speed of 480 rpm and mixing time of 5, 10, 15 and 20 minutes

| Mixing time (Minute) | Mean weight of ungrounded Corn/Tracer (Kg) | Mean Coefficient of Variation (CV %) | Degree of Mixing (DM %) |
|----------------------|--|--------------------------------------|-------------------------|
| 5                    | 0.0214                                     | 36.85                                | 63.15                   |
| 10                   | 0.0207                                     | 20.75                                | 79.25                   |
| 15                   | 0.0226                                     | 19.20                                | 80.80                   |
| 20                   | 0.021                                      | 15.91                                | 84.09                   |

The average weights of ungrounded corn recovered from the three replicates are 0.0214 kg, 0.0207 kg, 0.0226 kg and 0.0210 kg with corresponding coefficient of variability (CV) of 36.85 %, 20.75 %, 19.20 % and 15.91 %, during mixing times of 5, 10, 15 and 20 minutes respectively. From Table 2, it can be noted that at the mixing time of 20 minutes, the percentage coefficient variation and degree of mixing values were 15.91 and 84.09 % respectively. The values indicate that as the time of holding increases the percentage of coefficient variation decreases while percentage degree of mixing increases.

Table 3 gives values of performance indicators such as percentage mean mass of ungrounded corn, coefficient of variation, and degree of mixing at the mixing paddler shaft speed of 580 rpm and different mixing time in minutes.

Table 3. Prototype livestock feed mixer performance at paddler shaft speed of 580 rpm and mixing time of 5, 10, 15 and 20 minutes.

| Mixing time | Mean weight of ungrounded Corn/ | Mean Coefficient of | Degree of Mixing |
|-------------|---------------------------------|---------------------|------------------|
|-------------|---------------------------------|---------------------|------------------|

| (Minute ) | Tracer (Kg) | Variation (CV %) | (DM %) |
|-----------|-------------|------------------|--------|
| 5         | 0.0144      | 42.42            | 57.58  |
| 10        | 0.0184      | 13.09            | 86.91  |
| 15        | 0.0177      | 26.12            | 73.88  |
| 20        | 0.0194      | 26.76            | 73.24  |

The mean weight of ungrounded corn, and percentage coefficient of variation and degree of mixing of the prototype machine at mixing paddler speed 580 rpm and mixing time of 5, 10, 15, and 20 minutes were found to be 0.0144, 42.42 and 57.58, 0.0184, 13.09, and 86.91, 0.0177, 26.12 and 73.88 and 0.0194, 26.76 and 89.73.24, respectively. From Table 3, it can be seen that, at the mixing paddler shaft speed of 580 rpm, mixing time of 10 minute resulted in percentage coefficient variation of 13.09 %. The value of coefficient variations obtained at mixing times 10 minute is within upper boundary of rating as indicated by Herrman and Behnke (1994) (values of percentage coefficient of variations < 10, 10 – 15, 15 -20 and > 20 are rated excellent, good, fair and poor, respectively, in terms of uniformity/thoroughness of mixing). Hence, the mixing uniformity was superior at the combination of 580 rpm and 10 minutes of mixing time.

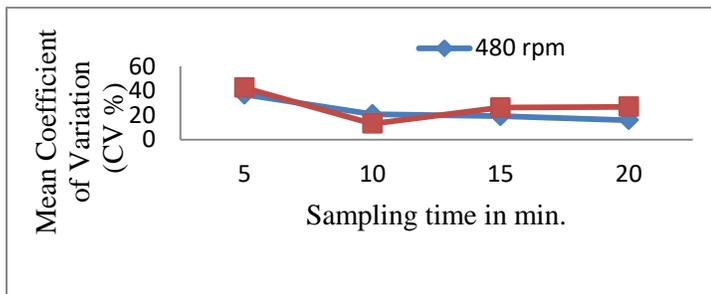


Figure 2. Effect of n sampling time and rpm on the coefficient of variation for the mixer using weight of ungrounded corn as the tracer (based on Tables 1 and 2)

From the above figure we observe that as the time of mixing and speed of the paddler increases percent coefficient of variation decreases and percent degree of mixing increases up to some extent and then vice versa.

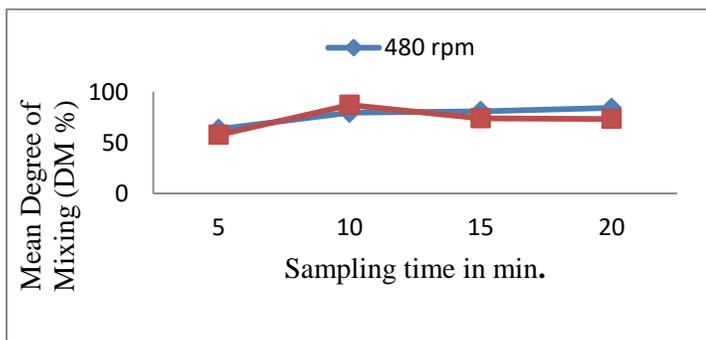


Figure 3. Effect of n sampling time and rpm on the degree of mixing for the mixer using weight of ungrounded corn as the tracer (based on Tables 2 and 3)

From figure 3 we observe that as the time of mixing and speed of the paddler increasing mean percent of mixing increases up to the optimum value attained. When the speed of paddler shaft is 480 rpm and duration of mixing time increases degree of mixing increases to some optimum level but it is not economical in terms of cost.

Results of the analysis of variance (ANOVA) presented in Table 4 revealed that the mixing paddler shaft speed and the interaction with mixing time had no significant effect while mixing time had significant effect (p = 0.05) on coefficient of variation. Table 4 shows the effect of mixing paddler shaft speed, mixing time and the combined effect of screw shaft speed with mixing/holding time on mean percent of coefficient of variation (CV %).

Table 3. Paddler shaft speed, mixing time and their interaction on means of % CV

| Parameter | Paddler shaft speed (R), rpm | CV %                           | LSD 5%                         | SE(M)                          |                                |       |      |
|-----------|------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|-------|------|
|           | 480                          | 22.8 <sup>a</sup>              | 12.16                          | 4.01                           |                                |       |      |
|           | 580                          | 27.2 <sup>a</sup>              |                                |                                |                                |       |      |
|           | Mixing time, min             |                                | 17.19                          | 5.67                           |                                |       |      |
|           | 5                            | 39.7 <sup>a</sup>              |                                |                                |                                |       |      |
|           | 10                           | 16.9 <sup>b</sup>              |                                |                                |                                |       |      |
|           | 15                           | 22.8 <sup>ab</sup>             |                                |                                |                                |       |      |
|           | 20                           | 20.7 <sup>b</sup>              |                                |                                |                                |       |      |
|           | Interaction R * T            |                                |                                |                                |                                |       |      |
|           |                              | 5 min                          | 10 min                         | 15 min                         | 20 min                         | 24.31 | 8.02 |
|           | 480 rpm                      | 36.7 <sup>a</sup> <sub>b</sub> | 20.7 <sup>a</sup> <sub>b</sub> | 19.3 <sup>a</sup> <sub>b</sub> | 14.7 <sup>b</sup>              |       |      |
|           | 580 rpm                      | 42.7 <sup>a</sup>              | 13.1 <sup>b</sup>              | 26.3 <sup>a</sup> <sub>b</sub> | 26.7 <sup>a</sup> <sub>b</sub> |       |      |

Means with similar letters indicated that there is no significant difference between them at 5% of significance level.

## 1.6. Conclusion and Recommendation

### 1.6.1. Conclusion

The livestock feed mixing machine was successfully designed, developed and tested. A mixing performance of up to 86.91% was attained in 10 minutes of operation and emptying of mixed materials from the mixer was accomplished in 5 minutes with the mixer at full capacity with small amount of feed left. The average value of coefficient of variation for the three replicates was 13.09 %. The salient implication of the result of this study is that the mixing machine developed from available materials on the market is effective, simple and easy to maintain. The mixer can mix about four quintals per hour.

### 1.6.2. Recommendation

In order to use this machine the user must consider the following recommendations. One of the recommendation is that, all the ingredients used for livestock feed preparation must be chopped and milled based on the size of their recommendation.

The ingredients that have larger volume and density must be filled first and then the next continued in the same manner. The machine is used for all stock raisers. The machine can mix uniformly when the ingredients is not filled at its full level and below half.

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# Improvement of Asella Wheat and Barley Thresher

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**Abstract-** Wheat and barley thresher was improved for its threshing capacity and suitability of operation and performance evaluation was done on wheat and barley crops. The size of previous wheat and barley thresher was increased and the feeding system that blows the dust outward to the operator was improved. The major components of the improved wheat and barley thresher include threshing unit, cleaning unit, feeding table, straw and chaff discharging unit and grain discharging unit. It was tested to thresh, separate and clean the wheat and barley seeds. The results showed that the machine had the maximum threshing capacity of 538 and 424 Kg/hr at feeding rate of 1000 Kg/hr and drum speed of 1100 rpm with grain straw ratio of 1:0.96 and 1:1.44 of wheat and barley crops respectively. The maximum threshing and cleaning efficiency of 98.95 and 99.93 %, 98.13 and 97.91 % and grain breakage of 0.52 and 1.06 % at above combination of 1100 rpm drum speed and 1000 Kg/hr feed rate for wheat and barley crops respectively. The maximum fuel consumption recorded were 0.73 and 0.60 liters per hour at moisture content of 12.5 and 11 % (d.b) at the combination of 1000 Kg/hr feed rate and 1100 rpm drum speed for wheat and barley respectively. The successful improvement of this machine is expected to reduce drudgery associated with the traditional method of threshing wheat and barley, and therefore increase productivity of farmers by reducing post-harvest losses.

**Index Terms-** Threshing, capacity, efficiency, breakage, wheat, barley, drum

## I. INTRODUCTION

Crop production is the major part of agricultural production in Ethiopia and over 98% of this is produced by smallholder farming sector (UNDO, 2008). Barley and wheat usage ranges from being used as raw materials in industries for production of malt, beverages, beer, etc. to being consumed directly as food. Its post-harvest processing could be done through traditional method (manual) or modern method. However, manual system of threshing cereal failed to meet up with this growing demand of cereals and is labor intensive (Osueke, 2011). In this sector agricultural activities are done by traditional method in the country as a whole. In addition to tiresome of the activities,

farmers are losing substantial parts of their product at each production steps.

In this method, about 40% of the total labor required to produce crop is extended in harvesting and threshing activities. The person hour per output of the method is very low, varying between 40 and 50 person hour per ton for both animal and manual threshing Johnson, (1992). However it is cheap, labor intensive and takes long time hence exposed to tremendous loss. The average post-harvest losses of food crops such as Teff, Wheat and Maize are annually 12.9%, 13.6% and 10.9% respectively Derege A. *et al*, (1989). Among this loss, threshing accounts for large place.

Threshing, the first major post-harvest operation, involves application of mechanical forces to detach grains from straws. The applied forces fall on the straws at random, breaking the straws stochastically, to free the enclosed grains. Some physical phenomena involved in threshing crops are: breakage of the grain pod which is dependent on the intensity of force, the orientation of the pod and moisture content; freedom of the grain from the straw and the passage of them through the concave Simonyan, (2006).

In order to address threshing problem of small-scale agriculture, many efforts have been made by different governmental and non-governmental organizations to replace traditional threshing with introduction of improved mobile threshers that can be locally developed or adopted. The development of mechanical threshers for the purpose has clearly an edge over conventional methods and has reduced the drudgery of work to a great extent. The use of these stationary threshing machines is based on the quick process, level of performance and economy. It is need of the hour to mechanize wheat threshing operation in order to recover better yield completing the operation timely (Ahmad, 2013). There are many factors affecting the performance of threshing machines such as cylinder peripheral speed, feeding rate and moisture content. (Mahmoud, 2007)

Different researchers try to design, develop, select, modify and evaluate many threshers for its performance based on evaluation parameters on cereal crops. Majumdar (1985), Morad (1997), Abdelghany and El-Sahar (1999), Gill *et al*. (2002), Behera *et al* (1990) and others are few of them.

Asella Rural Technology had modified and tested multi-crop thresher in 1982 and known as Asella wheat and barley

thresher. The problem of this thresher is its durability and cleaning system. Brehanu Atomsa (2006) of Harar Rural Technology Research Center (HRTRC) currently called as Fadis Agricultural Research Center (FARC) is extensively working on cleaning efficiency and promising result was obtained. Asella agricultural mechanization research center currently Asella Agricultural Engineering Research Center (AAERC) had modified on durability and it was completely resolved but the size and dusting problem is not that much promising. This wheat and barley crop thresher pushes out ward the material when feeding. There is a full of dust that an operator face when working with the machine and it could not easily take in ward the material to be threshed because the feed inlet position is at the end center of threshing drum. Another problem is its low threshing capacity (200-300kg and 300-400kg) of wheat and barley respectively. Therefore, the aim of initiating this activity is to improve and evaluate for its performance of Asella wheat and barley thresher.

## II. MATERIAL AND METHODS

### 1.1. Material

The material used for prototype production and performance evaluation were: angle iron, sheet metal, square pipe, pulleys, bearings, steel shaft, diesel engine, fuel, bolts and nuts, electrodes, flat iron, round bars, improved wheat and barley thresher, wheat and barley crops.

#### 1.1.1. Instrument

The instruments used during performance evaluation and data collection were: digital balance, spring balance, tachometer, graduated cylinder for measuring fuel, oil and stopwatch.

### 1.2. Methods

#### 1.2.1. Machine Description

Improved Asella wheat and barley thresher has the following components. These components are feeding table, threshing unit, cleaning unit, grain discharging unit, straw and chaff discharging unit. Threshing drum is made up of rolled sheet metal and steel shaft at the center. It has spike tooth and peg attached on the drum. Spike tooth type has attached on threshing drum with respective arrangement for facilitating straw motion and biting.



**Figure1. Improved Asella wheat and barley thresher during performance evaluation**

### 1.3. The threshing Parts Modified

#### 1.3.1. Threshing drum

The principal parameters of the threshing drum are the drum length, the drum diameter, number of beaters on the drum and the drum speed Soja *et al.* (2004).

$$Q = q_o \times L \times M$$

(1)

Where:-Q = Feed rate of thresher (kg/s),  $q_o$  = Permissible feed rate (kg/s. m) and varies between 0.35 – 0.4; L = Drum length (m) and M = Number of (rows of) beaters.

The thresher was modified as follow: drum diameter increased from 200 mm to 300 mm, the number of beaters also increased from 36 to 48 and 26 to 35 for peg beater and chopper respectively. From equation 1, drum length and threshing capacity has direct relation between them so that increasing drum length and diameter increases the threshing capacity of machine.

#### 1.3.2. Concave

Concave is the lower half of the drum which was served as the discharge through holes for the threshed crops. The clearance between threshing drum and concave was reduced from 45 to 25 mm. Length of the concave was also increased from 940 to 1000 mm. The upper half concave was served as the cover. It was made from rolled sheet metal and served as a cover for the crop material during threshed.

#### 1.3.3. Fan

The air blast created by fan pushes the straw out of the thresher. The fan of wheat and barley thresher has four blades attached to fan shaft mounted on two bearings on each end side to allow free rotation. So, this fan will be improved based on aerodynamic properties of crop. Diameter of the fan increased from 250 to 350 mm and the length also increased from 975 to 995 mm. For agricultural applications, fan speeds are recommended to be between 450 and 1000 rpm (Adane, 2004).

### 1.4. Selection of Drive and Transmission

#### 1.4.1. Selection of pulley diameters

The pulleys used in the drive system were made of cast iron. Pulley diameters were selected based on the need to reduce the engine speed to the required one. The following equation was used to determine pulley diameters.

$$\frac{N_2}{N_1} = \frac{D_1}{D_2}$$

(2)

Where:  $N_1$  and  $N_2$  are rpm of driving and driven pulleys;  $D_1$  and  $D_2$  are diameters of driving and driven pulleys

The values of  $D_1$ ,  $D_2$  and  $N_1$  was 140 mm, 225 mm and 2500 rpm and the maximum determined value of  $N_2$  was equal to 1372.55 rpm

#### 1.4.2. Selection of the drive

V-belt and pulley arrangements were used in this work to transmit power from the engine to the drum and fan shaft. The main reasons for using the v-belt drive was its flexibility, simplicity, and low maintenance costs. Additionally, the v-belt has the ability to absorb shocks there by mitigating the effect of vibratory forces (Khurmi and Gupta, 2005).

#### 1.4.3. Determination of belt contact angle

The belt contact angle is given by the following equation (Khurmi and Gupta, 2005).

$$\varphi = \text{Sin}^{-1}\left(\frac{R-r}{C}\right) \tag{3}$$

The angles of wrap for the smaller and larger pulleys are determined by the following equation:

$$\alpha_1 = 180 - 2\text{Sin}^{-1}\left(\frac{R-r}{C}\right) \tag{4}$$

$$\alpha_2 = 180 + 2\text{Sin}^{-1}\left(\frac{R-r}{C}\right) \tag{5}$$

Where: R = radius of larger pulley, mm; r = radius of smaller pulley, mm;  $\alpha_1$  = angle of wrap for the engine pulley, deg;  $\alpha_2$  = angle of wrap for the drum shaft pulley, deg; C = is the center distance between the two center pulleys.

Therefore, by using the above equations the determined values of  $\varphi$ ,  $\alpha_1$  and  $\alpha_2$  were  $4.34^\circ$ ,  $171.32^\circ$  and  $188.68^\circ$ .

**1.4.4. Determination of belt length**

The length of belt appropriate to drive the system was calculated using the equation given below by Shigley and Mischike (2001).

$$L = 2C + \frac{\pi}{2}(D_2 + D_1) + \frac{(D_2 - D_1)^2}{4C} \tag{6}$$

$$L = 2 * 0.76 + \frac{3.14}{2}(0.255 + 0.14) + \frac{(0.255 - 0.14)^2}{4 * 0.76} = 2.144 \text{ m}$$

The closest standard length of the belt was selected from standard table and this value was 2101 mm. Since the belt is B type of V- belt we add to inside length 43 so, the exact length of v belt is equal to 2144 mm. Then the exact center distance was determined by the following equation (Khurmi and Gupta, 2005):

$$C = \frac{K + \sqrt{K^2 - 32(D_2 - D_1)^2}}{16} \tag{7}$$

$$K = 4L - 6.28(D_2 + D_1) \tag{8}$$

Where: L = belt length, m; C = center distance between pulleys, m;  $D_2$  = pitch diameter of driven pulley, m;  $D_1$  = Pitch diameter of driver pulley, m.

Since the calculated length of v belt is equal to the closest standard belt the exact center distance is also correct. Therefore, center distance was equal to 760 mm. Speed of the belt was calculated by using the following equation as given by Khurmi and Gupta (2005).

$$v = \frac{\pi D_1 N_1}{60} \tag{9}$$

$$v = \frac{3.14 * 0.14 \text{ mm} * 2500 \text{ rpm}}{60} = 18.32 \text{ m / s}$$

This determined value was the highest for performing performance evaluation.

**1.4.5. Bearing Selection**

Bearing selection was made in accordance to American Society of Mechanical Engineers (ASME, 1995) standard as given by Hall *et al.* (1988). Therefore, UCP of 605 block bearing was selected.

**1.4.6. Determination of Belt Tensions**

To determine tensions on the tight and slack sides of the belt the following equations was used (Khurmi and Gupta, 2005).

$$T_1 = T - T_c \tag{10}$$

$$T = \sigma_{\max} a \tag{11}$$

$$T_c = mv^2 \tag{12}$$

Where:  $T_c$  and  $T$  = the centrifugal and maximum tension of the belts (N);  $T_1$  and  $T_2$  = tension in the tight and slack sides (N);  $\sigma_{\max}$  = maximum safe normal stress (N/mm<sup>2</sup>);  $a$  = is cross sectional area of belt (mm<sup>2</sup>);  $m$  = mass per unit length of belt (kg/m) and  $v$  = is speed of belt (m/s).

Values of  $\sigma_{\max}$ ,  $a$  and  $m$  are taken from standard tables. So their values were: 2.1 n/mm<sup>2</sup>, 81 mm<sup>2</sup> and 0.108 Kg/m respectively. Since the pulley is double line the number of belts used was also two. Therefore, the values of of  $T_1$ ,  $T$  and  $T_c$  determined by equations 10-12 were equal to 267.70, 340.20 and 72.50 N. For the smaller pulley, tension on the drum was equal to half of the bigger Pulley tensions because the belt is single line. Therefore, the values of these forces were 133.85, 170.10 and 36.25 N.

Tensions on the tight and slack sides of the belt were estimated using the equation given Khurmi and Gupta, (2005):

$$\frac{T_1 - T_c}{T_2 - T_c} = e^{\mu \alpha_1 \cos \frac{\beta}{2}} \tag{13}$$

Where:  $\mu$  = coefficient of friction between a belt and a pulley;  $\beta$  = groove angle in deg. From design book =  $40^\circ$  and  $\alpha_1$  = angle of wrap on small pulley in rad.

It is determined by multiplying angle of wrap and  $\pi$  then divides to  $180^\circ$  so the result is equal to 2.9886. Finally the value of  $T_2$  is equal to 160.67 N. again for the smaller pulley  $T_2$  was equal to half of the bigger pulley since the belt is single and it was equal to 80.34 N.

According to Khurmi and Gupta (2005) torsional moment ( $T_r$ ) due to double belt and single belt tensions was determined using the following equation.

$$T_r = (T_1 - T_2) \frac{D_2}{2} \tag{14}$$

Where:  $T_1$  = tension on tight side of a belt (N);  $T_2$  = tension on slack side of a belt (N) and  $D_2$  = is the diameter of driven pulley (m).

Therefore, the determined value of  $T_r$  was equal to 13.65 Nm.

**1.4.7. Shaft diameter determination**

Shaft must have adequate torsional strength to transmit torque and not over stressed. The diameter of the threshing drum and fan shaft was determined using maximum shear stress theory. It was mounted on bearings and transmits power through v- belts and pulleys. The threshing drum shaft was supported by two bearings ( $R_1$  &  $R_2$ ). On this shaft there was a load of threshing drum with beaters and crop materials that were uniformly distributed along the section of shaft (F). Pulleys (P) were placed at a specified distance to the left having specified weight each and tension forces due to belts.

The total bending moment was determined by using the following equation.

$$M = \sqrt{M_V^2 + M_H^2} \quad (15)$$

Where:  $M_V$  = vertical bending moment, Nm and  $M_H$  = horizontal bending moment, Nm

During force analysis the maximum bending moment of drum shaft was observed at bearing nearest to the single line pulley and the vertical and horizontal bending moment was equal to 37.04 Nm and 1 Nm respectively. Therefore, from the above equation bending moment was equal to 37.05 Nm.

According to (ASME) code (ASME, 1995); the diameter of threshing shaft was calculated using theory of maximum shear stress.

$$d^3 = \frac{16fs}{\pi S_s} \sqrt{(K_b M_b)^2 + (K_t T_r)^2} \quad (16)$$

Where: -  $d$  = Shaft diameter,  $S_s$  = Allowable shear stress for shaft ( $42N / mm^2$ ) from design book,  $K_b$  = Shock factor for bending moment = 2,  $K_t$  = Shock factor for torsional moment = 2,  $M_b$  = Maximum bending moment (N. m),  $T_r$  = Maximum torque (N. m) and  $fs$  = factor of safety which is = 3 for agricultural equipment's. Finally a shaft diameter of 31 mm was determined and the standard shaft diameter selected was equal to 35 mm.

### 1.5. Working Principle

The crop material put on the feeding table is pushed into the inlet of drum when engine put on. The drum which gets power from an engine rotated in the concave is used to thresh the crop material. As the crop threshed, grain passes to grain outlet and straw to straw outlet. The grain passed through a concave fall on grain collector and discharged to outside the machine. The straw, chaff and unwanted materials are passed to straw outlet by the help of air pressure created by blower and systems applied on the drum due to peg and chopper arrangements. Blower and drum shaft consist of pulleys at one of their end. Pulleys on each shaft are connected together with the help of belt to transmit power to each shaft.

### 1.6. Collected Data

The following data were collected during performance evaluation of improved Asella wheat and barley thresher. Technical specification, threshing capacity, threshing efficiency, visible grain breakage, grain- straw ratio, grain loss and optimum number of labors required to operate.

### 1.7. Performance Evaluation

The following parameters were determined during performance evaluation of this improved Asella wheat and barley crop thresher. Some of these parameters were: threshing capacity,

threshing efficiency, grain breakage, cleaning efficiency, grain loss.

#### a) Threshing capacity (kg/hr)

The weight of grains (whole and damaged) threshed and received per hour at the main grain outlet was called capacity. At the end of each test, total threshed grain was collected from the main grain outlet. The capacity will be calculated from the following equation:

$$T_c = \frac{W_g}{t} \times 60 \text{ min/ hr} \quad (17)$$

Where: -  $T_c$ - threshing capacity (kg/hr);  $W_g$  – Weight of threshed grain at main outlet (kg) and  $t$  – Recorded time of threshing (min)

#### b) Threshing efficiency (% TE)

Threshing efficiency is the ability of the thresher that separating the grain from the straw and the stuck correctly. It was calculated according to the following equation:

$$\% TE = \frac{T_G - Un_G}{T_G} \times 100 \quad (18)$$

Where:  $T_G$  = Weight of total grains input per unit time, kg and  $Un_G$  = Weight of un-threshed grains per unit time, kg.

#### c) Cleaning efficiency (% CE)

It is the ability of the thresher that can separate grain from the chaff and straw and calculated according to the following equation

$$\% CE = \frac{W}{W_o} \times 100 \quad (19)$$

Where:  $W$  = Weight of grains from the main output opening after cleaning, kg and  $W_o$  = Weight of grains and small chaff from the main output opening, kg.

#### d) Broken/damaged grain (% GB)

All physically damaged/broken grains were visually observed, manually sorted and weighed using digital balance. Damage due to mechanical threshing was determined as the ratio of weight of the actual damaged kernels to the weight of a sample taken.

$$\% GB = \frac{W_b}{W_s} \times 100 \quad (20)$$

Where:-  $W_g$  – percentage of broken grain;  $W_b$  – weight of broken (damaged) grains (g) and  $W_s$  – Weight of sample taken (g)

#### e) Grain-Straw Ratio

Grain-straw ratio was determined by taking the sample of material that was threshed. The samples is placed in sealed plastic containers and taken to the laboratory where the grains and straw are separated by hand. The straw and grains from each sample was kept paired. After weighing, the samples was dried to specific hours and then reweighed.

### 1.8. Experimental Design

The experimental design was a split-split plot design according to the principle of factorial experiment with three

replications. The two levels of crop types was assigned to main plot, the three levels of threshing drum speed was assigned to sub plot, while the three levels of feeding was assigned to sub-sub plot, each with three replications. The experiment design was laid as 2\*3\*3 with three replications and had total of 54 test runs (2\*3\*3\*3 = 54)

**1.8.1. Statistical Analysis**

The data were subjected to analysis of variances following a procedure appropriate for the design of the experiment (Gomez and Gomez, 1984) and using GenStat 15<sup>th</sup> edition statistical software. The treatment means that were different at 5% levels of significance were separated using least significant difference (LSD 5%) test. The least significant difference (LSD) test was performed for the mean values of threshing capacity, threshing efficiency, cleaning efficiency, percentage of visible grain breakage and percentage of grain loss in relation to crop type, threshing drum speed and crop feeding level.

**III. RESULTS AND DISCUSSION**

This study was undertaken to improve and evaluate the performance of a thresher prototype capable of threshing wheat and barley crops at three level of drum speed and three feeding level. Performance indicators such as threshing capacity (TrC),

threshing efficiency (TrE), cleaning Efficiency (CIE), percentage of visible grain breakage (GrB) and percentage of grain loss were used to assess functional fulfillment of the improved thresher. The result obtained were analyzed and discussed under the following heads.

**1.9. Effects of Drum Speed and Feed Rate on Performance Parameters of Improved Thresher**

**i. Threshing Capacity**

Table 1 showed the relation between drum speed and threshing capacity in wheat and barley crop at drum speed of 900 rpm, 1100 rpm, and 1300 rpm and feed rates of 800, 900 and 1000 Kg/hr. The maximum threshing capacity was observed to be 538 and 424 Kg/hr at drum speed of 1100 rpm and feed rate of 1000 Kg/hr and minimum threshing capacity was 408 and 316 Kg/hr at drum speed of 900 rpm and feed rate of 800 Kg/hr for wheat and barley crop respectively. As the feed rate increased from 800 to 1000 Kg/hr, the threshing capacity increased from 408 to 514.67 Kg and 316 to 408 Kg at 900 rpm drum speed for wheat and barley respectively. Similarly for the same range of feed rate the threshing capacity increased from 410.67 to 538 Kg and 326.67 to 424 Kg; 408 to 536 Kg and 322.67 to 426 Kg at drum speed of 1100 rpm and 1300 rpm, for wheat and barley respectively and which is similar to the finding of Behera *et al* (1990) and Chukuwa (2008).

**Table 1. Effect of drum speed and feed rate on performance evaluation of improved thresher on wheat and barley crop (moisture content 12.5 % and 11 % and grain straw ratio of 1:0.96 and 1:1.44 respectively)**

| Drum speed (rpm) | Feed Rate (Kg/hr) | Threshing Capacity (Kg/hr) |        | Threshing Efficiency (%) |        | Cleaning Efficiency (%) |        | Grain Breakage (%) |        | Fuel consumed (Lit) |        |
|------------------|-------------------|----------------------------|--------|--------------------------|--------|-------------------------|--------|--------------------|--------|---------------------|--------|
|                  |                   | Wheat                      | Barley | Wheat                    | Barley | Wheat                   | Barley | Wheat              | Barley | Wheat               | Barley |
| 900              | 800               | 408                        | 316    | 99.81                    | 99.84  | 96.27                   | 90.26  | 0.0955             | 0.07   | 0.60                | 0.54   |
|                  | 900               | 462.67                     | 364    | 99.91                    | 99.87  | 97.23                   | 93.02  | 0.41               | 0.32   | 0.62                | 0.60   |
|                  | 1000              | 514.67                     | 408    | 99.93                    | 99.91  | 97.7                    | 93.05  | 0.5                | 0.41   | 0.77                | 0.72   |
| 1100             | 800               | 410.67                     | 326.67 | 99.85                    | 99.87  | 96.67                   | 96.97  | 0.14               | 0.53   | 0.53                | 0.48   |
|                  | 900               | 485.6                      | 372    | 99.93                    | 99.91  | 97.78                   | 97.51  | 0.44               | 0.82   | 0.59                | 0.55   |
|                  | 1000              | 538                        | 424    | 99.95                    | 99.93  | 98.13                   | 97.91  | 0.52               | 1.06   | 0.73                | 0.60   |
| 1300             | 800               | 408                        | 322.67 | 99.83                    | 99.85  | 97.37                   | 94.77  | 0.233              | 0.83   | 0.56                | 0.56   |
|                  | 900               | 478.67                     | 369.33 | 99.92                    | 99.89  | 98                      | 96.05  | 0.467              | 1.31   | 0.62                | 0.63   |
|                  | 1000              | 536                        | 416    | 99.95                    | 99.92  | 98.4                    | 96.41  | 0.597              | 1.62   | 0.70                | 0.70   |

Results of the analysis of variance (ANOVA) revealed that the feed rate and crop type had significant effect (p < 0.05) whereas drum speed, interaction of crop type and drum speed, interaction of crop type and feed rate, interaction of drum speed

and feed rate, and interaction of crop type, drum speed and feed rate had no significant effect (p > 0.05) on threshing capacity.

Table 2 show the effect of threshing drum speed, feeding rate, crop type and the combined effect of drum speed and feed rate on mean threshing capacity.

| Parameter | Source of variation |                    |        | Measure of differences |       |
|-----------|---------------------|--------------------|--------|------------------------|-------|
|           | Drum Speed (DrS)    | Crop type (CrT)    |        | LSD (5%)               | SE(M) |
|           |                     | Wheat              | barley |                        |       |
|           | 900                 | 461.8 <sup>a</sup> | 362.7a | 15.13                  | 4.80  |
|           | 1100                | 482.5 <sup>b</sup> | 368.7a |                        |       |
|           | 1300                | 474.2ab            | 369.3a |                        |       |
|           | Feeding rate (FR)   | Wheat              | barley |                        |       |

|                     |                    |                    |                     |       |      |
|---------------------|--------------------|--------------------|---------------------|-------|------|
| TrC (Kg/hr)         | 800                | 413.3 <sup>a</sup> | 321.8 <sup>a</sup>  | 12.65 | 4.27 |
|                     | 900                | 475.6 <sup>b</sup> | 362.9 <sup>b</sup>  |       |      |
|                     | 1000               | 529.6 <sup>c</sup> | 416.0 <sup>c</sup>  |       |      |
| Interaction(DrS*FR) |                    |                    |                     |       |      |
|                     | 800 Kg/hr          | 900 Kg/hr          | 1000 Kg/hr          | 17.07 | 5.90 |
| 900 rpm             | 362.0 <sup>a</sup> | 413.3 <sup>b</sup> | 461.3 <sup>c</sup>  |       |      |
| 1100 rpm            | 375.3 <sup>a</sup> | 420.5 <sup>b</sup> | 481.0 <sup>d</sup>  |       |      |
| 1300 rpm            | 365.3 <sup>a</sup> | 424.0 <sup>b</sup> | 476.0 <sup>cd</sup> |       |      |

*Means followed by the same letters do not have significant difference at 5% level of probability*

**Threshing Efficiency**

The test result of feed rate and drum speed on threshing efficiency for wheat and barley has been given in the Table 1. It is evident from the Table that the maximum threshing efficiency 98.95 % and 99.93 % was obtained at the 1000 Kg/hr of feed rate and 1100-rpm speed for wheat and barley respectively. While the minimum threshing efficiency of 99.81 % and 99.84 % was obtained at the feed rate of 800 Kg/hr and drum speed of 900 rpm for wheat and barley respectively. As the feed rate increased from 800 to 1000 Kg/hr, the threshing efficiency increased from 99.81 % to 99.93 % and 99.84 % to 99.91 % at 900 rpm drum speed for wheat and barley respectively. Similarly for the same range of feed rate the threshing efficiency increased from 99.85 % to 99.95 % and 99.87 % to 99.93 %; 99.83 % to 99.95 % and 99.85 % to 99.92 % at drum speed of 1100 rpm to and 1300 rpm, for wheat and barley respectively and which is similar to the findings of Behera *et al* (1990).

The analysis of variance (ANOVA) revealed that drum speed and feeding rate had significant effect ( $p < 0.05$ ) whereas crop type and the interaction of crop type and drum speed, interaction of drum speed and feed rate, interaction of crop type and feed rate and interaction of crop type, drum speed and feed rate had no significant effect ( $p > 0.05$ ) on threshing efficiency. Table 3 show the effect of drum speed, feeding rate, crop type and the combined effect of drum speed and feed rate on mean threshing efficiency.

**Table 3. Means of threshing drum speed, feeding rate, crop type and their interaction on threshing efficiency**

| Parameter | Source of variation               |               |               |              | Measure of differences |         |
|-----------|-----------------------------------|---------------|---------------|--------------|------------------------|---------|
|           | Drum Speed (rpm)                  | Crop type     |               | LSD (5%)     | SE(M)                  |         |
|           |                                   | Wheat         | Barley        |              |                        |         |
| TrE (%)   | 900                               | 99.8178<br>a  | 99.8756<br>a  | 0.05919      | 0.01420                |         |
|           | 1100                              | 99.9100<br>b  | 99.9044<br>a  |              |                        |         |
|           | 1300                              | 99.8989<br>bc | 99.8878<br>a  |              |                        |         |
|           | Feeding rate (Kg/hr)              | Wheat         | Barley        | 0.05677      | 0.01665                |         |
|           | 800                               | 99.8333<br>a  | 99.8567<br>a  |              |                        |         |
|           | 900                               | 99.8511<br>a  | 99.8911<br>ab |              |                        |         |
|           | 1000                              | 99.9422<br>b  | 99.9200<br>b  |              |                        |         |
|           | Interaction(drum speed*feed rate) |               |               |              | 0.04357                | 0.01510 |
|           |                                   | 800 Kg/hr     | 900 Kg/hr     | 1000 Kg/hr   |                        |         |
|           | 900 rpm                           | 99.8283<br>ab | 99.7900<br>b  | 99.9217<br>c |                        |         |
| 1100 rpm  | 99.8633<br>a                      | 99.9200<br>c  | 99.9383<br>c  |              |                        |         |

|  |          |              |              |              |  |  |
|--|----------|--------------|--------------|--------------|--|--|
|  | 1300 rpm | 99.8433<br>a | 99.9033<br>c | 99.9333<br>c |  |  |
|--|----------|--------------|--------------|--------------|--|--|

Means followed by the same letter (or letters) do not have significant difference at 5% level of probability.

**ii. Cleaning efficiency**

The relationship between feed rate, drum speed and cleaning efficiency is presented in the Table 1. The maximum cleaning efficiency of 98.40 % and 97.91 % was obtained at 1000 Kg/hr feed rate and 1300 and 1100 rpm of drum speed for wheat and barley crops respectively, whereas a minimum cleaning efficiency of 96.27 % and 90.26 % was obtained at 800 Kg/hr feed rate and 900 rpm of the drum speed for wheat and barley respectively. As the feed rate increased from 800 to 1000 Kg/hr, at drum speed of 900 rpm, the cleaning efficiency increased from 96.27% to 97.23 % and 90.26 % to 93.05 % for wheat and barley respectively. Similarly for the same range of feed rate the cleaning efficiency increased from 96.67 % to 98.13 % and 96.97 % to 97.91 %; 97.37 % to 98.40 % and 94.77 % to 96.41 % at drum speed of 1100 rpm and 1300 rpm, for wheat and barley respectively. Above results revealed that for all set of observations minimum and maximum cleaning efficiency were obtained at the feed rate of 800 and 1000 Kg/hr respectively. The cleaning efficiency increased with increasing in speed of the drum from 900 to 1300 rpm for wheat and increased from 900 rpm to 1100 for barley. However, at 1300 rpm drum speed, cleaning efficiency is below drum speed of 1100 rpm for barley.

As evident from Table 1 that with increased in drum speed the cleaning efficiency increased. Since the speed of blower increased with drum speed, the cleaning efficiency was also affected considerably. The increase of the drum speed causes increase of blower speed, resulting high air blast, thereby increased the cleaning efficiency.

Result of the analysis of variance (ANOVA) revealed that drum speed, feeding rate and the interaction of crop type and drum speed had significant effect ( $p < 0.05$ ) on cleaning efficiency. On the other hand crop type and the interaction of crop type and feed rate, interaction of drum speed and feed rate, interaction of crop type, drum speed and feed rate had no significant effect ( $p > 0.05$ ) on cleaning efficiency.

Table 4 show the effect of cylinder speed, feeding rate, crop type and the combined effect of drum speed and feed rate on mean cleaning efficiency.

**Table 4. Means of threshing drum speed, feeding rate, crop type and their interaction on cleaning efficiency**

| Parameter | Source of variation     |                    |                    |          | Measure of differences |  |
|-----------|-------------------------|--------------------|--------------------|----------|------------------------|--|
|           | Drum Speed levels (rpm) | Crop type          |                    | LSD (5%) | SE(M)                  |  |
|           |                         | Wheat              | barley             |          |                        |  |
| CIE (%)   | 900                     | 97.07 <sup>a</sup> | 92.11 <sup>a</sup> | 1.018    | 0.319                  |  |
|           | 1100                    | 97.53 <sup>a</sup> | 97.46 <sup>b</sup> |          |                        |  |
|           | 1300                    | 97.92 <sup>a</sup> | 95.74 <sup>c</sup> |          |                        |  |
|           | Feeding rate (Kg/hr)    | Wheat              | barley             | 1.053    | 0.354                  |  |
|           | 800                     | 96.77 <sup>a</sup> | 94.00 <sup>a</sup> |          |                        |  |

|             |                                   |                     |                     |       |       |
|-------------|-----------------------------------|---------------------|---------------------|-------|-------|
|             | 900                               | 97.67 <sup>a</sup>  | 95.53 <sup>bc</sup> |       |       |
|             | 1000                              | 98.08 <sup>b</sup>  | 95.79 <sup>c</sup>  |       |       |
|             | Interaction(drum speed*feed rate) |                     |                     | 1.253 | 0.435 |
|             | 800<br>Kg/hr                      | 900<br>Kg/hr        | 1000<br>Kg/hr       |       |       |
| 900<br>rpm  | 93.27 <sup>a</sup>                | 95.13 <sup>d</sup>  | 95.38 <sup>d</sup>  |       |       |
| 1100<br>rpm | 96.82 <sup>bc</sup>               | 97.64 <sup>b</sup>  | 98.03 <sup>b</sup>  |       |       |
| 1300<br>rpm | 96.07 <sup>cd</sup>               | 97.03 <sup>bc</sup> | 97.40 <sup>b</sup>  |       |       |

Means followed by the same letter (or letters) do not have significant difference at 5% level of probability.

### iii. Grain Breakage

Table 1 showed the relation between drum speed, feed rate and grain breakage in wheat and barley crops at the drum speed of 900 rpm, 1100 rpm and 1300 rpm and feed rate of 800, 900 and 1000 Kg/hr. The maximum breakage observed to be 0.597 and 1.62 % at higher drum speed of 1300 rpm and feed rate of 1000 Kg/hr for wheat and barley crops respectively. There was moderate breakage at drum speed of 1100 rpm and minimum breakage of 0.0955 and 0.070 % were obtained at drum speed of 900 rpm and feed rate 800 Kg/hr for wheat and barley respectively. More grain breakage at higher speed was due to greater impact by pegs of drum to detach the grain from ear heads, which reflected in the increase of breakage percentage at higher speed.

Result of the analysis of variance (ANOVA) revealed that drum speed, feeding rate and the interaction of crop type and drum speed had significant effect ( $p < 0.05$ ) whereas crop type, interaction of crop type and feed rate, interaction of drum speed and feed rate and interaction of crop type, drum speed and feed rate had no significant effect ( $p > 0.05$ ) on threshing efficiency. Table 5 show the effect of drum speed, feeding rate, crop type and the combined effect of drum speed and feed rate on mean grain breakage.

**Table 5. Means of threshing drum speed, feeding rate, crop type and their interaction on Grain Breakage**

| Parameter | Source of variation               |                                 |                    | Measure of differences |       |   |
|-----------|-----------------------------------|---------------------------------|--------------------|------------------------|-------|---|
|           | Drum Speed level (rpm)            | Crop type                       |                    | LSD (5%)               | SE(M) |   |
| GrB (%)   | 900                               | 0.327 <sup>a</sup>              | 0.266 <sup>a</sup> | 0.173                  | 0.051 |   |
|           | 1100                              | 0.366 <sup>a</sup>              | 0.802 <sup>b</sup> | 2                      | 3     |   |
|           | 1300                              | 0.432 <sup>a</sup>              | 1.251 <sup>c</sup> |                        |       |   |
|           | Feeding rate (Kg/hr)              | Wheat                           | barley             | 0.192                  | 0.063 |   |
|           | 800                               | 0.147 <sup>a</sup>              | 0.474 <sup>a</sup> |                        |       |   |
|           | 900                               | 0.439 <sup>b</sup>              | 0.816 <sup>b</sup> |                        |       |   |
|           | 1000                              | 0.539 <sup>b</sup> <sub>c</sub> | 1.029 <sup>c</sup> |                        |       |   |
|           | Interaction(drum speed*feed rate) |                                 |                    | 0.207                  | 0.072 |   |
|           |                                   | 800<br>Kg/hr                    | 900<br>Kg/hr       | 1000<br>Kg/hr          | 8     | 1 |
|           | 900                               | 0.070 <sup>a</sup>              | 0.363 <sup>b</sup> | 0.455 <sup>b</sup>     |       |   |

|  |     |                    |                     |                    |  |  |
|--|-----|--------------------|---------------------|--------------------|--|--|
|  | rpm |                    |                     | <sup>c</sup>       |  |  |
|  | 110 | 0.332 <sup>b</sup> | 0.632 <sup>cc</sup> | 0.788 <sup>d</sup> |  |  |
|  | 0   |                    |                     | <sup>e</sup>       |  |  |
|  | rpm |                    |                     |                    |  |  |
|  | 130 | 0.530 <sup>b</sup> | 0.887 <sup>d</sup>  | 1.108 <sup>f</sup> |  |  |
|  | 0   | <sup>c</sup>       |                     |                    |  |  |
|  | rpm |                    |                     |                    |  |  |

Means followed by the same letter (or letters) do not have significant difference at 5% level of probability.

## 1.10. Conclusion and Recommendation

### 1.10.1. Conclusion

The performance evaluation of improved wheat and barley thresher was conducted under farmers' field. The following are the main conclusions drawn from the study. The grain straw ratio of wheat and barley crops at which performance evaluation of the thresher performed is 1:0.96 and 1:1.44 respectively. The maximum threshing capacity was found 538 and 424 Kg at drum speed of 1100 rpm and feeding rate of 1000 Kg/hr for wheat and barley crop respectively. The threshing and cleaning efficiency were 98.95 and 99.93 %, 98.13 and 97.91 % for wheat and barley crops respectively and grain breakage were 0.52 and 1.06 % at above combination of speed and feed rate for wheat and barley crops respectively. As compared to the previous thresher the improved one had more than 200 Kg/hr threshing capacity. The maximum fuel consumption of the engine was equal to 0.77 and 0.72 liter for wheat and barley at the maximum drum speed and feed rate respectively.

### 1.10.2. Recommendation

From the study result improved wheat and barley thresher was more effective and efficient than the previous thresher for its capacity and suitability of operation. Farmers must used combination of 1100 drum rpm and 1000 Kg/hr feed rate in order to get high values of threshing capacity, threshing efficiency and cleaning efficiency based on crop moisture.

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# The Midlife Crisis- “Her” Experience

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**Abstract-** The study aims to determine difference between the Mental Health of middle aged Working and Non-Working Women, in India. The dimensions under investigation are – ANXIETY, DEPRESSION and STRESS. Instruments used for data collection are ADSS and a Semi-structured Interview Schedule. Working (n=10); Non-Working (n=10) women of ages (45-60) formed the sample. Analysis of Quantitative data used t-test and Qualitative data used Content Analysis. Results indicate difference only in DEPRESSION levels; Non-Working women experience Midlife Crisis relatively more.

**Index Terms-** Midlife Crisis, Working Women, Mental Health

## I. INTRODUCTION

The concept of ‘midlife’ or ‘middle age’ is traced as early as 300 B.C., by Aristotle who spoke of the “*Prime Of Life*”, which according to him, occurred at age 50. The term “Midlife Crisis” was coined by Jaques (1965) in his essay ‘*Death and the Midlife Crisis.*’

According to Erik Erikson, a normal part of development in adulthood during the midlife years lies in the question: "Can I make my life count?" This question typically arises with regards to our work, children, parents, friends, and God. From here commences the period of Midlife Transition. It is a profound phase of closing the first half of life and healthily aligningself with the reality of second half. Midlife is thus viewed as a stage at which adults attain “full maturity” as their responsibilities become more complex. Theorists of the modern era namely Jung (1933), Erikson (1950), Levinson et al. (1978) and Gould (1980) too were of a view that focused upon developmental conflicts. They never emphasised the occurrence of ‘crises’ in midlife, although they did state that if midlife developmental issues and tasks are unresolved, then these regular ‘*transitions*’ can metamorphose into ‘*crises*’. Midlife transition is regarded by many researchers as a period of great changes in relationship dynamics such as marriage, birth of children, illness or death of parent, retirement as well as changes in roles (Arnold & McKenry, 1996; Kruger, 1994; Waskel & Phelps, 1995). Other researchers have focused on internal changes, such as the individual’s behaviour, values and identities (HudsonAllez, 1999; Vaillant, 1977) and have argued that midlife transition requires dealing with the feelings that may arise from these changes. Becker (2006) stated that there are four “fundamental elements of the existential discourse - death, isolation, freedom and meaning”. Ellman (1992) suggested that there are “universal phase specific tasks at midlife and if these are experienced as pathogenic trauma, they can be described as a crisis

event”. Kruger (1994) cited the Midlife Crisis definition of Cytrynbaum et al. as “a state of physical and psychological distress which results from developmental tasks being too overwhelming for a person’s internal resources and social supports”.

B. Neugarten (1968) observed that midlife represents an important turning point with the “restructuring of time and the formulation of new perceptions of self, time and death”. The terms used by her were ‘time’, ‘change’ and ‘interiority’ for individuals tend to become more reflective and self-evaluative during this period. Neugarten also outlines translations like- increasing responsibility for aging parents, awareness of the self as a ‘bridge’ between generations, the need to establish relationships with adult children’s marriage partners and grandparenthood.

Overall, many researchers (Brim, 1974; Cierna, 1985b; Dickstein, 1972; Jaques, 1965, Levinson et al., 1978, Neugarten, 1968b) have defined the concept of Midlife Crisis. The main aspects within these definitions are as follows:

- Deep changes in the psyche, attitudes, values, behaviour
- Fear and anxiety of death
- Emotional turmoil.

## II. UNDERSTANDING MIDLIFE FROM THE VIEW OF SUBJECTIVE CHRONOLOGICAL AGE AND DEVELOPMENTAL PARADIGMS:

Midlife is defined as “the part of life between youth and old age.” The boundaries of midlife are fuzzy with no clear demarcation. Subjective views of the period of transition show a wide range. However, the relation of chronological age to social, psychological and biological age may offer a way to study midlife. The most common conception is that midlife begins at the age of 40 and ends at 60 or 65, when old age begins (Lachman et al., 1994; Lachman and James, 1997). Although most surveys report, 40 is the modal entry year and 60 is the modal exit year there is tremendous variability in the expected timing of midlife (Lachman et al., 1995). Those between ages 40 and 60 are typically considered middle aged, but there is at least a 10 year range on either end so that it is not uncommon for some to consider middle age to begin at 30 and end at 75 (Lachman, 2001).

Many people associate the beginning of old age with a decline in physical health (Lutsky, 1980). Thus, those who are still relatively well functioning and healthy in their seventies, may still consider themselves middle aged. This is hence tied to the notion of *Subjective Age* in which middle-aged adults typically report feeling about ten years younger than they are (Montepare and

Lachman, 1989). The use of chronological age as a determinant of midlife may thus not be an ideal approach. Further, many people of the same chronological age may be found placed in different life phases, with regards to, social, family or work events or responsibilities (eg. at age 40, some adults may have become parents for the first time, while other may have grown children and raising grandchildren).

Although no consensus could be established for the points of 'entry' and 'exit' into the Midlife however agreement in the sequence of 'developmental tasks' that normatively occur during this period has been identified. By midlife, individuals are expected to have established a family, found a clear career direction in which they will peak during midlife, and have taken responsibility with respect to their children, their own aging parents, and sometimes their community. When considering the social, psychological and biological experiences of an individual, the domain of *social experiences* deals with the concepts relative to interpersonal relationships within family and societal setups like, family and parenting, friendship across life spans; the *psychological* realm incorporates ideas of change, continuity in life, personality and well-being; while the biological arena focuses upon the changes at *physiological* level eg. changes in sexual function and bodily functions- menopause, incidence of disease.

### III. THE SUPPLEMENTARY FACTORS:

The development of an individual during the early years of life has biological unfolding as a key element for progress, however, as the individual progresses towards adulthood, *social*, *cultural* and *environmental* constraints and opportunities come into an active participation in determining the progress, with certain biological events (eg. Menopause) also being important. Neugarten pointed that having an awareness of one's own 'life cycle' has consequences for an individual's goal choices and priorities as it allows comparison of his or her own progress with a view of the normative or societal timing of major events and transitions. Additionally, apart from life events their 'sequencing' is also important as it changes the way in which they are experienced or what they mean to an individual. Thus, Neugarten views Midlife as a potential period of crisis only when the normative events of midlife are experienced 'off-time' or to the extent that the normative progress through this phase is interrupted by unexpected events.

Neugarten further, proposed a change in *time perspective* as one of the main psychological characteristics of middle adulthood. Middle adulthood is characterized by a switch from perceiving one's life primarily as 'time since birth' to 'time left to live.' Middle-aged individuals evaluate themselves as having shown personal growth since their younger years, and look to the future with the expectation of further personal growth (Ryff, 1998). In the late midlife, one may begin to contemplate the end of the life cycle.

The nature of Midlife also varies as a function of such factors as, Gender, Cohort, Socioeconomic Status, Race, Ethnicity, Culture, Personality, Marital Status, Parental Status, Employment Status and Health Status – eg. groups with 'low' *socioeconomic status* reported earlier entry and exit years for Midlife (Kuper & Marmot, 2003). According to Heckhausen, Socioeconomic status at midlife can have a direct impact on an

individual's ability to control stresses such as unemployment and lack of financial resources. Middle class individuals at midlife are more likely to have the resources of finance, education and skill than unskilled, poorly educated and remunerated individuals. Higher the status, greater the ability to control constraints of middle age. The size and density of social networks during midlife is also important according to Heckhausen (2001) since the emotional needs of individuals change as they age.

### IV. MIDLIFE- THE CONCEPTUAL FRAMEWORKS:

The classic models of midlife are based on Jung's and Erikson's theories (Lachman & James 1997). A major goal of midlife according to Jung (1971) is reflected in the *individuation* process. *Individuation* involves the integration or balancing of all aspects of the psyche. He discussed the integration of the feminine (anima) and masculine (animus) aspects of the psyche as a part of the individuation process.

Stage models of midlife have also been popular, beginning with Erikson's (1963) discussion of midlife in the context of the Eight Stages of the lifespan. He put forth the base of 'Psychosocial Development' to explain this turning point of life. According to Erikson, the tasks of middle age rest upon successful resolution of earlier tasks, as portrayed in the *epigenetic theory*. At each stage there is a crisis, in the sense of a transition or turning point. In midlife, the central theme is '*Generativity versus Stagnation*'. The associated tasks involve concern with producing, nurturing, and guiding the next generation.

Erikson's theories have been applied and extended by other theorists. As a sequel to the Generativity stage and before achieving ego integrity, Vaillant (1977) included a substage called "keepers of the meaning," representing the focus on transmission of values to society. Levinson et al. (1978) created a stage theory that includes multiple transitions and stable periods throughout adulthood.

### V. LIFE DURING MIDLIFE CRISIS

Individuals typically experience a number of life events and role transitions during these years, including those related to physical appearance and health, sexuality, marital status, parenting, grand parenting, caring for aging family members, employment, retirement and many more.

These changes can be broadly categorised as – *physiological*, *affective*, *psychological* and *societal*.

At Physiological Level – physical appearance begins to change in midlife (Etaugh & Bridges, 2006). The body of an individual undergoes changes (like, redistribution of fat throughout the body, bones become thinner, brittle and porous, especially in women, sometimes resulting in painful and crippling fractures of the hip or vertebrae, drying of skin, loss in elasticity of muscles, blood vessels, and other tissues, appearance of wrinkles and age spots).

At Affective Level – individual may experience emotional dysregulation or imbalance, owing to the dissatisfaction for life or unfulfilled goals, a sense of incompetence or lack of having achieved anything substantial.

At Psychological Level – individual may experience random bouts of depression, loneliness, anxiety, disruptions in moods, conflicts with self, identity and/or existential crisis.

At the level of Societal Roles – changes are observable with reference to the roles of spouse, parents, caregivers, and so on.

The phase of Midlife transition is an important, yet often confusing time. This period can either wreak havoc into various domains of life of middle-aged adults, or act as a boon by availing them an opportunity to review their goals and perspective towards life. Erik Erikson suggested that older adults, when faced with mortality or a sense that time is running out, engage in a reminiscence process, the outcome of which may either be 'adaptive' or may result in 'despair'. Thus, midlife can be viewed from two perspectives, which have been discussed below:

- **WHEN MIDLIFE 'CRISIS' SETS IN:** An individual at this stage becomes profoundly aware of one's own mortality, the speed at which life is rushing by and assesses the targets that s/he had set to accomplish in life, the ones that succeeded, as well as, those that remained unaccomplished. There is a need to juggle and balance multiple spheres of life, with the physical changes of aging like fatigue, physical pain and the gradual deterioration of physical vigour surfacing. This often induces a state of unease and dissatisfaction from life, anxiety and pressure. Many people fear the aging process and attempt to deny it happening. Certain signs of an individual entering into 'Midlife Crisis' may include daydreams or erotic fantasies, strange obsessions and struggles, dependencies, a need to cut free of everyone and everything, intense mood shifts, troubles in marriage, physical ailments.
- **MIDLIFE ISN'T ALL ABOUT CRISIS:** When aroused by the demands and stresses of the midlife period, individual is likely to return to the unfinished business of past, while at the same time drifting towards an unknown future. However, midlife transition doesn't necessarily imply a state of disequilibrium; individuals may also be able to embrace the next stage of life in a healthy way through— choice and pursuit of life goals, reflection and re-evaluation, careful planning, decision making and choices about new directions which often lead to growth of the individual. The process of realization often leads one to reinterpret the past and make changes for the future, as well as, to modify the way one feels or thinks about life, including better emotional regulation (Magai and Halpern, 2001), increased wisdom and practical intelligence (Baltes et al, 1999) or a strong sense of mastery (Lachman and Bertrand, 2001).

The process of self-reflection during midlife, using 'regret' as a catalyst for productive change ushers higher well-being (Stewart and Vandewater, 1999).

Midlife may provide a training ground for aging, offering a glimpse of things to come. The midlife period often demands work in multiple domains of work, family, personal health and well-being. There is emerging evidence that midlife is often a period of enhanced mastery and competence, peak functioning, responsibility and balance (Lachman, 2004).

## VI. MIDLIFE CRISIS - EXPERIENTIAL DIFFERENCES PERTAINING TO GENDER ORIENTATION:

Little research supports the notion that men and women experience significant differences in the way they process a midlife crisis.

Both men and women reported 'awareness of time passing' as a trigger for midlife crisis; 14% of men and women said the midlife crisis is a time for making major personal changes.

In Men, midlife crisis can be seen to centre on— fancy cars, affairs, unusual new interests. Reportedly, midlife crisis may lead to engagement in youthful behaviours to reassert masculinity (such as taking up activities like motorcycling or skydiving, developing interests for a female counterpart of either younger or same age), trigger concerns on success-failure ratio in career, effects of aging on the desirability and strength, decline in interest in sexuality during and following their male climacteric (male menopause). But for some men, it is more about 'finding meaning' in life.

On the other hand, Women are about as likely as men to experience a midlife crisis. Women may experience pressures to remain youthful and desirable, isolation, loneliness, inferiority, uselessness, non-assertion, or unattractiveness. In our youth-oriented society, the stigma of aging is greater for women than it is for men. A woman's ability to provide sex, companionship and to have children is associated with the physical beauty and fertility of youth.

Men, on the other hand, are seen as possessing qualities— competence, autonomy, and self-control—that rather enhance with age. Thus, the same wrinkles and gray hair that may enhance the perceived status and attractiveness of an older man may be seen as diminishing the attractiveness and desirability of an older woman. Research findings suggest middle-aged women are much more dissatisfied with their appearance than men (Halliwell & Dittmar, 2003); Women are more likely than men to quit working outside the home to rear children. Some women may regret this choice, feel frustrated by limited career options, or feel less fulfilled as their children grow older.

The most distinct change for most midlife women, occurring at physical level, is *menopause*. In Western societies, menopause is often viewed in terms of loss of reproductive capability and decline in sexual functioning. Women in other cultures often have menopausal experiences and attitudes different from those reported by Western women. For example, in India, women of high social castes report very few negative symptoms; 'hot flashes' are virtually unknown among Mayan women. Menopause leads to disruption at hormonal levels which also lay noteworthy impact upon the moods of a female and the way they experience or perceive things around them. Further, middle-aged women may experience an increasing interest in sexuality, which can cause problems in their primary relationship if their significant other loses interest in sexual activity, leading some women to have extramarital affairs, sometimes with younger sexual partners.

However, some empirical evidence also show that midlife women consider this period to be one of *vibrancy* and *opportunity for growth*. According to Ettaugh and Bridges (2006), freedom from reproductive concerns, a sense of accomplishment, the successful

launching of children and increase in available time enables women to focus more on their self-development, partner, job and community.

Overall, Women can experience the same midlife crisis symptoms as Men, such as concerns about an aging body, desirability, career success, and relationships, however, the way in which these crises are experienced by either sex, varies in the light of environmental or situational set up, norms prescribed by the society guidelines and relative expectations.

#### MIDLIFE ROLE TRANSITIONS

Although, reportedly, few women experience a midlife crisis, many go through a process of life review (an intensive self-evaluation of their lives). One characteristic theme in the life reviews of current midlife women is the 'search for identity'. Many women attempt to affirm their own being, independent of their family, through graduate education, beginning a career, or switching careers. Middle-aged women who are involved in either beginning or building their career are both psychologically and physically healthier than women who are maintaining or reducing their career involvement (Etaugh & Bridges, 2006). For non-working women, being a full-time homemaker can be associated with the same degree of psychological well-being as that experienced by working women. Thus, there are multiple routes to well-being in midlife. It can be inferred that a key factor influencing midlife role evaluation is not the 'nature' of a woman's role but 'fulfilment' of her preferred role.

Although some midlife women remain satisfied with traditional roles, others are disturbed about missed educational or occupational opportunities, often voicing regrets in midlife about earlier decisions. According to Stewart and Vandewater (1999), women who acknowledge their regrets and make modifications based on these feelings experience greater psychological well-being at midlife than those who have regrets but do not use them as a basis for altering their life direction.

Midlife Transitions can be broadly categorised into :

- Transitions in Spousal Role - changes in terms of divorce (can lead to psychological distress, financial breakdown, loneliness or usher independence, autonomy), widowhood, loss of a partner (marked by poor mental and physical health, loneliness, lowered life satisfaction, financial breakdown), remarriage or discovering a potential novel love interest.
- Transitions in Parental Role Changes are in terms of loss of fertility, an "empty nest" (involves departure of the last child from the home) – can avail an opportunity to begin or expand development of personal identity, independent of family roles. For many women, their midlife review involves evaluating life; pursue new careers, further their education or provide service to communities. Women as mothers, remain involved in their children's lives in different ways- with contacts being less frequent, turn to advice, encouragement and financial assistance (Etaugh & Bridges, 2006) greater parent-child strain due to children's greater financial dependency.
- Transitions in Caregiver Role Typically, middle-aged women carry out the care giving and support functions. For middle-aged women likely to be employed, caring

for elderly relatives adds to their list of competing roles and responsibilities (Etaugh & Bridges, 2006).

- Transitions in Grandparental Role About half of women experience this event by age 47 (Etaugh & Bridges, 2006). During their grandchildren's infancy and preschool years, nearly half of grandmothers provide the children's parents with considerable emotional support; help with child care, household chores and economic support. While parenting a grandchild is an emotionally fulfilling experience, there are psychological, health, and economic costs. Grandparents primarily responsible for rearing grandchildren are more likely to suffer from a variety of health problems- depression, diabetes, high blood pressure, heart disease, decline in self-rated physical and emotional health.

#### VII. REVIEW OF LITERATURE

Some of the studies are –

**Judith R. Gordon, Joy E. Beatty and Karen S. Whelan-Berry (2002)** found – Women **rebalance and develop new perspectives** at Midlife;

**Deborah Carr (1997)** found – Women who had fallen short of their earlier career goals suffer from **Lower levels of Purpose** in life and **Higher levels of Depression**;

**Usha R. Rout, Cary L. Cooper and Helen Kerslake (1997)** found – **Working** mothers reportedly had **better Mental Health** and **less Depression**, as compared to the **Non-Working** mothers. Reportedly, **major stressor** for **Working** mothers was- 'not having enough time to do everything'; whereas for **Non-working** mothers- 'lack of social life'.

**L.M. Coleman and T.C. Antonucci (1983)** established – **Working** women at Midlife have **higher Self-Esteem**, **less psychological Anxiety** and better physical Health than homemakers. It was suggested- 'Work' may act as a stabilizing force for women during critical periods throughout the life cycle.

#### VIII. RATIONALE

Midlife Transition is a period of numerable intricate challenges having a primary purpose to enable the advancement of individual towards the quintessential goals of attaining wisdom, personal growth and striking a balance between the subtleties of passions, urges and the credible requisites to lead a life of satisfaction and happiness. However, in case of inability to effectively deal with these challenges often paves way for transformation of the 'transitory' phase into that of 'crisis'. This can be avoided to a good extent if we have awareness and keep a check of requirements and demands from our 'self', 'relationships' and the 'people' around us. And learn to discriminate between our 'goals' and 'desires.'

A significant amount of work has been done on 'Midlife Crisis.' The concept has been dissected for analysis, into various dimensions, to facilitate a comprehensive understanding. Researchers have aimed to study it at primarily 3 levels- *Physiological, Psychological and Social*. The processes and triggers contributing in the midlife crisis can be categorised in

these levels. Further, evidences suggesting the role of ‘Gender’, ‘Socioeconomic status’, ‘Culture’, ‘Personality’, ‘Employment Status’, in creating an experiential disparity among individuals have been found. It can thus be inferred that experience of ‘crisis’ involves - a need of exploring Self and purpose of life, revisiting unfulfilled ambitions, dissatisfaction from life, concern of aging, urge to explore and indulge in risk-taking behaviours, fear of death, marital dissatisfaction, need for attention and appreciation, sense of increased responsibility and at the same time an urge to cut free. This juxtaposition of drives and desires apparently leaves a significant impact on the mental health and well-being of an individual experiencing midlife crisis. Several researches done, thus focus upon the relation of Midlife Crisis with Mental Health, Self-Esteem, Life and Marital Satisfaction and Well-Being of people. Reportedly, Working women were found to show signs of betterment and progression in the above mentioned domains as compared to Non-Working women.

The present study purposes to determine difference between the mental health of Working and Non-Working women, in India, on the dimensions of- Anxiety, Stress and Depression. It further aims to detect presence of Midlife crisis. Among the selected dimensions, earlier studies have been done largely in relation with the ‘Depression’. As such no relevant research was found taking together all the 3 dimensions for evaluation of Mental Health among Working and Non-Working women and then lay ground for comparative assessment. Secondly, very limited research was found available on the Indian sample, in relation with the proposed study. Since, women in our society have a major role to play hence it is important to study the dynamics involved in the way the phenomenon is unique in experience to every female and the role played by Employment Status in re-structuring psychological and emotional upheavals of women during middle-age.

## IX. METHODOLOGY

**Purpose** - To determine difference in the Mental Health of Working and Non-Working women in India during midlife.

### Hypothesis-

1. There is a significant difference in the Anxiety level of Working and Non-Working women.
2. There is a significant difference in the Depression level of Working and Non-Working women.
3. There is a significant difference in the Stress level of Working and Non-Working women.

**Variables** - Dependent Variable: Anxiety, Depression and Stress  
Independent Variable: Employment Status

\*(IV is a Categorical Variable: i. Working women ; ii. Non-working women)

### Research Questions -

- Is midlife crisis experienced by every woman in middle adulthood?
- How the struggles of working and non-working women differ during midlife period?
- What are the possible causes of midlife crisis among working and non-working women?

- How does midlife crisis affect the mental health of working and non-working women in India?

**Sample**- Sample selected for the present study is of 50 adult females (Working women, N=25; Non-Working, N=25), age ranging from 45-60 years.

The sampling technique used is Purposive Sampling.

### Inclusion criteria -

- Working and Non-working adult females with the age ranging from 45-60 years.
- Marital status- Married.

### Exclusion criteria -

- Adult females who are below 45 and above 60 years of age.
- Marital status- Single or Divorced.

**Tools Used**- Data for the present study will be collected using Anxiety Depression Stress Scale (ADSS), developed by Bhatnagar et al., (2016). The scale comprises of 48 items which are divided into 3 Subscales, on which respondents are assessed, namely- Anxiety, Depression and Stress.

A semi-structured interview to be used for the collection of qualitative data from the sample.

**Procedure**- Researches on the topic of midlife crisis were studied thoroughly and a significant variable regarding an understanding of the midlife crisis faced by the Working and Non-Working women was chosen. A sample of 10 Working and 10 Non-Working women (married) was selected applying Purposive Sampling technique. Anxiety Depression Stress scale developed by Bhatnagar et al. was selected and applied on the sample to extract the data. Further, a Semi-structured interview schedule was administered. Scoring of the ADSS, followed by t-testing and Content analysis of Interview was carried out.

**Analysis** - t-testing was used for the scores obtained on ADSS to determine the difference between mental health of Working and Non-Working women during Midlife. Further, content analysis was used for the qualitative data collected from interview.

## X. RESULTS

### **Quantitative Data**

**Table 1.** Showing the MEAN values of –  
(a) WORKING respondents on ANXIETY, DEPRESSION and STRESS.

|       | ANXIETY | DEPRESSION | STRESS |
|-------|---------|------------|--------|
| Means | 3.7     | 1.4        | 5.4    |

**(b) NON-WORKING respondents on ANXIETY, DEPRESSION and STRESS.**

|              | ANXIETY | DEPRESSION | STRESS |
|--------------|---------|------------|--------|
| <b>Means</b> | 6.2     | 4.7        | 6.5    |

**Table 2. Showing the SD, SED and t-values of the samples on the dimensions - ANXIETY, DEPRESSION and STRESS.**

|                | ANXIETY | DEPRESSION | STRESS |
|----------------|---------|------------|--------|
| <b>SD</b>      | 3.19    | 2.97       | 3.32   |
| <b>SeD</b>     | 1.43    | 1.33       | 1.48   |
| <b>t-value</b> | 1.75    | 2.48       | 0.74   |

**DISCUSSION**

The present study was conducted with the aim of determining difference between the mental health of the Working and Non-Working Women in India, while taking a stock of the probability of them experiencing Midlife Crisis.

The phenomenon was put on the radar to assess its role in influencing the quality of mental health of the samples.

For conducting the present study, a samples of N = 10 respondents, each, were chosen. Age of the respondents who participated in the study ranged from 47 to 58 years. The pre-established exclusion and inclusion criteria of the study were strictly taken care of.

Herein, post noting the required demographic details, the first step taken was to administer the ADSS to the respondents. The English and Hindi versions of ADSS were employed in compliance with the comfort of each respondent. ADSS administration involved proper feeding of the instructions mentioned in the scale, followed by extension of assistance in case of any ambiguity in the item(s) of the scale. There was no time constraint. This was followed by administration of a semi-structured Interview Schedule. The responses to the questions were made note of by the researcher. Following the mentioned procedure for data collection, a careful scoring of the responses obtained in the ADSS was done. Further, t-testing was done to test the hypotheses framed. Responses obtained in the interview schedule were evaluated using the Content Analysis technique. The workings of two types of data – QUANTITATIVE as well as QUALITATIVE have been discussed in detail onwards.

The Quality of Mental Health of the samples was assessed on the 03 pre-selected dimensions: ANXIETY, DEPRESSION

and STRESS, using the Anxiety Depression Stress Scale (ADSS), developed by Dr. Pallavi Bhatnagar et al., (2016).

Following HYPOTHESES were developed for testing -

- There is a significant difference in the Anxiety level of Working and Non-Working women.
- There is a significant difference in the Depression level of Working and Non-Working women.
- There is a significant difference in the Stress level of Working and Non-Working women.

The VARIABLES under study –

Dependent Variable: Anxiety, Depression and Stress

Independent Variable: Employment Status

\*(IV is a Categorical Variable: i. Working women ; ii. Non-working women)

Scores of the samples obtained on the ADSS were computed and 03 separate t-tests were done to obtain a comparative view of mental health of the samples (i.e., Working and Non-Working Women).

The RESULTS obtained were tabulated in –

**Table 1 – (a) and (b)** which depicts the **MEAN** values of the samples on the 03 dimensions.

For the sample of **WORKING** Women, Mean values obtained on –

**ANXIETY = 3.7, DEPRESSION = 1.4 and STRESS = 5.4**

For the sample of **NON-WORKING** Women, Mean values obtained on –

**ANXIETY = 6.2, DEPRESSION = 4.7 and STRESS = 6.5**

**Table 2 –** depicts the **SD, SED** and **t-values** obtained on the 03 dimensions.

On **ANXIETY**, the value of **SD = 3.19, SED = 1.43** and **t = 1.75**

On **DEPRESSION**, the value of **SD = 2.97, SED = 1.33** and **t = 2.48**

On **STRESS**, the value of **SD = 3.32, SED = 1.48** and **t = 0.74**

From **Table D** (Table of t, for use in determining the significance of statistics) for **df = 18**, at confidence interval **0.05**, the value of **t = 2.10** and at confidence interval **0.01**, the value of **t = 2.88**.

The experimentally obtained t-value, for **ANXIETY = 1.75**, is **INSIGNIFICANT** at **0.05** interval implying, experimentally **NO SIGNIFICANT DIFFERENCE** was found in the **ANXIETY** levels of the samples.

Thus, the hypothesis ‘There is a significant difference in the Anxiety level of Working and Non-Working women’ stands **REJECTED**.

The experimentally obtained t-value, for **DEPRESSION = 2.48**, is **SIGNIFICANT** at the confidence interval **0.05** implying, experimentally, the **DIFFERENCE** in the levels of **DEPRESSION** found was **SIGNIFICANT**.

Thus, the hypothesis ‘There is a significant difference in the Depression level of Working and Non-Working women’ stands **ACCEPTED**.

The experimentally obtained t-value, for **STRESS = 0.74**, is **HIGHLY INSIGNIFICANT** at **0.05** interval implying, experimentally **NOSIGNIFICANT DIFFERENCE** was found in the **STRESS** levels.

Thus, the hypothesis ‘There is a significant difference in the Stress level of Working and Non-Working women’ stands **REJECTED**.

Further, a Semi-Structured Interview Schedule of 05 questions was used to detect the presence of Midlife Crisis by

adjusting a strict focus on and examining the subjective view of respondents on – ‘Life - related experiences’, ‘Changes at intrapersonal level’, ‘their take on these changes’ and ‘satisfaction with life’, in regards with the middle-age. The questions of Interview Schedule were drafted in Hindi Language keeping into view the cultural background of the sample under study.

The 05 Questions used in the schedule are –

1. आप अपनी जिन्दगी के इस पड़ाव पर कैसा महसूस करती हैं?

2.

क्या जिन्दगी के इस पड़ाव पर आपने खुद में किसी प्रकार के कोई परिवर्तन या बदलाव महसूस किए हैं?

3. आपकी जिन्दगी में इन बदलावों का क्या महत्व है?

4. व्यक्तिगत तौर पर इन बदलावों ने आपको किस तरह प्रभावित किया है?

5. आपने अपनी जिन्दगी जैसे बिताई है, अभी तक, क्या आप उससे संतुष्ट हैं?

Content Analysis was employed for analyzing data obtained in the schedule.

On the basis of the Interview Schedule, total **05** major **Categories** have been created-

*Life View, Challenges and Changes, Significance of Changes and Life Satisfaction.*

Each Category comprises a certain set of **Subcategories**. Each subcategory has been derived from the responses of the respondents in the interview.

Under each Category has been depicted the **PERCENTAGE** value of reporting of the respondents in each Subcategory –

### LIFE VIEW

This category focuses on how the respondents perceive and feel about the life they have led and are presently leading. It involved analyzing experiences and give an assembled view. This category consists of **03** subcategories–

- **Feel Good** - includes responses given in terms of *accomplishments* and *achievements* recounted.

Reportedly, **50%** of **Working** and **35.71%** of **Non-Working** responses formed it.

- **Happy and Content** - includes responses depicting *contentment* and *satisfaction* from the life.

Reportedly, **50%** of **Working** and **42.85%** of **Non-Working** responses formed it.

- **Unhappy** - includes responses depicting *dissatisfaction*, *unhappiness* and *loneliness* from the life.

Reportedly, **0%** of **Working** and **21.42%** of **Non-Working** responses formed it.

**Fig. 1 (a)** and **2 (a)** are pictorial views of the data obtained in this Category -

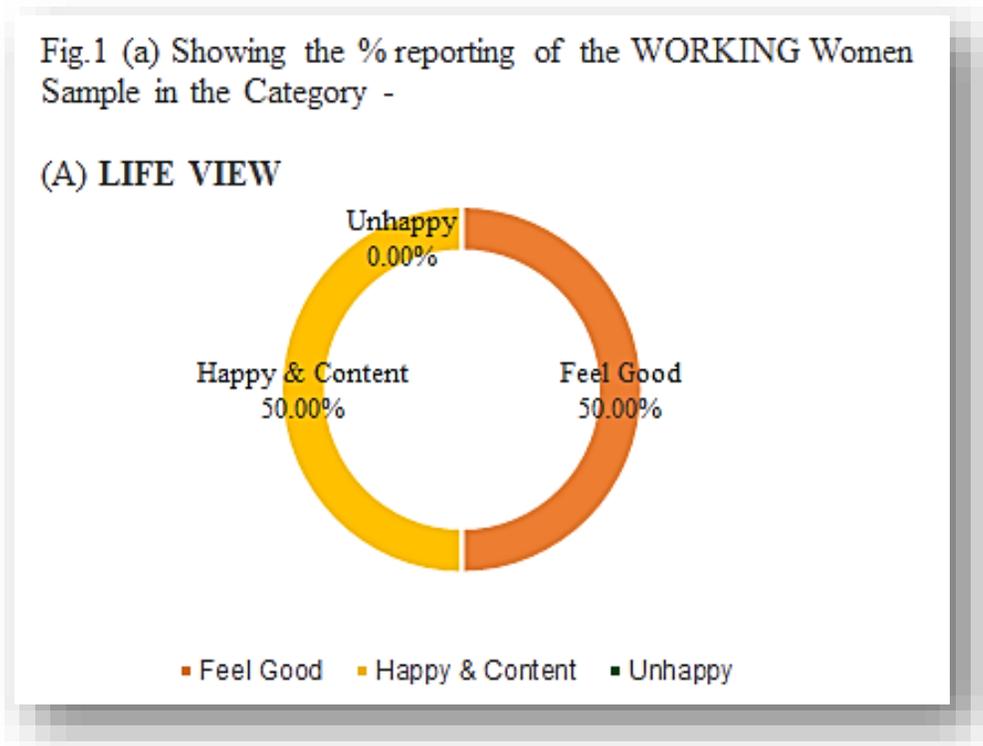
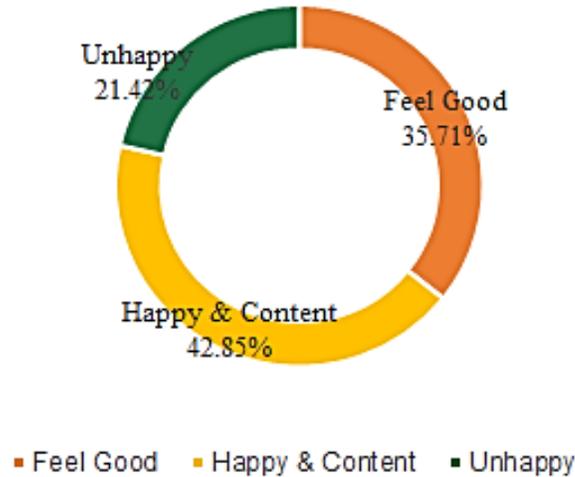


Fig.2 (a) Showing the % reporting of the NON-WORKING Women Sample in the Category -

(A) LIFE VIEW



**CHALLENGES and CHANGES**

This category focuses on how the respondents view Challenges faced by them, at the present moment, including the significant Changes associated with them.

This category consists of **03** subcategories–

- Childhood phase - includes responses depicting *encounters* and *descriptions of events* from the childhood phase.

Reportedly, **26.32%** of **Working** and **42.11%** of **Non-Working** responses formed it.

- Adolescent phase - includes responses depicting episodes from the adolescent phase. Reportedly, **21.05%** of **Working** and **5.26%** of **Non-Working** responses formed it.
- Adulthood phase–includes responses depicting episodes from the adulthood phase. Reportedly, **52.63%** of **Working** and **52.63%** of **Non-Working** responses formed it.

**Fig. 1 (b)** and **2 (b)** are pictorial views of the data obtained in this Category -

Fig. 1 (b) Showing the % reporting of WORKING Women Sample in the Category -

(B) CHALLENGES and CHANGES

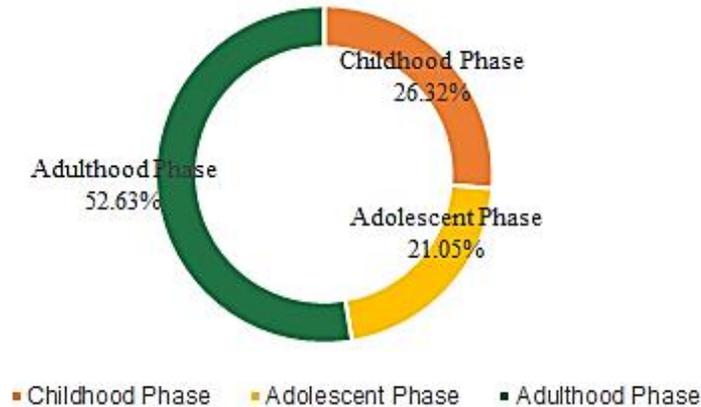
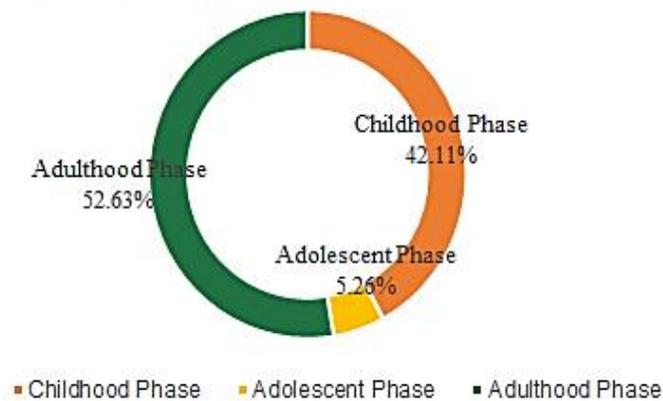


Fig. 2 (b) Showing the % reporting of NON-WORKING Women Sample in the Category -

(B) CHALLENGES and CHANGES



**SIGNIFICANCE of CHANGES**

This category focuses on determining the significance of the Changes underwent by the respondents and their opinion on how it played a remarkable role.

This category consists of **03** subcategories—

- **Open Mindset** - includes responses depicting changes as the harbingers of a *broad view on life, situations and people, becoming more understanding and accepting.*

Reportedly, **33.34%** of **Working** and **21.05%** of **Non-Working** responses formed it.

- **Life Lessons** - includes responses depicting Changes seen as *pleasant* and *unpleasant* lessons of life. Reportedly, **23.81%** of **Working** and **42.11%** of **Non-Working** responses formed it.

- **Feel Empowered** - includes responses depicting Changes as agents of *ability* and *confidence* to deal with the difficulties of life. Reportedly, **42.86%** of **Working** and **36.84%** of **Non-Working** responses formed it.

Fig. 1 (c) and 2 (c) are pictorial views of the data obtained in this Category -

Fig. 1 (c) Showing the % reporting of WORKING Women Sample in the Category -

(C) SIGNIFICANCE of CHANGES

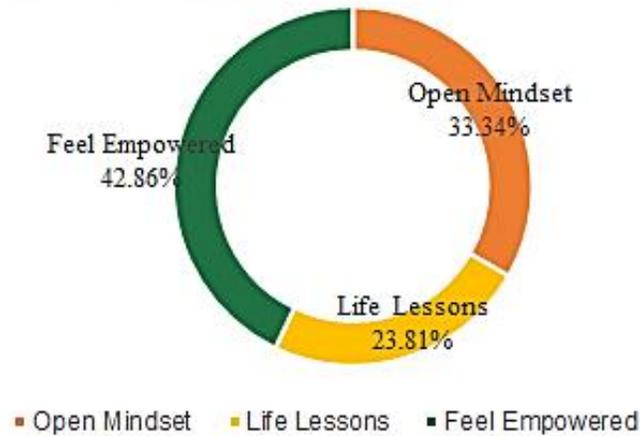
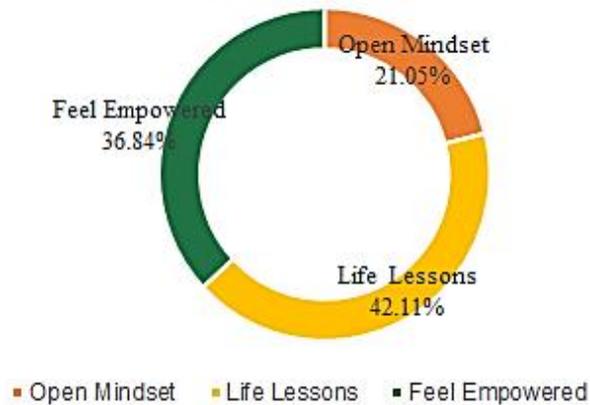


Fig. 2 (c) Showing the % reporting of NON-WORKING Women Sample in the Category -

(C) SIGNIFICANCE of CHANGES



**PERSONAL INFLUENCE of CHANGES**

This category aims at determining effect of changes on the respondents, at intrapersonal level and how they have evaluate them in their present stage of life.

This category consists of 03 subcategories –

- Experiencing Growth - includes responses depicting constructive effects- *decision making* ability, becoming *responsible, independent* and *confident*.

Reportedly, **38.89%** of **Working** and **33.34%** of **Non-Working** responses formed it.

- Adjustments - includes responses given in terms of episodes on *adjustments* made to deal with situations.

Reportedly, **44.45%** of **Working** and **13.34%** of **Non-Working** responses formed it.

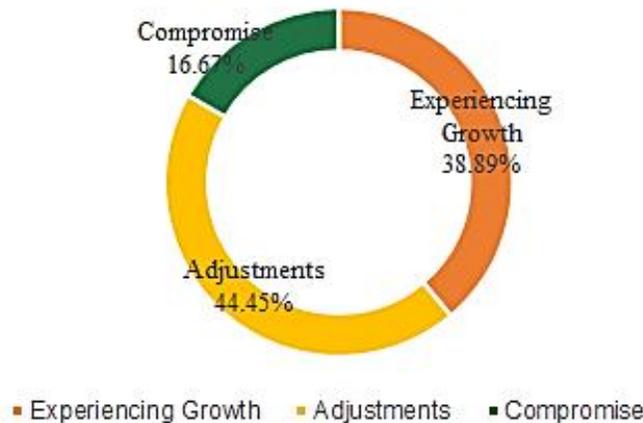
- Compromise - includes responses given in terms of episodes on *compromises* made to deal with situations.

Reportedly, **16.67%** of **Working** and **53.34%** of **Non-Working** responses formed it.

**Fig. 1 (d)** and **2 (d)** are pictorial views of the data obtained in this Category -

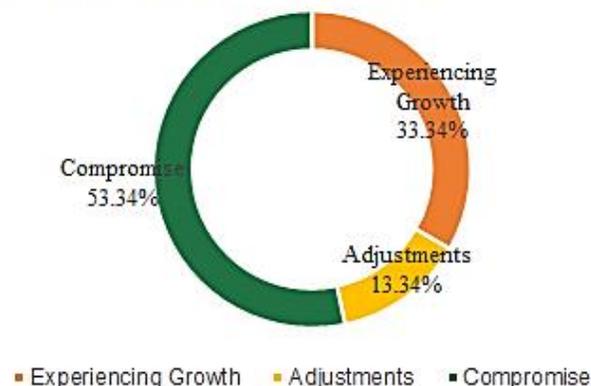
**Fig. 1 (d)** Showing the % reporting of **WORKING** Women Sample in the Category -

**(D) PERSONAL INFLUENCE of CHANGES**



**Fig. 2 (d)** Showing the % reporting of **NON-WORKING** Women Sample in the Category -

**(D) PERSONAL INFLUENCE of CHANGES**



**LIFE SATISFACTION**

This category aims at determining the satisfaction and/or dissatisfaction from life. It further attempts to probe into the aspect of dissatisfaction, in terms of regret(s) and unattended desires.

This category consists of **04** subcategories. They are –

- **Satisfied** - includes responses reflecting *satisfaction* of the respondents towards life. Reportedly, **57.14%** of **Working** and **31.82%** of **Non-Working** responses formed it.
- **Dissatisfied** - includes responses reflecting *dissatisfaction* of the respondents towards life. Reportedly, **0%** of **Working** and **18.19%** of **Non-Working** responses formed it.

- **Regrets** - includes responses depicting *unpleasant accounts* and *issues* that affect the respondents at present. Reportedly, **28.57%** of **Working** and **22.72%** of **Non-Working** responses formed it.
- **Unfulfilled Desires** - includes responses depicting *desires* and the willingness of pursuing it. Reportedly, **14.29%** of **Working** and **27.27%** of **Non-Working** responses formed it.

Fig. 1 (e) and 2 (e) are pictorial views of the data obtained in this Category -

Fig. 1 (e) Showing the % reporting of WORKING Women Sample in the Category -

(E) LIFE SATISFACTION

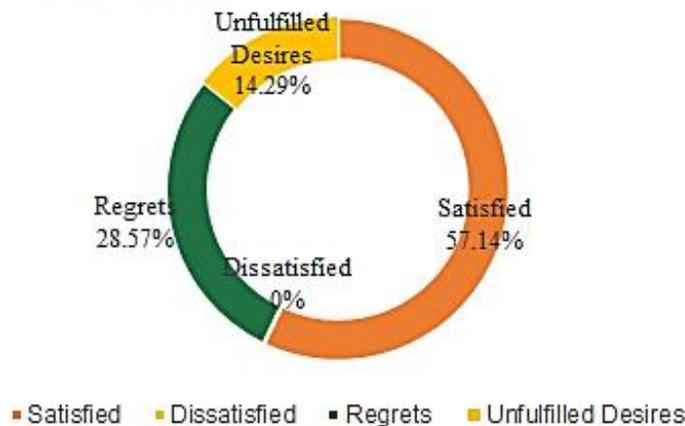
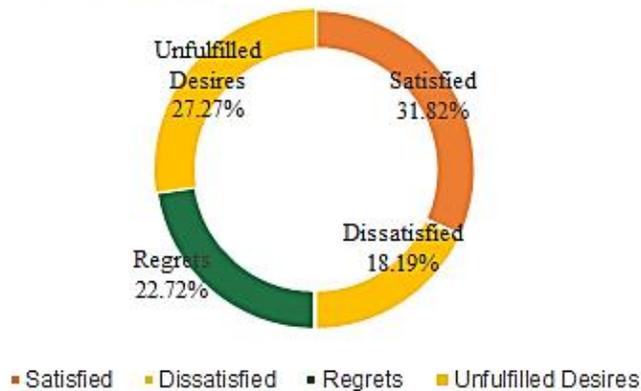


Fig. 2 (e) Showing the % reporting of NON-WORKING Women Sample in the Category -

(E) LIFE SATISFACTION



Results derived from the Interview Schedule apparently expose a cranny in the subjective views of the two samples. This difference is evident through those Subcategories wherein, a significant disparity can be seen in the ‘percentage reporting’ of the two samples–

- Feel Good, Unhappy – LIFE VIEW
- Childhood Phase, Adolescent Phase – CHALLENGES and CHANGES
- Life Lessons, Feel Empowered – SIGNIFICANCE of CHANGES
- Adjustments, Compromise – PERSONAL INFLUENCE of CHANGES
- Dissatisfied, Satisfied, Unfulfilled Desires – LIFE SATISFACTION

On subjecting the responses in the Interview to further scrutiny to probe into the experience of Midlife, some predominant ‘concerns’ were identified–

‘PARENTING’ (rearing of the children, responsibilities as a parent, and quality of bond with the children) in the **Non-Working** women was found to be **fairly greater** than **Working** women; ‘LONELINESS’ in the **Non-Working** women was found to be **greater** than **Working** women; ‘SATISFACTION FROM LIFE’ (episodes ranging from the childhood up to the middle age, the person that they have transitioned into) in the **Non-Working** women was found to be **lesser** than **Working** women; ‘REGRETS’ (achievements, aspirations related to career, children, hobbies long lost) in the **Non-Working** women was found to be **slightly lesser** than **Working** women; ‘PERSONAL VIEW OF SELF’ (responsible, independent, confident, taking stand of beliefs and opinions, making decisions, valuing self) in the **Non-Working** women was found to be **slightly greater** than **Working** women; ‘AGING’(appearance, decline in vigor) in the **Non-Working** women was found to be **greater** than **Working** women; ‘DESIRES’ (urge to fetch and invest in long lost interests, travelling, creating an identity) in the **Non-Working** women was found to be **greater** than **Working** women. The ‘concerns’ noted are seemingly indicative of the Midlife Crisis operating more actively in the sample of Non-Working women. This affirms a relatively **strong influence** of Midlife Crisis **over** the **Non-Working** sample.

Mental Health comprises of various factors among which, Anxiety, Depression and Stress are the primary. Quantitative results obtained on ADSS suggest that the difference observed in the mental health of the two samples on the dimensions – **ANXIETY** stands **INSIGNIFICANT** yet the **mean** values of **Non-Working** sample (= **6.2**) was **HIGHER** than that of **Working** sample (= **3.7**). **STRESS** stands **HIGHLYINSIGNIFICANT** yet the **mean** values of **Non-Working** sample (= **6.5**) was **HIGHER** than that of **Working** sample (= **5.4**). **DEPRESSION** stands **SIGNIFICANT** at 0.05 confidence interval.

Overall these values clearly depict a **moderate** difference in the mental health of the two samples that is apparently NOT SIGNIFICANT yet DOES EXIST. Finally, the Qualitative results suggest-‘transitions’ that the females go through during middle-age, at social, physiological and psychological levels do affect how they view their life, evaluate

the challenges faced and the related experiences. Some of these transitions were found common to both the samples, however, apparently, in the **NON-WORKING** women sample, they were found to **emerge** in the shape of ‘**crises**’ **moderately more** than the **WORKING** women sample. This proposition is supported by the following evidences –

- **Disparity** seen in the **percentage reporting** of the two samples (**Subcategories**).
- **Concerns** forming the core of responses.

**Subcategories** and **Concerns** are thus suggested to intricately connect with the mental health of the respondents and give an insight into it’s status. For instance –

**Feel Good, Open Mindset, Compromise, Unhappy** (SUBCATEGORIES); **Loneliness, Regrets, Aging, Personal view of Self** (CONCERNS)

Presence of some difference in the mental health of the **WORKING** and **NON-WORKING** women, in India during middle-age thus stands affirmed.

Several studies have been conducted to investigate the Midlife Crisis phenomenon and the ways in which the Mental Health and Well-Being of women get affected during the middle years of life. For the purpose, several factors have been investigated upon, primarily targeting – the **employment status**. Findings from the present study thus stand in harmony with the previous studies reaffirming the presence of a difference in the quality of mental health of the Working and Non-Working women. However, there are certain **determinants** in the present study that are suggested by the researcher to have played a role–

- **Cultural Background** – present study has been conducted on the sample from Indian population, affecting the transparency of the responses obtained.
- **Menopause** – age of the respondents ranged from 47 to 58 years. Thus, a fair share of respondents was fresh entrances to the Menopause. Adapting to the changes at biological and psychological levels is here, suggested to have affected the results obtained. Where having a professional life might act as a distractor for the **WORKING** women, whereas, the **NON-WORKING** women devoid of an escape hatch.
- **The Empty Nest** –Some of the **Non-Working** women were found to use this time for ‘nurturing self-interests’ while some reported feelings of ‘loneliness’ and ‘sadness’. Whereas Working women had more time in hand to ‘plan for a better retirement’ and slow down to ‘focus on self’.

## XI. CONCLUSIONS

Taking the Indian women exclusively on radar, it is apparent that being in the **middle-age** and the ways in which the **transitions** involved in it are **dealt** with has a **significant relationship** with the **mental health** of an individual. This relationship is suggested to be of a **direct proportionality**. An effective management creates room for ‘Growth’ whereas an ineffective coping or mismanagement leads to ‘Crises’. Midlife Crisis can thereby **adversely affect** the mental health of an

individual, prominently on the dimensions of – ANXIETY, DEPRESSION and STRESS.

## XII. LIMITATIONS –

Considering some confounding that may have influenced the findings reported this study has potential limitations attached–

- Small sample size is suggested to limit the generalizability of the results obtained.
- Semi-Structured Interview Schedule developed by the researcher was less intensive in approach, in an attempt to cover the major possible dimensions of life.
- Interplay of the cultural biases and personal issues of the sample under study is suggested to have strongly influenced the quality of data.

## XIII. IMPLICATIONS –

- Use of further variables – socioeconomic status, marital status, demographic status (rural population) and others can be made to examine their role and obtain a more comprehensive view of mental health.
- Taking a larger sample size under study is recommended to achieve a relative broader insight into the mental health status of women in India and increase applicability of the findings in compliance with the attribute of extensive cultural diversity.

Declaration Statement:

I hereby Declair Availability of my data

Dr .Manini Srivastava

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# Spectrophotometric Determination Of Vanadium (V) With Schiff Base Derived From Pyridine-2-Carboxaldehyde And 2-Amino Pyridine By Preliminary Adsorption On Polyurethane Foam

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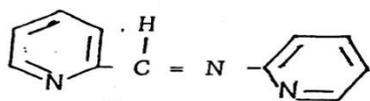
<http://dx.doi.org/10.29322/IJSRP.10.10.2020.p10668>

**Abstract-** The spectrophotometric determination of Vanadium (V) by adsorption of its pyridine-2-carboxaldehyde and 2-amino pyridine complex after adsorption on polyurethane foam is described. The complex is eluted from the foam with chloroform and absorbance is measured at 400 nm. Beer's law is obeyed in the concentration range 5-90  $\mu\text{g}$  of vanadium. The molar absorptivity was found to be  $2.3108 \times 10^4 \text{ Lmol}^{-1}\text{cm}^{-1}$  and sensitivity being  $1.14 \times 10^{-2} \mu\text{g cm}^{-2}$  for the absorbance of 0.001. The effect of various parameters namely pH, reagent, adsorbant, shaking time and diverse ions have also been investigated.

**Index Terms-** Polyurethane foam, Schiff base, Spectrophotometric determination, Vanadium,

## I. INTRODUCTION

Biological activities of Schiff bases are very well known. Some of them also show anticarcinogenic properties<sup>1-2</sup>. Schiff bases can be obtained from different amines and carbonyl compounds. These Schiff bases can form chelate complexes with different metal ions. These Schiff bases contain  $\text{-C=N-}$  imine linkage which is responsible for their biological activity and produce colour with metal ions by the formation of complex<sup>3-4</sup>. The following Schiff bases have been synthesized by respective carbonyl compound and amine in-



**Figure. 1:** SB derived from pyridine-2-carboxaldehyde and 2-amino pyridine.

Usually many organic compounds are used in analytical chemistry. Ample of investigation has been done for the development of new analytical organic reagents<sup>5-10</sup>. Due to the environmental contamination with vanadium in recent years it is the area of interest of chemists. This metal is widely involved in the enzymatic reactions and

nitrogen fixation.<sup>11</sup> It is a part of essential micronutrient in organisms which is responsible for health and disease.

Determination of vanadium is not easy from analytical point of view due to presence of interfering ions like iron(III). Hydroxyquinoline used for the determination of vanadium in bio samples has lack of selectivity and its pH range is not wide.<sup>12</sup> After this many reagents have been used for the determination of vanadium like reagent made by hydrogen peroxide,  $\alpha$ -benzoinoxime and diaminobenzidine, Schiff base derived from 2-furfural-dehyde and p-aminophenyl mercaptoacetic acid and one more Schiff base derived from ethylenediamine and 4-benzoyl-1-phenyl-3-methyl-2-pyrazidine-5-one.<sup>13-15</sup>

Above mentioned Schiff bases are valuable towards transition metal ions. In this series new Schiff base derived from pyridine-2-carboxaldehyde and 2-amino pyridine has interesting analytical application.<sup>16</sup> First row transition metals Vanadium (V) forms a stable water insoluble chelate complex with Schiff base derived from pyridine - 2 - carboxaldehyde and 2- amino pyridine. A new "Solid - Liquid Extraction" technique is used for the absorption of metal chelate on polyurethane foam.

## II. MATERIALS AND APPARATUS

Various materials and arrangements were utilized in the spectrophotometric assurance:

### A. SCHIFF BASE :-

Schiff was acquired from pyridine - 2 - carboxaldehyde and 2 - amino pyridine. Ethanolic arrangement of carbonyl compound pyridine-2-carboxaldehyde was blended in with 2-amino pyridine in ethanol in 1:1 molar proportion, refluxed over water shower for 3-5 hours. The subsequent Schiff base was isolated out. Blend was cooled, washed, dried in air and recrystallised by ethanol. Espresso earthy colored hued precious stones were acquired.

### B. STANDARD METAL ION SOLUTION:-

A standard stock arrangement of vanadium (V) (1000ppm) was set up by dissolving sufficient measure of ammonium meta

vendate in refined water. Weakened arrangements of different focus were set up by weakening of this stock arrangement.

#### C. BUFFER SOLUTION:-

Two cushion arrangements of pH run 3-6 and 8-11 are set up by blending explicit measure of 1M acidic corrosive and 1M ammonium acetic acid derivation arrangement and 1M fluid smelling salts and 1M ammonium acetic acid derivation arrangement individually.

#### D. REAGENT SOLUTION:-

It was set up by dissolving 0.2 gm of Schiff base compound in 100 ml ethanol.

#### E. POLYURETHANE FOAM :-

It was set up by the strategy for Hamon et al.<sup>17</sup> Polyurethane froth pieces were cut in 1 cm<sup>3</sup> size from a froth cushion which was gotten from a neighborhood departmental store. All froth pieces were cleaned by good cleaning strategies which were assessed previously. Right off the bat, the froth was more than once pressed in an enormous amount of 1M hydrochloric corrosive for certain minutes to a few hours to expel potential contaminants and afterward washed with refined water. They were next liberated from corrosive by crushing in water. Air dried in open at room temperature. No significant changes in polymeric properties because of these treatment was watched. Along these lines, perception uncovered that 1 hour pressing was

sufficient. Chow et al<sup>17</sup> recommended that the froth pieces ought to be as uniform as could be expected under the circumstances.

#### F. APPARATUS:-

Spectrophotometer EC model (GS – 5701) was used for the spectrometric estimations. Systronics model (Sr. No. 5244) was used for pH estimations.

### III. PROCEDURE

A fraction (1.0 ml) of standard vanadium(V) solution containing 15-90 µg of vanadium was taken in a beaker and 2.5 ml of 0.2% Schiff base solution was added to it. The pH was ranged for 3.0. After making volume 10 ml it was allowed to rest for 2 min for complete development of colour. Then, seven polyurethane pieces were added to this solution.<sup>18</sup> The flask was shaken for 60 seconds to allow the metal complex formed to be adsorbed on the foam. The foam pieces then squeezed with a glass plunger. These foam pieces which contain vanadium ion complex were transferred to glass beaker. The complex was rinsed from the foam pieces by squeezing with two portion of 2.5 ml chloroform. To remove traces of water 2.0 gm anhydrous sodium sulphate was added. Absorbance was measured in the region of 370-560 nm wave length. Calibration curve was constructed under similar conditions.

### IV. RESULT AND DISCUSSION

#### A. ABSORPTION SPECTRA :

A sample solution containing 60 µg of Vanadium (V), 2.5 ml of 0.2% reagent of Schiff base solution and 2.0 ml of the buffer solution was added to adjust the pH 3.0. The absorbance of the complex elutes with chloroform was measured at wave length range between 370-560 nm. Following curve fig 2. represents the absorption spectra of vanadium (V) complex. The maximum absorption is observed at 400 nm, so absorbance measurements were carried out at 400 nm wave length.

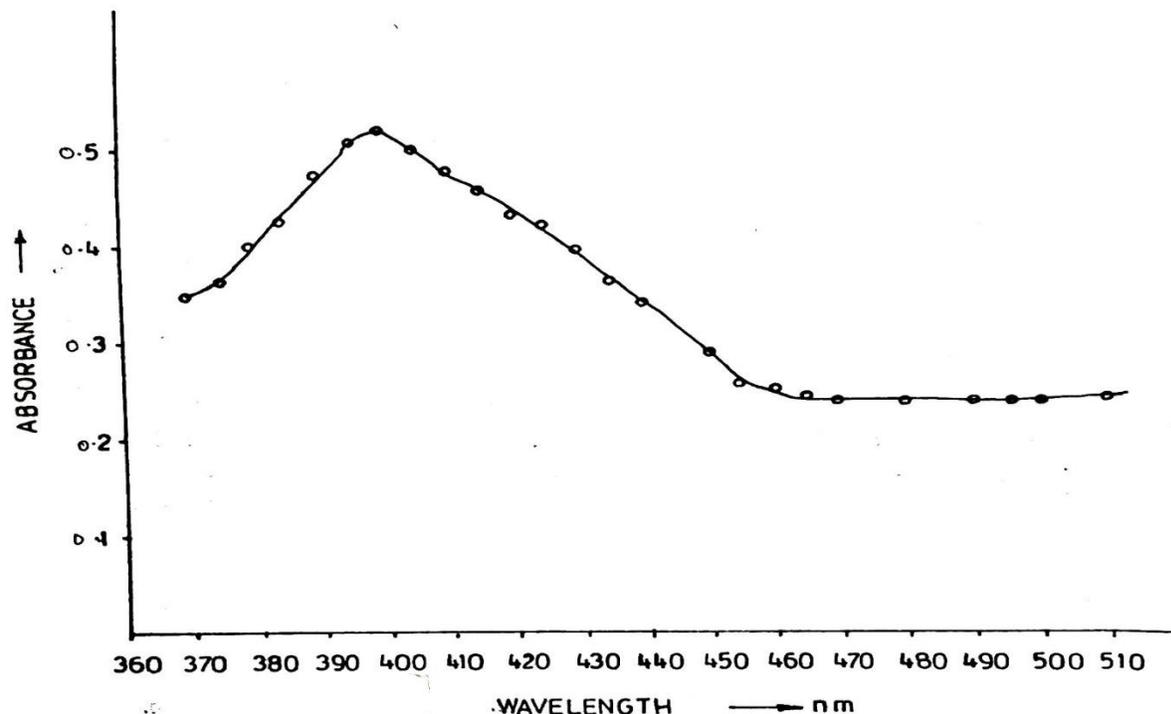


Figure .2 : Absorption Spectra of Vanadium

[VANADIUM (V) :60 µg, pH : 3.0, 0.2% REAGENT SOLUTION: 2.5ml, POLYURETHANE FOAM : 7 PIECES, SHAKING TIME :120 sec]

**B. EFFECT OF pH**

The effect of Ph on the absorbance of vanadium(V) complex having 60 µg vanadium ion in the solution was investigated at 400 nm in the pH range 1-10. The maximum and almost constant absorbance was obtained between the pH range 2.0 – 6.0 . So, for all absorbance measurements pH of solution was taken to be 3.0 shown in fig. 3 and table 1.

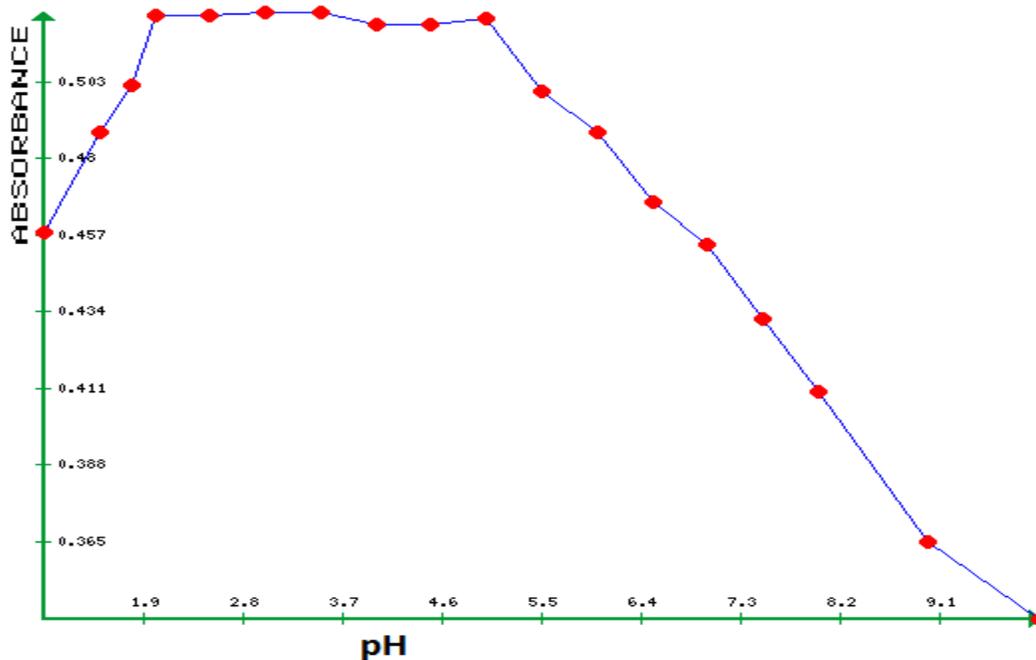


Figure. 3: Effect of pH on absorbance

(VANADIUM (V) : 60 µg, WAVELENGTH : 400 nm, 0.2% REAGENT SOLUTION : 2.5 ml, POLYURETHANE FOAM : 7 PIECES, SHAKING TIME : 120 sec.)

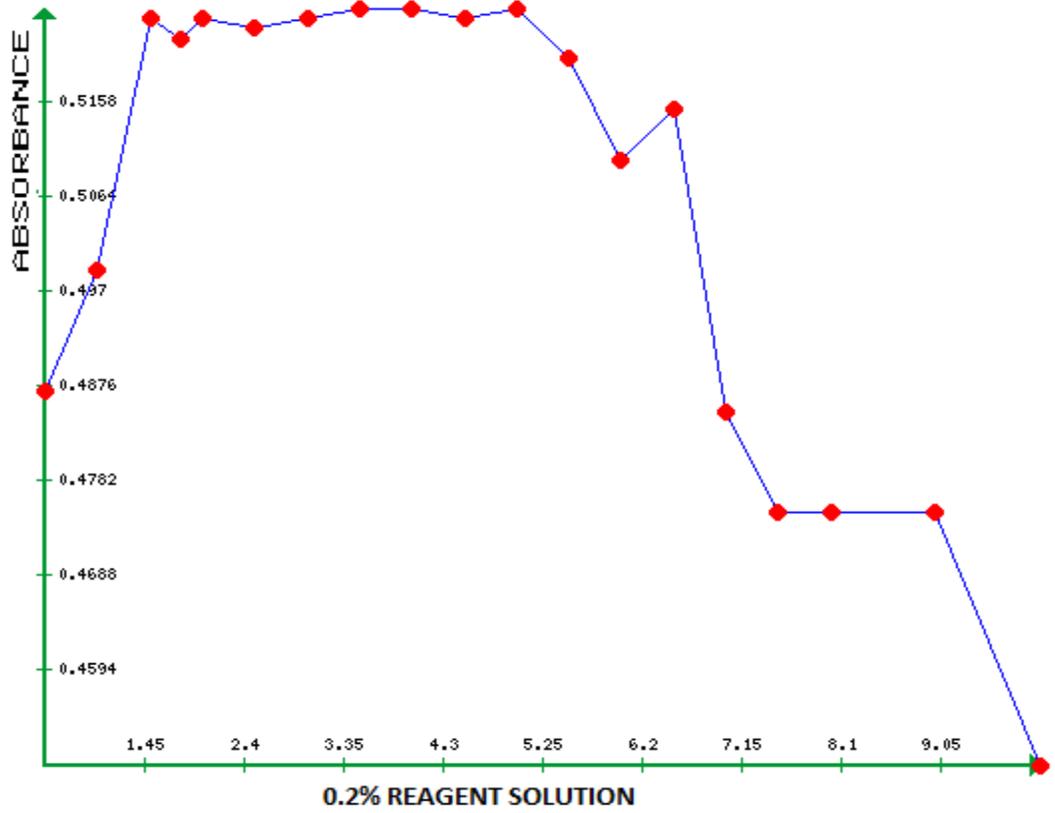
TABLE (1) : Effect of pH

| pH   | Absorbance at 400 nm |
|------|----------------------|
| 1.0  | 0.458                |
| 1.5  | 0.488                |
| 1.8  | 0.502                |
| 2.0  | 0.523                |
| 2.5  | 0.523                |
| 3.0  | 0.524                |
| 3.5  | 0.524                |
| 4.0  | 0.520                |
| 4.5  | 0.523                |
| 5.0  | 0.522                |
| 5.5  | 0.500                |
| 6.0  | 0.488                |
| 6.5  | 0.467                |
| 7.0  | 0.454                |
| 7.5  | 0.432                |
| 8.0  | 0.410                |
| 8.5  | 0.389                |
| 9.0  | 0.365                |
| 10.0 | 0.342                |

Vanadium (V) : 60 $\mu$ G  
0.2% Reagent : 2.5 ml  
Polyurethane foam : 7 pieces  
Shaking Time : 120 sec

### *C. EFFECT OF REAGENT SOLUTION :*

Different amounts of the reagent solution were prepared for the investigation of the effect of the reagent concentration on the absorbance of vanadium (v) complex. It was prepared by the sample solution containing 60  $\mu$ g of vanadium (v). It was observed at pH 3.0 . Almost same absorbance was obtained when 1.5 to 6.0 ml of reagent solution were added therefore, 2.5 ml of reagent solution was considered the suitable quantity to be used for all absorbance measurements as shown in fig. 4 and table 2.



**Figure. 4: Effect of Reagent**

[VANADIUM (V) :60 µg, WAVELENGTH : 400 nm, pH : 3.0, POLYURETHANE FOAM : 7 PIECES, SHAKING TIME :120 sec]

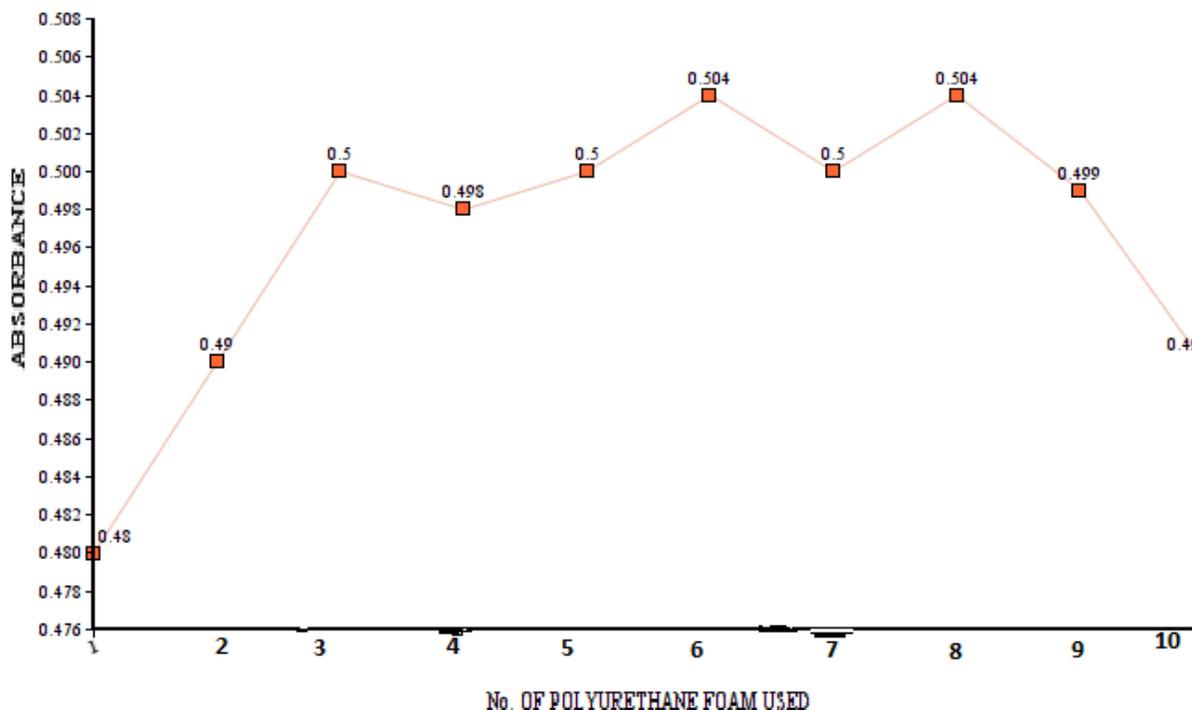
**TABLE (2) : Effect of Reagent Concentration**

| 0.2% Reagent | Absorbance at 400 nm |
|--------------|----------------------|
| 0.5          | 0.487                |
| 1.0          | 0.499                |
| 1.5          | 0.524                |
| 1.8          | 0.522                |
| 2.0          | 0.524                |
| 2.5          | 0.523                |
| 3.0          | 0.524                |
| 3.5          | 0.525                |
| 4.0          | 0.525                |
| 4.5          | 0.524                |
| 5.0          | 0.525                |
| 5.5          | 0.520                |
| 6.0          | 0.510                |
| 6.5          | 0.515                |
| 7.0          | 0.485                |
| 7.5          | 0.475                |
| 8.0          | 0.475                |
| 9.0          | 0.475                |
| 10.0         | 0.450                |

Vanadium (V): 60µG  
 pH : 3.0  
 Polyurethane foam : 7 pieces  
 Shaking Time : 120 sec

**D. EFFECT OF ADSORBENT :**

This effect was determined by adding different number of prepared polyurethane foam pieces in the vanadium (v) complex solution. The absorbance increased with the addition of 1-3 polyurethane pieces. The value of absorbance was found almost constant upto 9.0 therefore seven foam pieces were taken for all absorbance measurements( Fig. 5 and table 3.)



**Figure. 5: Effect of Adsorbant**

[VANADIUM (V) : 60 µg, WAVELENGTH : 400 nm, pH : 3.0, 0.2% REAGENT SOLUTION : 2.5 ml, SHAKING TIME : 120 sec]

**TABLE (3) : Effect of Adsorbent**

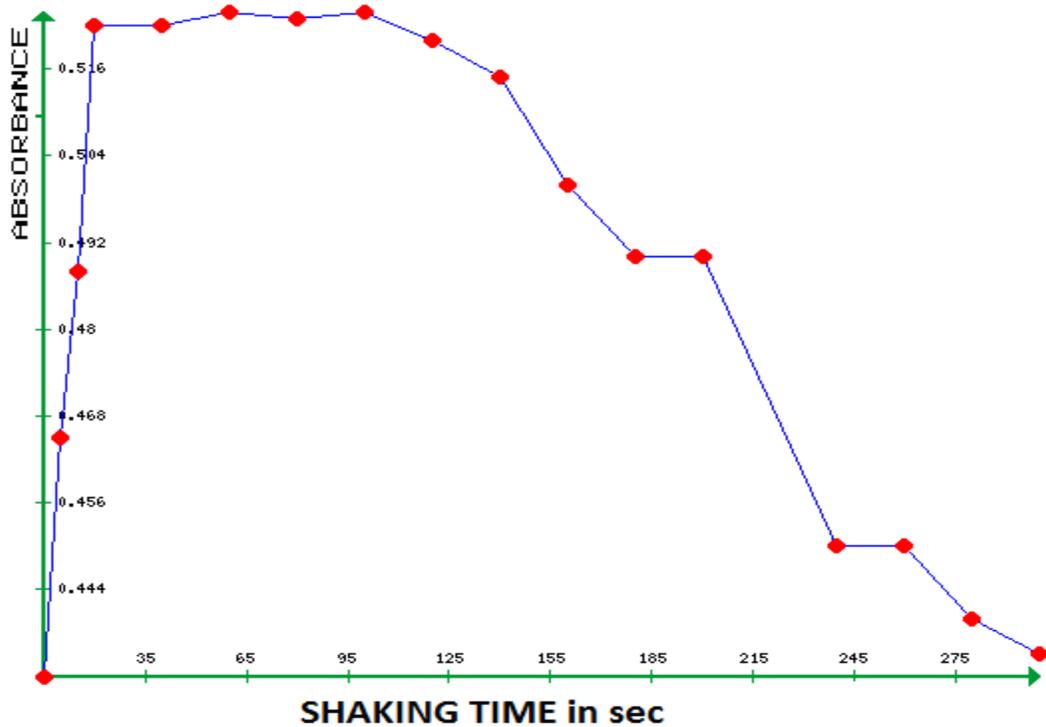
| No. of Polyurethane foam Pieces used | Absorbance at 400 nm |
|--------------------------------------|----------------------|
| 1                                    | 0.480                |
| 2                                    | 0.490                |
| 3                                    | 0.500                |
| 4                                    | 0.498                |
| 5                                    | 0.500                |
| 6                                    | 0.504                |
| 7                                    | 0.500                |
| 8                                    | 0.504                |
| 9                                    | 0.499                |
| 10                                   | 0.490                |

Vanadium (V) : 60µG  
 pH : 3.0  
 0.2% Reagent : 2.5 ml  
 Shaking Time : 120 sec

**E. EFFECT OF SHAKING TIME :**

Vanadium (v) solution containing 60 µg of vanadium on was allowed to satnd in contact with schiff base solution for two minutes. Then the complex was shaken from 5-300 seconds. Absorbance first increased, attained maximum and

became constant from 20 to 160 seconds. So, 120 second was chosen the shaking time for all absorbance measurements as in fig. 6 and table 4.



**Figure. 6: Effect of Shaking Time**  
 [VANADIUM (V) : 60 µg, WAVELENGTH : 400 nm, pH : 3.0, 0.2% REAGENT SOLUTION : 2.5 ml, POLYURETHANE FOAM : 7 PIECES]

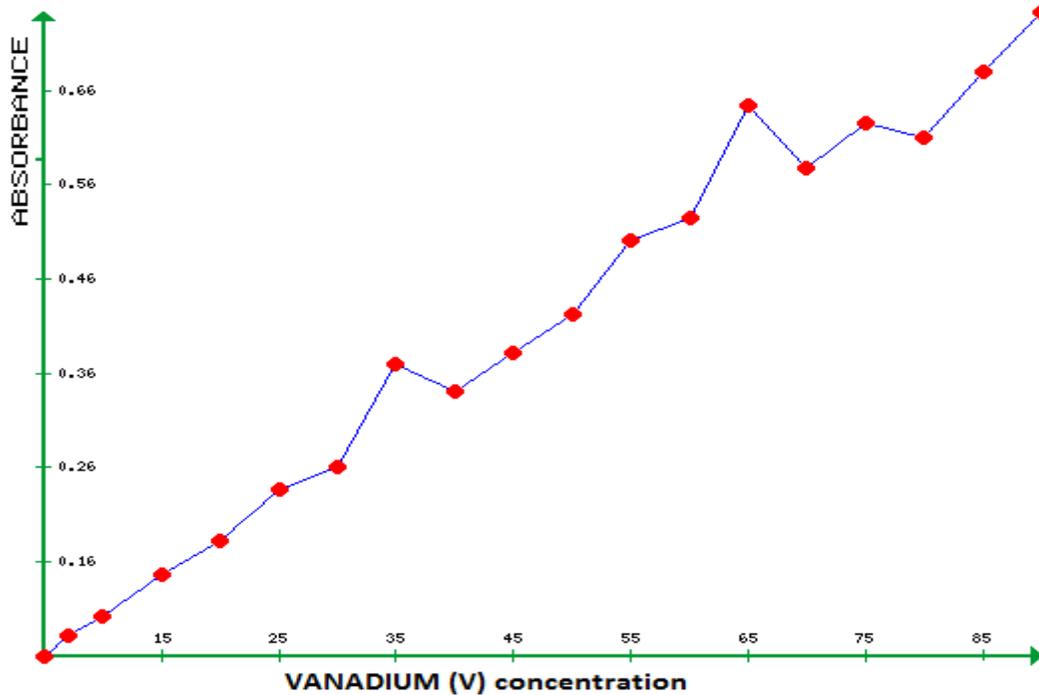
**TABLE (4) : Effect of Shaking Time**

| Shaking Time (sec.) | Absorbance at 400 nm |
|---------------------|----------------------|
| 5                   | 0.432                |
| 10                  | 0.465                |
| 15                  | 0.488                |
| 20                  | 0.522                |
| 40                  | 0.522                |
| 60                  | 0.524                |
| 80                  | 0.523                |
| 100                 | 0.524                |
| 120                 | 0.520                |
| 140                 | 0.515                |
| 160                 | 0.500                |
| 180                 | 0.490                |
| 200                 | 0.490                |
| 240                 | 0.450                |
| 260                 | 0.450                |
| 280                 | 0.440                |
| 300                 | 0.435                |

Vanadium (V) : 60µG  
 pH : 3.0  
 Polyurethane foam : 7 pieces  
 0.2% Reagent : 2.5 ml

**F. CALIBRATION CURVE FOR VANADIUM (V) :**

Calibration curve was obtained by the recommended procedure under the optimum condition according to Fig. 7. Beer's law was obeyed in the range 5-90 µg. The molar absorptivity was found to be  $2.310 \times 10^4 \text{ Lmol}^{-1} \text{ cm}^{-1}$  at 400 nm and sensitivity being  $1.58 \times 10^{-2} \text{ µg cm}^{-2}$  of vanadium (v) for the absorbance of 0.001.(Table 5)



**Figure. 7: Calibration Curve of Vanadium**

[WAVELENGTH : 400 nm, pH : 3.0, 0.2% REAGENT SOLUTION : 2.5 ml, POLYURETHANE FOAM : 7 PIECES]

**TABLE (5) : Calibration Data for Vanadium (V)**

| Vanadium (V) Concentration | Absorbance at 400 nm |
|----------------------------|----------------------|
| 5                          | 0.060                |
| 7                          | 0.082                |
| 10                         | 0.101                |
| 15                         | 0.146                |
| 20                         | 0.182                |
| 25                         | 0.236                |
| 30                         | 0.261                |
| 35                         | 0.369                |
| 40                         | 0.341                |
| 45                         | 0.382                |
| 50                         | 0.423                |
| 55                         | 0.501                |
| 60                         | 0.524                |
| 65                         | 0.644                |
| 70                         | 0.577                |
| 75                         | 0.625                |
| 80                         | 0.610                |
| 85                         | 0.680                |
| 90                         | 0.742                |

pH : 3.0  
 0.2% Reagent : 2.5 ml  
 Polyurethane foam : 7 pieces  
 Shaking Time : 120 sec

**G. EFFECT OF DIVERSE IONS :**

Interference due to the presence of various amounts of alkali metal salts and metal ions on the absorbance was studied according to the table 6 and 7.

**TABLE (6) : Effect of Diverse Alkali Metal Ion Salts**

| Alkali Metal Salts               | Amount Added mg | Vanadium (V) Found $\mu\text{g}$ |
|----------------------------------|-----------------|----------------------------------|
| NaCl                             | 50              | 60.8                             |
|                                  | 100             | 60.5                             |
| KCl                              | 50              | 60.2                             |
|                                  | 100             | 60.1                             |
| KNO <sub>3</sub>                 | 50              | 59.9                             |
|                                  | 200             | 59.2                             |
| NaNO <sub>3</sub>                | 50              | 60.8                             |
|                                  | 250             | 59.2                             |
| Na <sub>2</sub> CO <sub>3</sub>  | 50              | 60.2                             |
|                                  | 100             | 60.3                             |
| K <sub>2</sub> SO <sub>4</sub>   | 40              | 61.2                             |
|                                  | 150             | 61.3                             |
| Na <sub>2</sub> HPO <sub>4</sub> | 40              | 60.2                             |
|                                  | 200             | 59.8                             |
| Sodium Oxalate                   | 40              | 60.1                             |
|                                  | 100             | 60.3                             |

Vanadium (V) : 60  $\mu\text{g}$  ;  
 pH : 3.0;  
 0.2% Reagent : 2.5 ml;  
 Polyurethane foam : 7 pieces;  
 Shaking Time : 120 sec.

**TABLE (7) : Effect of Diverse Metal Ions**

| Diverse Metal Ions | Amount of Ion Added (mg) | Vanadium (V) Found $\mu\text{g}$ |
|--------------------|--------------------------|----------------------------------|
| Co (II)            | 40                       | 61.2                             |
|                    | 120                      | 62.3                             |
| Zn (II)            | 30                       | 61.0                             |
|                    | 80                       | 60.9                             |
| Pd (II)            | 100                      | 60.1                             |
|                    | 150                      | 61.6                             |
| Mn (II)            | 50                       | 60.9                             |
|                    | 150                      | 59.8                             |
| Cu (II)            | 40                       | 59.2                             |
|                    | 200                      | 58.6                             |
| Mg (II)            | 100                      | 59.3                             |
|                    | 250                      | 60.1                             |

|          |     |      |
|----------|-----|------|
| Sn (II)  | 50  | 60.0 |
|          | 100 | 59.9 |
| Fe (III) | 50  | 60.2 |
|          | 100 | 60.0 |
| Cr (III) | 100 | 60.0 |
|          | 200 | 59.9 |
| Al (III) | 40  | 59.8 |
|          | 100 | 58.6 |
| Bi (III) | 30  | 59.2 |
|          | 60  | 60.6 |

Vanadium (V) : 60 µg ;  
pH : 3.0;  
0.2% Reagent : 2.5 ml;  
Polyurethane foam : 7 pieces;

#### V. PRECISION

Ten examples of the arrangement containing 60 µg of vanadium (v) were set up by weakening the stock arrangement and the complex shaped with the reagent was gotten. The absorbance was estimated at 400 nm. Mean absorbance of 0.524 with a standard deviation of 0.28% was acquired.

#### VI. CONCLUSION

In this examination, Schiff base ligand and its complex with vanadium(v) particle were researched. It is found from the above conversation that Schiff base got from pyridine-2-carboxaldehyde and 2- amino pyridine is a decent touchy reagent for the spectrophotometric assurance of vanadium(v) particle by the methods for different parameters like pH, reagent focus, adsorbent, shaking time, assorted particle expansion. It likewise can be acceptable applied for the assurance of vanadium(v) in pharmaceutical samples.

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# “External Fixation Followed By Casting Compared To External Fixation Followed By Open Reduction Internal Fixation”- Which Method To Choose For Complicated Open Grade 3b Pilon Fractures?

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**Abstract-** Management of Pilon fractures continue to be unsolved mystery for Orthopaedic surgeons even in today’s modern era. Earlier, majority of these fractures were to be treated by conservative management only for want of improved surgical techniques and implants resulted in wound complications and poor functional outcome in terms of range of motion at ankle joint, pain and associated joint stiffness. Majority of the patients land up with ankle arthrodesis and amputations especially in 43-C3 fractures. With advancement and improvisation of our knowledge in anatomy and biomechanics of the distal tibia and with improved surgical techniques, now the trend has been shifted from conservative towards operative approach to manage such fractures showing dramatic improvements functionally. Despite all the efforts, dilemma still persists for the correct method to choose for management of such injuries. In order to vein off such confusion, a comparison has been studied between two cases of open grade 3B Pilon fractures managed by two different methods.

**Index Terms-** Pilon fracture, External fixator, Ovadia Beals criteria.

## I. INTRODUCTION

The word “Pilon” is a French terminology meaning a “pestle”. **Etienne Destot**, a French Radio-anatomist, first used the term ‘Pilon’ in 1911(1) to describe the anatomical region 5 cm proximal to the ankle joint. Describing the mechanism of fractures of this region, **Destot** stated that the talus acts as a “pestle” during the injury. On sustaining high velocity trauma of the distal part of tibia, Pilon fracture occurs as a result of axial loading which drives the talus into the distal tibia smashing the distal tibial articular continuity. This results in impaction of the comminuted fragments of metaphyseal bone up to approximately 8-10 cm proximal from the distal tibial articular surface. Pilon fracture affects weight bearing articular surface of distal tibia and commonly affects males (57- 65%) between 35-40 years of age.(2) Road traffic accidents (45.5%) closely followed by the fall from height are the two most frequent mechanisms of injury(2). High velocity tibial Pilon fractures remains a challenging task for the treating orthopaedic surgeons since the past several decades which is

evident from the fact that various methods are there for the management of such injuries but none has been proven to be superior to others. In 1959, **Jergesen** asserted that treatment of comminuted complicated Pilon fractures was impossible with open reduction internal fixation method resulted in an era of cast immobilisation as a sole mode of treatment for these debilitating injuries(2,3). It was in mid-1960’s when AO/ASIF first time had come up with general guidelines for the treatment of such intra-articular fractures of distal tibia which had changed the whole way of treatment method of these kind of fractures by paying attention towards articular congruity management, metaphyseal defect filling, length and rotational alignment by fixing fibula and fixation of metaphysis to tibia diaphysis and allowing early return of function of the joint(2)(4). Since then various studies had been conducted for obtaining the fruitful results in terms of post-traumatic functional outcome of such injuries but none has been universally standardized.

Present comparative study between two similar cases according to Gustilo Anderson classification is an attempt to elucidate the actual postoperative functional outcomes as per Ovadia Beals scoring system, to assess the complications associated with them and to conclude which method should be chosen for such fractures by treating one case with open reduction internal fixation and other with casting after applying external fixator primarily.

## II. CASE PRESENTATION

In this prospective comparative study, two cases have been included having open grade 3B fractures presented to the emergency department of MM Institute of Medical sciences and research, Mullana, Ambala and managed by department of Orthopaedics. Informed and written consent will be taken from the patients participating in the study beforehand.

### Case 1: AO 43-C3 Open grade 3B Fracture

A 25-year male patient Jonny brought to the emergency department of MM Institute of Medical sciences and research, Mullana on 8<sup>th</sup> September 2019 with alleged history of road traffic

accident. On presentation, proper history had been taken and on initial examination no other injury found.



**Fig 1. Image showing crush injury distal aspect of right leg medial side with bone protruded out of the wound and tendons exposed and degloving of the soft tissue over medial malleolus.**

At presentation, there was crush injury right lower limb with tibial bone fragment protruded out of the wound of approximately 12cm x 7cm along with tendon stretched over the medial malleolus. After through wash with saline and betadine, stay suture applied, empirical antibiotics were started and radiographs obtained of the injured limb which was suggestive of intraarticular tibial fracture (Pilon fracture) with metaphyseal comminution, Varus mal alignment and bone loss along with ipsilateral fracture fibula. There was no neurosensory deficit elicited and after primary management, POP slab given and planned for debridement and external fixation.



**Fig 2. Radiograph showing intraarticular tibial fracture (Pilon fracture) with metaphyseal comminution and fracture fibula just above syndesmosis.**

Within 24 hours of admission, debridement was done and External fixator applied. Patient started on empirical antibiotics (cephalosporins) and all baseline investigation send. Daily dressing done and monitoring done by infection markers such as CBC, ESR and CRP values. Daily dressing was done for 1 week but inflammatory markers remained increased and after 1-week serous discharge started oozing out of the wound from which swab was send for pus culture and sensitivity. MRSA was found in pus

culture report for which vancomycin was started for 10 days and monitoring done by repeat CBC, ESR and CRP. After 10 days of antibiotic and daily dressing wound become healthy, inflammatory markers decreased and patient planned for discharge with necessary antibiotics and advised to follow up in OPD after 4 weeks.

After 4 weeks of injury, patient right leg radiograph was taken to assess the status of fracture.



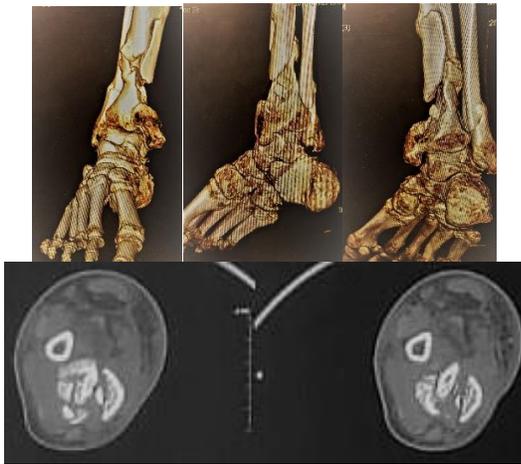
**Fig 3. September 2019 After 4 weeks**

Radiograph after Debridement and External fixator for temporary fracture stabilization. After 6 weeks of regular follow up, external fixator removed and above knee POP slab applied for 2 weeks and every alternate day dressing being done for medial side wound to heal completely. After total 8 weeks of injury again radiograph taken to assess the fracture. Since there was bone gap at the fracture site due to bone loss, fracture union was not possible without further intervention. Inflammatory markers investigation repeated after every 2 weeks to observe the status of infection. Meanwhile, active toe movement exercises continued. After 8 weeks of injury, inflammatory markers came within normal range and patient planned for definitive plate fixation along with autogenous bone grafting.



**Fig 4. After 6 weeks After 8 weeks**

Before plating of the distal tibia, CT with 3D reconstruction of the right leg was taken in order to understand the fracture fragments anatomy more clearly and accordingly surgical approach, type of implant and technique to be used were planned.



**Fig 5. Axial CT section at tibial plafond showing multiple fracture fragments.**

CT images clarified that there was a bone gap of approximately 3-4cm and ankle mortise was unstable due to numerous fracture fragments at the articular surface of tibia. Since, fibula was also fractured therefore to reduce both bones, anterolateral approach was used for plating. Bone graft was taken from iliac crest as distal metaphyseal region of tibia is corticocancellous in nature and iliac crest bone is also of similar composition.



**Fig 6. Intra operative images of anterolateral approach for distal tibia plating with bone grafting.**

Postoperatively, first dressing was done on day 2 and empirical antibiotics were started for 1 week postop. Radiograph was taken on second day to assess the fracture reduction, position of bone graft and articular congruency. Limb was elevated and strictly immobilized. Next dressing was done on postop day 5 which went uneventful and patient was planned for discharge and

advised for regular follow up in OPD for further management after 4 weeks. Patient was also advised for dressing after every 2 days and active toe exercise till next 4 weeks.



**Fig 7. After 8 weeks After 12 weeks**

Postoperative x-rays showed bone graft in place, articular congruency maintained but Varus mal-alignment persists. Patient advised toe exercises to continue and after 6 weeks of plating, partial weight bearing started with walker. Fracture showed formation of callus after 6 weeks of partial weight bearing upon which full weight bearing started and fracture union occur around 24 weeks after injury. Radiographs were taken after 6 months and then after 1 year of injury as per follow up protocol.



**Fig 8. Radiograph after 6 months, 1 year**

After 1 year of injury, patient was having mild pain at the ankle joint only after strenuous activity otherwise he was able to returned to his previous level of activity. There was no limping and ankle joint range of motion was around 40 degree of plantarflexion and 15 degree of dorsiflexion.



**Fig 9. Ankle joint range of motion around 40 degree of plantarflexion**



**Fig 10. Ankle joint range of motion around 15 degree of dorsiflexion**

**Case 2: AO 43-C2 Open grade 3B Fracture**

A 40-year female patient Ravinder Kaur brought to the emergency department of MM Institute of Medical sciences and research, Mullana on 4<sup>TH</sup> May 2019 with alleged history of road traffic accident. On presentation, proper history had been taken and on initial examination patient also had un-displaced fracture of bilateral pubic rami.



**Fig 11.**

At presentation, there was open wound at right lower limb anterior aspect of approximately 6cm x 3cm with fracture exposed outside environment. No neurosensory deficit elicited. After thorough wash with saline and betadine, stay suture applied, empirical antibiotics were started and radiographs obtained of the injured limb which was suggestive of intraarticular tibial fracture (Pilon fracture) with metaphyseal comminution along with ipsilateral fracture fibula. After primary management, POP slab given and planned for debridement and external fixation.



**Fig 12.**

Within 24 hours of admission, debridement was done and External fixator applied. Patient started on empirical antibiotics (cephalosporins) and all baseline investigation send. Daily dressing done for 7 days and monitoring done by infection markers such as CBC, ESR and CRP values. After 7<sup>TH</sup> day, inflammatory markers repeated which was remained increased and condition of

wound wasn't healthy and serosanguinous discharge started coming out of wound therefore it was opened for dressings and wound swab was send for pus culture and sensitivity.



**Fig 13. September 2019**

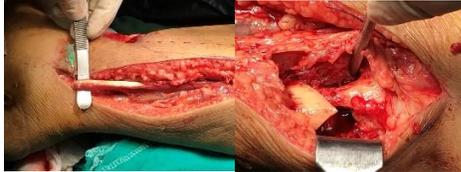


**Fig 14. Escherichia coli and Methicillin resistant staphylococcus aureus (MRSA) infection resulting in opening of sutures and daily dressing.**

Culture sensitivity suggestive of Escherichia coli and MRSA infection for which Tobramycin and chloramphenicol antibiotics started as per sensitivity index. Daily dressing was done for 2 weeks after which repeat inflammatory markers and culture send. Reports suggestive of absence of any micro-organisms. Inflammatory markers value decreased but serous discharge still persists. In order to close wound, Negative pressure wound therapy (NPWT) started with the help of Vacuum assisted closure (VAC). After 10 days, healthy granulation tissue came and wound now become ready to accept flap graft.



**Fig 15. Negative pressure wound therapy (NPWT) started with the help of Vacuum assisted closure (VAC).**



**Fig 16. Intra operative images of flap grafting with fracture reduction**

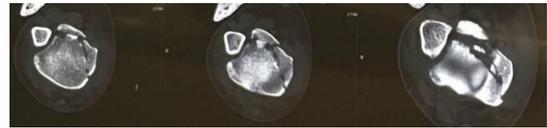


**Fig 17. After 4 weeks of injury, repeat radiograph was taken to assess the fracture reduction and anatomy of osseous components.**



**Fig 18. October 2019**

Radiograph obtained after 4 weeks showed maintenance of articular congruency and tibial shortening of less than 1cm with valgus mal-alignment. Metaphyseal comminution was there and ankle joint stability was questionable. Every alternate day dressing being done and wound condition assessed with help of inflammatory markers. CT with 3D reconstruction performed for better assessment of anatomy of impacted fracture fragments and further surgical approach and technique for definitive plate fixation.



**Fig 19. Axial CT section showing intra articular fracture with mild comminution.**



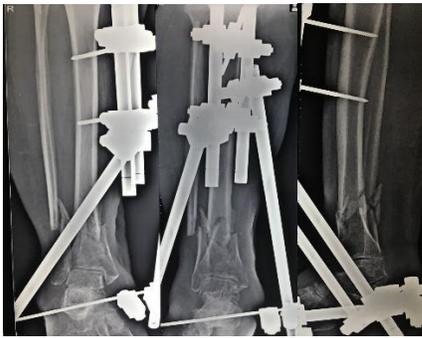
**Fig 20. Comparison between dressings of the flap and skin graft in 4 weeks interval**

After 4 weeks of flap grafting, anterior wound healed satisfactorily but medial side (skin graft site) showed graft necrosis with serous discharge. Repeat inflammatory markers were within normal limits. Amid peculiar vascular supply of soft tissue over ankle joint, thin soft tissue coverage over bone and poor flap graft conditions even after 4 weeks of grafting, it was decided to change plan from plating of distal tibia towards conservative management of the fracture with external fixator only followed by casting. Repeat radiograph was taken for assessment of fracture.



**Fig 21. November 2019**

Radiograph showed maintenance of articular congruency and mild callus formation and valgus mal-alignment. Clinically, wound at graft site become healthy and flap had been successfully accepted by the graft site and pain was also decreased. Therefore, patient was discharged with External fixator in situ and advised to follow up after 4 weeks in OPD. Active toe exercises advised to the patient.



**Fig 22. December 2019 (After 3 months of injury)**

After 4 weeks repeat radiograph was taken showing callus formation and ankle mortise maintained. Tibial shortening of less than 1cm persists and valgus mal-alignment of less than 5 degree was elicited. Clinically, patient pain was improved and wound was healed. After considering present status of fracture healing and patient clinical condition, External fixator was removed and above knee cast applied. Patient advised to follow up after 3 months in OPD.

After 6 months of injury, patients repeat radiograph was taken which shows abundant callus formation to allow patient for partial weight bearing with walker.



**Fig 23. March 2020 (After 6 months of injury)**

Above knee cast converted to patellar tendon bearing cast (PTB Cast) and patient allowed partial weight bearing with help of walker. Clinically, pain was improved form moderate to mild severity for which occasional analgesics were required. Again after 6 weeks of partial weight bearing patient was follow up with repeat radiograph showing fracture union after which PTB cast removed and full weight bearing allowed and advised to follow up after 1 year.



**Fig 24. 30 weeks of injury                      1 year**

After 1 year of injury, patient was having mild pain at the ankle joint only after strenuous activity otherwise he was able to returned to his previous level of activity. There was no limping and ankle joint range of motion was around 25 degree of plantarflexion and 5 degree of dorsiflexion.



**Fig 25. Ankle joint range of motion around 25 degree of plantarflexion**



**Fig 26. Ankle joint range of motion around 5 degree of dorsiflexion**

### III. RESULTS

In our study, results were analysed by Ovadia and Beals clinical scoring system. This criterion not only gives objective parameters for the assessment of the outcome but also included the subjective questionnaire which would be answered by the patient so that the results remained unbiased throughout. Data obtained were summarized in a tabular format for quick access.

| PARTICULARS                   | CASE 1   | CASE 2  |
|-------------------------------|--|---|
| Age /Sex                      | 25yr /Male   | 40yr /Female  |
| Mechanism of Injury           | Road traffic accident                                  | Road traffic accident                                   |
| Limb involved (side)          | Right  | Right   |
| Type of Fracture (Open)       | Gustilo Anderson 3B                                    | Gustilo Anderson 3B                                     |
| AO Classification of fracture | 43-C3  | 43-C2   |
| Associated Injury             | Fracture Fibula (Right side)                           | Fracture Fibula (Right side), Fracture B/L Pubic Rami   |
| Treatment                     | Debridement with External fixation, ORIF with Plating. | Debridement with External fixation, Cast immobilization |
| Period of Immobilization      | 14 weeks   | 24 weeks  |
| Partial weight bearing        | 8 weeks  | 6 weeks   |
| Union time                    | 24 weeks   | 30 weeks  |
| Secondary procedure           | Bone grafting & secondary closure                      | Flap & skin grafting, secondary closure                 |
| Complications                 | Deep infection, delayed union.                         | Deep infection, delayed union.                          |

**Table 1: Tabular representation of the data collected from two cases**

Since both the cases had Gustilo Anderson grade 3B open fractures with one case had AO 43-C3 fracture and other with AO 43-C2 fracture, case 1 had been treated with two staged protocol that is initially debridement done with application of external fixator along with intravenous antibiotics. Continuous monitoring was done with CBC, ESR AND CRP values. After counts decreased and wound appear healthy, external fixator removed and open reduction internal fixation was planned whereas in case 2, initial debridement done with application of external fixator which regularly scrutinized with serial radiographs and later on converted into (conservative method) below knee cast. Pt has been followed up at 3<sup>RD</sup> month, 6<sup>TH</sup> month and 1year postoperatively. The final results analysed as per Ovidia Beals scoring system to compare the functional outcome of both the patients with similar

open grade 3B fracture treated by two different modality and summarized in tabular form.

**Table 2: Tabular representation of final results as per Ovidia Beals scoring system.**

| OVADIA BEALS SYSTEM       | CASE 1 | CASE 2 |
|---------------------------|--------|--------|
| <b>OBJECTIVE SCORING</b>  |        |        |
| 3 <sup>RD</sup> month     | Fair   | Fair   |
| 6 <sup>TH</sup> month     | Good   | Fair   |
| 1 <sup>ST</sup> year      | Good   | Fair   |
| <b>SUBJECTIVE SCORING</b> |        |        |
| 3 <sup>RD</sup> month     | Poor   | Fair   |
| 6 <sup>TH</sup> month     | Fair   | Good   |
| 1 <sup>ST</sup> year      | Good   | Good   |

Above-mentioned results showed that after long time has elapsed, as per Objective criteria, there were difference between the functional outcome of two cases where patient treated with plate fixation had “Good” outcome as compared with patient managed with casting. On the other hand, as per subjective criteria, there was no difference between them. Subjectively, there was continuous improvement in the case operated with plate fixation whereas the patient treated with cast immobilization showed improvement of only one step ahead. The ankle joint range of motion is taken with the help of goniometer.

**Discussion**

Pilon fractures, being an uncommon injury, represent approximately 7-10% of total tibial fractures and 1-5% of total lower limb fractures(2). There is lack of methodical research regarding the management and outcome of these fractures in the published literature but since the incidence of this injury is rising in present world scenario amidst the rise in occurrence of road traffic accidents(5), there is renewed interest in the surgical fraternity for studies to better manage these injuries.

Pilon fracture affects weight bearing articular surface of distal tibia and commonly affects males (57- 65%) between 35-40 years of age.(6) Road traffic accidents (45.5%) closely followed by the fall from height are the two most frequent mechanisms of injury(2). The management of high velocity tibial Pilon fractures remains an unsolved mystery and challenging task for the treating orthopaedic surgeons since the past several decades. Earlier, most authors concluded that majority of the distal tibial fractures were to be treated conservatively and were not amenable to open reduction and internal fixation due to intra articular extension of the fracture segment, comminution at weight bearing surface and unavailability of instrumentation options and various surgical approaches what we have now a days which changes the final post-operative results dramatically. In today’s modern era, with the availability of improved surgical techniques and implants, there is not a single fixation method for all types of Pilon fractures that we encountered.

Suggested principles behind definitive fixation are:

- 1) Maintaining articular congruency and stability.

- 2) Restoration of length and preventing mal-alignment.
- 3) Management of bone stock either primarily or by late definitive fixation and grafting.
- 4) Minimize the soft tissue damage.
- 5) Early postoperative restoration of joint functional range.(7)

Optimal functional results depend upon the mechanism of injury and accordingly choice of implants selected on the basis of fracture pattern and soft tissue condition. Similar statement has been verified in present comparative study where in plate fixation case, due to open avulsed injury of the soft tissue of the right ankle, initially external fixation was done after proper debridement of the wound in order to avoid infections and afterwards plate fixation planned with bone grafting.

Factors indicating bad prognosis are:

- 1) Complete intra-articular comminution (AO43.C3 and Reudi Allgower type 3)
- 2) Injury to talus
- 3) Excessive soft tissue compromise
- 4) Articular mal-reduction
- 5) Unstable fracture fixation
- 6) Postoperative surgical site infection.(8)

There are certain flaws that prevails resulting in mal reduction and poor functional outcome especially in comminuted 43-C3 fractures where achieving articular congruency within acceptable range play a pivotal role in successful management.

Basic difficulties that arises in the management of pilon fractures are:

- 1) Tendency of re-displacement of the fracture fragments after swelling has been subsided mainly in spiral or comminuted fractures upon cast application.
- 2) Distal third tibia has precarious blood supply therefore chances of delayed union are very high.
- 3) Since knee and ankle joint are in same parallel axis, functional and cosmetic deformities occur if rotational malalignment is not corrected.(9)

Two most common pitfalls in the management of such fractures intra operatively-

- 1) Failure to reorganize the position of **Tillaux-Chaput Tubercle**.
- 2) Failure to recognize the lateral-disruption fractures.



“Disruption” is defined as more than 2 mm of incongruity at the articular surface or mal-alignment more than 10 degrees in any plane. The **TILLAUX-CHAPUT TUBERCLE** highlighting above is the only marker available for the assessment of correct anatomical reduction of the fractures involving complete articular surface.



**Radiographs exemplifying failure to recognize the lateral-disruption fractures after initial fixation showing the long-term consequence of onset of osteoarthritis with Varus deformity.**

Thus, restoration of the normal talofibular relationship in lateral-disruption fractures is of immense importance in achieving normal alignment and function of ankle joint postoperatively. This restoration will automatically be going to reduce the lateral tibial fragments which paved the way for fixation of the remaining articular surface.

Surgical intervention and complications go hand in hand. In this case, despite all the efforts to avoid infections, some part of bone at the distal tibia become necrosed due to exposure to the external environment and deep infection which got over in due course of antibiotics. Along with bone grafting, secondary wound closure was done due to excessive wound oedema initially. Similarly, in second case, initially debridement and external fixation was done followed by application of below knee cast because of deep wound infection which was treated with alternate day debridement's and vacuum assisted closure (VAC) was done as there was continuous discharge from the wound. In study conducted by **Rafael Carbonell-Escobar et al.**(10) in 2017 reported 13.04% infections, 7.6% skin necroses, 10.86% non-unions and 13.04% posttraumatic osteoarthritis of ankle joint. Similar results have been published in the study conducted by **Michael Sirkin and Roy Sanders** showing 31% incidence of infection and 10% cases diagnosed with osteomyelitis(11).

The treatment goal for intra articular fracture distal end tibia is stabilization, achievement of articular congruity and early restoration of motion at the ankle joint so that the chances of post traumatic ankle osteoarthritis and stiffness can be minimized and patient can have better functional outcome. It depends upon patient demographics and comorbidity, fracture morphology, articular incongruity, mechanism of injury, amount of fragment stability, reducibility and displacement which varies patient to patient. From this study, we have observed that optimum results depend more on the timing of surgery (staged procedure) and condition of soft tissue healing rather than type of instrumentation used.

#### IV. CONCLUSION

Pilon fracture is considered to be a constellation of numerous fractures that usually comprised of distal tibial metaphyseal fracture, fracture of medial malleolus, fracture of anterior tibial margin and posterior surface of tibia. Having multiple components and peculiarities of the anatomy and biomechanics at the distal end of tibia, successful management of such fracture continues to be a challenging task which requires consideration towards all these regions meticulously. Apart from bone fragments stabilization, timing of surgery, surgical procedure and paying respect to soft tissues are equally necessary components in order to achieve fruitful functional outcome. On comparing two different method of treatment in present study, we concluded that none of the method was superior to other. Since, as per subjective criteria, both of them had “Good” functional outcome despite the fact that both of the fracture gone into delayed union which highlights the immense importance of making decision according to condition pertaining to the particular injury and not to remain stick to single protocol for every open fracture.

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# The Influence of Tongue Cleaning Habit on the Occurrence of Adverse Halitosis Outcomes: A Review of Literature on the Current Evidence

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**Abstract:** The purpose of this paper was to review the literature whether tongue cleaning needs to be a part of daily oral hygiene owing to presence of large number of microorganisms. Among the studies included for the present review, it has been observed that the occurrence of halitosis is reduced to a level of 75% after cleaning with mechanical tongue cleaning aids such as tongue scraper after 1 week. This is also confirmed by the organoleptic rating which suggests that there is significant reduction in the level of volatile sulphur compounds (VSCs) such as hydrogen sulfide, methyl mercaptan, dimethyl sulfide. This review aimed at to find out on existing literature regarding whether tongue cleaning is essential part of oral hygiene habit or not. It is evident that tongue forms the largest niche for microorganisms in the oral cavity and its association with halitosis, dental caries and plaque. On the basis of literature available it is recommended to clean the tongue regularly. Proper tongue brushing has found to be useful particularly when there is complaint of oral malodor.

**Key words:** Oral malodor, Halitosis, Bad breath, Feter ex ore

## Introduction

Tongue is one of the most anatomically important structure in mouth. Due to its location between the oral cavity and pharynx it provides passage to many different types of nutrients, products and bacteria [1]. The dorsum of tongue contains many papillae that provides a large surface area favouring the accumulation of oral debris and bacterias [2,3]. The microorganisms present on it may contribute to plaque formation [4]. These microorganisms comprise of up to 90% of the bacterial mass on the tongue. Gilmore and Bhaskar in there study found that the level of plaque-forming streptococci counts increases by tenfold after one week of not brushing the tongue [5]. It was recommended that tongue has to be cleaned daily in morning on an empty stomach to avoid vomiting or gagging [6].

Tongue hygiene has been routinely practiced till date by natives of Arabia, Africa, India, and South America. [7,8] whereas attention towards tongue cleaning is of little importance in western countries. Many ancient religions emphasized cleanliness of the entire mouth, including tongue. In these early cultures, oral cleansing often had religious ritual significance. Recently, tongue cleaning has received more attention because of the development of so called "Oral malodor" that can be considered as a social impediment. It has been studied that the food debris in the mouth contributes for up to 90 percent of oral malodor [9].

The tongue coating on posterior part of the dorsum of tongue comprises of millions of organisms. Tongue coating tends to vary in color and thickness. Normally, tongue is pink in color or has a thin white coating [10], and discoloured tongue is seen more likely in elderly because of change in dietary habits, decrease in salivary flow and their inability to cope with oral-hygiene methods [11]. The purpose of this paper was to review whether tongue cleaning needs to be a part of daily oral hygiene owing to presence of large no of microorganisms.

## Tongue coating

The normal tongue coating is characterized by a thin, slightly moist, whitish substance, which is associated with the dorsal surface of the tongue. Tongue coating is comprised of dead epithelial cells, bacteria, blood end products, secretions from the postnasal area & the gingiva, and saliva [12]. The filiform papillae of tongue because of its specific structure is involve in Tongue coating formation. Light and transmission electron microscopic studies on the Tongue coating revealed the presence of bacteria and exfoliated (desquamated) keratinized epithelium that originated from filiform papillae. Furthermore, filiform

papillae, which assist in Tongue coating formation, were found to increase with age, and fungiform papillae decreased with age [15]. Entrapment of food remnants, saliva and microorganisms in filiform papillae leads to formation of thick coating [13].

As the age progresses Tongue coating becomes more thicker [14] and there is also variation in color, thickness, moisture and distribution depending on the patient's health. There is change in the color of Tongue coating after consuming substances including food like chocolates, drinks like coffee or black tea, and mouthwashes containing chlorhexidine and drugs [16]. There have been studies that indicate variations in thickness of Tongue coating depending on periodontal status and Halitosis. The Tongue coating thickness increases in patients suffering from periodontal disease, due to the migration of WBCs from periodontal pockets into the saliva, and subsequently, these cells are deposited onto the tongue surface [12] Gomez et al in his study found that Tongue coating was greater in periodontitis patients as compared to healthy individuals [14].

**Quantification of Tongue Coating**

Tongue coating has to be properly evaluated so as to motivate the patient in maintaining proper tongue hygiene. Tongue coating is quantified using visual parameters such as the coated area, Tongue coating discoloration and Tongue coating thickness (Table 1). Tongue coating can be quantified using alternative methods such as wet weight measurements of scrapings collected from the dorsum of tongue [12].

**Table 1.** The different types of tongue coating indices

| Authors                       | Score                                     | Description   |
|-------------------------------|---|---|
| <b>Gross et al (1975)</b>     | 0   | No Coating  |
|                               | 1   | Slight Coating  |
|                               | 2   | Moderate Coating  |
|                               | 3   | Heavy Coating   |
| <b>Kojima et al (1985)</b>    | 0   | No coating  |
|                               | 1   | Thin coating of <1/3 of the tongue  |
|                               | 2   | Thin coating of <2/3 of the tongue or thick coating on <1/3 of the tongue         |
|                               | 3   | Thin coating of >2/3 of the tongue or thick coating on <2/3 of the tongue         |
| <b>Miyazaki et al. (1995)</b> | 0   | No coating  |
|                               | 1   | <1/3 Tongue dorsum surface covered  |
|                               | 2   | <2/3 Tongue dorsum surface covered  |
|                               | 3   | >2/3 Tongue dorsum surface covered  |
| <b>Mantilla Gomez (2001)</b>  | Discoloration                             |   |
|                               | 0   | Pink  |
|                               | 1   | White   |
|                               | 2   | Yellow/Light Brown  |
|                               | 3   | Brown   |
|                               | 4   | Black   |
|                               | Thickness                                 |   |
|                               | 0   | No Coating  |
|                               | 1   | Light-thin coating  |
|                               | 2   | Heavy-thick coating   |
| <b>Oho et al. (2001)</b>      | Area                                      | Area score × thickness score = tongue coating (range 0–6).                        |
|                               | 0   | No tongue coating   |
|                               | 1   | <1/3 Tongue dorsum surface covered  |
|                               | 2   | 1/3–2/3 Tongue dorsum is surface covered  |
|                               | 3   | >2/3 tongue dorsum surface covered  |
|                               | Thickness                                 |   |
|                               | 0   | No coating  |
|                               | 1   | Thin tongue coating (papillae visible)  |
| 2                             | Thick tongue coating (papillae invisible) |   |
| <b>Winkel et al. (2003)</b>   | (Six areas grid)                          | Tongue dorsum is divided into six areas (i.e. three posterior and three anterior) |
|                               | Coating                                   |   |

|                          |                     |   |
|--------------------------|---------------------|---|
|                          | 0                   | No coating  |
|                          | 1                   | Light coating   |
|                          | 2                   | Severe coating  |
|                          | Discoloration       |   |
|                          | 0                   | No discoloration  |
|                          | 1                   | Light discoloration   |
|                          | 2                   | Severe discoloration  |
|                          |                     | Score is calculated by adding all six scores (range 0–12)                           |
| <b>Kim et al. (2009)</b> | Tongue coating area | Calculated from digital images obtained by the digital tongue imaging system (DTIS) |

### ***Relationship of Tongue coating and Oral Malodor***

The role of tongue coatings in the causation of bad breath has been extensively studied. Sulfur substrates are essential for VSC production. These substrates are produced naturally in the oral cavity from gingival fluid, crevicular fluid and saliva. Delanghe et al evaluated patients with halitosis and concluded that main cause of halitosis in 51% of patients was because of tongue coating, 17% as a result of gingivitis, 15% as result of periodontitis and 17% because of combinations [17].

Miyazaki et al examined 2672 individuals aged 18 to 64 years suffering from halitosis and found that tongue coating is the only cause in younger individuals whereas periodontal diseases together with tongue coating was mainly responsible for oral malodor in older individuals [18].

Morita and Wang studied the relationship between sulcular sulfides level and oral malodor in patients with periodontal disease and found that volume of tongue coating and the percentile of sites with bleeding upon probing were significantly associated with halitosis [19].

Yaegaki and Sanada did an extensive study on biochemical and clinical factors influencing oral malodor in periodontal patients and found that the levels of disulfide increased in relation to the pocket depth, 60% of the VSC was produced from the tongue surface, and the amount of coating was four times greater in test group than in control subjects. It was suggested that it is not only the microorganisms that contribute to VSC but also Tongue coating is a factor enhancing the production of VSC in patients with periodontal disease [20].

Quiryen et al studied the effect of one stage full mouth disinfection on oral malodor and also microbial colonization on patient's tongue having periodontal disease. He observed that there was correlation between baseline organoleptic ratings and VSC scores with the presence of tongue coating [21].

### ***Microflora on the dorsum of tongue***

In the year 1996 Gordon and Gibbons were the first to identify anaerobic microorganisms residing on dorsal surface of the tongue. Tongue serves as a potential reservoir for variety of periodontopathic microorganisms and may possibly function as a nidus for these organisms [22]. Krasse found the distribution of Streptococci salivarius and other streptococci in mouth and concluded that a large proportion of Streptococci salivarius is present on tongue [23]. Various investigators concludes that tongue is the ultimate reservoir of many salivary microorganisms and in general influence the microflora of entire oral cavity.

*P.gingivalis* was detected in high numbers on the dorsum of tongue, tonsils, buccal mucosa, gingiva and other mucous membranes in patients suffering from periodontitis where as it was absent or low in no in healthy individuals [24] *A.actinomycetocomitans* has been detected in subgingival samples and tongue taken from patients suffering from juvenile periodontitis. Approx 55% of *A.actinomycetocomitans* has been detected in samples taken from dorsum of tongue [25].

*P. Intermedia* isolated from oral mucous membranes and saliva was detected in 99% of tongue samples from young adult Indonesian population. *P intermedia* was also found in 80% of tongue samples isolated from western population [26]. *P. melaninogenica*, *P. loecheii*, *P. denticola*, *Candida albicans*, *Odontomyces viscosus*, *Oral spirochetes* are found on the tongue of either periodontally healthy and diseased subjects and are considered as normal colonizers of oral cavity [27,28,29].

Dental caries is correlated with the presence of streptococcus mutans which is found in plaque and its presence in saliva is considered to influence and contribute to the presence of these microorganisms on the tongue [30,31]. When the number of Colony Forming Unit (CFU) in saliva increases, the number of CFU on tongue increases as well [31].

### ***Tongue brushing***

Tongue can be easily cleaned using tongue scrapers which are made of either plastic ribbon or stainless steel held in both hands and can be pulled down over the dorsal surface of tongue and removing the coating. Brushing is the most common and easy method of cleaning the tongue, provided that one can have a control on gag reflex.

Massler suggested that if tongue cleaning habit is practised from the beginning of tooth brushing, the easier it will be to control the gag reflex [32].

Arnim S et al stated that dental caries and periodontal disease can be prevented by advocating routine tongue cleaning [33].

Gilmore EI, Gross A and Whitley R found that the level of streptococcus salivarius variant present in plaque is altered by a regimen of daily tongue brushing [34].

Jacobson SE did a study on 30 patients for two weeks and concluded that brushing of tongue and palate twice a day significantly reduce oral debris which in turn reduces the initial rate of plaque formation [35].

Gross A et al concluded that tongue brushing when used as adjunct with tooth brushing have drastically reduced the salivary levels of caries causing streptococcus mutans [36].

Vasilakis GJ et al found that daily cleaning of rat tongue results in reduced plaque scores in the mouth [37].

Axelsson P et al found the presence of high numbers of Streptococcus mutans on the dorsum of tongue after thorough scrapings and reduction in their number after tooth cleaning and tongue scraping and concluded that dorsum of tongue was an important reservoir for Streptococcus mutans [38].

Menon V and Coykendall AL estimated the levels of bacterial load streptococcal counts from the tongue of 22 volunteers before and after tongue scraping. They concluded that tongue scraping may impart a feeling of cleanliness and health to its user but does not reduce the count of streptococci on the tongue [39].

Gulati MS and Gupta L conducted a study on 20 female patients for 16 days and found 61.44% reduction in plaque accumulation in subjects performing brushing of tongue and teeth as compared to subjects performing brushing of teeth alone [40].

Dawes C et al studied the outcome of four oral hygiene procedures which includes tongue scraping and brushing on the output of bacteria into human saliva and concluded that all four oral hygiene procedures have similar effects on bacterial outputs into saliva [41].

Quirynen M et al found that 2 weeks of tongue brushing and scraping twice daily results in negligible reductions in aerobic and anaerobic bacteria on the tongue [42].

White GE and Armaleh MT in their study compared the efficacy of tongue scraping, listerine oral strip and saline as an adjunct to twice daily tooth brushing and found tongue scraping to be most effective in reducing the count of streptococci mutans levels [43].

Roldan S et al evaluated while treating halitosis patients using mechanical and pharmacological approach based on clinical and microbiological outcomes and conclude that it significantly affected the microbial composition in tongue coating, saliva, and subgingival microflora [44].

Rupesh et al evaluated the effects of both tongue scraping and tongue brushing on streptococcus mutans level in saliva of children and concluded that both the methods were equally effective in reducing bacterial counts [45].

Jacob et al evaluated the effects of tongue cleaning and tongue scraping on plaque and streptococcus mutans levels and concluded that it results in reducing streptococci counts but there was no significant reduction in plaque level [46].

Ana Carolina et al evaluated a new technique referred as the X technique for tongue brushing and concluded that X technique reduces the bacterial counts as well as improves the organoleptic rating [47].

## Conclusion

This review aimed at to find out on existing literature regarding whether tongue cleaning is required or not. It is evident that tongue forms the largest niche for microorganisms in the oral cavity and its association with halitosis, dental caries and plaque. On the basis of literature available it is justified to clean the tongue at least once a day. Tongue brushing on a regular basis has found to be fruitful particularly when there is complaint of oral malodor which have a great impact on the social impediment.

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# Economic Globalization and Population Health Outcomes in Nigeria: Implications of Achieving the Health Sustainable Development Goals (SDGs).

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**Abstract-** Globalization as a whole, and economic globalization in particular is a key challenge to public health outcomes, especially in developing countries. The paper examined the effects of economic globalization on health outcomes in Nigeria. Specifically, it showed the drivers of health outcomes in Nigeria. The paper covered the period of 1970-2020 and the vector error correction model (VECM) approach was utilized on data sourced from Central Bank of Nigeria Statistical Bulletin of various years and the World Bank Development Indicator (WDI, 2019) database. The result showed that health infrastructure, foreign aid, population growth, access to sanitation were significantly and negatively related to health outcomes while real gross domestic product(GDP) and index of globalization were positively and significantly related to health outcome, such that 1% increase in health infrastructure brought about 17% decrease in infant mortality rate and 1% increase in foreign aid brought about 7% decrease in infant mortality rate. It further showed that 1% increase in population growth rate brought about 4.64% decrease in infant mortality rate and 1% increase in access to sanitation brought about 1.12% decrease in infant mortality rate. The implications of these results on the relationship between economic globalization and health outcomes were discussed. The paper concludes that globalization may not have address health outcomes in Nigeria via extant factors including micro and macro issues. Therefore, a genuinely health-centered process of globalization can be achieved only by ensuring that the interest of developing countries, Nigeria inclusive and vulnerable populations are fully represented in global decision-making processes.

**Index Terms-** Economic globalization, infant mortality rate, under-five mortality, sustainable development goal, vector error correction (VECM), Nigeria.

**JEL Codes:** F6, QO1, Q53, I12, G11

## I. INTRODUCTION

There are various explanations to health outcomes. However, the World Health Organization (WHO) defines population health outcomes as changes in the health of an individual, group

of people, or the population that is attributable to an intervention or series of interventions. Accordingly, measures of outcome or health status include: mortality, re-admission, patient experience, effectiveness of care, timeliness of care, efficient use of medical imaging, and so on (Krabbe, 2016). Meanwhile Anyanwu (2007) has submitted that infant mortality rate (IMR) and the under-five mortality rate (U5-MR) are the most widely used measures in the health literature of health outcomes. The U5-MR is the probability of dying between birth and age five years expressed per 1000 live births, which have been used as a measure of children's well-being. The infant mortality rate is the number of deaths per 1000 live births of children under one year of age. It is regarded as a sensitive measure of the availability, utilization and effectiveness of healthcare system, used for comparing health system, programmes and policies internationally (Health Policy Institute, Ohio, 2007). In the paper, we used infant mortality rate measures to capture population health outcomes. In Nigeria, infant and child mortality has remained seemingly high. Using the trend and profile, in 2015, about 9% deaths of newborn babies in the world occurred in Nigeria, thus placing Nigeria as the third country in the world with the highest infant mortality rate outside India and Pakistan (Owoseye, 2017; Joseph, 2018), as Nigeria recorded 69.4% death rate per 1,000 infants. The lack of access to basic health facilities and resources due to environmental and social barriers (such as the isolation of those in rural areas, the absence of health facilities in rural areas and poverty) contributes immensely to the increase in infant mortality in Nigeria. Nigeria is among the nations in sub-Saharan Africa with very high under-five mortality rates (UNICEF, 2014; Anthony, Isaac and Victor, 2019). The U-5 mortality rate in the 1990s for example was 201 deaths per 1000, which later dropped to 128 deaths per 1000 within the 2000s and has continued to drop in the recent time. Again, according to the 2017 National Development Health Survey (NDHS), the most recent data available, infant and child mortality is 69 and 64 per 1000 live births respectively. This implies that one in every 15 Nigerian child dies before reaching age 1, and one in every sixteen does not live to their fifth birthday from birth.

There are various components of globalization. However, the Peterson Institute for International Economics (PIIE, 2018)

defined globalization as the growing independence of the global economies, cultures, and populations, brought about by cross-border trade in goods and services, technology, and flows of investment, people and information. The focus of this paper is on the economic dimensions of globalization. In the words of Anyanwu (2006) and Farzanegan and Hazzan (2017), economic globalization has two dimensions: international trade dimension, proxy by trade openness or liberalization and capital flow dimension, proxy by foreign direct investment (FDI) and foreign portfolio investment (FPI).

There are multiple and indirect linkages between globalization and health outcomes. The direct linkages include impact of globalization on health system and policies operating directly on health (e.g. the effects of World Trade Organization (WTO) General Agreement on Trade in Services (GATs) and through international markets (e.g. The effect on pharmaceutical prices of the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs); and the direct effects on other influences on health at the population levels (e.g. cross-border transmission of infectious disease and marketing of tobacco). The indirect effects includes effects operating through the national economy on the health sector (e.g. effects of trade liberalization and financial flows on the availability of resources for public expenditure on health, and on the cost of inputs); and on population risks (particularly the effects on nutrition and living conditions resulting from impacts on household income) (Woodward, Drager, Beaglehole & Lipson, 2001).

The research questions arising from the background information is as follows: How does economic globalization affect infant mortality in Nigeria? What are the transmission mechanisms through which economic globalization affects infant mortality rates in Nigeria? The objective(s) of the paper are framed thereof. The theoretical, empirical and methodological justification of the paper is not in doubt. While plethora of studies (see Temikin & Veizaga, 2010; Farganegan et al, 2017; Verter, 2014; Mohanty, 2017; Wako, 2018; Ali et al., 2018; Song et al., 2017. Goldberg, 2007; Westling, 2012; have conducted studies on economic globalization and unemployment; tourism; environment; inequality; economic growth; labour market; higher education; migration; corporate structure and income distribution, there is yet to be identified study on economic globalization and health status or outcome at specific country level. The study by Novignon and Atakorah (2016) focused on trade openness (an integral part of globalization, which is not globalization) and the health sector including health financing which is not a health outcome at the sub-Saharan African level with its unobserved heterogeneity. The study of Popoola (2018) focused on economic globalization and life expectancy (and life expectancy is also based on the mortality rate, although more comprehensive measures would include indicators measuring mortality rate) (Wang,2002). The paper contributes and extends the literature on economic globalization (trade openness and foreign direct investment) and health outcome (infant mortality and under-five mortality) in four ways: First, the paper is country specific, using Nigerian dataset to show some interesting stylized facts on the subject matter. Second; the paper empirically investigates the effect of economic globalization (using the KOF index of trade openness and FDI inflow) on health outcomes (infant mortality, recognized in the literature as a measure of

health status/outcome) in Nigeria with a view of drawing some key policy lessons. Third, the paper incorporates other key drivers of health outcomes not considered by the study of Popoola (2018) which include; real gross domestic product (RGDP); health infrastructure (HELINFR); overseas development assistance (ODA); population rate (POPR); access to sanitation (SANITA). Four, we offer policy suggestions in the light of the empirical evidence that would help the Nigerian policymakers to manage economic globalization in such a way as to limit the negative effects on health outcome and increase opportunities for its improvement. Fifth, we used the conventional KOF index of economic globalization and the vector autoregression (VAR) with its impulse response function (IRF) and variance decomposition (VDC) to investigate the magnitude of shocks of economic globalization on health outcomes as well as the transmission mechanism.

The paper is divided as follows: section II discusses some stylized facts on health outcomes in Nigeria within the reviewing period (1970-2018); section III presents the literature review while section IV examines the model, data and methods. Section V discusses the empirical results of the estimation process and section VI concludes the paper with policy implications, focusing on what can be done within the policy arena to achieve Goal 3- "Good health and well-being of the Sustainable Development Goal (SDGs) in Nigeria.

## II. SOME STYLIZED FACTS ON ECONOMIC GLOBALIZATION AND HEALTH OUTCOMES IN NIGERIA

Although, the global number of child deaths remains high, the world has made tremendous achievements in reducing child and young adolescent mortality over the past few decades. The global under-five mortality rate declined by 59 percent from 93 deaths per 1,000 live births in 1990 to 39 in 2018, while mortality rate among children ages 5-14 years fell by 53 percent from 15 to 7 deaths per 1,000 children age 5 in 2018. Still, the number of children aged 0-14 years died in 2018 (Child Mortality Report, 2019). Meanwhile, out of the 195 countries analyzed in the Child Mortality Report, 121 countries already met the SDG targets on under-five mortality, and 21 countries are expected to do so by 2030 if sustained efforts are maintained. However, efforts to accelerate progress need to be scaled up in the remaining 53 countries, two thirds of which are in sub-Saharan Africa, if the SSA countries are to achieve the SDG target on under-five mortality. Based on the global relationship of neonatal mortality to under-five mortality, observed for all the countries in the report, sub-Saharan Africa had the highest neonatal mortality rate in 2018 at 28 deaths per 1,000 live births, followed by Central and Southern Asia with 25 deaths per 1,000 live births. By implication, a child born in sub-Saharan Africa is 10 times more likely to die in the first month than a child born in a high-income country like the USA.

From the Multiple Indicator Cluster Survey (2016-2017) on Children and Women conducted by National Bureau of Statistics and United Nations Children's Fund (UNICEF), neonatal mortality rate is estimated at 39 per 1,000 live births, while post-neonatal mortality rate is at 31 per 1,000 live births in Nigeria. Infant mortality rate, often used as indicator of health status of a country, on the other hand is 70 per 1,000 live births, while

under-five mortality rate is 120 per 1000 live births. This implies that in five years preceding the survey, 1 in 15 live births in Nigeria die before their first birthday, while 1 in 9 live birth die before their fifth birthday. About 1 in 19 children surviving to age 12 months die before celebrating their fifth birthday. From the survey, Nigeria requires a 69 percent reduction from her current mortality rate to achieve the SDG 3.2 target of 25 per 1,000 live births within a period of 13 years. Also, she requires 79 percent reduction in current under five mortality rates to meet the SDG target.

**Table 1: Early Childhood Mortality Rates in Nigeria (2016-2017)**

| Neonatal, post-neonatal, infant, child and under-five mortality rates for five-year periods preceding the survey, Nigeria; 2016-2017 |             |                                       |  |                                    |                                   |  |
|--|-------------|---------------------------------------|--|------------------------------------|-----------------------------------|--|
| Years preceding the survey   | Period      | Neonatal mortality Rate <sup>-1</sup> | Post-neonatal mortality rate <sup>-2,a</sup> | Infant mortality rate <sup>3</sup> | Child mortality rate <sup>4</sup> | Under-five mortality rate <sup>5</sup> |
| 0-4  | 2013 - 2017 | 39                                    | 31   | 70                                 | 54                                | 120                                    |

1. MICS indicator 1.1; Neonatal mortality rate<sup>2</sup> MICS indicator 1.3- Post-neonatal mortality rate  
 3 MICS indicator 1.2; SDG indicator 3.2-Infant mortality rate<sup>4</sup> MICS indicator 1.4-Child mortality rate  
 5 MICS indicator 1.5; MDG indicator 4.1 – under five mortality rates  
 a Post-neonatal mortality rates are computed as the difference between the infant and neonatal mortality rates.

**Sources:** National Bureau of Statistics (NBS) and United Nations Children’s Fund (UNICEF) Multiple Indicator Cluster Survey (2016-2017).

On the socioeconomic characteristics of the early childhood mortality rates computed for the geographical zones, states, residence and maternal education, the survey reported that mortality rates were lower in the southern part of the country than the northern part. All the mortality rates are consistently highest in the north western region, while neonatal, infant and under-five mortality rates are lowest in the South-South region for the five years preceding the survey. Post-neonatal and child mortality rates are however lowest in the South West of Nigeria. The chances of the child surviving to first birthday are 2.2 times higher in the South-South than in the North West while for under-five, it is 2.7 times higher. Urban-rural mortality differential is also pronounced across early childhood age groups. As expected, mortality rates in urban areas are lower than rural areas in Nigeria. Infant mortality rate is 77 per 1,000 live births in the rural areas, while it is 53 per, 1000 live births in urban areas. Also, children survival to fifth birthday is 1.8 times higher in urban than rural areas.

Maternal education is expected to have inverse relationship with early childhood mortality. The survey also showed that neonatal, post-neonatal, infant, child and under-five mortality

rates decreases with higher level of maternal education in Nigeria. This is more evident on child mortality rate, where women with non-formal education have a rate of 86 per 1,000 livebirths, while those with higher education have 9 per 1,000 livebirths. Early childhood mortality rates decrease as household wealth index increases. Infant mortality among the poorest household is higher (80 per 1,000 livebirths) than the richest (45 per 1000 livebirths). One in 6 children under-five who lives in the poorest household in Nigeria will likely die before their fifth birthday, compared to 1 in 18 in the richest quintile households. While the national average of under-five mortality rate is relatively high and still far from the target of Sustainable Development Goal in Nigeria, 9 states have higher values than the national average, including; Nasarawa, Niger, Bauchi, Gombe, Jigawa, Kano, Katsina, Kebbi and Zamfara. Box 1 presents an overview of health outcomes in Nigeria following the MICS of 2016-2017

**Box 1: Key finding of the Multiple Indicator Cluster Survey, 2016-2017.**

- Neonatal mortality is 39 per 1,000 livebirths
- Infant mortality rate is 70 per 1,000 livebirths
- Under-five mortality rate is 120 per 1,000 livebirths
- One in 15 livebirths in Nigeria die before their first birthday
- One in 9 lives births die before their fifth birthday
- One in 6 children who lives in the poorest household in Nigeria die before their fifth birthday
- Nine states have higher under-five mortality rates than the national averages: Nasarawa, Niger, Bauchi, Gombe, Jigawa, Kano, Katsina, Kebbi and Zamfara
- To achieve SDG. 3.2, there must be at least 5% reduction in early childhood mortality rates before 2030 across all groups.

**Source:** NBS & UNICEF, 2018:38

Analysis by the Oxford Business Group (OBG) suggests that the development of the Nigerian healthcare system has been hindered by several notable challenges, including limited public funding, a high communicable diseases burden, rising incidence of non-communicable diseases, elevated rates of infant and maternal mortality rates (Medic West Africa, 2019). Similarly, the World Health Organization (WHO) over the years have highlighted that there is high incidence/reliance on out-of-pocket (OOP) health payments as a means of financing health system in Nigeria and that this has continued for many years in spite of a consensus to move closer to universal health coverage (UHC) and sustain it when achieved. The Economic Recovery and Growth Plan 2017-2020(ERGP), a plan document of the present Government summarizes several reasons for the poor performance of the country’s healthcare services. Accordingly, these include insufficient financing, inadequate and inequitable access, weak supply chain management, limited human resource capacities and insufficient coordination, cohesion and accountability. The Federal Government’s health policy under the ERGP 2017-2020 aims to improve the availability, accessibility, affordability and quality of health services by increasing access to primary healthcare services, expanding health coverage and improving the quality of the services provided. The policy initiatives to achieve these goals are:

revitalizing the primary healthcare system, the rollout of UHC, strengthening delivery beyond the primary healthcare system, partnering with the private sector to develop mega-health services, and optimizing the health-to-population ratio in the country.

The World Trade Organization (WTO) has underlined the role of foreign direct investment (FDI) in the efficient utilization of scarce resources and growth acceleration in poor countries such as the SSA economies. However, given the bad reputation that has befallen the African continent in general due to corruption, political instability and others causes in recent times, it has become difficult for the sub-region to attract substantial FDI compared to her peers such as the Latin-Americans, Middle East and Asia. Available Statistics from UNCTAD in 2018 reveals that international trade for developing economies declined from 31 percent in 2006 to 22 percent in 2017. FDI to West Africa fell 15 percent to \$9.6 billion, the lowest level since 2006. This was largely due to the substantial drop in FDI flow to Nigeria, for the second consecutive year. Foreign investors may have adopted a cautious approach and withhold planned investment in light of the risk of instability associated with Nigeria's 2019 pre-elections period and disputes between the Government and some large MNEs. In 2018, both HSBC (United Kingdom) and UBS (Switzerland) closed their local representative offices in Nigeria, and the telecommunication giants MTN (South Africa) remained in litigation related to the repatriation of profits. In addition, international oil companies have been ordered to pay \$20 billion in back taxes. Nevertheless, investment by oil companies, which included significant reinvested earnings by established investors, remained prominent in 2018. The new policy to reduce public ownership in joint-venture assets to 40 percent could drive up FDI in Nigeria in the coming years (UNCTAD, 2019).

Nigeria's total trade in goods in 2017 was \$92.2bn (\$51.5bn exports, \$40.7bn imports) comprising of \$75.8bn from formal trade (\$44.5bn exports and \$31.3bn imports) and \$16.4bn from informal trade (\$7bn exports, \$9.4bn imports). Informal trade involved unrecorded cross-border transactions in agricultural products, livestock, and parallel trade including trans-shipment and smuggling Nigeria's trades within Africa in 2017 of \$6bn (\$4.9bn exports, \$1.1bn imports), represented 8% of its total trade in goods, making her the 4<sup>th</sup> highest intra-African trader in goods after South Africa (\$31.8bn), Namibia (\$6.8bn) and Zambia (\$6.7bn) (Guobadia, 2019).

Crude oil and gas accounted for 95% of Nigeria's formal exports to the world in 2017, while agricultural commodities and manufactured products accounted for 2.5% and 2% respectively. While the main importers of Nigeria's goods in Africa are: South Africa, Togo, Cote d' Ivoire, Senegal, and Cameroon, the major African exporters to Nigeria are South Africa, Morocco, Cote d' Ivoire, Swaziland and Egypt. Meanwhile, Nigeria's global trade in services of \$23.25bn in 2015 made her the 3<sup>rd</sup> highest African country in trade in services, after Egypt (\$36.06bn) and South Africa (\$30.58bn). Although Nigeria maintained the same value in its trade in services in 2017 (\$23.26bn), Nigeria was pushed down to the 4<sup>th</sup> position by Morocco, which grew her services in trade from \$22.6bn in 2015 to \$27.06bn in 2017. In addition, Nigeria has been experiencing an unfavorable balance of trade in services vis-à-vis other African countries. In 2017, Nigeria's imports of services, at \$18.2bn, far outweighed exports, at \$5bn,

resulting in a huge balance of trade deficit of \$13.2bn. On the other hand, Egypt and Morocco achieved trade surpluses. Nigeria's trade in services is dominated by transport, travel and other business services, which together accounted for 86% of services import and 76% of export. In 2017, travel services, which include citizen's expenditure for business and personal travel on short term trips abroad (less than 1 year) for education, health, leisure and so on, amounted to \$8.33bn or 36% of Nigeria's total trade in services (Guobadia, 2019). In July 7, 2019, Nigeria signed into the African Continental Free Trade Area (AfCFTA) with the benefits thereof. Table 2.1 presents an overview of Africa's trade pattern as at 2017 amongst the African zones or blocs.

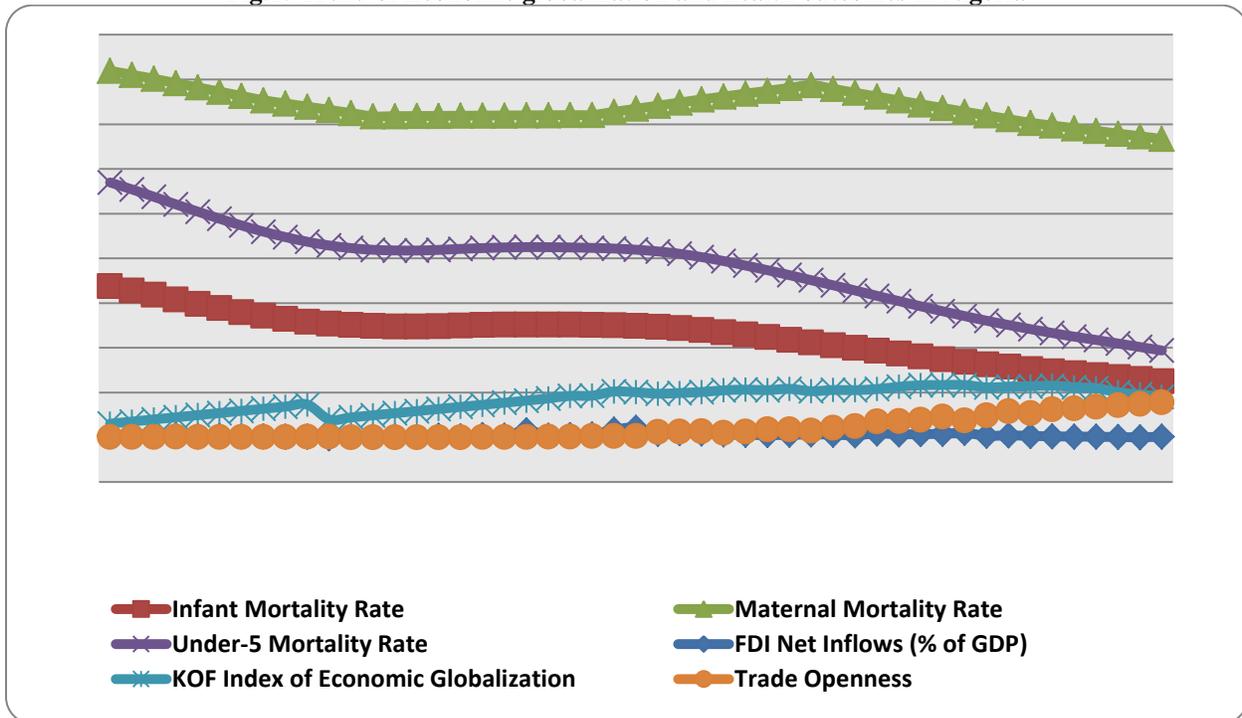
**Table 2: Africa's Trade Pattern as at 2017**

| RE C Name               | GD P (\$B n)     | % of Africa GDP | Popu latio n (Mil) | % of Africa Popu . | GD P per capita | Gl ob al Trade (\$ Bn ) | Int ra-Afric a Trade (\$ Bn ) | Glo bal Trade Bal anc e (\$B n) | Int ra-Afric a Trade bal anc e (\$B n) |
|-------------------------|------------------|-----------------|--------------------|--------------------|-----------------|-------------------------|-------------------------------|---------------------------------|--|
| ECO WA S                | 565 .09          | 24. 9%          | 359.8              | 28. 9%             | 1,5 37. 40      | 16 5.9                  | 25. 9                         | 48                              | 5                                      |
| SAD C                   | 680 .02          | 30. 0%          | 316.9              | 25. 4%             | 2,1 46. 70      | 32 7.1                  | 73. 4                         | 18. 4                           | 2                                      |
| EAC                     | 169 .66          | 7.5 %           | 185.5              | 14. 9%             | 914 .5          | 45. 7                   | 9.8                           | - 18. 5                         | 0.9                                    |
| UM A                    | 360 .35          | 15. 9%          | 99.4               | 8.0 %              | 3,6 25. 00      | 22 1.1                  | 11. 1                         | -28                             | 0.6                                    |
| ECC AS                  | 180 .74          | 8.0 %           | 89.5               | 7.2 %              | 2,0 19. 00      | 54. 7                   | 12. 1                         | 6.5                             | -1.7                                   |
| CO MES A                | 714 .56          | 31. 5%          | 528.7              | 42. 4%             | 1,3 51. 50      | 23 7.3                  | 35. 6                         | - 66. 4                         | -6.2                                   |
| <b>Afri ca (Tot al)</b> | <b>226 6.6 8</b> | <b>10 0 %</b>   | <b>1246. 2</b>     | <b>10 0 %</b>      | <b>181 8.9</b>  | <b>93 0.6 5</b>         | <b>13 5.4</b>                 | <b>- 77. 7</b>                  | <b>6.5</b>                             |

Source: Guobadia (2017).

The cause and effects of the trends and profile of health outcomes (infant mortality, US-MR and maternal mortality) and index of economic globalization (trade openness and capital inflow, FDI) over the reviewing period is presented in Figure 2.1.

**Fig.1: Trend of Economic globalization and health outcomes in Nigeria**



Source: World Development Indicator (WDI, 2018)

### III. LITERATURE REVIEW

#### 3.1 Conceptualizations

To identify the key determinants of health outcomes in poor countries both at the national, and for rural and urban areas separately, Wang (2002) focused on two health indicators of the infant mortality rate (IMR) and the under-five mortality rate (U5MR). The author asserted further that child mortality rates are generally regarded as the principle measures of a country's level of health status. Life expectancy is another important indicator, but its estimates is also based on the mortality rate, although more comprehensive measures would include indicators measuring mortality. However, the latter measures tend to be less reliable and in most cases, are less comparable across countries.

Anand and Barnighausen (2004) focused on the standard measures of maternal, infant and under-five mortality rates as the population health outcomes. According to the authors, all the three have been incorporated as indicators of the United Nations Millennium Development Goals (MDGs). Anyanwu and Erhijakpor (2007) used infant mortality and under-five mortality rates as measures of health outcome. Accordingly, these indicators have been consistently available for most African countries. From the foregoing on conceptual review, it can be deduced that infant mortality and under-five mortality is the acceptable measure of health outcome in the literature and therefore should form the conceptual framework of the current study.

#### b. Economic Globalization

Defining and measuring globalizations seems too complex following two points of observations: First, there is not a single, general accepted definition of globalization, as the wide range of indicators tries to reflect the complexity of the process-economic, social, political, technological and cultural dimensions of globalization which have been reflected separately or aggregated through indexes and globalization impact scale (Marginean, 2015). Second, is the changing character of the complex process of globalization, following the crisis effects and dramatic collapse of international trade and foreign direct investment, the two main drivers of globalization.

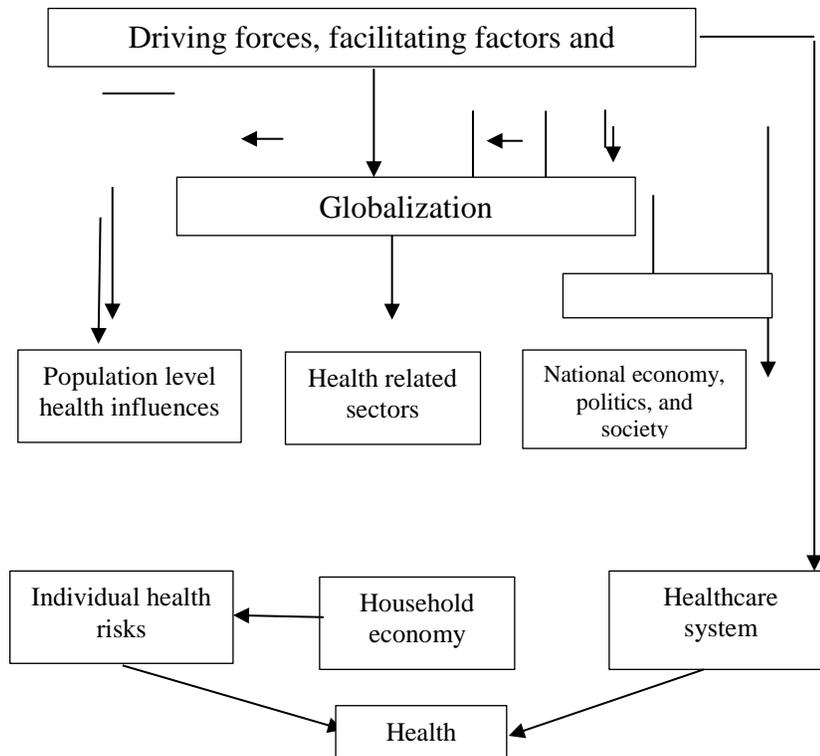
In 2010, Organization for Economic Cooperation and Development (OECD) second edition book on economic globalization indicators provided a comprehensive selection of the main dimensions of economic globalization measures. The book covers indicators that can measure the magnitude and intensity of globalization: (i) globalization of trade and investment; international trade of goods and services; foreign direct investment; portfolio investment; (ii) globalization of technology and knowledge (iii) multinational enterprises, (iv) global value chain (OECD, 2010). According to the Maastricht Globalization Index (MGI) proposed by Pim Martens (Marten, 2012), there are five dimensions of globalization: Political, economic and cultural, technological and ecological. Economic globalization is evaluated based on the stocks as a share of GDP; capital (Gross private flows as a share of GDP). Meanwhile, the ATK Globalization index (ATK-GI) covers four dimensions of globalization process (Keaney & FP, 2007): political engagement, personal contacts, technological connectivity and economic integration. These indicators used for

evaluating these four dimensions are: political engagement: foreign aid, treaties, organizations and peacekeeping; personal contact: telephone calls, travel and remittances; technological connectivity: number of internet users, hosts, secure servers; economic integration: international trade and foreign direct investment. All of them include both micro and macro dimensions of economic globalization. The Globalization Index of A.T. Kearney/Foreign Policy (2002) was probably the first attempt to construct a composite measure of globalization. It categories 14 indicators into the four dimensions of economic integration, personal contact, technology, and political engagement. Several other composite measures followed, including the G-Index (Randolph, 2001), (SGR Globalization Index (Lockwood & Redoano, 2005), Maastricht Globalization Index (Martens & Zywiets, 2006), and KOF Index of Globalization (Dreher, Gaston & Martens, 2008). While these indexes differ in the number of countries analyzed, years covered, indicators, and weighting schemes utilized, each of them combines data on a country-by-country basis into one aggregate to measure globalization. Hug and Cyn (2019) constructed a new index of globalization, Global Economic Integration Index (GEII) based on 25 variables for 158 countries

over the period 2006-2014. The key difference from existing composite measures of globalization is that the GEII can be decomposed into regional and non-regional integration. The GEII can assess the relative contributions of intra-regional and extra regional integration to globalization. This can be useful for assessing the role of regional integration in relation to globalization and informing national and international policy decisions about how best to manage economic integration at different layers of geographic groupings, given its potential risks and weaknesses.

From the foregoing, and aligning with the assertions of Popoola (2018), over the last three decades, economic globalization (which is often characterized by international trade and finance) has been the key driving force behind the overall process of globalization both developed and developing economies. The figure 2 sketches the conceptual framework for globalization and health outcomes. The framework provides a basis for comprehensive cases studies of the impact of globalization on health or its effects on a particular health problem or determinants of health.

**Figure 2: Conceptualizing globalization and Health outcomes**



Sources: Woodward et al (2001)

### 3.1.2 Empirical Literature

There are related studies on the focus of the study. For example, Welander, Lyttkens and Wilson (2014) examined the impact of globalization and the role of democracy child health outcomes in, 70 developing countries between 1970 and 2009. The variables used are child health, globalization, democracy and

a dummy variable, capturing policy variations. The panel data estimation approach was used. The results suggested that globalization reduces infant mortality and that the level of democracy in a country generally improves child health outcomes. The results further revealed that democracy matters for the size of the globalization effect on child health.

Owen and Wu (2007) investigated the relationship between trade openness and health. The variables used are trade as a share of GDP, Sachs-Warner Index (1995), black market premium, male and female life expectancy at birth and the infant mortality rate. The fixed effects estimations technique between the periods 1960-1995 were used on 219 low-, middle and high-income countries. The results revealed that trade openness is positively related to health and the relationship is stronger in low-income countries than other countries. The mechanisms seem to be knowledge spillovers and sound macroeconomic policies that are positively correlated with trade openness policies that are positive for health.

Tsai (2007) examined globalization and human well-being. The KOF index of globalization and its three dimensions and the Human Development Index (HDI) were used. The random effects estimation technique was employed on data set between 1980-2000 for 112 low, middle-and high-income countries. The results show that overall, economic globalization and political globalization are positively related to HDI and that the effect appeared stronger in high income countries than low income countries.

Bergh and Nilsson (2010) explored the correlation between globalization and health using KOF index and its three dimensions, total male and female life expectancy at birth. The panel corrected standard errors (PCSE) procedure with country and period dummies and fixed effects estimations were used between the period 1970-2005 on 92 low-middle- and high-income countries. The result showed that overall other globalization dimensions and economic globalization increases life expectancy.

Mukherjee and Kriekhaus (2011) investigated the nexus between globalization and health in 132 low-, middle-and high-income countries, between 1970-2007 using the fixed effects estimations technique. The variables used are the KOF index and its three dimensions, total life expectancy at birth, the infant and child mortality rates. The result revealed that overall, political globalization, and economic and social globalization positively relates to health outcome. This also holds for a sample of only non-OECD countries.

Popoola (2018) examined the impact of economic globalization and life expectancy in Nigeria between the 1986 to 2016 using the Johansen cointegration approach. The variables used are life expectancy at birth; trade and FDI. The findings showed that economic globalization have positive and significant impact on life expectancy in Nigeria.

Fatile and Adesanya (2016) examined the effect of globalization on Health care service delivery in Lagos University State Teaching Hospital (LUTH) using the questionnaire approach and in-depth interview technique. The findings revealed that there is a strong relationship between structures of globalization and health care service delivery in LASUTH.

Riman and Akpan (2012) examined the relationship between healthcare financing and Health outcomes in two rural local government area and one urban local government area of Cross River State, Nigeria. The study demonstrated that the high levels of infant mortality and morbidity rate was associated with the high incidence of out-of-pocket payment, and the wide disparity and inequality in income distribution. The study further observed a disproportionate disparity in the spatial distribution of

health facilities, with concentration of health facilities at the urban areas rather than the rural areas, which of course contributed to the poor service demand.

Imo, Isiugo-Abanihe and Chikezie (2017) examined socio-economic determinants of under-five children health outcome with data from a sample of 609 women of childbearing age in rural and urban areas of Abia State. The multi-stage sampling technique were utilized. The study showed that the outcome of an under-five child's health depends on socio-economic factors.

Levine and Rothman (2006) focused on the impact of trade openness on child health. The authors reported a coefficient of -0.63, which implies that a 1% increase in trade openness would lead to about more than half a year reduction in infant mortality.

Hudak (2014) explored the relationship between trade openness and differential health outcomes, considering a panel data set of thirty low and high income countries from 1960 to 2012. Using the random effect estimation technique, results from the study indicate that at 10% significance level, an increase in trade openness leads to 14.09% increase in life expectancy.

Stevens, Urbach and Wills (2013) studied the relationship between free trade and health. The empirical findings revealed that free trade is correlated with better health and this becomes clearer when dealing with low income countries. Using the synthetic control method to estimate the effects of trade liberalization on health outcomes for the periods of 1960 to 2010 in South Africa, Olper et al., (2014) found a significant short-run and long-run reduction in child mortality by trade liberalization. Herzer (2014) also estimated that long-run relationship between trade and population health using a panel time series data from 1960-2010 for seventy-four (74) developed and developing countries. The study found a positive relationship between life expectancy and trade openness while a negative relationship between infant mortality and trade openness existed. The paper therefore concluded that trade openness has positive and significant impact on population health. It also found a long-run causality running from both directions.

The empirical evidence highlighted the trend of research on the subject matter. However, despite the growing studies on globalization and health outcomes in developing countries, there is no agreement on the effects of globalization on health status. While some studies evidenced the hazards of globalization on health status (Ajayi & Garba, 2008) through infectious diseases transmitted through fake drugs, other studies showed improvement in health outcome through access to health facilities and technology (Martens, Akin, Huynen & Raza, 2010). In conclusion, the effects of globalization on health outcome is mixed.

#### IV. METHODOLOGY AND DATA

##### 4.1 Theoretical Framework

The theoretical framework of the study is anchored on the Grossman (1972) demand for health production function. Following Grossman, Fayissa and Gutema (2008) theoretical production function given as follows:

$$H = f(X) \quad 4.1$$

Where H = Individual health output/outcome, X = vector of individual inputs to the health production function, f. The

elements of the vector include nutrient intake, income, consumption of public goods, education, time devoted to health related procedures, initial health stock and the environment. The above model represents the micro health production analysis. To account for macro level health production, Fayissa and Gutema (2008) presented a macro level specification of equation (4.1) by representing the elements of the vector X as per capita variables and then regrouped them into sub-sector vectors of social, economic and environmental factors. The macro level health production health function is represented in the equation as:

$$h = f(Y,S,V) \tag{4.2}$$

where h is the aggregate population health status outcome, Y is a vector of per capita economic variables, S is a vector of per capita social variables and V is also a vector of per capita environmental factors. In the study, we introduce economic globalization variable as a component of the economic variable in the theoretical formulation and re-specified the model.

#### 4.2 The Model

To be able to provide estimates for the parameters of the study, an econometric specification of the model to be used is necessary. From the theoretical model, globalization and population health status function takes the reduce form as follows:

$$\ln PHS = \alpha_0 + \alpha_1 \ln KOF + \alpha_2 \ln RGDP + \alpha_3 \ln HELINFR + \alpha_4 \ln ODA + \alpha_5 \ln POPR + \alpha_6 \ln SANITA + \alpha_7 \ln GOVHEXP + e$$

#### 4.4

where PHS = population health status (proxy, infant mortality rate); KOF = index of economic globalization (trade openness and foreign direct investment); RGDP = real gross domestic product (a proxy for the economy); HELINFR = health infrastructure. ODA = overseas development assistance (donor aid to health sector financing mechanism); SANITA = access to sanitation and PPOR = population growth, e = error term and Ln= the natural logarithms.

#### 4.3 Data Sources

The study employed annual time series data from 1970-2018 for Nigeria. The description of the variables is provided in Table 1.

**Table 3: Description of Variables of the Model**

| Variables | Description  | Sources                                  |
|-----------|--|--|
| INF MOR   | Infant mortality rate (Dependent variable)   | WDI, 2018                                |
| KOFIND    | KOF Index of Economic globalization (trade openness, FDI and foreign portfolio inflow) | WDI, 2018                                |
| RGDP      | Real gross domestic product, proxy for the economy                                     | CBN Statistical Bulletin (Various Years) |
| HELINFR   | Health Infrastructure (proxy, hospital beds)   | WDI (2018)                               |
| ODA       | Overseas Development   | WDI (2018)                               |

|         |                                     |            |
|---------|-------------------------------------|------------|
|         | Assistance (donor health financing) |            |
| POPR    | Population growth                   | WDI (2018) |
| SANITA  | Access to clean water health        | WDI (2018) |
| GOVHEXP | Government expenditure on health    | WDI (2018) |

Note: WDI – World Development Indicator  
CBN = Central Bank of Nigeria Statistical Bulletin of various years.

In accordance with the literature, health expenditure as an indicator of the volume of resources flowing into health is expected to have negative effect on infant mortality rates, thus an increase in health expenditure implies a broader access to healthcare and services which helps to decrease infant mortality rates. Given the redistributive effect of public intervention, a positive correlation between public financing and health outcome is expected (Anyanwu & Erhijakpor, 2007). However, as shown by Herzer (2014), there is a negative relationship between infant mortality and trade openness, one of the indicators of economic globalization. In addition, as Herzer, Korbiniah and Peter (2015) had shown, the relationship between FDI and health is non-linear, depending on the level of income. FDI has a positive effect on health at low level of income, but the effect decreases with increasing income. As posited by Bloom, Kuhn and Prettnner (2018), the underlying mechanisms of the correlation between health and economic growth are complex and difficult to predict. First, the causality between health and economic growth is challenging. Second, the relation between health and economic growth changes the process of economic development and the different dimensions of health (mortality vs. morbidity, children’s and women’s health, and health at older ages) may have different economic effects. Following theoretical and empirical literature, we expect a positive relationship between health infrastructure and measure by bed space.

Sadck (2012) found a statistically significant and positive effect of aid on infant mortality, as doubling of aid leads to an approximately 1.3% reduction in infant mortality rates in 135 countries between 1975 and 2010 examined. Similarly, Prachi and David found out that aid has a statistically significant effect on infant mortality in 118 countries examined between 1973 and 2004 as such, doubling per capita health aid is association with a 2 percent reduction in the infant mortality rate. We therefore expect a positive and significant relationship between the index of globalization and public health outcomes within the reviewing period.

Lakshmi and Sahoo (2013) established a negative relationship between health infrastructure and health indicator in the case of Andhra Pradesh, India, such that the elasticity coefficient of health indicators like crude birth rate, crude health rate, infant mortality and life expectancy at birth with respect to health infrastructure are -37.966, -27.816, -30.598 and 10.282 respectively. Meanwhile, Hati and Majumder (2013) posited a strong relation between primary health infrastructure and preventive and curative health achievements. Therefore, the coefficient of health infrastructure on health outcome is expected to be positive.

Fertility, migration and urbanization affect the spread of diseases including tuberculosis, malaria and HIV/AIDS.

Increased population densities and unhealthy living conditions in urban slums can ease the transmission of infections. Migrations may also increase vulnerability to disease (Population Action International, 2012). We anticipated a negative relationship between growth in population and health outcomes. Limited access to sanitation infrastructure, poor hygienic practices, and unsafe drinking water negatively affect the health of millions of people in the developing world. Using sanitation interventions to interrupt disease pathways can significantly improve public health outcomes. Sanitation interventions primarily benefit public health by reducing the prevalence of enteric pathogenic illnesses, which cause diarrhea (Lipson, Anderson & Bolton, 2010; Wolfgang et al., 213; Bouzid et al., 2018). We expect the coefficient of sanitation to be positively and significantly related to health outcomes.

#### 4.4 Estimation Technique

First, we check for the characteristics and movements of the variables using the descriptive statistics and correlation matrix. This is followed by the time series properties of the variables. We check stationarity of the series using Philip-Peron (PP) and Augmented Dickey Fuller at level and first difference to avoid spurious results. If the variables are found to be order of I(1) or say non-stationary, there may be chancing of forming I(0) variable. This is called cointegration test which means testing for long-run relationship among the variables of the model. If the variables under study are cointegrated, the cointegrating vector is normalized with respect to public health outcomes. To test whether cointegration exists or not, we apply the systems method of cointegration proposed by Johansen and Juselius (1992). This

enables the usage of the vector error correction model (VECM). The appropriate specification for the error-correction model will be:

$$\Delta Y_t = \beta_0 + \beta_1 \Delta X_t + \lambda \eta_{t-1} + e_t \tag{4.3}$$

Or,

$$\Delta Y_t = \beta_0 + \beta_1 \Delta X_t + \lambda(Y_{t-1} - \alpha_0 - \alpha_1 X_{t-1}) + e_t \tag{4.4}$$

The  $\eta_{t-1}$  term is the magnitude by which y was above or below its long-run equilibrium value in the previous period. The coefficient  $\lambda$  (which we expected to be negative) represents the amount of “correction” of this period (t-1) disequilibrium that happens in period t.

### V. RESULTS AND INTERPRETATION

#### 5.1 Summary of Descriptive Statistics

The summary of descriptive statistics of infant mortality (proxy for health outcome), index of economic globalization (KOFIND), real gross domestic product (RGDP), health infrastructure (HELINFR), overseas development assistance (ODA), population growth rate (POPR) and access to sanitation (SANITA) variables included in the model are reported in Table 5.1. The statistics indicate the existence of wide variations in the variables. For instance, the average INFMOR for the 1970-2018 period was 113.88 percent, compared to 42.60 percent, 1.37 percent, 0.85 percent, 2.6 and 44.34 percent respectively for KOFIND, HELINFR, ODA, POPR and SANITA.

**Table 4: Descriptive Statistics (1970-2018)**

|              | <b>INFMOR</b> | <b>KOFIND</b> | <b>REALGDP</b> | <b>HEL/NFR</b> | <b>ODA</b> | <b>POPR</b> | <b>SANITA</b> |
|--------------|---------------|---------------|----------------|----------------|------------|-------------|---------------|
| Mean         | 113.8755      | 42.60180      | 393607.3       | 1.375804       | 0.859115   | 2.607276    | 44.33776      |
| Median       | 123.9000      | 48.03922      | 275450.6       | 0.742040       | 0.514087   | 2.582376    | 44.800000     |
| Maximum      | 168.9000      | 58.44728      | 1239342        | 6.370300       | 8.117241   | 3.048043    | 71.36667      |
| Minimum      | 62.76667      | 15.20503      | 4219.000       | 0.342000       | 0.054814   | 2.293336    | 15.33000      |
| Std Dev.     | 26.92365      | 13.32031      | 351180.7       | 1.452929       | 1.416226   | 0.151628    | 16.93553      |
| Skewness     | -0.217807     | -0.552292     | 0.915721       | 2.009993       | 4.126110   | 0.993633    | -0.064516     |
| Kurlosis     | 2.406774      | 1.893879      | 2.788518       | 6.244659       | 19.99145   | 4.677000    | 1.773515      |
| Jarque-Bera  | 1.105925      | 4.989033      | 6.939426       | 54.48820       | 728.4842   | 13.80485    | 3.105263      |
| Probability  | 0.575243      | 0.082536      | 0.031126       | 0.000000       | 0.000000   | 0.001005    | 0.211690      |
| Sum          | 5579.900      | 2087.488      | 19286759       | 67.41440       | 42.09665   | 127.7565    | 2172.550      |
| Sum Sq. Dev. | 34794.38      | 8516.674      | 5.92E+12       | 101.3281       | 96.27341   | 1.103563    | 13766.98      |
| Observations | 49            | 49            | 49             | 49             | 49         | 49          | 49            |

Note: INFMOR = infant mortality rate, KOFIND = Index of economic globalization (openness of trade and FDI); REAL GDP = economic growth proxy; ODA = foreign aid; POPR = Population growth; SANITA = Access to sanitation; HELINFR = health infrastructure.

Source: Author’s Computation using EVIEW 10.0

The statistics in table 5.1 showed that the average value of INFMOR stood at 113.87; 43% for KOFIND; 393607 for real GDP; 1% for health infrastructure; 0.86% for foreign aid; 2.6% for population growth rate and 44% for access to sanitation. The table 5.1 further indicates that the values ranges from 62-168 for INFMOR; 15-58 for KOFIND; 4219-1239342 for real GDP; 0-6

for health infrastructure; 0-8 for foreign aid; 2-3 for population growth; and 15-71 for access to sanitation. The table 4 further revealed that informant mortality and index of economic globalization were negatively and significantly skewed to -0.217807 and -0.552292 respectively while the other variables

were positively and significantly skewed within the reviewing period 1970-2018.

**Table 5: Correlation Matrix**

|          | LKOFIND   | LREALGDP  | LHELINFR  | LODA      | LPOPR   | LSANITA | LGOVHEXP |
|----------|-----------|-----------|-----------|-----------|---------|---------|----------|
| LKOFIND  | 1.00000   | 0.859463  | -0.197856 | 0.460346  | 0.092   | 0.918   | 0.890    |
| LREALGDP | 0.859463  | 1.000000  | -0.057326 | 0.267440  | 0.062   | 0.96    | 0.894    |
| LHELINFR | -0.197856 | -0.057326 | 1.000000  | -0.225543 | -0.1156 | -0.242  | -0.44    |
| LODA     | 0.460346  | 0.267440  | 5543-0.22 | 1.000000  | -0.507  | 0.379   | 0.402    |
| LPOPR    | 0.092506  | 0.062926  | -0.115671 | -0.507233 | 1.0000  | 0.018   | 0.03     |
| LSANITA  | 0.918996  | 0.961713  | -0.242712 | 0.379027  | 0.0188  | 1.000   | 0.97*    |
| LGOVHEXP | 0.890422  | 0.894780  | -0.441251 | 0.402191  | 0.030   | 0.974   | 1.000    |

Note: KOFIND = Index of economic globalization; REAL GDP = economic growth proxy; HELINFR = health infrastructure; ODA = foreign aid; POPR = population growth; SANITA = Access to sanitation; GOVHEXP = Government health expenditure; L = natural logarithm.

Source: Authors' Computation using EVIEW 10.0

The matrix showed that with the exception of SANITA; GOVHEXP and REALGDP, the other variables are within the standard of non- multicollinearity indicated by 0.95% following (Iyoha, 2009 & Tella,2018). However, our unit root result of order one, I(1) will suppress the negative effect of multicollinearity in the model (Stock & Watson, 2007).

**Table 6: Unit Root Test**

| Variables | PP Test Statistics         |                            | ADF                      |                            |
|-----------|----------------------------|----------------------------|--------------------------|----------------------------|
|           | Level [I(0)]               | 1 <sup>st</sup> Difference | Level [I(0)]             | 1 <sup>st</sup> Difference |
| LKOFMOR   | -1.0401(0.99)              | -1.1371(0.69) <sup>±</sup> | 4.311(1.000)             | -2.91(0.05)*               |
| LKOFIND   | -2.88(0.5)                 | -6.587(0.000)***           | -2.87(0.05)*             | -6.59(0.00)***             |
| LREALGDP  | -5.22(0.00)***             | -6.384(0.000)***           | -2.54(0.11)              | -1.98(0.29) <sup>±</sup>   |
| LHELINFR  | -1.101(0.708)              | -3.600(0.00)***            | -1.43(0.56) <sup>±</sup> | -3.52(0.00)**              |
| LODA      | -2.1068(0.24) <sup>±</sup> | -6.055(0.000)***           | -1.97(0.29) <sup>±</sup> | -5.76(0.00)***             |
| LPOPR     | -2.806(0.06)*              | -2.511(0.11) <sup>±</sup>  | -2.96(0.04)**            | -3.82(0.05)***             |
| LSANITA   | -2.806(0.06)***            | -11.23(0.000)***           | -4.46(0.00)****          | -4.84(0.00)***             |
| LGOVHEXP  | -1.362(0.59) <sup>±</sup>  | -7.76(0.000)***            | -1.75(0.39) <sup>±</sup> | -3.22(0.02)**              |

Note: (\*) significant at the 10%; (\*\*) significant at the 5%; (\*\*\*) significant at the 1% and <sup>±</sup> Not significant.

Source: Authors' Computation using E-view 10.0

Table 6 showed the results of the stationarity test of the variables of the model. It revealed that majority of the variables were stationary at the first difference, I(1) at both the Phillip-Peron and Augmented Dickey Fuller test at the denoted level of

significance. The satisfactory unit root test results lead to the further confirmation of the time series properties of the variables using the Johansen cointegration rank test and the normalized cointegration coefficients as reported in Table 5.4 and 5.5.

**Table 7: Cointegration Rank Test**

| Johansen and Julius Maximum Likelihood Cointegration Rank Tests |                 |               |         |             |                          |
|---|-----------------|---------------|---------|-------------|--------------------------|
| Eigen value   | Trace statistic | Max statistic | CV @ 5% | CV @ 5% Max | Hypothesized No of CE(s) |
| 0.906261  | 398.3874        | 108.8931      | 159.52  | 52.36       | None*                    |
| 0.848748  | 289.4943        | 86.88516      | 125.62  | 46.23       | At most 1*               |
| 0.799641  | 202.6092        | 73.95176      | 95.75   | 40.07       | At most 2*               |
| 0.672149  | 128.6574        | 51.29867      | 47.86   | 33.87       | At most 3*               |
| 0.585119  | 77.35874        | 40.46916      | 29.79   | 27.58       | At most 4*               |
| 0.428302  | 36.88957        | 25.72062      | 15.49   | 21.13       | At most 5*               |
| 0.211477  | 11.16896        | 10.92932      | 3.84    | 14.26       | At most 6                |
| 0.005196  | 0.239633        | 0.239623      | 69.81   | 3.84        | At most 7                |

Note: \* denotes rejection of the hypothesis at the 0.05 level.

**Source:** Authors' Computation using the E-VIEW 10.0

The cointegration test of Johansen & Juselius revealed 6 cointegrating eqn.(s) at the 0.05 level of significance for both the Trace and Max-Eigen Statistics. The implication is that there exist long-run equilibrium relationship for the variables of the model. Table 5.5 revealed the long-run normalized coefficients, the results indicates the magnitude and pattern of long-run equilibrium behavior of our model.

**Table 8A: Normalized Cointegrating Coefficients**

| LINFMOR  | LKOFIND  | LREALGDP | LHELINFR  | LODA      | LPOPR   | LSANITA | LGOVHEXP |
|----------|----------|----------|-----------|-----------|---------|---------|----------|
| 1.000000 | 1.470863 | 1.970740 | -0.114383 | -0.176585 | -8.81   | -0.83   | -0.053   |
|          | (0.33)   | (0.145)  | (0.090)   | (0.035)   | (1.115) | (1.059) | (0.120)  |

Note: Normalized cointegrating coefficients (standard error in parentheses)

Source: Authors' Computation using EVIEW 10.0

**Table 8B: Normalized Cointegrating Coefficients**

| LINFMOR  | LKOFIND  | LREALGDP  | LHELINFR  | LODA      | LPOPR   | LSANITA | LGOVHEXP |
|----------|----------|-----------|-----------|-----------|---------|---------|----------|
| 1.000000 | 0.000000 | 0.911542  | -0.175637 | -0.073568 | -4.642  | -1.121  | 0.114    |
|          |          | (0.06362) | (0.04839) | (0.01660) | (0.597) | (0.549) | (0.063)  |
| 0.000000 | 1.000000 | 0.720120  | 0.041645  | -0.07003  | -2.837  | 0.197   | -0.114   |
|          |          | (0.04143) | (0.03151) | (0.01081) | (0.389) | (0.35)  | (0.04)   |

Source: Author's Computation using EVIEW 10.0

Tables 8A and 8B revealed the results of the normalized cointegrating coefficients. From the first panel (8A), the coefficients of KOFIND and REALGDP appeared positive in line with the theoretical postulations/behavioural restrictions in both Tables. The coefficients of health infrastructure showed negative relationship with health outcome as expected theoretically in both panels. These results are in tandem with the earlier findings of Lakshni et al. (2013) for Andhra Pradesh, India. The coefficients of foreign assistance (aid) was negative against the theoretical postulation and findings of Sadek(2012) for the

135 countries examined and the findings of Prachi and David(2014) for 118 countries examined. The negative relationship between foreign aid and health outcome could be linked to aid fungibility in developing countries, Nigeria inclusive. Population growth has a negative relationship with health outcome as theoretical expected. Furthermore, access to sanitation appeared negative against the expectations and government expenditure appeared negative as expected. The vector error correction (VECM) estimate re reported in Table 9

**Table 9: Equilibrium Vector Error Correction**

| Variable  | LINFMOR    | LKOFIND   | LREALGDP   | LHELINFR   | LODA      | LPOPR     | LSANITA    |
|-----------|------------|-----------|------------|------------|-----------|-----------|------------|
| Coint Eq1 | -0.000555  | 0.11880   | -0.526935  | -0.016882  | 0.780405  | 0.005293  | -0.00075   |
|           | (0.00121)  | (0.07587) | (0.10312)  | (0.13367)  | (0.47443) | (0.00245) | (0.00075)  |
|           | [-0.45652] | [1.56598] | [-5.10915] | [-0.12629] | [1.64493] | [2.15751] | [-1.01288] |

Source: Authors' Computation using EVIEW 10.0

The coefficients of ECM (-1) as seen in Table 9 conforms with the theoretical standing, as it is correctly signed (negative), statistically significant and its absolute magnitude being between 1 and 0 for real GDP, health infrastructure and access to sanitation. It shows that the model has self-adjusting mechanism for correcting short-run dynamics in the series to their long-run path. With the ECM (-1) for the variables (Real GDP, health infrastructure and access to sanitation) satisfying the rule of thumb, we can conclude that there exists a long run converging relationship between economic globalization and public health outcomes. The ECM (-1) reveals that about 52.7 percent, 2 percent and zero percent of short-run disturbances are adjusted back to equilibrium path in the long-run. Additionally, the speed of error correction tends to be moderate for real GDP, the statistical significance at about 10 percent significance level and magnitude of 52.7 percent indicates that a deviation in health

outcomes from equilibrium is corrected by 52.7 percent in the successive period.

## 5.2 Impulse Response Function and Variance Decomposition Results

### 5.2.1 Impulse Response Function (IRFs)

The Choleski decomposition traces the long-run responses of the system variables to one standard deviation shocks to the system innovations spanning the initial 10 quarters. The results showed that an increase in real GDP, health infrastructure shocks to health outcome depressed health outcome in the long-run, whereas the responses of health outcome to economic globalization, foreign aid, access to sanitation and government health expenditure shocks increase health outcomes, particularly in the short-run. The IRFs are attached as appendix.

### 5.2.2 Variance Decomposition Results (VDC)

The forecast error variance decomposition tells us the proportion of the movements in a sequence due to its “own” shocks (health outcomes) versus the shocks to other variables (economic globalization and other variables). The impulse analysis and variance decompositions together called (innovation accounting) can be useful tools to examine the relationship among economic variables. It displays information on the role played by different structural shocks in explaining the variability of the series at different horizons. This gives a better explanation of the relationship which exists among the major variables in the study.

Table 10 presents the variances decomposition of population health outcome to innovation stocks in economic globalization. The “S.E”, comprises the prediction noise of the variables at a given prediction period. The basis of this prediction noise is the difference between the actual and prediction values of the innovations to each of the endogenous variables in the VECM. The other columns show each variable as measured health outcome and economic globalization as well as the percentage of the prediction variance due to each innovation, with each row summing up to 100.

**Table 10: Variance Decomposition Analysis of Economic Globalization and Health Outcome (Infant Mortality)**

| PERIOD | S.E      | INF MOR  | KOFIN    | REALGDP  | HELINFR  | ODA      | POPR      | SANITA   |
|--------|----------|----------|----------|----------|----------|----------|-----------|----------|
| 1      | 0.001175 | 100.0000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000  | 0.000000 |
| 2      | 0.002588 | 97.35759 | 0.074042 | 0.386661 | 0.089147 | 0.265574 | 0.00614   | 0.072293 |
| 3      | 0.004241 | 93.47529 | 0.125199 | 1.065283 | 0.102084 | 0.756575 | 0.004033  | 0.054619 |
| 4      | 0.006072 | 88.44631 | 0.633390 | 1.904380 | 0.098478 | 1.411748 | 0.022742  | 0.032215 |
| 5      | 0.008097 | 82.52624 | 1.476705 | 2.820016 | 0.116742 | 2.352035 | 0.138200  | 0.018128 |
| 6      | 0.010362 | 75.94953 | 2.354951 | 3.777889 | 0.160014 | 3.705508 | 0.430588  | 0.019032 |
| 7      | 0.012879 | 69.00607 | 3.176065 | 4.846686 | 0.219871 | 5.391522 | 0.9486130 | 0.054162 |
| 8      | 0.015664 | 61.90279 | 3.900790 | 6.137055 | 0.286617 | 7.241540 | 1.675172  | 0.143785 |
| 9      | 0.018724 | 54.85297 | 4.503887 | 7.637590 | 0.344006 | 9.113417 | 2.533885  | 0.295813 |
| 10     | 0.022043 | 48.14919 | 4.962834 | 9.193972 | 0.378270 | 10.90549 | 3.420313  | 0.501842 |

Note: The others are attached as an appendix.

Source: Authors’ Computation using EVIEW 10.0

Table 10 shows that shocks to infant mortality is explained by a 100 percent shock to itself in the period at which it continuous to decline through to the 10 period. This can be attributed to series of factors including poor health facility, inadequate access to healthcare services following catastrophic health expenditure and the associated out-of-pockets (OOPs). The variability of health outcome to shocks in economic globalization (KOFIND) is unnoticeable in the first quarter, but begins to rise after the third period, and rises slowly till the tenth period. Thus the changes occurring in health outcome is not highly influenced by index of economic globalization as changes in economic globalization did not initially contribute much to the changes in health outcome, but its contribution became significant at the latter part. The variance of health outcome to the changes in real GDP and health infrastructure is relatively insignificant in the first period. Meanwhile, the changes start increasing from the 3<sup>rd</sup> period down to the 10<sup>th</sup> period over and above that of health infrastructure. The variations in real GDP seems to be the second major shocks to health outcome. The percentage variance of overseas development assistance(ODA) was initially zero but continues to rise from the 4<sup>th</sup> period to the 10<sup>th</sup> period, thus accounting for the majority of the shock to health outcome. From the table, the variance of population growth is zero from the period to the 7<sup>th</sup> period, but relatively significant changes started from the 7<sup>th</sup> period to the 10<sup>th</sup> period. Finally, access to sanitation shock to health outcome is relatively zero and insignificant throughout the period. Therefore, aside the shock of health outcome to itself, the index of economic globalization, real GDP and foreign aid accounted for most of the

variation in health outcome in Nigeria within the reviewing period.

### 5.6.3 Sensitivity Analysis

The final stage of the examination was the post estimation tests. This ensures the stability of the long-run coefficients by using the Inverse Roots of AR characteristic polynomial in the context of VECM. From the figure (see appendix), all the dots are inside the circle on inverse roots graph which implies that the VECM estimation is dynamically stable, robust enough to aid policy inference.

## VI. POLICY IMPLICATION AND CONCLUSION

### 6.1 Policy Implication

Some notable policy implications can be drawn from the empirical results:

- The paper points clearly to the significant role of other policy intervention, in particular health policy in other to reduce health outcome challenges in Nigeria and other developing countries.
- The empirical results from the normalized cointegrating coefficients shows negative relationship between health infrastructure and health outcome (infant mortality),

negative relationship between foreign aid and health outcome, negative relationship between population growth, access to sanitation and health outcome. In order to reduce these negative results, there is need to ensure universal access to cost-effective interventions, and to improve services essential to health, such as water and sanitation, environmental protection, and effective nutrition and health safety net programmes. Again, in order to reduce the negative effect of foreign aid, there is need to protect health-related spending from reduction in public expenditure against laid down standard (15% of total expenditure) and foreign donors increasing and improving policy design to check the usage and allocation of foreign aid to the health.

- From the variance decomposition and impulse response results, outside its own shock, economic globalization, Real GDP and foreign aid variance accounted for more of the variations in health outcomes. This implies that for Nigeria to enjoy the benefits of globalization, she needs to manage the process of integration with the international economy in ways that maximize the economic opportunities and minimize the economic risk and social costs. In addition, macroeconomic and structural policies that accompany economic opening must be well designed and implemented.
- It is important to monitor the effects of globalization and health, and to ensure that the results of such monitoring are fed effectively into decision-making processes at the

national and international level.

## 6.2 Conclusion

The objective of this paper was to examine how economic globalization affect health outcome in Nigeria. Specifically, it shows the channels of real GDP, health infrastructure, foreign aid, population growth, access to sanitation and government health expenditure as proximate determinants of health outcome in Nigeria. The paper is remarkably significant because it bridges the seemingly gap in the current knowledge about the effects of economic globalization on health outcomes. The coefficients of health infrastructure showed negative relationship with health outcome as expected theoretically. The coefficients of foreign assistance (aid) was negative against the theoretical postulation while population growth has a negative relationship with health outcome as theoretical expected. Furthermore, access to sanitation appeared negative against the expectations and government expenditure appeared negative as expected. The estimated results show that economic globalization account for about -5% of the total shocks causing variation in health outcome. Real GDP account for about -9% of the total shocks causing variation in health outcome while foreign aid account for about 10% variation in health outcome. To that end, the analysis shows that relying on trade liberalization and international financial flow to reduce health outcome may not generate the desired level of health system improvement in Nigeria. This needs to be complimented by designed and implemented health policy measures.

The paper, therefore, concludes that globalization may not have address health outcomes in Nigeria as it somehow challenged by extant factors including micro and macro issues. Therefore, a genuinely health-centered process of globalization can be achieved only by ensuring that the interest of developing countries, Nigeria inclusive and vulnerable populations are fully represented in global decision-making processes.

**Data Availability:** See the appendix

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Appendix: Data Estimation Results

| Date: 12/02/19 Time: 08:18<br>Sample: 1970 2018 |           |           |          |          |          |          |           |
|---|-----------|-----------|----------|----------|----------|----------|-----------|
|   | INF MOR   | KOFIND    | REALGDP  | HELINFR  | ODA      | POPR     | SANITA    |
| Mean  | 113.8755  | 42.60180  | 393607.3 | 1.375804 | 0.859115 | 2.607276 | 44.33776  |
| Median  | 123.9000  | 48.03922  | 275450.6 | 0.742040 | 0.514087 | 2.582376 | 44.80000  |
| Maximum   | 168.9000  | 58.44728  | 1239342. | 6.370300 | 8.117241 | 3.048043 | 71.36667  |
| Minimum   | 62.76667  | 15.20503  | 4219.000 | 0.342000 | 0.054814 | 2.293336 | 15.33000  |
| Std. Dev.                                       | 26.92365  | 13.32031  | 351180.7 | 1.452929 | 1.416226 | 0.151628 | 16.93553  |
| Skewness  | -0.217807 | -0.552292 | 0.915721 | 2.005993 | 4.126110 | 0.993633 | -0.064576 |
| Kurtosis  | 2.406774  | 1.893879  | 2.788518 | 6.244659 | 19.99145 | 4.677000 | 1.773515  |
| Jarque-Bera                                     | 1.105925  | 4.989033  | 6.939426 | 54.48820 | 728.4842 | 13.80485 | 3.105263  |
| Probability                                     | 0.575243  | 0.082536  | 0.031126 | 0.000000 | 0.000000 | 0.001005 | 0.211690  |
| Sum   | 5579.900  | 2087.488  | 19286759 | 67.41440 | 42.09665 | 127.7565 | 2172.550  |
| Sum Sq. Dev.                                    | 34794.38  | 8516.674  | 5.92E+12 | 101.3281 | 96.27341 | 1.103568 | 13766.98  |
| Observations                                    | 49        | 49        | 49       | 49       | 49       | 49       | 49        |

- INF MOR - Infant mortality Rate  
 - KOFIND - KOF Index of Economic Globalization  
 - REALGDP - Real Gross Domestic Product  
 - HELINFR - Health Infrastructure  
 - ODA - Overseas Development Assistance  
 - POPR - Population Rate  
 - SANITA - Access to Sanitation

Correlation

|          | LKOFIND   | LREALGDP  | LHELINFR  | LODA      | LPOPR     | LSANITA   | LGOVHEXP  |
|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| LKOFIND  | 1.000000  | 0.859463  | -0.197856 | 0.460346  | 0.092506  | 0.918996  | 0.890422  |
| LREALGDP | 0.859463  | 1.000000  | -0.057326 | 0.267440  | 0.062926  | 0.961713  | 0.894780  |
| LHELINFR | -0.197856 | -0.057326 | 1.000000  | -0.225543 | -0.115671 | -0.242712 | -0.441251 |
| LODA     | 0.460346  | 0.267440  | -0.225543 | 1.000000  | -0.507233 | 0.379027  | 0.402191  |
| LPOPR    | 0.092506  | 0.062926  | -0.115671 | -0.507233 | 1.000000  | 0.018816  | 0.030004  |
| LSANITA  | 0.918996  | 0.961713  | -0.242712 | 0.379027  | 0.018816  | 1.000000  | 0.974005  |
| LGOVHEXP | 0.890422  | 0.894780  | -0.441251 | 0.402191  | 0.030004  | 0.974005  | 1.000000  |

| UNIT ROOT TEST TABLE (PP)  |             |               |               |               |               |               |               |               |               |
|----------------------------|-------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| At Level                   |             | LINF MOR      | LKOFIND       | LREALGDP      | LHELINFR      | LODA          | LPOPR         | LSANITA       | LGOVHEXP      |
| With Const                 | t-Statistic | 1.0401        | -2.8858       | -5.2267       | -1.1012       | -2.1088       | -2.8064       | -21.2020      | -1.3620       |
|                            | Prob.       | <b>0.9964</b> | <b>0.0545</b> | <b>0.0001</b> | <b>0.7080</b> | <b>0.2430</b> | <b>0.0649</b> | <b>0.0001</b> | <b>0.5929</b> |
|                            |             | n0            | *             | ***           | n0            | n0            | *             | ***           | n0            |
| With Const                 | t-Statistic | -0.3883       | -2.0497       | -2.4944       | -1.6067       | -2.4381       | -2.7563       | -15.4360      | -1.7762       |
|                            | Prob.       | <b>0.9853</b> | <b>0.5598</b> | <b>0.3294</b> | <b>0.7756</b> | <b>0.3562</b> | <b>0.2200</b> | <b>0.0000</b> | <b>0.7007</b> |
|                            |             | n0            | n0            | n0            | n0            | n0            | n0            | ***           | n0            |
| Without Co                 | t-Statistic | -4.2396       | 1.1516        | 2.2886        | -1.0935       | -1.6324       | 0.2210        | 4.5971        | 4.5535        |
|                            | Prob.       | <b>0.0001</b> | <b>0.9335</b> | <b>0.9940</b> | <b>0.2447</b> | <b>0.0962</b> | <b>0.7461</b> | <b>1.0000</b> | <b>1.0000</b> |
|                            |             | ***           | n0            | n0            | n0            | *             | n0            | n0            | n0            |
| At First Difference        |             |               |               |               |               |               |               |               |               |
|                            |             | d(LINFMO)     | d(LKOFIND)    | d(LREALG)     | d(LHELIN)     | d(LODA)       | d(LPOPR)      | d(LSANITA)    | d(LGOVH)      |
| With Const                 | t-Statistic | -1.1371       | -6.5879       | -6.3846       | -3.6005       | -6.0558       | -2.5112       | -11.2320      | -7.7621       |
|                            | Prob.       | <b>0.6934</b> | <b>0.0000</b> | <b>0.0000</b> | <b>0.0094</b> | <b>0.0000</b> | <b>0.1193</b> | <b>0.0000</b> | <b>0.0000</b> |
|                            |             | n0            | ***           | ***           | ***           | ***           | n0            | ***           | ***           |
| With Const                 | t-Statistic | -1.5470       | -7.0286       | -6.9962       | -3.6893       | -8.0102       | -2.5826       | -11.7794      | -7.9414       |
|                            | Prob.       | <b>0.7986</b> | <b>0.0000</b> | <b>0.0000</b> | <b>0.0329</b> | <b>0.0000</b> | <b>0.2897</b> | <b>0.0000</b> | <b>0.0000</b> |
|                            |             | n0            | ***           | ***           | **            | ***           | n0            | ***           | ***           |
| Without Co                 | t-Statistic | -0.5059       | -6.4554       | -5.7102       | -3.6310       | -6.1209       | -2.5358       | -10.5302      | -5.2471       |
|                            | Prob.       | <b>0.4919</b> | <b>0.0000</b> | <b>0.0000</b> | <b>0.0005</b> | <b>0.0000</b> | <b>0.0123</b> | <b>0.0000</b> | <b>0.0000</b> |
|                            |             | n0            | ***           | ***           | ***           | ***           | **            | ***           | ***           |
| UNIT ROOT TEST TABLE (ADF) |             |               |               |               |               |               |               |               |               |
| At Level                   |             | LINF MOR      | LKOFIND       | LREALGDP      | LHELINFR      | LODA          | LPOPR         | LSANITA       | LGOVHEXP      |
| With Const                 | t-Statistic | 4.3114        | -2.8798       | -2.5452       | -1.4260       | -1.9797       | -2.9615       | -4.4664       | -1.7566       |
|                            | Prob.       | <b>1.0000</b> | <b>0.0552</b> | <b>0.1115</b> | <b>0.5617</b> | <b>0.2945</b> | <b>0.0478</b> | <b>0.0008</b> | <b>0.3958</b> |
|                            |             | n0            | *             | n0            | n0            | n0            | **            | ***           | n0            |
| With Const                 | t-Statistic | -0.2357       | -2.0497       | -17.8831      | -2.0720       | -2.3169       | -2.8795       | -1.7124       | -1.9836       |
|                            | Prob.       | <b>0.9899</b> | <b>0.5598</b> | <b>0.0000</b> | <b>0.5475</b> | <b>0.4171</b> | <b>0.1801</b> | <b>0.7297</b> | <b>0.5938</b> |
|                            |             | n0            | n0            | ***           | n0            | n0            | n0            | n0            | n0            |
| Without Co                 | t-Statistic | -2.1274       | 1.1741        | 2.2775        | -1.4345       | -1.2997       | -0.8499       | 2.9754        | 1.6438        |
|                            | Prob.       | <b>0.0334</b> | <b>0.9361</b> | <b>0.9938</b> | <b>0.1393</b> | <b>0.1761</b> | <b>0.3416</b> | <b>0.9990</b> | <b>0.9736</b> |
|                            |             | **            | n0            |
| At First Difference        |             |               |               |               |               |               |               |               |               |
|                            |             | d(LINFMO)     | d(LKOFIND)    | d(LREALG)     | d(LHELIN)     | d(LODA)       | d(LPOPR)      | d(LSANITA)    | d(LGOVH)      |
| With Const                 | t-Statistic | -2.9126       | -6.5900       | -1.9835       | -3.5285       | -5.7668       | -3.8227       | -4.8448       | -3.2297       |
|                            | Prob.       | <b>0.0518</b> | <b>0.0000</b> | <b>0.2927</b> | <b>0.0114</b> | <b>0.0000</b> | <b>0.0056</b> | <b>0.0003</b> | <b>0.0257</b> |
|                            |             | *             | ***           | n0            | **            | ***           | ***           | ***           | **            |
| With Const                 | t-Statistic | -5.0785       | -7.0078       | -6.7096       | -3.6955       | -5.7076       | -3.8180       | -6.0765       | -3.4884       |
|                            | Prob.       | <b>0.0010</b> | <b>0.0000</b> | <b>0.0000</b> | <b>0.0325</b> | <b>0.0001</b> | <b>0.0255</b> | <b>0.0000</b> | <b>0.0547</b> |
|                            |             | ***           | ***           | ***           | **            | ***           | **            | ***           | *             |
| Without Co                 | t-Statistic | 0.9964        | -6.4554       | -1.9612       | -3.5604       | -5.8330       | -3.7592       | -7.2736       | -1.7009       |
|                            | Prob.       | <b>0.9127</b> | <b>0.0000</b> | <b>0.0487</b> | <b>0.0007</b> | <b>0.0000</b> | <b>0.0004</b> | <b>0.0000</b> | <b>0.0840</b> |
|                            |             | n0            | ***           | **            | ***           | ***           | ***           | ***           | *             |

Notes: (\*)Significant at the 10%; (\*\*)Significant at the 5%; (\*\*\*) Significant at the 1%. and (no) Not Significant  
 \*MacKinnon (1996) one-sided p-values.

This Result is The Out-Put of Program Has Developed By:  
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 College of Business and Economics  
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Johansen Cointegration Test

Date: 12/02/19 Time: 08:12  
 Sample (adjusted): 1973 2018  
 Included observations: 46 after adjustments  
 Trend assumption: Linear deterministic trend  
 Series: LINF MOR LKOFIND LREALGDP LHELINFR LODA LPOPR L SANITA LGOVHEXP  
 Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob.** |
|---------------------------|------------|-----------------|---------------------|---------|
| None *                    | 0.906261   | 398.3874        | 159.5297            | 0.0000  |
| At most 1 *               | 0.848748   | 289.4943        | 125.6154            | 0.0000  |
| At most 2 *               | 0.799841   | 202.6092        | 95.75366            | 0.0000  |
| At most 3 *               | 0.672147   | 128.6574        | 69.61889            | 0.0000  |
| At most 4 *               | 0.585119   | 77.35874        | 47.85613            | 0.0000  |
| At most 5 *               | 0.428302   | 36.88957        | 29.79707            | 0.0064  |
| At most 6                 | 0.211477   | 11.16896        | 15.49471            | 0.2013  |
| At most 7                 | 0.005196   | 0.239633        | 3.841466            | 0.6245  |

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level  
 \* denotes rejection of the hypothesis at the 0.05 level  
 \*\*MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

| Hypothesized No. of CE(s) | Eigenvalue | Max-Eigen Statistic | 0.05 Critical Value | Prob.** |
|---------------------------|------------|---------------------|---------------------|---------|
| None *                    | 0.906261   | 108.8931            | 52.36261            | 0.0000  |
| At most 1 *               | 0.848748   | 86.88516            | 46.23142            | 0.0000  |
| At most 2 *               | 0.799841   | 73.95176            | 40.07757            | 0.0000  |
| At most 3 *               | 0.672147   | 51.29867            | 33.87687            | 0.0002  |
| At most 4 *               | 0.585119   | 40.46916            | 27.58434            | 0.0007  |
| At most 5 *               | 0.428302   | 25.72062            | 21.13162            | 0.0105  |
| At most 6                 | 0.211477   | 10.92932            | 14.26460            | 0.1578  |
| At most 7                 | 0.005196   | 0.239633            | 3.841466            | 0.6245  |

Max-eigenvalue test indicates 6 cointegrating eqn(s) at the 0.05 level  
 \* denotes rejection of the hypothesis at the 0.05 level  
 \*\*MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'S11\*b=I):

| LINF MOR  | LKOFIND   | LREALGDP  | LHELINFR  | LODA      | LPOPR     | L SANITA  | LGOVHEXP  |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 5.540145  | 8.148795  | 10.91818  | -0.633696 | -0.978304 | -48.83892 | -4.602568 | -0.297156 |
| 21.63459  | -33.38154 | -4.317897 | -5.190015 | 0.746349  | -5.728287 | -30.88283 | 6.291197  |
| 11.45292  | -5.453003 | 0.719826  | -6.370140 | -2.313295 | 19.30928  | 45.53704  | -4.784611 |
| -36.47635 | 41.27773  | 8.109430  | 0.448625  | 0.461402  | -103.6036 | -74.27150 | -4.193385 |
| 6.515940  | -6.092849 | -3.815496 | -4.409891 | -1.041292 | -16.91420 | 71.18570  | -5.411480 |
| -4.968240 | -0.333945 | -0.339082 | 0.403114  | -0.989706 | -49.88440 | -19.67347 | -2.229343 |
| -4.550244 | 9.220821  | -2.618868 | 2.751772  | -1.222773 | 22.13487  | -0.957379 | 4.803065  |
| 21.08535  | 1.036431  | -1.139553 | -0.548725 | -0.716593 | 31.30671  | 31.52035  | 1.968228  |

Unrestricted Adjustment Coefficients (alpha):

|             |           |           |           |           |           |           |           |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| D(LINF MOR) | -0.000100 | -0.000520 | 0.000512  | -0.000242 | -0.000520 | -6.01E-05 | -0.000109 |
| D(LKOFIND)  | 0.021444  | 0.014348  | -0.020270 | -0.038495 | -0.016302 | -0.020967 | -0.012619 |
| D(LREALGDP) | -0.096112 | -0.036415 | -0.032291 | -0.044725 | 0.035269  | -0.003659 | -0.003018 |
| D(LHELINFR) | -0.003017 | 0.045254  | 0.081228  | -0.012558 | -0.002087 | 0.017429  | -0.024722 |

Johansen Cointegration Test

|  | D(LODA)   | D(LPOPR)  | D(LSANITA) | D(LGOVHEXP) |
|--|-----------|-----------|------------|-------------|
|  | 0.140864  | 0.000955  | -0.000137  | -0.041755   |
|  | -0.017382 | -0.000498 | 0.000129   | -0.058031   |
|  | 0.151063  | -0.001109 | -6.19E-06  | 0.018325    |
|  | -0.180211 | 0.000218  | -1.65E-05  | 0.061128    |
|  | 0.135735  | 0.001081  | -0.000241  | 0.075653    |
|  | 0.106181  | 0.000501  | 0.000380   | -0.026091   |
|  | 0.037865  | -0.000324 | -8.48E-05  | -0.011425   |

| 1 Cointegrating Equation(s):  | Log likelihood | 902.7539  |           |           |            |           |           |
|---|----------------|-----------|-----------|-----------|------------|-----------|-----------|
| Normalized cointegrating coefficients (standard error in parentheses) |                |           |           |           |            |           |           |
| LINFMOR   | LKOFIND        | LREALGDP  | LHELINFR  | LODA      | LPOPR      | LSANITA   | LGOVHEXP  |
| 1.000000  | 1.470863       | 1.970740  | -0.114383 | -0.176585 | -8.81E-09  | -0.830767 | -0.000324 |
|   | (0.33085)      | (0.14562) | (0.09080) | (0.03533) | (1.11E-70) | (1.05908) | (0.12041) |
| Adjustment coefficients (standard error in parentheses)               |                |           |           |           |            |           |           |
| D(LINFMOR)  | -0.000555      |           |           |           |            |           |           |
|   | (0.00121)      |           |           |           |            |           |           |
| D(LKOFIND)  | 0.118803       |           |           |           |            |           |           |
|   | (0.07587)      |           |           |           |            |           |           |
| D(LREALGDP)   | -0.526935      |           |           |           |            |           |           |
|   | (0.10312)      |           |           |           |            |           |           |
| D(LHELINFR)   | -0.016882      |           |           |           |            |           |           |
|   | (0.13367)      |           |           |           |            |           |           |
| D(LODA)   | 0.780405       |           |           |           |            |           |           |
|   | (0.47443)      |           |           |           |            |           |           |
| D(LPOPR)  | 0.005293       |           |           |           |            |           |           |
|   | (0.00245)      |           |           |           |            |           |           |
| D(LSANITA)  | -0.000757      |           |           |           |            |           |           |
|   | (0.00075)      |           |           |           |            |           |           |
| D(LGOVHEXP)   | -0.231330      |           |           |           |            |           |           |
|   | (0.16549)      |           |           |           |            |           |           |

| 2 Cointegrating Equation(s):  | Log likelihood | 946.1965  |           |           |           |           |           |
|---|----------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Normalized cointegrating coefficients (standard error in parentheses) |                |           |           |           |           |           |           |
| LINFMOR   | LKOFIND        | LREALGDP  | LHELINFR  | LODA      | LPOPR     | LSANITA   | LGOVHEXP  |
| 1.000000  | 0.000000       | 0.911542  | -0.175637 | -0.073568 | -4.842407 | -1.121982 | 0.114458  |
|   |                | (0.06362) | (0.04839) | (0.01660) | (0.99770) | (0.54978) | (0.06333) |
| 0.000000  | 1.000000       | 0.720120  | 0.041645  | -0.070038 | -2.837145 | 0.197990  | -0.114283 |
|   |                | (0.04143) | (0.03151) | (0.01091) | (0.38918) | (0.35797) | (0.04123) |
| Adjustment coefficients (standard error in parentheses)               |                |           |           |           |           |           |           |
| D(LINFMOR)  | -0.011806      | 0.016545  |           |           |           |           |           |
|   | (0.00438)      | (0.00674) |           |           |           |           |           |
| D(LKOFIND)  | 0.429223       | -0.304225 |           |           |           |           |           |
|   | (0.29976)      | (0.46122) |           |           |           |           |           |
| D(LREALGDP)   | -1.314749      | 0.440525  |           |           |           |           |           |
|   | (0.38623)      | (0.59426) |           |           |           |           |           |
| D(LHELINFR)   | 0.962165       | -1.535472 |           |           |           |           |           |
|   | (0.50385)      | (0.77525) |           |           |           |           |           |
| D(LODA)   | 0.404361       | 1.728093  |           |           |           |           |           |
|   | (1.91105)      | (2.94040) |           |           |           |           |           |
| D(LPOPR)  | -0.005488      | 0.024421  |           |           |           |           |           |
|   | (0.00966)      | (0.01487) |           |           |           |           |           |
| D(LSANITA)  | 0.002024       | -0.005405 |           |           |           |           |           |
|   | (0.00296)      | (0.00456) |           |           |           |           |           |
| D(LGOVHEXP)   | -1.486803      | 1.596904  |           |           |           |           |           |
|   | (0.62050)      | (0.95472) |           |           |           |           |           |

| 3 Cointegrating Equation(s):  | Log likelihood | 983.1724 |          |      |       |         |          |
|---|----------------|----------|----------|------|-------|---------|----------|
| Normalized cointegrating coefficients (standard error in parentheses) |                |          |          |      |       |         |          |
| LINFMOR   | LKOFIND        | LREALGDP | LHELINFR | LODA | LPOPR | LSANITA | LGOVHEXP |

Johansen Cointegration Test

|   |           |           |           |           |           |           |           |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1.000000  | 0.000000  | 0.000000  | -0.825718 | -0.365077 | 4.327562  | 8.234962  | -0.942710 |
|   |           |           | (0.12085) | (0.04253) | (1.21684) | (1.26945) | (0.16197) |
| 0.000000  | 1.000000  | 0.000000  | -0.471921 | -0.300330 | 4.249170  | 7.590000  | -0.949449 |
|   |           |           | (0.10185) | (0.03584) | (1.02553) | (1.06987) | (0.13651) |
| 0.000000  | 0.000000  | 1.000000  | 0.713167  | 0.319797  | -9.840461 | -10.26497 | 1.159759  |
|   |           |           | (0.14871) | (0.05233) | (1.49731) | (1.56205) | (0.19931) |
| Adjustment coefficients (standard error in parentheses)               |           |           |           |           |           |           |           |
| D(LINF MOR)   | -0.005940 | 0.013752  | 0.001521  |           |           |           |           |
|   | (0.00428) | (0.00593) | (0.00201) |           |           |           |           |
| D(LKOFIND)  | 0.197074  | -0.193694 | 0.157585  |           |           |           |           |
|   | (0.32287) | (0.44757) | (0.15132) |           |           |           |           |
| D(LREALGDP)   | -1.684570 | 0.616605  | -0.904461 |           |           |           |           |
|   | (0.40614) | (0.56300) | (0.19035) |           |           |           |           |
| D(LHELINFR)   | 1.892464  | -1.978409 | -0.170201 |           |           |           |           |
|   | (0.41497) | (0.57524) | (0.19449) |           |           |           |           |
| D(LODA)   | 2.134467  | 0.904349  | 1.721765  |           |           |           |           |
|   | (2.02465) | (2.80662) | (0.94892) |           |           |           |           |
| D(LPOPR)  | -0.018192 | 0.030470  | 0.011785  |           |           |           |           |
|   | (0.00950) | (0.01317) | (0.00445) |           |           |           |           |
| D(LSANITA)  | 0.001953  | -0.005371 | -0.002051 |           |           |           |           |
|   | (0.00333) | (0.00462) | (0.00156) |           |           |           |           |
| D(LGOVHEXP)   | -1.276917 | 1.496973  | -0.192128 |           |           |           |           |
|   | (0.69190) | (0.95913) | (0.32428) |           |           |           |           |
| 4 Cointegrating Equation(s): Log likelihood 1008.822                  |           |           |           |           |           |           |           |
| Normalized cointegrating coefficients (standard error in parentheses) |           |           |           |           |           |           |           |
| LINF MOR  | LKOFIND   | LREALGDP  | LHELINFR  | LODA      | LPOPR     | LSANITA   | LGOVHEXP  |
| 1.000000  | 0.000000  | 0.000000  | 0.000000  | -0.207332 | 6.464732  | 8.438367  | -0.488145 |
|   |           |           |           | (0.02537) | (0.70454) | (0.81040) | (0.08290) |
| 0.000000  | 1.000000  | 0.000000  | 0.000000  | -0.210175 | 5.470610  | 7.706549  | -0.689652 |
|   |           |           |           | (0.02420) | (0.67233) | (0.77302) | (0.07908) |
| 0.000000  | 0.000000  | 1.000000  | 0.000000  | 0.183554  | -11.58630 | -10.44110 | 0.767154  |
|   |           |           |           | (0.03415) | (0.94888) | (1.09108) | (0.11161) |
| 0.000000  | 0.000000  | 0.000000  | 1.000000  | 0.191040  | 2.586232  | 0.246968  | 0.550510  |
|   |           |           |           | (0.03758) | (1.04402) | (1.20037) | (0.12279) |
| Adjustment coefficients (standard error in parentheses)               |           |           |           |           |           |           |           |
| D(LINF MOR)   | 0.002881  | 0.003770  | -0.000440 | -0.000609 |           |           |           |
|   | (0.00727) | (0.00887) | (0.00235) | (0.00136) |           |           |           |
| D(LKOFIND)  | 1.601223  | -1.782670 | -0.154585 | 0.023795  |           |           |           |
|   | (0.46977) | (0.57277) | (0.15159) | (0.08757) |           |           |           |
| D(LREALGDP)   | -0.053152 | -1.229557 | -1.267159 | 0.434895  |           |           |           |
|   | (0.61097) | (0.74493) | (0.19715) | (0.11389) |           |           |           |
| D(LHELINFR)   | 2.350529  | -2.496769 | -0.272038 | -0.756005 |           |           |           |
|   | (0.72449) | (0.88333) | (0.23378) | (0.13505) |           |           |           |
| D(LODA)   | 8.707892  | -8.534335 | 0.260360  | -1.042191 |           |           |           |
|   | (3.23787) | (3.94776) | (1.04481) | (0.60355) |           |           |           |
| D(LPOPR)  | -0.026129 | 0.039451  | 0.013549  | 0.009145  |           |           |           |
|   | (0.01666) | (0.02031) | (0.00538) | (0.00311) |           |           |           |
| D(LSANITA)  | 0.002566  | -0.006053 | -0.002185 | -0.000549 |           |           |           |
|   | (0.00587) | (0.00716) | (0.00190) | (0.00109) |           |           |           |
| D(LGOVHEXP)   | -3.506650 | 4.020206  | 0.303587  | 0.238326  |           |           |           |
|   | (1.10828) | (1.35126) | (0.35762) | (0.20659) |           |           |           |
| 5 Cointegrating Equation(s): Log likelihood 1029.056                  |           |           |           |           |           |           |           |
| Normalized cointegrating coefficients (standard error in parentheses) |           |           |           |           |           |           |           |
| LINF MOR  | LKOFIND   | LREALGDP  | LHELINFR  | LODA      | LPOPR     | LSANITA   | LGOVHEXP  |
| 1.000000  | 0.000000  | 0.000000  | 0.000000  | 0.000000  | -14.88092 | 17.28592  | -0.878919 |
|   |           |           |           |           | (4.34438) | (4.52140) | (0.48643) |

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|   |                        |                        |                        |                        |                        |                        |                        |
|---|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 0.000000  | 1.000000               | 0.000000               | 0.000000               | 0.000000               | -16.18771<br>(4.35874) | 18.67488<br>(4.53634)  | -1.085785<br>(0.48804) |
| 0.000000  | 0.000000               | 1.000000               | 0.000000               | 0.000000               | 7.211318<br>(3.73426)  | -18.27350<br>(3.88642) | 1.113112<br>(0.41812)  |
| 0.000000  | 0.000000               | 0.000000               | 1.000000               | 0.000000               | 22.25652<br>(3.90891)  | -7.904856<br>(4.06819) | 0.910577<br>(0.43767)  |
| 0.000000  | 0.000000               | 0.000000               | 0.000000               | 1.000000               | -102.9540<br>(21.5804) | 42.67085<br>(22.4701)  | -1.884779<br>(2.41742) |
| Adjustment coefficients (standard error in parentheses)               |                        |                        |                        |                        |                        |                        |                        |
| D(LINF MOR)   | -0.000508<br>(0.00589) | 0.006939<br>(0.00715)  | 0.001545<br>(0.00195)  | 0.001685<br>(0.00123)  | -0.001045<br>(0.00038) |                        |                        |
| D(LKOFIND)  | 1.495003<br>(0.45437)  | -1.683347<br>(0.55157) | -0.092387<br>(0.15014) | 0.095683<br>(0.09501)  | 0.035833<br>(0.02901)  |                        |                        |
| D(LREALGDP)   | 0.176661<br>(0.54073)  | -1.444448<br>(0.65640) | -1.401729<br>(0.17868) | 0.279361<br>(0.11306)  | 0.083206<br>(0.03452)  |                        |                        |
| D(LHELINFR)   | 2.336933<br>(0.73208)  | -2.484056<br>(0.88868) | -0.264077<br>(0.24190) | -0.746804<br>(0.15307) | -0.154770<br>(0.04674) |                        |                        |
| D(LODA)   | 9.592656<br>(3.05464)  | -7.361650<br>(3.72020) | -0.257726<br>(1.01266) | -1.640986<br>(0.64079) | -0.724773<br>(0.19564) |                        |                        |
| D(LPOPR)  | -0.019084<br>(0.01414) | 0.032863<br>(0.01717)  | 0.009424<br>(0.00467)  | 0.004376<br>(0.00296)  | 0.000234<br>(0.00090)  |                        |                        |
| D(LSANITA)  | 0.000985<br>(0.00557)  | -0.004584<br>(0.00677) | -0.001265<br>(0.00184) | 0.000515<br>(0.00117)  | 0.000487<br>(0.00036)  |                        |                        |
| D(LGOVH EXP)  | -3.013700<br>(0.91950) | 3.559263<br>(1.11619)  | 0.014933<br>(0.30383)  | -0.095296<br>(0.19226) | -0.095428<br>(0.05870) |                        |                        |
| 6 Cointegrating Equation(s):      Log likelihood      1041.917        |                        |                        |                        |                        |                        |                        |                        |
| Normalized cointegrating coefficients (standard error in parentheses) |                        |                        |                        |                        |                        |                        |                        |
| LINF MOR  | LKOFIND                | LREALGDP               | LHELINFR               | LODA                   | LPOPR                  | LSANITA                | LGOVH EXP              |
| 1.000000  | 0.000000               | 0.000000               | 0.000000               | 0.000000               | 0.000000               | 10.33519<br>(1.77176)  | -0.327005<br>(0.20480) |
| 0.000000  | 1.000000               | 0.000000               | 0.000000               | 0.000000               | 0.000000               | 9.123107<br>(1.63617)  | -0.486145<br>(0.18913) |
| 0.000000  | 0.000000               | 1.000000               | 0.000000               | 0.000000               | 0.000000               | -14.90517<br>(2.36681) | 0.845654<br>(0.27358)  |
| 0.000000  | 0.000000               | 0.000000               | 1.000000               | 0.000000               | 0.000000               | 2.490942<br>(1.73631)  | 0.085112<br>(0.20070)  |
| 0.000000  | 0.000000               | 0.000000               | 0.000000               | 1.000000               | 0.000000               | -5.417918<br>(6.79627) | 1.933650<br>(0.78558)  |
| 0.000000  | 0.000000               | 0.000000               | 0.000000               | 0.000000               | 1.000000               | -0.467090<br>(0.19030) | 0.037069<br>(0.02200)  |
| Adjustment coefficients (standard error in parentheses)               |                        |                        |                        |                        |                        |                        |                        |
| D(LINF MOR)   | -0.000210<br>(0.00590) | 0.006959<br>(0.00712)  | 0.001565<br>(0.00194)  | 0.001661<br>(0.00123)  | -0.000986<br>(0.00040) | 0.054605<br>(0.01673)  |                        |
| D(LKOFIND)  | 1.599169<br>(0.42091)  | -1.676345<br>(0.50784) | -0.085278<br>(0.13827) | 0.087231<br>(0.08755)  | 0.056584<br>(0.02826)  | 3.788932<br>(1.19339)  |                        |
| D(LREALGDP)   | 0.194838<br>(0.54317)  | -1.443226<br>(0.65534) | -1.400488<br>(0.17843) | 0.277886<br>(0.11298)  | 0.086827<br>(0.03647)  | 8.449929<br>(1.54002)  |                        |
| D(LHELINFR)   | 2.250342<br>(0.72149)  | -2.489877<br>(0.87049) | -0.269987<br>(0.23701) | -0.739778<br>(0.15007) | -0.172019<br>(0.04845) | 1.924955<br>(2.04561)  |                        |
| D(LODA)   | 9.065124<br>(2.94810)  | -7.397108<br>(3.55696) | -0.293730<br>(0.96846) | -1.598183<br>(0.61323) | -0.829861<br>(0.19796) | 7.213853<br>(8.35865)  |                        |
| D(LPOPR)  | -0.021574<br>(0.01357) | 0.032696<br>(0.01638)  | 0.009254<br>(0.00446)  | 0.004579<br>(0.00282)  | -0.000262<br>(0.00091) | -0.131065<br>(0.03848) |                        |
| D(LSANITA)  | -0.000903<br>(0.00450) | -0.004710<br>(0.00553) | -0.001394<br>(0.00151) | 0.000668<br>(0.00096)  | 0.000111<br>(0.00031)  | -0.007345<br>(0.01299) |                        |
| D(LGOVH EXP)  | -2.884075<br>(0.89811) | 3.567976<br>(1.08359)  | 0.023780<br>(0.29503)  | -0.105813<br>(0.18681) | -0.069606<br>(0.06031) | -3.585642<br>(2.54638) |                        |

Johansen Cointegration Test

| 7 Cointegrating Equation(s):  |                        | Log likelihood         | 1047.381               |                        |                        |                        |                        |
|---|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Normalized cointegrating coefficients (standard error in parentheses) |                        |                        |                        |                        |                        |                        |                        |
| LINF MOR  | LKOFIND                | LREALGDP               | LHELINFR               | LODA                   | LPOPR                  | LSANITA                | LGOVHEXP               |
| 1.000000  | 0.000000               | 0.000000               | 0.000000               | 0.000000               | 0.000000               | 0.000000               | 1.131517<br>(0.23546)  |
| 0.000000  | 1.000000               | 0.000000               | 0.000000               | 0.000000               | 0.000000               | 0.000000               | 0.801325<br>(0.21252)  |
| 0.000000  | 0.000000               | 1.000000               | 0.000000               | 0.000000               | 0.000000               | 0.000000               | -1.257792<br>(0.32258) |
| 0.000000  | 0.000000               | 0.000000               | 1.000000               | 0.000000               | 0.000000               | 0.000000               | 0.436838<br>(0.11520)  |
| 0.000000  | 0.000000               | 0.000000               | 0.000000               | 1.000000               | 0.000000               | 0.000000               | 1.169064<br>(0.45273)  |
| 0.000000  | 0.000000               | 0.000000               | 0.000000               | 0.000000               | 1.000000               | 0.000000               | -0.028828<br>(0.01408) |
| 0.000000  | 0.000000               | 0.000000               | 0.000000               | 0.000000               | 0.000000               | 1.000000               | -0.141122<br>(0.02130) |
| Adjustment coefficients (standard error in parentheses)               |                        |                        |                        |                        |                        |                        |                        |
| D(LINF MOR)   | 0.000286<br>(0.00586)  | 0.005955<br>(0.00713)  | 0.001850<br>(0.00194)  | 0.001361<br>(0.00126)  | -0.000852<br>(0.00042) | 0.052194<br>(0.01677)  | 0.022073<br>(0.01533)  |
| D(LKOFIND)  | 1.656587<br>(0.40906)  | -1.792696<br>(0.49806) | -0.052231<br>(0.13577) | 0.052508<br>(0.08823)  | 0.072014<br>(0.02948)  | 3.509622<br>(1.17112)  | 0.658347<br>(1.07020)  |
| D(LREALGDP)   | 0.208571<br>(0.54532)  | -1.471053<br>(0.86397) | -1.392584<br>(0.18100) | 0.269581<br>(0.11763)  | 0.090517<br>(0.03930)  | 8.383126<br>(1.56124)  | 5.999290<br>(1.42670)  |
| D(LHELINFR)   | 2.362833<br>(0.69365)  | -2.717828<br>(0.84457) | -0.205243<br>(0.23024) | -0.807807<br>(0.14962) | -0.141790<br>(0.04999) | 1.377737<br>(1.98591)  | 2.780291<br>(1.81477)  |
| D(LODA)   | 8.892830<br>(2.94537)  | -7.047973<br>(3.58621) | -0.392892<br>(0.97763) | -1.493988<br>(0.63532) | -0.876161<br>(0.21226) | 8.051982<br>(8.43253)  | 27.69264<br>(7.70585)  |
| D(LPOPR)  | -0.020099<br>(0.01336) | 0.029706<br>(0.01628)  | 0.010103<br>(0.00443)  | 0.003686<br>(0.00288)  | 0.000134<br>(0.00096)  | -0.138242<br>(0.03824) | 0.011736<br>(0.03495)  |
| D(LSANITA)  | -0.000517<br>(0.00455) | -0.005492<br>(0.00554) | -0.001172<br>(0.00151) | 0.000435<br>(0.00098)  | 0.000215<br>(0.00033)  | -0.009222<br>(0.01302) | -0.026959<br>(0.01190) |
| D(LGOVHEXP)   | -2.832088<br>(0.89738) | 3.462629<br>(1.09263)  | 0.053701<br>(0.29788)  | -0.137253<br>(0.19356) | -0.055635<br>(0.06467) | -3.838536<br>(2.56918) | 4.188411<br>(2.34778)  |

Vector Error Correction Estimates

| Vector Error Correction Estimates            |                                      |                                      |                                      |                                      |                                      |                                      |                                      |
|--|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|
| Date: 12/02/19 Time: 08:13                   |                                      |                                      |                                      |                                      |                                      |                                      |                                      |
| Sample (adjusted): 1973 2018                 |                                      |                                      |                                      |                                      |                                      |                                      |                                      |
| Included observations: 46 after adjustments  |                                      |                                      |                                      |                                      |                                      |                                      |                                      |
| Standard errors in ( ) & t-statistics in [ ] |                                      |                                      |                                      |                                      |                                      |                                      |                                      |
| Cointegrating Eq:                            | CointEq1                             |                                      |                                      |                                      |                                      |                                      |                                      |
| LINF MOR(-1)                                 | 1.000000                             |                                      |                                      |                                      |                                      |                                      |                                      |
| LKOFIND(-1)                                  | 1.470863<br>(0.33085)<br>[ 4.44569]  |                                      |                                      |                                      |                                      |                                      |                                      |
| LREALGDP(-1)                                 | 1.970740<br>(0.14562)<br>[ 13.5335]  |                                      |                                      |                                      |                                      |                                      |                                      |
| LHELINFR(-1)                                 | -0.114383<br>(0.09080)<br>[-1.25979] |                                      |                                      |                                      |                                      |                                      |                                      |
| LODA(-1)                                     | -0.176585<br>(0.03533)<br>[-4.99747] |                                      |                                      |                                      |                                      |                                      |                                      |
| LPOPR(-1)                                    | -8.815459<br>(1.11570)<br>[-7.90126] |                                      |                                      |                                      |                                      |                                      |                                      |
| LSANITA(-1)                                  | -0.830767<br>(1.05908)<br>[-0.78442] |                                      |                                      |                                      |                                      |                                      |                                      |
| LGOVHEXP(-1)                                 | -0.053637<br>(0.12041)<br>[-0.44543] |                                      |                                      |                                      |                                      |                                      |                                      |
| C  | -22.33556                            |                                      |                                      |                                      |                                      |                                      |                                      |
| Error Correction:                            | D(LINF MOR)                          | D(LKOFIND)                           | D(LREALGDP)                          | D(LHELINFR)                          | D(LODA)                              | D(LPOPR)                             | D(LSANITA)                           |
| CointEq1                                     | -0.000555<br>(0.00121)<br>[-0.45652] | 0.118803<br>(0.07587)<br>[ 1.56598]  | -0.526935<br>(0.10312)<br>[-5.10995] | -0.016882<br>(0.13367)<br>[-0.12629] | 0.780405<br>(0.47443)<br>[ 1.64493]  | 0.005293<br>(0.00245)<br>[ 2.15757]  | -0.000757<br>(0.00075)<br>[-1.01288] |
| D(LINF MOR(-1))                              | 1.700302<br>(0.14974)<br>[ 11.3550]  | -4.240422<br>(9.35095)<br>[-0.45347] | 13.40935<br>(12.7102)<br>[ 1.05500]  | 27.28772<br>(16.4760)<br>[ 1.65621]  | -13.36451<br>(58.4769)<br>[-0.22854] | -0.960140<br>(0.30239)<br>[-3.17516] | 0.122342<br>(0.09211)<br>[ 1.32820]  |
| D(LINF MOR(-2))                              | -0.716569<br>(0.14503)<br>[-4.94069] | 4.203716<br>(9.05710)<br>[ 0.46413]  | -5.718553<br>(12.3108)<br>[-0.46452] | -28.03213<br>(15.9582)<br>[-1.75659] | 23.32065<br>(56.6393)<br>[ 0.41174]  | 0.578374<br>(0.29289)<br>[ 1.97473]  | -0.074186<br>(0.08922)<br>[-0.83153] |
| D(LKOFIND(-1))                               | -0.001851<br>(0.00424)<br>[-0.43838] | -0.793824<br>(0.26487)<br>[-2.99704] | -1.086125<br>(0.36002)<br>[-3.01683] | -0.629873<br>(0.46689)<br>[-1.34986] | -3.436945<br>(1.65638)<br>[-2.07497] | 0.001512<br>(0.00857)<br>[ 0.17654]  | 0.000621<br>(0.00261)<br>[ 0.23802]  |
| D(LKOFIND(-2))                               | 0.002628<br>(0.00535)<br>[ 0.49125]  | -0.459962<br>(0.33405)<br>[-1.37694] | -0.029941<br>(0.45405)<br>[-0.06594] | -0.364813<br>(0.58858)<br>[-0.61982] | 0.249102<br>(2.08899)<br>[ 0.11925]  | 0.004859<br>(0.01080)<br>[ 0.44982]  | -0.001090<br>(0.00329)<br>[-0.33127] |
| D(LREALGDP(-1))                              | 0.001037                             | -0.127923                            | 0.359839                             | -0.139053                            | 0.086626                             | -0.004700                            | 0.000670                             |

Vector Error Correction Estimates

|   |                                      |                                      |                                      |                                      |                                      |                                      |                                      |
|---|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|
|   | (0.00172)<br>[ 0.60227]              | (0.10750)<br>[-1.18993]              | (0.14613)<br>[ 2.46253]              | (0.18942)<br>[-0.73410]              | (0.67229)<br>[ 0.09910]              | (0.00348)<br>[-1.35202]              | (0.00106)<br>[ 0.63254]              |
| D(LREALGDP(-2))                         | 0.000750<br>(0.00112)<br>[ 0.86922]  | 0.016032<br>(0.06996)<br>[ 0.22917]  | 0.119103<br>(0.09509)<br>[ 1.25255]  | 0.051119<br>(0.12326)<br>[ 0.49585]  | 0.048142<br>(0.43748)<br>[ 0.11004]  | -0.005145<br>(0.00226)<br>[-2.27436] | 0.000757<br>(0.00069)<br>[ 1.09860]  |
| D(LHELINFR(-1))                         | -0.000515<br>(0.00177)<br>[-0.29150] | -0.040991<br>(0.11027)<br>[-0.37174] | -0.216879<br>(0.14988)<br>[-1.44700] | 0.508467<br>(0.19429)<br>[ 2.61707]  | -0.421582<br>(0.68957)<br>[-0.61137] | -0.000738<br>(0.00357)<br>[-0.20689] | -0.001992<br>(0.00109)<br>[-1.83354] |
| D(LHELINFR(-2))                         | 0.000402<br>(0.00161)<br>[ 0.24969]  | 0.038778<br>(0.10053)<br>[ 0.38575]  | -0.077881<br>(0.13684)<br>[-0.56987] | -0.274957<br>(0.17712)<br>[-1.55235] | -0.177721<br>(0.62865)<br>[-0.28270] | -0.000402<br>(0.00325)<br>[-0.12372] | 0.000381<br>(0.00099)<br>[ 0.38446]  |
| D(LODA(-1))                             | 0.000316<br>(0.00041)<br>[ 0.76888]  | 0.032765<br>(0.02563)<br>[ 1.27859]  | 0.013815<br>(0.03483)<br>[ 0.39663]  | -0.053919<br>(0.04515)<br>[-1.19419] | 0.131709<br>(0.16025)<br>[ 0.82188]  | -1.03E-05<br>(0.00083)<br>[-0.01240] | 6.13E-05<br>(0.00025)<br>[ 0.24269]  |
| D(LODA(-2))                             | 0.000218<br>(0.00042)<br>[ 0.52037]  | 0.008959<br>(0.02616)<br>[ 0.34251]  | -0.011608<br>(0.03555)<br>[-0.32648] | 0.031004<br>(0.04609)<br>[ 0.67269]  | -0.417524<br>(0.16358)<br>[-2.55238] | 0.000560<br>(0.00085)<br>[ 0.66232]  | -0.000168<br>(0.00026)<br>[-0.65198] |
| D(LPOPR(-1))                            | -0.008451<br>(0.05237)<br>[-0.16138] | 3.502595<br>(3.27015)<br>[ 1.07108]  | 22.66899<br>(4.44493)<br>[ 5.09696]  | 3.722213<br>(5.76186)<br>[ 0.64601]  | -15.64728<br>(20.4501)<br>[-0.76514] | 1.361650<br>(0.10575)<br>[ 12.8761]  | 0.028595<br>(0.03221)<br>[ 0.88769]  |
| D(LPOPR(-2))                            | 5.81E-05<br>(0.05209)<br>[ 0.00112]  | -0.802332<br>(3.25302)<br>[-0.24654] | -26.47092<br>(4.42165)<br>[-5.98666] | -4.771959<br>(5.73168)<br>[-0.83256] | 28.35399<br>(20.3430)<br>[ 1.39380]  | -0.781416<br>(0.10520)<br>[-7.42820] | -0.024615<br>(0.03204)<br>[-0.76818] |
| D(LSANITA(-1))                          | -0.283767<br>(0.30880)<br>[-0.91894] | -0.590343<br>(19.2838)<br>[-0.03061] | -44.27767<br>(26.2115)<br>[-1.68925] | -17.13246<br>(33.9774)<br>[-0.50423] | -27.80197<br>(120.593)<br>[-0.23054] | 0.712826<br>(0.62360)<br>[ 1.14308]  | 0.253302<br>(0.18995)<br>[ 1.33349]  |
| D(LSANITA(-2))                          | 0.205530<br>(0.28646)<br>[ 0.77133]  | 21.65104<br>(16.6400)<br>[ 1.30115]  | -30.20444<br>(22.6178)<br>[-1.33543] | 17.13545<br>(29.3189)<br>[ 0.58445]  | 142.6272<br>(104.059)<br>[ 1.37064]  | 0.414832<br>(0.53810)<br>[ 0.77092]  | 0.506937<br>(0.16391)<br>[ 3.09276]  |
| D(LGOVHEXP(-1))                         | -0.001505<br>(0.00156)<br>[-0.98775] | -0.041241<br>(0.09711)<br>[-0.42468] | 0.003550<br>(0.13200)<br>[ 0.02690]  | 0.100229<br>(0.17111)<br>[ 0.58577]  | -1.167359<br>(0.60730)<br>[-1.92223] | 0.006982<br>(0.00314)<br>[ 2.22341]  | -0.000711<br>(0.00096)<br>[-0.74367] |
| D(LGOVHEXP(-2))                         | 0.000400<br>(0.00137)<br>[ 0.29212]  | 0.036983<br>(0.08552)<br>[ 0.43246]  | -0.028374<br>(0.11624)<br>[-0.24410] | 0.048565<br>(0.15080)<br>[ 0.32231]  | -0.913184<br>(0.53479)<br>[-1.70754] | 0.004928<br>(0.00277)<br>[ 1.78214]  | 0.000154<br>(0.00084)<br>[ 0.18281]  |
| C                                       | 0.001831<br>(0.00698)<br>[ 0.26251]  | -0.637218<br>(0.43563)<br>[-1.46274] | 2.653263<br>(0.59213)<br>[ 4.48087]  | -0.036922<br>(0.76757)<br>[-0.04810] | -3.204883<br>(2.72426)<br>[-1.17642] | -0.044378<br>(0.01409)<br>[-3.15020] | 0.006495<br>(0.00429)<br>[ 1.51358]  |
| R-squared                               | 0.993024                             | 0.534099                             | 0.901352                             | 0.809231                             | 0.399899                             | 0.988238                             | 0.997428                             |
| Adj. R-squared                          | 0.988789                             | 0.251230                             | 0.841458                             | 0.371978                             | 0.035551                             | 0.981097                             | 0.995865                             |
| Sum sq. resid                           | 6.19E-05                             | 0.241524                             | 0.446227                             | 0.749811                             | 9.445313                             | 0.000253                             | 2.34E-05                             |
| S. E. equation                          | 0.001487                             | 0.092875                             | 0.126241                             | 0.163643                             | 0.580803                             | 0.003003                             | 0.000915                             |
| F-statistic                             | 234.4726                             | 1.888152                             | 15.04919                             | 2.567856                             | 1.097575                             | 138.3839                             | 638.7269                             |
| Log likelihood                          | 245.6451                             | 55.46571                             | 41.34693                             | 29.41007                             | -28.85935                            | 213.3153                             | 267.9967                             |
| Akaike AIC                              | -9.897614                            | -1.628944                            | -1.015084                            | -0.496090                            | 2.037363                             | -8.491971                            | -10.86942                            |
| Schwarz SC                              | -9.182059                            | -0.913388                            | -0.299529                            | 0.219465                             | 2.752918                             | -7.776415                            | -10.15386                            |
| Mean dependent                          | -0.020233                            | 0.017759                             | 0.120317                             | -0.010650                            | -0.008124                            | 0.001595                             | 0.030200                             |
| S. D. dependent                         | 0.014046                             | 0.107331                             | 0.317049                             | 0.206495                             | 0.591411                             | 0.021845                             | 0.014230                             |
| Determinant resid covariance (dof adj.) |                                      | 6.59E-26                             |                                      |                                      |                                      |                                      |                                      |
| Determinant resid covariance            |                                      | 1.24E-27                             |                                      |                                      |                                      |                                      |                                      |

Variance Decomposition using Cholesky (d.f. adjusted) Factors

| Variance Decomposition of LINF MOR: |          |          |          |          |          |          |          |          |
|-------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| Period                              | S.E.     | LINF MOR | LKOFIND  | LREALGDP | LHELINFR | LODA     | LPOPR    | LSANITA  |
| 1                                   | 0.001175 | 100.0000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 2                                   | 0.002588 | 97.35759 | 0.074042 | 0.386661 | 0.089147 | 0.265574 | 0.006414 | 0.072293 |
| 3                                   | 0.004241 | 93.47529 | 0.125199 | 1.065283 | 0.102084 | 0.756575 | 0.004033 | 0.054619 |
| 4                                   | 0.006072 | 88.44631 | 0.633390 | 1.904380 | 0.098478 | 1.411748 | 0.022742 | 0.032215 |
| 5                                   | 0.008097 | 82.52624 | 1.476705 | 2.820016 | 0.116742 | 2.352035 | 0.138200 | 0.018128 |
| 6                                   | 0.010362 | 75.94953 | 2.354951 | 3.777889 | 0.160014 | 3.705508 | 0.430588 | 0.019032 |
| 7                                   | 0.012879 | 69.00607 | 3.176065 | 4.846686 | 0.219871 | 5.391522 | 0.948813 | 0.054162 |
| 8                                   | 0.015664 | 61.90279 | 3.900790 | 6.137255 | 0.286617 | 7.241540 | 1.675172 | 0.143785 |
| 9                                   | 0.018724 | 54.85297 | 4.503887 | 7.837590 | 0.344006 | 9.113417 | 2.533885 | 0.295813 |
| 10                                  | 0.022043 | 48.14919 | 4.962834 | 9.193972 | 0.378270 | 10.90549 | 3.420313 | 0.501842 |

| Variance Decomposition of LKOFIND: |          |          |          |          |          |          |          |          |
|------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| Period                             | S.E.     | LINF MOR | LKOFIND  | LREALGDP | LHELINFR | LODA     | LPOPR    | LSANITA  |
| 1                                  | 0.074729 | 8.120752 | 91.87925 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 2                                  | 0.079826 | 7.138533 | 81.59342 | 2.936287 | 2.128390 | 1.590130 | 3.456282 | 0.314821 |
| 3                                  | 0.088933 | 6.055845 | 65.73919 | 15.54950 | 2.259110 | 4.646952 | 4.080804 | 0.319361 |
| 4                                  | 0.095107 | 5.301168 | 56.05895 | 22.70750 | 2.326340 | 4.219443 | 4.126887 | 0.339391 |
| 5                                  | 0.098264 | 5.201251 | 55.12135 | 21.53608 | 2.995018 | 3.982146 | 3.944555 | 0.324015 |
| 6                                  | 0.100763 | 5.327338 | 52.57305 | 22.14710 | 3.496122 | 3.809923 | 3.822532 | 0.360861 |
| 7                                  | 0.103432 | 5.323215 | 50.48343 | 24.15324 | 3.508804 | 3.850522 | 4.056437 | 0.554697 |
| 8                                  | 0.106539 | 5.023187 | 49.36338 | 25.10950 | 3.327291 | 3.799264 | 4.585035 | 0.903350 |
| 9                                  | 0.109358 | 4.989987 | 48.03016 | 25.60317 | 3.540255 | 3.610931 | 5.083556 | 1.166444 |
| 10                                 | 0.111680 | 5.559192 | 46.38840 | 25.90099 | 4.075498 | 3.496744 | 5.245893 | 1.233578 |

| Variance Decomposition of LREALGDP: |          |          |          |          |          |          |          |          |
|-------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| Period                              | S.E.     | LINF MOR | LKOFIND  | LREALGDP | LHELINFR | LODA     | LPOPR    | LSANITA  |
| 1                                   | 0.150559 | 5.563577 | 4.749416 | 89.68701 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 2                                   | 0.234371 | 5.069818 | 33.97000 | 58.94923 | 0.068614 | 0.015525 | 0.210197 | 0.685689 |
| 3                                   | 0.248944 | 4.500789 | 30.12185 | 52.51623 | 0.678067 | 1.461004 | 0.425869 | 0.609776 |
| 4                                   | 0.274401 | 3.781741 | 25.66050 | 50.80275 | 0.560065 | 4.020838 | 0.350707 | 0.509075 |
| 5                                   | 0.284210 | 3.570823 | 24.43872 | 53.16408 | 0.580526 | 4.026453 | 0.362738 | 0.477813 |
| 6                                   | 0.289937 | 3.433642 | 26.26244 | 51.08487 | 0.644346 | 3.869300 | 0.412256 | 0.472162 |
| 7                                   | 0.297196 | 3.308793 | 26.64910 | 50.69205 | 1.060017 | 3.913378 | 0.524298 | 0.449493 |
| 8                                   | 0.302363 | 3.273644 | 25.75028 | 50.46226 | 1.424159 | 4.686176 | 0.742487 | 0.503786 |
| 9                                   | 0.306453 | 3.188620 | 25.40062 | 49.40097 | 1.447605 | 5.324435 | 1.081739 | 0.706835 |
| 10                                  | 0.308718 | 3.248190 | 25.14783 | 48.82999 | 1.449781 | 5.438697 | 1.429162 | 0.892115 |

| Variance Decomposition of LHELINFR: |          |          |          |          |          |          |          |          |
|-------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| Period                              | S.E.     | LINF MOR | LKOFIND  | LREALGDP | LHELINFR | LODA     | LPOPR    | LSANITA  |
| 1                                   | 0.127413 | 14.50123 | 3.965635 | 2.515668 | 79.01747 | 0.000000 | 0.000000 | 0.000000 |
| 2                                   | 0.208909 | 11.55688 | 22.89109 | 2.938539 | 55.76318 | 5.325852 | 0.487140 | 1.026544 |
| 3                                   | 0.263805 | 12.69053 | 25.53446 | 1.972957 | 43.65895 | 13.00519 | 0.483135 | 1.438866 |
| 4                                   | 0.294671 | 13.20465 | 24.68665 | 1.581896 | 36.50831 | 18.56332 | 0.387988 | 2.077684 |
| 5                                   | 0.309755 | 13.41552 | 23.89188 | 1.470110 | 33.12690 | 20.79880 | 0.394081 | 2.523212 |
| 6                                   | 0.316415 | 13.64336 | 23.48331 | 1.487930 | 31.76328 | 21.36764 | 0.414517 | 2.689143 |
| 7                                   | 0.320189 | 13.96783 | 23.09964 | 1.680625 | 31.05895 | 21.46172 | 0.413055 | 2.697536 |
| 8                                   | 0.324451 | 14.20838 | 22.51674 | 2.321360 | 30.26114 | 21.35325 | 0.682486 | 2.664027 |
| 9                                   | 0.331833 | 14.05403 | 21.52611 | 3.909323 | 28.92963 | 20.96887 | 1.583838 | 2.623029 |
| 10                                  | 0.343739 | 13.32316 | 20.06078 | 6.625628 | 26.96170 | 20.30360 | 3.049366 | 2.627296 |

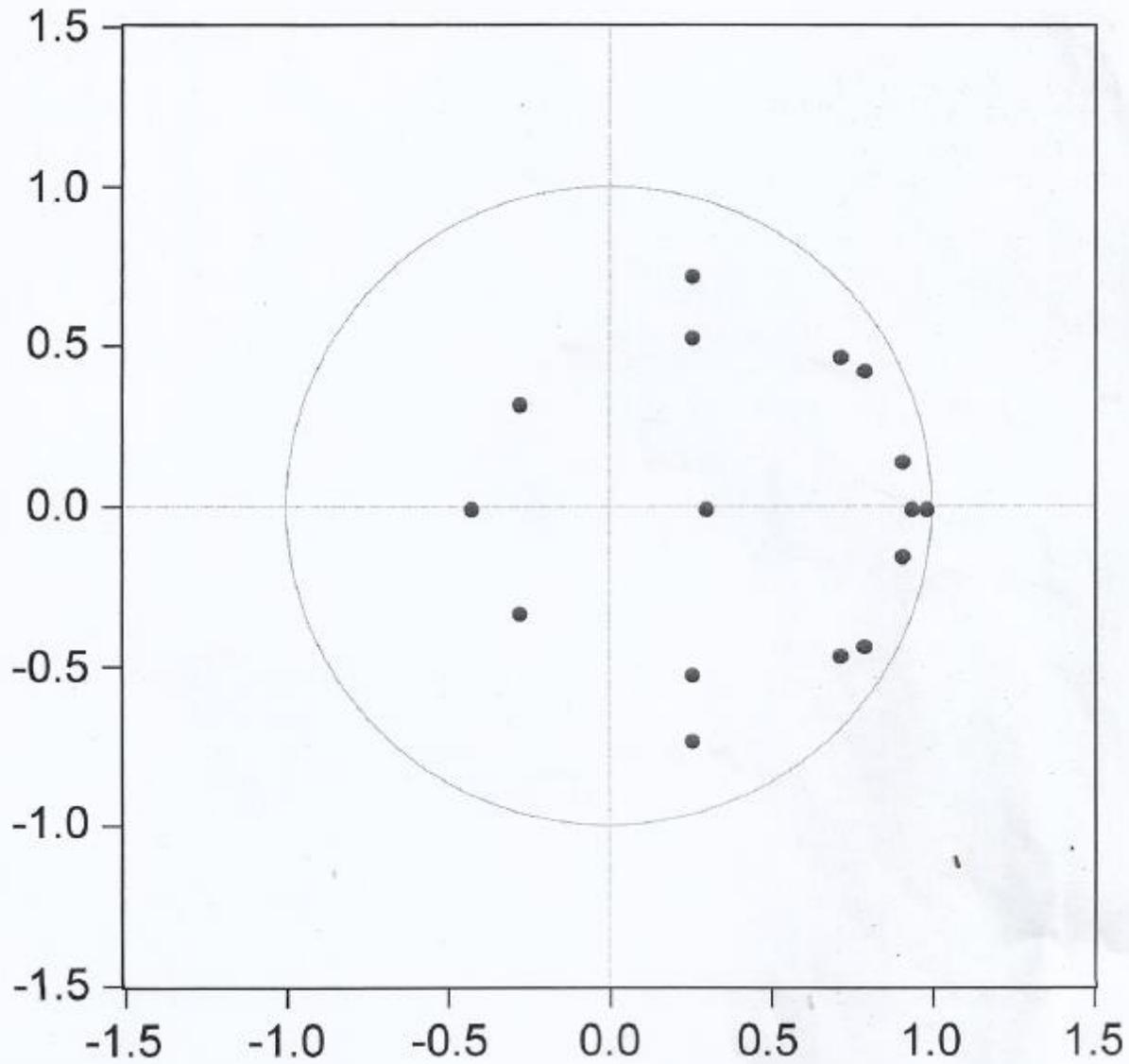
| Variance Decomposition of LODA: |          |          |          |          |          |          |          |          |
|---------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| Period                          | S.E.     | LINF MOR | LKOFIND  | LREALGDP | LHELINFR | LODA     | LPOPR    | LSANITA  |
| 1                               | 0.522008 | 11.54083 | 1.565354 | 1.366583 | 0.061780 | 85.46546 | 0.000000 | 0.000000 |
| 2                               | 0.649001 | 9.956726 | 1.127804 | 1.997370 | 4.410287 | 78.65814 | 0.515489 | 3.293492 |
| 3                               | 0.709068 | 8.561637 | 0.946737 | 1.831103 | 10.01474 | 67.84658 | 1.117675 | 7.839961 |
| 4                               | 0.732813 | 8.371693 | 0.901900 | 2.081815 | 11.99810 | 63.61028 | 1.077517 | 9.154308 |

Variance Decomposition using Cholesky (d.f. adjusted) Factors

|  |          |          |          |          |          |          |          |          |
|--|----------|----------|----------|----------|----------|----------|----------|----------|
| 5  | 0.740792 | 8.369430 | 1.049090 | 2.829892 | 11.76460 | 62.49461 | 1.115094 | 9.589921 |
| 6  | 0.756243 | 8.045997 | 2.571768 | 3.965608 | 12.02234 | 60.00862 | 1.216321 | 9.369235 |
| 7  | 0.776935 | 7.759323 | 4.200684 | 5.045928 | 12.97952 | 56.97556 | 1.306888 | 8.918257 |
| 8  | 0.795002 | 7.854353 | 5.031722 | 5.838373 | 13.68837 | 54.91500 | 1.364212 | 8.517572 |
| 9  | 0.806090 | 8.190852 | 5.322348 | 6.112598 | 13.97011 | 53.89136 | 1.396082 | 8.309677 |
| 10   | 0.811140 | 8.575602 | 5.391902 | 6.059734 | 14.01654 | 53.45525 | 1.402381 | 8.249079 |
| <b>Variance Decomposition of LPOPR:</b>  |          |          |          |          |          |          |          |          |
| Period   | S.E.     | LINFMOR  | LKOFIND  | LREALGDP | LHELINFR | LODA     | LPOPR    | LSANITA  |
| 1  | 0.004121 | 2.211855 | 2.527475 | 33.84222 | 0.009083 | 0.743423 | 60.66594 | 0.000000 |
| 2  | 0.009465 | 0.829641 | 3.292234 | 46.78893 | 0.003589 | 2.877972 | 44.49534 | 0.701062 |
| 3  | 0.015336 | 0.351669 | 2.984261 | 52.28149 | 0.031378 | 3.929300 | 34.77981 | 1.658701 |
| 4  | 0.020272 | 1.243678 | 2.342111 | 52.21140 | 0.252752 | 4.358034 | 29.05043 | 2.567102 |
| 5  | 0.023611 | 3.495932 | 1.883997 | 48.50221 | 0.763992 | 4.604692 | 25.17193 | 3.047239 |
| 6  | 0.025476 | 6.923716 | 1.619647 | 43.52955 | 1.539190 | 4.673108 | 22.42849 | 3.136482 |
| 7  | 0.026575 | 10.59825 | 1.721457 | 40.13665 | 2.188479 | 4.482400 | 20.61789 | 2.962464 |
| 8  | 0.027683 | 12.93786 | 2.255016 | 39.76060 | 2.311408 | 4.131629 | 19.68267 | 2.745683 |
| 9  | 0.029136 | 13.18131 | 2.857180 | 41.25223 | 2.089031 | 3.795320 | 19.27399 | 2.629537 |
| 10   | 0.030741 | 12.17714 | 3.098585 | 42.46661 | 2.041662 | 3.562033 | 18.90881 | 2.578549 |
| <b>Variance Decomposition of LSANITA:</b>  |          |          |          |          |          |          |          |          |
| Period   | S.E.     | LINFMOR  | LKOFIND  | LREALGDP | LHELINFR | LODA     | LPOPR    | LSANITA  |
| 1  | 0.000825 | 2.957657 | 1.435049 | 6.675013 | 0.695681 | 12.43696 | 0.000362 | 75.79928 |
| 2  | 0.001366 | 1.162686 | 1.488627 | 9.951321 | 1.736067 | 14.43136 | 0.004695 | 70.96844 |
| 3  | 0.001914 | 1.694860 | 1.297493 | 11.77431 | 2.204521 | 17.95552 | 0.150095 | 64.10433 |
| 4  | 0.002469 | 2.624543 | 1.190553 | 14.36062 | 1.754119 | 20.38003 | 0.503578 | 57.15304 |
| 5  | 0.003018 | 3.072343 | 1.218095 | 17.56018 | 1.202751 | 20.99833 | 0.938661 | 51.47542 |
| 6  | 0.003557 | 3.160297 | 1.292841 | 20.83783 | 0.889612 | 20.57905 | 1.428977 | 46.49767 |
| 7  | 0.004079 | 3.030103 | 1.321899 | 23.49914 | 0.787930 | 19.87302 | 1.963058 | 42.24048 |
| 8  | 0.004582 | 2.820241 | 1.281269 | 25.31993 | 0.781761 | 19.27858 | 2.533422 | 38.65726 |
| 9  | 0.005064 | 2.590809 | 1.161433 | 26.42361 | 0.786531 | 18.93790 | 3.112263 | 35.70818 |
| 10   | 0.005526 | 2.369273 | 1.001272 | 27.02924 | 0.764156 | 18.86393 | 3.656483 | 33.28692 |
| <b>Variance Decomposition of LGOVHEXP:</b>                                       |          |          |          |          |          |          |          |          |
| Period   | S.E.     | LINFMOR  | LKOFIND  | LREALGDP | LHELINFR | LODA     | LPOPR    | LSANITA  |
| 1  | 0.163743 | 13.99062 | 2.682433 | 1.268993 | 1.053308 | 3.151035 | 3.991713 | 6.372877 |
| 2  | 0.189560 | 11.16671 | 9.720054 | 11.38905 | 1.651830 | 2.442748 | 4.137895 | 5.827516 |
| 3  | 0.205341 | 10.79705 | 17.23871 | 9.725968 | 1.722166 | 3.049660 | 3.928714 | 5.264039 |
| 4  | 0.228687 | 9.163206 | 26.45869 | 8.608853 | 1.836152 | 6.105673 | 3.279748 | 4.315125 |
| 5  | 0.247334 | 9.108535 | 25.76180 | 7.650399 | 2.941384 | 10.64260 | 2.825040 | 3.882840 |
| 6  | 0.262065 | 9.186611 | 23.94974 | 6.830183 | 3.610537 | 14.44388 | 2.631043 | 4.089324 |
| 7  | 0.272680 | 9.292692 | 22.93331 | 6.354183 | 3.890353 | 16.61986 | 2.828961 | 4.533658 |
| 8  | 0.283256 | 9.129524 | 22.05455 | 7.246248 | 3.836872 | 17.72218 | 3.393600 | 4.935834 |
| 9  | 0.296831 | 8.589154 | 20.41077 | 10.08636 | 3.551733 | 18.19187 | 4.126276 | 5.182786 |
| 10   | 0.311688 | 7.857523 | 18.52680 | 12.89068 | 3.221241 | 18.34791 | 4.854593 | 5.381698 |
| Cholesky Ordering: LINFMOR LKOFIND LREALGDP LHELINFR LODA LPOPR LSANITA LGOVHEXP |          |          |          |          |          |          |          |          |



# Inverse Roots of AR Characteristic Polynomial



# The Changing Role of Audit Committee Responsibilities in the Light of COVID-19 Pandemic

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**Abstract-** The communication between internal auditor and audit committee is often questioned in the context of the acted upon of any findings. Many cases found that there is incompatibility with the regulatory, where these weaknesses have the potential to cause harm and difficulty to the Company. The responsibility of an internal auditor is to ensure that any weaknesses found must be reported and acted upon by the Audit Committee through Internal Audit report. This research attempts to understanding of what approach the internal audit should use to be received and acted upon by the audit committee so it could make advantage to Company during this pandemic. This study is a descriptive study in nature. The rationale for utilizing this approach is to explain the originality of the case, when the circumstance existed at the moment of the analysis, and to investigate the phenomena. The findings of the study shows that, there will be a shift in the execution of audit committee functions during this COVID-19 pandemic. The result of the study is expected to be useful to practitioners and audit committee members in making a solid and reliable decision in their business dealings.

**Index Terms-** Execution, Internal Auditor, Audit Committee, Internal Control, Adventegous

## I. INTRODUCTION

As companies confront the profound disruption of operations, finances and the workforce caused by the COVID-19 pandemic, there is no such thing as usual. For corporate boards, that is just as true as it is for frontline workers. In the coming months in particular, audit committees will have plenty on their plates to provide critical oversight of financial reporting in this environment about the same time, audit committees would need to keep working on their other key duties in areas such as risk management, internal and external audit management, and ethics and compliance. Given the current industry and market dynamics in the coronavirus pandemic, it is possible that businesses will face many accounting and reporting problems depending on where they are in the fiscal year. Such difficulties come in the form of realistic requirements, such as a company's ability to "close its books," apply complex accounting principles based on discretion, meet regulatory standards and reporting deadlines, and satisfy investors' expectations (PWC, 2020). Audit committee needs to take closer attention to impact of online through work. The first is the effect of corporate regulation, the second is adjustments to the organizational process and public management, such as the Act, Enforcement or Transparency, Human Resources, and the last thing to remember is whether and how relevant concerns are communicated to the Board of Directors Across other relevant areas of quality management, the audit committee will insure that there are no significant threats and that the procedure is carried out with great accuracy. The audit committee will monitor the environment to insure that staff will be requested for additional energy and money and guarantee that the procedure is operating efficiently (PWC, 2020).

This study attempts to understanding of what approach the internal audit should use to be received and acted upon by the audit committee so it could make advantage to Company during the covid-19 pandemic. The paper also sake to explore the impacts of COVID-19 on the execution of audit committee functions and to answer if the new pandemic changes the execution of audit committee responsible.

From the case of the failure of BUMN companies in Indonesia, such as PT Dok Kodja Bahari, PT Sang Hyang Seri, PT PAL, PT Dirgantara Indonesia, PT Pertani, Perum Bulog, and PT Krakatau Steel in maximizing profit in 2019 yesterday, the Company must learn to review and improve internal controls. Looking from the page [www.cnbcindonesia.com](http://www.cnbcindonesia.com), the loss was caused by excess revenue recognition from the distribution of RASTRA (Perum Bulog). PT Sang Hyang Seri and PT Pertani are caused by business inefficiencies, interest expenses, and changes in government policies in seed procurement mechanisms. PT Dirgantara lost because of the cancellation of contracts and orders that did not reach the target and at PT Dok Kodja Bahari suffered losses due to administrative and general expenses which were too high at 58% of revenue, PT Krakatau Steel due to financial burden during construction. At PT PAL lost due to increased other expenses up to three times due to exchange rate losses and losses from associates (PT GE Power Solution Indonesia). All of these BUMN includes in Penyertaan Modal Negara (PMN) in according President Jokowi's Program "Nawa Cita".

Effectiveness is the main business achievement goal within the scope of internal audit for the past four decades, in addition to efficiency and honesty. Mainly also harmonized with the definition of the business risk approach to auditing (Abdullah et al., 2019). The audit committee is the front and center, as the financial impact on companies is widespread and it is more critical than ever to

maintain market confidence in reported information on the impact of the pandemic. It is essential that the audit committees take into account their responsibilities and keep in mind.

So, the role of internal audit function and the role of audit committee must be recovered. Better internal control not only be the needed of a Company, but it should be compulsion of a Company. Also the ruined company must be follow the culture of People where their main Company operationalized. Legitimacy theory asserts that companies continue to try to ensure that they operate within the framework and norms that exist in the community or environment in which the company is located, where they try to ensure that their activities of the company are accepted by outsiders as a "legitimate". Roussy et al. (2020) states that the success of the Company depends on whether the Company has focused its attention on information and on the relationship between community, government, individuals, and certain professional groups.

Upper Echelon theory stated that the individual characteristic of top management define the strategic decision that they made. Hambrick & Mason (1984) revealed that Upper Echelon theory emphasizes both the visible Cognitive and the invisible Intelligence Knowledge from the Top Management level, which means that here is the Internal Auditor and the Audit Committee Board. In terms of intelligence, the Internal Auditor and the Audit Committee must be people who have experience, education, and qualified social life. While the cognitive aspects of the internal auditor and the Audit Committee can be judged by their speed in responding to the situation and their expertise in building strategies.

So that the findings of internal audit reporting give benefit to Company that should be reported and followed up by Committee Audit. If the Communication between Internal Auditor and Committee Audit is good enough, so the acted up by Board of Committee audit must be good too, and vice versa. It is stated in Internal Audit Charter by The Institute of Internal Auditors (IIA) (2019) that internal auditor and Board of Audit Committee have to held a Meeting at least once every 5 years.

The Internal Audit unit research in Azzali & Mazza (2018) states that there is an increase in audit committee management approval when the internal auditor uses the Participatory Approach. A decrease in Audit Committee Management approval occurs when the internal auditor uses the Traditional approach. This research resulted in the finding that although the internal auditor has shown a positive attitude, the audit committee management can still suspect manipulation if the internal auditor uses a traditional approach. The main gap of the study is the limited and lack of previous studies on audit committee and COVID-19, this area of study is still new and unexplored.

This study intend to fill this gap by taking a closer look at COVID-19 and its impacts on the execution of audit committee functions in deep. However, it is the first time a study is conducted on the execution of audit committee functions and COVID-19. The result of the study is expected to be useful to practitioners and audit committee members in making a solid and reliable decision in their business dealings. This findings from this study will also serve as a benchmark and reference for future and coming researcher are will be interested in the same stream.

The rest of the paper is structured as follows; a theoretical framework, followed by a detailed research methodology followed by results and discussions which discussed the main findings from academic literature in other to justify the findings of the study. The final section consists of the conclusion and limitations of the study.

## II. THEORITICAL FRAMEWORK

The study aims to explore the impact of covid-19 on the execution of audit committee functions. Specifically, the paper scrutinized previous literatures where intentions of external auditors, internal auditors and members of the audit committee make changes to the execution of their functions as a predictor of the future behaviors of audit committee members.

**Diffusion of Innovation (DOI) Theory-** The study make use of the diffusion of innovation (DOI) theory to give a detail explanation of the level of adoption of the new COVID-19 pandemic in the new business settings. The diffusion of innovation theory model was first brought to the world stage by Rogers in the year 1962, with the main concept evolving over later editions (Rogers, 1983). The diffusion of innovative theory posit that innovation diffusion is a general process not tied by the type of invention and innovation, by who the adopters are or by place or culture. Rogers (1983) defined diffusion as the process by which an innovation is communicated via various channels over time and among the members of a particular social system.

As explained above, Rogers et al. (2004) argued that pioneer of change are a crucial factor in the time of innovation being adopted, that uncertainty reduces the velocity of innovation adoption, adopters must be aware of all the benefits and threats they face. Rogers (1983) further suggested that diffusion of innovation theory require certain attributes, such as relative advantage, estimated complexity, and estimated compatibility which are vital for the adoption of an innovation. For companies in Indonesia to understand and share information regarding the effect of COVID-19 on the execution of audit committee, online conferences and seminars in the form of webinars need to be organized by interested bodies, such as the Komite Nasional Kebijakan Governance KNKG, prominent audit experts, and public relations offices of companies (Bananuka et al., 2020). The citizenry need to be aware of the gains and losses of change in functions of audit committee due to COVID-19.

### III. RESEARCH METHOD

This study used a descriptive type of research. The purpose of implementing this method is to explain the originality of the case, when the circumstance existed at the moment of the analysis, and to investigate the phenomena (Boswell & Cannon, 2014). This research is based on the qualitative research method. It permissible an investigation of crucial new issues and questions as they arose. They also study used this method of research since this research intends to find solutions that would explain the relationship of one variable with another variable through qualitative factors in research. These qualitative factors are behavior, attitudes, opinions, and beliefs. The study used this kind of research considering the goal of the study to obtain sound and reliable information to formulate rational conclusions and recommendations for the study. The paper deliberately chose a research methodology, which is consistent with the research interests. Query Phenomenon "is an attempt to dealing with unexplained internal experiences in daily life (Merriam, 2002). The study chose this method to help determine the meaning behind the human experiment because it is connected to Strauss & Corbin (1998) methodological methodology as "a way of thinking about Study of social reality ".Furthermore to help determine the meaning behind the human experience because it is associated with a phenomenon or a significant collective event (Creswell, 2009).

Data was gathered through a collection of published articles from reputable journals using keywords such as; audit committee, internal auditor, and COVID-19 that relates to the topic of interest. Secondary data collection data was mostly used considering the unavailability of data and the restrictions impose by the government for person to person meetings.

### IV. RESULT AND DISCUSSION

It is the responsibility of audit committees to oversee how the managerial monitors and controls the significant financial potential risk of the company, including fraud. Keeping the confidence in the market that financial reporting documentation is accurate is crucial, which means focusing on audit committees during a crisis, especially one of this magnitude, is even more important. The audit committee must be extra cautious and not overburdened with broader responsibilities, given the complexities of financial reporting right now.

Communication is the process of sending and receiving messages from two or more people. Intended to increase the effectiveness of understanding messages from sender to recipient Barata (2003). DeSimone et al. (2020) defines communication as a reaction to the behavior of the organism, both verbal and stimulus. The reactions that occur can occur anytime and anywhere. Although the communication between the internal audit and the audit committee has been more active since the SOX regulations, the audit committee also has other responsibilities of the board of directors. And usually not displayed in day-to-day operations. The most frequently communicated internal audit committee with the audit committee is an educated person. Although the audit committee does not usually take care of financial matters, the audit committee also knows a lot about financial reporting related to external auditors, and may perceive the internal auditor as a party that is not recognized (Khelil et al., 2016).

The audit committee has a unique role compared to the board of commissioners. The audit committee only has duties on the outsourced directors, independent from management. Responsible for understanding, supervising, coordinating, and interpreting with Internal Audit for financial stability (Khelil et al., 2016). Al-Ajmi (2009) emphasize. A multidisciplinary commitment to effective government, developing knowledge and collaborating alongside others is key. This provides a detailed picture of the various positions in government, namely board members, audit committee, executives, internal auditors and external auditors. It is necessary for board members not only to understand what the audit committee is doing and the nature of their partnership with the auditor, but also, ultimately, to recognize their own mutual responsibilities in terms of disclosing integrity and ethical behavior (Momeni & Nakhaee, 2018).

The vision of the internal audit profession is that the mission of the internal audit profession is to add and protect the organization's value by providing risk-based assurance, advice, and insight (Sarens et al., 2012). According to The Institute of Internal Auditors (IIA) (2019), there are 4 codes of ethics for internal audit, namely Integrity, Objectivity, Confidentiality, and Competency.

Abdullah et al. (2019) explain how efforts to uphold Good Corporate Governance have been initiated by several developed countries such as Britain and America. In 1992 in England, the Cadbury Committee was formed which provided several recommendations for implementing corporate governance. These recommendations are summarized in a report entitled The Financial Aspect of the Corporate Governance. Meanwhile in America, there were 10 recommendations regarding corporate governance made by the Blue Ribbon Committee in 1999 (BRC, 1999). In Indonesia, in 2001, the National Committee for Governance Policy developed a guideline for good corporate governance which was refined in 2006. These guidelines are intended to provide a basic reference for the concept and pattern of GCG implementation (KNKG, 2001). In these guidelines, there are guidelines for the formation of several committees that are formed by the board of commissioners, one of which is the audit committee.

The Audit Committee is part of the Board of Commissioners which is responsible for internal control and financial reporting but because of this broad responsibility, the Audit Committee may not have any relationship with the Company's Management. Usually, for a Board of Directors consisting of 12-16 people, Moeller (2016) must have an Audit Committee member of at least 3 or 4 people. The responsibility of an Audit Committee is that while the format varies from company to company, an audit committee charter generally includes:

- 1) The objectives and strengths of the audit committee;
- 2) Composition of the audit committee;
- 3) Meeting schedule
- 4) Audit committee procedures
- 5) Main activities of the audit committee: a) Corporate governance b) Public reporting c) Independent accountants
- d) Auditing and accounting e) Other activities;
6. Discretionary activities: a) Independent accountant b) Internal audit c) Accounting d)

Control and system e) Public reporting f) Responsibility for compliance monitoring g) Risk assessment h) Responsibility for financial oversight i) Responsibility for planning Employee benefits fiduciary investment 7) Limits of Moeller's audit committee (2016).

Finally, audit committees will need to ensure that they collaborate closely with their internal and external auditors. These are two tools which can be leveraged by the committee in its oversight obligations. As it contributes to internal audit, provided COVID-19, priorities may have shifted. The audit committee will understand what tasks are overdue and the internal audit should be relaxed COVID-19 is creating a structural change in their responsibilities for the audit committee, which is an essential component of successful governance, the job is tougher than ever. Throughout general, the audit committee plays a role in developing and sustaining a business culture and environment that encourages transparency and the exchange of information related to the decision-making of the organization and its shareholders and others. Transparency is required in times of uncertainty (Von Gaudecker et al., 2020). The role of audit committee is to track the effect of the pandemic on productivity, cash flow, capital management and a fresh emphasis on balance sheet efficiency, as well as to recognize early indicators of financial pressure, continuing negotiations and certain financial reporting consequences, such as asset revaluation and post-reporting incidents. (IFAC, 2020).

In reaction to COVID-19, audit committees should be alert to the increasing number of possible challenges and must evaluate their goals and targets. Around the same period, though, the Audit Committee should ensure that they will consistently reflect on their main duties with respect to oversight of financial statements and internal management, which would contribute to the uncertainty of the pandemic.

## V. CONCLUSION

From the discussion above, we can make conclusion that every personnel of audit committee must follow the Rule in executing their responsibilities, such as Blue Ribbon Committee BRC (1999) in America or Komite Nasional Kebijakan Governance KNKG (2001) in Indonesia. That Rules for example consists of many aspects that is not easy to follow by audit committee, like compulsion of act in Internal Control and contribute in employee compliance, etc., and give a percentage points in every aspects. So, that will be good to Board of Directors to monitoring the audit committee performances. As business continuity difficulties keep going, companies may encounter issues with the timely "closure of their books." Companies should apply "lessons learned" from the closing of their preceding quarter to help them develop this quarter. Audit committees should be aware of potential issues concerning the workforce, both domestic and international, and the ability of a company to meet reporting deadlines. A control system may be rendered irrelevant by individuals who are unavailable or unable to fulfill the responsibilities on which the system relies, or who fail to adapt controls to changes in the business environment and how those controls are performed remotely. Making sure that internal controls continue to function effectively should be a constant focus (Lord, 2020).

This paper followed by such limitations like difficulty to find any real practice of Internal Auditor work in Indonesia and difficulty to find the relationship between different division in one Firm. Future research expected to find the progress of audit committee profession in react to COVID-19.

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# Comorbidity burden of Tuberculosis: Implications for Sri Lanka

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## Abstract-

### Introduction and aims:

Rising trends of comorbidities associated with tuberculosis (TB) have been observed in recent literature. This review explores these global trends and the implications of these for Sri Lanka.

### Methods

Literature search was done in PubMed and Embase databases using subject headings and keywords. Articles and content of grey-literature were screened for the relevance and quality. Selected articles were included in a narrative review of the findings.

### Results:

The evidence for the rising TB-comorbidity burden was synthesized under 6 domains: TB comorbidity burden in general, TB-diabetes, TB-HIV, TB-malnutrition, TB-mental disorders and TB-other non-communicable conditions. The relevant statistics, pathophysiological basis and the implications were discussed.

### Conclusions and Recommendations:

Person-centered care model is recommended as comorbidity-burden of TB is rising. Additional strategies must be integrated in Sri Lanka in addressing the burdens of TB and comorbidities. More research must be promoted.

**Index Terms-** Tuberculosis, Co morbidities, Non- Communicable Diseases, Diabetes Mellitus, Mental Health Disorders

## I. INTRODUCTION

Tuberculosis (TB) is regarded as the global leading cause of death among the infectious diseases(1). It is caused by the organism *Mycobacterium tuberculosis*. It is reported than only in 2017 it has been attributed as the cause of 1.3 million deaths. To make the situation worse, in the same year an additional 10 million cases were newly reported (1). While a relatively adequate attention is given on the burden of TB around the world, even some developing settings like Sri Lanka have managed to keep the TB burden as “low” within their regions(2). However, a new facet related to TB has been highlighted in recent global literature, which

of importance to all settings including those which are well-controlling TB in the form its comorbidity-burden. This means that the patients with TB are found to be associated with numerous disease conditions with a higher prevalence compared to those without TB. Similarly, the burden of TB is found to be associated with numerous disease conditions with a higher prevalence compared to those without TB. Similarly, the burden of TB is found to be relatively higher among people with many such conditions.

This research was done to explore the published literature and novel insights on the TB-comorbidity burden and to synthesize implications in relation to the Sri Lankan healthcare system.

## II. METHODS

A comprehensive literature search was done in PubMed and Embase databases. The related subject headings (MeSH in PubMed and Emtree in Embase) as well as related keywords were used in the search strategy. In addition, related grey literature was searched in reputed websites. The articles and content were screened by the investigator for the eligibility (relevance and quality). The selected articles were included in a narrative review of the findings under 6 domains: TB comorbidity burden in general, TB-diabetes, TB-HIV, TB-malnutrition, TB-mental disorders and TB-other non-communicable conditions.

## III. RESULTS

### ***TB-comorbidity burden***

Even the World Health Organization has highlighted the comorbidity burden of TB. It has emphasized the importance of detecting these comorbidities due to several reasons. One is that the co-management of the conditions can be done smoothly. Secondly the high prevalence of these comorbidities could be worsening

the TB burden. On the other hand, the proper control of these conditions would help in reducing the TB burden(3). It can be argued that in the same line, the proper management of TB could enable reducing the burden of these other conditions as well.

A significant comorbidity burden has been observed in relation to many disease groups throughout the world. Comorbidities of TB have been well observed in relation to “HIV, diabetes, smoking, alcoholism, chronic lung diseases, cancer, immunosuppressive treatment, malnutrition” according to the Marais et al (2013)(4). Owing to these associations, they highlighted the importance of integrated management of TB in relation to both the communicable and non-communicable diseases among the national programmes(4).

### ***TB and Diabetes***

Ill effects of TB-diabetes comorbidity have been observed even in relatively developed regions like the Europe as well as in developing regions. The prevalence of diabetes among the people with TB has been documented as in the range of 44% to 28.5% with an overall figure of 10.7%(5). The magnitude of this burden has been found to vary among people among certain demographic groups. The Asians are categorized as within the high-risk group for this burden along with the Pacific Islanders and Hispanic diabetics. It has been also documented that the prevalence of TB among these groups have increased from 4.6% to 9.6% between 1998 to 2011(6). In Ethiopia, the prevalence of diabetes has been documented as higher than among the people with TB, compared to the national estimates(7).

It has been mentioned that while TB can impair the glycaemic control among the people with diabetes, the clinical profile of TB could be negatively affected by diabetes. It is also mentioned that the risk of getting TB is 2-3 times higher among the people with diabetes compared to those who without(3). Tesket *et al* (2017) have documented that the risk of mortality from TB is nearly two times among the diabetics compared to those without diabetes(8). In addition other worse outcomes like; slower conversion of bacteria, reduced cure rate, more relapses and increased drug resistances have been observed due to diabetes-TB comorbidity(8). Of the chest images of people with

TB, it has been reported that the cavities are seen more when the person is affected with diabetes(5).

Mechanism which lead to this increased TB burden among diabetes is describes as related to the effects on cytokines, reactive oxygen species and antioxidants. All these are expected to increase the vulnerability of a person for infectious agents(8). Other suggested reasons include; deficiencies of micronutrients, microangiopathies of lungs as well as renal implications (e.g. renal insufficiencies) which are associated with diabetes(7).

### ***TB and HIV***

The co-infection between the TB and HIV has been described as the leading infectious disease burden in many resource-poor settings(9). It is documented that in AIDS settings, Tb is the leading single cause of death. TB is attributed to 26% of AIDS deaths while 99% of these occur in developing settings(10). The agents responsible for these two disease conditions do “potentiate” each other according to the available literature leading to a diminished and deteriorated immune system. Thus in relation to HIV, the progression to AIDS is accelerated whereas for TB, “susceptibility to primary infection, reinfection as well as risk of reactivation” is increased(9). As documented by Pawlowski and others (2012) the latent-Tb reactivation risk is increased by 20 times with HIV(10).

### ***TB and Malnutrition***

Patients wit TB are found to be with reductions in both lean body mass and fat mass. The parameters like “arm muscle area”, “mid arm circumference”, “skin fold thickness” as well as “serum albumin” levels are found to be lower in patients with TB(11). These associations are augmented through the evidence available on vitamin D receptors, immunity status and infections of the respiratory system of malnourished children(12). Also the processes among the TB patients like; reduced appetite, malabsorption of nutrients and alterations of metabolism are suggested as responsible for this association(13).

### ***TB and Mental disorders***

In a recent scoping review done by Resnsburg et al (2020), associations of mental disorders with TB were

explored(14). The review identified four comorbidities of TB- alcohol use, depression, anxiety and general mental health. Both men (especially for alcohol use) and women (for worse mental health outcomes) were observed to be affected by these associations. These associations were augmented in relation to advantaged age and history of mental illnesses(14). The review emphasized the utility of its findings especially for the lower income countries.

### ***TB and other Non Communicable Diseases***

Yakar et al (2017) have documented the negative impact of TB on the progression of Chronic Obstructive Pulmonary Disease(15). They concluded that the even though the mortality remained the same, when there was a history of TB, the diagnosis and deaths were found to be 5 years earlier(15). In some settings, the TB-COPD comorbidity becomes only second to that of TB-diabetes. In Indian literature, 32.4% of the patients with COPD were found to be with a history of TB (16). The impact of prevalent risk conditions like smoking and alcoholism are also being described with worsening the TB burden(4, 16). As an example, risk of getting TB is documented as 3-5 times higher among smokers. Similarly, worse clinical course (e.g. high degree of dissemination, extensiveness of involvement of lung and less closure of lung cavities) is also observed among the smokers(16).

## IV. DISCUSSION

TB is described to be associated with multiple infectious as well as non-communicable conditions. These non-communicable conditions include not only physical elements but extend across the mental well-being as well. Based on the findings, important implications were synthesized in relation to the novel recommendations and for the way forward of Sri Lanka.

### ***Novel strategies***

Considering these facts, a customized approach is recommended in the recent literature for TB management. This is based on the fact that holistic care is needed in optimizing the well-being of the clients.(14) TB is associated with many comorbidities and hence the clinical profile is influenced by each of

these conditions in addition to the socio-demographic characteristics of the patient. Since the effects of TB-comorbidity burden extends into the psychological domains as well, addressing of both the physical as well as mental wellbeing components are needed. This optimal care package is termed as “person-centred TB care”. In a review by Resnsburg et al (2020), it was identified that just one study has been done up to the time of that review on such a model(14). This highlights the paucity of evidence on the person-centred model throughout the world. Countries need to expand the evidence generations in relation to individualized care for TB and explore the best service delivery model for each setting.

### ***Implications for Sri Lanka***

Sri Lankan health achievements are well appreciated in comparison to those countries with similar economic statuses. Prior to the ongoing Covid-19 pandemic, Sri Lanka had been able to control the communicable diseases except for few conditions like dengue and leptospirosis. Even for TB, within the South East Asian region, Sri Lanka is regarded as a low prevalence country with an estimated prevalence rate (of all types of TB) being 103 per 100,000 people(2). It is utmost essential that Sri Lanka continue to maintain the low burden of TB in the coming years.

However, Sri Lanka is undergoing a demographic and an epidemiological transition as a result of which the non-communicable disease burden is on the rise. Disease conditions like diabetes and chronic respiratory diseases are being shown among the main non-communicable conditions. In addition, the risk factors associated with these conditions are also becoming more prevalent. The findings of the current review suggest that the burden of TB is expected to increase with these conditions. Hence the burden of comorbidity must be given complete emphasis by the policy planners in the longer run. This becomes essential in identifying these comorbidities early in minimising the healthcare costs associated with these, as otherwise once the complications are developed the cost becomes increased. On the other hand, for ensuring the holistic care for the clients of the healthcare system, it becomes essential in screening the people with any of these conditions for the other.

In order to achieve these, the clinical guidelines of management of TB as well as of these other conditions must be revisited. Periodic screenings for these comorbidities must be incorporated into these guidelines. These must be conveyed throughout all levels of healthcare even to the level of general practitioners whom play an essential role in the achievement of universal health coverage. More research must be encouraged in eliciting the local findings in relation to what have been documented in global literature. This is vital as the global literature suggest variations of these comorbidities across different regions and demographic groups. By applying these measures Sri Lanka will be able to retain the low burden of TB as well as would be able to lower the burdens of associated comorbidities.

#### V. CONCLUSIONS AND RECOMMENDATIONS

Comorbidity-burden of TB is rising with the increase of the prevalence of comorbid conditions and their risk factors. Person-centred care model is recommended to be introduced in managing this burden. By integrating the strategies suggested, Sri Lanka would be able to retain the current low TB-burden as well as the burden of the comorbid conditions. More research must be promoted on TB-comorbidity burden.

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# Indion resin: Efficient, environmentally friendly and reusable catalyst for acylation of amines

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**Abstract-** Amines are efficiently acylated with anhydrides by using Indion Resin as catalyst and acyclic anhydrides react with an amine and amines of various stereo-electronic factors react with the same rates with an anhydride. No chromatographic separation is needed for isolation of the acylated product. Method was developed for the acylation of amine, and in the presence of catalytic amount of Indion 190 resin. Short reaction time, ambient conditions, simple work-up procedure, high yield, easy availability, reusability, and use of an eco-friendly catalyst are some of the striking features of the present protocol.

**Index Terms-** Amines, acylation, anhydrides, Indion resin;

## I. INTRODUCTION

The acylation of amines is a common method and acylated amine is often used as protecting group in organic synthesis as it provides an efficient and inexpensive means for protecting an amino functionality in a multi-step synthetic process [1]. Acetic anhydride and acetyl chloride are generally used in the presence of acidic [2,-5] or basic [6,-8], catalysts in an organic medium. These reactions have advantages and drawbacks too, as recently described by Katritzky [9]. Some of these reagents and catalysts lead to waste as well as some reactions involving organic solvents, often are toxic and polluting, hence unacceptable in present days. One of the major factors for a green chemical process in solution involves the choice of cheap, safe and non-toxic solvents. Water being abundant in nature is the first choice. In addition to satisfying above criteria it has also special effects on reaction arising from intra- and inter-molecular non-covalent interactions leading to assembly processes. After Breslow's discovery of positive effect on the reaction rates and selectivities of Diels-Alder reaction, which is otherwise insensitive to solvent effects, special attention was focused on the origin of the aqueous acceleration [10]. Reaction of N-acylation are broadly applied in organic synthesis, biology, agriculture and pharmaceuticals [11-13]. In multi step synthesis it is robust technique for protection of amino group in organic synthesis, for their appropriate activation of the towards chemical synthesis, or as universal biologically active targets containing amide building block, pharmaceutical and natural products [14,15]. In medicinal chemistry amide bond is unusually important [16,-18]. In natural compound and organic compounds amide bond give individual property also in peptide and proteins. Amide bond predominantly present in Active pharmaceutical and natural compound [19-24]. Amide unit

contributes in pharmaceutical market around 25% [25], and by drug candidate survey of major pharmaceutical company found in 2006 that 2/3 functional amide group present [26]. Drugs are available in market of different pharmaceutical activity such as atorvastatin (antihyperlipidemic) [27], penicillin (antibacterial), pyrazinamide (antitubercular) contains main activity due to presence of amide functional in the structure [28].

N-acylation via acetic anhydride and acid chloride has been associated with many disadvantages [29,30] but acylation strategy using acid chloride and acetic anhydride is very common in all reported strategies. Also other methodology are used for acylation of amine through different coupling reagents, but they don't have selectivity and contains hazardous in nature so they are difficult to handle and gives hazardous waste into environment [31].

The various strategies under metal catalyzed and direct coupling of inactivated carboxylic acid are reported [32-34] acylation by using N-acyl 1,5-diazabicyclo[4.3.0]non-5-ene (DBN) tetraphenyl borate salt [35], those strategy will be overcome the challenges of acyl chloride and acid anhydride mediated acylation reactions on amine using acid chloride and acid anhydrides.

Use of ruthenium and mercury catalyst for acylation reaction in Beckmann rearrangement [36,37] Acyl transfer reaction via triazole and imidazole-mediator [38-40] Oxidative amidation of aldehyde using copper catalyst [41,42]. Acylation reaction and their methods in various types of reaction including synthesis of amide chemistry have been explored.

In development of green synthetic methods in organic synthesis has become an important strategy. Environmentally benign, inexpensive Water has experienced increasing popularity due to being inexpensive, readily available, and environmentally benign. In addition, water: (i) is cheap, nonflammable, non-toxic and safe for use; (ii) eliminates additional efforts required to dry the substrates/reagents before use; (iii) offers unique physical and chemical properties that often achieve the reactivity or selectivity unattainable in organic solvents; and (iv) allows easy product isolation by filtration.

Thus development of an efficient and convenient synthetic methodology in water is an important area of research. Considering the importance of acylation and environmental factors as well as our interest in green chemical processes [43-45], we report in this method acylation of amines using Indion resin as catalyst, which fulfills many of the above requirements.

## II. EXPERIMENTAL SECTION

**Typical Experimental Procedure.** To a stirred heterogeneous suspension of anhydride (1-1.5 mmol) in ethanol (15 mL) was added to the Indion resin catalyst solution. (PH cal.4.5). The resulting solution was cooled in an ice bath. To this was then added amine (1-mmol) until effervescences appeared and pH of the mixture became 5. The completion of the reaction was confirmed by TLC. The catalyst was recovered by filtration and was washed with methanol (2 × 1 mL). The filtrate was distilled out to get crude product. The crude products were crystallized from ethyl acetate to yield the pure products which were identified by comparison of their NMR, IR, <sup>13</sup>C NMR.

### Spectral Data:

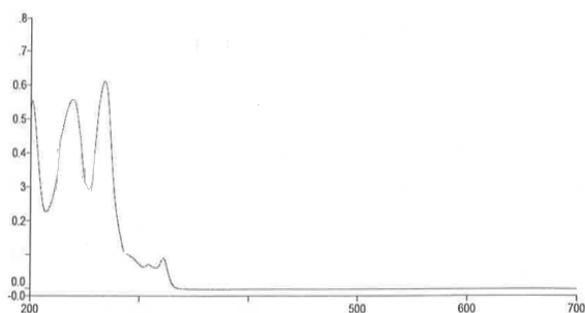
Selected spectroscopic data:

10. Selected spectroscopic data: **N-(2-fluoro-phenyl)-acetamide (5a)**: 1H NMR (400 MHz, CDCl<sub>3</sub>) δ 2.2 (s, 3H), 7.02 (m, 1H), 7.28 (s, 1H), 7.3 (s, 1H), 7.42 (s, 1H), 8.2 (m, 1H); 13C NMR (100 MHz, CDCl<sub>3</sub>) δ 24.45, 114.64, 114.89, 122.17, 124.35, 124.38, 124.43, 126.17, 126.31, 150.91, 154.13, 168.63. **N-(2,4-Difluoro-phenyl)-acetamide (6a)**: 1H NMR (400 MHz, CDCl<sub>3</sub>) δ 2.20 (s, 3H), 6.86 (m, 2H), 7.27 (brs, 1H), 8.22 (m, 1H); 13C NMR (100 MHz, CDCl<sub>3</sub>) δ 24.50, 103.25, 103.48, 103.52, 103.76, 111.10, 111.14, 111.32, 111.35, 122.52, 122.91, 123.00, 153.56, 157.36, 159.81, 168.28. **N-(2,4-Dimethoxy-phenyl)-acetamide (9a)**: 1H NMR (400 MHz, CDCl<sub>3</sub>) δ 2.15 (s, 3H), 3.77 (s, 3H), 3.82 (s, 3H), 6.44 (m, 2H), 7.52 (brs, 1H), 8.18 (d, 1H, J = 9.5 Hz); 13C NMR (100 MHz, CDCl<sub>3</sub>) δ 24.66, 55.47, 55.60, 98.49, 103.65, 120.74, 121.18, 149.10, 156.27, 167.86. **(R)-N-Phenyl-ethylacetamide (10a)**: 1H NMR (200 MHz, DMSO-d<sub>6</sub>) δ 1.30 (d, 3H, J = 7.0 Hz), 1.82 (s, 3H), 4.87 (m, 1H), 7.23 (m, 5H), 8.4 (brs, 1H); 13C NMR (50 MHz, DMSO-d<sub>6</sub>) δ 22.78, 22.96, 48.15, 126.29, 126.92, 128.57, 145.09, 168.82. **N-(2-Mercapto-phenyl)-acetamide (12a)**: 1H NMR (300 MHz, CDCl<sub>3</sub>) δ 1.27 (s, 1H), 1.98 (s, 3H), 7.02 (m, 1H), 7.40 (m, 2H) 7.93(brs, 1H), 8.31 (m, 1H); 13C NMR (75 MHz, CDCl<sub>3</sub>) δ 24.97, 121.75, 123.47, 124.40, 124.88, 132.48, 136.69, 140.19, 168.91. **Thioacetic acid S-(2-acetyl-amino-phenyl)ester (12aa)**: 1H NMR (200 MHz, CDCl<sub>3</sub>) δ 2.14 (s, 3H), 2.42 (s, 3H), 7.13 (m, 1H), 7.42(m, 2H), 7.69 (brs, 1H), 8.25 (brs, 1H); 13C NMR (50 MHz, CDCl<sub>3</sub>) δ 25.02, 30.70, 117.73, 122.86, 125.20, 131.91, 136.46, 140.02, 168.67, 193.82. **2-Methyl-benzothiazole (12ab)**: 1H NMR (300 MHz, CDCl<sub>3</sub>) δ 2.81 (s, 3H), 7.29 (m, 1H), 7.43 (m, 1H), 7.78 (m, 1H), 7.93 (m, 1H); 13C NMR (75 MHz, CDCl<sub>3</sub>) δ 20.07, 121.35, 122.34, 124.66, 125.87, 135.60, 153.31, 166.92. **N-(2-Amino-phenyl)-acetamide (13a)**: 1H NMR (200 MHz, CDCl<sub>3</sub>) δ 2.10 (s, 3H), 3.65 (brs, 2H), 6.75 (m, 2H), 7.01 (m, 2H), 7.64 (brs, 1H); 13C NMR (50 MHz, CDCl<sub>3</sub>) δ 23.94, 118.41, 119.81, 126.04, 127.72, 129.42, 141.37, 169.69. **N-(2-Acetyl-amino-phenyl)-acetamide (13aa)**: 1H NMR (300 MHz, DMSO-d<sub>6</sub>) δ 2.07 (s, 6H), 7.11 (m, 2H), 7.52 (m, 2H), 9.37 (s, 2H); 13C NMR (75 MHz, DMSO-d<sub>6</sub>) δ 23.63, 124.51, 124.67, 130.40, 168.57. **N-(4-Acetyl-amino-phenyl)-acetamide (14a)**: 1H NMR (300 MHz, DMSO-d<sub>6</sub>) δ 2.06 (s, 6H), 7.10 (m, 2H), 7.53 (m, 2H), 9.43 (s, 2H); 13C NMR (75 MHz, DMSO-d<sub>6</sub>) δ 23.7, 124.8, 130.5, 168.8. **N-(4-Hydroxy-phenyl)-propionamide (11b)**: 1H NMR (400 MHz, DMSO-d<sub>6</sub>) δ 1.04 (t, 3H), 2.26 (q, 2H), 7.47 (s, 4H), 9.76 (s, 2H); 13C NMR (100 MHz, DMSO-d<sub>6</sub>) δ 9.86, 18.57, 114.99, 120.80, 131.08, 153.05, 171.24.

**N-(2-Mercapto-phenyl)-propionamide (12b)**: 1H NMR (400 MHz, CDCl<sub>3</sub>) δ 1.10 (t, 3H), 2.14 (q, 2H), 6.96 (t, 1H), 7.36 (m, 3H), 7.95 (s, 1H), 8.33 (d, 1H); 13C NMR (100 MHz, CDCl<sub>3</sub>) δ 9.49, 30.62, 120.85, 124.10, 132.03, 136.35, 139.79, 171.94. **2-Ethyl-benzothiazole (12bb)**: 1H NMR (400 MHz, CDCl<sub>3</sub>) δ 1.47 (t, 3H), 3.15 (q, 2H), 7.25 (t, 1H), 7.35 (t, 1H), 7.75 (d, 1H), 7.88 (d, 1H); 13C NMR (100 MHz, CDCl<sub>3</sub>) δ 13.76, 27.65, 121.45, 122.34, 124.61, 125.87, 134.90, 152.99, 173.72. **N-(4-Hydroxy-phenyl)-benzamide (11c)**: 1H NMR (400 MHz, DMSO-d<sub>6</sub>) δ 6.75 (m, 2H), 7.38-7.61(m, 6H), 7.93 (m, 2H), 10.04 (s, 1H); 13C NMR (100 MHz, DMSO-d<sub>6</sub>) δ 115.05, 122.35, 127.56, 127.74, 128.34, 131.31, 135.23, 153.86, 165.03. **N-p-Tolyl-succinamic acid (7d)**: 1H NMR (400 MHz, DMSO-d<sub>6</sub>) δ 2.19 (s, 3H), 2.49 (s, 4H), 7.04 (d, 2H, J = 8.4Hz), 7.42 (d, 2H, J = 8.4Hz), 9.82 (s, 1H), 12.08 (brs, 1H); 13C NMR (100 MHz, DMSO-d<sub>6</sub>) δ 20.44, 28.84, 30.71, 118.92, 129.06, 131.77, 136.84, 169.83, 173.91. **N-(4-Hydroxyphenyl)-succinamic acid (11d)**: 1H NMR (300 MHz, DMSO-d<sub>6</sub>) δ 2.56 (s, 4H), 6.74 (d, 2H, J = 8.7 Hz), 6.90 (m, 1H), 7.20 (m, 1H), 7.41 (d, 2H, J = 8.4 Hz), 9.74 (s, 1H); 13C NMR (75 MHz, DMSO-d<sub>6</sub>) δ 29.2, 31.1, 116.1, 121.1, 131.2, 153.3, 169.8, 174.2. **N-p-Tolylphthalamic acid (7f)**: 1H NMR (300 MHz, DMSO-d<sub>6</sub>) δ 2.26 (s, 3H), 7.13 (d, 2H), 7.50- 7.67 (m, 5H), 7.87 (d, 1H), 10.25 (s, 1H), 13.02 (s, 1H); 13C NMR (75 MHz, DMSO-d<sub>6</sub>) δ 20.68, 119.14, 127.31, 128.50, 128.83, 129.02, 129.56, 131.14, 131.73, 136.56, 138.41, 166.48, 166.86. **N-(4-Methoxy-phenyl)-phthalamic acid (8f)**: 1H NMR (300 MHz, DMSO-d<sub>6</sub>) δ 3.75 (s, 3H), 6.92 (d, 2H), 7.55-7.67 (m, 5H), 7.87 (d, 1H), 10.32 (s, 1H). 13.10 (s, 1H); 13C NMR (75 MHz, DMSO-d<sub>6</sub>) δ 55.22, 113.46, 120.78, 127.39, 128.88, 129.10, 129.74, 131.19, 132.35, 138.51, 154.81, 166.36, 167.02. **N-(4-Hydroxy-phenyl)-phthalamic acid (11f)**: 1H NMR (300 MHz, DMSO-d<sub>6</sub>) δ 6.72 (d, 2H), 7.44-7.66 (m, 5H), 7.84 (d, 1H), 9.20 (s, 1H), 10.07 (s, 1H), 13.14 (s, 1H); 13C NMR (75 MHz, DMSO-d<sub>6</sub>) δ 114.49, 120.79, 127.24, 128.64, 128.86, 129.69, 130.69, 130.93, 138.37, 152.70, 165.91, 166.88.

## III. RESULTS AND DISCUSSION

Acetylation of aromatic amines has been carried out in aqueous media but with a limited number of substrates[46-53]. The same has been achieved using amine, acetic anhydride and Indion resin as catalyst. We thought to add Indion resin protonate the anhydride and react it with acetic anhydride and convert the liberated acetic acid. To test our hypothesis and to optimise the reaction conditions, aniline **4** was converted to acetanilide using acetic anhydride and Indion resin. Thus, when acetic anhydride was added to solution of amine no acetylation occurred. However, upon addition of Indion resin to the above medium, free amines form which reacted immediately with protonated acetic anhydride, precipitating the acetylated product with the evolution of carbon dioxide. The reaction works best when the final pH of the medium is 5.5, approximately one pKa unit higher compared to that of acetic acid (pKa 4.8). Protonation of amine in an acidic medium has been confirmed by hypochromic shifts at 226 nm and 276 nm for (π-π\*) and (n-π\*) respectively, by titrating a dilute solution of 2-fluoroaniline **5** with a dilute solution of HCl using UV spectrophotometer. A hyperchromic shift of these transitions upon addition of a dilute solution of sodium bicarbonate confirms the regeneration of free amines.



To choose the best catalyst among various catalysts available for the reaction using a criteria of maximum product yield and time requirement for the completion of reaction, we carried out screening test of catalysts. To achieve the goal we set up reactions namely A1, A2, A3, A4, A5, A6, A7, A8, A9 and A10. All the substrates were added as described in the procedure but we varied the catalyst for each reaction. We had added the catalysts as follows B1- RuCl<sub>3</sub>, B2- La(NO<sub>3</sub>)<sub>3</sub>.6H<sub>2</sub>O, B3- NbCl<sub>5</sub>, B4- NaHSO<sub>4</sub>.SiO<sub>2</sub>, B5- ammonium acetate in acetic acid, B6- ZrOCl<sub>2</sub>.8H<sub>2</sub>O, B7- zinc dust, B8-18-Crown-6, B9- iodine, B10- Indioin 190 resin, respectively. We then allowed the reactions to complete while noting the time required for the same. Upon recovery of products we observed that, Indioin 190 resin successfully fulfilled both the criteria applied. So it was selected for further analysis.

**Table 1. Acylation of the Amine using various catalysts**

| Entry | Catalyst   | Time | Yield |
|-------|--|------|-------|
| 1     | RuCl <sub>3</sub>                                    | 9    | 65    |
| 2     | La(NO <sub>3</sub> ) <sub>3</sub> .6H <sub>2</sub> O | 10   | 72    |
| 3     | NbCl <sub>5</sub>                                    | 8    | 66    |
| 4     | NaHSO <sub>4</sub> .SiO <sub>2</sub>                 | 7    | 69    |
| 5     | ammonium acetate in acetic acid                      | 12   | 70    |
| 6     | ZrOCl <sub>2</sub> .8H <sub>2</sub> O                | 10   | 59    |
| 7     | zinc dust  | 13   | 65    |
| 8     | 18-Crown-6   | 14   | 55    |
| 9     | Iodine   | 11   | 65    |
| 10    | Indioin 190 resin                                    | 5    | 90    |

After selection of a good catalyst we then decided to check the effect of solvent system being used during reaction on the yield of product as well on the rate of reaction. A series of ten reactions was set up as 1,2, 3-----, 10. Each of the reaction set up consisted of all the reagents with Indioin 190 resin as a catalyst. The reactions were run using Methanol in 1<sup>st</sup> set, Dichloromethane in 2<sup>nd</sup>, Ethanol in 3<sup>rd</sup>, Butanol in 4<sup>th</sup>, Isopropanol in 5<sup>th</sup>, Acetonitrile in 6<sup>th</sup>, DMF in 7<sup>th</sup>, Ethyl acetate in 8<sup>th</sup>, Acetone in 9<sup>th</sup> and Ethylene dichloride in 10<sup>th</sup> set correspondingly. While reactions were

proceeding time required for the completion of the reaction in presence of each solvent was being monitored. Completion of reaction was being examined using TLC. After completion of reactions products were obtained and quantified. The results for the time requirement for the completion of reaction and the product yield revealed ethanol as the best solvent.

**Table2: Screening of solvent**

| Entr y | Solvent             | Time | Yield |
|--------|---------------------|------|-------|
| 1      | Methanol            | 7    | 65    |
| 2      | Dichloromethane     | 9    | 55    |
| 3      | Ethanol             | 5    | 90    |
| 4      | Butanol             | 7    | 60    |
| 5      | Isopropanol         | 7.5  | 62    |
| 6      | Acetonitrile        | 12   | 58    |
| 7      | DMF                 | 14   | 57    |
| 8      | Ethyl acetate       | 10   | 45    |
| 9      | Acetone             | 14   | 40    |
| 10     | Ethylene dichloride | 13   | 48    |

We then decided to check the efficiency of the catalyst Indioin 190 resin in terms of maximum product yield at its lowest possible quantity used. (by using the lowest possible amount of it). We had now set up the series of reaction with all the substrates along with ethanol as a solvent but we varied the catalyst loading in the range of 1% to 10% progressively. We monitored the progress of reaction by using chromatography techniques. After completion of the reaction the harvested products were measured to know the yield with each loading of the catalyst. Upon observation it was found that 10% catalyst loading has given 90% product yield.

After all of these screening tests we optimized our reaction conditions based on the results. We used Indioin 190 resin at 10% loading as our catalyst along with ethanol as a solvent.

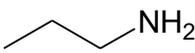
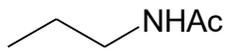
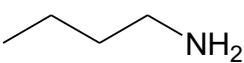
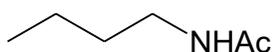
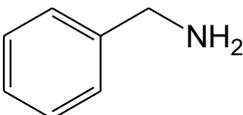
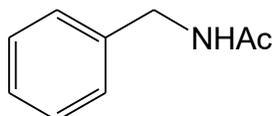
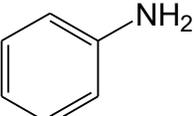
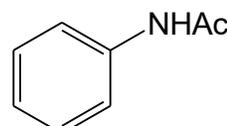
**Table 3: Catalyst loading**

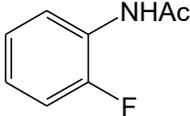
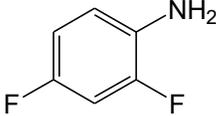
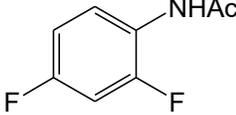
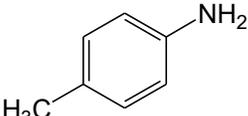
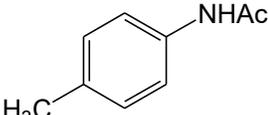
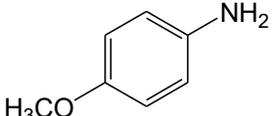
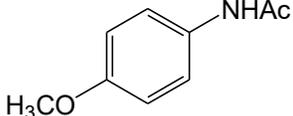
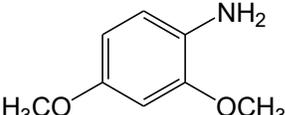
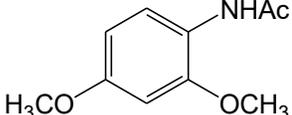
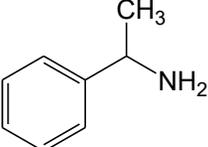
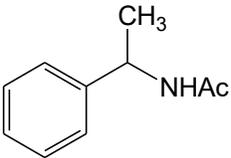
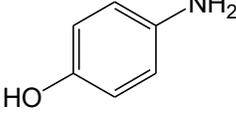
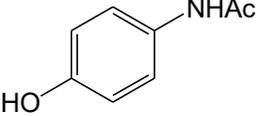
| Entry | Indioin 190 Resin | Cat. % loading | Yield% |
|-------|-------------------|----------------|--------|
| 1     | Indioin 190 Resin | 1              | 25     |
| 2     | Indioin 190 Resin | 2              | 36     |
| 3     | Indioin 190 Resin | 3              | 40     |
| 4     | Indioin 190 Resin | 4              | 45     |
| 5     | Indioin 190 Resin | 5              | 50     |
| 6     | Indioin 190 Resin | 6              | 56     |
| 7     | Indioin 190 Resin | 7              | 60     |
| 8     | Indioin 190 Resin | 8              | 64     |
| 9     | Indioin 190 Resin | 9              | 75     |
| 10    | Indioin 190 Resin | 10             | 90     |

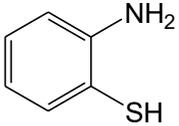
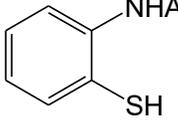
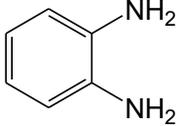
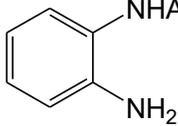
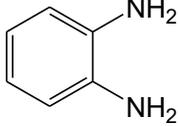
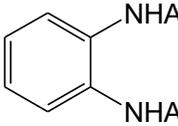
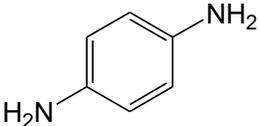
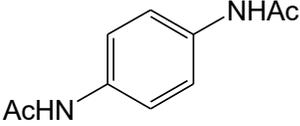
As shown in Table 4 several amines underwent acetylation very smoothly gives good yields. The optimized acetylation reaction was performed by adding acetic anhydride (1.5 equiv) to the dissolved in methanol followed by addition of Indion resinone lot to obtain a final pH ca. 5.5. The methodology works well for aliphatic, **1-2** and aromatic, **3-9** amines, as reported in Table 1 [49]. Primary amines of varying electronic and steric factors, substrate **3-9** were examined. It is interesting to note that in most of these cases the product precipitates in less than 5 minutes. It has been observed that the acetylation of arylamines performed in an organic reaction medium substrate containing electron-donating groups in the aromatic ring facilitate the reaction, whereas electron-withdrawing groups slow down the reaction. No such

effect was observed by the present methodology and all the substrates react with equal rates. However, aryl amines gave better yields as compared to alkyl amines. Chiral amines **10** can be easily acetylated with complete retention of optical activity. Phenol and thiophenol reacted slowly under the identical conditions giving poor yields of products. Thus, by taking advantage of the differential reactivity among nucleophiles, we were able to carry out chemoselective acetylation of amines over phenols and thiols. Similarly, in a competitive acetylation reaction with an equimolar mixture of aniline **4** and phenol by this procedure, the amine is acetylated selectively leaving the phenol unaffected.

Table-4 Acylation of amines with acetic anhydride

| Substrate  | Anhydride | Product  | Yield |
|--|-----------|--|-------|
|  <b>1</b>   | Acetic    |  <b>1a</b>   | 85    |
|  <b>2</b>   | Acetic    |  <b>2a</b>   | 75    |
|  <b>3</b>  | Acetic    |  <b>3a</b>  | 95    |
|  <b>4</b> | Acetic    |  <b>4a</b> | 97    |

| Substrate   | Anhydride | Product   | Yield  |
|---|-----------|---|--------|
|    | 5 Acetic  |     | 5a 84  |
|    | 6 Acetic  |     | 6a 87  |
|    | 7 Acetic  |     | 7a 97  |
|    | 8 Acetic  |     | 8a 95  |
|  | 9 Acetic  |   | 9a 86  |
|  | 10 Acetic |  | 10a 80 |
|  | 11 Acetic |   | 11a 95 |

|   |    |        |  |      |                 |
|---|----|--------|--|------|-----------------|
|  | 12 | Acetic |  | 12a  | 35 <sup>c</sup> |
|  | 13 | Acetic |  | 13a  | 95              |
|  | 13 | Acetic |  | 13aa | 85              |
|  | 14 | Acetic |  | 14a  | 85              |

a Confirmed by comparison with IR, <sup>1</sup>H and <sup>13</sup>C NMR of the authentic sample. b Isolated yields' Rest of the products being diacetylated product **12aa** and 2-methyl-benzothiazole **12ab**. d Based on the recovery of starting material. e 3 equivalent of Ac<sub>2</sub>O was used.

In an analogous reaction between aniline **4** and thiophenol, the thiophenol is unaffected. Similar selectivity was observed for intramolecular reaction as well. Thus, acetylation of 4-aminophenol **11** and 2-aminothiophenol **12** produced the corresponding acetamides; the phenolic and thiophenolic moiety remained untouched with one equivalent of the reagent. The selective acetylation is of significant interest for the preparation of antipyretic and analgesic drugs, like paracetamol **11a**. Monoacetylation of 1,2-phenylenediamine **13** demonstrates the efficacy of the method. However, no chemoselectivity was observed for symmetrical diamine 1,4-phenylenediamine **14** even with one equivalent of the acetic anhydride.

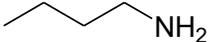
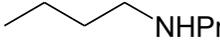
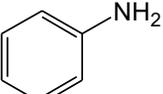
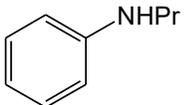
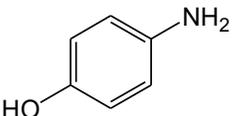
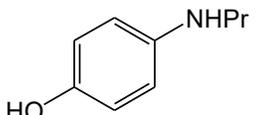
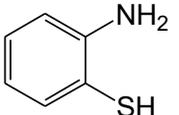
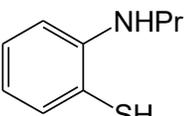
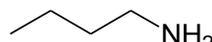
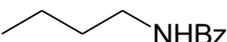
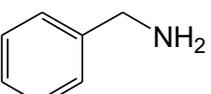
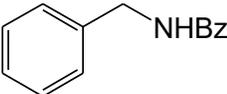
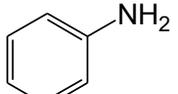
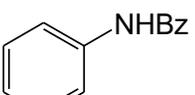
When 2-aminothiophenol **12** was treated with one equivalent of acetic anhydride under the identical conditions; along with a trace amount of diacetylated product **12aa** (<5 %) and monoacetylated product **12a** (>28%) and an interesting heterocyclic product 2-methylbenzothiazole **12ab** was obtained (ca.40%). The formation of 2-methyl-benzothiazole **12ab** is via acetylation of amine is followed by a nucleophilic attack of

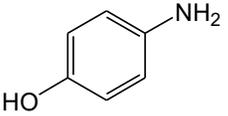
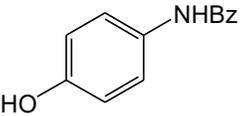
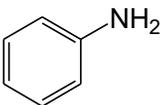
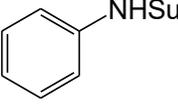
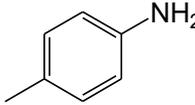
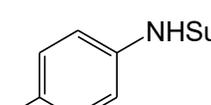
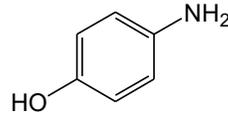
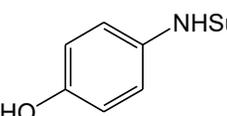
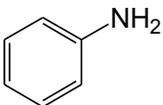
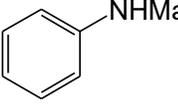
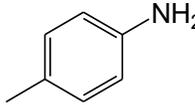
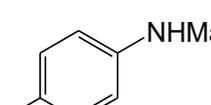
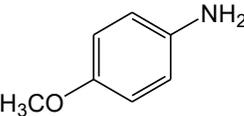
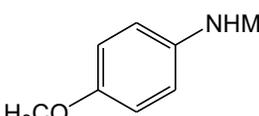
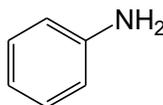
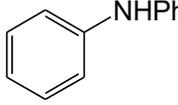
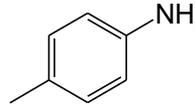
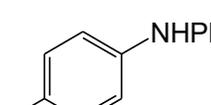
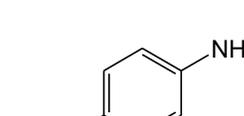
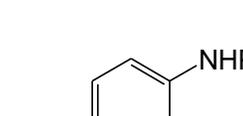
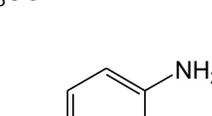
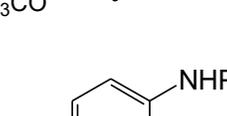
thiophenolic group on the carbonyl carbon of the amide and subsequent water elimination. Formation of 2-methylbenzothiazole **12ab** has confirmed the chemoselective acetylation of amines over thiols. In most of these cases the acetylated product precipitated out from the aqueous reaction medium and in few cases it was extracted with ethyl acetate to obtain the pure product, except for substrates **1** and **2** where the products needed extraction and in the case of substrates **13** and **14** the products required extraction as well as chromatographic separation. It was found that primary amines underwent smooth acetylation while secondary amines such as diphenylamine remained inert under the present experimental conditions. The by-product, sodium acetate is a useful buffering agent and it can be recovered from the aqueous effluent upon concentration of the aqueous medium, if desired.

The novel aspect of the present methodology was applied to cyclic anhydride such as succinic and maleic anhydride. In this case the anhydride 1.2 equivalent was used per equivalent of amine. All these substrates reacted easily as shown in Table 2, giving good yields. The reaction took place readily with simultaneous precipitation of white coloured solid product. Finally the methodology was tested with an aromatic cyclic anhydride, the phthalic anhydride. Finely powdered phthalic anhydride, 1 equivalent, was added to amine solution followed by Indion resin. This methodology has been tested with a number of aromatic amines and the results are summarized in Table 2.

**Table 2.** Acylation of amines with different anhydrides

| Substrate | Anhydride | Product Yield |
|-----------|-----------|---------------|
|-----------|-----------|---------------|

|  |    |           |   |     |    |
|--|----|-----------|---|-----|----|
|   | 2  | Propaonic |   | 2b  | 85 |
|   | 4  | Propaonic |   | 4b  | 94 |
|   | 11 | Propaonic |   | 11b | 92 |
|   | 12 | Propaonic |   | 12b | 87 |
|   | 2  | Benzoic   |   | 2c  | 85 |
|   | 3  | Benzoic   |   | 3c  | 90 |
|  | 4  | Benzoic   |  | 4c  | 90 |

|   |    |          |  |     |    |
|---|----|----------|--|-----|----|
|    | 11 | Benzoic  |    | 11c | 92 |
|    | 4  | Succinic |    | 4d  | 85 |
|    | 7  | Succinic |    | 7d  | 80 |
|    | 11 | Succinic |    | 11d | 90 |
|    | 4  | Maleic   |    | 4e  | 75 |
|    | 7  | Maleic   |    | 7e  | 82 |
|   | 8  | Maleic   |   | 8e  | 85 |
|  | 4  | Phthalic |  | 4f  | 90 |
|  | 7  | Phthalic |  | 7f  | 85 |
|  | 8  | Phthalic |  | 8f  | 80 |
|  | 11 | Phthalic |  | 11f | 88 |

Confirmed by comparison with IR,  $^1\text{H}$  and  $^{13}\text{C}$  NMR of the authentic sample, b Isolated yields.

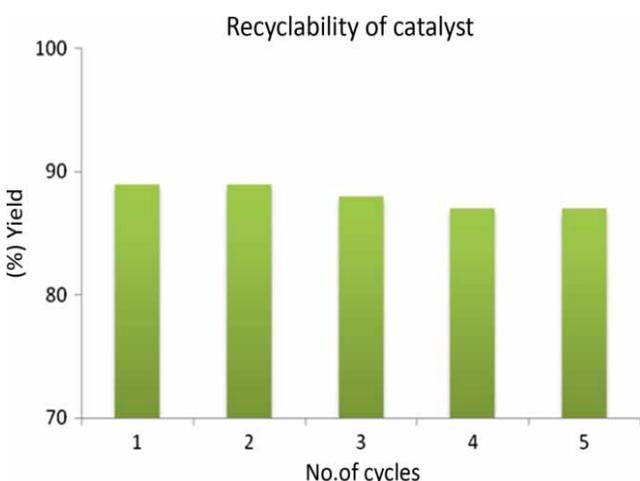
Besides, acetic anhydride this procedure is amenable also to acyclic, cyclic, aliphatic and aromatic anhydrides, Table 2.10 Propionylation of aliphatic **2** and aromatic amine **4** using propionic anhydride was carried out under the identical conditions as described for acetic anhydride. Here again the amino functionality

has been chemoselectively propionylated in the presence of phenols and thiols as demonstrated for 4-aminophenol **11** and 2-aminothiol **12** correspondingly. Substrate 2-aminothiol **12** gave heterocyclic product, 2-ethylbenzothiazole **12bb** as the exclusive product and N-(2-mercapto-phenyl)-propionamide **12b** as the

minor product thereby supporting the chemoselective propionylation of amines over thiols. Benzoylation of aliphatic amine **2**, benzylamine **3**, aromatic amine **4** and chemoselective benzoylation of 4-aminophenol **11** further proves the efficacy. The product precipitated into lumps, can then be recrystallised either from acetone or from ethyl acetate. The catalyst can be recovered from the reaction mass.

### Recycle study:

With the increasing interest in human health and environmental protection more attention is being paid to green chemistry. With the view we studied the recyclability and reusability of the catalyst, after completion of the reaction the catalyst was separated by filtration, washed with hexane and dried. The activated catalyst was used for two more subsequent cycles. To our surprise consistent performance of the catalyst is observed in all the cycles



### Conclusions

In conclusion, this method represents a tremendous opportunity for the practice of green chemistry. The notable advantages of the method are: (i) operational simplicity, (ii) moderate to good yield of products, (iii) no chromatographic separation, (iv) excellent selectivity for aryl amines over phenols and thiols and (v) general applicability. The method is environment friendly with respect to the by-products and the effluents are innocuous. We believe this will present a better and more practical alternative to the existing methodologies for selective acylation of primary amines and thus will find useful application in the synthesis of complex natural products where selective protection of hydroxy, thio and amino groups is required.

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# Evaluation of Communicable diseases surveillance at Provincial General Hospital, Kurunegala - Sri Lanka

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## **Abstract**

Infectious diseases surveillance has been identified as the cornerstone of public health activities and decision making. By evaluating a surveillance system, it is expected to monitor communicable diseases in efficient and effective manner. Aim of this study is to evaluate the current practice of communicable diseases surveillance at Provincial General Hospital, Kurunegala, one of the largest government healthcare institutions in Sri Lanka.

Methods : Secondary data were extracted from hospital notification register, ward notification registers of some selected wards, Electronic Indoor Morbidity and Mortality Return (e-IMMR) and discharge registers of those selected wards. Key informant interviews were carried out with hospital deputy director, medical officer - infection control unit, nursing officer - infection control unit, development officer - information management unit, and ward sisters.

Results : Notification performances of the whole hospital as well as in two selected wards were assessed in relation to five selected communicable diseases. Number of notifications done for Dengue fever, Viral hepatitis, Food poisoning and Leptospirosis were very low compared to number of diagnosed cases of same. However, hospital wise notification of Leishmaniasis is extraordinary high compared to the diagnosed number, since those notifications are done by the Dermatology clinic and currently hospital does not have a mechanism to track diagnosis making at Clinics and Out Patient Department.

During key informant interviews, it was revealed that, people related issues, process related issues and resources related issues were the main underlying causes for low level of notifications done at PGH Kurunegala.

***Key words - Communicable Diseases, Evaluation, PGH Kurunegala, Surveillance***

## **Introduction**

The term "Surveillance" has been defined as "Systematic ongoing collection, analysis, and interpretation of data and timely dissemination to those who need to know, so that action can be taken"(Mavji, n.d.). Surveillance is a major public health strategy in prevention and control of communicable diseases which guides immediate action for cases of public health importance. It helps to identify the epidemiology of diseases and measure the burden of a disease including changes in related factors, identify the population at risk and identify new or emerging health concerns(WHO, 2006). In addition to that, surveillance helps in monitoring trends in disease burden in relation to time, place, and person.

Communicable diseases surveillance is being carried out in three ways in Sri Lanka as, routine notification of communicable diseases, special surveillance on selected set of communicable diseases and sentinel site surveillance.

Under the routine notification, 26 disease conditions, which have been broadly categorized as group A and group B, have to be notified to the relevant authority. According to the quarantine & prevention of disease ordinance of 1897, notification of those diseases is mandatory. Every medical officer or person professing to treat diseases in the list, shall do the notification. When a patient is suspected to be having a communicable disease, medical officer who treat, should notify it using a standard notification form (H544) and relevant details should be entered in the notification register of the healthcare institution. Then it is sent to the relevant Medical Officer of Health(MOH) office where details will be entered in the notification register of MOH office and distributed to the respective Public Health Inspector(PHI) for investigation. The investigation report (H411 for unconfirmed cases and H411a for confirmed cases) will be sent back to the MOH, once they complete the investigation. Information in these reports is entered in relevant registers and finally weekly return of communicable diseases (H399) is prepared at the MOH office, on weekly basis and sends to the Epidemiology unit and respective regional epidemiologist (RE).

In manual system of notification, all these steps have to be followed before it reach the Epidemiology unit. Hence unexpected level of delays occur due to many reasons, which cannot be corrected easily. Currently there is an “e-surveillance” system, through which notification data send to the RE and Epidemiology unit by each of the MOH office. Feedback of this surveillance published by the Epidemiology unit (national level) through the Weekly Epidemiological Report (WER) and Quarterly Epidemiological Bulletin (QEB).

In addition to the routine surveillance of communicable diseases, special surveillance is also carried out for some selected set of diseases (all diseases covering under the Expanded Programme of Immunization, Dengue Hemorrhagic Fever, Human Rabies, Hepatitis and Leptospirosis). Furthermore, there are 19 sentinel sites to report Influenza Like Illnesses (ILI) and 4 sites to report Severe Acute Respiratory Illnesses (SARI) in the country(Ministry of Health, 2009).

### ***Evaluation of Disease Surveillance at PGH Kurunegala***

PGH Kurunegala is the largest hospital in North Western province and provides tertiary level care to a very large draining population. Evaluation of the disease surveillance performances was done at the institutional level as well as at some selected wards level.

### ***Objective of the study***

To evaluate the hospital's communicable diseases surveillance performance

### ***Methodology***

- Primary survey of secondary data, through hospital notification register, ward notification registers of some selected wards, Electronic Indoor Morbidity and Mortality Return (e-IMMR) and discharge registers of those selected wards
- key informant interviews with hospital deputy director, medical officer - infection control unit, nursing officer - infection control unit, development officer - information management unit, and ward sisters

Only the following five notifiable diseases were considered in this study.

1. Dengue Fever

2. Leptospirosis
3. Leishmaniasis
4. Food poisoning
5. Viral Hepatitis

### **Results**

Number of diagnosed cases of above five diseases during the last 6 months (from January 2020 – June 2020) were obtained from the e-IMMR. Then, the number of total notifications for same diseases during the same time period was obtained from the hospital notification register. Finally the gaps between number of notifications and number of diagnosed cases were calculated. The results are summarized in Table 1.

**Table 1: Gaps between Diagnosed and Notified Cases of the Hospital**

| <b>Disease</b>    | <b>Diagnosed No</b> | <b>Notified No</b> | <b>Gap</b> | <b>No notified as a percentage of no diagnosed</b> |
|-------------------|---------------------|--------------------|------------|--|
| Food poisoning    | 11                  | 02                 | 09         | 18.18%   |
| Dengue Fever/ DHF | 1185                | 674                | 511        | 56.87%   |
| Leptospirosis     | 178                 | 52                 | 126        | 29.21%   |
| Leishmaniasis     | 01                  | 148                | 147        | 14800%   |
| Viral Hepatitis   | 03                  | 00                 | 03         | 00   |

According to Table 01, there is a huge gap between number of diagnosed cases and the number of notified cases of aforementioned five diseases. When number of notified cases expressed as percentages of number of diagnosed cases for each of those diseases, results were, 18.18%, 56.87%, 29.21% and 00%, respectively for Food poisoning, Dengue Fever/ DHF, Leptospirosis and Viral Hepatitis. However, number of notified cases of Leishmaniasis was extraordinary high compared to diagnosed number, since almost all the Leishmaniasis cases have been notified by the Dermatology clinic and those cases were not included in to the e- IMMR. It further revealed that, there is no any database at the hospital to catch number of diagnosis done at clinics and outpatient department.

### **Assessing the level of Disease Surveillance at Wards Level**

Two wards were selected (one Medical ward and one Pediatrics ward) to assess the performance of disease surveillance at Wards level. Number of diagnosed cases with aforementioned diseases were calculated using the ward discharge register and number of notifications for each of those conditions were taken from ward notification register of respective wards. Results are summarized in Table 02 and Table 03.

**Table 02; The Gaps between the Diagnosed and Notified Cases in Medical Ward (Ward 01)**

| <b>Disease</b>    | <b>Diagnosed No</b> | <b>Notified No</b> | <b>Gap</b> | <b>No notified as a percentage of no diagnosed</b> |
|-------------------|---------------------|--------------------|------------|--|
| Food poisoning    | 00                  | 00                 | 00         | 00   |
| Dengue Fever/ DHF | 120                 | 48                 | 72         | 40%  |
| Leptospirosis     | 52                  | 21                 | 31         | 40.38%   |
| Leishmaniasis     | 01                  | 00                 | 01         | 00   |
| Viral Hepatitis A | 01                  | 00                 | 01         | 00   |

It is clear that, number of notified cases were very low compared to number diagnosed in ward 01. Even though there were very few diagnosed cases of, Leishmaniasis, viral hepatitis and Food poisoning, nothing has been notified. It further revealed that, only 40% of diagnosed dengue cases and 40.38% of Leptospirosis cases have been notified by the ward 01.

**Table 03: Gaps between the Diagnosed and Notified Cases in Paediatrics ward(Ward 18)**

| <b>Disease</b>    | <b>Diagnosed No</b> | <b>Notified No</b> | <b>Gap</b> | <b>No notified as a percentage of no diagnosed</b> |
|-------------------|---------------------|--------------------|------------|--|
| Food poisoning    | 03                  | 01                 | 02         | 33.33%   |
| Dengue Fever/ DHF | 180                 | 102                | 78         | 56.66%   |
| Leptospirosis     | 00                  | 00                 | 00         | 00   |
| Leishmaniasis     | 00                  | 00                 | 00         | 00   |
| Viral Hepatitis A | 00                  | 00                 | 00         | 00   |

It can be observed that, even a single case of Leptospirosis, Leishmaniasis and viral hepatitis has not been diagnosed at the ward 18 during first 6 months of this year. However, 180 Dengue/DHF cases and 3 food poisoning cases were diagnosed and only 56.66% and 33.33% of those have been notified respectively.

**Discussion**

In an ideal setup, number of notifications should be higher than the number of diagnosed cases since notifications are done with a tentative diagnosis, which can be changed with time and investigation results. However, number of notifications are significantly lower than diagnosed cases in PGH Kurunegala. Key informant interviews were carried out with the deputy director of the hospital, MO - Infection control unit, ICNO, Medical Record Officer and two sisters of aforementioned wards to find out underlying causes for poor practice of notification in the hospital. Results are summarized in Figure 01.



During the routine operations of hospital (Particularly in wards and the OPD), there is no a proper mechanism to make the notifications happen when it requires. It solely depends on the particular doctors' interest. There is no proper monitoring and evaluation system to assess the performance of notification and to correct it. In addition to that, unavailability of a focal point at the hospital to handle this process, also an identified major issue.

### ***Resources related issues***

Unavailability of adequate number of human resources in the hospital is one of the major reasons to avoid them from doing most of the paper work. PGH Kurunegala is one of the busiest hospitals in the country, particularly wards of major four specialities are extremely busy with their routine curative work.

### ***Conclusion and Recommendation***

Surveillance is a well known effective public health measure used for prevention and control of diseases. However PGH Kurunegala shows a very poor level of communicable diseases surveillance practices mainly due to, people related issues, process related issues and resources related issues. Followings are the recommendations to improve the existing level of communicable diseases surveillance at PGH Kurunegala.

1. All the doctors should be educated regarding the importance of notification and how to do the notification in correct way. Particularly they should be educated regarding the fact that, it is a legal requirement and failure of doing the notification is a punishable offence.
2. During the orientation programmes for new HOO, they should be strictly advised to do notifications as a mandatory requirement.
3. A mechanism should be developed in the hospital to make it a routine process and not depends only on personnel interests. For example, nursing officers of relevant units should be educated regarding the notification and notifiable diseases. Whenever a patient comes with a suspected notifiable disease, they should be asked to attach a notification form to the BHT during the patient registration itself. After the patient is seen by a doctor, nursing officers can recheck whether the notification form has been filled or not.
4. Head of the institution (HOI), should develop a proper monitoring and evaluation system to assess the performance of notification in each unit. Quarterly reviews should be conducted in order to identify gaps and to take necessary corrective actions.
5. A focal point should be there in the institution to handle notification process. Ideally it can be the infection control unit, headed by the consultant microbiologist. Planning and implementation of related activities, resource allocation, monitoring and evaluation of the process should be done by the focal point.

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# Strategies Employed In Nairobi County Incident Command Systems Of Selected Organizations Influencing Disaster Response Operations

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**Abstract-** Response to disasters among response organizations reveal exceptionally complex management scenarios contributing to delay in response due to lack of Incident Command System. Previous disasters reveals that there no management structure that discuss, analyze, and describe complex disaster scenarios and response under exceptional circumstances as a single system by various response organizations. Therefore, the article assess the strategies employed on Nairobi County incident command systems of selected organizations influencing disaster response operations. The study adopted conceptual framework. Contingency theory and goal theory guided the study. Descriptive research design was used. A stratified sampling technique was used to determine sample category of 155 respondents from, Red Cross Society, Kenya Police Service, Nairobi Fire Brigade and National Youth Service. The instruments of data collection were questionnaire, focus group discussion and interview guides. The SPSS version 27 was used to analyze data then presented it on tables and graphs. Validity was determined using content validity while reliability using test and retest technique. The study found that Nairobi Fire Brigades and National Youth Service had no formalized ICS but were only using one improvised by other response organizations and this becomes a challenge in response due to lack of ICS training. That lack of training contributes to mismatch between response agencies during joint response. Therefore, the study recommends that there should be joint training and mock exercises to understand each organization capabilities and resources available through use of Incident Command System.

**Index Terms-** Emergency relief; incident command system; response operation

## I. INTRODUCTION

**I**1.1 Background to the study  
Incident Command System (ICS) has become a primary tool used to reduce the impact of non-recurrent disasters due to their effects. Longer incident response time comes with notable delay to Humanitarian relief organizations and this increases the likelihood of a secondary incident that is often more severe than the initial incident. The traditional incident management approach is a systematic approach, largely performed independently with

limited coordination among involved agencies. To minimize the incident response time, Incident command system has ensured that every agency involved in the response operation work effectively and efficiently (Zobel and Khansa, 2011).

The impetus for the development of these systems at global level was the disastrous and devastating in the 1970 fire season in Southern California. Individual Command Posts and fire camps were established by multiple agencies for the same incident. Response resource availabilities reached critically low levels. The number of fires burning at the same time taxed the organizational capability to protect live property, and the environment, especially where wilderness bordered urban communities, creating a dangerous wild land-urban interface. These fires, over 13 days, resulted in 16 deaths, 700 destroyed structures, more than 500,000 acres burned, and over \$234 million in damage (Tatham and Pettit, 2010).

The aftermath of the 9/11 terrorist attacks and the dissemination of anthrax in 2001, the ability of the U.S. healthcare system to provide an effective and coordinated response to mass casualty or complex incidents came under intense scrutiny. The devastation caused by Hurricane Katrina and the mass disruption of public health and medical services along the Gulf Coast spotlighted the need for cohesive strategies that focus on management systems for major public health, medical and other humanitarian organizations response. The needs of management structure that will allow U.S to discuss, analyze, and describe complex disaster scenarios and response under exceptional circumstances as a single system. Examinations of major emergencies reveal exceptionally complex management scenarios. This is true for all hazard types, natural disasters, infectious diseases, terrorism, large-scale explosives and is apparent even in events without large numbers of physically injured or ill patients (Olowu, 2010).

Disasters experienced in recent years have had significant impact on people, property and the environment, and this widespread impact has informed the review of policies, measures and approaches in managing them. Despite response arrangements such as multi-agency response, military efforts and various other international efforts, disasters continue to have a negative impact on communities across the world. Human history shows that disaster has been with humanity for time immemorial (Haddow *et al.*, 2011). Many of these disasters or occurrences of unprecedented scale of emergency have found their cause in

climate change, globalization, human-activity, and rapid urbanization (Perrow, 2011). Therefore, a comprehensive disaster emergency management framework may be very useful. Such a framework should include plans and support structures for road networks to ensure easy access to emergency help zones, good quality hospitals to address emergency needs of flood victims, rapid response capacity of police and firefighters, and rapid response capacity to disaster emergencies (Olowu, 2010).

In Africa, response to the 2014–2015 Ebola virus disease (EVD) outbreak in Sierra Leone overwhelmed the national capacity to contain it and necessitated a massive international response and strong coordination platform. Due to lack of effective establishment of the incident command system, led to competition and duplication of efforts between the numerous coordination groups, slow resource mobilization, inadequate capacity of staff for health coordination, and an overtly centralized coordination and decision-making system as the main coordination challenges during the outbreak (Nassos, 2014).

Kenya has had a fair share of disasters some have been natural like floods, famine, drought, hurricanes and man-made disasters like terrorist bombings that have become common today in our society. The Sachang'wan fuel Tanker fire of 31<sup>st</sup> January 2009, Kenya Defense Forces, Nakuru municipal fire brigade and Kenya Red Cross volunteers coordinated the evacuation of the injured to Molo and Nakuru hospitals. The Ministry of Health with assistance from Kenyatta National Hospital and other medical suppliers provided medical assistance at Molo District Hospital and the Provincial General Hospital, Nakuru though their uncoordinated rescue efforts and lack of medical staff on duty, medical supplies and equipment is thought to have contributed to the death of 113 people (Okobie, 2012). The fire was the second in Kenya in the same week, after [Nakumatt supermarket fire in Nairobi which caused](#) the deaths of 25 people. The [Kenyan media criticized the government](#) for its poor safety standards and inadequate [disaster preparation](#) (Okobie, 2012). The act of unpreparedness by government of Kenya to respond to these incidents showed lack of centralized incident command system for effective preparedness.

Nabutola (2012), noted that despite many important disaster management initiatives undertaken in Kenya over the past two decades, adequate level of preparedness required to address its significant risk profile has not been achieved. Initiatives have been undertaken in an inconsistent, unharmonious, reactive and uncoordinated manner due to lack of a unified policy framework. That disaster systems and risk management are still centralized and tall neck beauracracies which have not been devolved to the counties. Although Kenya's economy and by extension its population could be classified as highly vulnerable to natural and man-made disaster risks, the country does not have a comprehensive disaster management framework and strategies guided by appropriate policy and legislative provisions. The country is fortunate to have been able to sort of manage from one emergency to another, without an effective disaster management system (Nabutola, 2012). She further noted that the frameworks and legislations to facilitate the coordination of disaster management activities from the central level to local level have not been institutionalized.

The continued lack of disaster preparedness is a development challenge in Kenya. Poor collaboration and coordination efforts from all stakeholders including government departments have led to poor responses to flood incidents in Kenya. The United Nations Office for Coordination of Humanitarian affairs (2013), indicates that 170 people died and 22,500 people were displaced due to the March-April-May enhanced rains in 2013 that impounded parts of Kenya. According to the Famine Early Warning Systems Network, these rains were enhanced by more than 200%. These negative effects of enhanced rainfall, coupled with infrastructural destruction have called for cross border disaster risk reduction and flood mitigation response measures.

In Nairobi County, the response to Westgate shopping mall terrorists attack on Saturday 21, September 2013, which lasted 80 hours and resulted in at least 67 deaths and wounding more than 175 people in the [mass shooting](#). McConnell (2015), was a result of fatal friendly fire between response agencies undermining their response and left the attackers free to prolong their slaughter (Sageman, 2004). According to Dron (2013), Kenyans have questioned the ability of forces both in terms of operations and skills to effectively respond to daily threats when they occur. The most evidence of operational decay was during the pipeline fire which was caused by an explosion secondary to fuel, at least 122 casualties were admitted in Kenyatta National Hospital with severe burns (O'Keeffe, 2013) and the August 2013 fire at Jomo Kenyatta International Airport (JKIA) in Nairobi. What was initially a small fire escalated into a full-blown inferno that gutted the international arrivals lounge (Dron, 2013). The JKIA fire was an indicator of the dangerous limitations of disaster management system, thus need to assess the strategies employed in Nairobi County incident command systems of selected organizations influencing disaster response operations.

## 1.2 Statement of the problem

Despite lesson learnt from the previous disasters in Nairobi County, response still appears to be more reactive rather than use of incident command system as depicted from the background of the study. Over the past years, various disasters have taken place in Nairobi County, for instance the Westgate shopping mall terrorists attack 2013 and Jomo Kenyatta International Airport (JKIA) fire in august, 2013 (Dron, 2013).

Regardless of these disasters, the need for developing an incident command system that can coordinate response activities has not been embraced by the response agencies. Most response have been undertaken in an inconsistent, inharmonious, reactive and uncoordinated manner due to the multiplicity of response organizations. Under normal circumstance, the previous terrorists attack could have been a case for identification of response organizations preparedness challenges for future preparedness for effective response and coordination. Nikbakhsh and Farahani (2001), noted that the scale and complexity of emergencies in Nairobi County strongly suggests the need for appreciating the role of incident command system for effective response to these emergencies. Yet, preparedness of incident command system for effective humanitarian disaster response operation has not been adequately assessed.

The needs for management structure that can discuss, analyze, and describe complex disaster scenarios and response under exceptional circumstances as a single system is paramount. Examinations of major emergencies reveal exceptionally complex management scenarios contributing to delay in response to emergencies, infighting and incompetence among response agencies during disasters due to lack of incident command system (Katzenback and Smith, 2015).

The Kenya government has formulated a draft in relation to emergency management in relation to training for effective response, the draft on National Disaster Management Policy to emphasize proactive and preventive strategies in addressing disaster situations to date yet finalized and yet it still needs revision to reflect the requirements of the Constitution of Kenya 2010 (Aparna, 2006). Therefore, the study investigated on preparedness of Nairobi County incident command systems of selected organizations influencing disaster response operations.

Scholars like Jensen and Junior (2014), asserts that there is no documented research describing specific preparedness of incident command systems for effective humanitarian disaster response operations. While ICS has been used by emergency responders for nearly four decades, there has not been much scientific research on the effectiveness of the system. That in a recently published paper, there was only 14 scholarly, peer-reviewed journal articles reporting the findings of empirical research on ICS in the United States but were not again addressing on the issue of preparation effectiveness of the systems. It's in view of this that this study investigated on preparedness of Nairobi County incident commands system for effective humanitarian disaster response operations.

### 1.3 Objective of the study

The objective of the study was to assess the strategies employed on Nairobi County incident command systems of selected Organizations influencing disaster response operations.

### 1.4 Research Question

What strategies are put in place in incident command system on effective disaster response operation?

### 1.5 Justification of the Study

Effective management of all disasters in Nairobi depends on the incident command system put in place for response. However, although there is extensive preparedness in disaster response, different organizations train differently highlighting the need for incident command system for coordinative response. Most of disasters are not effectively responded to due to confusion from responding agencies. The West gate terrorist attack (Blair, 2013), highlights the role of incident command system on effective response to disaster incidents. This prompted the study to understand preparedness of Nairobi County incident command systems of selected organizations influencing disaster response operations.

#### 1.5.1 Academic Justification

There seem to be very little research conducted on this topic and particularly no study has been done on preparedness of Nairobi County incident command systems of selected organizations influencing disaster response operations yet the

issue of disasters management is a global issue. The study findings bridges that gap and contribute to the general field of knowledge, which may be of utmost importance to other researchers doing their research in disaster management field. The research findings will also assist response organizations in assessing their training curriculum so that they can make changes on aspects that seem to be lacking for effective response to disasters.

#### 1.5.2 Policy Justification

The study findings will be useful to the Kenya government in formulation of policies, plan for revamping and improving on existing policies and practices in relation to emergency response to disasters. The findings may also be useful to any disasters First Responder organizations and NGOs interested in planning and directing of response to disasters or providing their services, towards saving life in case of disaster in Nairobi County.

## II. 2.1 STRATEGIC FRAMEWORK FOR EMERGENCY PREPAREDNESS AND RESPONSE

Intervention to address disasters has evolved through time into a complex policy subsystem, and disaster policy is implemented through a set of functions. Modern approaches to emergency management and response involve multidimensional efforts to reduce our vulnerability to hazards, diminish the impact of disasters and to prepare for, respond to, and recover from those that occur. These responsibilities present formidable challenges for governments because of the extraordinary demands disaster events impose on the decision making systems and service delivery infrastructure of the communities they affect (Akhtar *et al.*, 2012).

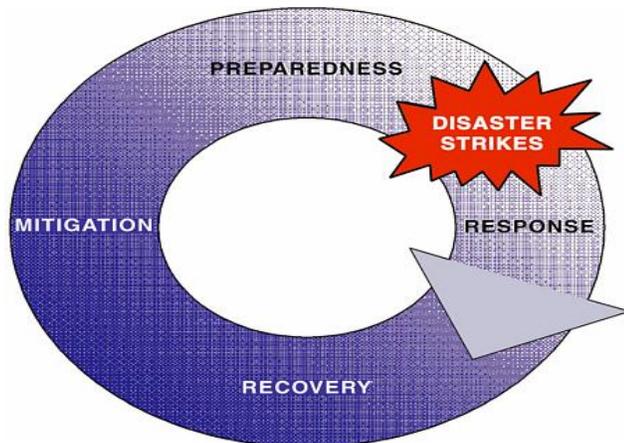
In the context of Incident Command System, when the capacities of the response may be viewed to be affected due to multiagency response, the applicability of it may help in solving such problems. Disasters are dynamic events and they evolve as they progress, and they change in response to human actions and natural forces. This makes it imperative that response strategies be flexible and argues for the value of analysis in helping responders understands and adapt to the changing conditions they face (Caplice and Sheffi, 2004). Managing these phenomena can thus be a highly technical endeavor requiring specialized expertise for both policy development and policy implementation.

These inherent qualities of disasters leave governments in a quandary about what to do to manage them. More specifically, the magnitude, scope, uncertainty, dynamism, and infrequency of disasters give rise to some important questions on the type of Incident Command System to develop which can effectively provide assistance to those who have been affected through development of a common operating picture and common situational awareness shared by all emergency responders or through better search and rescue procedures. Thus, both policy issues and practical issues are the baseline that forms strategic framework for emergency preparedness and response working towards reducing risk to which our populations are exposed and to protect people and infrastructure (Bennett, 2011).

To address these and other issues and challenges related to response, the emergency services professions have specified a host of activities aimed at assuaging the losses that disasters

inflict. The degree to which these activities have been identified, assigned to responsible parties, and coordinated has evolved over time into a broad framework first defined in a 1979 National Governors Association report on its study of emergency preparedness known as Comprehensive Emergency Management which specifies four phases of modern disaster management: preparedness, response, recovery, and mitigation (Jamieson, 2005).

Each of these phases levies particular demands on emergency managers and responders, and each can be informed and improved by the application Incident Command System.



**Figure 1: Emergency Management Cycle**  
**Source: Emergency Management Framework (2007)**

According to Locke and Latham (2000), planning, training and exercises may be conducted by agencies in isolation, but they are more powerful when conducted jointly so that interfaces can be resolved. Perhaps the most important result of joint planning and exercising is the relationships developed between those who will be involved in response. In the best instances, these processes develop trust among those who will be called upon to work together during an event.

Dara *et al* (2005), asserts that in test of implemented framework, model of event scenarios is used either in the development of single or multiagency response plans or as part of exercises designed to test agency preparedness and the adequacy of those plans in relation to incident command system. These scenarios are essential in developing the master scenario events lists that enable exercise designers and controllers to test critical aspects of response plans and to develop additional modifications of the course of events during an exercise with the guide of the Incident Command System.

The ability to organize multiagency efforts continues to improve, some of the actions that have traditionally been thought of as recovery activities are now beginning at essentially the same time as the response with use of incident command system. A modification of this paradigm is used for acts of terrorism where awareness, detection, deterrence, and prevention are seen as the key elements in reducing or eliminating the impacts or even the occurrence of events. Specific emergency management activities may differ for those described above as they are influenced by the intelligence and security communities, but the sequence is analogous to that followed for natural disasters and has elements

that parallel what is required for technological disasters which can only be achieved through coordination (Decker, 2011).

According to Baltic (2004), the catastrophic nature of disasters means that all levels of government and all sectors of society share responsibility for dealing with them. In general, disasters are managed through a national structure of responsibilities and resources, where discretion and authority for management reside with the affected jurisdictions, and where requests for resource support travel upward from those jurisdictions until enough are garnered to stabilize the incident.

As jurisdictions are overwhelmed, neighboring jurisdictions may assist through the provision of mutual aid. Nongovernmental organizations (both private and nonprofit) also supplement response with a range of assistance from providing shelter and food to helping manage donations of money, goods, and services, to tracking and serving populations with special needs which can only be effective through use of Incident command system to coordinate these agencies (Balcik *et al.*, 2010).

## 2.2 Incident Command System hazard approach to incident management

One critical function of emergency responders at all levels of government is incident management. It is usually effected through a functionally oriented incident command system (ICS) that can be tailored to the type, scope, magnitude, complexity, and management needs of the incident and can operate at all levels of government. An ICS is employed to organize and unify multiple disciplines, jurisdictions, and responsibilities on-scene under one functional organization. Balcik *et al* (2010), acknowledges that the ICS establishes lines of supervisory authority and formal reporting relationships, but allows for team-based leadership approaches. In particular, the ICS may include the adoption of a formal unified command, a multiagency governance structure that incorporates officials from agencies with jurisdictional or functional responsibility at the incident scene and allows them to provide management and direction jointly within a commonly conceived set of incident objectives and strategies. Regardless of whether the ICS is configured as a unitary or a unified command, the ICS organization develops around five major functions that are required for any incident whether it is large or small (Moynihan 2009).

While the concept of incident command has been developed over more than three decades and is broadly employed, different disciplines and jurisdictions understand and implement ICS differently, this makes implementation of a coherent command structure for a large-scale disaster a challenge. Very often, multiple, overlapping, duplicative, and even conflicting command processes and structures emerge. This, in turn, makes coordination and application of resources difficult. The National Incident Management System attempts to address these tensions by incorporating longstanding ICS and unified command principles into a common incident management operating philosophy (Akhtar *et al.*, 2012).

## 2.3 Strategies employed on Nairobi County incident command systems of selected Organizations influencing disaster response operations

The need for Strategic management in an organization in management of an organization's resources to achieve its goals and objectives is essential in Nairobi County. This involves setting objectives, analyzing the competitive environment, analyzing the internal organization, evaluating strategies, and ensuring that management rolls out the strategies [across the organization](#). The skills and competencies of employees, and [organizational structure](#) are all important factors that influence how an organization can achieve its stated objectives. Inflexible companies may find it difficult to succeed in a changing business environment. Creating a barrier between the development of strategies and their implementation making it difficult for managers to determine whether objectives have been efficiently met among disaster response organizations in Nairobi County (Nag *et al.*, 2007).

While an organization's upper management is ultimately responsible for its [strategy](#), the strategies themselves are often sparked by actions and ideas from lower-level managers and employees. An organization may have several employees devoted to strategy rather than relying solely on the manager for guidance. Organizational leaders focus on learning from past strategies and examining the environment at large. The collective knowledge is then used to develop future strategies and to guide the behavior of employees to ensure that the entire organization is moving forward (Porter and Michael, 1996).

For these reasons, effective strategic management requires both an inward and outward perspective among disaster response organizations in Nairobi County. According to John (2006), strategic management extends to internal and external communication practices as well as tracking, which ensures that the organization meets goals as defined in its strategic management plan.

Incident Command System (ICS) has become a primary tool used to reduce the impact of non-recurrent disasters due to their effects. Longer incident response time comes with notable delay to response organizations and this increases the likelihood of a secondary incident that is often more severe than the initial incident. Incident management and clearance involve multi-agency emergency response including representatives from the state department of fire service, emergency medical service, towing, and hazardous-spill cleanup services. The traditional incident management approach is a step-by-step approach, largely performed independently with limited coordination among involved agencies (Ozdem, 2011). To minimize the incident response time, Incident command system has ensured that every agency involved in the response operation work effectively and efficiently which lacks among response organizations responding to disasters in Nairobi County.

### 2.3.1 Unity of command

Each individual participating in the operation reports to only one supervisor. This eliminates the potential for individuals to receive conflicting orders from a variety of supervisors, thus increasing accountability, preventing freelancing, improving the flow of information, helping with the coordination of operational efforts, and enhancing operational safety. This concept is fundamental to the ICS chain of command structure (Bharosa *et al.*, 2010).

### 2.3.2 Common terminology

Individual response agencies previously developed their protocols separately, and subsequently developed their terminology separately. This can lead to confusion as a word may have a different meaning for each organization.

When different organizations are required to work together, the use of common [terminology](#) is an essential element in team cohesion and communications, both internally and with other organizations responding to the incident (Bigley and Roberts, 2001).

An incident command system promotes the use of a common terminology and has an associated glossary of terms that help bring consistency to position titles, the description of resources and how they can be organized, the type and names of incident facilities, and a host of other subjects. The use of common terminology is most evident in the titles of command roles, such as Incident Commander, Safety Officer or Operations Section Chief which should always apply to all disaster response organizations.

### 2.3.3 Flexible and modular organization

Incident Command structure is organized in such a way as to expand and contract as needed by the incident scope, resources and hazards. Command is established in a top-down fashion, with the most important and authoritative positions established first. For example, Incident Command is established by the first arriving unit (Dara *et al.*, 2005).

Only positions that are required at the time should be established. In most cases, very few positions within the command structure will need to be activated. For example, a single fire truck at a [dumpster](#) fire will have the officer filling the role of IC, with no other roles required. As more trucks get added to a larger incident, more roles will be delegated to other officers and the Incident Commander (IC) role will probably be handed to a more-senior officer.

Only in the largest and most complex operations would the full ICS organization be staffed. Conversely, as an incident scale down, roles will be merged back up the tree until there is just the IC role remaining (Decker, 2011).

### 2.4.4 Span of control

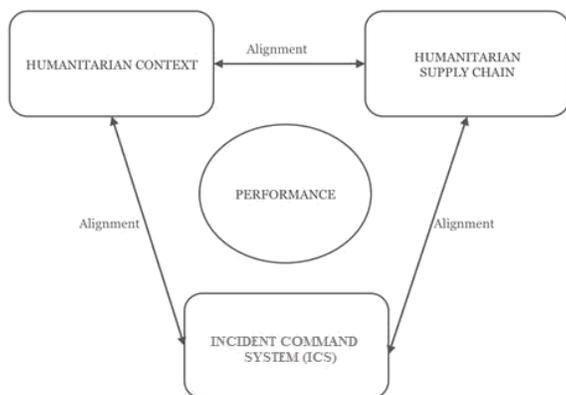
To limit the number of responsibilities and resources being managed by any individual, the ICS requires that any single person's [span of control](#) should be between three and seven individuals, with five being ideal. In other words, one manager should have no more than seven people working under them at any given time. If more than seven resources are being managed by an individual, then they are being overloaded and the command structure needs to be expanded by delegating responsibilities by defining new sections, divisions, or task forces. If fewer than three, then the position's authority can probably be absorbed by the next highest rank in the chain of command but lack of adhering to the span of control during response to emergencies in Nairobi County by response organizations leads to confusion among responders in conflicting issuing of command (Dara *et al.*, 2005).

## 2.4 Conceptual model aspects of the study

### 2.4.1 Contingency model

The contingency theorists presented an open system view and rationalized that the organization in itself is not a closed system but an open one in which the organization is dependent on other external variables such as the environment (Burns and Stalker, 2013). Contingency theory is concerned with how an organization can systematically achieve a good fit with its environment, how it can adapt to changing environmental circumstances, how it can ensure that internal relations are in balance and appropriate and what it means in operational terms. Contingency theory is predictive, thus providing guidance for leaders as to how to deal with certain situations. Morgan (2007) claims that there is no best way to organize a corporation or to [make decisions](#). Instead, the optimal course of action is contingent (dependent) upon the internal and external situation. A contingent leader effectively applies their own style of [leadership](#) to the right situation. Being flexible in choosing and adapting to succinct strategies to suit change in situation at a particular period in time in the running of the organization which also fits the characteristics of the effective incident command system (Donaldson, 2001). A contingency theory related the external and internal factors that an organization can face when implementing strategies in response to any scenario in the organization which can be in assistance of incident command system.

The core of the theory is that contingency variables are present that “moderate” the relationship between two other variables. Originally, three main contingency variables were introduced: the environment, the organizational structure (size), and the organizational strategy. A fit between these variables would lead to better performance. The theory answered a call from practitioners for theories and frameworks that would explain the complexity of the context in which they were operating. The theory received support from empirical evidence in the late 1960s, particularly from studies by Lawrence and Lorsch (2001) that identified different environmental characteristics organizations needed to cope with in order to prosper.



**Figure 2:** Theoretical Approach to Contingency Theory

**Source:** (NIMS, 2008)

The development of a contingency model soon after Burns and Stalker (2013), is an extended version of contingency theory. In this model, sub-systems exist in organizations and a good fit between the sub-systems which then influences the function ability of the theory. [Friedberg](#) (2007), argued that some

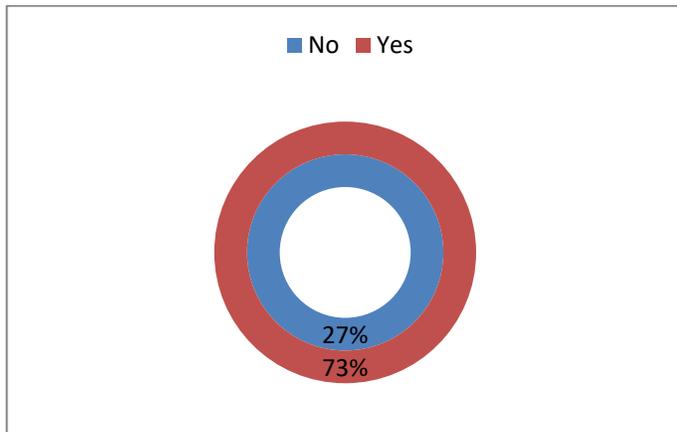
subsystems have a more extensive need to find a fit with the environment while other sub-systems do not thus calling the managers to make them fit in the system through improvised strategies for effective and normal running of the organization. According to Bourgeois (2012), expand on the model and state that strategic choices are made internally (in spite of the environmental characteristics) in an organization; therefore, they include aspects of organizational culture and values in the classical contingency model in relation to adaptation of contingency theory to disaster response organizations context with aid of incident command system.

### 2.5.2 Goal setting model

Bass (2000), states that goal theory provides four leadership styles: directive, supportive, participative, and achievement-oriented. The intervening variables are subordinate expectations and valences. Situational moderator variables include characteristics of task and environment and the characteristic of subordinates. Goal setting theory emphasizes on the relationship between the incident command system and the characteristics of the subordinates and the work setting. Of particular interest with path-goal are the situational moderator variables. In the study at hand, the situational variables involved emergency conditions. According to Northouse (2001), the theory provides explanation for understanding how different leadership behaviors affect subordinate satisfaction and performance. The theory helps leaders decide which leadership style to use based on the demands of the situation and type of subordinate handling the task.

Goal-setting theory can further illuminate the concept of performance and strategy when presenting contingency theory in relation to mission of the disaster response organizations for instance, when responding to disasters in Nairobi County. Locke and Latham (2000), stated that organizations should strive to set challenging, yet attainable, goals. That the performance of an organization is enhanced by setting (measurable) goals, theorized the importance of setting goals and actions for organizations in the 1960s. The definition of a goal was the aim of an action that one consciously desired to achieve or obtain. Goal-setting theory consequently suggests that a conscious goal will regulate behavior which will then change the mindset of the first responders in Nairobi County to work towards their goal (Locke and Latham, 2000). Duke and Long (2007), have implemented goal-setting theory in the humanitarian sector, for example, to predict success in achieving sustainable agricultural systems in developing communities. Latham (2004), argued that the enhanced performance outcome could not be achieved if several goals were set at the same time, since a focus on one goal could lead to difficulties in achieving another. According to Latham (2004), trade-offs between goals can include trade-offs between quantity versus quality. The same effect has been identified when goals are measured. In operational performance management literature, the effect of individuals being too focused on one goal, thus leading to a blurred understanding of other goals, is discussed as a dysfunctional behavior among disaster response organizations (Bourne *et al.*, 2000). While goal setting theory explains the relationship between goal setting and performance, performance management strives to explain the relationship between goals and the strategic management of activities and performance towards these goals. Figure 3 showing the interaction of the variables





**Figure 4:** The existence of Incident Command System in various organizations and its updating

Source: Field data (2019)

From figure 4, 113 (73%) of the respondents under “Yes” response from various organizations indicated that their organizations had Incident Command System which they normally use during response to humanitarian relief assistance. 42 (27%) of the respondents under “No” response indicated that their organizations was not using incident Command System. In response to the department which the respondents indicated to be coming from, from background information, it was evident that those who were using ICS were; Red cross, Kenya Police Service and Nairobi Fire Department, while National Youth Service department did not use ICS, but were only using the one improvised by other response organization, though it becomes a challenge to them due to lack of training (Dara *et al.*, 2005). Further, upon interrogating some of the respondents, one of the National Youth Service respondents asserted that;

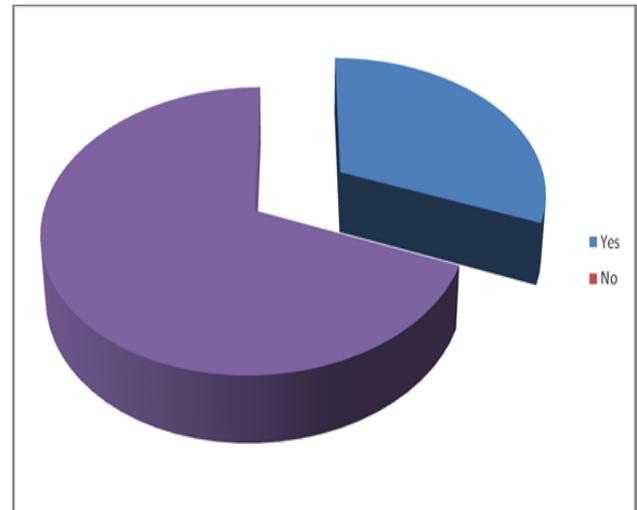
“We have participated in various emergency responses in the country, mostly through joint operation with other respondents but we are normally assigned the role of securing the scene of emergency as outer cordon.” (Interview with a key informant from National Youth Service in Nairobi, August, 2019).

On further determining how often these organizations updates their Incident Command System, those agencies which were using it responded that they were updating it through training and also joint training with other organizations to identify the flaws from each organizations so that they can improve in response to humanitarian relief assistance with use of Incident Command System.

According to Mendonca and Wallace (2004), ICS system has proven itself over time and provides a solid base on which to build response. However, we need to be less rigid in how we employ it, focusing on ICS principles rather than just structure and being open to adjustments based on organizational needs. Just because your organizational chart is built on the ICS structure doesn’t mean you’re really using ICS. As Mendonca and Wallace puts it, being proficient at ICS doesn’t mean that you have the supporting plans and processes that you need to be successful. Generic ICS checklists won’t cut it when you really have to deal with a crisis, but always has to be updated for the system to be effective.

#### 4.2 Incident Command System Strategies that assist in effective disaster response operations in Nairobi County

On understanding the strategies that assist in effective humanitarian disaster response operations while using Incident Command System, respondents were asked if the strategies laid down in Incident Command System contributed to effective humanitarian disaster relief operations. Their response is captured in figure 5.



**Figure 5:** Incident Command System Strategies that assist in effective disaster response operations

Source: Field data (2019)

Basing on the findings, 85 (54%) of the respondents agreed that the strategies that their organization put in place assisted in effective humanitarian disaster relief operation in Nairobi County, while 45 (29%) of the respondents disagreed that the strategies that their organization put in place did not assist in effective humanitarian disaster relief operation in Nairobi County. The findings obtained were not in agreement with the expectations of the Researcher since the total response rate was not obtained. 25 (17%) of the respondents did not contribute in participation on this question, but because the response rate was above 50%, the views of the respondents could be captured during the study. In logic, response findings under “No” response indicated that some organizations were not using incident command system, lack of Incident Command system use make these organizations not to come up with strategies that can assist in effective humanitarian disaster relief operation (Bigley and Roberts, 2001).

Strategic planning is important to an organization since it provides a sense of direction and outlines measurable goals. In relation to the findings on figure 4, McEvily and Chakravarthy (2002), observes that it is a tool that is useful for guiding day to day decisions and evaluating progress and changing approaches when moving forward. In order to make the most of strategic planning, organization should give careful thought to the strategic objectives it outlines, and then back up these goals with realistic, thoroughly researched, quantifiable benchmarks for evaluating results. These measurable goals set specific, concrete objectives expressed in terms of quantities and timelines.

Prahalad and Hamel (1990), further affirmed that the definition of the company mission, strategic planning assists in

synthesising and distilling the overarching idea linking its practical strategies, enabling management and employees to align the specifics of their actions and decisions with a clearly defined vision and direction in relation to the findings on figure 2. Define your strategic mission in a way that is broad enough to guide both management and employees, and narrow enough to focus their efforts.



Figure 6: Organization strategic mission

Source: strategy formulation app (2013)

An organization is generally established with a goal in mind, and this goal defines the purpose for its existence. All of the work carried out by the organization revolves around this particular goal, and it has to align its internal resources and external environment in a way that the goal is achieved in rational

expected time which is done through the strategies put in place and this becomes a necessary factor for successful working internally, as well as to get feasible returns on the expended resources by the organization (Hambrick and Fredrickson, 2001). Strategy implementation in an organization normally incorporates preparation for future opportunities, response to risks. This makes way for the firms to analyze, examine and execute administration in a manner that is most likely to achieve the set aims. As such, strategizing or planning must be covered as the deciding administration factor.

**4.3 Rating various incident command system strategies on effective disaster response operation**

The study sought to assess specific Incident Command system strategies on effective humanitarian disaster relief operation, these were; standard management hierarchy and procedures, common terminologies and inter-grated communication. Findings are presented in the table 1.

Response rate was on a likert scale where (1 means= very effective, 2 = effective, 3=undecided, 4 = ineffective and 5= very ineffective).

Table 1: Rating various incident command system strategies on effective disaster response operation

| Aspect                                       | 1  | 2  | 3  | 4  | 5  |
|--|----|----|----|----|----|
| Standard management hierarchy and procedures | 55 | 70 | 13 | 15 | 2  |
| Common terminologies                         | 59 | 75 | 9  | 12 | 0  |
| Intergrated communication                    | 30 | 73 | 6  | 0  | 46 |

Source: Field data (2019)

Findings from table 1 indicated that, 55 (35%) of the respondents had opinion that Standard management hierarchy and procedures as an aspect of incident command system strategy was very effective on humanitarian disaster relief operation. 70 (45%) of the respondents indicated that the standard management hierarchy and procedures as a strategy of incident command system was effective on humanitarian disaster relief operation in Nairobi County. 13 (8%) of the respondents were undecided if standard management hierarchy and procedures as a strategy of Incident Command system contribute to effective disaster operations in Nairobi County, while 15 (11%) of the respondents indicated that standard management hierarchy and procedures as a strategy of Incident Command system was ineffective while 2 (1%) of the respondents indicated that standard management hierarchy and procedures strategy of Incident Command system was very ineffective affecting effective humanitarian disaster relief operations.

According to John *et al* (2003), the ICS is a management system designed to enable effective and efficient domestic incident management by integrating a combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure, designed to enable effective and efficient domestic incident management. It is used to organize both near-term and long-term field level operations for a broad spectrum of emergencies, from small to complex incidents, both natural and manmade. An area command in this case may be established to oversee the management incidents. Standard management hierarchy and procedures enable emergency responders within a single jurisdiction, and direct supporters of emergency responders.

The study findings agrees with David and Giles (2010) study on “Evacuating the Houston-Galveston Region in Advance of Hurricane Rita”, where they noted that standard management hierarchy and procedures helps in responding to diverse

emergencies. That incident that begin with a single response discipline within a single jurisdiction may rapidly expand to multidiscipline, multijurisdictional incidents requiring significant additional resources and operational support. Whether for incidents in which additional resources are required or are provided from different organizations within a single jurisdiction or outside the jurisdiction, or for complex incidents with national-level implications the standard management hierarchy and procedures provides a flexible core mechanism for coordinated and collaborative incident management. When a single incident covers a large geographical area, multiple local ICS organizations may be required. Effective cross-jurisdictional coordination using processes and systems described in the NIMS is absolutely critical in this instance. The NIMS requires that field command and management functions be performed in accordance with a standard set of ICS organizations, doctrine, and procedures, which is commonly achieved by use of standard management hierarchy and procedures.

According to Jamieson (2005), it is important to develop a standard management hierarchy and procedures whereby organizations who have jurisdictional responsibility, such as a local government, federal government, and provincial government, can contribute in: determining response strategy and objectives; planning and tactical activities; and sharing of resources.

Decker (2011), asserts that Incident Command structure is organized in such a way as to expand and contract as needed by the incident scope, resources and hazards. Command is established in a top-down fashion, with the most important and authoritative positions established first. For example, Incident Command is established by the first arriving unit. Only positions that are required at the time should be established. In most cases, very few positions within the command structure will need to be activated. For example, a single fire truck at a [dumpster](#) fire will have the officer filling the role of IC, with no other roles required. As more trucks get added to a larger incident, more roles will be delegated to other officers and the Incident Commander (IC) role will probably be handed to a more-senior officer (Decker, 2011).

In relation to the incident command system strategies, Bigley and Roberts (2001), ICS consists of a standard management hierarchy and procedures for managing temporary incident(s) of any size. ICS procedures should be pre-established and sanctioned by participating authorities, and personnel should be well-trained prior to an incident. That ICS includes procedures to select and form temporary management hierarchies to control funds, personnel, facilities, equipment, and communications. Personnel are assigned according to established standards and procedures previously sanctioned by participating authorities. A system designed to be used or applied from the time an incident occurs until the requirement for management and operations no longer exist Bigley and Roberts (2001).

Dara *et al* (2005), observes that Emergency Managers determine the existing [management](#) structures frequently unique to each agency, did not scale to dealing with massive [mutual aid](#) responses involving dozens of distinct agencies and when these various agencies worked together their specific training and procedures clashed. As a result, a new [command and control](#)

[paradigm](#) collaboratively developed to provide a consistent, integrated framework for the management of all incidents from small incidents to large, [multi-agency](#) emergencies basing on the standard management hierarchy and procedures.

On common terminology as a strategy contributing to effective disaster response operation, 59 (38%) of the respondents indicated that it was very effective, supported by 75 (48%) of the respondents who indicated that it was effective. 9 (6%) of the respondents were undecided if common terminology can contribute to effective humanitarian disaster relief operations. 12 (8%) of the respondents indicated that common terminology as a strategy to ineffectively contributed to humanitarian disaster relief operation.

Basing on the findings under common terminology as a strategy, the ability to communicate within ICS is absolutely critical. Using standard or common terminology is essential to ensuring efficient, clear communication. ICS requires the use of common terminology, meaning standard titles for facilities and positions within the organization and that it can includes use of “clear text” that is, communication without the use of agency-specific codes or jargon (Donini and Norah, 1994). ICS establishes common terminology, standards, and procedures that enable diverse organizations to work together effectively including a standard set of predesignated organizational elements and functions, common names for resources used to support incident operations, common typing for resources to reflect specific capabilities, and common identifiers for facilities and operational locations used to support incident operations. This acts as an interactive management component that set the stage for effective and efficient incident management and emergency response (Jaffin, 2008).

Individual response agencies previously developed their protocols separately, and subsequently developed their terminology separately. This can lead to confusion as a word may have a different meaning for each organization (Werman *et al.*, 2014).

Further, Jamieson (2005) observes that when different organizations are required to work together, the use of common [terminology](#) is an essential element in team cohesion and communications, both internally and with other organizations responding to the incident. An incident command system promotes the use of a common terminology and has an associated glossary of terms that help bring consistency to position titles, the description of resources and how they can be organized, the type and names of incident facilities, and a host of other subjects. The use of common terminology is most evident in the titles of command roles, such as Incident Commander, Safety Officer or Operations Section Chief (Jamieson, 2005).

On aspect of integrated communication in table 1, 30 (19%) of respondents indicated that integrated communication was very effective strategy in effective response to humanitarian disaster relief operations in Nairobi County, 73 (47%) of the respondents indicated that it was effective while 6 (4%) of the respondents were undecided whether integrated communication strategy contributed to effective humanitarian disaster relief operations in Nairobi County. 46 (30%) of the respondents indicated that integrated communication was very ineffective

strategy in response to humanitarian disaster relief operations. Command and control is predicated on a communications infrastructure ensured by the Public Information Officer, who serves as the conduit for information to internal and external stakeholders, including the media or other organizations seeking information directly from the incident or event. In the event that communications are destroyed by an emergency, agency sectors should have equipped to set up cell towers for emergency communications.

Research findings are in agreement with Katzenbach and Smith (2015), every incident requires a Communications Plan. Incident communications are facilitated through the development and use of a common communications plan and interoperable communications processes and architectures. This integrated approach links the operational and support units of the various agencies involved and are necessary to maintain communications connectivity and discipline and enable common situational awareness and interaction. Preparedness planning must address the equipment, systems, and protocols necessary to achieve integrated voice and data incident management communications. Communications should include the systems that transfer information, planning for the use of all available communications frequencies and resources, the procedures and processes for transferring information internally and externally.

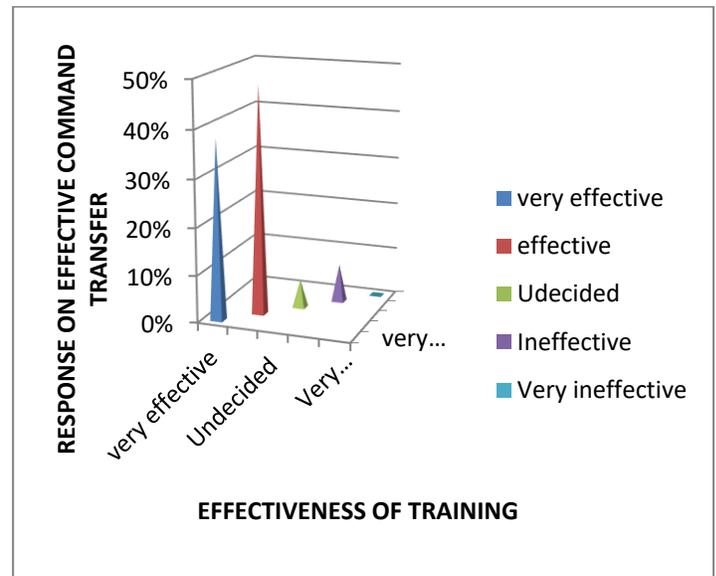
Communications needs for large incidents may exceed available radio frequencies. Some incidents are conducted entirely without radio support. In such situations, other communications resources; cell phones, alpha pagers, email, and secure phone lines may be the only communication methods used to coordinate communication and to transfer large amounts of data efficiently. Okari (2013), note that with substantial numbers of military or paramilitary personnel on site, the authorities had not yet established a clear command and control structure. With no radio communications between army and police units, KDF soldiers opened fire on what they thought was an armed suspect yet was a police officer.

Chain of command cannot be realized without integrated communication since it contributes to the orderly line of authority within the ranks of the incident management organization. Unity of command means that every individual has a designated supervisor to whom they report at the scene of the incident. These principles clarify reporting relationships and eliminate the confusion caused by multiple, conflicting directives. Incident managers at all levels must be able to control the actions of all personnel under their supervision which is done through clear communication (Katzenbach and Smith, 2015).

Developing an integrated voice and data communications system, including equipment, systems, and protocols, must occur prior to an incident (Moynihan, 2009). That effective ICS communications include three elements: Modes: The hardware systems that transfer information, planning: Planning for the use of all available communications resources and networks: The procedures and processes for transferring information internally and externally.

#### 4.4 Effectiveness of training as a component of disaster preparedness for effective command transfer during emergencies

On understanding the effectiveness of training as a component of disaster preparedness for effective command transfer during emergencies, respondents were asked if training contributed to effective command transfer during humanitarian disaster relief operations. Their response was captured in figure 5.



**Figure 7:** Effectiveness of training as a component of disaster preparedness for effective command transfer during emergencies  
**Source:** Researcher (2019)

Study findings indicated that, 59 (38%) of the respondents had opinion that training was very effective in relation to effective command transfer during emergencies. 75 (48%) of the respondents indicated that training was effective in relation to effective command transfer during emergencies. 9 (6%) of the respondents were undecided while 12 (8%) of the respondents indicated that training was ineffective in relation to effective command transfer during emergencies.

The findings are in agreement with Hage (2011) who affirms that training is teaching, or developing in oneself or others, any [skills](#) and [knowledge](#) or [fitness](#) that relate to specific [useful competencies](#). Training has specific goals of improving one's [capability](#), capacity, [productivity](#) and [performance](#). Training also refers to the development of physical fitness related to a specific competence.

Jahre and Jensen (2010) compliments Hage (2011), observations that organizations responsibilities and level of expertise can be achieved through standardized training. All trained employees follow same methods and techniques of production and hence there can be little variation in output and standards produced by different employees. By using standardized methods, it effectively contributes to effective command transfer. Increased morale of employees because of reduction in dissatisfaction at work, reduced complaints, and increased interest in work during the post-training period. Heightened morale results in increased loyalty to the organization response to emergencies and easy transfer of command since trained employee knows what job he has to do and how to do that job and require no guidance and supervision (Jahre and Jensen, 2010).

Training is central assets in modern societies, but their impact on disaster relief operations remains mostly associated with interest of different response organizations to explore the need of it in relation to organizations mission (Akhtar *et al.*, 2012). The emerging literature on cascading disasters tries to look on training as one of the strategies being used by the incident command system for effective humanitarian relief operation.

**4.5 The level of preparedness of organization incident command system in response to the disasters**

The study sought to assess the level of preparedness of response organizations and applicability of the Incident Command

system in response to various disasters in Nairobi County, this was based on Westgate attack, Fire break at 20<sup>th</sup> century building in Nairobi and Nairobi Market fire. These are some of the disasters that have occurred in Nairobi County which were responded to and which needed use of incident command system. Results are presented in table 2.

Response rate was on a likert scale where (1 means= very effective, 2 = effective, 3=undecided, 4 = ineffective and 5= very ineffective).

**Table 2: The level of preparedness of organization incident command system in response to the various disasters in Nairobi County on effective disaster response operation**

| Aspect  | 1  | 2  | 3  | 4  | 5  |
|---|----|----|----|----|----|
| West gate attack                                | 2  | 15 | 13 | 70 | 55 |
| Nairobi Market fire                             | 59 | 75 | 9  | 12 | 0  |
| Fire break at 20 <sup>th</sup> century building | 30 | 73 | 6  | 0  | 46 |

Source: Researcher (2019)

Findings from table 2, 2 (1%) of the respondents indicated that Westgate terrorist attack was very effectively responded to due to preparedness level of the response organizations that participated in rescue operation. 15 (11%) of the respondents indicated that response organization were effectively prepared in response to West Gate terrorist attack, 13 (8%) of the respondents were undecided whether the response organizations were prepared or not. 70 (45%) of the respondents indicated that preparedness of response organizations was ineffective in response to West Gate terrorist attack while 55 (35%) of the respondents had opinion that preparedness level of response organizations was very ineffective in response to West Gate terrorist attack in Nairobi. This was evident when first army units arrived on the scene, including infantry from the Embakasi base outside Nairobi and US-trained Kenyan rangers from their base in the Rift Valley. Behind the scenes, that a power struggle was emerging between the police chief David Kimaiyo and Julius Karangi from Kenya Defence Forces over whose forces would take the lead. This further contributed to shoot out between the security forces (Petrecca and Bhatti, 2013).

On Nairobi Market fire response, 59 (38%) of the respondents indicated response organizations were very effectively prepared in response to Nairobi Market fire, 75 (48%) of the respondents who indicated that preparedness was effective. 9 (6%) of the respondents were undecided on the level of preparedness of response organization in response to the terrorist attack. Twelve, 12 (8%) of the respondents indicated that response to Nairobi Market fire was ineffectively prepared.

On fire break at 20<sup>th</sup> century building in Nairobi in table 2, 30 (19%) of respondents indicated that preparedness of response organization was very effective in response to fire break at 20<sup>th</sup> century building, supported by 73 (47%) of the respondents who indicated that preparedness was effective while 6 (4%) of the respondents were undecided whether response organizations were

prepared in response to fire break at 20<sup>th</sup> century building. 46 (30%) of the respondents indicated that preparedness for response to fire break at 20<sup>th</sup> century building was very ineffective. The findings concurs with Kagabo and Kiyesi (2008), who observed that fire fighters arrived at the scene in split seconds and contained the fire. He further commends that this was achieved through preparedness and ready response to fire disasters. This disparity in response indicates the level of preparedness among different response agencies. Some agencies uphold the need for training, planning and need to acquire resources for equipping themselves for effective response to emergencies while others not. The level of preparedness depends on the role of the agencies and the assignment at hand that pushes it to prepare for it, and this brings disparities in level of preparedness between Response Agencies in Nairobi County.

V. SUMMARY AND CONCLUSION

On existence of Incident Command System in various organizations and its updating, presence of ICS in these organizations showed that there are strategies that are put forward to make Incident Command System effective for organizations to effectively respond to disaster response operation.

Nairobi Fire brigade and NYS had no formalized ICS, but were only using one improvised by other response organization, though it becomes a challenge to them due to lack of training. Lack of training contributed to mismatch between response agencies during joint operation.

VI. RECOMMENDATION

Training of all emergency responders on Incident Command System is recommended, mock exercises in joint training to understand each organizations capabilities and

resources available. Share each organization strategies put in place for effective use of Incident Command System.

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# Super Maglev Trains

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Super Maglev Train is a new concept using which a train can attend high speed by reducing the most favorable resistances like AIR, FRICTION.

The train works on the principles of Electromagnetic fields, EMF are surrounded all over the body and which keeps the train away from the ground.

The EMF used in SMT should be accurate and it is placed in such a way that all the Electromagnetic fields are accepted by the acceptor of SMT and the outermost field does not intermit with the interior part of the body.

## Special Features of SMT:-

- A. Wheels.
- B. Electromagnets.
- C. Air Absorbent & Air Supplier.
- D. Negligible Friction.
- E. High Speed with more comfort.

SMT is designed such a way that it can attend high speed by enabling limited amount of air for its passage. Using this unwanted air causing Resistance can also be avoided. Thus it can be done by one of its key features Air Absorbent & Air Supplier.

As SMT works on EMF, the body is moving without making contact with a ground. Thus Friction can also be avoided. SMT is an upgrade version of bullets trains. SMT can attend high speed with negotiable air resistance. Bullets trains are conical from front side so that it can act as an air cutter and which helps to attend additional speed but at the same time it also allows the air to fall on it, which leads to pressure mounting on the first compartments of the bullet.

Thus, SMT is the better option which allows limited air needed for its motion thus the additional unwanted air can be removed.

SMT is exactly at the centre of its closed circular Electromagnetic runway surface. It is well balanced from all the side. EMF is induced from the runway for e.g. From 12 sides of that closed surface and those EMF are accepted by the acceptor Electromagnet on the body of SMT such that the body attends the steady state forming equilibrium at the center.

SMT is small in size which is equivalent to one compartment of the train; it is equipped with certain load policy. It can withstand to certain load once the equivalent weight is filled, the train or a capsule is move ahead enabling 2<sup>nd</sup> SMT to move inside the platform. thus each compartments are released one by one and traffic is not possible, as the SMT is fully based on EMF, it is programmed very first with the respective motion from the reference

position to the Destination, thus using its Field strength, distance of FS, time to enabling FS, this important features of motion are varied depending on the speed of the SMT.

These features are explained in the very last motion topic.

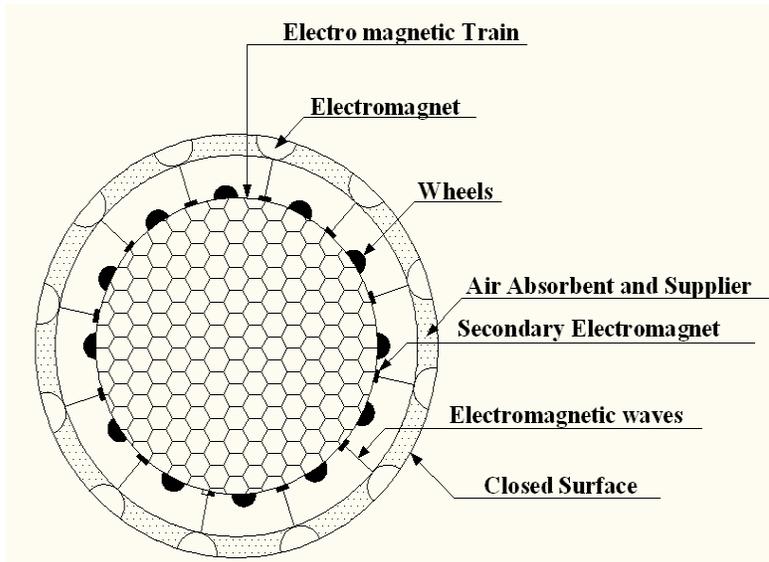
## Application of SMT:-

- A. High speed transport of goods.
  - B. Travelling.
  - C. It can surpass the airplane with its speed.
- SMT is a future technology which is 30-40 feet above the ground and it is focused straight away to its destination without turning.
- It is designed to travel long distance with less possible time. It can surpass airplane with its speed and straight runway.

## SMT is sub-grouped depending on the jobs done by each component:-

- A. Front view of Electromagnetic Train.
- B. Side view of EM train.
- C. Outer Surface (Runway of train).
- D. External supply.
- E. Field Strength.
- F. Motion.

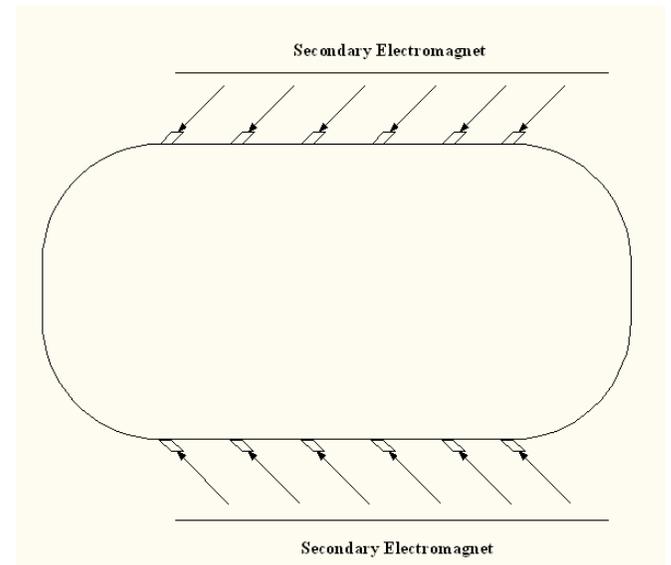
**A. Front View of Electromagnetic Train:-**



**Figure 1**

1. Hexagon surface at the centre is the front view of Electromagnetic Train.
2. Runway consists of Electromagnet and Air Absorbent & Supplier region which are well separated with each other.
3. Electromagnets are present with specific gaps all over the body and are represented by the semicircle on the Runway (closed Surface).
4. Gaps between the Electromagnet are acting as Air Absorbent and Supplier, thus to control Aerodynamics.
5. Required amount of air is supplied through it, once the train is passed, air is again absorbed.
6. There is a secondary electromagnetic attach on the train, so as to accept the Electromagnetic waves only at that specific region.
7. Wheels play a crucial role in landing the train.

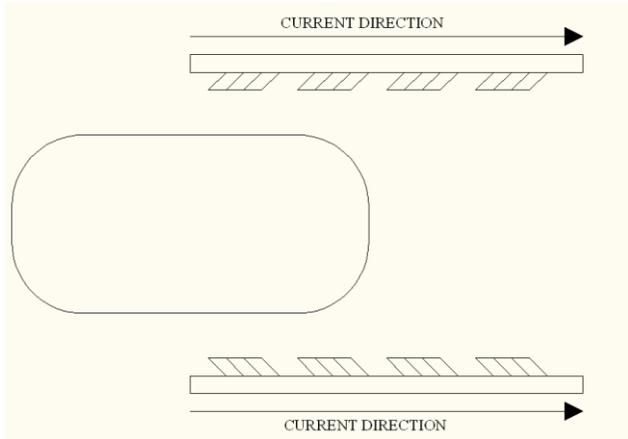
**B. Side view of Electromagnetic Train:-**



**Figure 2**

1. The small boxes shown on the SMT are the acceptor Secondary Electromagnets.
2. When the Current pass through the Electromagnet, it charges and attracts the secondary electromagnetic present on the SMT.
3. Since, the Train is under influence of electromagnet from all the sides, Equilibrium is attended by the train.
4. Thus the only factor affect the train is its load, which can be neglected by using single compartment train instead of 12 compartments.
5. Once the load limit exceeds, capsule is set into motion and next capsule is reported on the platform.

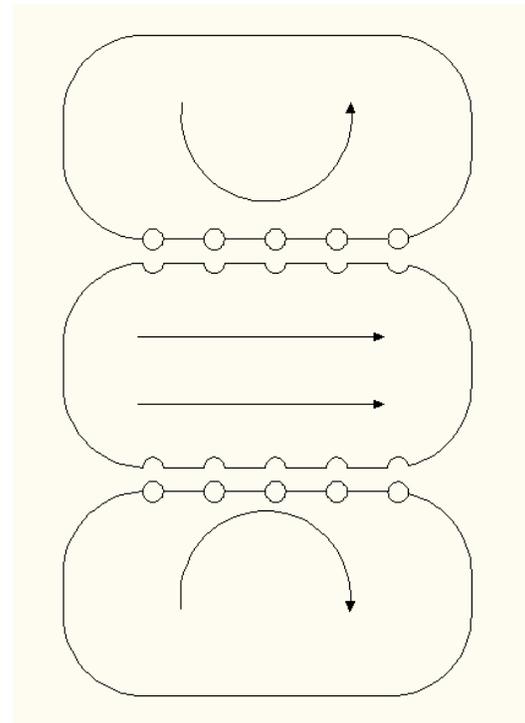
**C. Outer Surface (Runway of train):-**



**Figure 3**

1. Electromagnets are divided into many sections, when body is lifted from its reference point; high Electromagnetic field is required through these sections of runway for the motion of the body.
2. While the body is in motion, the speed of SMT increases linearly with increase in the distance of field strength throughout the sections.
3. Thus this section plays an important role in adjusting speed of train.
4. These sections require the *Field strength*, *Time*, and *Distance of Field Strength* to be adjusted with respect to the movement of the train which is further explained in the Motion topic.
5. Thus current is supplied in SMT is similar to the functioning of LED lights when the body is in motion.
6. At specific location current is passed for few seconds to few minutes depending on the speed of SMT.
7. This current is allowed to move ahead, leaving behind the remaining section unmagnetized, (the portion which body had done with its acceleration).

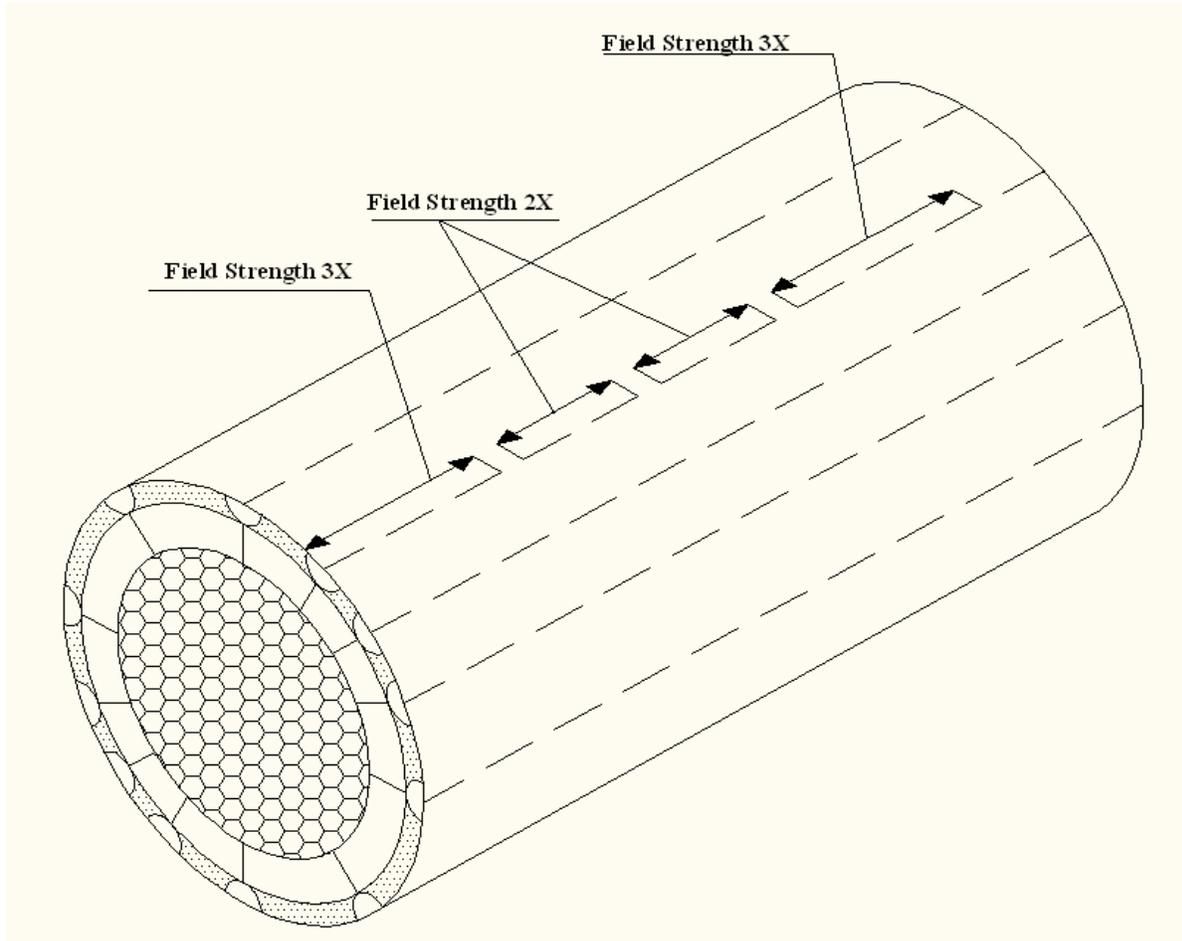
**D. External Supply:-**



**Figure 4**

1. When the body is resting, it requires strong field in order to come in motion, thus secondary method irrespective of High Field Strength can also be applied.
2. There are two cycles present below and above the train, which behaves like gears of cycle.
3. 1<sup>st</sup> cycle move in anti clock wise direction, while 2<sup>nd</sup> in clock wise direction, though there is a supporter attached on both the side, thus train is pushed in forward direction.
4. Once the SMT is set into motion, High Electromagnetic Field Strength is applied to attend high speed. Thus High Fields is 2<sup>nd</sup> step after the external supply.

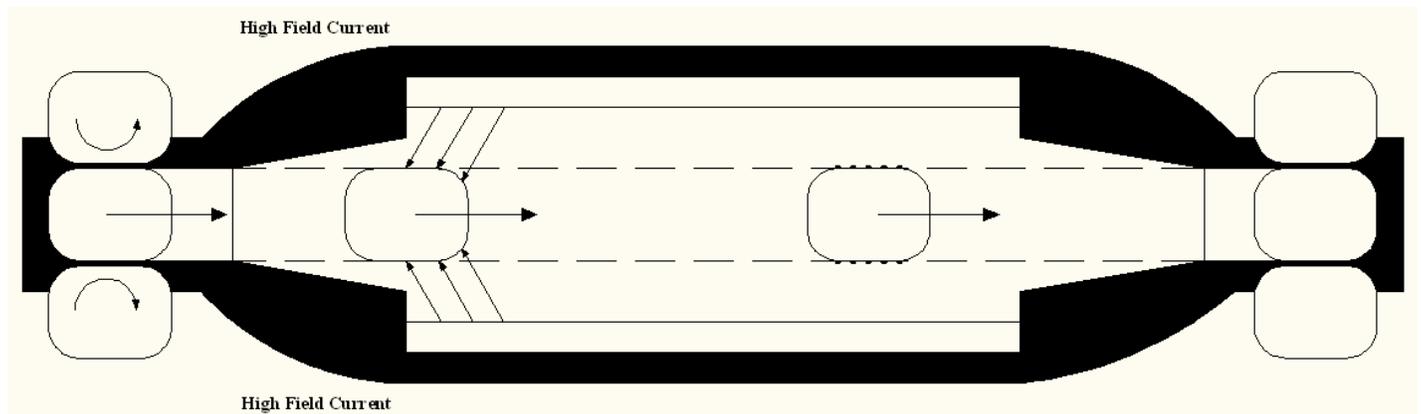
E. **Field Strength:-**



**Figure 5**

1. As shown in the figure, Field Strength are varied with respect to the speed of the SMT.
2. At initial condition, when the body is in equilibrium state, External supply pushes the body and once the body is in motion high electromagnetic field strength is applied across it.
3. High field is necessary because of the heavy weight of SMT and its initial slow speed.
4. This high field try to accelerate the body linearly until it get its average speed, there after field strength is slowly decreased because at that instant body is already set in motion and moderate field strength is sufficient for further operations.
5. When the body is to be stopped at the platform, its high field act as a repulsive factor for the SMT.
6. With high field the distance of the field strength is also minimized such that equilibrium state is formed that too linearly.
7. Thus the Field Strength plays an crucial role by accelerating and decelerating the speed of SMT.

#### F. Motion (Working of SMT):-



**2D-sideview of the working of SMT (Figure 6)**

When the current is applied across the apparatus, External supply region gets active, External supply uses the concept of bicycles gear, the two cycles moves in opposite directions as shown in the figure, it gradually pushes the SMT in forward direction, once the current reaches the closed runway surface, current is converted into magnetic fields by the electromagnets and thus Magnetic fields are induced.

These magnetic fields are attracted by the Acceptor Electromagnet on the SMT, due to these acceptors, no extra fields are surrounded in the background, and all this fields are focused only on the SMT.

Thus the field does not interfere with the interior and the exterior of the body.

Initially when high field strength is applied across the SMT, the speed of the body increases linearly, Field strength requires for the motion of the body should be high and distance of field strength should cover whole body such that body is attracted in forward direction

When the body attends certain speed, Field strength can be minimize because the field is much stronger for the moving body. A bit smaller field strength is sufficient for the motion of the body and ultimately distance of field strength is increased such that it covers certain additional distance from the moving body, and which forces the body move forward with more speed. Similarly timing is also an important factor, as discuss earlier this train uses concept of LEDs, when output is 1 LED glows, and when output is zero it again vanishes. Thus proper timing is a must. Which are represented in below table.

Air absorbent and supplier were also discussed earlier, when a bullet train runs there are some repulsive factors acting on it i.e. Air, once the body is in motion, front side of the body is opposed by the air and which results in heating. Thus they are build in such a way that they can act as an air cutter, due to which it is pointed from the front side and gain some speed.

But in this case, SMT uses required amount of air proportionally with its field strength distance, which goes on increasing when the body accelerates from the reference position. It doesn't mean that the body is in vacuum, it just clears the way of the body by limiting the air inside the closed surface thereafter the unwanted air is again absorbed by air absorber, it also works on the principle of field strength thus when field strength is on the verge to vanish, air is again absorbed by the Air Absorber. Thus Air absorber and Supplier plays an important role in the motion of the SMT.

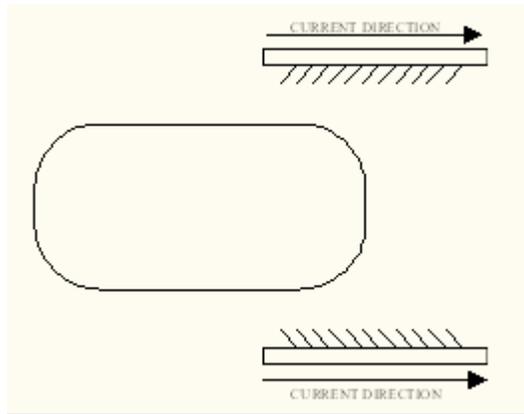
In order to land body successfully and safely, Field strength distance is minimized with increasing its field strength and time. Once the field strength is high, body tries to cooperate with the field simultaneously time is also increasing which helps SMT to acquire its equilibrium state.

Thus when the platform is near, body slow down and wheels are released by the body in order to attend safe landing, body is acting on the wheels just before the body is coming to rest, it is used as a safety precautions and finally train is stops at the exact point where it should be. And finally when the SMT is in equilibrium state it rest on the wheel and electromagnets are turned off.

As Discussed earlier this train is completely automatic, once the coding is right, human error may not occur in this train.

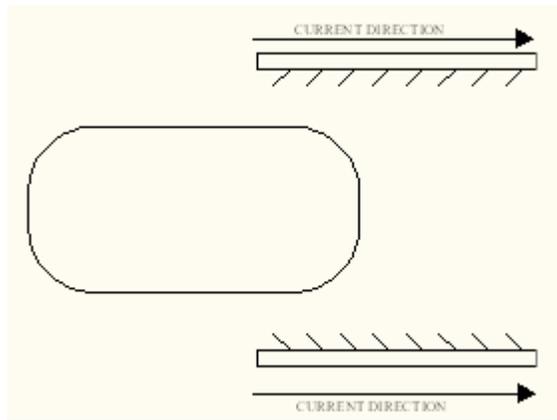
**Field Strength at initial condition**

|                       |    |
|-----------------------|----|
| <u>Distance of FS</u> | X  |
| <u>Time</u>           | 2Y |
| <u>Field Strength</u> | 2Z |



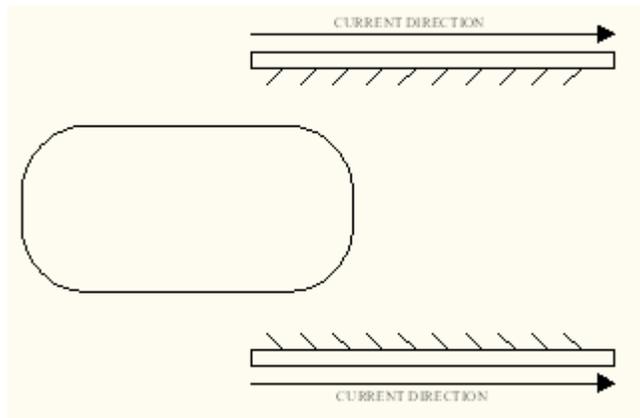
**Moderate Speed**

|                       |    |
|-----------------------|----|
| <u>Distance of FS</u> | 2X |
| <u>Time</u>           | Y  |
| <u>Field Strength</u> | Z  |



**High Speed**

|                       |     |
|-----------------------|-----|
| <u>Distance of FS</u> | 3Z  |
| <u>Time</u>           | Y/2 |
| <u>Field Strength</u> | Z   |



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# College Conversion Into Quarantine Center: Parents Perception On Covid-19 Mitigation Measures At Kenya Medical Training College Mombasa

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**Abstract-** The purpose of the study was to determine perception of parents in regard to Covid-19 mitigation measures before and after resumption of learning activities in the college. **Methodology:** This study was carried out at KMTC-Mombasa using descriptive cross-sectional design. Participants (parents) were selected using multi stage sampling and convenient sampling technique was used. There was assumption that one student had one parent representation. The population of students was 850 and 10% of the students population was used (0.1 X 850 N=85), (p=95%), n=73. Data was obtained using interviewer administered questionnaire. Data analysis was done using SPSS and Excel. The results were presented using tables, charts and narrations. **Results:** 54.8% (40) of the respondents were males and the dominant age bracket of the respondents was (50-59) 42.5% (31). For the measures to be taken before college reopens, 32.9% (24), recommended restructuring of the college to ensure social distancing as it is required by the Government of Kenya during this time of pandemic, 30.1% (22) suggested provision of infection prevention measures (PPE, sanitizers and soaps) and stoppage of quarantine activities in the college and 28.8% (21) recommended fumigation of the college. After students had reported back, 47.9% (35) of the parents felt that infection prevention measures should be to maintained to mitigate spread of COVID-19. **Unique contribution to Theory, practice and Policy:** Parents are key stake holders in issues related to the learning institutions during this time of pandemic and so social distancing and infection prevention measures should be addressed before and after resumption of learning. Parent's opinions should therefore be considered if the students have to resume studies given that they are the main financier. When the institution management has addressed the implementation of these measures then the students will be safe from contracting COVID-19.

**Index Terms-** COVID-19, Kenya Medical Training College, Mitigation, Mombasa, Perception, Quarantine centre

## I. INTRODUCTION

The Corona Virus Disease of 2019 (COVID-19) pandemic is considered as the most crucial global health calamity of the century. In December 2019, the disease emerged in Wuhan, Hubei province, China. Kenya confirmed its' maiden case on 13th March 2020 after which the cases have continued to be on the increase.

As part of containment measures the World Health Organization (WHO) on 29th February 2020 introduced quarantine as a control measure which was then adopted by the Government of Kenya in which selected learning institutions and hotels were temporarily converted into COVID-19 quarantine centers. Kenya Medical Training College Mombasa was one of the learning institutions converted into COVID-19 quarantine centre where the study was conducted.

The COVID-19 pandemic has caused great disruptions of education systems in history by affecting about 1.6 billion learners in more than 190 countries in the whole world. Closing of schools has impacted 94 percent of the world's student population and about 99 percent in low and lower middle income countries. In this regard there is need to listen to the voices of all concerned persons. Considering the role that parents, caretakers and teacher played since the onset of crisis an essential part in decision making process is consultation and joint planning for reopening with communities and education key stakeholders (Education during COVID-19 and Beyond 2020 United Nations)

Parent's perception on mitigation measures before reopening of learning institution after a pandemic has been considered to be a good concept given that, studies have majorly focused on parents as the decision maker. A study by Schueler, McIntyre and Gehlbach (2017), where they were measuring parent's perceptions of family-school engagement, concluded that measuring parental engagement is deceptively challenging. This theory is consistent to this study, given that parents are more often indirectly affected when decision of either closing or reopening places of learning is arrived at by sitting governments. They however play key role as major stake holders, and this therefore calls for their involvement in making their proposals to some key mitigation measures to be assured that satisfactory methods are put in place to enhance safety of their children.

A survey done by the University of Michigan on parents living in three different states noted that a third of parents would not be ready to send their children back to school because of COVID-19. This is so because they were not sure whether any substantive mitigation measures had been put in place (Phys.org, 2020, June, 26). Chua believed it was important to continue to survey parents regarding their plans and support for COVID-19 risk mitigation measures. "In our survey, parents expressed a lot of uncertainty regarding their plans for school attendance," he says. "Many are waiting to see how schools address safety and

how the pandemic evolves. It's very likely that parents' views and plans will change as new information becomes available." Ibid. Since COVID-19 pandemic has caused great disruptions of education systems in history by affecting about 1.6 billion learners in more than 190 countries in the whole world, Closing of schools impacted 94 percent of the world's student population and about 99 percent in low and lower middle income countries according to a report by United Nations(2020). In their conclusion, they regard listening to the voices of all concerned persons as a critical role which cannot be overlooked especially; parents, caretakers and teacher who have been instrumental since the onset of crisis. An essential part in decision making process is consultation and joint planning for reopening with communities and education key stakeholders.

## II. PROBLEM STATEMENT

COVID-19 mitigation measures before and after reopening of learning institution has been a responsibility of the sitting governments with biased involvement of parents in decision making. When such happens, parent may feel left out and therefore lose confidence on the handedness measure by such institutions of learning. This could significantly reduce the number of the

students expected to report back to school. By bringing parents on board therefore will ensure maximization and good utilization of government resources while at the same time enhancing children performances, a hypothesis supported in a study done by Diranian S.,(2017), looking at "How Lack of Parenting at Home Affect Children's Grades in School?"

## III. METHODOLOGY

The study was done at KMTC-Mombasa using multistage sampling technique. Participants (parents) were selected randomly by convenient sampling technique. There was assumption that one student represented one parent. A 10% of the students population was used (0.1 X 850), n= 85. Out of this sample size, the ones who accepted to be interviewed were 73. An interviewer administered structured questionnaire was used. Data analysis was done using SPSS version 26. Presentation of the results was by use of tables, charts and narrations.

## IV. RESULTS

### Demographics of respondents

**Table 1: Distribution of Respondents by Age,**

| AGE                | Frequency | Percent |
|--------------------|-----------|---------|
| 30-39 years        | 4         | 5.5     |
| 40-49 years        | 25        | 34.2    |
| 50-59 years        | 31        | 42.5    |
| 60 years and above | 13        | 17.8    |
| Total              | 73        | 100.0   |

Table 1 shows distribution in terms of age. A parent is any person who although not a biological parent, has parental responsibility for a child or young person. Age was defined as the length of time during which a person has existed. 42.5% (31) of the respondents were within the age group of 50-59 years, While 5.5% (4) are aged between 30-39 years, forming the least parent's respondents. It was not clear why the number of young parents

was very low compared to the senior parents but this hypothesis is consistent with a 2019 census report, on Mother's mean age at first birth which was noted as 20.3 years (2014 est.) while the median age at first birth among women is 25-29years. This means for a child born to reach college level, the mother will be in her 40s. Secondly, cultural norms allow siblings to support each other's education hereby taking the role of a parent.

**Table 2: Distribution of Respondents by gender**

| GENDER | Frequency | Percent |
|--------|-----------|---------|
| Male   | 40        | 54.8    |
| Female | 33        | 45.2    |
| Total  | 73        | 100.0   |

**Table 2** shows distribution in terms of gender. Gender was defined as biological characteristic of being either male or female. 54.8% (40) of the respondents are male and 45.2% (33) female, a difference of 9.6% (7). This may support hypothesis that men in Africa still play critical role in decision making, according to Maseno and Kilonzo (2011), who in their wisdom viewed a system of male authority which oppresses women through its social, political and economic institutions. This therefore reveals more on how decisions are made in the African society, favoring male dominance.

## V. COLLEGE MITIGATION MEASURES TO PREVENT SPREAD OF COVID-19

Measures were referred to the actions that the college would take to prepare for the resumption of college activities (before and after) while mitigation was referred to as specific preventive measures to minimize spread of COVID-19. Since parents are the major college or school financier, their involvement in the mitigation measures cannot be over emphasized. To address the

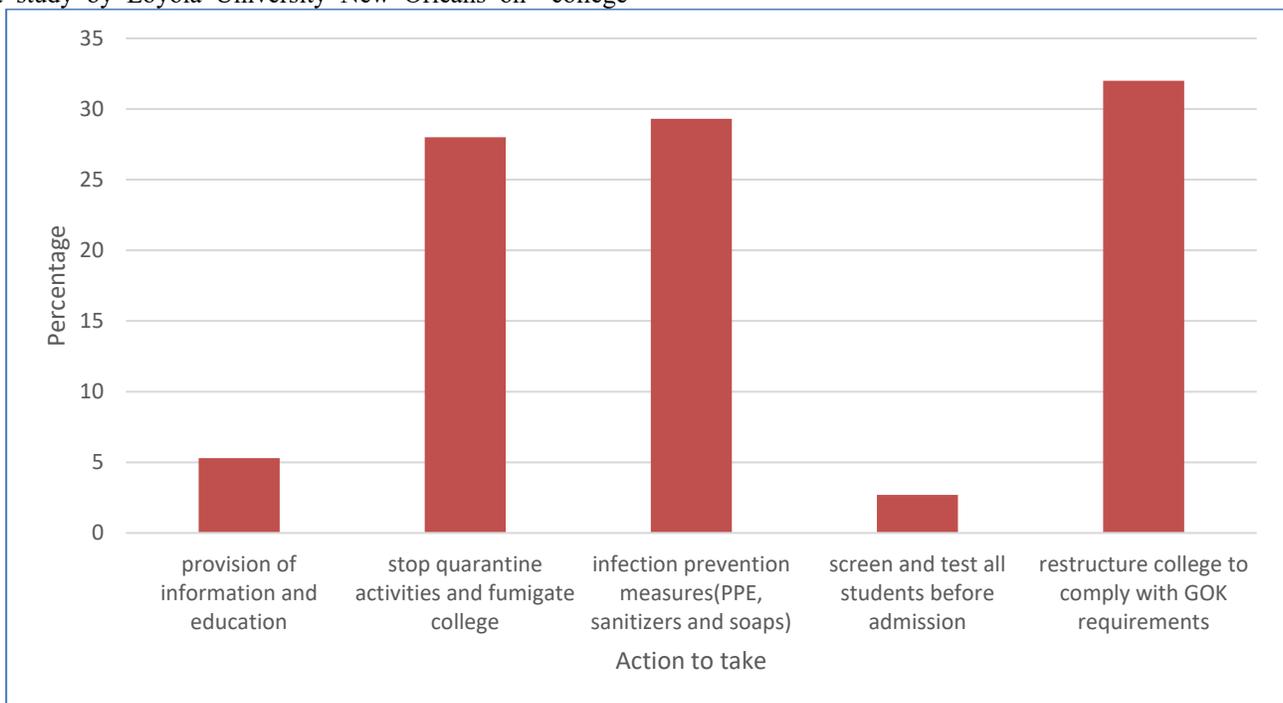
above objective, parents were asked through structured questionnaire to highlight measures the college should take to maintain safety and prevent spread of COVID-19 before and after return to college. Results were as follows:

**Table 3: Measures to be taken by the college before students resume college.**

| Grouped response   | Frequency | Percent |
|--|-----------|---------|
| Provision of information and education                   | 4         | 5.5     |
| Stop quarantine activities and fumigate college          | 21        | 28.8    |
| Infection prevention measures(PPE, sanitizers and soaps) | 22        | 30.1    |
| Screen and test all students before admission            | 2         | 2.7     |
| Restructure college to comply with GOK requirements      | 24        | 32.9    |
| Total  | 73        | 100.0   |

Table three shows mitigation measures to be taken before students resume college. 32.9% (24) of the respondents recommended restructuring of college to comply with the Government of Kenya guidelines while 2.7% (2) of the parents which is the least number, recommended screening and testing of the students before admission. These findings of 32.9% agrees with a study by Loyola University New Orleans on “college

restructuring” that strongly recommend restructuring classes as way of preventive to COVID-19 and college development( Loyola University 2015). This study however negate findings of a study done by Gravatt J. (2018), on “College restructuring is complex, costly and shrouded in secrecy” drawing a conclusion that other methods can be explored before deciding to restructure a college.



**Fig.1: Mitigation measures before reopening of college**

The figure above Shows pictorial presentation of mitigation measures to be taken against COVID-19 infection before reopening of college.

**Table 4: Measures to be taken by the college after students resume college**

| Coded responses                           | Frequency | Percent |
|---|-----------|---------|
| Cleaning and Fumigation of college        | 4         | 5.5     |
| infection prevention and provision of PPE | 35        | 47.9    |
| Adhere to GOK guidelines                  | 21        | 28.8    |
| provision of information and education    | 7         | 9.6     |
| screening and testing                     | 6         | 8.2     |
| Total                                     | 73        | 100.0   |

**Table 4** shows measures to be taken after students resume college. 47.9% (35) of the respondents suggested that the college should provide personal protective equipment (PPE). 5.5% (4) recommended the college to be cleaned and fumigated regularly which forms the least number of the parents. This data correspond to a study by center for Disease Control and Prevention (CDC, 2020) which proposed regular supply of PPE to students while in college to reduce chances of disease spread.

## VI. DISCUSSION

The World Health Organization declared COVID 19 as a Public Health Emergency of International Concern leading to closure of learning institutions and social gatherings. Several public health measures were proposed to prevent and control transmission of COVID-19. A part from closure of learning institutions according to Blanco & Lurye (2020, July, 30), these included case identification, contacts tracing and case isolation, environmental disinfection and use of personal protective equipment (WHO, 2020). The implementation of case isolation led to conversion of several learning institutions in Kenya into COVID-19 quarantine centres to focus on triaging and sorting of suspected contact clients. Kenya Medical Training College Mombasa was among the quarantine centres.

Several reports agreed with our study. A report by Neil Campbell (2020, Sept., 21) on Vouchers over Virus: How the Department of Education Prioritized Private School Vouchers Over Responding to COVID-19, agreed with Table 4 above, where parents were lamenting how the Virus had forced closure of learning institution while at the same time making them think best mitigation measures before reopening of school. In their proposals, they suggested creation of budget to cater for necessary technology and personal protective equipment (PPE) to students and staff, to enhance retention of students and educators. The study had limitations on accessing adequate literature on mitigation measures to facilities that had been converted into quarantine centres. Despite parent's involvement on the matter of reopening, the end decision was found to still remain with the implementers who in this case being either the government or the school proprietors.

In conclusion, there was clear need to implement preventive measures before and after resumption of the college activities to optimize on controlling the spread of COVID -19. It is equally important to involve parent's input in order to build their confidence on safety of their children.

## VII. CONCLUSION

Parents are key stakeholders in matters pertaining students learning. Their contribution therefore forms a critical part in creating self confidence that their children would be safe once they report back in college. College restructuring and infection prevention measures have to be in place before and after reopening of college, this would ensure high confidence in parents that their children shall be safe while they are within the learning institution.

### Recommendations:

1. College Management should implement proposed measures before resumption of learning activities.
2. After students have resumed, preventive measures should be adhered and maintained to ensure their safety.
3. Further study to be carried out understand parents' fear on existing health and safety measures in places of higher learning in relation to a pandemics.

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# Study of linear buckling analysis on curvilinear fiber composites subjected to uniaxial compressive load

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**Abstract-** In modern days, composite materials play a major role in many applications specifically in commercial aircraft due to its high specific structural properties and high corrosion resistance as well as being relatively lightweight compared to their metal counterparts. These features that composite materials possess facilitate the designers to come up with various possible designs with high structural efficiency. Subsequently, numerous alternatives in varying fiber orientations have been studied over the years in order to customize in-plane stiffness which leads to enhanced structural performance, especially buckling performance. This paper presents a finite element model of conventional straight fiber and curvilinear fiber composites with respect to compressive load considering different boundary conditions. The variation of orientation variation and buckling load will be investigated for curvilinear fiber composites. And finally the results will compared with the conventional straight fiber composites.

**Index Terms-** Composite materials, curvilinear fiber, finite element, linear buckling analysis

## I. INTRODUCTION

Over the years thin plates have been used vastly in aviation and naval applications [1]. And in many cases, these plates usually have to undergo compressive load and this specific condition could potentially lead to buckling phenomenon. Buckling is a phenomenon of change of structural geometry when subjected to load, subsequently a buckled structure becomes ineffective to bear loads. Various studies have been conducted to investigate buckling phenomenon due to its complexity [2-8]. Buckling starts to develop even when the stresses over the structure are below its failure point. Although buckling itself does not necessarily mean as a complete collapse, further loading beyond buckling point might cause startling structural deformation and eventually failure due to loss of load bearing capability. It is also commonly found that elastic instability contributes more to failure of thin plates than the lack of the strength of the plates itself. In aviation industry, many components are slender and thin, naturally it makes buckling analysis necessary in the general analysis of the structure.

## II. THE THEORY OF PLATE STABILITY

This section provides brief explanation of the classical theory of stability analysis of thin plates. In addition, the formulation for

stability of thin plates has some qualitative similarities with column stability that was introduced by Euler.

In this paper, an ideal thin elastic rectangular composite plate is considered. It is assumed that the plate is perfectly flat in its initial state and subjected to external uniaxial in-plane compressive load. Important to note that the material used is composite materials rather than isotropic materials, thus the formulation would differ from buckling of isotropic plates. Based on the derivation of Von Karman equation, the governing equation of composite plates under uniaxial compressive load could be expressed as:

$$D_{11} \frac{\delta^4 w}{\delta x^4} + 2(D_{12} + 2D_{66}) + D_{22} \frac{\delta^4 w}{\delta y^4} = N_x \frac{\delta^2 w}{\delta x^2}$$

Whereas  $w$  being the out-of-plane displacement and  $N_x$  is the compressive load applied in  $x$  axis. It is worth noting that the governing equation considers an assumption of the variables  $D_{16}$  and  $D_{26}$  being negligible compared the other variables in the bending-twisting coupling matrix ( $D_{11}$ ,  $D_{12}$ ,  $D_{22}$  and  $D_{66}$ ). In order to solve the critical buckling load, solving the nontrivial solution for  $w$  that satisfies specific boundary conditions is necessary.

$$w = \sum \sum A_{mn} \sin \frac{m\pi x}{a} \sin \frac{\lambda n\pi x}{b}$$

The value of  $\lambda$  is chosen based on the boundary conditions. For instance,  $\lambda=1$  represents simply supported conditions. Then substitute the equation into the governing equation, rearrange the equation and take aspect ratio of the plate into consideration will give us the critical buckling load of the plate.

Using similar approach as presented equations previously would help figure out the buckling load of rectangular plates with different boundary conditions. In this study itself, the author would consider a simulation study with four boundary conditions; all simply supported edges, simply supported and clamped loaded edges, simply supported and clamped non loaded edges and simply supported with one free edge, which would be presented in the following section.

III. PROBLEM DESCRIPTION

**Buckling load of rectangular composite plates**

As mentioned previously, four boundary conditions would be considered in this study. The idea is to firstly solve the buckling load of the composite plates using analytical method and afterwards compare the analytical results with the finite element analysis software to ensure accountability of the results. Based on section 6.6 of the reference textbook [9], critical buckling load ( $N_{cr}$ ) could be solved numerically using these following formulae.

1. Simply supported edges

$$N_{cr} = \frac{\pi^2 [D_{11}m^4 + 2(D_{12} + 2D_{66})m^2(AR)^2 + D_{22}(AR)^4]}{a^2m^2}$$

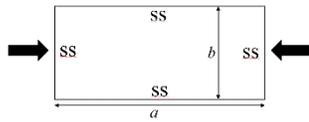


Fig. 1. Plate boundary condition (BC1)

2. Simply supported and clamped on loaded edges

$$N_{cr} = \frac{\pi^2}{b^2} \sqrt{D_{11}D_{22}}(K)$$

$$K = \frac{4}{\lambda^2} + \frac{2(D_{12} + 2D_{66})}{\sqrt{D_{11}D_{22}}} + \frac{3}{4}\lambda^2 \quad (0 < \lambda < 1.662)$$

$$K = \frac{m^4 + 8m^2 + 1}{\lambda^2(m^2 + 1)} + \frac{2(D_{12} + 2D_{66})}{\sqrt{D_{11}D_{22}}} + \frac{\lambda^2}{m^2 + 1} \quad (\lambda > 1.662)$$

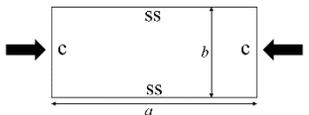


Fig. 2. Plate boundary condition (BC2)

3. Simply supported and clamped on unloaded edges

$$N_{cr} = \frac{\pi^2}{b^2} \sqrt{D_{11}D_{22}}(K)$$

$$K = \frac{m^2}{\lambda^2} + \frac{2(D_{12} + 2D_{66})}{\sqrt{D_{11}D_{22}}} + \frac{16}{3} \frac{\lambda^2}{m^2}$$

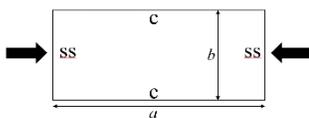


Fig. 3. Plate boundary condition (BC3)

4. Simply supported with one free edge

$$N_{cr} = \frac{\pi^2}{b^2} \sqrt{D_{11}D_{22}}(K)$$

$$K = \frac{12}{\pi^2} \frac{D_{66}}{\sqrt{D_{11}D_{22}}} + \frac{1}{\lambda^2}$$

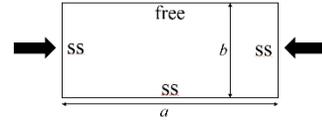


Fig. 4. Plate boundary condition (BC4)

$AR$  refers to the aspect ratio ( $a/b$ ) of the plate meanwhile the corresponding value of  $K$  can be obtained by

$$\lambda = \frac{a}{b} \left( \frac{D_{22}}{D_{11}} \right)^{1/4}$$

In order to simplify the names, simply supported edges will be called BC1; simply supported and clamped on loaded edges will be called BC2; simply supported and clamped on unloaded edges will be called BC3 and simply supported with one free edge will be called BC4.

In this paper, rectangular composite plate of 200 mm length and 100 mm width ( $AR=2$ ) is considered. For the material, carbon fiber reinforced polyether ether ketone (CF / PEEK) is chosen. The following table shows the material elastic properties.

|           |        |
|-----------|--------|
| E1 (MPa)  | 135000 |
| E2 (MPa)  | 7540   |
| Nu12      | 0.3    |
| G12 (MPa) | 5000   |
| G13 (MPa) | 5000   |
| G23 (MPa) | 5000   |

Table 1. Material elastic properties

The chosen stacking sequence for the laminate is  $[45/-45/0/90]_s$  and the ply thickness is 0.125 mm. Total thickness would be 1 mm, relatively thin enough to avoid the significance of transverse shear on the laminate.

Subsequently analytical approach of the buckling load of rectangular composite plate with different boundary conditions were performed and the obtained buckling loads are 20.94 kN (BC1), 22.9682 kN (BC2), 38.703 kN (BC3) and 3.634 kN (BC4).

**Finite element model**

ABAQUS software was used in order to simulate the linear buckling analysis of the composite plate. S4R reduced integration elements were used to represent the discretized elements and 1600 elements were considered in this simulation. subspace eigensolver was chosen to obtain eigenvalues and

buckling shape of the structure. Naturally, the least eigenvalue of each simulation would be the main interest since this would give the “worst” buckling strength as a verification of the structure.

The results of linear buckling load of composite plate with four different boundary conditions using ABAQUS solver are compared with analytical solution and the results are shown in table 2 and buckling shapes obtained for BC1 to BC4 respectively from ABAQUS are depicted in fig.5 – fig.8.

|     | Analytical (kN) | FEA (kN) | Diff  |
|-----|-----------------|----------|-------|
| BC1 | 20.94           | 21.107   | 0.79  |
| BC2 | 22.968          | 23.356   | 1.69  |
| BC3 | 38.703          | 39.499   | 2.05  |
| BC4 | 3.614           | 3.522    | -2.54 |

Table 2. Buckling load result comparison

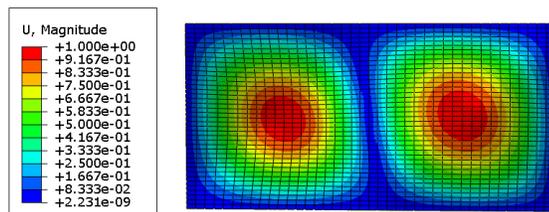


Fig. 5. Buckling shape of BC1

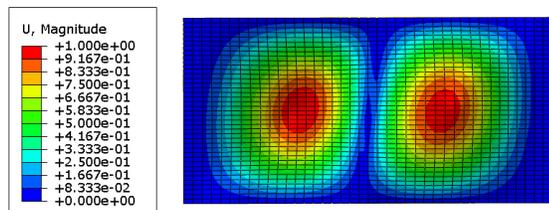


Fig. 6. Buckling shape of BC2

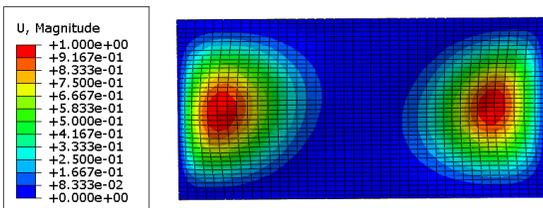


Fig. 7. Buckling shape of BC3

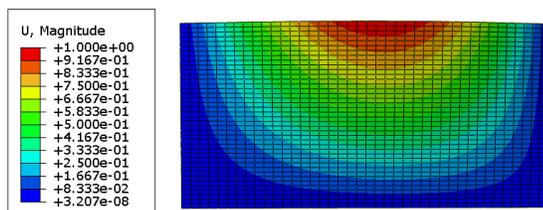


Fig. 8. Buckling shape of BC4

#### IV. CURVILINEAR FIBER COMPOSITES

##### Curvilinear fiber composites introduction

For conventional straight fiber composite material manufacturing, ply stacking method has been used over the years in order to achieve desired structural stiffness. By understanding the loadings that the structure might experience would help the designers design the laminates that suits the requirements. Correspondingly, composite materials have been rapidly developed due to its promising features, various alternatives have been studied in order to improve composite materials in structural design. One of the alternatives is curvilinear fiber composites, sometimes also called variable angle tow (VAT) composites. This approach allows the fiber orientation to vary within the plate. Subsequently this would lead to in-plane stiffness variation, which could be beneficial depending on the situation.

Biggers [10,11] studied composite plates using a unique approach. Their approach used a distinctive stiffening patterns of the fibers of the composite plates by manipulating the of fiber distribution. This customized fiber tailoring approach let the fibers act like local stiffeners. These composite plates later were subjected to compressive and shear load. The results were satisfactory, without sacrificing weight efficiency and changing the average of in-plane stiffness, buckling load of the plates could be enhanced. Nagendra et al. [12] carried out research to develop an optimization method of tow paths using NURBS (non-uniform rational B-splines). A single curve through a set of fixed control points based on a single cubic were implemented for the tow paths to pass. They studied optimal frequency and buckling load design of laminated composite plates with a central hole subject to deformations, ply failure and inter-laminar stress constraints using finite element analysis which eventually their experiment demonstrated an increased performance. Meanwhile Honda et al. [13] used linear combined B-spline functions to define the fiber paths. Parnas et al. [14] expressed the trajectories of the fiber in terms of either Bezier curves or cubic polynomials. On the other hand, Olmedo and Gürdal et al. [15,16] proposed a simple definition of linear variation of fiber paths identification by using three independent angles to characterize each VAT ply. Although in the beginning had a limitation due to the fiber variation only in one axis, later on other studies were conducted to expand the method by allowing the fiber orientation to vary in two dimensions. This specific method has been vastly used in curvilinear fiber composite plate studies over the years. In this paper, the presented plate would use their approach of linear fiber variation as well.

##### Model parameterization

As mentioned before, linear function that was proposed by Gürdal and Olmedo [15,16] would be used to carry out this study and it is expressed in this following equation

$$\theta(x) = \frac{2(T_1 - T_0)}{a} |\tilde{x}| + T_0$$

With  $a$  being the representation of the length of the panel whereas  $T_0$  is the angle of fiber trajectory at the center of the panel ( $\tilde{x} = 0$ ) and  $T_1$  is the angle of fiber trajectory at the end of the panel ( $\tilde{x} = \pm a/2$ ). Therefore, a variable angle tow composite lamina could be represented by the notation of  $\langle T_0|T_1 \rangle$  and the corresponding negative ply would be referred as  $-\langle T_0|T_1 \rangle$ .

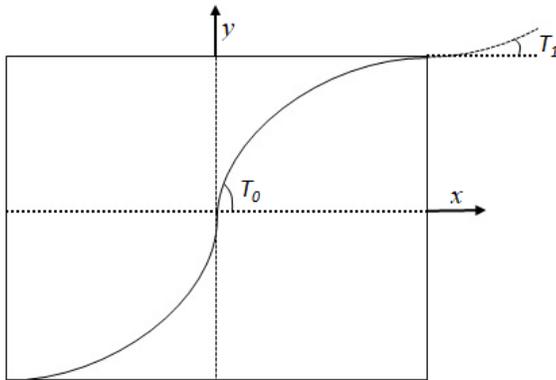


Fig. 9. Reference of fiber trajectory

Furthermore, when  $T_0$  is equal to  $T_1$ , it indicates that the fiber orientation is constant within the lamina. In addition the reference of fiber trajectory could be defined using these following equations

$$y = \frac{a}{2(T_1 - T_0)} \left\{ -\ln \left[ \cos \left( T_0 + \frac{2(T_1 - T_0)\tilde{x}}{a} \right) \right] + \ln[\cos T_0] \right\}$$

*for*  $0 \leq \tilde{x} < \frac{a}{2}$

$$y = \frac{a}{2(T_1 - T_0)} \left\{ \ln \left[ \cos \left( T_1 + \frac{2(T_1 - T_0)\tilde{x}}{a} \right) \right] - \ln[\cos T_1] \right\}$$

*for*  $-\frac{a}{2} \leq \tilde{x} < 0$

Python script was used in order to create a composite plate then mesh will be generated and ABAQUS S4R shell element is used. Parameter of the model are established within the code, this will also help further parametric studies in the future of related topic. Firstly the center of each element would be calculated by the coordinates of each element nodes and the connectivity between nodes is ensured. Then fiber angle would be mapped according to the fiber trajectory definition in the above equation then the data of varying angles will be stored in discrete field in ABAQUS.

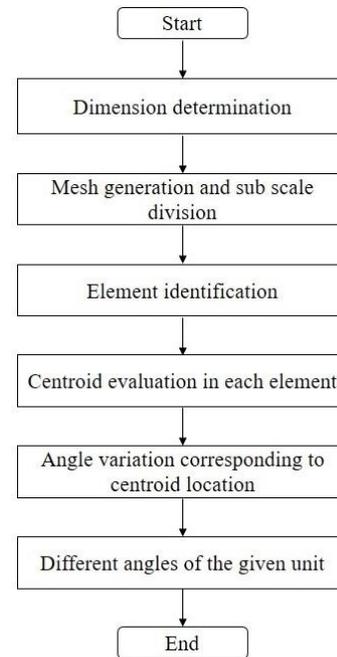


Fig. 10. Modeling steps of curvilinear fiber design

### Curvilinear fiber composites utilization

In this section, parametric study will be done to observe the effect of varying the fiber orientation towards the buckling load. Plies with certain angle will be modified in order to see enhancement possibilities in the buckling load under uniaxial compressive load. 45, -45 and 90 degrees plies will be replaced with curvilinear fiber composites. Furthermore, the simulation will be divided into two groups, replacing 45 and -45 plies while maintaining the 90 degree ply and vice versa.  $T_1$  will remain constant (45, -45, 90 and -90) meanwhile  $T_0$  will vary within some certain range. Important to note that -90 degrees will be considered due the variation of the fiber orientation in negative direction in order to balance with the 90 degree counterpart. The following table 3 and 4 show the buckling loads of modified laminates.

| $T_0$ (°) | Buckling load (kN) |        |        |       |
|-----------|--------------------|--------|--------|-------|
|           | BC1                | BC2    | BC3    | BC4   |
| 60        | 19.609             | 23.688 | 41.004 | 3.653 |
| 58        | 19.840             | 23.67  | 41.046 | 3.654 |
| 56        | 20.065             | 23.64  | 41.011 | 3.649 |
| 54        | 20.283             | 23.609 | 40.9   | 3.638 |
| 52        | 20.491             | 23.571 | 40.714 | 3.622 |
| 50        | 20.687             | 23.525 | 40.375 | 3.6   |
| 40        | 21.410             | 23.09  | 38.155 | 3.411 |
| 38        | 21.442             | 22.949 | 37.523 | 3.357 |
| 36        | 21.605             | 22.788 | 36.844 | 3.3   |
| 34        | 21.616             | 22.604 | 36.123 | 3.237 |
| 32        | 21.625             | 22.395 | 35.366 | 3.17  |
| 30        | 21.612             | 22.159 | 34.58  | 3.1   |

Table 3. Buckling load result (first group)

| $T_0$ (°) | Buckling load (kN) |        |        |       |
|-----------|--------------------|--------|--------|-------|
|           | BC1                | BC2    | BC3    | BC4   |
| 80        | 21.279             | 23.552 | 39.471 | 3.517 |
| 70        | 21.8               | 24.163 | 39.402 | 3.5   |
| 60        | 22.716             | 25.299 | 39.334 | 3.473 |
| 50        | 23.84              | 26.807 | 39.315 | 3.439 |
| 45        | 24.39              | 27.569 | 39.327 | 3.421 |
| 40        | 24.978             | 28.472 | 39.407 | 3.403 |
| 30        | 25.886             | 29.9   | 39.637 | 3.372 |
| 20        | 26.433             | 30.784 | 39.967 | 3.35  |
| 10        | 26.641             | 31.098 | 40.312 | 3.34  |
| 0         | 26.635             | 31.043 | 40.586 | 3.328 |

Table 4. Buckling load result (second group)

88 models were observed in this section. As can be seen that the variation of fiber orientation affect the buckling load differently in four different boundary conditions. Variation of 90 degree ply for BC1 and BC2 cases show major improvement while the modification of 45 degree ply seem only improve the buckling performance by a small margin. And for BC3, varying in both 45 and 90 plies also enhanced the buckling load but not as distinct as in BC1 and BC2. Variation for 45 degree ply in BC4 also shows improved buckling performance. In general, varying the fiber angle could improve the buckling load. However, the variation of 90 degree ply in BC4 seems to be ineffective compared to the others. Correspondingly, it is worth noting that the purpose of this paper is not to show optimization method but rather show the potential of customized fiber tailoring approach. In conclusion, via this approach the buckling load could possibly be improved without having to sacrifice the structural weight. Structural strength could be improved by manipulating the fiber orientation in a certain manner while at the same time maintaining the same material efficiency, this definitely expands the design space for composite laminates manufacturing. Subsequently, table 5 shows the best stacking sequence obtained from the simulation result and their buckling load improvement compared to the initial stacking sequence.

| BC  | Stacking seq.                       | Buckling load diff. (%) |
|-----|-------------------------------------|-------------------------|
| BC1 | $[\pm\{32 45\}/0/90]_s$             | 2.45                    |
|     | $[\pm 45/0/[\pm\{10 90\}/0/\pm 45]$ | 26.22                   |
| BC2 | $[\pm\{60 45\}/0/90]_s$             | 1.42                    |
|     | $[\pm 45/0/[\pm\{10 90\}/0/\pm 45]$ | 33.15                   |
| BC3 | $[\pm\{58 45\}/0/90]_s$             | 3.92                    |
|     | $[\pm 45/0/[\pm\{10 90\}/0/\pm 45]$ | 2.75                    |
| BC4 | $[\pm\{60 45\}/0/90]_s$             | 3.75                    |
|     | <i>none</i>                         | <i>none</i>             |

Table 5. New laminates and their buckling loads

## V. CONCLUSION

Finite modeling of composite plate was presented in this study. 4 initial models of conventional straight fiber composites with various boundary conditions were proposed and their buckling loads were obtained by analytical solution and ABAQUS software, both results were compared in order to investigate the accountability of the results. 88 models in total were simulated afterwards to see whether the variation of fiber orientation could improve the buckling performance of the plate. Simulation was divided into 2 groups, variation of 45 degree ply and 90 degree ply. In most cases, enhanced buckling performance could be seen, especially variation of 90 degree ply in BC2 and BC3 cases meanwhile the others were improved in relatively small margin and variation of 90 degree ply in BC4 seems to be not effective for this case study. However, the essence of this study is to show that the varying fiber angle approach could improve the structural performance without having to sacrifice the weight aspect and material efficiency. This also means more freedom in the design of composite materials.

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# The Influence Of Setting Speed And Hauling Speed On Mini Purse Seine Productivity In Sawu Sea Waters, Sikka Nusa Tenggara Timur District

(PENGARUH KECEPATAN SETTING DAN KECEPATAN HAULING TERHADAP PRODUKTIVITAS MINI PURSE SEINE DI PERAIRAN LAUT SAWU KABUPATEN SIKKA NUSA TENGGARA TIMUR)

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## Abstract:

Setting and hauling the technical aspects that were instrumental in the operation of mini purse seine fishing gear, previous studies have examined the setting and hauling of technical factors that affect the productivity of purse seine. In the scope of research just to the arrest of the night, so that should also be studied setting and hauling mini purse seine operated during daylight hours. This study aimed to analyze the influence of setting and hauling mini purse seine during the production of fish in the waters of the Savu Sea. This research was conducted in Sikka village Fisherman Village Mbengu precisely which is the object and the Savu Sea which is the operation of regional Mini purse seine fishing gear. Survey method is done by taking the data speed setting, hauling speed and the number of production units of a fleet of 24 units of the total population of mini purse seine trawler in the waters of the Savu Sea and follows the fishing operation for 40 days. The results showed  $F$  count  $< F$  table (0.746  $<$  2.06) so did the value of  $t < t$  table (0.010  $<$  1.97402). This shows Setting (X1) and Hauling (X2) simultaneously and partially not affect the production of the catch on mini purse seine fishing gear operated during daylight hours in the waters of the Savu Sea.

**Keywords:** *Hauling, Mini Purse seine, Production, Settings.*

## I. INTRODUCTION

Large fisheries potential is a major factor in the increase of the potential fishing, various types of fishing gear used by fishermen as a tool to exploit fish resources available. Walden and Mcguire (2011) states that the marine waters of common pool resources (common property), where fishermen have the same rights to use resources or do fishing business. One of the fishing efforts that is developing is the fishing effort by using mini purse seine fishing the smaller size of the purse seine.

The use of mini purse seine fishing is used by fishermen to exploit the pelagic fish, according to McCluske and Lewison (2008) that the fishing effort is a measure to generate a number of catches or measure the productivity of fishing unit. To achieve maximum production yields so many ways made by fishermen from increasing the length and the inside of the gear to the increase the size of ships and speed boats. Any fishing gear used to have principles and work differently, so the ability to capture in production is also different (Nelwan *et al.*, 2012).

Purse seine fishing gear performance is influenced by technical factors that work, according to Picaulima (2012) that the technical factors that affect the productivity of purse seine is the size of the ship, Purwanto and Nugroho (2011) purse seine productivity is influenced by the speed of the ship, other technical factors also affect the productivity of the purse seine, according to Pratama *et al* (2016), is a long trip, the number of crews, Watt, net length, width or depth of the nets, engine power, fuel and skipper experience. Aside from the productivity of fishing gear depends on the design and physical characteristics of the materials used to build the fishing gear. Structural components such as a mesh that gives vary in chemical composition and specific gravity. Similarly, the size of the mesh, the thickness of the yarn, and the volume of floats and ballast weight is used to provide positive and negative buoyancy in various parts of the nets may affect the behavior and performance of gear (Kim *et al.*, 2007)

Utilization of mini purse seine fishermen in Sikka, especially in the southern region of Sikka used to catch pelagic fish during the day. The development of mini purse seine in the southern region of Sikka district in the year 2016 is developing a fleet of 18 units and increased in 2018 by 24 units of the fleet (village profile Mbengu 2018). The increase in the number of mini purse seine fleet is expected to take effect on increasing the production value of fish catches. Many factors work and affect the productivity of the workings of the purse seine especially during an operation carried out such fishing gear speed of the ship, vessel GT, net length and depth of the net. Technical factor of considerable influence upon the operation of mini purse seine is the speed setting and hauling speed. this corresponds Kefi *et al* opinion (2013), that the successful operation of the purse seine based research results show that the success of purse seine operations using FADs is speed at the time of setting (setting speed) and pursing speed (pursing speed).

The purpose of this study was to determine the effect on the production Setting and Hauling catches mini purse seine fishing gear operated during daylight hours.

## II. METHODS

This research was conducted in November 2019 - December 2019 in the waters of the Savu Sea, Sikka Regency, to be precise in the Mini Purse Seine fishing village, Mbengu Village, Nusa Tenggara Timur Province. The method used is a survey method which case study that is taking data directly following the arrest of six unit processes Mini Purse seine fleet for two months. Data taken the form of data speed setting fishing gear or fishing gear release of the six units of the fleet. Calculated using a stopwatch, the data withdrawal hauling rope drawstring or data from a fleet of six units is calculated by using a stopwatch. Total production or catch fish every trip the arrest of the six units of the fleet is calculated by weighing the fish is done. The analysis used in this research is multiple linear regression analysis.

## III. RESULTS AND DISCUSSION

### A. Characteristics of the Mini Purse Seine

Mini purse seine in Sikka regency, to be exact, Savu Sea, namely the fishing village of Mbengu Village, totaling 24 units of fleet with mini purse seine sizes consisting of 3 Grosstonage, 5 grosstonage and 7 grosstonage. Mini size purse seine in the region has long nets between 250-300 meters with a depth of 12-15 meters.

#### 1. Component Mini purse seine

One unit of mini purse seine fishing equipment consists of several components forming (Figure 1), such as nets, buoys, rings, weights or lead rope and rigging as RIS above, below ris rope, rope buoy, rope rings and rope drawstring. Each component has a different function. Nets used is made of Polyethylene (PE) with a mesh size of 2 inches, while the ring is made of tin or of brass, used ropes made of Polyethylene (PE), buoys are usually packed of plastic materials with different shapes, some are round and some are ovals.

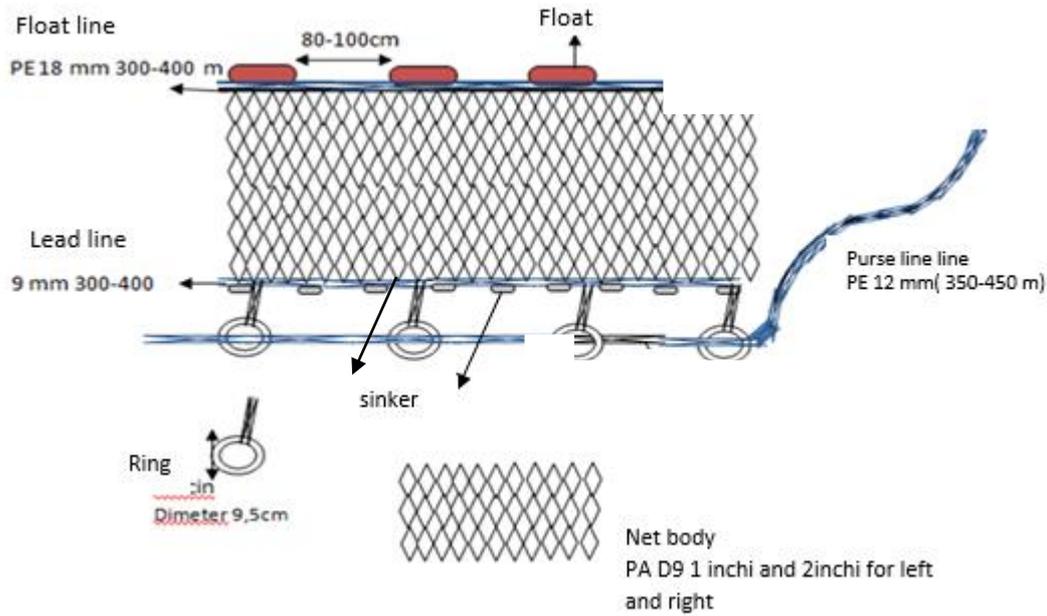


Figure 1. Component Mini Purse seine

## 2. Catching Mini purse seine operations

### Operation Preparation Arrest

Before the ship set out to search the area fishing ground, routine activities performed by the skipper and all employees are engaged in preparing, technically good preparations such as preparation of fuel, engine inspection, preparation throw stones and setting fishing gear. The amount of fuel needed fisherman every day for 40 liters. Each fuel requirements are usually in accordance with the distance or length of time of arrest.

## 3. Catchment Area

Catching strip is an area that has the potential of fish and become a target region capture by fishermen. Fishing areas using mini purse seine fishing gear in pursuit of fish by fishermen system Mbengu village is along the waters of the territorial waters of the Savu Sea to the waters wolowirol ball. There is no definitive determination of the fishing area, the fishermen usually do a search along the waters. Determination seen fishing ground area of some signs such as discoloration of sea water, the presence of bubbles or water surface buoy, seen sea birds swooping or small fish leap above the water surface.

## 4. Mechanical Operation

Mechanical operation of mini purse seine fishing gear made after finding ground fishing areas or schools of fish, the operation of the process consists of two processes, among others:

### 1. Setting

- a. Setting is the process of decline in fishing gear, the early fishermen fishing ground or looking towards the fishing area begins from 6:00 to 11:00 hours. This is done because at that hour the surface of the sea water is not too hot and the fish can be seen or played above sea level, while in the afternoon the search process starts from 15.00- 17 .30 hours when the sun is not too hot or heat.
- b. When seen schools of fish quickly monitor your interpreter to convey to the skipper, so the skipper will steer the boat moved closer to the schools of fish as directed.

- c. Crew or all workers on board began to prepare for the position and duties of each
- d. Ships approaching the schools of fish to observe some things like, swimming direction of fish, water depth, type of fish, fish swimming speed, direction of currents and winds. A distance of approximately 40-50 meters monitor so that the fish do not escape or fear.
- e. Skipper will determine the starting point decrease in the net. Ships do if the motion to take a position prepare for loopin. The principle of the loop is to block the swimming direction of the fish, the maximum speed is according to the swimming speed of the fish so that the looping process is quickly completed.

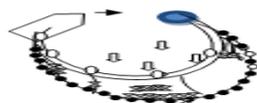


Figure 2. Illustration of Mini Purse Seine Settings in Mbengu Village

### Hauling

“Hauling” or net withdrawal process will be done if both ends meet or mesh nets have been fused. Net withdrawal process is performed as follows:

- a. Withdrawal rope wrinkle as soon as possible in order to avoid the possibility of the fish being trapped can escape. Officers withdrawal wrinkle withdrawal rope rope together to close the vertical direction fish swimming.
- b. When the ring is almost reached the side rollers or information officer signaled to stop the withdrawal. Wrinkle rope hooked to the stopper in order not to sink.
- c. Appointment ring on the vessel, removal of the ring carried by several crews. This is done by fishermen for fishermen not to use the auxiliary engine or engine Derek but still using manpower.
- d. d. Once the ring is increased then the entire member simultaneously withdrawing a net weight starting from the withdrawal of the top rope ris (buoys) are landless and together.
- e. Body pulled nets so that the only remaining space is enough (which had bags of net section)
- f. Catches of fish (fish raised above board and inserted into the fish hold).
- g. After all the process has been completed and the fish in the hold then the nets will be trimmed back to the process of catching the next one.

### B. Catch fish

Production of fish catches using mini purse seine fishing gear carried by a fisherman in the village of Mbengu is small pelagic fish species such as *Sardinella lemuru*, *Hemiramphus brasiliensis*, *Euthynnus affinis*, *Leioagnathus ecuulus*. Total production during the study can be found on the curve below.

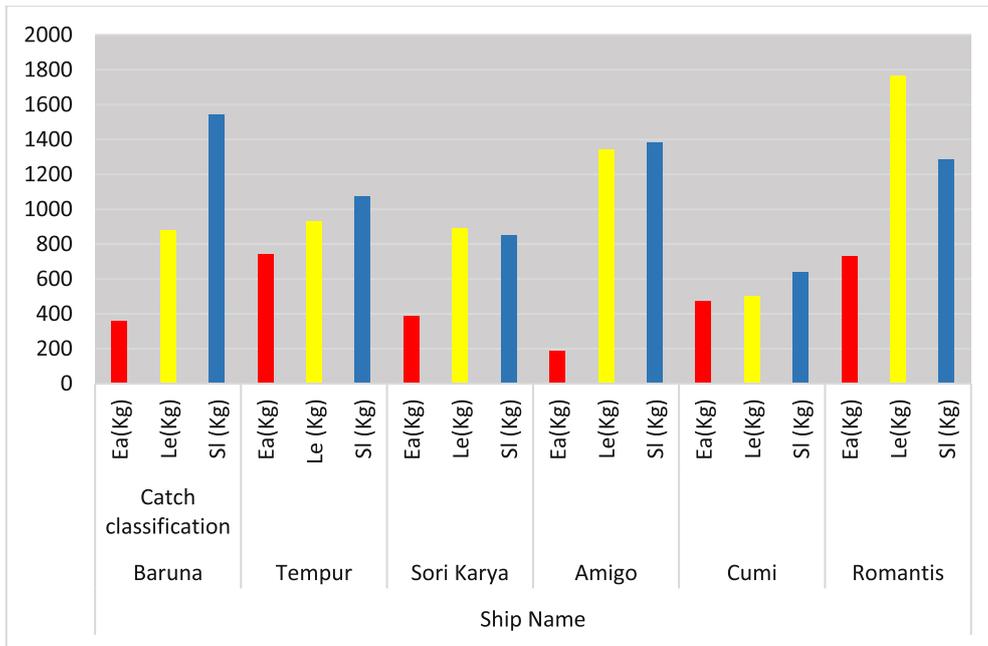


Figure 3. Curva Fish Production in November 2019

From the curve arrests made during research there are three dominant types of fish caught on a mini purse seine fishing gear during the day. Among the *Euthynnus affinis*, *Leioagnathus ecuulus* , and *Sardinella lemuru*. Of production during November catches most fish caught are *Sardinella lemuru* as shown in the diagram below.

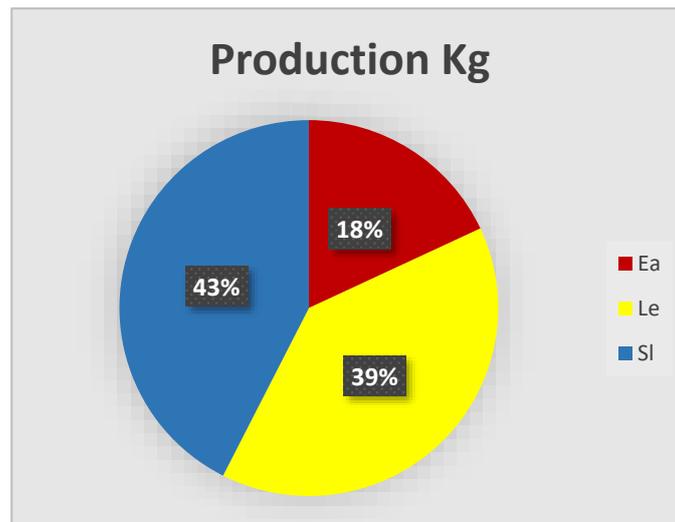


Figure 4. Diagram Catches Production Month November 2019

The most fish production in November 2019 was the type of *Sardinella lamuru*, which was 43% of the total catch, while *Leioagnathus ecuulus* was 39% and *Euthynnus affinis* 18%

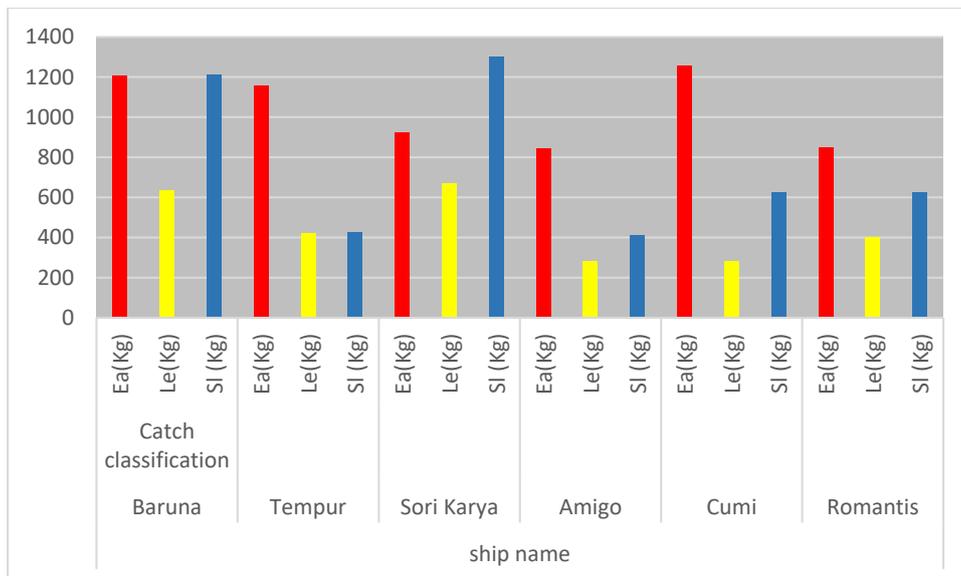


Figure 5. Production curva Month December 2019

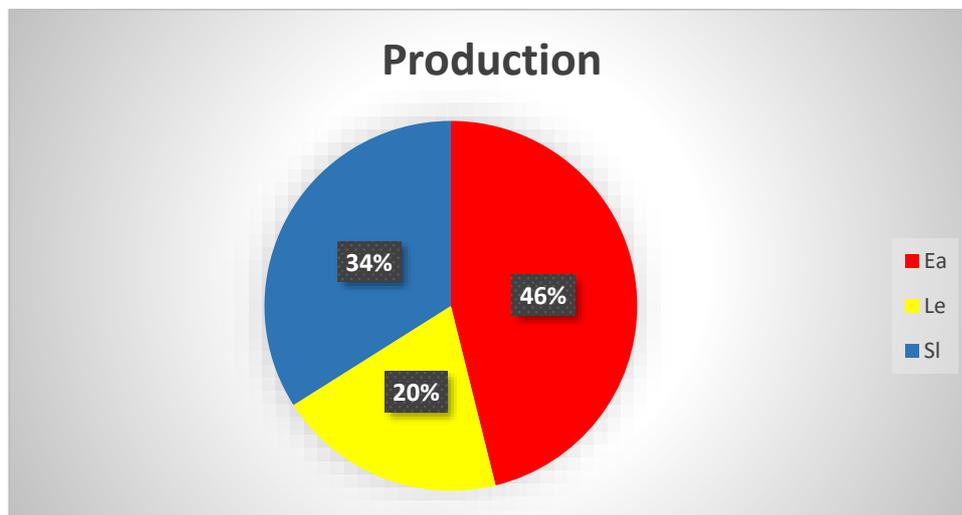


Figure 6. Diagram Production Month December 2019

Production of catches occurred in December as seen in the curves and diagrams explaining that the production catches in december catches the most is the kind *Euthynnus affinis* by 46% or 6231 kg, *Sardinella lamuru* 34% or 4592 kg and *Leioagnathus ecuulus* 20% or 2682 kg.

According to several researchers such as Safitri and Magdalena (2018), the composition of the catch of purse seine is *Decapterus makrosoma*, *Selaroides*, *euthinus affinis*, *Restrelliger*, *Parastromateus niger* and *Sardinella lamuru*. production quantities by fishermen is decreased compared to a few years ago. According to fishermen it is because of the excessive heat so the fish are not on the surface of the waters. Fluctuations catching perceived by fishermen is the impact of climate change that is very difficult to predict by fishermen. This is according to Saumanan (2012) that climate change is happening so quickly is a result of climate Variability is causing extreme weather. According Interter Governmental Panel on Climate Change (IPCC) (2014), states that climate change in the last decade has been in the spotlight of the world, causing climate change impacts on natural and human systems changes that can lead to the risk of harm associated with the interaction of the climate.



Figure 7. Fish from Mini Purse Seine Production

### C. Setting Speed and Hauling influence on the production of the catch

#### 1 Value The coefficient of determination ( $R^2$ )

Coefficient of determination can be used to determine the level of influence of the independent variable (X) to the value of the dependent variable (Y). In Table 2 the coefficient of determination of the analytical results is 0.38, or 3.8% Production is able to be explained by the variable setting, hauling, as well as speed, ABK, length, size, the depth of which is a supporting factor. And the rest is affected by environmental variables such as cuaca and climate that are not described in this study.

#### 2 F Test

For the F test can be used to determine the effect of variable X jointly or wholly to variable Y. Based on the test results in Table 3 obtained F F count = 0.746, F count < F table (0.746 < 2.06). This shows the variable X no significant effect on production. It can also be seen from the significant value of 0.633 is > 0.05, which is a probability value.

#### 3 T Test

The t-test is used to determine the effect of each variable X to Y regression model independent variable is the speed setting (X1), hauling speed (X2) and the dependent variable. Catch (Y) Based on Table 4 for the t test results showed that:

##### a) Speed setting (X1)

The speed setting (X1) has a sig. = 0.992 > 0.05. This shows that the speed setting no significant effect on produks. It can also be seen in the value of t < T table (0.010 < 1.97402). It shows a little different from the opinions Maulana. (2017) says that the length of time the settings that affect the production of fish catches using a purse seine fishing gear, but not a dominant factor affecting the catch.

Setting speed has no effect because the use of the ship's engine, vessel size, and the size of the fishing gear by not having variety. Setting speed itself has a relationship with the ship's speed or power boats used as communicated by Pratama *et al.* (2016). That the process of looping fish schools will be faster if it is supported by the strength of the ship's engine. The same thing also delivered by Muntana *et al.* (2013). The use of large machines is needed in the process of looping fish schools. The process of setting fishing gear during the day requires precision from the skipper. This is because the fish are not concentrated so that the faster the circular then the less likely a fish out of the net.

##### b) Hauling Speed (X2)

Hauling speed has significant value = 0.824 > 0.05 that is a probability value. It shows that the hauling speed does not affect the catch, but it also can be seen in the value of t < t table (0.222 < 1.97492). Which means that hauling did not affect the production of the catch. It is the possibility of the hauling speed is influenced both external factors and internal factors according to (Pratama *et al.*, 2016). Determination of setting and hauling speed, heavily dependent on technical factors, among others, the dimensions of the vessel, the size of fishing gear, engine power, and the number of crew. According to Imanda *et al.* (2016) to

maximize the time the withdrawal cord drawstring, replaced human labor with technology. This was deemed necessary to reduce the number of crews and the crews operating costs.

Overall the test results have shown that the speed setting and hauling speed does not significantly influence the production of the catch. According Maulana *et al* (2017) on the partial test duration setting only has an influence on the production of 27.8% while hauling only affect production by 3.3%. Another determining factor is also affected currents and winds. Currents and winds will affect the net circle become imperfect when looping and the net will be torn due to strong currents and waves.

Climatic factors are environmental factors which influenced the setting and hauling the impact on the production catches mini purse seine fishing. Changes in sea surface temperatures are increasing resulting in fish that are in the water column, making it hard fisherman when looking for fishing areas. This is resulting in setting and hauling can only be done one time in a day that originally could reach 4-5 times a day. According to Thomton et. al. (2014) climate change resulting in climate variability such as the frequency, intensity and duration of extreme weather. This resulted in certain months of the fishing very difficult to determine or predict the fishing season and the time of going to sea because climate change is happening so quickly and in the long term. It is also the Interter Governmental Panel on Climate Change (IPCC) (2014), states that climate change in the last decade has been in the world spotlight. Climate change is causing impacts on natural and human systems changes that can lead to the risk of harm associated with the interaction of the climate. Climate change is felt by fishermen, fishing became very little time so that the effect on the earnings of fishermen. As climate change is felt fishermen are the currents and waves.

Based on the results of multiple linear regression analysis obtained by value of setting and hauling is not significant so the regression model can not be used to determine the effect of variable X to variable Y constant value 186 931 If assumed that all of the variables X or independent variable is 0 then there will be an increase in production of 186.931kg.

#### IV. CONCLUSION

Based on the results it can be concluded that the factor of speed setting and hauling speed does not affect the catch on mini purse seine fishing gear. The dominant factor is the effect on other factors not tested as the aquatic environment, fishing seasons and climate.

For further research may add to environmental factors that are considered quite an impact, as well as a research and reproduced samples.

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# Disaster in Democracy - A Global Phenomenon

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**Abstract-** What we see may not always be the reality and what we presume as real may not be our observation always. In democratic set-up, this has often emerged as reality. Democracies had always been subjected to criticism but it is astonishing to note how the interplay of corrupt vision and changing social attitudes playing a havoc in our democratic systems. This paper broadly investigates the voting behavior and attitudes in response to sophisticated tempting actions by political parties to pull voters. This research demonstrates that higher the level of temptation combined with many socio-economic perils, leads to higher biasness towards them. Participatory research, interviews, journals, publications, and observation and media reporting have been studied, analyzed, and scrutinized to discover how different poor and illiterate people vote. Findings and results attributes greater role of education, financial liberty, backwardness and awareness to political reality in determining voting behavior.

**Index Terms-** Democracy, Electoral Fraud, Voting Behavior, Regulation, Poverty and Illiteracy.

## I. RESEARCH PURPOSE

The key purpose of this paper is to classify/elaborate wide range of factors that pose a big threat to democratic system, all over the world. The central aim was to differentiate common and uncommon factors (which largely go unnoticed) affecting the integrity and purpose of democracy and furthermore to elucidate their impact and reasons for such consequences.

## II. RESEARCH METHODOLOGY

This paper is basically an explanatory research that focuses on examining the inter-linkages of various socio-economic and institutional aspects related to the subject, structured on empirical research to verify whether commonly identified factors are truly responsible or some other factors are responsible for problems discussed in the paper. Inductive reasoning has been majorly followed and sequentially deductive reasoning is also followed briefly in one chapter to disapprove own findings in this paper, as to retest the reality.

Primarily published journal articles has been the key source of information, secondly much of the information was obtained from media, this provided true and verifiable structure of information that helped in figuring current reality. Academic research provided conceptual and analytical base that helped in critical analysis of evidence found and hypothesis carried in this paper.

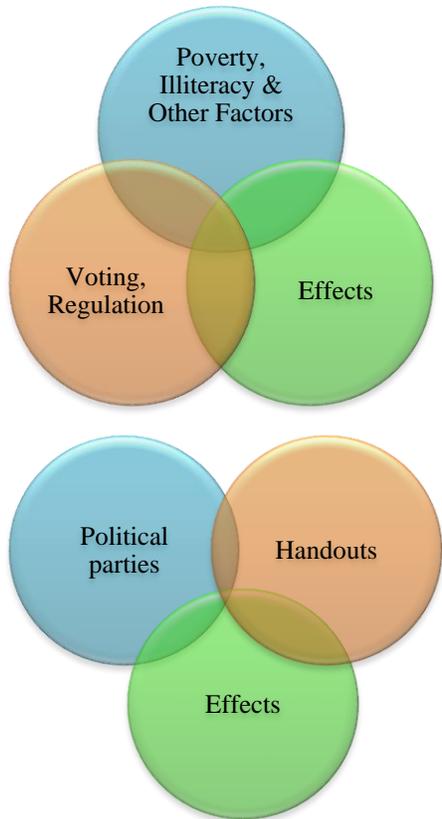
In other words, approach followed here helped in double examination of facts, where academic literature provided solid foundation for comparisons and critical analysis of facts, both supportive and non-supportive claims related to the study. This led to discovery of new concepts and unrecognized realities.

Each chapter is designed on wide range of different methods of analysis like chapter 1 is structured upon socio-economic, socio-regulatory analysis and chapter 2 is based on socio-philosophical or socio-moral analysis and lastly chapter 3 is designed on socio-cultural analysis.

## III. RESEARCH DESIGN

Recent research on vote choice, vote-behavior, decisions making, electoral handouts, and vote-buying strategies provides strong and in-depth account of how the mechanism works, like Schaffer in his paper "what is vote-buying" brilliantly explained vote-buying practice from wide range of different but realistic perspectives which helped us in understanding how it should be viewed and how parties rely on variety of tactics to influence voters. Similarly, Josephine T Andrews and Kris Inman, eloquently explained the relationship between vote choice and urban and rural level based on certain parameters but however didn't focused on what makes people sell to their votes.

Figure 1:



Moving further, the primary purpose of Jenny Guardado R and Leonard Wantchekon's paper, "Do electoral handouts affect voting behavior" was to estimate or assess the impact of handouts on voting behavior. A number of socio-economic parameters were studied to estimate.

The first Venn diagram depicts the approach followed in this paper and the second diagram showcases the approach generally followed to study the voting behavior.(among other approaches). According to this approach, political parties are at the center-stage during the election process and are explicitly engaged in persuading people to vote of them in exchange for cash for vote. And furthermore this approach helps in assessing the impact of such handouts on voting decisions, in uncovering types of different strategies followed by parties and other crucial aspects.

The approach followed in this paper (the first Venn diagram) is based on socio-economic and socio-regulatory parameters, where people are at the center of study. Based upon non-economic, economic and administrative parameters; reasons, impact assessment, behavior, social attitude, socio-moral aspects (related to problem), consequences are critically analyzed. This approach helped in discovery of new concepts based on real and most commonly observed events in our society, which unfortunately escaped from mainstream focus due to its complex nature and common occurrence

<sup>1</sup> Bunch of countries are considered together

<sup>2</sup> Democratic Country: A type of Government in which people choose their leader by voting. A system where elections are held periodically and every citizen has right to vote during elections.

### Research Benefits

This paper offers 5 great benefits to numerous fields like science of voting, public policy, regulatory science sociology, and political science. Primarily helps in identifying various voting practices that were largely unrecognized and their impact at local, national and global level, secondly helps in finding loopholes in policy design and more critically in implementation of laws, thirdly, this paper helps in gauging impact of regulation on social attitudes and social actions, fourthly highlights cause and effects of interaction between institutions and society and finally critically analyses behavior and outlook of current day political parties across the countries.

### Research Questions<sup>1</sup>

1. Why electoral fraud exists?
2. Why people sell their Votes, irrespective of their socio-economic conditions?
3. What role morality play in electoral fraud?
4. How many different forms of unrecognized voting exist?
5. How to eradicate electoral fraud from a global perspective?

## IV. INTRODUCTION

Democracy is one of the dominant system of governance today. There are 123 democratic<sup>2</sup> countries in the world (Magazine B. , How Many Democratic Nations Are There?, 2013). Nearly ½ of the world's population, close to 3 billion live on less than \$2.50 a day, 781 million adults and 126 million youths cannot read and write a simple sentence. Women accounts for 2/3 of the total population. In 2014, Elections took place in almost 21 countries in African continent. Almost 6-10 national level elections were held in Asia. A total of 15-18 elections were held in Europe including parliamentary, presidential and local. 5 elections were held in Latin America in countries like Brazil [Voter Turn-out Ratio 80%] Colombia [44%] Uruguay and other. In Central American Region Costa Rica and Panama were the 2 regions where elections were held in 2014. In the Oceania region 3 elections were held. And In Northern America no general elections were held in 2014.

For the smooth functioning of democracy, or for true and impartial reflection of people's choice in a democratic country, recognition of the value of democracy and its real reach must be well understood by the people. Franklin D. Roosevelt, had said, "Let us never forget that government is ourselves and an alien power over us. The ultimate rulers of our democracy are not Presidents and senators and congressman and government official, but the voters of this country".

This explains the primacy of a system which is chosen and governed by the people and that is based on the pillar of voting. Moving beyond the argument for or against democracy, its functioning and its achievements, what is more important to understand is what makes up the decision to vote and what inspires to vote for the majority of people around the world.

-No distinction has been considered between republican and democratic country, as this paper does not go beyond voting

John F. Kennedy cleverly remarked on voting by saying “The ignorance of the one voter in a democracy impairs the security of all”. If one voter’s decision would cost the future of entire society then the question arises why would he take such a decision? Philosophically, the voter is delivering his/her ignorance than the vote rather. Ideally, it is the pool of knowledge, logic behind reasoning and ethicality of preferences that shape up the decisions that are made and actions taken. The centrality of this issue is ironically contrary to the general belief in voting and voting decisions as said above.

Voting is perceived as an instrument for change, prosperity, peace and harmony in democratic state, but sometimes evidence suggests that the situation seems to greatly contradict entirely to the philosophy of voting. Evidence suggests that regulatory vacuum and feeble enforcement tends to tilt social attitudes and influence their actions, creating a vicious cycle where market for rights is booming and fortunes of buyers are bright.

The examination of social attitudes and its impact on political situation, governance, economy, foreign relations and global peace needs a wide range of different standards and methods of analysis, which has been followed in this paper to find out actually what’s happening and why. Furthermore evidence tend to suggests political parties in some countries view governance from a different angle and try to exploit it for their secret agendas, against principles and purpose of democracy and by gravely overlooking people’s will. This stems from the ugly fact related to absolute negligence in implementation and administrating laws enacted. These is high degree of correlation between social behavior, voting decisions, regulatory set-up and its reach, future of the country and global situation. Voter’s decision and government actions and policies play a significant role in maintaining or improving bilateral or multilateral economic, social, cultural relations but when political parties loss their vision and turn more ambitious towards national political supremacy then things tend to wither badly.

Disaster in democracy is mixed up analysis of behavior of political parties, their ideology, tactics, social attitudes, institutional set-up, efficiency in governance and impact of all these on people, society and world at large. Though brief critical analysis has been performed to uncover the reasons and impact of all these due lack of statistical data but this paper provide deep insights. On the other hand, by keeping regulatory loopholes to some extent intact, political parties in most of countries have resorted to corrupt practices where they open up market of voter’s right (i.e. vote) and operate like a big Corporation working on full capacity.

To understand the entire mechanism, first we need to understand briefly how socio-economic situation in some countries paving the way forward but before that it is necessary to understand what tactics political parties exercise to exploit the regulatory vacuum and socio-economic circumstances. Below are the some of the few examples of activities that act as a persistent threat to principles and integrity of democracy.

“Nigeria’s Political parties bribe voters with rice” (Moore, 2015). “In the year 2006, Government of Tanzania banned election handouts during election campaigns”. (news, 2006). “The chairperson of legal affairs committee of parliament Kezzia Msukwa has called on electoral stakeholders to fight for criminalizing of handouts in the electoral process so that only

aspirants who have real issues to offer to the public should make it in the forthcoming tripartite elections” (Times, 2013). “Helsinki voters won’t be getting much free coffee this election season, after the city banned parties from handing it out in major marketplaces.” (News, 2015). “Tories accused of trying to bribe pensioners with pre-election handouts” (Grice, 2015)

“In Thailand, thirty percent of household heads surveyed in a national sample said that they were offered money during the 1996 general election” (Schaffer, Clean elections and the great unwashed, vote buying and voter education in the philippines, 2005). “Voters in Taiwan of different ethnic backgrounds approach politics in distinctive ways, revealing modern echoes of conflicts beginning even before Chiang Kai-shek’s retreat to the island in 1949”. (Ching-Yuan Lin, 2007) “Recent elections in the United States provide example of turnout buying. During the 2004 election, five Democratic Party operatives in East St. Louis were convicted in federal court for offering cigarettes, beer, medicine and \$5 to \$10 rewards to increase turnout of the poor”. (Nichter, Vol 102 Feb 2008). “Indian Voters expect more handouts as parties compete to outdo one another with costly pre-election “gifts”. This practice is, of course, explicitly forbidden yet routinely pursued” (Vaishnav, 2014).

The exertion of influence to vote in their favor naturally suppresses the “free will” of the voter and does not reflect his/her preference. Political parties often attempt to pursue voters for political gain. These events reveal the magnitude of vulnerability and depth of complexities prevalent in some countries. But it should be acknowledge the fact that not all countries listed or discussed in this paper may equally be vulnerable to these problems but to project the reality and grasp the entire subject it is worth noting these problems.

Perhaps this paper is not limited to vote-buying strategies and tactics it goes well beyond and finds out why it happens and how. Furthermore it presents complete picture of how the entire mechanism works and how voting decisions are made across wide range of countries discussed. The nexus between voting, elections, results, policies, politics, international relations and ultimately world peace greatly rests on how we chose our governments and how well they deliver to their promises.

Disaster in democracy is based of precise observation; hard core evidence and broad analysis which attempts to bring global community together and rededicated ourselves to build global consensus and a mechanism where reach and impact of democracy is fair, unbiased and ethical. This is because, every vote and every human being whether working in a landfill or Parliament, has the equal right when it comes to voting and should get fair degree of opportunity to express his/her will freely during elections.

Many different kinds of voting have been mentioned in this paper which may affect the system, future and which requires global attention and dedicated effort so that systems entirely get refined and deliver their true proposes. This paper is been designed to empower and strengthen global democracy, based on micro-level constituency, province or district and national level evidence and analysis.

## V. BENEFIT VOTING

Difference between Vote-Selling and Benefit Voting is very thin and bleak, and thus remained unrecognized, but both have

certain distinguishing characteristics that help us differentiate both. The practice of benefit voting relates to the tendency of a voter to seek material (or any) benefit or other help in exchange of their vote for a particular party during elections. Broadly, it is general and willful act to obtain something, that leads to vote trading activities and on the contrary, practice of vote selling is largely based on exertion of influence and persuasion by a party. Even in case of benefit voting party's influence remains key but wide range of other different factors creates a situation where people tend accept it more openly. Benefit voting in other words, is a kind of general phenomenon, where people generally expect or ask for something for their vote regardless of their socio-economic condition. More precisely, benefit voting is a sort of evolution in vote-selling activities due many socio-economic, institutional and regulatory loopholes. Benefit Voting is a common occurrence in many democratic countries where people expect something in return of a vote; this is not just because of poverty.

In case of vote-selling, voters are usually tempted to trade by political parties and on the contrary in case of benefit voting, voters generally seem to seek, or ask any benefit for their vote. But in both the cases selling vote will be central. Benefit voting explains vote-selling from socio-regulatory perspective and whereas vote-selling explains it from socio-economic stand-point. In other words, vote-selling as we generally know, is prevalent because of certain-socio economic problems but benefit voting is gaining momentum due certain regulatory aspects, where both poor and non-poor try to get immediate material help or any other gain in return of their votes.

Literature on voting behavior or more precisely voting behavior under electoral handouts focuses to large extent on after effects of electoral handouts based on socio-political or other model. But owing to shortcomings in methodologies and statistical evidence, many critical questions remain unanswered like what drives voters to sell vote? And do voters seek benefits for voting? This chapter however attempts to answer this key question based on socio-regulatory and socio-economic analysis and answers the questions like why people trade their vote from demand and supply perspective.

Simeon Nichter in his paper brilliantly distinguished the vote-buying and turnout buying but from distributors perspective based on certain objectives; certainly ignoring the supply side. And Susan Stokes classic work assumes that political parties' targets people "who are moderate oppressors".

"Vote-buying is defined as a transaction whereby candidates distribute private goods such as cash and gifts in exchange for electoral support or higher turnout" (Wantchekon, 2014). Concept of benefit voting captures the phenomenon from the voter's perspective and whereas the above definition covers it from distributors perspective, but ironically from either way it's prevalent and active mechanism.

A person admitted that, " voting for a generous candidate in the most recent local elections: she and her friends got a taxi ride to the polling station, cash, saris, prayer utensils and a free trip to a famous temple" (Magazine E. , Illiterate Voters, Making thier Mark, 2014). The generosity viewed here is fundamentally based on certain short term offerings made by parties, which furthers proves that people generally accept offerings made by the party, furthermore it also proves that central focus of people during

elections is material generosity then policy oriented progress, direction and development; as political parties are expected to deliver after assuming the office. In an another instance, "Politicians and their aides in Tamil Nadu and Andhra Pradesh admitted to violating election law to influence voters in the 2009 Lok Sabha polls through payments in the form of cash, goods, or services" (Hiddleston, 2011). First evidence shows the view of public in general (at particular location) and the second evidence explains the same phenomenon from distributors perspective, but both cases explicitly shows what methods and tools parties use to influence people and how political parties view elections.

From analytical standpoint, the first evidence presented above is related to benefit voting because here a candidate is viewed as generous since he's offering taxi ride and other things and furthermore in second case related to Tamil Nadu state presented above is an example of tempting voters to "sell".

Recent parliamentary elections held in Uganda, sets out clear examples that precisely distinguish vote-selling and benefit voting. "A bar of soap or a bag of salt is sometimes what decides how a person votes in Uganda" (Segawa, 2016). This again is evidence of political persuasion or corruption similar to what we noticed in case of Tamil Nadu state above and this is not benefit voting. "I never won because I never gave money to voters" (Segawa, 2016). Ironically this statement explains how voters are trying to obtain or get something for their votes and this evidence also explains the efficiency of law implementing agencies.

In other words, only if strict laws that are in place in Uganda against any sort of electoral fraud had been implemented stringently then the people would not have demanded something from the candidate, this clearly shows there is failure in implementation of the law and this clearly anchors the expansion of benefit voting. "Ugandans always demand money when they see political candidates" (Segawa, 2016). This is perfect example of benefit voting and how this evil system is thriving.

Benefit voting is a function of many complex set of variables both economic and social among other. In other words benefit voting is a materialistic voting behavior emerged due to wide range of socio-economic and regulatory factors which remains the same for most of the countries and relevant to many regions specifically around the world. "Voting behavior can be attributed to several well-known factors such as socio-economic status, gender, ethnic group, religion, and psychological factors" (Ching-Yuan Lin, 2007). As in general, voting behavior can be attributed to many factors, similarly benefit voting rests on series of identical factors. Benefit voting is a sort of behavior where people *naturally* expect something for every vote. This is due to confluence of multiple factors has created a situation where it is considered normal. More clearly benefit voting has become an acceptable norm in general, where people tend to accept open vote-buying activities clearly violating the law and indirectly engage themselves in supporting such activities.

At first, 3 key reasons will explain the extent of vulnerability and its impact. These 3 key factors that inarguably lead to benefit voting are,

1. *Hard core poverty*
2. *Illiteracy*
3. *Regulatory weakness*

Casting vote for certain material gain or more precisely selling vote for certain monetary or material benefit without consciously assessing the impact, its importance and its consequences for such action, has evidently created a vicious phenomenon that is prevalent in many countries. Combination of poverty and illiteracy creates a grave impact on voting decisions especially when regulatory environment is weak and process of reform is slow.

In other words, Poverty and illiteracy is a disastrous combination that gradually isolates the society from being aware and act on their decisions, this naturally leads a situation where the possibility of delivering someone else's interest will be high and furthermore it promotes wide spread vote-buying activities. . "Extreme poverty is defined as those whose standard of living is insufficient to meet their basic nutritional requirements even if they devoted their entire consumption budget to food." (Survey G. L., 2014). As this research is fundamentally designed to uncovers how poorest of the poor vote and how parties try to influence their entire electorate, it is worth noting what exactly "extreme poverty" is and how does it affects the political behavior. Primarily it is the lack of considerable knowledge in judging and identifying the methods of assessment for judgment for voting that leads to weak or undesired outcomes in the country.

This stems from the fact that hard core poor people usually lack elementary facilities and access to source of information. "The poor will continue to trade their loyalty for bags of rice and odorless fufu, until egalitarian policies are implemented by the government. The onus is on the poor to use their conscience and not vote for tentative bag of rice, because poverty is not getting off the land anytime soon under this hegemonic party in Nigeria". (Obafemi, 2014).

For example, in 2013 in Cebu province Philippines, vote buying incidence were reported. Cebu being economically progressive cities in the country but poverty also goes hand in gloves there. "In Cebu city alone, 9,232 families are living under poverty out of 34,149." (Lorenciana, 2014). Incidence of vote buying in Cebu province represents the case of political persuasion to sell votes as we noted above in case of Tamil Nadu. And similarly the above Nigerian evidence represents case of vote-selling rather than benefit voting because here people subject to hardcore poverty and lack of knowledge are "trading their rights "and not because we can get it easily as in case of taxi ride and Ugandan example above.

Coming back to the topic, people with abject poverty are literally out of the realm of access to information and sources of information and knowledge that could have made them aware about the importance and practice of voting and how it has to be carried out. "Survey evidence also suggests that vote buying is more widespread amongst poor and uneducated voters" (Toke S. Aidt, 2015). Hard core poverty is situation where life every day is struggle. Struggle for nutritious food, for affordable medicine, struggle for health, for basic amenities like, clean drinking water, (in some places), and struggle for safe shelter. Hard core poverty is such a disastrous situation where gradually people tend to isolate themselves from main stream educated and financially sound communities owing to nature of their occupation or standard of living.

"Vijay"<sup>3</sup>, a rag picker in the Govindpuri area of south Delhi, explains how the system of bribing voters works. During the Delhi Assembly polls, each house in our jhuggi was offered 1,000" (Vishnu, 2014) . This validates the fact that parties tend to target those people who are socio-economically weak and live in separate communities with poor housing and living conditions, to vote in their favor and this highlights the fact that poverty and illiteracy are the 2 primary reasons why people sell their votes and going beyond poverty and illiteracy it reveals how weak are the enforcement agencies are in the country.

As in this case cash was distributed to buy votes, it means that parties tend to target low income people engaged in unorganized sector and comparatively in case of "free taxi ride" as we have noted above people expect some sort of unusual or totally unrelated "benefit" from their vote/s. these two evidence clearly distinguishes vote-selling and benefit voting. . "The non-manual occupations provide greater intellectual stimulations than the manual occupations, giving therefore greater access to information about registration and voting process and about voting issues" (Venezky, 1994) It means that there is a direct and strong correlation between occupations and creation of separate communities or localities slightly far away from city centers and affluent residential localities and ability stay well informed especially about practice and importance of voting.

From the other eye, till now it's been found that vote-buying tactics are in full swing just because the organizations and departments overlooking elections and entire operative mechanism in these countries are weak or ineffective in curbing or even controlling this phenomenon.

And secondly illiteracy alone also plays a central role in vote-selling activities. But in this section, brief analysis of impact of illiteracy on voting decisions is explained and in the 3 chapter detailed analysis of impact of illiteracy on voting decision are considered at length. "Illiterates are also more likely to be persuaded to sell their votes, or tricked or intimidated into voting for crooks and thugs". (Magazine E. , Illiterate Voters, Making thier Mark, 2014). Being poor imply being less aware [with regards to importance of voting and voting decisions] and being illiterate implies lesser opportunities to stay well aware, and thus being less-aware exponentially expands the possibility of easily being carried away with someone else's interest, as we have seen above.

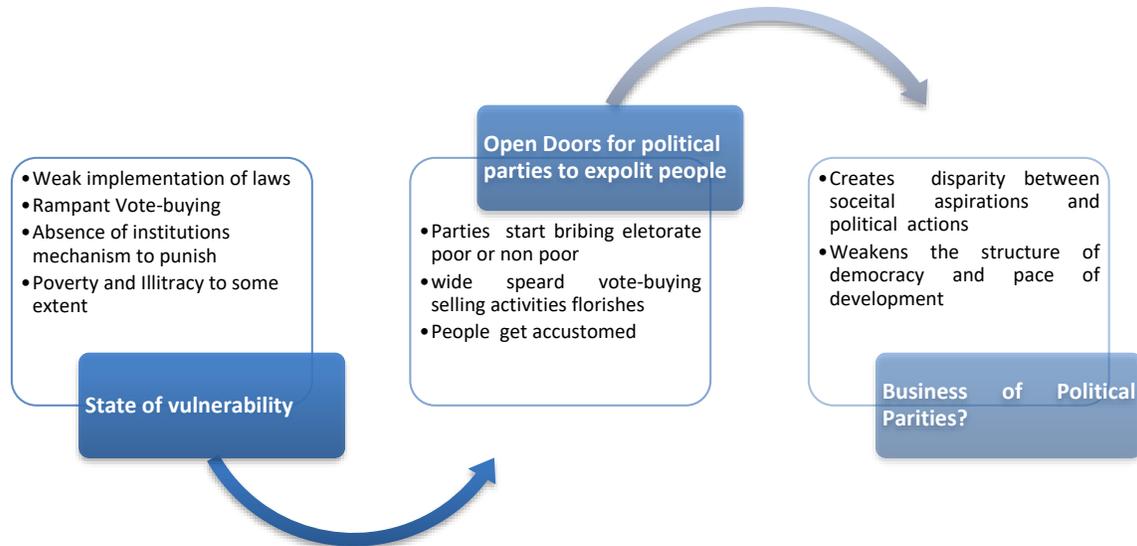
"Illiterate citizens inevitably lack in awareness and reasoning skills. How can we expect a voter to make an informed decision when he/she is unable to even read a newspaper? Illiterate voters are easily misled." (Ghosh, 2013). But destitution coupled with illiteracy makes it impossible for these people to engage themselves in news reading or watching. "Analyses of media coverage of campaigns have found newspapers to present the greater range and in- depth issues, to have partisan bias, and to require readers to engage themselves more actively and more creatively" (Venezky, 1994). Furthermore watching news requires television but as these people are struggling to find a proper shelter or nutritional food for their families who labor usually in fields, factories or sometimes in mines or sometimes in brick making centers find it increasingly unaffordable. People who are poor, lack access to education and thereby lack opportunities to enhance

<sup>3</sup> Not the real name

their understating and thirdly people with combination of narrowed economic opportunities and broadened poverty naturally loses desire to understand the whole cycle that invariably puts them under precarious situation where they act on some else's interest.

Coming back to benefit voting phenomenon revolves around three important events and circumstances.

Figure 2:



“Selling your votes makes for bad governance, encourages corruption and is very likely to keep some of best potential candidates from running for office” (Cheeseman, 2015). Disparity between societal aspirations and political actions will be widened because party who won the elections based on vote-buying and will be less concerned and more negligible and delivers something which does fit into the aspirations of the people.

All these circumstances create opportunities for political parties that eventually lead to a phenomenon where the democratic values and code of functioning gets badly affected, leading to disastrous consequences. Political parties seems to have commercialized the whole system of electoral process and democracy where they intentionally target vulnerable people to vote in their favor, but due to lack of statistical matrices we cannot conclude that only the vulnerable people sell their votes, and since we have seen examples where people intentionally expect something in return of their than in this case it would be totally incorrect to say that only poor and illiterate people sell their votes.

Benefit voting is essentially a kind of general behavior where expect something material gain or something and readily agree to sell their votes due certain shortcoming in implementation of laws, due certain socio-economic factors as discussed, and these days benefit voting has become more common than vote-selling. The degree of vulnerability (in terms of regulatory and implementation mechanism) decides the game in democratic set-up. “I think candidates give out money not because they particularly think it’s a great way of winning an election, but because voters demand it” (Cheeseman, 2015) . The view that mostly poor and illiterate people to sell is parochial to some extent because evidence suggests many people out of the circle of poverty and illiteracy tend to sell vote, as we have seen above.

Furthermore, I observed a strange phenomenon during by polls in Gulbarga (My native place) district India, contrary to the

general belief that poverty and lack of knowledge makes people to sell their votes. I noticed that people (few people) voted to those parties who offered “free pick and drop” facility to the polling station who were educated and financially sound. And furthermore even the hard core poor and illiterate section of society generally followed the same practice. But not all people had the same attitude and lot of people casted their votes without any “benefit”. This evidence strongly suggests that there exists a considerable difference between vote-selling and benefit voting. . And the biggest shortcoming of this research is that it does cannot classify vote-selling groups or people based on certain economic or socio-economic parameter as no reliable statistical data is available today.

From analytical standpoint, examination of this nexus and its after effects might lead us to point where one would ask, who are responsible for all these? Parties? Vulnerable society? If vulnerable society has been alleged with unethical behavior than what about political parties? If only they had introduced wide range of electoral reforms while in power, then the question of vote-selling and buying hadn’t been shaped at all.

All democratic countries have prohibitive laws, but the feeble implementing mechanism has greatly favored the parties. According to Institute for Democratic Electoral Assistance, in “South-Asia more precisely in countries like Srilanka, India, Maldives, Iran, Nepal, Bhutan, Bangladesh and Pakistan vote-buying is completely ban.” (Assitance, 2015). On the contrary, we have witnessed wide-spread vote-buying activities in India & Pakistan, this highlights the fact even though stringent laws are in practice but implementation is absent. This is the third most critical factor that boosts electoral fraud and misrepresentation and most importantly benefit voting as noted above.

For example, “it is a punishable with imprisonment” (Assistance, 2015) in Chile and similarly in Ecuador “it is prohibited for candidates to provide any type of donation or gift to citizens” (Assistance, 2015). In India bribery of any gift, or promise by the candidate and many other forms and activities are deemed to be corrupt. (Assistance, 2015). Contrary to this, we observed gross negligence of laws set in place by political parties and voters at large, and ironically at social level, it is widely acceptable in general. Selling vote on account of hardcore poverty or occupation or illiteracy is something different and trading votes for some immediate gains or benefit even though they are non-poor and literate is something disastrous. Because we found that voters attitudes owing to weaker implementation of stricter laws (that are in place in many countries) created a situation where people especially voters have started demanding or asking something in return of a vote irrespective of their financial or literary conditions.

This proves the fact that there is huge difference between vote-selling and benefit voting, which something related to social behavior, attitudes, effect of weaker law implementation mechanism. Socio-regulatory analysis is a kind of novel analysis where effect of regulation or laws on the society are studied and when applied to study voting behavior and attitudes where vote-buying exists we found that it gradually leads to benefit voting .

This chapter saliently also highlighted the fact that even after wide spread out cry in the media and academic circles, there is hardly in change in implementation mechanism in most of the countries and vote-buying is active. This interplay of set of unethical activities and vulnerable society (and partly due benefit voters) definitely impacts the process of democracy where eligible citizens supposed to be at the heart of government formation based on their free will, but we observed that greedy politicians, with blurred vision, and dishonest practices coupled with unethical social attitude of the electorate filled the environment with unjustifiable practices only desire to cling to power, has transformed the entire society into puppets of political fancies and hidden their agendas.

In this chapter both vote-selling and benefit voting were studied in a mixed up style based on strong evidence for both and it was found that benefit voting is chiefly prevalent on account of ineffective regulatory mechanism and whereas vote-selling is because of socio-economic weakness. And furthermore this chapter showed us how gradually it turned into more common. Benefit voting is evolving phenomenon where even the non-poor and literate would expect something for their vote but whereas vote-selling occurs due lack of knowledge, resources for building knowledge and other factors as discussed above.

### **Someone Else's Interest**

*Generally it is the socio-economic factors that create a vacuum of abstract among a particular class of society that leads to confusion and exploitation at the hands of political parties. The world over especially in countries where large income disparities exist and socio-economics gaps are wider in terms of occupation, earning, literacy levels, access to information; political parties rely on unethical ways to get on to the power.*

*The nexus between power and competition between political parties in light of democracy is unjust and heinous, that directly*

*undermines that capacity, value and purpose of democracy leading to some disturbing questions like is democracy just a mechanism to govern the society by political parties? Or is it political parties deceive people in the name of democracy for their hidden interest?*

*Nevertheless, the delivery of preference under persuasion of political parties doesn't reflect the true will of the people and leads to large disparities between what people want and what the state does. Many elections take place in Latin America and Africa but under the shadow of crime, riots, atrocities, rigging, reluctance to accept the electoral outcomes that has always results in social chaos, economic inequality, political destabilization, backwardness, stagnant economics, leading to increased improvidence, illiteracy, poverty, unemployment, civil wars, mass crime, assassinations and bribery.*

*If relationship between the state and society is based on fundamentals of equality, transparency, security and overall development, then proposition of disparities between society's aspirations and government's intentions and actions wouldn't had taken place.*

But it does not mean that the entire set of less-privileged more destitute people sell their votes more often. On the contrary to what we have seen above, many economically well-off people are found to be involved in benefit voting activities in many countries but due to lack of statistical data in every country we cannot classify them based on the standard of living, income or literacy levels.

Furthermore it does not mean that people from all economic backgrounds sell their votes, perhaps moving beyond the realm of economics and law, philosophical analysis present some of the contradictory testimonials for the practice of benefit voting. The terminology of judgment refers to the actual capacity based on available resources, opportunities and understanding of poor and illiterate people. Values and judgment for action if shaped by ethics, then decision will be rational and unbiased to some extent. This aspect of voting will be discussed in the next chapter.

Strength of moral, virtue and philosophical inclinations prohibit people from selling their vote for something. Here it is the question about economic opportunities and social engagement. It is very hard to define whether it is a process or outcome, outcomes are contradictory.

## VI. VALUE VOTING

In the earlier chapter we analyzed reasons for vote-selling (from socio-economic standpoint) and reasons for benefit voting, but it would be completely inaccurate to say that all poor and illiterate people sell their votes, because evidence suggests that people will refrain from vote-selling and this chapter briefly elaborates those reasons.

Value voting is a moral practice equally contrary to practice of benefit voting; entirely based on morality and values. Morality is considered to be the guiding principle for people's choice and action, a divine attribute distinguishing right and wrong. “Moral values are the standards of good and evil, which govern an individual's behavior and choices. Individual's morals may derive

from society and government, religion, or self” (Philosophy, 2015). The very nature of this concept is gravely challenging to the practice of benefit voting discussed above. This is because in the earlier chapter the key aggregator for people to vote of a particular party was any benefit in return, but here key factor that drives people to vote are moral values, that will stop them from engaging in vote-selling and buying activities. Epistemologically, value voting rests upon conscience. Here it represents the core assumption of this concept or practice. Value voting or moral voting is essentially a type of natural voting, or voting based on free understanding and will, (As voting is supposed to be) and it is in complete contradiction of benefit voting because value voting is free from any external influence and influencers. In other words, value voting is backed moral values, forbidding any compromise in reluctance. The core pillars of value voting are:

1. *Free of any influence.*
2. *Nothing is expected in return of a vote, and*
3. *No vote is casted for any apparent or hidden, direct or indirect material gain.*

These three key pillars of value voting rests upon basic principles of morality, i.e.: honesty, fairness and no cheating. More precisely value voting is essentially a practice of delivering preference freely. Societies the world over have been greatly influenced by philosophy or religion and that remains the fundamental aspect for their motivation towards right or wrong. In other words for centuries religion and philosophy had impregnable impact on human thinking and actions. From theological perceptive the validity of good and evil; is governed by divine laws derived from books of wisdom which remains one of the greatest source and even today it plays a pivotal role in shaping human thinking.

Value voting profoundly asserts that voters will refrain themselves from engaging into vote-selling activities backed by strong moral. In other words, value voting stress the point that not all people will be ready barter their votes for material gain, and in many occasions, around the world voters out rightly renounced their will to exercise franchise under “someone else interest”.

“Malawian voters are beginning to value their vote more than handouts” (Dulani, 2014) “In a recent study; over 70 percent of Latin America respondents [opposed vote buying](#). Further, these questionable electoral practices in Mexico seem to operate contrary to official commitments to transparency and accountability on the part of the national government”. (Matteson, 2015). “Similarly, in a 2011 Afrobarometer survey conducted in [Uganda](#), 76 percent of voters said they would accept money from election candidates but still vote for a candidate of their choice” (Dulani, 2014). “Anti-vote buying” campaigns in both Thailand and the Philippines, for example, have been carried out largely by middle class reformers who seek to “educate” the poor” (Schaffer, What is Vote Buying?, 2002)

The basic assumption is; even though abject poverty and complete illiteracy coupled with weaker regulatory mechanism may prevail but it is not necessary that people may not be guided by moral values and ethical sentiments that prevent people from selling their votes. “Some were honest enough to tell me that I had ideas for constituency, but they were voting for someone giving them something that I wasn’t” (Segawa, 2016). In other words, the lack of sources that help build awareness and strength to form

an idea (towards a political party for voting) and the liberty of expressing that choice in terms of vote, does not push people to merely selling their votes for material gain as we seen above. Morality is believed to be naturally embedded in human nature and to any extent it’s not based on education or luxuries living. Morality sometimes acts as barrier for vote-selling. But advocates of moral relativism claim that positions of right and wrong are culturally dependent (among others) and differ in different cultures. “Different Societies have different moral codes” (Rachels, 2003). It is true that certain practice by certain section of society at a certain place might be considered moral but ironically the same it might be viewed as evil in certain different part of the world.

But philosophy of universal morality sets out that all people have similar moral obligations irrespective of race, culture, faith or social code. Ironically, moral universalism turns out to be largely effective because the process, purpose of voting, purpose of government, voting rights, system of establishing government and many other parameters remains the same in all places, so the relationship between morality with vote-selling is basically very close to the integrity and purpose of democratic system, where people are allowed to choose their government to serve in their best interest, then voting under persuasion of political parties.

The relationship between morality and vote-selling especially for any monetary or material gain is simple; vote-selling broadly involves 3 key things

1. *Suppression of own free idea,*
2. *Getting super imposed by someone’s idea and*
3. *Selfishness*

Vote-selling is one of the most selfish acts on part of the voters because in this case voter is just concerned about deriving any material gain out of his action, and not literally concerned about the moral consequences if his choice goes wrong. Technically, in the first instance, where own free idea got suppressed under someone’s influence for material gain; morality vanishes, because the action of vote-selling for gain in return is cheating and lack fairness and thus is immoral. Fairness would call for voting based on personal judgment and not based on someone’s assertion to vote.

From philosophical perspective, the moment an individual agrees of set aside his own idea and adopts “someone else’s” preposition, (just in case of voting) then individual has lost moral ground since he acting under the guidance of selfishness, rather than fairness. There has been universal condemnation against selfishness and deceit, irrespective of culture and tradition, and more importantly when viewed in conjunction with impact of selfishness on democratic system as whole, it is more disastrous. Because individual’s selfishness creates opportunity for political parties to entice poor and illiterate people to vote in their favor and this will ultimately leads to a system where parties can rule illegitimately.

Analysis of impact of such a sordid system reveals that wicked politicians and greedy political parties make an adverse effect on weaker section of our society and human freedom. “Political and social participation has intrinsic value for human life and well-being” (Sen, 1999). But rampant vote buying activities results in congested environment for social and political participation which in turn lowers value for human life and well-being.

The intrinsic values of democracy and democratic system will reduced to “corruptocracy”, a system where political parties pursued, influence, suppress, pressurize people to sell their votes most of the time through money and sometimes by muscle power. It’s a major jolt to fundamentals of democracy. Coming back to value voting, it is always true that people no matter their living conditions tend to have at least some degree of moral values that forbids them from illicit activities to certain extent. Contrarily, the most vulnerable section of the society consistently turns out to be the victims of vote mobilization techniques and this chapter clearly demonstrates the difference between vote-sellers and non-sellers along with in-depth and broad reasoning for both, which helped us in understanding prevalence of both the phenomena. In other words, the purpose of this chapter was to highlight the fact that not all voters sell their votes and to distinctively elaborate the reasoning for not selling their votes. On account of lack statistical evidence across the countries the examination and analysis (to clearly distinguish between benefit voters and value voters) has been carried out on philosophical grounding to provide broader critical analysis between the two and its reasoning and impact.

Value voting also highlights the underlying fact that people themselves have raised their voice against vote-buying activities by expressing their reluctance towards it, and on the hand it also proves that in many countries so far no concrete measures initiated to curb vote-buying. These two important facts were recognized only because of the problem was studied under philosophical background. This sort of analysis established the strong foundations to understand the reasoning behind as to why people sell their votes and why not. (Among other reasons) Value voting proves that social and moral values no matter in what society as so strong and vibrant that, it literally encouraged people to refrain from vote-selling and protest against vote-buying activities that would gradually strengthen the process of democracy and fairness in representation.

“In Abitibit village in eastern Uganda, one participant commented “we lack so public services, we don’t want to receive their 1000 shillings. Whoever wants to help us should come and put up a classroom block instead” (Institute, 2016). Realistically, it’s been also found that, it is not just values or theosophical inspiration or moral values that hinder voters from selling their vote, as in case of Uganda. People have recognized the failure of party of keep up their promises, they are able to assess their socio-economic conditions and correlate with promises made by parties during elections. Secondly many international organizations are organizing village level or town level workshops in many countries like recently in Uganda by an international organization to educate the electorate about their rights and impact of selling vote. To some extent it had been greatly successful especially in Uganda. On the other hand candidates of many different political parties (for example in Uganda and Philippines) have openly urged voters to not sell their votes and this approach is effective to some extent.

## VII. BLIND VOTING

Blind voting is kind of voting where voters prefer candidates based on their own set of criteria for judgment then rather than performance, achievements, ideology and expertise of a party. The central purpose this chapter is to explain how poorest of the poor

and illiterate section of our society forms their decisions to vote and what exactly they deliver. In other words this chapter specifically focuses on particular section of our society and explains how this section forms their judgment and consequentially answers the key question that remains at the heart of discussion and debate in politics and democracy, i.e. Why caste, color, creed, clan based voting still exist.

But conclusions drawn in this chapter are not just limited to poor and illiterate voters, since evidence suggests that even the non-poor and educated voters has similar attitudes. In this chapter we first briefly evaluate the impact of illiteracy on voting decisions and then in 2<sup>nd</sup> section we will focus on impact of poverty. Illiteracy can simply be defined as inability to read and write. Complete illiteracy can be defined as no ability to read or write any language. Illiteracy exists in varying forms and degrees in different places in the world.

“Complete illiteracy means a person cannot read or write at all. Of equal relevance is the concept of functional illiteracy, which means an individual may have basic reading, writing and numerical skills but cannot apply them to accomplish

tasks that are necessary to make informed choices and participate fully in everyday life. Poor literacy also limits a person’s ability to engage in activities that require either critical thinking or a solid base of literacy and numeracy skills. Such activities may include:

1. *Understanding government policies and voting in elections*
2. *Calculating the cost and potential return of a financial investment*
3. *Using a computer to do banking or interact with government agencies”* (Foundation W. L., 2015)

Three different forms of illiteracy has been defined above, of all the three, poor literacy phenomenon is most critical to this chapter. Since as per definition, poor literacy limits the ability of person to understand government policies and voting in elections. In other words, Illiteracy naturally lowers (as we have seen earlier) the degree of awareness required to understand and chose a candidate to vote, because it generally creates a situation where it acts as barrier to evaluate and understand the situation, schemes and policies offered by different parties during elections and its impact.

Put simply poor illiteracy tend to limit learning opportunities for people because they became isolated from print, digital, social media except the television, and if those families are poor then the chances of having a television will also be bleak, in that case opportunities for leaning and staying well aware about national or even local politics and situation will be diminished.

“Greater education might lead to greater awareness of one’s own responsibilities as a citizen, or it might like the informal education gained from non-manual occupations, provide increased ability to handle the mechanics of registering and voting”. (Venezky, 1994). The relationship between education and literacy is strong and positive certainly because education helps people to study, understand, participate, analyze, gather information, and chose the best the candidate but ironically; poor illiteracy lessens these opportunities and leads people to something different. “Illiteracy plays into the hands of corrupt politicians who try to win votes on the basis of religious, tribal or ethnic affiliations, rather than on their contributions to the nation”. (Ghosh, 2013).

On the contrary, widespread illiteracy creates a situation where people start relying on “other” factors or prepositions for choosing their candidate during elections. This deviation results In a situation where voters might consider number of different totally irrelevant factors that does not hold any connection with party or its action plan as basis for expressing their will (vote).

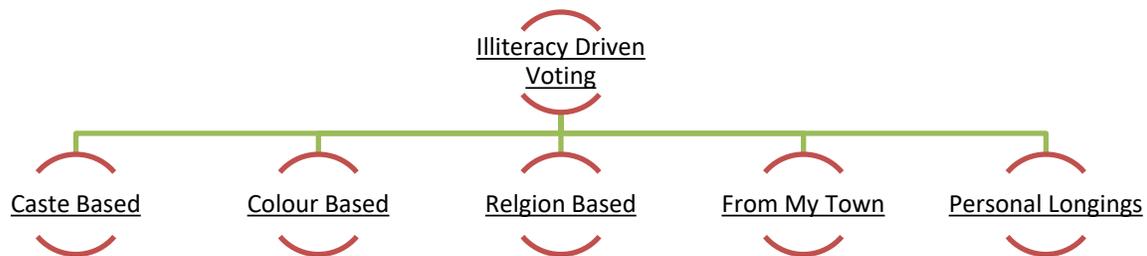
“It seems that present-day elections are no longer about the candidate or proposition with the most appealing content, but rather the candidate or proposition with the best-edited commercial, the brightest colors or the most memorable slogan. In essence, ignorance and superficiality have taken a stronghold on our voting system. People, more than ever before, are voting without knowing what they're voting for”. (Mohr, 2008) So now the question arises what factors generally go into their reckoning for vote? Observation suggests that wide range of socio-cultural,

factors like caste, creed, and color are considered. For example in India, caste based voting is largely prevalent in many of the states. This stems from the fact that illiteracy seriously blocks avenues to learn and understand where they gradually get isolated from general public and relies on their self-created philosophies to vote, which are totally out of the realm of voting philosophy. Three factors might be the biggest factors that led people to form their judgment on something not relevant to current state of their country or region

1. *Lack of ability to read and write*
2. *Partial isolation from literate community*
3. *Lack of awareness about parties and their candidates*

Different forms of illiteracy driven voting is being described in the chart below, based on findings, and observation.

Figure 3:



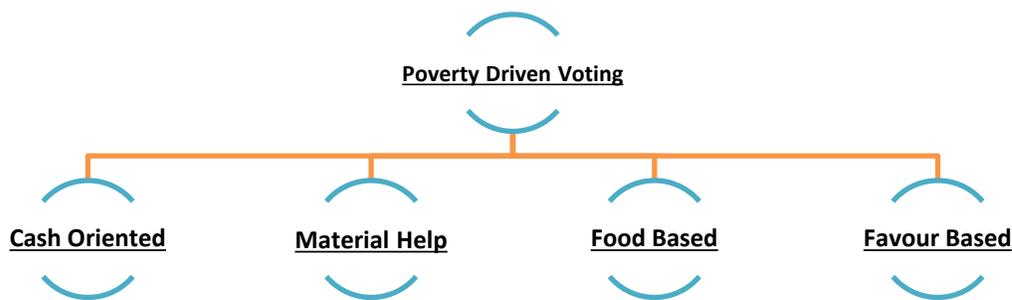
The most common type of voting especially found in India is caste based voting, where people prefer to vote of a candidate who belongs to their caste. “The Caste based factor has without doubt defined the performance of the parties in the past elections”. (Narain, 2014). This remains of the most crucial aspect in India democracy. And second most common type of voting is religion based voting where people tend to support and vote for a candidate who belongs to their religion. “A Pew Forum Analysis of nearly final exit poll data released on Wednesday found that Obama won among Catholics, Jews, and non-whites across religious traditions, but saw a dip in his support among white evangelicals, a white Catholics, among other.” (Kaleem, 2012). But it should be noted that as mentioned above, illiteracy “may” not be the only factor for these diverse forms of voting and varied attitudes; many other

factors might be responsible, examination of which is literally beyond the scope of this paper. But theoretically it’s been found that the consequences of poor of complete illiteracy may sometimes lead to these forms of voting.

Furthermore, “From my town” is type of voting where people unreasonably prefer voting a candidate who belongs to their home-town, or native place. This naturally shrinks the opportunity for another candidate from a different province to stand for elections. Personal longings is having a deep culture orientation where set of people tend to vote to candidate with whom they had old family ties, or someone in their family had good personal ties or close relationship.

Now let focus on how hard core poverty may influence the voting decision.

Figure 4:



Perhaps hard core poverty does have a strong impact on how voters make their decisions, these include cash oriented, material help, food based and favor based. “Last year in West Memphis

Ark. a statehouse candidate used \$2 half pints of vodka” (Fahrenthold, 2012).

The above is example of cash oriented vote-selling mainly driven by poverty, secondly material help based vote-selling means selling vote for “mixer and grinder” or saree. Parties in India raised allegations of distribution of saree and other dress materials by other party ahead of state assembly polls. (Oneindia, 2015) Thirdly, food based vote-selling is a type of vote-selling where person agrees to sell vote for lunch or dinner or some other eatables and finally favor based vote selling is a type of trade where candidates promises a person to do something good for him,(promises of government job or allocate of house in government housing colony ) though this is mainly a kind of benefit voting.

This chapter elaborated social attitudes towards voting under certain socio-economic conditions, just to showcase a glimpse of how voting as such is exercised. Primary aim of this chapter was to go beyond benefit voting and vote-selling and focus on how hard core poverty and poor illiteracy impacts voter’s psychology. This helps us understand, how socio-economic characteristics of a region of county or district or entire state opens avenues to exploitation and misrepresentation by political parties or the ruling class and in the other hand this chapter deciphers how social attitudes transforms due to poverty and illiteracy and how disastrous it will be of our democracy.

## VIII. DISCUSSION AND FINDINGS

It’s been observed that electoral fraud stretches beyond voting, where vote selling or benefit voting are just the beginning of entire process. Many democratic countries around the world suffer from cruelties of wicked politics. To some extent regulatory vacuum is greatly responsible and to large extent and on top of it absence of strategic reform process is adding fuel to fire. It also been observed that political parties have created an environment where political power and electoral mandate seem to have overtaken the values and purpose of democracy. “Nigeria is in the league of less successful countries in the area of election management and outcomes: the electoral rules are either unclear, ever changing, or easily subverted; the electoral body is structurally weak and perennially ineffective; the political actors and agencies are like gladiators in their conduct; while the people are often powerless in an environment of political and electoral misdemeanor”. (Agbaje, 2006). As discussed above, it’s the culmination of weak regulatory structure, irresponsible politicians, greedy political parties and irrational voters that have created conducive atmosphere where electoral fraud, misrepresentation, corruption and selfishness have become a central part of establishment of government.

From micro stand point, disobedient citizens ( towards the law of the land) and greedy candidates have started taking advantage of certain continuing loopholes in regulatory structure at the macro level and nourished a culture of where illicit practices have become a socially acceptable and politically beneficial. In case of Tamil Nadu, as we observed that political parties try to lure voters to vote in their favor by distributing certain very short-term goods like rice cooker or saree which clearly demonstrates that parties target people with simpler and cheaper needs which can be fulfilled easily so that they can vote in their favor easily.

Similarly as in case of Delhi, rag picker provides sufficient evidence that political parties work through a coveted mechanism where they target people with limited accessibility to knowledge and smaller needs. *Jhuggi* literally in English means *Slum* and parties during assembly elections offered INR 1000 Rs (15 USD Exchange rate observed on April/17/2016) to vote in their favor

The above 2 cases gives us insights into the strategy followed by the political parties and how well they are exploiting it, but the evidence suggests the other way around. In the above case, poverty and lack of resources to understand the process and meaning voting has become a bed rock voting corruption. “In the context of a weak electoral body, a perverted electoral process and undemocratic political parties, the stage is set for flawed elections”. (Agbaje, 2006).

Similarly in Uganda we noted a candidate’s confession that she never won because she never offered anything to voters to vote in her favor. This sort of social attitude and social acceptance will certainly destroy the integrity and fairness associated with the democratic system and will eventually lead to a situation where standing for elections becomes a profession for the affluent which will completely overshadow the purpose of elections and effectiveness in governance.

On the other hand if we look at strong evidence from India, related to “taxi ride” and “free trip to temple”, it generally explains how strong the interaction is between weak regulatory and social attitudes, totally different from what we observed in the above 2 cases where we identified strategies employed the parties. These both set of verifiable evidence is strong enough to consider these case at macro level, because majority of the underlying facts about these practices are taken from the media and they have presented this a more broader and social level, so it ultimately proves something that went unnoticed so far before this research.

Coming back to the topic, further more we also found that sometimes even abject poverty and lack of information will not act as hindrance that will stop people from selling votes. Social values in some have emerged for more superior in shaping the conscience and social actions. On the other hand we also observed that many international organizations are working tirelessly in creating awareness by educating them distance themselves from voting selling activities. This proves that it is a two-way mechanism where realization at social level has emerged and thereby association has been formed between social attitudes and vision of many international organizations which in fact resulted in defiance of vote buying and selling activities in some parts of the world.

Similarly we also observed different patterns of voting and voting behavior based on personal, cultural, social aspects which seems to be slightly surprising. This proved that voting behavior in many countries to some extent is largely influenced by many non-economic and non-political factors that certainly go unnoticed. But its seems rather rigid to straight away make any negative conclusions of its impact of process of establishing government since its requires rigorous and lengthy research to find accurate and strong correlation but based on preliminary evidence presented in the third chapter it can be said that voting involves preference of personal and cultural biasness coupled with social attachments towards candidates, parties, race, color, food and many other factors.

Finally it's been found that the practice of voting in most of the countries observed is different from conventional beliefs. Many factors play a central role in the process of voting and decision making and it does create long-lasting, severe impact of quality of governance, integrity of democracy, future of billions of people, resource utilization, foreign relations and many other variables.

## IX. CONCLUSION

Battle between political supremacy and fairness or fair voting will always be there, until political parties refrain themselves as honest servants of the nation willing to serve, based on true and fair reflection of society's will. It is the ideological error that most of the parties around the world suffer from; which gradually drifts them away from electoral ethics and democratic fairness. This creates a situation of discontented citizens, weak governance, disparity between political will and social aspirations; leading to mass protests, social unrest, violence, rebellion and chaos. It's a transition to disaster.

Many poor countries (only democratic) around the world suffer from increasing socio-political disparity and the root cause lies in electoral fraud and social attitudes. Impact of electoral fraud will not be limited to a particular constituency or district, province or state but it gradually culminates into a global mayhem. On the other hand, we must not forget that social attitude towards governance and electoral system also needs to be realigned and readjusted in line with the principles of democratic system, or otherwise a tradition of rights trading will flourish and democratic values will be sidelined. Weak democratic system will weaken governance and administrative system and gradually this will reflect in decisions and policies executed by the government.

Weak regulatory environment, vote-buying, hard core poverty and illiteracy nourishes illicit activities (to some extent) and establishes a government which may not function as per the social aspirations and this leads to disaster and effects lives of millions of people around the world.

It's really saddening to note the elimination of electoral fraud and strengthening of democratic process is not a part of Sustainable Development Goals (SDG's) recently released by the United Nations because I think without electoral fairness and democratic justice it is to some extent not possible to align national vision with these goals and may result to another extension of these goals in future, so to fill that presumed void and achieve goal together its critical to include elimination of electoral fraud into SDG's. This is because recent experience with respect to Millennium Development Goals strongly suggests that global partnership was hugely successful and the entire apparatus proved to be very effective as a system, perhaps more specifically with regards to extreme poverty and universal primary education goals where almost half of the goals were met. More precisely in case of sustainable environmental goals, almost 50% of the targets were achieved comparatively. For example, 4.2 billion people gained access to piped water till 2015 compared to just 2.3 people in 1990 (Nations, 2015).

Global problem demands a global solution, and I think that we can tackle these issues very effectively with the help of system of current global governance. Because it create a global system of accountability and transparency where national governments will

be monitored on the basis of their action against these evil practices which promotes transparency and responsibility.

## Four-Point Solution

1. Create a global database based in surveys related to electoral fraud, intensity, and frequency
2. Include this goal as a part of SDG's.
3. Create a global system or reporting on progress and challenges
4. More coordination between local government and international organizations

One of the biggest shortcoming for this research is it lacks statistical data, this is partly due the fact that there's no such global database on electoral fraud, frequency and magnitude of voting trading, tactics of political parties, action by national governments among other, so creation of huge data base will help us monitor changes, keep track of events, develop insights and finally to initiate necessary action.

Furthermore, due to absence on reporting on electoral performance, conduct and practices, it's becoming increasingly difficult to understand the entire system from global perspective and monitor it. This way we can create a system of checks and balances and promote cooperation between national government and international organizations. Organizations like the World Bank among others can play a central role in bringing more transparency because these organizations based on their expertise can conduct surveys and maintain data and coordinate with governments in building effective solutions and rescue democracies from disasters.

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# Bayes Implementation in Decision Support Systems Student Satisfaction Evaluation of Services

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**Abstract-** Dehasen University (Unived) Bengkulu is one of the private universities that is committed to improving service quality standards and continuously strives to improve and dissect in meeting the expectations of its customers, namely students. Good service quality is a guarantee desired by every student in conducting lectures. Then it is necessary to build a decision support system with the application of Bayes calculations in evaluating University services to students, because qualified services will get the attention of the public. The results of this measurement can be used by university leaders to improve and improve services in fulfilling student rights so that the quality of unived education will be better and improved

**Index Terms-** Fuzzy Serqual, Service, Agricultural Extension )

## I. INTRODUCTION

Quality service is the main goal of every college, this is a guarantee of the quality desired by students. The level of student satisfaction becomes the benchmark of excellence of a college so that required criteria for service standards. In improving the quality of service requires measurement of services to students, because the quality of service will get the attention of the community [1].

Dehasen University (Unived) Bengkulu is one of the private universities that is committed to improving service quality standards and continuously strives to improve and dissect in meeting the expectations of its customers, namely students. In an effort to improve the quality of Dehasen University, various forms of human resources, facilities, facilities and infrastructure have been provided for students, lecturers and students provided by foundations and universities. This is done in addition to increasing the quality standard of education at Unived as well as to meet student expectations related to the services received and fulfillment of student rights.

In order to improve the performance of the university in carrying out its obligations to improve service quality, it is necessary to know the level of student satisfaction with university services. Therefore it is necessary to know how much the level of satisfaction felt by students, for the efforts made by the university in providing student satisfaction with services in fulfilling student rights, student satisfaction measurements are held, the results of these measurements can later be used by

university leaders to improve and improving services in fulfilling student rights so that the quality of unived education will be better and improved.

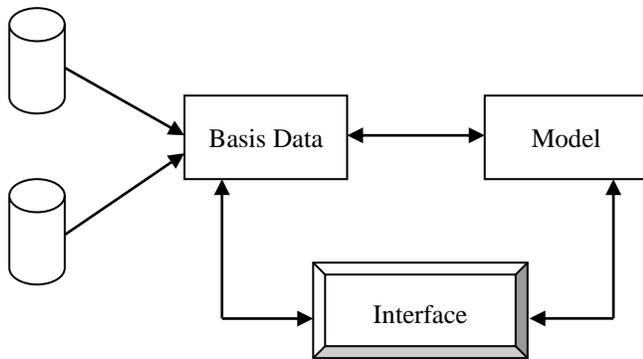
In order to improve the performance of the university in carrying out its obligations to improve service quality, it is necessary to know the level of student satisfaction with university services. Therefore it is necessary to know how much the level of satisfaction felt by students, for the efforts made by the university in providing student satisfaction with services in fulfilling student rights, student satisfaction measurements are held, the results of these measurements can later be used by university leaders to improve and improving services in fulfilling student rights so that the quality of unived education will be better and improved.

Decision support systems are an excellent method for evaluating student satisfaction with services. This research uses study Bayes for Decision Support System (SPK) evaluates student satisfaction with university services. Bayes Method is a classification method using probability and statistical methods based on the Bayes theorem [2]. The purpose of this study is to make a decision support system in evaluating students of the services provided by the university using the Bayes method. Evaluation of student satisfaction with university services include the following fields: Student Affairs, Library, Academic and Student Administration Bureau (BAAK), Facilities and infrastructure and finance available at Dehasen University Bengkulu. This study focused on the rare steps of building a decision support system with the application of Bayes calculations in service evaluation [3].

## II. LITERATURE REVIEW

### 2.1. Decision Support System

Decision Support System (SPK) is designed to support all stages of decision making ranging from identifying problems, selecting relevant data, determining the approach used in decision making percentages, to evaluating alternative choices [4]. Specifically SPK is a system that supports the work of a manager or group of managers in solving semistructural problems by providing information or proposals leading to certain decisions [5].



**Fig. 1. Decision Support System Components**

## 2.2. Service

According to [6] every action or activity that can be offered by one party to another party, which is basically intangible and does not result in any ownership. Service is the behavior of producers

## III. METHODOLOGI

Evaluation of students' satisfaction with services is not good or good, the evaluation must be based on service criteria determined by the university. The level of satisfaction is the value of the number of each criterion in each section of service. This value is obtained from each criterion divided by the total weight of each criterion. The stages in the Bayes method use the following equation [9] - [11]:

1. Calculate the Weight of Each Criteria

$$Bk = \sum_{i=1}^n (\sum_{j=1}^{oi} oi) \quad (1)$$

In equation 11,  $i$  is a statement to,  $n$  is a lot of statements,  $j$  is a choice to,  $oi$  is the number of choices for the statement  $i$  and  $Bk$  is the weight of each criterion.

2. Calculating the Total Weight Value

$$Btotal = \sum_{k=1}^l Bk \quad (2)$$

In equation 12,  $k$  is the criteria to,  $l$  is the number of criteria,  $Bk$  is the weight for each criterion,  $Btotal$  is the total of the weights. The next step is to find the probability value for each criterion with equation 3.

3. Calculating the Probability Value

$$Pk = \frac{Bk}{Btotal} \quad (3)$$

In equation 4,  $Bk$  is the weight of each criterion,  $Btotal$  is total weight,  $Pk$  is probability per criterion.

Evaluation of student satisfaction is said to be good based on the criteria that have been set if the resulting  $\geq$  score ambang threshold value of each criterion ( $Ak$ ) [12] [10]. The threshold value for each criterion obtained based on equation 4 is a value.

$$Ak = \frac{Bk}{2} \times Pk \quad (4)$$

Equation 5,  $Bk$  is the weight value for each criterion,  $Pk$  is the probability of each criterion. If a student satisfaction evaluation score is set both of each criterion is  $Yk$ , by using equation 5.

in order to meet the needs and desires of consumers for the achievement of satisfaction to consumers themselves.

## 2.3. Service Satisfaction

Satisfaction is the level of one's feelings after comparing the perceived performance compared with his expectations, so that the level of satisfaction is a function of differences between the perceived performance with the desired expectations. Satisfaction is an evaluation tool where the alternative chosen is at least the same or exceeds expectations, while dissatisfaction can arise if the expected results are not achieved [7].

## 2.4. The performance

Performance is an achievement achieved by employees in carrying out a job in an organization. Achievement means the achievement of work. It shows that performance is very closely related to productivity [8].

$$B = \begin{cases} Yk > Ak = B \\ Yk \leq Ak = TB \end{cases} \quad (5)$$

4. Calculates the overall threshold value

$$Atotal = A1 + A2 + A3 \dots An \quad (6)$$

Equation 7, the index of each criterion is  $1, 2, 3 \dots n$ . If  $Y$  is the total value of all criteria, University Services are said to be good (B) if the value is obtained  $>$  of the total threshold value ( $Atotal$ ), and declared not good (TB) if the value is obtained  $\leq$  from the total threshold value ( $Atotal$ ), as in equation 7.

$$Y = \begin{cases} Y > Atotal = B \\ Y \leq Atotal = TB \end{cases} \quad (7)$$

Based on the results of the evaluation of student satisfaction obtained if the service is said to be good (B), then it can be grouped again included in the criteria of very good or not. University services are said to be very good (SB) if the value produced  $>$  from the threshold value is good ( $Avery Good$ ) [11], can be calculated like equation 8 and equation 9.

$$SB = \begin{cases} Atotal < Y \leq Avery Good = B \\ Y \geq Avery Good = SB \end{cases} \quad (8)$$

$$(Avery Good) = (2 \times Atotal) \times \frac{3}{4} \quad (9)$$

To calculate the data collection value of each criterion in equation 10.

$$Xk = X1 + X2 + X3 \dots Xn \quad (10)$$

In equation 11,  $Xk$  is the result value for each criterion, and  $X1, X2, X3 \dots Xn$  is the answer to each statement of each criterion. The data collection value is generated based on equation 11.

$$Results = Xk + Pk \quad (11)$$

## IV. RESULTS

#### 4.1. Result

Recapitulation of student satisfaction levels for university services for the year academic 2019/2020 obtained from the sum of each respondent's score score divided by the number of respondents. The recapitulation results of each university service and the weight of the sum of each service can be seen in Table 1.

Table 1 Recapitulation Results of Student Satisfaction Level Against University Services

| No | University Services                    | Satisfacti on Level Recapitul ation | Number of Criteria Weights |
|----|--|-------------------------------------|----------------------------|
| 1  | Student Services                       | 17,61                               | 24                         |
| 2  | Library Services                       | 32,89                               | 44                         |
| 3  | BAAK services                          | 51,60                               | 68                         |
| 4  | Facilities and Infrastructure Services | 67,87                               | 92                         |
| 5  | Financial Services                     | 45,18                               | 60                         |

The next step is the application of the Bayes method. The implementation phase of the Bayes method starts with calculating the values for weighting per service, probability per service, threshold per service and setting threshold values for the level of student satisfaction with University services as follows.

1. Weight per criterion is obtained by equation 1, namely by adding up the values weight for each question contained in each service.

a. Weight per criteria for Student Services

$$Bk1 = 4 + 4 + 4 + 4 + 4 + 4 + 4 = 24$$

b. Weight per criteria for Library Services

$$Bk2 = 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 = 44$$

c. Weight per criteria for BAAK Services

$$Bk3 = 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 = 68$$

d. Weight per criterion for Infrastructure Services

$$Bk4 = 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 = 92$$

e. Weight per criteria for Financial Services

$$Bk5 = 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 = 60$$

2. Total Weight values are obtained based on equation 3, namely by adding overall weight value for each service.

$$BT = 24 + 44 + 68 + 92 + 60 = 288$$

3. Probability results for each criterion are obtained based on equation 3, viz by dividing the weight value of each service by the total weight.

a. Probability for Student Services

$$Pk1 = \frac{24}{288} = 0,083$$

b. Probability for Library Services

$$Pk2 = \frac{44}{288} = 0,153$$

c. Probability for BAAK Services

$$Pk3 = \frac{68}{288} = 0,236$$

d. Probability for Infrastructure Services

$$Pk4 = \frac{92}{288} = 0,319$$

e. Probability for Financial Services

$$Pk5 = \frac{60}{288} = 0,208$$

4. To get the Total Probability by adding each value probability of each service

$$Bk1 = 0,083 + 0,153 + 0,236 + 0,319 + 0,208 = 1$$

5. Threshold value for each service criterion is obtained according to equation 5, by dividing the value of the weight of each service then the results are multiplied by the value of propobality of each service.

a. Threshold for Student Services

$$Ak1 = \frac{24}{2} \times 0,083 = 1$$

b. Threshold for Library Services

$$Ak2 = \frac{44}{2} \times 0,153 = 3,361$$

c. Threshold for BAAK Services

$$Ak3 = \frac{68}{2} \times 0,236 = 8,028$$

d. Threshold for Facilities and Infrastructure Services

$$Ak4 = \frac{92}{2} \times 0,319 = 14,694$$

e. Threshold for Financial Services

$$Ak5 = \frac{60}{2} \times 0,208 = 6,250$$

6. The total Threshold results are obtained by equation 6, namely by adding the overall threshold for each university service.

$$AT = 1 + 3,361 + 8,028 + 14,694 + 6,250 = 33,333$$

7. Very good threshold value is obtained according to equation 9, by multiplying the total threshold with a value of two then the result is multiplied by the value of three quarters.

a. Very Good Threshold for Student Services

$$AVery\ Good\ 1 = (2 \times 1) \times \frac{3}{4} = 1,5$$

b. Very Good Threshold for Library Services

$$AVery\ Good\ 2 = (2 \times 3,361) \times \frac{3}{4} = 5,042$$

c. Very Good Threshold for BAAK Services

$$AVery\ Good\ 3 = (2 \times 8,028) \times \frac{3}{4} = 12,042$$

d. Very Good Threshold for Facilities and Infrastructure Services

$$AVery\ Good\ 4 = (2 \times 14,694) \times \frac{3}{4} = 22,042$$

e. Very Good Threshold for Financial Services

$$AVery\ Good\ 5 = (2 \times 6,250) \times \frac{3}{4} = 9,375$$

8. Excellent Total Threshold for all University services

$$ATVery\ Good = 1,5 + 5,042 + 12,042 + 22,042 + 9,375 = 50,001$$

#### 4.2. Discussion

The stage of applying Bayes Method in processing the results of the questionnaire recapitulation to the service of the Dehasen University Bengkulu. Based on the recapitulation of

respondents' answers, the average score obtained by respondents for each university service can be seen in Table 2.

Table 2. Recapitulation Results of Student Satisfaction Levels Against University Services

| University Services                    | Average Respondent Score |
|--|--------------------------|
| Student Services                       | 17,61                    |
| Library Services                       | 32,89                    |
| BAAK services                          | 51,60                    |
| Facilities and Infrastructure Services | 67,87                    |
| Financial Services                     | 45,18                    |

The next stage, calculates each criterion from university services based on the answers given by respondents. Answers from respondents were divided by the number of respondents so that the average value obtained for each service. The next step is to find the results of calculations based on equation 11, which is the average number of respondents per service criterion multiplied by probability per criterion.

- Student Services Criteria  
Results =  $17,61 \times 0,083 = 1,468$
- Criteria for Library Services  
Results =  $32,89 \times 0,153 = 5,025$
- Criteria for BAAK Services  
Results =  $51,60 \times 0,236 = 12,183$
- Criteria for Facilities and Infrastructure Services  
Results =  $67,87 \times 0,319 = 21,681$
- Criteria for Financial Services  
Results =  $45,18 \times 0,208 = 9,413$

The next step is to compare the results of the data collection with the Very Good Threshold can be seen in Table 3.

Table 3. Comparison of Student Satisfaction Bayes Calculation Results Against Threshold Very Good

| University Services                    | Results       | Very Threshold Good | Conclusion  |
|--|---------------|---------------------|-------------|
| Student Services                       | 1,468         | 1,5                 | Good        |
| Library Services                       | 5,025         | 5,042               | Good        |
| BAAK services                          | 12,183        | 12,042              | Very Good   |
| Facilities and Infrastructure Services | 21,681        | 22,042              | Good        |
| Financial Services                     | 9,413         | 9,375               | Very Good   |
| <b>Total</b>                           | <b>49,769</b> | <b>50,001</b>       | <b>Good</b> |

**4.2.1. Design Features**

The design features possessed by the decision support system evaluating the level of satisfaction can be seen in table 4 below. The design features are intended to facilitate two types of users, namely administrators and Respondents (students). Administrators are staff who are given the right to manage a number of data such as managing student satisfaction data on university services, respondent data and managing various

information relating to evaluating student satisfaction. Respondents are all students who obtained a token given the right of access to get information as well as who gives the right to provide answers to services that have been felt during lectures given by the university. This feature is very useful to facilitate system users, namely administrators and respondents. Administrators as an extension of the quality assurance agency to maintain the evaluation of student satisfaction levels so that they can run continuously in carrying out their functions properly, while respondents from their side this feature is very helpful for respondents in assessing the services they have received during lecture activities.

| Fitur |                                 | Use of level evaluation systems student satisfaction |                     |
|-------|---------------------------------|--|---------------------|
|       |                                 | administrato r                                       | Respondent /student |
|       | Registration                    | ✓  |                     |
|       | Manage respondent data          | ✓  |                     |
|       | Manage data management services | ✓  |                     |
|       | Manage evaluation management    | ✓  |                     |
|       | Information                     | ✓  | ✓                   |
|       | Manage profile data             |  | ✓                   |
|       | Evaluating                      |  | ✓                   |

**4.2.2. System Requirement Design**

The next step is to design a supporting system for the benefits contained in the use of case diagrams, which show the relationship between actors and the system. Based on Figure 2, there are two actors involved namely admin and respondent. Admin can manage all existing data while respondents can manage accounts, request and evaluate services received during lectures that are entitled as students using the format determined by the system.

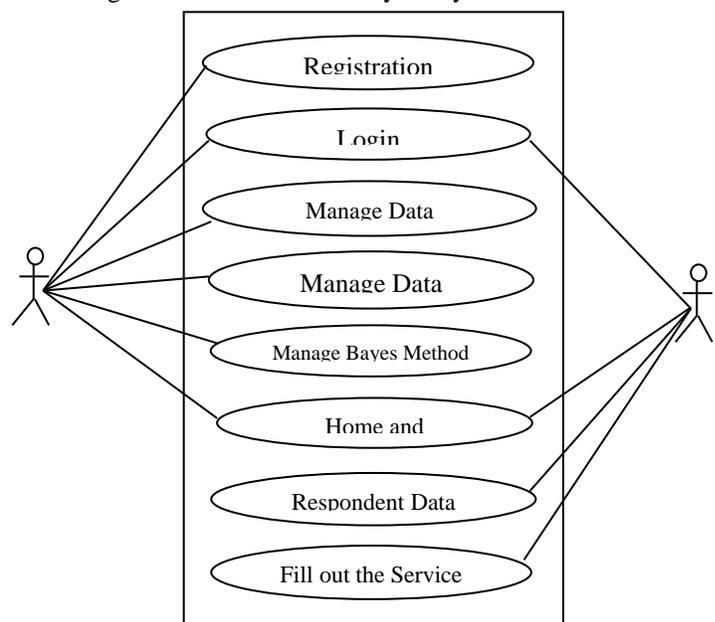


Fig. 2. Use Case Evaluation Diagram

## of Student Satisfaction

### V. CONCLUSION

The results of this study are the making of a decision support system evaluating the level of student satisfaction with university services, the design that has been produced will then be used by researchers to proceed to the next stage which is to build a decision support system for evaluating student satisfaction levels based on web, then implementing it. The purpose of this implementation phase is to prepare all activities for the implementation of the system so that in accordance with the design determined together, in this case the system built can assist the university in evaluating the services that have been provided to students to improve service quality standards and provide various information about service evaluation results activities.

### ACKNOWLEDGMENT

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# On the comparative Study of Compactness and some of its relative notion in Metric and topological spaces.

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**Abstract-** In this paper, we compared compactness and its related properties in metric and topological spaces and determine what topological spaces can do that metric spaces cannot.

**Index Terms-** Metric Spaces, Topological Spaces, Compact Spaces, Lindelöf space, Countably compact Spaces, Separable Space, Sequentially Compact Space, Second Countable Space, Complete Space.

## I. INTRODUCTION AND DEFINITIONS

The general topology has become foundation of knowledge for all branches of mathematics. Its methods have enriched other fields of mathematics and also give enough clues to their new development.

In this work, we compared compactness property and its related notions within metrics and topological spaces, we further study the implication of the notions. As we know, sequences are not sufficient for the study of general topological spaces, that is why sequential compactness is not a best notion. Compactness is the most important property of topological space, it has very wild application to both analysis and functional analysis [1]. [5] The following definition below leads us to the main work as we can see in [5], [7].

**Definition 1.1:** Suppose  $X$  is a topological space. A cover of  $X$  is a family  $O \subseteq \mathcal{P}(X)$  of subset of  $X$  such that  $\bigcup_{A \in O} A = X$ . This cover is open if every  $A \in O$  is closed.

**Definition 1.2:** Suppose  $X$  is a topological space. A subfamily  $B \subseteq O$  of a cover  $O$  is said to be a subcover iff  $\bigcup B = X$ .

**Definition 1.3:** A topological space  $X$  is said to be compact if every open cover of  $X$  has a finite subcover. i.e for each open cover  $\{O\}_{\alpha_i}$  of  $X \exists$  a finite subset of index set  $\{\alpha_1, \alpha_2, \dots, \alpha_n\}$  such that  $\bigcup O_{\alpha_i} = X$ .

**Definition 1.4:** [6] A topological space  $X$  is Lindelöf if every open cover has a countable subcover.

**Example:** (i) Every finite space is compact

(ii) Closed and bounded interval  $[a, b]$  in  $\mathbb{R}$  is compact while bounded interval  $(a, b)$  in  $\mathbb{R}$  is not compact. To show this, let  $L = b - a$  and consider the collection  $U = \{U_n : n \in \mathbb{N}\}$  of open subsets of  $(a, b)$  given by  $U_n = \left(n + \frac{1}{n}, b\right)$ . Then,  $U$  is a cover of

$(a, b)$  infact  $a < x < b \Rightarrow x - a > \frac{1}{n}$  for some integer  $n \geq 1$  and then  $x \in U_n$ . However, if  $F$  is any finite subcollection of  $U$ , then  $a + \frac{L}{M+1} \notin U_n, U_n \in F$ , where  $M = \max\{n : U_n \in F\}$ , so  $F$  is not a cover of  $(a, b)$ .

(iii) No any half-open interval  $(a, b)$  or  $[a, b)$  is compact

(iv) The real line  $\mathbb{R}$  is not compact for  $(-n, n)$  is an open cover of  $\mathbb{R}$  that has no finite subcover of  $\mathbb{R}$ .

(v) The discrete topology on a countably infinite set gives an example of a space which is Lindelöf but not compact.

(vi) The Sorgenfrey line is Lindelöf

(vii) Countable and cocountable spaces are Lindelöf

**Definition 1.5:** [6] A collection  $F$  of sets is said to have the finite intersection property if  $F$  is nonempty and each nonempty finite subcollection of  $F$  has nonempty intersection. [2]

**Lemma:** [3] A topological space  $X$  is compact iff each collection of closed subsets of  $X$  having the finite intersection property itself has nonempty intersection.

Two generalization of compactness will be derive by weakening the requirement that subcovers must be finite. A topological space is  $\sigma$ -compact if it can be express as the union of countably many compact sets, by comparing this definition of  $\sigma$ -compact to definition 1.4 above, we see that every compact space is  $\sigma$ -compact and every  $\sigma$ -compact space is Lindelöf. A topological space  $X$  is countably compact if every countable open cover has a finite subcover and two other compactness notions are closely related, but not equivalent to countable compactness a topological space  $X$  is said to be sequentially compact if every sequence in  $X$  has a convergent subsequence and  $X$  is weakly countably compact if every infinity set has a limit point [4]. These are the view among other compactness properties we would start comparing between metric and topological spaces to determine what topological spaces can do that metric space cannot.

## II. COMPACTNESS PROPERTIES AND ITS RELATED NOTIONS.

The following charts (Fig. A and B) below demonstrate the comparative study of compactness properties and its related notions in topological spaces and metrics spaces respectively. We would study notions like  $\sigma$ -compactness, Lindelöf, countably compactness and determine that they are all equivalent to compactness on metrics spaces and show where they failed to do so in topological spaces, that is, what topological notions can do

that metric notions cannot. We start our comparative study from **theorem 2.1** below.

**Theorem 2.1:** Every  $\sigma$  - compact space is Lindelöf  
 $\sigma$  - compactness  $\implies$  Lindelöf

**Proof:** suppose  $X$  is a  $\sigma$  - compact space. Then there exist a countable family  $\{F_n: n = 1, 2, \dots\}$  of compact subsets of  $X$  such that  $X = \cup\{F_n: n = 1, 2, \dots\}$ . Now, consider any open cover  $U$  of  $X$  so that for each  $n = 1, 2, \dots \exists$  a finite subfamily  $U_n$  of cover  $U$  which cover a countable family  $F_n$  is compact,  $\cup\{U_n: n = 1, 2, \dots\}$  is a countable subfamily of cover  $U$  which cover  $X$ . Therefore  $X$  is Lindelöf.

**Proposition 2.1:** Sequentially compactness properties implies countably compactness in a topological space. i.e. if a topological space  $X$  is sequentially compact, then is countably compact.

**Proof:** First, we shall show that if  $\{x_n\}$  is a sequence which has a subsequence  $\{x_{n_k}\}$  converging to  $t$  in a topological space  $X$ , the  $t$  is an accumulation point of the sequence  $\{x_n\}$ . By let  $O$  be an open neighbourhood of  $t$ , provided that  $t$  is an accumulation point of subsequence  $\{x_{n_k}\}$ ,  $\exists N \in \mathbb{N}$  such that  $k \geq N$  implies that  $x_{n_k} \in O$ , that means there are infinitely many  $n$  such that  $x_n \in O$ . So,  $t$  is an accumulation point. Therefore, the sequentially compactness implies that every sequence in a topological space  $X$  has an accumulation point.

From the figure B below, we have the **Lemma 2.1** below.

**Lemma 2.1:** A metric space is totally bounded iff it is sequentially compact.

Totally boundedness  $\implies$  Sequentially boundedness.

**Proof:** We shall provide proof of this Lemma from contradictory point of view. Suppose a metric space  $X$  is not totally bounded,

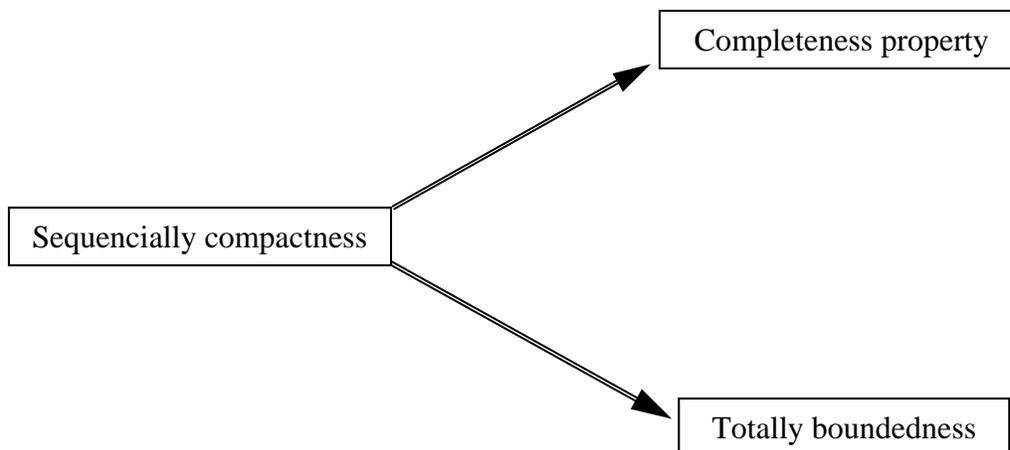
that means there does not exist finite many points for  $\epsilon > 0$   $x_1, x_2, \dots, x_n$  such that  $\cup_{i=1}^n B(x_i, \epsilon) = X$ , that is  $X$  cannot be covered by finitely many  $\epsilon$ -balls. Let  $\{x_n\}$  be a sequence such that  $x_n$  is a member of  $X \setminus \cup_{i=1}^n B(x_i, \epsilon), \forall n \implies d(x_i, x_j) \geq \epsilon \forall i > j$

$X \setminus \cup_{i=1}^n B(x_i, \epsilon), \forall n \implies d(x_i, x_j) \geq \epsilon \forall i > j$ , this provides that  $i \neq j$  gives that  $d(x_i, x_j) \geq \epsilon$ , so that the sequence  $\{x_n\}$  has a subsequence  $\{x_{n_k}\}$  which is not Cauchy.

Conversely, suppose  $\{x_n\}$  is a sequence in a metric space  $X$ . Since  $X$  is totally bounded, that means it can be covered by finitely many  $\epsilon$  - balls of radius 1. Let  $B_1$  be one of the ball and  $x_n \in B_1$  for  $n > 0$ . Then  $B_1$  can be covered by finitely many balls of radius  $\frac{1}{2}$ . Also, let  $B_2$  be another ball which satisfy that  $B_1 \cap B_2$  holds and  $x_n \in B_1 \cap B_2$  for  $n > 0$ . If we continue like this, we have a sequence  $B_i$  of an open balls of radius  $\frac{1}{i}$  such that  $B_1 \cap B_2 \cap \dots \cap B_m$  holds and contains  $x_n$  for  $n, m > 0$ . Thus, if we take a subsequence  $\{x_{n_k}\}$  such that for each  $k, B_1 \cap B_2 \cap \dots \cap B$  contains  $x_{n_k}$ . Now, if  $j \geq k$ , both  $x_{n_j}$  and  $x_{n_k}$  are also contained in  $B_k$ , then  $d(x_{n_k}, x_{n_j}) < \frac{2}{i}$ . Therefore, the subsequence  $x_{n_k}$  contains in  $i = 1 B_1 \cap B_2 \cap \dots \cap B_i$  which converges to  $k$  is a Cauchy sequence and since the subsequence  $x_{n_k}$  converge to  $k$ , therefore, the metric space  $X$  is sequentially compact.

**Proposition 2.3:** suppose  $(X, d)$  is a metric space. Then, the following must satisfy: (i) sequentially compactness  $\implies$  completeness and sequentially compactness  $\implies$  totally boundedness.

**Proof:**



Suppose  $\{x_n\}$  is a Cauchy sequence, by sequential compactness,  $\exists$  a subsequence  $x_{n_k}$  of  $x_n$  such that  $x_{n_k} \rightarrow K$ . due to the fact that a Cauchy sequence which has a convergent subsequence also converge. This shows that the metric space is

complete. And for the second statement. Let  $X$  be a metric space and for every radius  $r > 0$ , there exist the family of open ball  $\{B(x, r)\}$  which serves as an open cover of  $X$ , for each  $x \in X$ , there is an open cover of  $X$ , the compactness of  $X$  provides a finite subcover. Therefore  $X$  is totally bounded. The proof is complete.

Suppose  $X$  is a metric space, we have from the **Fig. B** below  
 Compactness property  $\Rightarrow$  Lebesgue property  $\Rightarrow$  completeness.

**Theorem 2.2:** If  $X$  is compact metric space then  $X$  is complete. i.e. If  $X$  is compact metric space, Compactness  $\Rightarrow$  completeness.

**Proof:** Suppose  $\{x_n\}_{n \in \mathbb{N}}$  is a Cauchy sequence in the subspace  $A \subset X$  and  $S \subseteq A$  be the following subset  $S = \{x_1, x_2, \dots, x_n, \dots\} \subseteq A$ . If we take  $S$  to be infinite, then, we follow the proof as follows:  
**Step A:**  $\exists$  an accumulation point  $z \in A$ , for each  $\varepsilon > 0$ ,  $B_{z,\varepsilon} \cap S \neq \emptyset$  and also  $B_{z,\varepsilon} \cap S = \{z\}$ . Suppose there does not exist such  $a \in A$ , then for each  $x \in A \exists$  some  $\mathcal{E}(x) > 0$  such that  $B_{z,\mathcal{E}(x)} \cap S = \emptyset$  and also  $\{x\}$ . As shown in **Lemma 2.1** above, the collection of open balls  $\{B_{x,\mathcal{E}(x)}\}_{x \in A}$  covers set  $A$  and is open, so, by compactness, it will contain a finite subcover; for this,  $\exists x_1, x_2, \dots, x_k$  such that  $S \subseteq A \subseteq \bigcup_{i=1}^k B_{x_i,\mathcal{E}(x_i)}$ -----  
 ----- (\*)

But since  $S$  is infinite and  $B_{z,\mathcal{E}(x)} \cap S \neq \emptyset$  and also  $\neq \{x\}$ ,  $\forall x \in A$ , then (\*) above is not possible.

**Step B:** Suppose  $z \in A$  is an accumulation point as we shown in step A above. Then the sequence has a subsequence  $\{x_{n_k}\}$  where  $k \in \mathbb{N}$  and has  $z$  as its accumulation point. If we let  $z \notin S$ , this part is done by using an induction method. Now, let  $n(1) \in \mathbb{N}$  such that  $x_{n(1)} \in B_{z,1} \cap S$ . Assume that we have  $n(1) < n(2) < \dots < n(k)$  such that  $x_{n(1)} \in B_{z,\frac{1}{t}} \cap S$ ,  $t = 1, \dots, k$  and if

$\mathcal{E} = \min\left\{\frac{1}{kM}, d_X(z, x_1), d_X(z, x_2), \dots, d_X(z, x_n(k))\right\}$ . Provided that  $x_n \neq z \forall n$ , we have that  $\mathcal{E} > 0$  and by part A above,  $\exists$  some  $n(k+1) \in \mathbb{N}$  such that  $x_{n(k+1)}$  contains in  $B_{z,\mathcal{E}} \cap S$  and  $B_{z,\mathcal{E}} \cap S \subseteq B_{z,\frac{1}{k+1}} \cap S$ . Then, we see that choice of  $\mathcal{E}$  provides that  $n(k) < n(k+1)$  and this ends the induction method of Step B.

**Step C:** We have  $z$  as an accumulation point of the sequence  $\{x_n\}_{n \in \mathbb{N}}$  as shown above due to the fact that it is a Cauchy sequence. For this let  $\mathcal{E} > 0$ , then there are two reasons to study here

(i)  $N \in \mathbb{N}$  such that, if  $p, q \geq N$ , then  $d_X(x_p, x_q) < \mathcal{E}$  and (ii)  $R \in \mathbb{N}$  such that, if  $r \geq R$ , then  $d_X(z, x_n(r)) < \mathcal{E}$ . If we let  $r \in \mathbb{N}$  such that  $n(r) \leq N, R$ . Therefore if  $n \geq N$ , we have  $d_X(z, x_n) \leq d_X(z, x_{n(r)}) + d_X(x_{n(r)}, x_n) < 2\mathcal{E}$  (by triangle inequality). Therefore, the sequence  $\{x_n\}_{n \in \mathbb{N}}$  has  $z$  as its accumulation point.

**Definition 2.1:** [6] If  $A$  is an open cover of a metric space  $X$ , a real number  $\lambda > 0$  is called a Lebesgue number for the cover  $A$ , if for every  $B \subseteq X$  with  $\text{diam}(B) < \lambda \exists a K \in A$  such that  $B \subseteq K$ .

**Theorem 2.3:** [2] Let  $X$  be metric space and  $\{U_\alpha\}$  be an open cover of  $X$ . Then there is a positive number  $\lambda(\{U_\alpha\})$  called Lebesgue number of the cover of  $X$  which satisfy the following property: Each ball  $B(X, \lambda)$  is contained in at least one  $U_\alpha$ . From implication  $\phi$  above, we shall develop this result below by follow **theorem 2.3** above.

**Theorem 2.4:** Compactness property  $\Rightarrow$  Lebesgue property for compact metric space  $X$ .

**Proof:** Let us assume  $O_x \in F$  such that  $x \in O_x$  for every  $x \in O_x$  and consider  $O_x$  open. Since  $O_x$  is open  $\exists \lambda_x > 0$  such that the open ball  $B(x, 2\lambda_x) \subseteq O_x$ . Then, for every  $x \in X$ ,  $X$  has  $\{B(x, \lambda_x)\}$  as its open cover so that for  $x_1, x_2, \dots, x_n \in X$   $U_{m=1}^n B(x_n, \lambda_{x_m}) = X$  by compactness property.

If Lebesgue number  $\lambda = \min(\lambda_{x_1}, \lambda_{x_2}, \dots, \lambda_{x_m}) > 0$  and if  $A \subseteq X$  such that  $D(Y) < \lambda$ , then, we choose  $a \in A$  and  $m \in \{1, \dots, n\}$  such that  $a \in B(x_m, \lambda_{x_m})$ . Now, we need to consider the inclusion relation below.

$$A \subseteq B(a, \lambda) \subseteq (x_m, 2\lambda_{x_m}) \subseteq O_{x_m} \text{-----}$$

(K)

In the inclusion relation (K) above,  $A \subseteq B(a, \lambda)$  follow from  $a \in A$  and  $D(A) < \lambda$  and by choice of  $\lambda_x$ , the third inclusion relation holds. Lastly, for the inclusion  $B(a, \lambda) \subseteq (x_m, 2\lambda_{x_m})$  if  $t \in B(a, \lambda)$ , then, we have  $d(t, x_m) \leq d(t, a) + d(a, x_m) < \lambda + \lambda_{x_m} \leq \lambda_{x_m} + \lambda_{x_m} = 2\lambda_{x_m}$  (by triangle inequality).

**Proposition 2.2:** In a metric space  $X$ , if  $X$ , is countably compact, then is sequentially compact.

**Proof:** If  $X$  is countably compact, then every sequence in  $X$  has an accumulation point, this shows that the any sequence  $\{x_n\}_{n \in \mathbb{N}} \in X$  has an accumulation point. By the fact that if  $X$  is first countable, then for every accumulation point  $m$  of a sequence  $\{x_n\}_{n \in \mathbb{N}} \in X \exists$  a subsequence  $\{x_{n_k}\}$  which converges to  $m$ , which proof for sequentially compactness.

**Theorem 2.5:** Suppose  $X$  is a topological space. If  $X$  is second countable, then is separable space.

Second countability  $\Rightarrow$  Separability

**Proof:** Note that a topological space  $X$  is said to be second countable if it has a countable base. Then, if  $L$  is a base for topology, then,  $\exists$  a dense subset  $A \subseteq X$ . Such that  $\text{card}(A) \leq \text{card}(L)$ . Which shows that  $X$  is separable.

**Theorem 2.6:** If topological space  $X$  is second countable then is Lindelöf.

Second countability  $\Rightarrow$  Lindelöf

**Proof:** If  $\{O_i\}_{i \in J}$  is an open cover of topological space  $X$ . We shall show that there must be a countable subcover by follow the existence of countable basis  $L$  for the topology  $\tau$  of a topological space  $X$ . Suppose one of the cover  $O_i = \emptyset$ . We shall adopt element of basis  $L$  to direct to certain  $U_i$ 's. Specifically, for each set  $Y \in L$ , we select one set  $O_Y$  from  $U_{i_s}$  by taking the following steps:

**Step A:** We verify if there is at least one of the open sets  $O_i$  such that  $Y \in O_i$ . If not, we let  $O_Y = \emptyset$ . If the set  $Y \in O_i$ , then, we choose one such  $O_i$  and consider it as  $O_Y$ . We can also choose the same  $O_i$  corresponding to many  $Y$ 's as the given  $O_i$  contains many basis, but we have at most one  $O_i$  chosen for each  $Y$ , so the set  $\{O_Y: Y \in L\}$  is countable.

**Step B:** Here, we shall show that the set  $\{O_Y: Y \in L\}$  in step A above is a cover of topological space  $X$ . for every  $x \in X$ , we need to show that one of the set  $O_Y$  contains  $x$  in  $X$ . Since  $O_i$ 's is a cover of  $X$ , then  $\exists O_i$  such that  $x \in O_i$ . Provided that we have  $L$  as a basis as defined in step A above, there is  $Y \in L$  such that  $x \in Y \in O_i$ . As  $Y \in O_i$ 's,  $Y$  will be one of the basis sets for which a set  $Y \subseteq O_Y$  such that  $x \in Y \in O_Y \Rightarrow x \in O_Y$ , which ends the proof.

**Theorem 2.7:** In a metric space  $X$ , if  $X$  is separable, then is a second countable space.

**Proof:** If the sequence  $\{x_n\}_{n \in \mathbb{N}}$  is a countable dense in  $X$ . Then for each  $x_n$ , let  $O_n$  be the set of all open balls centred at  $x_n$  in which its radius is rational. Then the  $O_n$  is countable for each  $n$ , so, we have that  $O = U\{A_n: n \in \mathbb{N}\}$  is a basis. Now, choose an open set  $K \subseteq X$ , we shall show that  $K$  is a union of our basis  $O$  defined above. If  $x \in K$ , we shall show that there is one of basis set  $O$  such that  $x \in A \subseteq K$ . Then, the point  $x$  contained in some  $\mathcal{E}$ -balls in  $K$ . If we consider an  $\frac{\mathcal{E}}{10^2}$ . Ball around  $x$ , this ball must contain some point  $x_n$  from dense subset of countable dense set  $\{x_n\}$  so that  $d(x_n, x) < \frac{\mathcal{E}}{10^2}$ . Then, if we take a rational radius which is strictly more than  $\frac{\mathcal{E}}{10^2}$ , then, we have a rational radius ball with centre  $x_n$  containing  $x \in K$ .

**Theorem 2.8:** Every compact topological space is  $\sigma$ -compact. Compactness  $\Rightarrow \sigma$ -compactness

**Proof:** Suppose  $X$  is a compact topological space. Let  $K \subset X$  be a compact subset of  $X$ . Let  $\{A_n: n \in \mathbb{N}\}$  be the family of compact subset of  $X$  that covers  $X$ ,  $K \cap A_n$  is a subset of the subspace  $A_n \subset X$ , for every  $n$  in  $\mathbb{N}$ . For this,  $K \cap A_n$  is compact in  $K$  for every  $n$  in  $\mathbb{N}$ . Then  $K$  will be union of countable family  $\{K \cap A_n: n \in \mathbb{N}\}$  of its compact subsets. Therefore,  $K$  is  $\sigma$ -compact. This completes the proof.

**Theorem 2.9:** Every totally bounded metric space is separable. Total boundedness  $\Rightarrow$  separability

**Proof:** Let  $X$  be a metric space and is totally bounded. Then, there exist  $x_{p,1}, x_{p,2}, \dots, x_{p,n_p}$  such that  $X = U_{k=1}^{n_p} B(x_{p,q}, \frac{1}{p})$ . Then there exist  $A \in X$  such that  $A = \{x_{p,q}: p \in \mathbb{N}, q = 1, 2, \dots, n_p\}$  is countable choose  $x \in X$  and  $\mathcal{E} > 0$ , also  $\mathcal{E}^{-1}$  such that  $p > \mathcal{E}^{-1}$ , so that there exist  $a$  such that  $d(x, x_{p,q}) < \frac{1}{p} < \mathcal{E}$ . Then,  $A$  is dense and the metric space  $X$  is separable.

**Theorem 2.10:** Every totally bounded space is bounded. Totally bounded  $\Rightarrow$  Boundedness

**Proof:** Let  $X$  be a metric space and is totally bounded. From definition of totally boundedness, there exist finitely many points  $x_1, x_2, \dots, x_n$  such that  $U_n B(x_n, 1) = X \Rightarrow$  the open ball of radius 1 covers  $X$ . By  $M = \max_{n,m} d(x_n, x_m)$ , by triangle inequality, we have  $diam(X) \leq M + 2 < \infty$ . Therefore,  $X$  is bounded.

**Theorem 2.11:** Every compact metric space  $X$  is totally bounded. Compactness property  $\Rightarrow$  Totally boundedness property

**Proof:** For the radius  $r > 0$  of the ball  $B(x, r)$ ,  $\exists$  family of open ball  $\{B(x, r)\}_{x \in X}$  such that  $X = U\{B(x, r)\}_{x \in X}$ , by compactness,  $\{B(x, r)\}$  cover  $X$  and  $\exists$  a finite subcover for the cover  $\{B(x, r)\}$ . Therefore,  $X$  is totally bounded.

**Theorem 2.12:** If a metric space  $X$  is sequentially compact, then  $X$  is Lebesgue.

Sequentially compactness  $\Rightarrow$  Lebesgue property.

**Proof:** Let  $\lambda > 0$  be a Lebesgue number. Now if  $O$  is an open cover that not accept  $\lambda$ , there exist open sets of diameter  $D$  which is arbitrarily small such that  $D \not\subset A \in O$ . Particularly, for each  $n \in$

$\mathbb{N} \exists x_n$  such that  $B(x_n, \frac{1}{n}) \not\subset A, \forall A \in O$ . Due to sequentially compactness, the sequence  $\{x_n\}$  has  $x$  as its accumulation point. Provided that  $O$  cover  $\lambda$ , we have  $x \in A$  for some  $A \in O$ . Since  $A$  is open,  $\exists$  radius  $r > 0$  such that the metric  $d(x, x_n) < \frac{r}{2}$  and  $\frac{1}{n} < \frac{r}{4}$ . Assume  $q \in B(x_n, \frac{1}{n})$ , then by triangle inequality,  $d(q, x) \leq d(q, x_n) + d(x_n, x) < \frac{1}{n} + \frac{r}{2} < \frac{r}{4} + \frac{r}{2} = \frac{3}{4}r < r$ . Therefore, the open ball  $B(x_n, \frac{1}{n}) \subseteq A$ , which is contrary to the choice of the sequence  $\{x_n\}$ . This end the proof.

**Definition 2.2:** [7] A topological space  $X$  is pseudocompact, if every continuous real-valued function on  $X$  is bounded.

**Theorem 2.13:** Every pseudocompact metric space  $X$  is countably compact.

Pseudocompactness  $\Rightarrow$  Countably compactness

**Proof:** Suppose the implication above is not true, then there exist a sequence  $A = \{a_n\}$  which is not converge. Hence  $A$  is closed and also discrete. Therefore, the function  $f: A \rightarrow \mathbb{N}$  defined by  $f(a_n) = n$  is continuous, so by Tietze extension theorem, this function can be extended to the space  $X$ . But due to the fact that  $f(a_n) = n$  is continuous, then, is not bounded which is contrary to pseudocompactness notion, which proved the theorem. The converse of this is also true in topological spaces.

### Topological Spaces

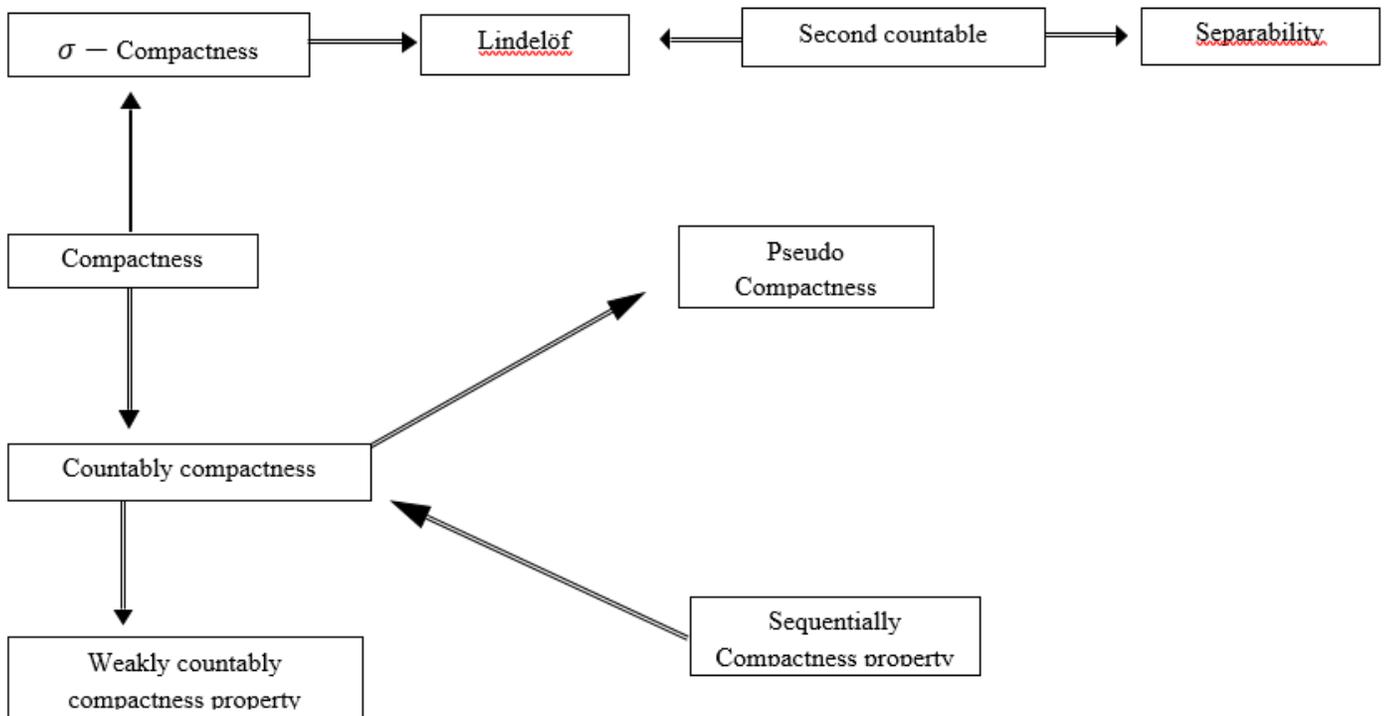


Fig. A

### Metric Spaces

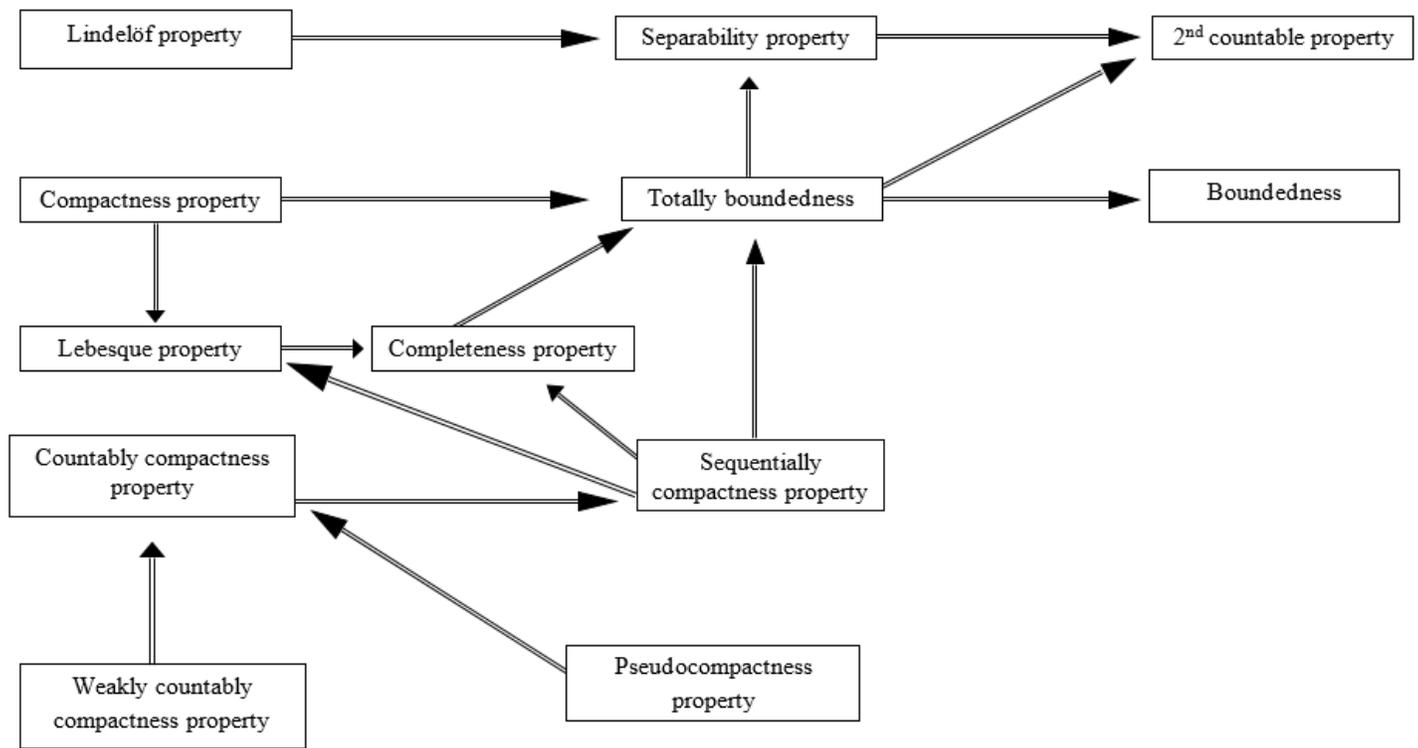


Fig. B

### III. CONCLUSION

In this paper, we noticed that there are some compactness properties and some of its relative notions that satisfied in both topological spaces and metric spaces. But out of these properties, there are some that satisfied in arbitrary topological spaces and metric spaces only and some on metric topological spaces.

The figure A and B above provides us those properties that satisfied in topological spaces and in metric spaces respectively.

By comparing these two figures, we conclude that:

- (i) Completeness, Lebesgue, Boundedness, Total boundedness are not consider in arbitrary topological spaces, this shows that they are properties of metric spaces
- (ii) While some other properties mentioned above like  $\sigma$  – compactness, compactness, second countability, separability, Lindelöf, etc. Plays roles in both metric and topological spaces.
- (iii) Converse of **Theorem 2.6** does not hold in topological spaces. Also It does not holds in metric spaces as shown in Fig A and B above.
- (iv) Converse of **theorem 2.7** does not holds in metric space but holds in topological spaces as in **Fig A and B** above.
- (v) Converse of **theorem 2.9, 2.10, 2.11 and 2.12** does not holds.
- (vi) Converse of **theorem 2.13** holds in topological spaces.

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# The Effects of Production Cost on Dividend Payout in Kericho Tea Estates

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## **Abstract**

In Kenya Tea sector is a major source of revenue to the government, however the relationship between cost and dividend payout in the Kenyan tea estates remains unclear. The therefore worked on establishing the effect. A descriptive research design approach was used and the target population comprised of all the 105 respondents for a target population of 300 in selected tea factories in the county. The questionnaire was personally administered and the validity of the study was ensured through critical review by the research supervisor. The analysis was performed using data derived from the financial statements of listed factories under KTDA during the most recent period. Ordinary Least Squares model was used to estimate the regression equation. The data was analyzed using regression with the help of statistical package for social sciences (S.P.S.S) computer software program version 21 and presented using a pie chart and tables. Permission was obtained from the management of the institution before questioning and interviewing occurred. Efforts were made to avail results of the interviews and other instruments for inspections by management of the institutions and officers were involved where there was need. The main value of the study was to identify how dividend policy affects performance of tea factories in the county.

## **Introduction**

Tea production process combines the transformation of the various input resources and the value addition in a controlled manner in the organization. According to Kadu and Oluoch (2018) pointed that every organization has its subsection in the organization concern with the transformation of the its inputs to the desired requisite quality levels. The tea industry in Kenya remains the leading economic driver in the country and for the past few years has been experiencing favorable climatic conditions thus the increased rates of production. However, according to Singla and Samanta (2019), despite the increase in production in the country, the average price for tea have remained relatively fair even with Tea board of Kenya maintaining its focus on the international markets. One of the major problems noted to be facing the tea companies in Kenya is the dividend policy. In fact, the issue dividend payout remains a crucial policy not only from the view of the company but also to the shareholders since it determines the future of the company's investments.

Oloruntoba and Adeleke (2018) noted that companies make dividend decisions to determine the exact profitability of the organization and how to distribute the amount earned against the stakeholders, company's cost and even more investments. According to Salman et al., (2015), dividend policy is a controversial policy, many firms cannot not make decisions on the exact pattern to pay its stakeholders. The indecision becomes even more complicated with the tea factories since its management work on satisfying other production cost which include employees, creditors, farmers, regulatory authorities and other factory expense. Yashin and Koshelev

(2016) noted that dividend payout influences share price and thus the flow of cash in the organization. The reason behind the argument is that large payouts reduce cost of capital but on the other hand increase the value of the firm. Manneh and Naser (2015), noted that dividends payments are taxed while capital gains remain untaxed unless when the share is sold. Dividend payout decisions in the firm therefore starts with profits and which is depend on the cost of production in the firm.

Researchers have diverged in their result in factors affecting dividend policy. Most of the economic models do not consider the production cost effects on the dividend policy in the firm. For instance, Tiruvengadam (2016) noted that increase in dividends increases cash out flows to the investors, On the other hand, Ojuye (2018) pointed that the amount retained for re-investment will decrease in the company thus an effect on the company's future growth harming the investors in the long-run. According to Lazonick (2017) noted that the dividend policy is a controversy, investors have an interest to improve their welfare which they hope to improve their welfare through capital gains and yields from dividends. If the company takes the decision to pay dividends using the earned profits, retained earnings will reduce and further a reduction in the total amounts from the internal sources. On the contrary, Mui and Mustapha (2016) noted that choosing to withhold profits and reinvest them in the firm will establish higher internal funding but at the expense of investor's welfare. As a result, financial management need to come up with an optimal dividend policy that will benefit both the company's interests and the investors' welfare.

The dividend policy phenomenon impacts the company's stock price, the amount to be paid to the shareholders on the other hand depends on the dividend policy adopted by the company (Farooq and Jabbouri, 2015). Before investing investors are always interested to know the amount, they will earn back from their investment based on its dividend policy. According to Bhattacharya and Rhee (2016), the value of a company is noted from its stock price development in the capital market and which depends on the production cost in the company. As a result, it can be induced that production cost has an effect on the dividend policy in the company through the stock prices, liquidity position and flow of funds in the company (He et al., 2020). Although many studies have been done in regard to dividend policy, especially in the developed economies, very little studies provide the evidence for its relationship with production cost which influences profits directly. Can earlier relationships established be replicated to emerging economies considering the likelihood in production costs difference expected in the developed and the developing economies? The study therefore sought to analyze the effect of cost of production on the company's dividend policy.

### **Statement of the Problem.**

Although many studies have been done in regard to dividend policy, especially in the developed economies, very little provides the evidence for its relationship with production cost which influences profits directly. Dividend is considered one of the sensitive issues in the corporate finance yet cash dividend policy behavior remains unanalyzed in many developing countries including Kenya. Kenya's economy depends on its exported cash crops with tea being a major cash crop, and although profits from tea production in the country have been noted to rise in the recent years, tea estates still find it difficult to pay out dividend to its shareholders with managers opting not to pay their shareholders for the purpose of expansion. While investors invest to make a profit, the firms are interested with more profits influenced by the cost production cost. However, very few studies are evident in Kenya in the banking sector and other corporate firms that link dividend payout and costs of production, Can the relationships have established and replicated in Kenyan tea estates considering the likelihood in production costs difference depending on the country's economy? The study therefore sought to analyze the effect of cost of production on the company's dividend policy

### **Literature Review**

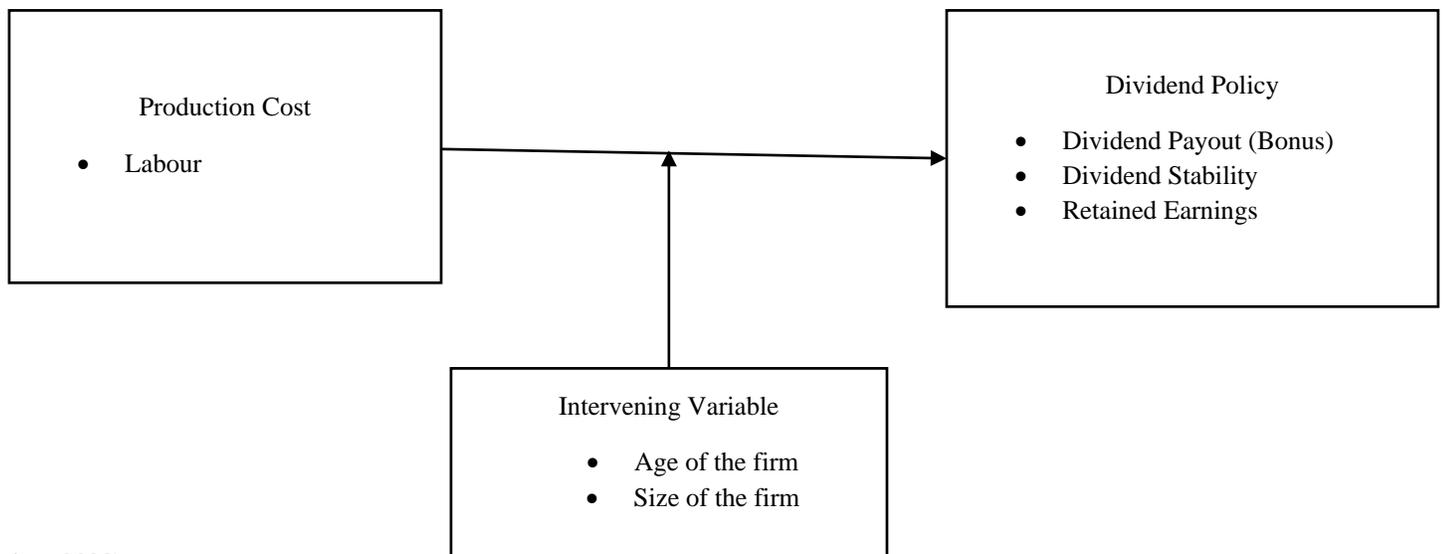
#### **Agency Theory**

According to Bhattacharya and Rhee (2016), the agency cost theory gives the relationship between the dividend policy and the cost of production in the company. according to the theory, costs are incurred while monitoring the company operation to avoid failures in the routine operation. Guizani (2017) noted that with large dividend payout, cash flows in the company will reduce forcing managers to seek other external financial sources for the company. The exposure to external sources of finance makes the company liable to capital suppliers and which in turn reduces its agency costs. Wasike and Ambrose (2015) pointed that in Kenya, the law does not provide much protection of the shareholders since most of the corporate companies are owned by the government. The government therefore plays a crucial role by acting out on behalf of all other shareholders who own the minority of the shares. This makes the government more powerful and thus controls all the other shareholders and their rights resulting to reduced agency cost. Bhattacharya et al., (2016) proposed that for any company, the cost of financing both for internal and external funding, debts and equity increases with the reduction of asymmetric information according to the pecking order theory. The theory asserts that companies rank their financing methods in a hierarchical order with the internal method being the most preferred method. At the same time, firms strive to maintain the pre-determined dividend ratios while at the same time ensure the avoidance of any issue that would change the predetermined set dividend targets (He et al., 2020).

### Conceptual Framework

Independent Variable

Dependent Variable



(Author, 2020)

According to Kothari (2004), the relationship between variable in a study can be well articulated through a conceptual model. In the conceptual framework, the moderating variable provides a link between the independent and the dependent variable.

### Research Design

The study adopted descriptive design in obtaining the evidence for the testing and evaluation of the phenomenon under analysis since it provides more flexible techniques to evaluate the various aspects under analysis. Nassaii (2015) noted that descriptive research design is more convenient where study seeks explanations of opinions and events being investigated. Nassaii (2015) further asserted that descriptive design identifies the common feature of phenomenon through observation and examines the correlation between the variables under study.

### Validity and instrument Reliability

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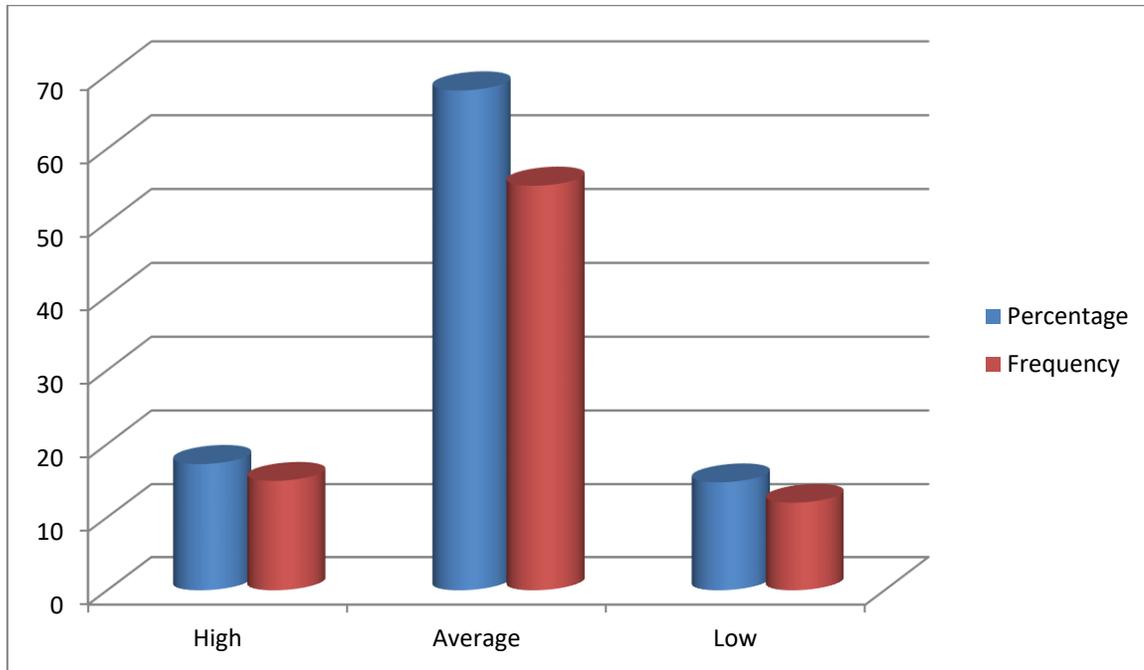
[www.ijsrp.org](http://www.ijsrp.org)

According to Heale and Twycross (2015), instruments should be evaluated to establish its extent in which it can measure and provide reliable data for the research. The researcher sought the experts' opinion when developing the questioners to validate the research instruments. For reliability, a pilot study was carried out which was consistent with Cronbach's alpha coefficient and a figure of  $0.802 > 0.7$  which was adequate consistent with Mugenda and Mugenda (2003).

**Results and Discussion**

The research employed descriptive statistics to analyze the research findings.

**Response on impact of production cost on dividend payout**



Source: field data (2015)

From the data, the production cost impacts on the dividend payout averagely on 67.9% of the shareholders while 17.3% are impacted highly while 14.8% argued to be low as pointed in the figure above.

**Descriptive Statistics analysis**

The analysis combines data from all firms with the first step of multivariate analysis describing the mean and standard deviation.

|                 | N | Minimum | Maximum | Mean   | Standard deviation |
|-----------------|---|---------|---------|--------|--------------------|
| Production Cost | 7 | 0.32    | 2.69    | 1.4625 | 0.8110             |
| Dividend        |   | 0.0     | 2.50    | 0.5604 | 0.70541            |

Source: field data (2015)

From fig4.4 the dependent variable, dividend payout has a minimum value of 0.00 and the maximum value of 2.50 with standard deviation of 0.70541. The minimum value for production cost is 0.32 while the maximum stands at 2.69 and standard deviation of 0.8110.

## Regression Results

### Regression Coefficients and their Significance

| Regression coefficients |         | Prob. |
|-------------------------|---------|-------|
| Constant                | -8.476  | .000  |
| Production Cost         | -.0570* | 0.045 |

Source: field data (2015)

From the analysis, the regression coefficient of cost of production is negative and thus a insignificant a 5% level of significance. Since regression coefficient for the production cost is negative and not significant at 5% level of significance is an indication that although production cost impact amount od dividends paid negatively, the effect is not significant. The results are consistent are consistent with findings by Tiruvengadam (2016), Ojuye (2018), Mui and Mustapha (2016) and Guizani (2017).

## Conclusion

The negative regression coefficient insignificant at 5% level of significance level and with a negative effect on the dividend payout. This imply that the higher the production costs the lower the ability to pay the dividends due to the high input costs. However, the effect does not affect dividend payment by the organization.

## Recommendation

The negative regression coefficient on production cost with an insignificant level of 5% has a negative effect on dividend payout in that the higher the production cost the lower the ability of the firm to pay dividend because of high input cost. The government therefore should come up policies that will allow subsidized fertilizers and other inputs for the tea production to minimize cost and minimize returns for higher dividends payout to the stakeholders.

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# The Effects of Overall Growth on Dividend Payout in Kericho Tea Estates

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## Abstract

Tea sector is a major source of revenue to the Kenyan government. The study established the effect of production index on dividend payout policy on firms. The objective of the study was to establish the effect of dividend policy on increase and decrease of growth in Kericho tea estate. A descriptive research design approach was used and the target population comprised of all the 105 respondents for a target population of 300 in selected tea factories in the county. The questionnaire was personally administered and the validity of the study was ensured through critical review by the research supervisor. The analysis was performed using data derived from the financial statements of listed factories under KTDA during the most recent period. Ordinary Least Squares model was used to estimate the regression equation. The data was analyzed using regression with the help of statistical package for social sciences (S.P.S.S) computer software program version 21 and presented using a pie chart and tables. Efforts were made to avail results of the interviews and other instruments for inspections by management of the institutions and officers were involved where there was need.

**Keywords:** Overall growth, Dividend pay-out, firm performance, Shareholders wealth

## Introduction

In Kenyan economy, business fields have been hugely affected by issues of globalization, privatization and liberation as result of technological advancements effects. Baker et al., (2015) noted that to survive the competition, firms have always strived to increase their value through the settlement of the basic business and budgets activities that would increase their growth and expand its share to the shareholders and better the firm's value. According to Bresciani et al., (2016), profits is a main economic drive for firms and the urge to better performance in the firm can be attributed to two main factors: the firm hold profits to use for the company's future growth, and secondly, to distribute to their shareholders. Manneh and Naser (2015) noted that distribution of profits to the shareholders can be done in two forms: through a dividend policy or through repurchasing of the shares in circulation. Further, Floyd and Skinner (2015) pointed that the two actions of profits are mutually related thus, firms need a policy that guide its dividend payment in relation to growth of the company. According to Ahmed (2015) dividend policy remains an essential for firm's strength and also helps the firm predict the organization future prospect and development.

According to Michiels et al., (2015), before potential investors undertake any investment in any company, usually they will undertake a research on the company's capacity to pay dividends. But since the management prosperity is determined by the wealth held by the shareholders, management should exhaustively analyse its dividend policy. Kighir et al., (2015) pointed that from the investors point of view, dividends are the company's main source of income for investment while according to the firm, dividend pay-out is a way in which the company is redistributing its profits to the shareholders as a way of appreciating them and further encourage them to support the company. Baker and Weigand (2015) noted that dividends are used to announce the company's growth and performance since a company that pays dividends do so from retained profits after substantial profits have been earned by the company. Kumar and Sujit (2018) further noted that while establishing its dividend policy, firms thus pay attention to profits consistency thus the different

policies established by the firm. Budagaga (2017) noted that the difference in the mounts paid by firms to its stakeholders has become an interesting aspect that market researcher observes keenly.

According to Attig et al., (2016), many prior researches have not provided a conclusive analysis on dividend policy in relation to the growth of the firm. Priya and Mohanasundari (2016) in his study asserted that low dividends to the shareholders signifies increased growth in the firm in the future. But then, what if the company paid lower dividends due to less retained earnings in the business. However, the logical argument is that lower dividends offers the firm a higher chance to grow itself in the near future (Bushra and Mirza, 2015). Issa (2015) noted that companies with high growth rates prefer exhausting its internal cash before seeking other external funds for its growth. This means that high growth rates are associated with higher retained earnings in the organization. Dewasiri et al., (2019) contrasted the findings and noted that higher earning rates is associated with higher dividend levels thus, implying that the current dividend pay-out is highly correlated with future projection of the firm. Researches however, pointed the challenge of the market observers in that observation of the market trends against the behaviour of the dividend levels in the firm is not enough to justify the future growth rates of the firm since such factors vary from one firm to the other (Setiawan et al., 2016).

In Kenya, tea growing is a major economic activity for both small- and large-scale holders and thus the country prides itself as a leading country in tea production (Obara, 2018). The tea sector has been wholly liberated and thus the market is independently operated. However, despite the independence in the company, most estates in the country have been faced by management inconsistencies since operations are unreliable (Langat et al., 2019). In the industry, shareholders lack consistent information on the performance, as a result, they rely on market trends to predict the future growth in the industry. Since dividend is a crucial aspect that investors study to give them direction on whether to invest or not, practitioners have always tried to establish effective approach to understand the earning growth against share earnings (Roy, 2015). However, despite the imperative nature of dividend policy in the industry, little studies have been carried on to understand the effect dividend policy on growth analysis in the tea sectors in Kenya. Thus, the study will examine dividend policy and future growth in the tea sector in Kericho county, Kenya.

### **Statement of the problem**

The question on whether growth in the company affect dividend pay-out in Kenyan tea sector has not been solved for a long time. This is because there is significant variation in prior results across different countries thus researchers have left a huge gap that need to be analysed. Prior studies have been carried out in various sectors and in also in less developed country like Kenya but such studies that directly analyse dividend in the tea factories have been ignored. Payment of dividends to the shareholders and the growth in the factories is crucial and needs to be researched in order to understand the mind of the potential shareholder. Thus, the research is vital to understand dividend pay-out in relation to firm performance and growth. Evaluating growth in relation to dividend pay-out in Kenyan tea factories is crucial in limiting risks and in ensuring efficiency and profit sustainability.

### **Literature Review.**

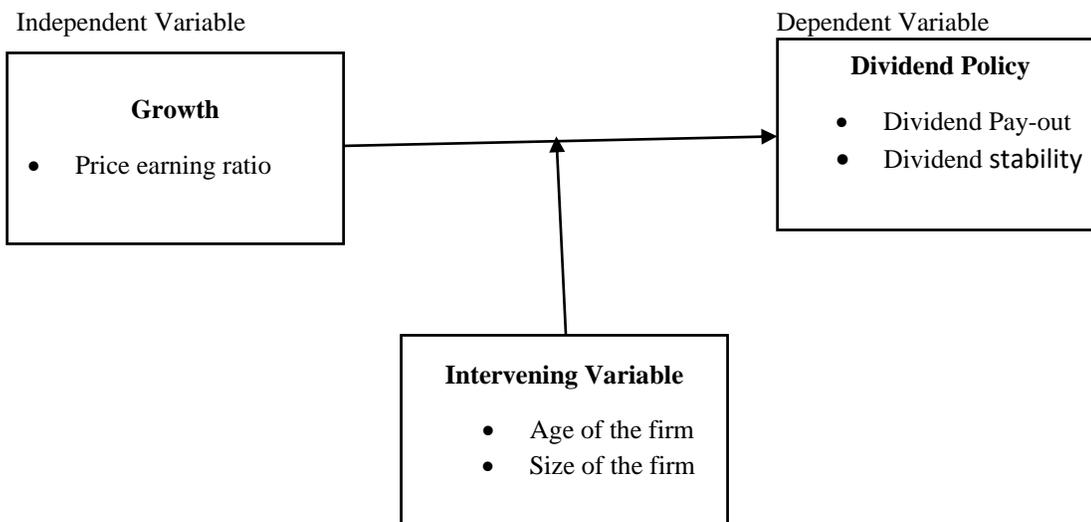
#### **Signal Theory**

The theory was developed by Miller and Modigliani (1961) and they stated that dividends have a signalling effect (Abdullah, 2016). Investors usually forecast the profits of the company and determine its growth rate by analysing their dividend rates. According to Baker et al., (2016), firms have the obligation to distribute dividends among its shareholders and higher dividends distributed imply a positivity in the firm's profitability. Esqueda (2016) noted that dividends have signalling effects since its pay-outs gives information on the firm performance to the market. When firms announce its dividends, its share prices increase and thus shareholders are in

position to predict the context of profitability in the firm. Forti and Schiozer (2015) noted that an increase in dividend pay-out is a good sign for the firm therefore increases its goodwill and the reputation of the firm in the mind of the investor thus increase in the share prices and growth in the organization. On the other hand, a cut in the dividends will result to bad reputation which affects the share price and thus growth in the organization.

### Conceptual Framework.

According to Kothari (2014), conceptual framework model describes the relationship between the independent and the depend variables under investigation. In the study, the model will link growth as the independent variable and dividend policy. Moderation variable links the independent and the dependent variable under study.



### Research design adopted

The study adopted descriptive design to obtain data used to test and evaluate the phenomenon under investigation. Nassaji (2015) noted that the design is more flexible in considering the various parts of the research problem. According to Willis et al., (2016) researchers adopt descriptive design when the phenomenon under investigation requires explanations in its variables under study.

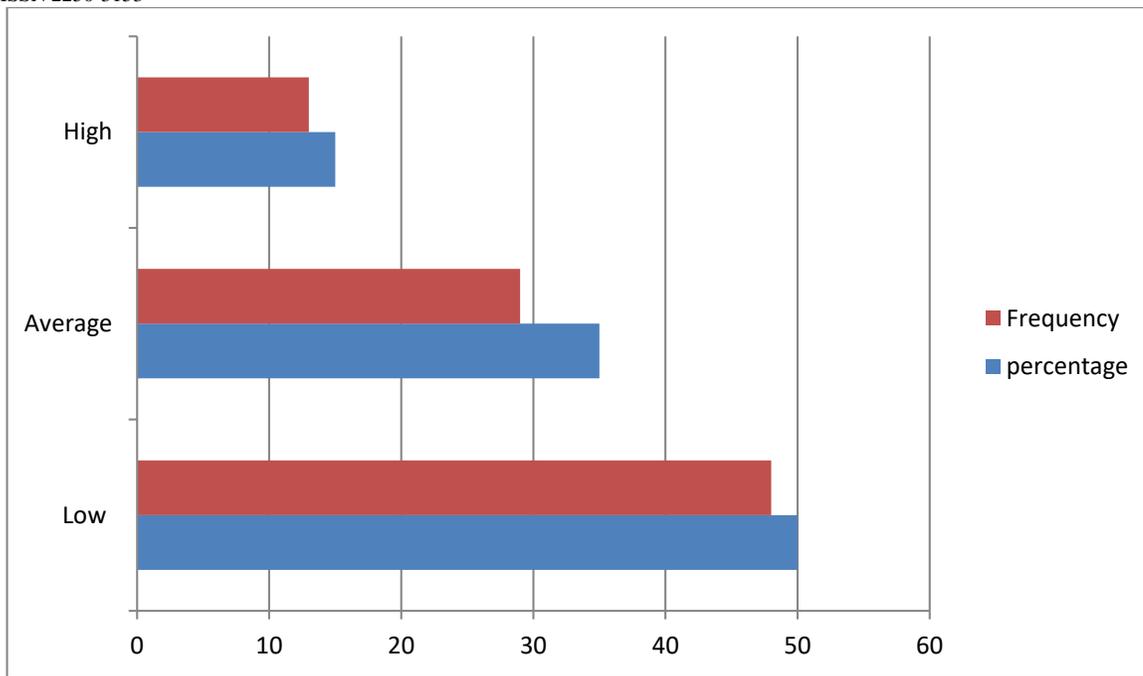
### Validity and Reliability

Validity of the instruments was tested to assess the instrument accuracy, the researcher thus sought expert's opinion to assess consistency in results. Further, a pilot test was carried out to ascertain the validity. Reliability refers to international consistency and stability of the research instruments. This was tested using the Cronbach's Alpha coefficient and a figure of 0.801 which was adequate according to Mugenda and Mugenda (2003).

### Results and Discussion

Descriptive analysis was adopted to analyse and present the findings.

### Response on impact overall growth of the firm on dividend pay-out



Source: Field Data (2019)

The impact of the firm’s overall growth was shown to be low at 50%, average rated at 35% and high rated 15% as shown in the above. This shows that tea estate with high growth rate were paying lower dividends than those with lower overall growth rates. Therefore, firms which pay lower dividends to its shareholders retained more for its reinvestments thus the increased rates in the investment needs. The results were consistent with the findings by Bushra and Mirza (2015) that showed a negative relationship between overall growth variables and the dividend pay-out of the firm.

**Descriptive Statistics**

|          | N | Minimum | Maximum | Mean    | Standard deviation |
|----------|---|---------|---------|---------|--------------------|
| Growth   | 7 | 0.0     | 85.67   | 13.9685 | 18.21197           |
| Dividend | 7 | 0.0     | 2.50    | 0.5604  | 0.70541            |

Source: field data (2019)

From the results, the depend variable which is the dividend payout has a maximum value of 2.50 and with a minimum of 0.00 presenting a standard deviation of 0.70541. Overall growth value on the other hand showed a variability of 0.0 value on the minimum and 85.67 on the maximum, a standard deviation of 18.21197 and a mean of 13.9685.

**Regression Values**

**Regression Coefficients and their Significance**

| Regression coefficients | Prob. |
|-------------------------|-------|
|                         |       |

|           |         |      |
|-----------|---------|------|
| Constant  | -8.476  | .000 |
| Growth X4 | -.0865* | 0.03 |

Source: field data (2015)

The regression coefficient for growth at 5% significance level is negative implying that growth of firms has a negative effect on the level of payouts paid to the shareholders. This could be attributed to the fact that most of the profits are retained by the firm to be reinvested or rather kept as capital reserve. The results are consistent with findings by King'wara (2015); Jabbouri (2016); Sinaga (2016) who noted a negative relationship in their findings. On the other hand, Ahmed and Murtaza (2015); Hooi et al., (2015) and Flavin and O'Connor (2017) in their empirical findings noted a positive relationship between growth and dividend payout although their value was insignificant.

### Conclusion

From the research findings, the regression value obtained is negative at 5% significance level and thus indicated that the overall growth of the firm affects dividends payout negatively. A firm with growth from its investments will always pay less dividends to the shareholders and instead will distribute security dividends and plough back the profits to any viable venture. This in agreement with residual theory which states that with higher growth opportunities will pay low dividend payout. Growth of firms has a negative relationship with dividends policy of the firm, this imply that with an overall increase I growth will result to reduction in dividend payout.

### Recommendations

The firm's overall growth variable has a negative significant effect on the dividend payout, the government therefore should come up policies which include setting up state owned marketing boards, storage places for the farmers' produce, price controls and stabilization to spur growth in the tea estates. This calls for the government to adopt and implement state intervention policies that would guide production of agricultural products considering their perishability. Through this firms can generate funds for their growth while expanding the firm's dividend policy to shareholders.

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# Effects Of 2019 Flood And Willingness Of Residents To Relocate In Parts Of Obio/Akpor Local Government Area, Rivers State, Nigeria

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## Abstract

Throughout history, flood disasters have occurred, but recently, there is increase in their occurrence and intensity. At the moment, out of the two million people representing one-third of the world's population who have been subjected to the effect of natural disasters in the last decade, flood and drought accounts for 86% of all such catastrophes. The study set out to examine the effects of the 2019 flood incidence on residence of Obio/Akpor Local Government Area (LGA), Rivers state. The study leans on the mixed research paradigm as it combines both quantitative and qualitative approaches. Owing to the fact that data will be collected as one-time, the study adopted a cross-sectional survey research design. Data were collected from both primary and secondary sources. Primary data were gotten through the use of pre-coded questionnaire administered face-to-face to 389 respondents who were heads of households. Secondary data were sourced from documented information on flooding from government agencies in the area. Data analysis was achieved using univariate statistics such as percentages, measures of central tendency (mean, median and mode), and measures of dispersion (range, standard deviation and variance). To ascertain if there is any statistically significant relationship between our residents' personal characteristics (independent variables) such as sex, marital status, income, length of stay and age and the desire to relocate (dependent variable), the Multiple Classification Analysis (MCA) was used. The result of analysis showed that the combined explanation provided by all the factors (independent variable) to desire to relocate (dependent variable) was  $R^2 = 4.059\%$ . On factor by factor basis, sex of respondents (0.472063) was identified as most important factor that induces residents desire to relocate from flood prone areas. The monetary cost of the 2019 flood in the study area was arrived at the sum of two billion, five hundred and nine million, seven hundred and twenty nine thousand Naira (₦2,509,729,000). With the perennial nature of flooding in the study area and its attendant negative effects on the socio-economic status of residents, it is recommended that deliberate and conscious attempt by government and cooperate agencies is needed to stem the rising trend of flooding in the study area.

**Keywords:** flood impacts, socio-economic impact; wellbeing; willingness to relocate; flood prone area; forced Migration.

## 1. Introduction

Throughout history, natural disasters have occurred, but recently, there is increase in their occurrence and intensity (Obinna et.al. (2018). According to Balogun (2012), more than two million people representing one-third of the world's population have been subjected to the effect of natural disasters in the last decade, with flood and drought accounting for 86% of all such catastrophes. Although the courses of flooding are many, Ladan (1998) attributes the occurrence of flooding to the actions and inactions of individual developers, communities and nations. Flooding is simply "water where such water is not wanted". Ikiriko and Imegi (2014) see flooding as an event that result when an outrageous volume of water has overflowed from a source onto an area that was previously dry. Flood is one of the most frequent and widespread of all environmental hazards.

Flood impacts negatively to the socio-economic wellbeing of its victims. It also constitute one of the greatest natural risks to sustainable development; it reduces the asset base of households, communities and societies through the destruction of standing crops, dwellings, infrastructure, machinery buildings, and loss of life (Ejizu, Eri, Oyedirim & Malizu, 2014).

Obio/Akpor is one of the Local Governments Areas (LGA) in Rivers State that is prone to flooding. Due to the low nature of settlements in Obio/Akpor LGA the area is prone to urban flooding that is usually triggered by heavy rainfall. No wonder the phrase “You need a canoe in your streets” is very common in some settlements in the study area. The implication is that some streets are not accessible during flood months (July-October), some inhabitants even abandon their residential area; health facilities and educational facilities are not accessible and means of livelihood are disrupted.

Inspite of the flood prediction alert by Nigerian Meteorological Agency, residents in the study area have continued to suffer from the devastating effects of flood. The sad reality is that flooding has become an inevitable phenomenon in the study area that residents must learn to live with. Though the incidence of flooding is almost an annual event, the 2019 flooding was chosen for this study due to the need to quantitatively determine the actual impact on the residents of the study area.

Our surmise is that if a flood event is isolated, it makes the mechanism of its occurrence and quantification easily understood, while measures aimed at ameliorating flood impacts can be advanced before, during and after flood events.

In the absence of coordinated response to flooding, reactions to flood incidence either at the central or state level has been so much reactive in the form of provision of relief materials to victims in some cases. Again, is the fact that little is known on while residents of flood area will usually remain without a relocation plan. The concern here is why are flood victims in the area adamant of relocating to non-flood safe areas? Does the personal characteristics of one affects ones tendency to relocate from flood areas?

This is the crux of the present study is to objectively quantify the monetary cost of the 2019 flood with a view to highlighting the factors that influence residents’ choice of relocating from flood areas in the study area.

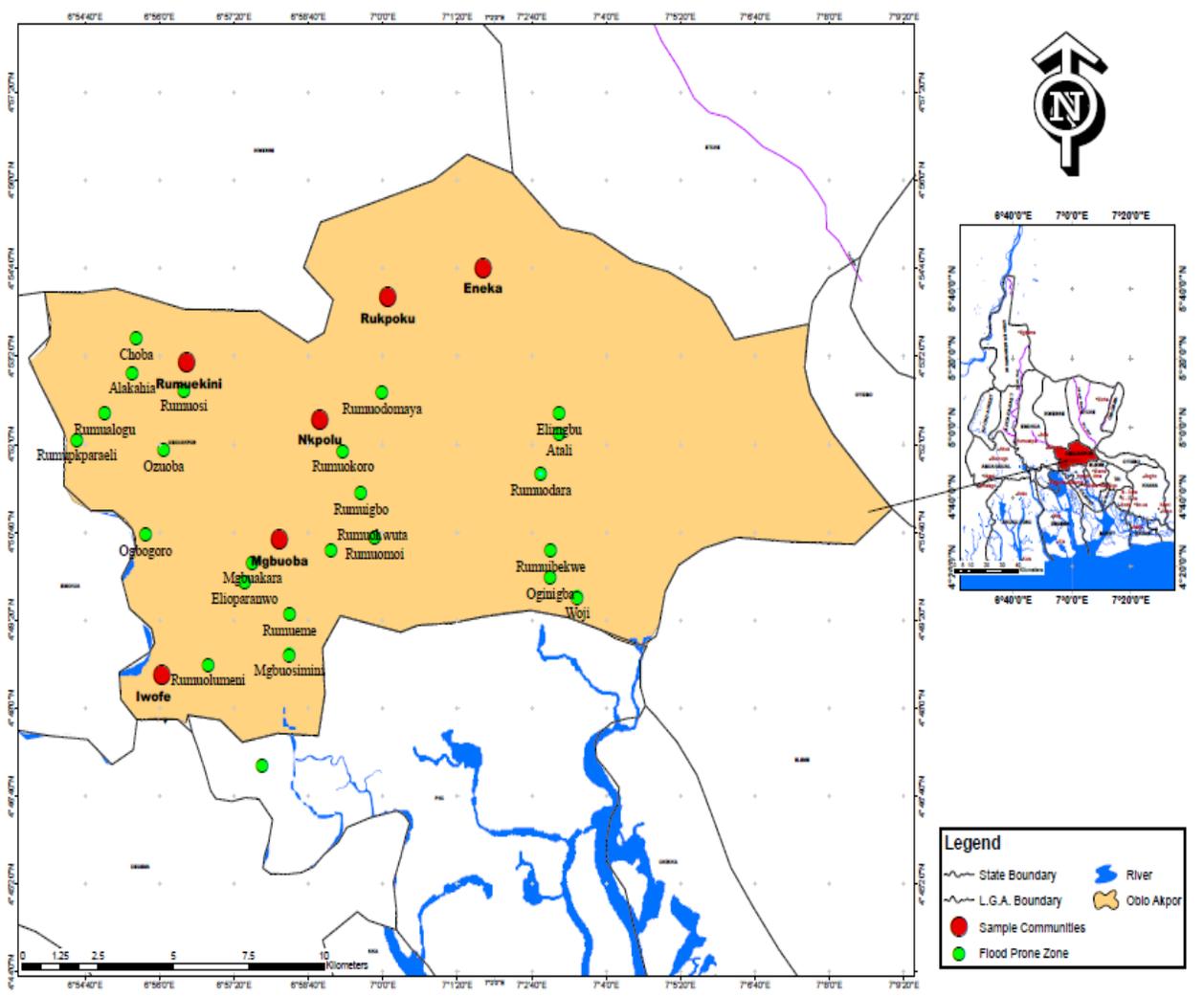
## 2. Study Area

Obio/Akpor is one of the 23 LGAs in Rivers State, Nigeria. It situates on Latitudes  $4^{\circ}45'N$  and  $4^{\circ}60'N$  and Longitudes  $6^{\circ}50'E$  and  $8^{\circ}00'E$  Obio/Akpor lies about 66km from the Atlantic Ocean ( Wokocha , 2015) (figures 1). The location attribute of the study area as a lowland area predisposes it to constant flooding with attendant environmental and health consequences on the residents of the area. Geologically, Obio/Akpor LGA is made up of basically alluvial sedimentary basin and basement complex. Due to high rainfall, the soil in the area is usually sandy or sandy loamy. It is always leached, underlain by a layer of impervious pan (Eludoyin, Wokocha and Ayolagha, 2011).

There are basically three types of soil in the study area namely: (1) fluvial marine and marine sediments. (2) alluvial soils of the mangrove swamps and (3) sandy loams and fresh water brown loams (Ayo *et al*, 2017). According to Alamiokuma and Ofuyah

(2017), Obio/Akpor has a very thick vegetation cover which in a way enhances loss of water by evaporation, especially through the stomata. It is generally a low land area. Egwuogu et al (2016) describe the study area as having an average elevation between 20 metres and 30 metres above sea level.

. The climate of Obio/Akpor is under the influence of both the South-West and North-East winds. The South-West wind brings wetness to the study area. It starts from the month of February to November which we can term the region's rainy season. The North-East trade wind brings about dry season; it passes through Saharan desert from the month of November to February (Ayo et al, 2017). The study area has nine months of rainy season and three months of dry season. It has an average of 2500mm and 330 days of rain fall (Mamman, Oyebanji and Peters, 2000 and Ayo et al, 2017).



**Fig 1: Rivers State showing Obio/Akpor Local Government Area and Flood Prone Settlements**

Source: Egwuogu et al, (2016) ,GoogleEarth, (2019)

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### 3. Methods and materials

The study leans on the mixed research paradigm as it combines both quantitative and qualitative approaches. The quantitative aspects seeks to objectively determine the actual cost of the 2019 flood on residents of the study area while the qualitative aspect of the study sought to subjectively examine the impact of 2019 flooding and willingness of residents in flood prone area in Obio/Akpor LGA to relocate to safe areas.

Owing to the fact that data will be collected as one-time, the study will adopt a cross-sectional survey research design (Cook and Campbell, 1979). Data were collected from both primary and secondary sources. Primary data were gotten from via the use of pre-coded questionnaire administered face-to-face to 389 respondents who were heads of households. Secondary data were sourced from documented information on flooding from government agencies in the area.

The target population for this study consists of all households in the twenty nine (29) flood prone communities identified by Egwuogu, Okeke, Emenike and Abayomi(2016) in Obio/Akpor local LGA.

Multistage sampling technique was the basis for sample selection as each community served as primary sampling unit (PSU). The sampling stages are as follow:

**Stage 1:** The study area is made up of 29 communities and 20% of them were selected for intensive study, yielding six (6) communities for the survey.

**Stage 2:** identification of number of house hold in the six selected communities that came up to 13,571 households in the six sampled communities,

The selection of respondents was done using systematic random sampling; a probability sampling method (Kish, 1965). To achieve this, one elementary unit is taken as a starting point and subsequent samples was picked at every 44<sup>th</sup> term.

The population of each community was used to determine the number of respondents from each selected community as shown in table 1

Data analysis was achieved using univariate statistics such as percentages, measures of central tendency (mean, median and mode), and measures of dispersion (range, standard deviation and variance).

To ascertain if there is any statistically significant relationship between our residents' personal characteristics (independent variables) such as sex, marital status, income , length of stay and age and the desire to relocate (dependent variable), the multiple Classification analysis (MCA), a multiple regression technique was used (Andrews, Morgan, Sonquist and Klem, 1973).

Mathematically, MCA is given as:

$$Y_{ij, \dots, n} = Y + a_i + b_j + \dots + e_{ij, \dots, n}$$

Where  $y_{ij\dots n}$  = The score (on the dependent variables) of individual n who falls in category i of prediction A, category j of prediction B etc.

Y = Grand mean of the dependent variable

$a_i$  = The “effect” of membership in the  $i^{\text{th}}$  category of prediction A

$b_j$  = the effect of membership in the  $j^{\text{th}}$  category of prediction B

$e_{ij\dots n}$  = error term for the individual.

To appreciate the results of this study, data were presented in pictorial formats through the use of tables and graphs

#### 4. Table 1: Determination of sample size for the study

| S/No | Sampled Communities | 1991 Population | **2020 Population | **Number of Households | **Number of H/H selected per community |
|------|---------------------|-----------------|-------------------|------------------------|--|
| 1    | Rumuekini           | 5,080           | 16,750            | 3,350                  | 96                                     |
| 2    | Rukpoku             | 4,689           | 15,461            | 3,092                  | 89                                     |
| 3    | Eneka               | 6,229           | 20,539            | 4,108                  | 118                                    |
| 4    | Nkpolu              | 1,660           | 5,474             | 1,095                  | 31                                     |
| 5    | Mgbuoba             | 2,308           | 7,610             | 1,522                  | 44                                     |
| 6    | Iwofe               | 613             | 2,021             | 404                    | 11                                     |
|      | <b>Total</b>        | <b>20,579</b>   | <b>67,855</b>     | <b>13,571</b>          | <b>389</b>                             |

Source: Rivers State Ministry of Budget & Economic Planning(2003)

\*\* Researcher’s computation (2020)

### 5 Conceptual Orientation/Review of literature

#### 5.1 The Concept of Flood

Flood is an old phenomenon; it is the overflow of water on land that is not normally covered by water. However, mere overflow of water on land that is not normally covered by water cannot be termed a significant flood unless such overflow endangers land areas used by wildlife or man for habitation, socio-economic infrastructure, agriculture, livestock maintenance, mineral exploitation and exploration facilities (Fubara, 2014). Flood is the result of excessive quantity of water from either run off or underground sources which spread beyond the banks of stream channel (Gobo & Abam, 2014). Flooding is one of the major natural disasters that have

become something of serious concern in recent decades. It is estimated that 75% of the world's population lived in settlements threatened by flood and other natural disasters (Gobo & Abam, 2014).

### 5.1.2 Causes of Flood

There are various causes of flooding. Kakulu and Brisibe (2014) made it clear that low lying areas are prone to inundation. Imegi *et al* (2014) grouped the causes into two, namely: natural causes and man-made causes. Man-made causes of flood include blockage of drainage or absence of drainage, burning of fossil fuels, lack of town planning, subsidence, river dumping, poor road network and construction of dams. The natural causes of flood include the greenhouse effect, climate change, river overflow, hurricane, tornadoes, monsoon rains and moon phases (Imegi *et al*, 2014)

### 5.1.3 Impact of Flooding

The mention of flooding gives many people the impression that the impacts are always negative. In fact, flooding has both negative and positive impacts. Some authors have discussed the negative impacts while some have discussed the positive ones.

Barinweni *et al* (2002) categorically stated that flooding causes lots of damages to property, public health and local biodiversity. Flooding is associated with rapid runoff which causes soil erosion and destruction of spawning grounds for aquatic life. When flood is intense and lasts for a very long time, it causes traffic congestion in areas with low elevated road ways, it also affects agricultural activities thereby threatening national food security. Floods can interfere with the drainage system and various land uses. Flood causes damage to urban and rural infrastructure such as public buildings and hydroelectric/thermal power stations which in turn leads to huge financial losses and chaos, thereby aggravating the existing security challenge. Ekenem *et al* (2014) made it clear that flooding can result in loss of livelihood, production and other prolonged economic impacts which can force the affected populace to migrate or be displaced.

According to Obinna *et al* (2014), flood damage can be categorized firstly as direct and indirect; secondly as tangible and intangible. Direct flood damage involves harm caused as a result of immediate physical contact of flood water with humans, property and the environment, while indirect flood damage involves loss of production of businesses as a result of the flood (Obinna *et al*, 2014). Tangible damages are those damages that can be specified in monetary terms while intangible damages are those damages that cannot be specified in monetary terms (Obinna, *et al*, 2014).

Writing on impact of flooding among residents located along the Taylor Creek in Orashi region, Rivers state, Nigeria, Obinna *et al*. (2018) observed that constant flooding of the area affects social and economic environment of people of the area as it destroys agricultural farmland as well as seeds stored for replanting; that eventually culminate into a decline in food production; loss of income for many in the affected communities.

There appears to be some positive impacts of flooding. Backinsal (1966) and Chisolm (1979) asserted that flooding can lead to development of settlement, and in most cases the settlements originate by the riverside. Robinson (1979) supports such assertion by saying that flooding has enhanced the existence and development of agricultural settlements and development of cities right from ancient times. Further remark by Robinson (1979) is that the earliest towns appear to have grown up in the great river low lands of the near and middle east and that the idea of city life spread from ancient Egypt and Mesopotamia through the Mediterranean Sea of which the flooding of associated rivers were very helpful. Faniran and Jeje (1983) hold the view that even in non-deltaic environment, observable morphological features like those found between Aboh and Samabiri in the lower Niger and those along river Amazon and its tributaries can equally occur as a result of flooding to develop settlements and support their inhabitants. . Oyebande (2014) agrees that flood is not just negative natural phenomenon that we should do our utmost to control, flood waters are very important for many ecosystems if they are well contained and managed, floods are natural phenomenon which form part of the natural regime of the river.

## 5.2 The Concept of Forced Migration

The International Organization for Migration (2017) defined forced migrants as any person migrating to escape persecution, conflict, repression, natural and human-made disasters, ecological degradation, or other situations that endanger their lives, freedom or livelihood. Forced migration can be termed movement of people displaced by conflicts, environmental disasters, chemical or nuclear disasters, famine or development projects. Castles(2005) includes refugees, asylum seekers, internally displaced persons, protracted refugee situations, returnees, those displaced as a result of Development, environmental issues, disasters andtrafficked people as forced migrants.

A theory of forced migration would encompass a multiplicity of factors at various scales in the region of origin, along itineraries of flight, in the region of destination as well as global level. Worthy of note is the fact that all migrations involve choices and constraints. Even those fleeing for a reason are in need of protection and have degree of knowledge about where they go and how they travel (Piguet, 2017). Forced migration is an important aspect of social change. It is inevitably related to change which is often acute and disruptive (Eastmond, 2015). Displacement or forced migration affects core issues such as livelihood, kinship, social, political and cultural factors, which gives coherence and predictability to everyday life.

Causes of forced migration can be grouped into three categories, namely:

- ❖ Conflict-induced migration which occurs when people are forced to flee their homes as a result of armed conflict.
- ❖ Development – induced migration which occurs when people are compelled to move as a result of policies and projects implemented to advance development effort.

- ❖ Disaster – induced migration which occurs when are displaced as a result of natural events such as floods, volcanoes, landslides, earthquakes; environmental change such as deforestation, desertification, land degradation, global warming; and human – made disasters such as industrial accidents, radioactivity etc (Easmond, 2015).

## 7. Results and Discussion

### 7.1: Socio-economic Characteristics of Respondents

Figure 3 shows the percentage distribution of respondents’ gender. Male accounted for 61.7% of respondents, while female accounted for 38.3%. in terms of age The modal age brackets were 31 – 40 years and 20 – 30 years, accounting for 39.9% and 38.3%, respectively. (Figure 4.)

Most respondents in the study locations were married (54.4%). Single respondents accounted for 41.8% of the distribution (Fig.5). The modal age category was “5-9 years”, accounting for 11% of the entire distribution. For the female, the modal age category was “5-9 years”, accounting for 6% of males, while for the female it was “25-29 years”, accounting for 5.5% of males. Those aged less than 15 years accounted for 26.5% of the distribution. Those of retirement age “60 years and above” accounted for 12.9%. The active working population accounted for 60.6% of the distribution.( Figure 6)

Household members who have “Completed Secondary School” accounted for 31.6% and those who have “Completed Tertiary School” accounted for 20.2%. This implies that over 50% of household members in the study locations had minimum of Secondary education (Table 2).

With respect to employment status of household members 49.7% of house hold members are under various forms of employment while 47.5% are unemployed. Furthermore, there were more unemployed females (52.1%) than males (43.6%). Those who are retired and full-time housewives accounted for 1.4% respectively. (table 3)

**Table 2: Percentage Distribution of Education of Household Members**

| S/N | Level                        | Male |      | Female |     | Total |      |
|-----|------------------------------|------|------|--------|-----|-------|------|
|     |                              | N    | %    | N      | %   | N     | %    |
| 1   | No formal education          | 36   | 5.2  | 35     | 5.2 | 71    | 5.2  |
| 2   | Pre-primary education        | 41   | 5.9  | 56     | 8.3 | 97    | 7.1  |
| 3   | Primary school (uncompleted) | 78   | 11.2 | 60     | 9.0 | 138   | 10.1 |

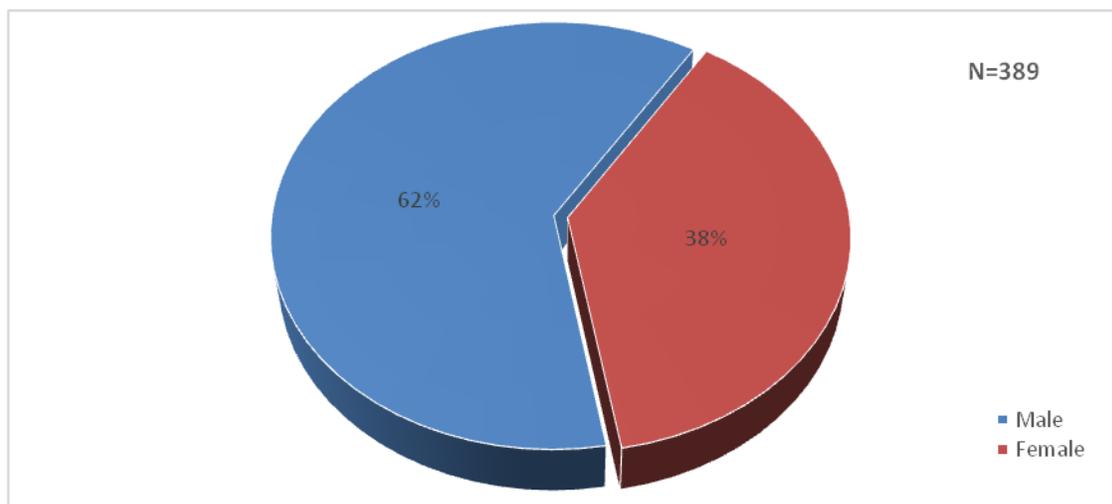
|              |                                |            |            |            |            |              |            |
|--------------|--------------------------------|------------|------------|------------|------------|--------------|------------|
| 4            | Primary school (completed)     | 28         | 4.0        | 19         | 2.8        | 47           | 3.4        |
| 5            | Secondary school (uncompleted) | 84         | 12.1       | 86         | 12.7       | 170          | 12.4       |
| 6            | Secondary school (completed)   | 210        | 30.2       | 224        | 33.1       | 434          | 31.6       |
| 7            | Tertiary School (Uncompleted)  | 61         | 8.8        | 76         | 11.2       | 137          | 10.0       |
| 8            | Tertiary School (Completed)    | 157        | 22.6       | 120        | 17.7       | 277          | 20.2       |
| <b>Total</b> |                                | <b>695</b> | <b>100</b> | <b>676</b> | <b>100</b> | <b>1,371</b> | <b>100</b> |

(Source: Author’s Field Survey, June 2020)

**Table 3: Percentage Distribution of Employment Status of Household Members**

| S/N          | Status               | Male       |            | Female     |            | Total        |            |
|--------------|----------------------|------------|------------|------------|------------|--------------|------------|
|              |                      | N          | %          | N          | %          | N            | %          |
| 1            | Employed             | 367        | 54.2       | 258        | 44.4       | 625          | 49.7       |
| 2            | Unemployed           | 295        | 43.6       | 303        | 52.1       | 598          | 47.5       |
| 3            | Retired              | 15         | 2.2        | 3          | 0.5        | 18           | 1.4        |
| 4            | Full-time House Wife | 0          | 0          | 17         | 3.0        | 17           | 1.4        |
| <b>Total</b> |                      | <b>677</b> | <b>100</b> | <b>581</b> | <b>100</b> | <b>1,258</b> | <b>100</b> |

Source: Author’s Field Survey, (2020)

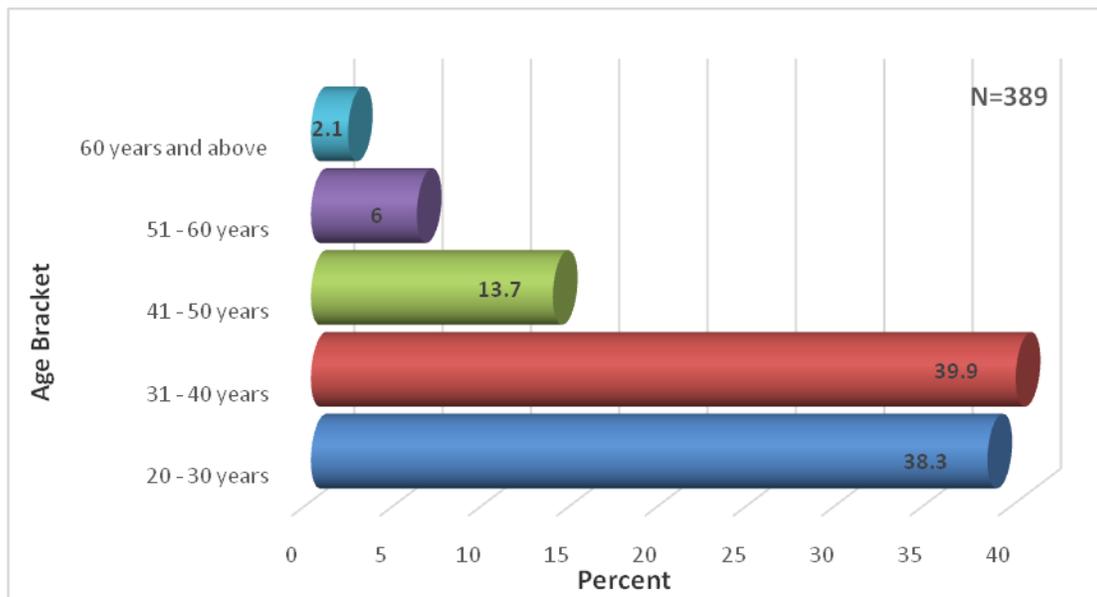


**Fig.3: Percentage Distribution of Respondents' Gender**

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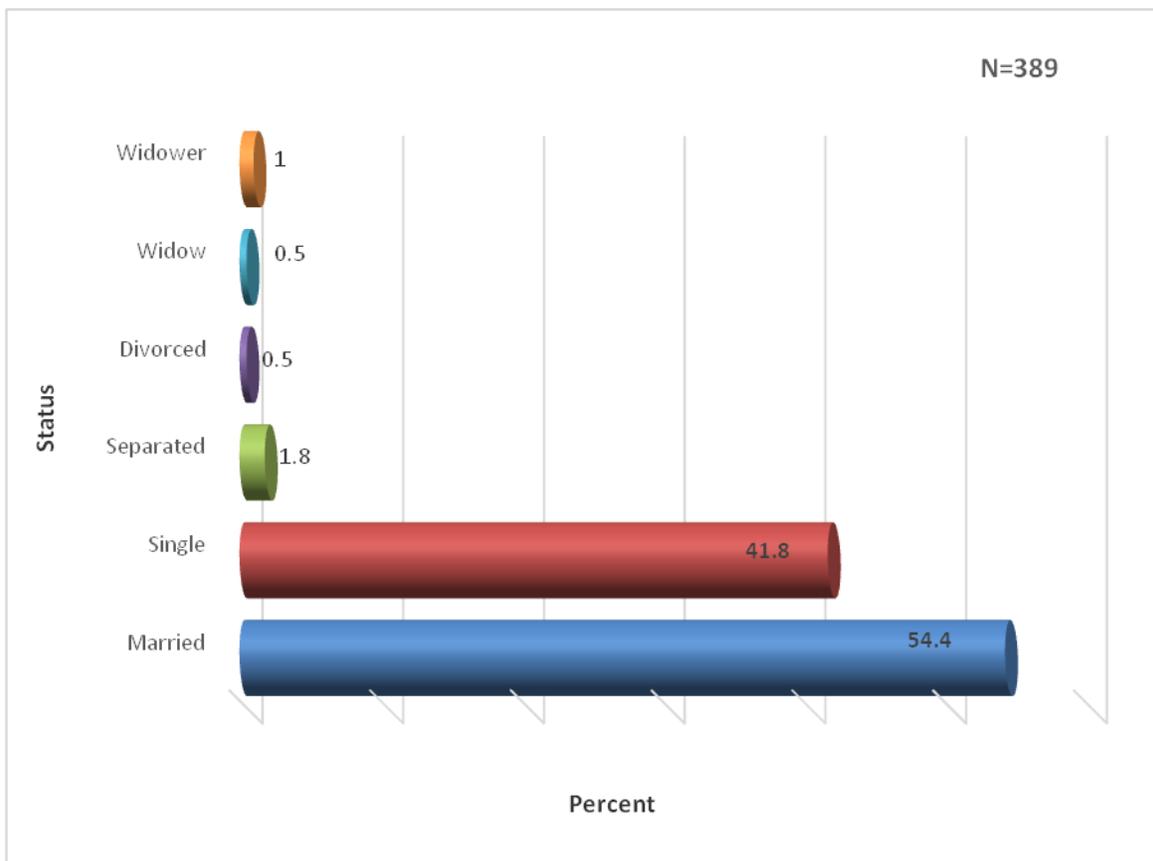
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**Figure 4: Percentage Distribution of Age Brackets of Respondents**

Source: Author's Field Survey, (2020)

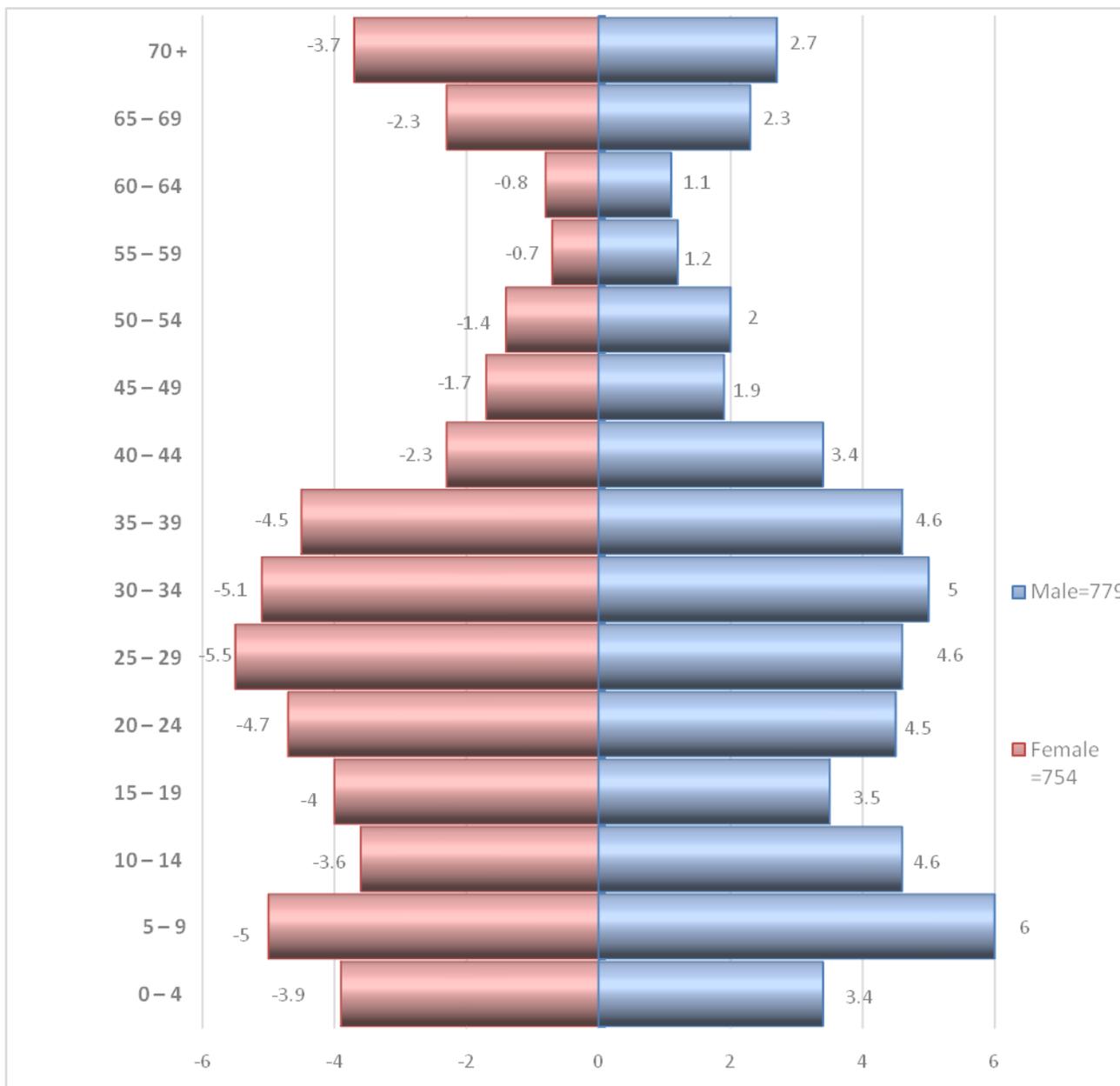


**Figure 5: Percentage Distribution of Marital Status of Respondents**

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**Figure 6: Percentage Distribution of Age/Sex of Respondents**

Source: Author's Field Survey, (2020)

**7.2: Causes of Flooding in Obio/Akpor LGA**

Table 4 shows the likely causes of flooding in the study areas. Respondents were asked to state the most likely cause of flooding in their settlements. The modal cause opined by respondents was “No drainage facility”, accounting for 44.2% of the distribution. The next most likely cause was “Blockage of waterways”, accounting for 25.8%. Other likely causes of flooding stated by respondents were “rise in sea levels” and “absence of large canals”.

**Table 4: Causes of Flooding**

| S/N          | Cause                      | N          | %          |
|--------------|----------------------------|------------|------------|
| 1            | No drainage facility       | 171        | 44.2       |
| 2            | Blockage of waterways      | 100        | 25.8       |
| 3            | The area is low-lying      | 47         | 12.1       |
| 4            | Excessive rainfall         | 59         | 15.2       |
| 5            | Inadequate drains          | 8          | 2.1        |
| 6            | Wrong channelling of water | 2          | 0.5        |
| <b>Total</b> |                            | <b>387</b> | <b>100</b> |

Source: Author’s Field Survey, (2020)

Respondents were asked if they suffered losses during flooding. The modal answer was “No” accounting for 59.1%. Those who said they suffered loss accounted for 40.9% of the distribution.

Furthermore, respondents were asked to state what kind of losses they suffered. Table 5 presents their responses. The modal response for the first, second and third mentions were, “Household Items” (47.9%), “Car Damage” (25.8%) and “Business Decline” (22.6%).

**Table 5: Percentage Distribution of Type of Losses Suffered in the Settlement**

| S/N | Type            | First Mentions |      | Second Mentions |      | Third Mentions |     |
|-----|-----------------|----------------|------|-----------------|------|----------------|-----|
|     |                 | N              | %    | N               | %    | N              | %   |
| 1   | Household Items | 70             | 47.9 | 8               | 12.9 | 1              | 3.2 |

|              |                                 |            |            |           |            |           |            |
|--------------|---------------------------------|------------|------------|-----------|------------|-----------|------------|
| 2            | Car damage                      | 15         | 10.3       | 16        | 25.8       | 2         | 6.5        |
| 3            | Electronics                     | 11         | 7.5        | 8         | 12.9       | 5         | 16.1       |
| 4            | Personal Effects                | 16         | 11.0       | 13        | 21.0       | 6         | 19.4       |
| 5            | Money                           | 15         | 10.3       | 4         | 6.5        | 1         | 3.2        |
| 6            | Tenants relocating              | 0          | 0          | 4         | 6.5        | 3         | 9.7        |
| 7            | Business decline                | 7          | 4.8        | 5         | 8.1        | 7         | 22.6       |
| 8            | Building                        | 2          | 1.4        | 1         | 1.6        | 3         | 9.7        |
| 9            | Clothes damaged due to dampness | 1          | 0.7        | 0         | 0          | 2         | 6.5        |
| 10           | Crops                           | 1          | 0.7        | 0         | 0          | 0         | 0          |
| 11           | Livestock                       | 1          | 0.7        | 0         | 0          | 0         | 0          |
| 12           | Food Items                      | 1          | 0.7        | 1         | 1.6        | 1         | 3.2        |
| 13           | Agricultural loss               | 3          | 2.1        | 2         | 3.2        | 0         | 0          |
| 14           | Documents/stationaries          | 2          | 1.4        | 0         | 0          | 0         | 0          |
| 15           | Furniture                       | 1          | 0.7        | 0         | 0          | 0         | 0          |
| <b>Total</b> |                                 | <b>146</b> | <b>100</b> | <b>62</b> | <b>100</b> | <b>31</b> | <b>100</b> |

Source: Author’s Field Survey, (2020)

### 7.3: Assistance received During Flooding Events

Respondents were asked if they received any assistance from any agency during flooding. The modal response was “Churches” and “NGOs”, representing 56% and 19.3%, respectively. Table 6 shows the distribution.

**Table 6: Agency that Assisted During Flooding**

| S/N | Agency             | N  | %   |
|-----|--------------------|----|-----|
| 1   | Federal Government | 5  | 4.6 |
| 2   | State Government   | 10 | 9.2 |
| 3   | Local Government   | 3  | 2.8 |

|              |                         |            |            |
|--------------|-------------------------|------------|------------|
| 4            | Multinational Companies | 1          | 0.9        |
| 5            | NGOs                    | 21         | 19.3       |
| 6            | Private Firms           | 8          | 7.3        |
| 7            | Churches                | 61         | 56.0       |
| <b>Total</b> |                         | <b>243</b> | <b>100</b> |

Source: Author’s Field Survey, ( 2020)

**7.4: Monetary cost of 2019 flood Damage**

Attempt was made to quantify the actual damages suffered by respondents in monetary terms in the six communities studied. The inventory of items lost during the 2019 flood in all the communities in the study area was made. Attempt was made to estimate their cost price of each using current price for each item (appendix 1). From the calculations, the cost of damages suffered by residents in the 2019 flood amounted to two billion, five hundred and nine million, seven hundred and twenty nine thousand Naira ( ₦2,509,729,000) during 2019 flood.

**7.5: Flood Impact and Desire to Relocate**

To statistically determine there is significant relationship between individual personal characteristics such as Sex of Respondents, marital status, income, age bracket and length of stay (independent variable) and desire to relocate (dependent variable), the Multiple Classification Analysis (MCA) was carried out and the results is as shown in table 7. From the table, the combined explanation provided by all the factors to desire to relocate is  $R^2 = 4.059\%$ . On a factor by factor basis, sex of respondents (0.472063) was identified as most important factor that induces residents desire to relocate from flood prone areas.

What can be gleaned from the result of our analysis made above is the fact that the presence of more males (65%) and married population (married 54.4%) in the study make movement by way of relocation a difficult task. Decision to move among the male gender with families is not usually made in a hurry as it involves more logistics to effect compared to the single households.

**Table 7: Predicting Desire to Relocate Using Perception of Flood Effects  
 (Multiple Classification Analysis, N=389)**

| Predictors | Eta | Beta |
|------------|-----|------|
|            |     |      |

|                                       |          |           |
|---------------------------------------|----------|-----------|
| Sex of Respondents                    | 0.371880 | 0.472063* |
| Marital Status                        | 0.150254 | 0.194098  |
| Income                                | 0.140131 | 0.180070  |
| Length of Stay                        | 0.165482 | 0.159187  |
| Age Bracket                           | 0.114584 | 0.145100  |
| Variance Explained ( $R^2$ ) = 4.059% |          |           |

\* Most important predictor

Source: Author's Field Survey, (2020)

## 8. Conclusion and Recommendations

Flooding in urban areas constitutes a major public health emergency. Rapid urbanization and pressure on land in the study area has led to extension of development even in areas that are flood prone. The matter is made worse given the uncoordinated nature of these development that further heightens the problem of flooding with attendant negative consequences. In the absence of coordinated response to flooding, reactions to flood incidence either at the central or state level has been so much reactive in the form of provision of relief materials to victims in some cases. The research found that the 2019 flood impacted on residents' sources of livelihood leading to impoverishment and relocation for some. The estimated monetary cost of the 2019 flood for communities studied was over Two Billion Naira. Lack of drainage facilities, blockage of water ways and heavy rains are the primary causes of flooding incidences in the study area.

Given the negative impacts of flooding on residents, it was observed that victims of flood are unwilling to relocate to safe areas. The reason may not be unconnected to the very high cost of land and harsh economic realities in the area. All these make relocation to non-flood areas difficult.

The study recommends both structural and non-structural methods of flood management to deal with annual flooding in the area. There should be construction of concrete drainage channels in Obio/Akpor so as to channel waters into the natural drains such as New Calabar River and the Bight of Bonny.

Further study is required to identify all buildings in core flood plains by relevant government agencies with a view to carrying out demolition exercise after property owners have been duly compensated. Strict enforcement of development control measures is also needed to ensure that buildings, once demolished are not re-erected in the flood plains. This will reduce the impact of flood incidence and usher a new lease of life for residents in the area.

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## APPENDIX 1

### COST OF DAMAGES SUFFERED BY RESPONDENTS IN MONETARY TERMS (ESTIMATED)

| H/H No | Type of Damage       | Extent of Damage | Unit Cost(₦) |
|--------|----------------------|------------------|--------------|
| 1      | Cracked walls        | 12sqm            | 24,000       |
|        | Painting/wall papers | 12sqm            | 12,000       |

|    |                                    |                  |             |
|----|------------------------------------|------------------|-------------|
| 2  | Cracked walls                      | 9sqm             | 18,000      |
|    | Personal belongings (Clothes etc.) | 5 shirts         | 15,000      |
| 3  | Cracked walls                      | 16sqm            | 32,000      |
|    | Painting/wall papers               | 16sqm            | 16,000      |
| 4  | Cracked walls                      | 32sqm            | 64,000      |
|    | Painting/wall papers               | 32sqm            | 32,000      |
| 5  | Vehicle damage                     | Exhaust pipe     | 20,000      |
| 6  | Cracked walls                      | 24sqm            | 48,000      |
|    | Personal belongings (Clothes etc.) | 6 dresses        | 24,000      |
|    | Painting/wall papers               | 24sqm            | 24,000      |
|    | Cleaning                           | 120sqm           | 36,000      |
| 7  | Vehicle damage                     | 4 tyres          | 60,000      |
| 8  | Cracked walls                      | 24sqm            | 48,000      |
|    | Road Damage                        | 1 km             | 400,000,000 |
| 9  | Cracked walls                      | 36sqm            | 72,000      |
|    | Painting/wall papers               | 36sqm            | 36,000      |
| 10 | Vehicle damage                     | Shaft            | 20,000      |
| 11 | Livestock                          | 30 birds         | 90,000      |
| 12 | Cracked walls                      | 30sqm            | 60,000      |
|    | Painting/wall papers               | 30sqm            | 30,000      |
| 13 | Cracked walls                      | 42sqm            | 82,000      |
|    | Road Damage                        | 1 km             | 400,000,000 |
| 14 | Cracked walls                      | 26sqm            | 52,000      |
|    | Personal belongings (Clothes etc.) | 3 pairs of shoes | 12,000      |
| 15 | Cracked walls                      | 42sqm            | 84,000      |
| 16 | Cracked walls                      | 30sqm            | 60,000      |
|    | Painting/wall papers               | 30sqm            | 30,000      |
| 17 | Vehicle damage                     | 2 tyre           | 30,000      |
| 18 | Cracked walls                      | 40sqm            | 80,000      |
| 19 | Cracked walls                      | 32sqm            | 64,000      |
|    | Painting/wall papers               | 32sqm            | 32,000      |
| 20 | Cracked walls                      | 56sqm            | 112,000     |

|    |                                    |                        |                 |
|----|------------------------------------|------------------------|-----------------|
|    | Personal belongings (Clothes etc.) | 3 trousers             | 9,000           |
| 21 | Livestock                          | 20 birds               | 60,000          |
|    | Road Damage                        | 1.5 km                 | 600,000,000     |
| 22 | Cracked walls                      | 36sqm                  | 72,000          |
| 23 | Vehicle damage                     | Exhaust pipe           | 20,000          |
| 24 | Livestock                          | 35 birds               | 105,000         |
| 25 | Cracked walls                      | 62sqm                  | 124,000         |
| 26 | Painting/wall papers               | 52sqm                  | 104,000         |
| 27 | Cracked walls                      | 48sqm                  | 96,000          |
| 28 | Cracked walls                      | 52sqm                  | 104,000         |
|    | Personal belongings (Clothes etc.) | 2 shirts<br>4 trousers | 6,000<br>12,000 |
| 29 | Painting/wall papers               | 82sqm                  | 82,000          |
| 30 | Cracked walls                      | 42sqm                  | 84,000          |
| 31 | Personal belongings (Clothes etc.) | 15 children clothes    | 30,000          |
|    | Painting/wall papers               | 46sqm                  | 46,000          |
| 32 | Cracked walls                      | 102sqm                 | 204,000         |
| 33 | Cracked walls                      | 82sqm                  | 164,000         |
| 34 | Vehicle damage                     | ½ engine               | 200,000         |
|    | Road Damage                        | 2 km                   | 800,000         |
| 35 | Cracked walls                      | 60sqm                  | 120,000         |
|    | Painting/wall papers               | 60sqm                  | 60,000          |
| 36 | Livestock                          | 52 birds               | 156,000         |
|    | Painting/wall papers               | 46sqm                  | 46,000          |
| 38 | Personal belongings (Clothes etc.) | 2 shoes<br>5 dresses   | 6,000<br>20,000 |
|    | Livestock                          | 18 birds               | 54,000          |
| 39 | Livestock                          | 18 birds               | 54,000          |
|    | Painting/wall papers               | 56sqm                  | 56,000          |
| 40 | Personal belongings (Clothes etc.) | 6 dresses              | 18,000          |
|    | Painting/wall papers               | 78sqm                  | 78,000          |
| 41 | Vehicle damage                     | Exhaust pipe           | 20,000          |
|    |                                    | 4 tyres                | 60,000          |

|    |                                    |                      |         |
|----|------------------------------------|----------------------|---------|
| 42 | Floor tiles/floor damage           | 52sqm                | 208,000 |
| 43 | Livestock                          | 52 birds             | 156,000 |
| 44 | Floor tiles/floor damage           | 68sqm                | 272,000 |
| 45 | Personal belongings (Clothes etc.) | 6 shirts             | 18,000  |
|    |                                    | 2 trousers           | 6,000   |
|    |                                    | 2 shoes              | 8,000   |
|    | Farm/Crops                         | Crops on 900sqm      | 450,000 |
| 46 | Electronics                        | 32" LG TV            | 70,000  |
|    | Septic tank collapse               | 18m <sup>3</sup>     | 180,000 |
| 47 | Personal belongings (Clothes etc.) | 4 shirts             | 12,000  |
|    |                                    | 6 dresses            | 18,000  |
|    | Floor tiles/floor damage           | 42sqm                | 168,000 |
| 48 | Electronics                        | LG sound system      | 80,000  |
| 49 | Electronics                        | Samsung sound system | 80,000  |
| 50 | Personal belongings (Clothes etc.) | 3 shirts             | 9,000   |
|    |                                    | 2 shoes              | 8,000   |
|    | Floor tiles/floor damage           | 32sqm                | 128,000 |
| 51 | Electronics                        | 43" Hisense TV       | 120,000 |
| 52 | Cracked walls                      | 62sqm                | 124,000 |
|    | Farm/Crops                         | Crops on 450sqm      | 225,000 |
| 53 | Vehicle damage                     | 4 tyre               | 60,000  |
| 54 | Electronics                        | 32" LG TV            | 70,000  |
|    | Floor tiles/floor damage           | 62sqm                | 248,000 |
| 55 | Electronics                        | 32" LG TV            | 70,000  |
|    |                                    | LG sound system      | 80,000  |
| 56 | Electronics                        | HP laptop            | 120,000 |
| 57 | Electronics                        | Samsung TV 32"       | 70,000  |
|    | Floor tiles/floor damage           | 46sqm                | 184,000 |
| 58 | Electronics                        | 32" TV               | 70,000  |
| 59 | Personal belongings (Clothes etc.) | 2 shoes              | 8,000   |
|    |                                    | 3 dresses            | 9,000   |
| 60 | Electronics                        | 43" TV               | 120,000 |

|    |                                    |                        |             |
|----|------------------------------------|------------------------|-------------|
| 61 | Electronics                        | 32" TV                 | 70,000      |
|    |                                    | Sound system           | 80,000      |
| 62 | Floor tiles/floor damage           | 68sqm                  | 272,000     |
|    | Septic tank collapse               | 36m <sup>3</sup>       | 360,000     |
| 63 | Electronics                        | 43" TV                 | 120,000     |
| 64 | Floor tiles/floor damage           | 56sqm                  | 124,000     |
| 65 | Cracked walls                      | 102sqm                 | 204,000     |
| 66 | Electronics                        | 32" TV                 | 70,000      |
| 67 | Cracked walls                      | 82sqm                  | 164,000     |
|    | Floor tiles/floor damage           | 46sqm                  | 184,000     |
| 68 | Electronics                        | 32" TV                 | 70,000      |
| 69 | Electronics                        | 43" TV                 | 120,000     |
| 70 | Electronics                        | 32" TV                 | 70,000      |
|    |                                    | Sound system           | 80,000      |
| 72 | Cracked walls                      | 74sqm                  | 148,000     |
| 73 | Electronics                        | 32" TV                 | 70,000      |
| 74 | Floor tiles/floor damage           | 68sqm                  | 272,000     |
| 75 | Cracked walls                      | 108sqm                 | 216,000     |
|    | Road Damage                        | 1.8km                  | 720,000,000 |
| 76 | Electronics                        | Infinix8 S5 phone      | 60,000      |
| 79 | Cracked walls                      | 42sqm                  | 84,000      |
|    | Farm/Crops                         | Crops on 450sqmOf land | 225,000     |
| 80 | Personal belongings (Clothes etc.) | 8 children clothes     | 16,000      |
|    | Farm/Crops                         | Crops on 900sqm land   | 450,000     |
| 81 | Cracked walls                      | 48sqm                  | 96,000      |
|    | Floor tiles/floor damage           | 26sqm                  | 104,000     |
|    | Farm/Crops                         | Crops on 450sqm land   | 225,000     |
| 82 | Personal belongings (Clothes etc.) | 3 dresses              | 9,000       |
|    |                                    | 2 shoes                | 8,000       |
| 83 | Cracked walls                      | 72sqm                  | 144,000     |
|    | Farm/Crops                         | Crops on 900sqm land   | 450,000     |
| 84 | Electronics                        | 32" TV                 | 70,000      |

|                   |                                    |                          |             |
|-------------------|------------------------------------|--------------------------|-------------|
| 85                | Electronics                        | Itel P6 phone            | 35,000      |
| 86                | Cracked walls                      | 46sqm                    | 92,000      |
|                   | Shop and goods                     | 2 bags of rice           | 36,000      |
|                   |                                    | 1 bag of beans           | 50,000      |
| 6 basins of garri |                                    | 30,000                   |             |
| 87                | Electronics                        | HP laptop                | 120,000     |
|                   | Floor tiles/floor damage           | 42sqm                    | 168,000     |
| 88                | Cracked walls                      | 54sqm                    | 108,000     |
|                   | Farm/Crops                         | Crops on 120sqm land     | 600,000     |
| 89                | Personal belongings (Clothes etc.) | Rolex watch              | 6,000       |
|                   |                                    | 2 shirts                 | 6,000       |
|                   |                                    | 1 trousers               | 3,000       |
|                   | Floor tiles/floor damage           | 62sqm                    | 248,000     |
|                   | Farm/Crops                         | Crops 450sqm land        | 225,000     |
|                   | Evacuation                         | To and Fro               | 40,000      |
| 90                | Electronics                        | 32" TV                   | 70,000      |
| 91                | Cracked walls                      | 96sqm                    | 192,000     |
|                   | Farm/Crops                         | Crops on 900sqm land     | 450,000     |
| 92                | Electronics                        | 32" TV                   | 70,000      |
| 93                | Cracked walls                      | 42sqm                    | 84,000      |
|                   | Floor tiles/floor damage           | 28sqm                    | 112,000     |
|                   | Furniture                          | Set of upholstery chairs | 300,000     |
| 94                | Electronics                        | 43" TV                   | 120,000     |
| 95                | Electronics                        | 32" TV                   | 70,000      |
|                   | Furniture                          | Waldrope                 | 50,000      |
| 96                | Cracked walls                      | 64sqm                    | 128,000     |
|                   | Floor tiles/floor damage           | 42sqm                    | 168,000     |
|                   | Road Damage                        | 1.2km                    | 480,000,000 |
| 97                | Cracked walls                      | 68sqm                    | 136,000     |
|                   | Farm/Crops                         | Crops on 450sqm land     | 225,000     |
| 98                | Electronics                        | 32" TV                   | 70,000      |
| 99                | Electronics                        | 43" TV                   | 120,000     |

|          |                          |                             |         |
|----------|--------------------------|-----------------------------|---------|
| 100      | Cracked walls            | 96sqm                       | 192,000 |
|          | Farm/Crops               | Crops on 600sqm land        | 300,000 |
| 101      | Electronics              | 32" TV                      | 70,000  |
|          | Evacuation               | To and Fro                  | 40,000  |
| 102      | Electronics              | To and Fro                  | 40,000  |
|          | Shop and goods           | Biscuit & Indomie (Cartons) | 10,000  |
| 103      | Cracked walls            | 94sqm                       | 188,000 |
|          | Floor tiles/floor damage | 54sqm                       | 216,000 |
| 104      | Cracked walls            | 78sqm                       | 156,000 |
|          | Floor tiles/floor damage | 42sqm                       | 164,000 |
| 105      | Electronics              | 32" TV                      | 70,000  |
| 106      | Electronics              | 43" TV                      | 120,000 |
|          | Fence                    | 36sqm                       | 72,000  |
| 107      | Cracked walls            | 64sqm                       | 128,000 |
|          | Floor tiles/floor damage | 36sqm                       | 144,000 |
|          | Evacuation               | To and fro                  | 40,000  |
| 108      | Electronics              | 43" TV                      | 120,000 |
| 109      | Shop and goods           | 4 bags of rice              | 144,000 |
|          |                          | 1 bag of beans              | 50,000  |
|          |                          | 5 basins of garri           | 25,000  |
| 110      | Cracked walls            | 52sqm                       | 104,000 |
|          | Farm/Crops               | Crops on 750sqm of land     | 360,000 |
| 111      | Electronics              | 43" TV                      | 120,000 |
| 112      | Floor tiles/floor damage | 24sqm                       | 96,000  |
| 113      | Farm/Crops               | Crops on 900sqm of land     | 450,000 |
| 114      | Electronics              | 32" TV                      | 70,000  |
| 115      | Floor tiles/floor damage | 54sqm                       | 216,000 |
| 116      | Cracked walls            | 68sqm                       | 136,000 |
|          | Shop and goods           | 30 shirts                   | 90,000  |
|          |                          | 20 trousers                 | 60,000  |
|          | Evacuation               | To and fro                  | 40,000  |
| Cleaning | 2 bedroom flat           | 10,000                      |         |

|     |                          |                                   |                  |
|-----|--------------------------|-----------------------------------|------------------|
| 117 | Electronics              | 32" TV                            | 70,000           |
|     | Books                    | 5 textbooks                       | 10,000           |
| 118 | Cracked walls            | 45sqm                             | 90,000           |
|     | Shop and goods           | 2 bags of rice<br>1 bag of beans  | 72,000<br>50,000 |
| 119 | Electronics              | 32" TV                            | 70,000           |
| 120 | Cracked walls            | 32sqm                             | 64,000           |
| 121 | Floor tiles/floor damage | 34sqm                             | 128,000          |
|     | Shop and goods           | Goods worth 100,000               | 100,000          |
| 122 | Cracked walls            | 36sqm                             | 72,000           |
|     | Food stuff               | ½ bag of rice<br>1 basin of garri | 18,000<br>5,000  |
| 123 | Vehicle damage           | 4 tyres                           | 60,000           |
| 124 | Floor tiles/floor damage | 46sqm                             | 184,000          |
| 125 | Cracked walls            | 62sqm                             | 124,000          |
| 126 | Floor tiles/floor damage | 42sqm                             | 168,000          |
| 127 | Cracked walls            | 54sqm                             | 108,000          |
|     | Shop and goods           | Goods worth 80,000                | 80,000           |
| 128 | Borehole System damage   | 1.5HP sumo                        | 40,000           |
| 129 | Cracked walls            | 42sqm                             | 84,000           |
|     | Painting/wall papers     | 42sqm                             | 42,000           |
|     | Shop and goods           | Goods worth 75,000                | 75,000           |
|     | Evacuation               | To and Fro                        | 40,000           |
| 130 | Cracked walls            | 46sqm                             | 92,000           |
|     | Farm/Crops               | Crops on 450sqm                   | 225,000          |
| 131 | Borehole System damage   | 2HP sumo                          | 50,000           |
| 132 | Vehicle damage           | 4 tyres                           | 60,000           |
|     |                          | Exhaust pipe                      | 20,000           |
| 133 | Cracked walls            | 46sqm                             | 92,000           |
|     | Furniture                | Waldrope                          | 50,000           |
| 134 | Cracked walls            | 82sqm                             | 164,000          |
|     | Painting/wall papers     | 82sqm                             | 82,000           |

|            |                                    |                      |         |
|------------|------------------------------------|----------------------|---------|
| 135        | Borehole System damage             | 1.5 HP sumo          | 40,000  |
| 136        | Cracked walls                      | 64sqm                | 108,000 |
|            | Books                              | 8 textbooks          | 16,000  |
| 137        | Cracked walls                      | 62sqm                | 124,000 |
|            | Farm/Crops                         | Crops on 600sqm land | 300,000 |
| 138        | Cracked walls                      | 58sqm                | 116,000 |
|            | Painting/wall papers               | 58sqm                | 58,000  |
| 139        | Road Damage                        | 1.2km                | 560,000 |
| 140        | Cracked walls                      | 54sqm                | 108,000 |
| 141        | Electronics                        | 32" TV               | 70,000  |
| 142        | Cracked walls                      | 58sqm                | 116,000 |
| 143        | Vehicle damage                     | 4 tyres              | 60,000  |
|            | Furniture                          | Upholstery set       | 250,000 |
| 144        | Cracked walls                      | 72sqm                | 144,000 |
|            | Farm/Crops                         | Crops on 900sqm land | 450,000 |
| 145        | Cracked walls                      | 62sqm                | 124,000 |
|            | Painting/wall papers               | 62sqm                | 62,000  |
|            | Food stuff                         | 1 bag of rice        | 36,000  |
|            |                                    | 4 rubbers of rice    | 4,000   |
|            |                                    | 1 basin of garri     | 5,000   |
| Evacuation | To and Fro                         | 40,000               |         |
| 146        | Personal belongings (Clothes etc.) | 2 shirts             | 6,000   |
|            | Electronics                        | 32" TV               | 70,000  |
| 147        | Cracked walls                      | 92sqm                | 184,000 |
|            | Farm/Crops                         | Crops on 600sqm land | 300,000 |
| 148        | Cracked walls                      | 74sqm                | 148,000 |
|            | Electronics                        | 32" TV               | 70,000  |
| 149        | Borehole System damage             | 1HP sumo             | 35,000  |
| 150        | Cracked walls                      | 48sqm                | 96,000  |
|            | Electronics                        | 32" TV               | 70,000  |
| 151        | Borehole System damage             | 1HP sumo             | 35,000  |
| 152        | Cracked walls                      | 54sqm                | 108,000 |

|                   |                      |                              |                      |
|-------------------|----------------------|------------------------------|----------------------|
|                   | Painting/wall papers | 54sqm                        | 54,000               |
|                   | Food stuff           | 2 rubbers of rice            | 4,000                |
|                   |                      | 2 rubbers of beans           | 2,000                |
|                   |                      | 1 basin of garri             | 5,000                |
|                   | Furniture            | Upholstery set               | 250,000              |
| 153               | Cracked walls        | 62sqm                        | 124,000              |
|                   | Painting/wall papers | 62sqm                        | 62,000               |
|                   | Farm/Crops           | Crops on 450sqm land         | 225,000              |
| 154               | Cracked walls        | 94sqm                        | 188,000              |
|                   | Painting/wall papers | 94sqm                        | 94,000               |
| 155               | Vehicle damage       | Crown shaft (Toyota corolla) | 40,000               |
|                   | Furniture            | Set of upholstery chair      | 250,000              |
| 156               | Cracked walls        | 82sqm                        | 164,000              |
|                   | Electronics          | 32" TV                       | 70,000               |
| 157               | Vehicle damage       | 4 tyres                      | 60,000               |
|                   | Painting/wall papers | 72sqm                        | 72,000               |
| 158               | Cracked walls        | 86sqm                        | 172,000              |
|                   | Painting/wall papers | 86sqm                        | 86,000               |
|                   | Food stuff           | 2 rubbers of rice            | 4,000                |
| 1 rubber of beans |                      | 1,000                        |                      |
| 1 basin of garri  |                      | 5,000                        |                      |
| 159               | Road Damage          | 1.6km                        | 640,000,000          |
|                   | <b>Total</b>         |                              | <b>2,509,729,000</b> |

(Source: Author's Field Survey, June 2020)

# Profile of Students Metacognitive Skills in The Perspective of Gender

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**Abstract-** This study aims to investigate the potential gender differences regarding the metacognitive skills of biology education students. The subject of this research is student of class 2016 Departement of Biology Education of IKIP Budi Utomo Malang, Indonesia. This research is an ex post facto research with data analysis using descriptive and inferential approach. Descriptive approach is used to describe the level of metacognitive skills of male and female students, whereas the inferential approach is used to see the difference of metacognitive skills of male and female students. The result of this research are: (1) Level of metacognitive skills of male students in Department of Biology Education 43,71 while the level of metacognitive skills of female students in Department of Biology Education 42,67;(2) There is no significant difference between metacognitive skills of male students and female students in Department of Biology Education, and (3) metacognitive skills of male students better than metacognitive skills of female students in Department of Biology Education.

**Index Terms-** metacognitive, gender, genetic concept

## I. INTRODUCTION

Livingston [1] states that metacognition is a high-level thinking that involves active control of the cognitive processes involved in learning activities. Furthermore, Howard [2] states that metacognition refers to one's knowledge of the processes and products of one's own cognition. Metacognitive skills is the ability to associate important information or messages with prior knowledge and monitor personal abilities in the reading process [3]. Based on this statement, it can be concluded that if students have sufficient metacognitive skills, students will be able to easily control the learning process. Metacognitive skills is very important in learning and are a determinant of academic success. Setiawan and Supiandi [4] research showed that metacognitive skills and reasoning skills are important predictors for making successful learning.

Metacognitive skills is necessary for successful learning. Peters [5] argues that metacognitive skills enable students to develop as independent learners, because they encourage them to become managers of themselves and become assessors of their own thinking and learning [6]. Metacognition, one of the dimensions of self-regulated learning, is defined as one's ability to use skills to understand and monitor one's cognitive processes [7]. Metacognition enables learners to evaluate and adapt their learning strategies based on awareness over how they learn most effectively. In order to effectively use metacognition, individuals must be aware of their own cognition in order to regulate and adapt in a way that is effective for learning [8].

Pintrich [9] states that metacognition involves the ability to actively control a variety of cognitive processes. Though, in order to be able to control one's own learning, students have to focus on several components of metacognition [10]. Flavell [11] states that the metacognitive components that underlie the ability to control cognitive processes during learning are: metacognitive knowledge, metacognitive experiences and metacognitive skills. Metacognitive knowledge encompasses knowledge or beliefs about tasks, strategies and goals. Metacognitive experiences comprise the affective experience that accompanies a cognitive process and metacognitive skills involve the voluntary use of specific strategies for controlling cognitive processes [10].

There are some factors that can affect students metacognitive skills, one of the factor is gender. Although there are many studies concerned with gender differences in metacognition and self-regulation skills, the findings are unsettled [10]. For example Niemivirta [12] reported that male students use more superficial learning strategies than females and on other hand Bidjerano [13] indicated that girls use much more often than boys on self-monitoring, goal setting and planning. Research indicates that the self-perception of academic ability in mathematics and science tend to be lower in the case of females, and this tendency appears to reach its highest point during adolescence [14]. Nonetheless, Zimmermann and Martinez-Pons [15], and recently Zhu [16] reported that there are no significant differences between boys and girls regarding mathematics self-efficacy [10].

Ciascai *et al.* [10] states that previous research has shown inconsistent results regarding these differences rely on metacognitive skills between male and female. Some research showed that there were differences regarding boys and girls metacognitive skills, while others suggest that the difference is not significant. However, steady research is still needed since the findings of the study can

be used in educational practice. Considering the inconsistent findings on gender differences in metacognitive skills, this study was to describe the differences of metacognitive skills of male and female biology education students in understanding the genetic concept. In fact, the empowerment of metacognitive skills was still get very little attention in the learning process. In the learning process at IKIP Budi Utomo Malang, metacognitive skills have not yet been developed due to a lack of knowledge about these metacognitive skills. In the learning process students have not been able to monitor, evaluate and control the learning activities carried out. Students have not thought for themselves how to learn well so they can achieve the expected goals. So this research want to describe the differences of metacognitive skills of male and female biology education students in understanding the genetic concepts.

## II. RESEARCH METHOD

The subject of this research is student of class of 2016 Department of Biology Education of IKIP Budi Utomo, Malang Indonesia. There are 64 students of biology education consisting of 39 women and 25 men. This research is an ex post facto research with data analysis using descriptive and inferential approach. A descriptive approach is used to describe the level of metacognitive skills of male and female students in the Department of Biology Education, whereas the inferential approach is used to see the difference of metacognition skills of male and female students in the Department of Biology Education.

Data on metacognitive skills are measured by giving written tests in the form of essays that integrated with tests of cognitive learning outcomes. Scoring of metacognitive skills was obtained from the special scoring rubric of metacognitive skills developed by Corebima [17].

Data that has been obtained before analyzed was carried out prerequisite test first. This test was conducted to see the distribution of the data that has been obtained which was normally distributed and homogeneous or not. The prerequisite tests used were the normality test and variance homogeneity test. Normality test used the Shapiro-Wilk Test. The Shapiro-Wilk Test was used to test the level of normal distribution and test the difference in mean values. Test variant homogeneity using Levene's Test of Equality of Error Variances.

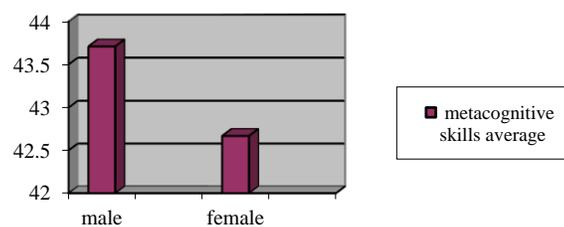
The results of the research data were then analyzed using t-test analysis with the help of the SPSS program for windows 16.00. The significance of the data analyzed was based on the following.

1. If the significance value was  $> 0.05$ , the null hypothesis was accepted, and the research hypothesis was rejected
2. If the significance value was  $< 0.05$ , the null hypothesis was rejected and the research hypothesis was accepted

## III. RESULT AND DISCUSSION

The results of measuring the average score of metacognitive skills of male and female students showed different results. The average of metacognitive skills value of male student is 43.71. The average of metacognitive skills value of female is 42.67. The results of the study can be seen in Chart 1.

**Chart 1**  
**The Average of Metacognitive Skills Score**



**Table 1**  
**Total Partisipants**

|                      | Gender | N  | Mean    | Std. Deviation | Std. Error Mean |
|----------------------|--------|----|---------|----------------|-----------------|
| Metacognitive_Skills | male   | 25 | 43,7144 | 13,87232       | 2,77446         |
|                      | female | 39 | 42,6736 | 14,86646       | 2,38054         |

**Table 2**  
**The Result of Independent Samples Test**

|   |                               | Metacognitive Skills    |                             |
|---|-------------------------------|-------------------------|-----------------------------|
|   |                               | Equal variances assumed | Equal variances not assumed |
| Levene's Test for Equality of Variances<br>t-test for Equality of Means | F                             | ,000                    |                             |
|   | Sig.                          | ,989                    |                             |
|   | t                             | ,280                    | ,285                        |
|   | df                            | 62                      | 53,896                      |
|   | Sig. (2-tailed)               | ,780                    | ,777                        |
|   | Mean Difference               | 1,04081                 | 1,04081                     |
|   | Std. Error Difference         | 3,71234                 | 3,65577                     |
|   | 95% Confidence Lower Interval | -6,38005                | -6,28888                    |
|   | Of the Difference Upper       | 8,46168                 | 8,37050                     |

The homogeneity of variance test for male and female metacognitive skills data result presented that metacognitive skills have a constant significance level by 0.989 at the 0.05 significance level. It means that the data of male and female metacognitive skills is homogeneous. Based on the results of data analysis, there is no difference in final metacognitive skills between male and female students. That is indicated by a significance value of 0.780 or more than 0.05 so that the null hypothesis was accepted and the research hypothesis was rejected. This means that there was no difference in metacognitive skills between male and female students. From Chart 1 known that the metacognitive skills better on male student than female student. This research was in line with previous research by Niemivirta [12] that reported boys use more superficial learning strategies than girls [8].

The results showed that there is no difference in metacognitive skills between male and female students in understanding the genetic concepts. This findings is in line with Özsoy and Günindi [18] research. Özsoy and Günindi explored the prospective preschool teachers' metacognitive awareness and its relation in terms of gender, grade, and the types of high school they have graduated. The results argued that there was no significant difference between females and males in their metacognitive awareness.

Yenilmez *et al.* [19] research on Biology achievement that study about the role of gender in the use of metacognitive awareness reading strategies among biology students. In that study most of the students apply problem-solving strategies compared to the other metacognitive reading strategies, but there was no significant difference between males and females. Furthermore, Kamid [20] stated that there was not any difference in metacognition ability between male and female students when completing a task [21].

Past research on gender differences in metacognition and self-regulation has been generally inconsistent, Bidjerano [13] and Zimmerman and Martinez-Pons [14] reported that girls use self-monitoring, goal setting, and planning more often than boys [8]. Gender and equity in science education have been reviewed since 1971. By 1990s, researchers interested to create a school environment in which girl-friendly instructional strategies, topics, and curriculum would be implemented. Researchers started to investigate the relationship among gender, race, ethnicity, economic status, and religion. After 2001 researchers started to investigate gender and urban issues. Historical understanding of gender studies indicated a very important issue for researchers. In this understanding, it was clear that gender issue had been investigated in relationship with other variables such as cognitive abilities, attitudinal variables, sociocultural variables, and home-family variables [22]. It was indicated that females and males develop their understanding about different aspects of science teaching and learning under the influence of those variables. That is to say, gender differences show heterogeneous findings across different variables [23].

Furthermore, another acceptable explanation for this finding is that the students' metacognitive skills tends to develop over time. The metacognitive skills developed over pre test to post test time. A bulk of research asserts that metacognitive growth is an ongoing developmental procedure. Kuhn maintains that metacognition should be conceptualized in a developmental framework [21].

La Misu and La Masi [24] said that experts have sought to explain the attributes that contribute to gender differences in learning and mathematical achievement. Leder [25] and Spencer *et al.* [26] stated that the difference was due to the socialization of gender roles and the threat of stereotypes of each sex. It was generally understood that the various factors that link gender differences in mathematics learning are enormous because they include: educational opportunities, teaching styles, influences and social values, the way men and women socialize places, social environments, student reactions to cultural contexts which was faster in learning.

In other hand, Anderson *et al.*, [27] suggested that it is difficult to assess metacognition skills using simple paper measurements (paper and pencil measure). Preferably objectives related to metacognition knowledge can be tested in the context of classroom activities and discussions of varying strategies. One of the fundamental problems in learning the field of metacognition was to develop and use the right tasks to measure metacognition ability. This was because assessing metacognition ability means assessing metacognition

knowledge and experience or setting metacognition (control and evaluation). According to Panaoura [28], one common approach to measuring metacognition ability is to ask students directly about what they know or do. To assess students' metacognition control, they are asked to voice their thoughts (think aloud) about what to do and think about in solving problems. Some aspects of metacognition can be developed with metacognition strategies such as problem solving in pairs (pair problem solving). In learning process student talks about the problem by describing the thought process, the partner hears and asks to help clarify his thoughts. Therefore, metacognition is a dimension of knowledge that emphasizes the role of students in solving problems, where students are required to think systematically in solving problems independently [29].

#### IV. CONCLUSION

Based on the results of the research it can be concluded that: First, there is no differences in metacognitive skill between male and female students. Second, the metacognitive skills better on male student than female student

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# Factors Influencing Procurement And Utilization Of Essential Drugs At Primary Health Care Centres In Shira Local Government Area Of Bauchi State

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**Abstract-** Access to essential drugs is very vital to the good performance of the health care delivery system all over the world. The procurement of safe, effective and affordable essential drugs of good quality in the right quantity to the whole population in particular the poor is a priority in health as drug policy. The study was aimed at investigating the factors influencing procurement and utilization of essential drugs at primary health care centres in Shira Local Government Area of Bauchi State. The survey approach was used for this study; via random sampling technique. The researcher collected all the relevant data from primary source. The use of percentages, table and chi-square are employed to organize data collected via SPSS version 23. The factors influencing procurement and utilization of essential drugs at primary health care Centres are, good or large turn up of patients and good account system, seeking of approval, and the cost of getting approval.

The study revealed that 64% believed that, the management has problems procurement and utilization of essential drugs at rural health centre. It also revealed that, there was problem with procurement which affected the operation in primary health care centre. The study further revealed that 72% believed that there was no proper funding to the health care from the govern. The study revealed that there was no enough qualified staff at the various health centre. It also revealed that 72% believe that there was no manpower at primary health care centres which then hinder the effective service delivery to the community. The availability of essential drugs at the health centres was rather low, showing that the system has failed in achieving its main goal to manage availability also in remote area. The drug procurement and management system from the state, local government to district did not function well. There were no regular meeting with Primary Health Care Management Committee and there was no regular monitoring, auditing or supervision of primary health care centre.

**Index Terms-** health centres, essential drugs, factors, procurement, utilization

## I. INTRODUCTION

Access to essential drugs is very vital to the good performance of the health care delivery system all over the world. The procurement of safe, effective and affordable essential drugs of good quality in the right quantity to the whole population in

particular the poor is a priority in health as drug policy (Umeni and Narula, 1999). Providing the necessary finances of primary health care system is one of the major management supports which could make or mar primary health care services (Ola-Kunda, 2012). Over the years, this health sector has witnessed increase budgetary allocation. However funds released are not commensurate with the amount allocated. Given the limited resources, the state government for some years have been implementing free ante- natal care (ANC) programmed for pregnant women and under 5 children as well as providing nutritional supplements for malnourished kids (Bauchi State Strategic Health Development, 2015).

The list of essential drugs includes, acetylsalicylic acid tablet, adrenaline injection, ascorbic acid tablet, benzathine penicillin injection, benzoic acid/salicylic acid ointment, benxyl benzoate emulsion, calamine lotion, chloroquine syrup, chloroquine tablet, chlopheniramine tablet, chlorpromazine hydrochloride injection, co-trimazole syrup, co-trimazole tablet, ergometrine/methlagometine, ferrous sulphate tablets, folic acid tablet, Iodine solution, paracetamol tablet, etc.

The procurement of drugs involves the process of acquiring the needed drugs and medical supplies after due process of selection and quantification. It is a critical stage in the essential drug system. The following are the components of the procurement of a properly selected, and quantified essential drugs: training of personnel, well-designed procurement, functional information system, suitable organizational structure, adequate funds, facilities and equipments (World Bank, 2010). The sources of procurement/ supply of essential drugs can be grouped into three; primary, secondary and tertiary suppliers. Primary suppliers are the manufacturer themselves. **Secondary suppliers** are groups that procure directly from the manufacturer s and supply to others. **Tertiary Suppliers** are procurement agencies commissioned by essential drugs programme to procure drugs and medical suppliers on their behalf.

The world health organization (WHO) in 1997 defined drugs utilization as the distribution prescription and use of drugs in a society with special emphases on the medical ,social and economic consequences (Sachdeva et al., 2010) . The procurement and utilization of essential drugs is of paramount importance to Nigeria as a country, and to the whole world at large. This is true with respect to the requirement on the previous Millennium Development Goals (MDG) and currently on Sustainable Development Goal (SDG). Failure to meet with the goals as it

affects the health sector, spells doom for the whole world, in particular with the present pandemic, Covid 19. Due to upsurge in the level of financial corruption in Nigeria, it is disheartening to observe that, most money allocated to procure essential drugs in health care centres, are diverted for personal use, or simply siphoned into private account. Consequently, the lack of essential drugs in primary health centres has led to increase in maternal mortality in particular. This is the bases upon which the present study on “factors influencing procurement and utilization of essential drugs at primary health care centres in Shira Local Government Area of Bauchi State’ was conducted.

Some scientists have identified the main factors facing the procurement of drugs to include, inadequate funding resulting in delay in paying the suppliers and poor quantification (Muhia et al., 2017). Chandani et al. (2012) also identified the following as the factors that affect essential drug procurement; the product availability, supply chain knowledge and capacity, availability of appropriate transportation, product availability and capacity among health supervisors. Kanda and Iravo (2015) reported that Procurement process, level of technology and extent of technology affects efficiency of medical supply of drugs in their health facility in Kenya. Muiruri & Mugambi (2017) further reported that untrained staff, inadequate and untimely disbursements of budgets allocated to the health facilities, no of suppliers and supplier stock factors. In a related study, Kgaruki et al. (2013) reported that lack of strong IS at Medical Store Department and Ministry of Health and Social Welfare to manage the organization, suppliers and clients needs; lack of compliance to the national ordering and deliveries guideline and procedures; inadequate funds; low capacity in implementing integrated logistic system; lack of national representative data during annual budgeting and forecasting of EMs requirements; and political interests in a study in Tanzania. Ahmad et al. (2019) reported the following factors influencing utilization of drugs in Kano state, availability of health care personnel, timely service delivery and accessibility of service with ease.

### **Aim/Objectives**

The aim of the study is to evaluate the factors influencing procurement and utilization of essential drugs at primary health care centres in Shira Local Government Area of Bauchi State.

### **Study Area**

The local government covers an area of 1202 square kilometers. It has six district namely, Shira, Disina, Tsafi, Beli, Andubun, Faggo, with 36 village heads. The local government has Yana as the administrative health – quarters. The geographical location of the area is quite interesting; it falls within the Sahel Savannah belt, and the climatic condition is typical of the harsh tropical desert climate. The local government shares the boundaries with Giade local government at the east, Darazo local government to the south, Gwaram local government in Jigawa State to the west, Jamaare and Katagum Local Government to the north and northwest respectively.

### **Study Population**

According to the 2006 census, the local government has a projected population of 400,470. The people are dominantly farmers. There are to major rivers that pass through Shira local government. The rivers include river Dilimi in Jos Plateau State and Kari in Darazo local government area. In terms and social amenities, the local government headquarters and 20 other villages are connected with national grid.

### **Research Design**

The survey approach was used for this study; via random sampling technique.

### **Sources of Data/ Method of data**

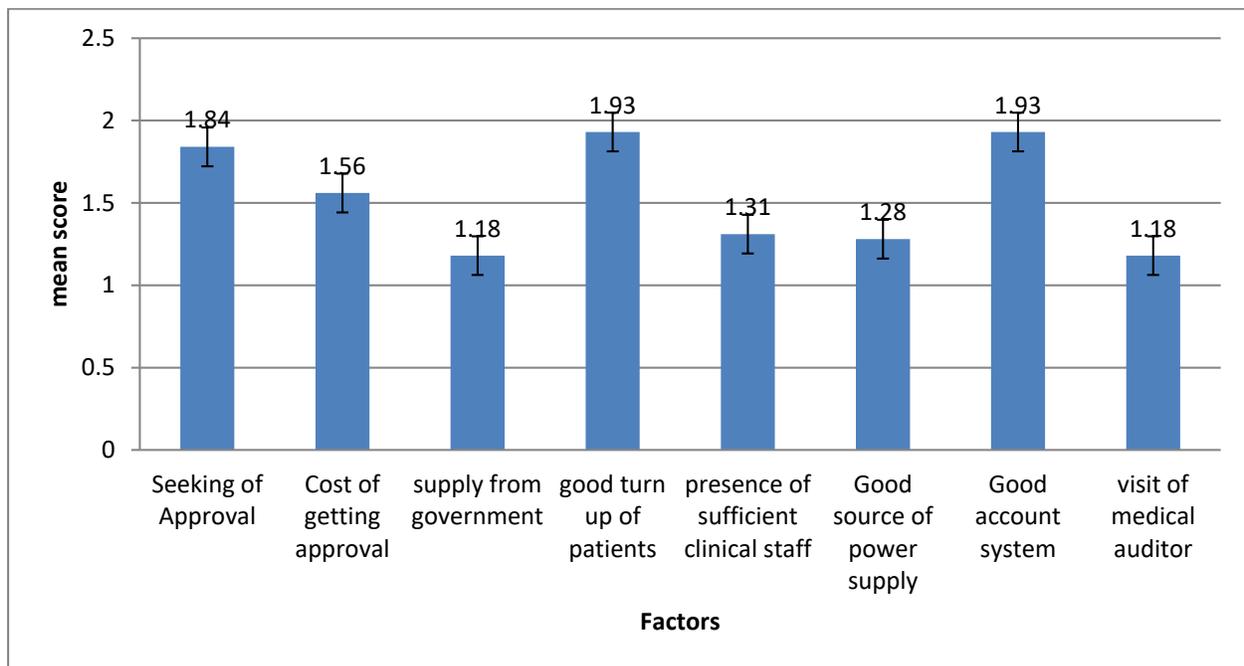
The researcher collected all the relevant data from primary source. The primary data consisted of data gathered by the researcher himself for the purpose of the study, through the use of questionnaire. The primary data was collected through the use of questionnaire administered to the primary health care centers staff (skilled).

### **Method of Data Analysis**

e use of percentages, table and chi-square are used to organize data collected via SPSS version 23.

## **II. RESULT**

The results were based on sixty one (61) retrieved questionnaires from the respondents. Level of significant was generally taken at 0.005.



**Figure 1: Factors influencing procurement and utilization of essential drugs at primary health care centres in Shira Local Government Area of Bauchi State**

The factors influencing procurement and utilization of essential drugs at primary health care Centres are presented in Figure 1. The result shows the mean scores for each factor. The acceptable mean score is 1.5 (2+1= 3 divided by 2= 1.5). Hence, the factors that influencing procurement and utilization of essential drugs are: good or large turn up of patients and good account system (1.93); seeking of approval (mean score= 1.84) and the cost of getting approval (1.56).

**Table 1: Is procurement a major problem to the effective operation in primary health care center?**

| Option       | Respondent frequency | % of Response |
|--------------|----------------------|---------------|
| Yes          | 43                   | 70            |
| No           | 18                   | 30            |
| <b>Total</b> | <b>61</b>            | <b>100</b>    |

Based on the data collection 70% representing forty three (43) respondents agreed that procurement a major problem to the effective operation in primary health care center, while 30% representing eighteen respondents said no .This probably suggest that there was problem in procurement.

**Table 2: The provision of enough funds to the health care department for drugs procurement by state / LG**

| Option          | Respondent frequency | % of Response |
|-----------------|----------------------|---------------|
| Strongly agreed | 15                   | 25            |
| Agreed          | 2                    | 3             |
| Not agreed      | 44                   | 72            |
| <b>Total</b>    | <b>61</b>            | <b>100</b>    |

From the above data, 25% representing fifteen (15) respondents strongly agreed that the State/ L.G. provides enough funds for the procurement of essential drugs, 3% representing two respondents simply agreed, while 72% representing forty four (44) respondents were not in agreement to this claim.

**Table 3: The utilization of the funds provided by the government appropriately by the management of primary health care department**

| Option       | Respondent frequency | % of Response |
|--------------|----------------------|---------------|
| Yes          | 28                   | 46            |
| No           | 33                   | 54            |
| <b>Total</b> | <b>61</b>            | <b>100</b>    |

Table 3 shows that 46%, representing twenty eight (28) respondents agreed that funds provided are appropriately utilized, while 54% representing thirty three respondents did not agree.

### III. DISCUSSION AND CONCLUSION

The study revealed that 64% believed that, the management has problems procurement and utilization of essential drugs at rural health centre. It also revealed that, there was problem with procurement which affected the operation in primary health care centre. The study further revealed that 72% believed that there was no proper funding to the health care from the govern. The study revealed that there was no enough qualified staff at the various health centre. It also revealed that 72% beleive that there was no manpower at primary health care centres which then hinder the effective service delivery to the community.

Financial regulation was revised in (1999) requires accounting officer of a ministry or extra ministerial; department to establish internal audit /medical audit to conduct a complete and

continue audit of the account and record of revenue and expenditure, and located store. The study revealed that medical auditors are not usually auditing the primary health care centre which also contributes for the in proper utilization of the drug and other health facilities. The study revealed the factors influencing procurement and utilization of essential drugs at primary health care Centres. The result shows that the factors that influencing procurement and utilization of essential drugs are: good or large turn up of patients and good account system, seeking of approval and the cost of getting approval.

Chandani et al. (2012) identified the following as the factors that affect essential drug procurement; the product availability, supply chain knowledge and capacity, availability of appropriate transportation, product availability and capacity among health supervisors. Kanda and Iravo (2015) reported that Procurement process, level of technology and extent of technology affects efficiency of medical supply of drugs in their health facility in Kenya. Muiruri & Mugambi (2017) further reported that untrained staff, inadequate and untimely disbursements of budgets allocated to the health facilities, no of suppliers and supplier stock factors.

In a related study, Kgaruki et al. (2013) reported that lack of strong information system at Medical Store Department and Ministry of Health and Social Welfare to manage the organization, suppliers and clients needs; lack of compliance to the national ordering and deliveries guideline and procedures; inadequate funds; low capacity in implementing integrated logistic system; lack of national representative data during annual budgeting and forecasting of EMs requirements; and political interests in a study in Tanzania. Ahmad et al. (2019) reported the following factors influencing utilization of drugs in Kano state, availability of health care personnel, timely service delivery and accessibility of service with ease.

#### IV. CONCLUSION

The availability of essential drugs at the health centres was rather low, showing that the system has failed in achieving its main goal to manage availability also in remote area. The drug procurement and management system from the state, local government to district did not function well. There were no regular meeting with Primary Health Care Management Committee and there was no regular monitoring, auditing or supervision of primary health care centre. There was also lack of necessary guideline for primary health care staff.

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# Classifying Outdoor Recreation Opportunities in Urban and Semi-Urban Areas: A Case of Sri Lanka

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**Abstract-** Outdoor recreation (OR) bring pleasure to individuals as it gives recreational opportunities to them. OR provides both physical and mental health benefits, supports manage stress, and balances the burdens of work and family with physical and mental wellbeing. In this connection, this study aims to consent people to be happy through maintaining, developing and creating Outdoor Recreation Opportunities (ORO) in the area concerned. The objectives of the study were to identify the existing ORO in the selected area in Gampaha district and classify the existing ORO in the general setting. Study Areas of the study were Grama Niladhari (GN) Divisions which covered 3.534 km<sup>2</sup> in the Gampaha district, in Sri Lanka. Primary data was used in the data collection, and the direct observation method of the qualitative approach was used through GEO Tracker software. The survey data shows that there are 50 ORO with different capacities, and usages existed in a particular area. Such ORO available in the area were classified into different categories based on altered classifications such as; Basic Entertainments, Mental Activity, Relaxation, and Self-Awareness, Nature Activities/Open Air Recreation, Sports and exercises, Active or Passive, Classification by OR benefit, Semi-urban or Urban. This study was strictly limited to outdoor recreation opportunities. However, the people in the area concerned do not limit to the same as people also engage in Indoor Recreation Opportunities. The researchers expected to have further studies to understand the demographic profile of the area, to explore the capacities and utilities of the existing ORO in the area, to understand the new avenues for creating new ORO in the area and motivation and attitudes towards ORO of the area.

**Index Terms-** Outdoor recreation opportunities, Classification, Geographic Information System (GIS)

## I. INTRODUCTION

Recreation opportunities are "a function of user preferences and the ability of management to provide diverse settings and let people know they exist (Van Oosterzee, 1984)." Outdoor recreation gives people greater satisfaction and a stronger human bond, which provides them with fun opportunities. It also protects from non-communicable diseases related to physical and mental health and allows for healthy family life. Eventually, good people with physical and mental wellbeing open up to society. Camping,

hiking, backpacking, climbing, shelter building, cooking, canoeing, kayaking, dog sledging (Lee, Graefe, & Burns, 2008), walking, jogging, running, cycling, skiing, walking with a dog, fishing, wild Berry picking, mushroom collecting (Vaara & Matero, 2011), cross country, golf (Christensen, Wilson, & Holt, 2013), wildlife viewing (Parry, Gollob, & Frans, 2014), walking in the forest (Doctorman & Boman, 2016), swimming, spending time at nature (Neuvonen, Riala, Nummelin, Sievänen, & Tuulentie, 2018) bring physical health, psychological/mental health, social and spiritual benefits. OR help a family to grow together and maintain cohesiveness (Lee & Graefe, 2010; Lee et al., 2008). OR provide positive psychological benefits from the environment, reductions in anxiety and depression levels, increase self-esteem and self-confidence, improve quality life (Christensen et al., 2013). These activities reduce diabetes, reduce high blood pressure and heart disease, reduce the risk of obesity, postpone mortality, relaxation, wellbeing, reductions in myopathy and reduced stress levels (Bailey, Allen, Herndon, & Demastus, 2018). Thus, this article explores the current outdoor recreation opportunities available in the entire region of Dalugama, Eriyawetiya, Kiribathgoda, Mahara, and Wewelduwa. This article attempts to identify outdoor recreation opportunities, map out those places, and attain to the public's attention. This particular study aims to consent people to be happy through maintaining, developing and creating Outdoor Recreation Opportunities (ORO) in the area concerned. Consequently, the objectives of the study were to; i) identify the existing ORO in the Kiribathgoda, Eriyawetiya, Mahara, Dalugama and Wewelduwa, in Gampaha district, ii) classify the existing ORO in the general setting.

The Geographic Information System (GIS) can use as a valuable tool for evidence-based activities (MSW, 1997). Mapping is a practice that has been around since the early Paleolithic and civilisation of the Cro-Magnan man (MSW, 1997). With the development of this GIS, it has become a tool for the employees of the society to plan, develop, implement and analyse programs and policies (MSW, 1997). The US Geological Survey defines the GIS as defining, ".....a computer system capable of capturing, storing, analysing, and displaying geographically referenced information; that is, data identified according to location" as the (MSW, 1997). Professionals define GIS technology as "procedures, operating personnel and spatial data that go into the system". Simply put, GIS technology is used to display descriptive data, such as the location or density of agencies

in an identified population (MSW, 1997). Benefits to users through GIS functionality include the ability to identify areas, identify patterns, and predict or model the impact of a service or policy (MSW, 1997).

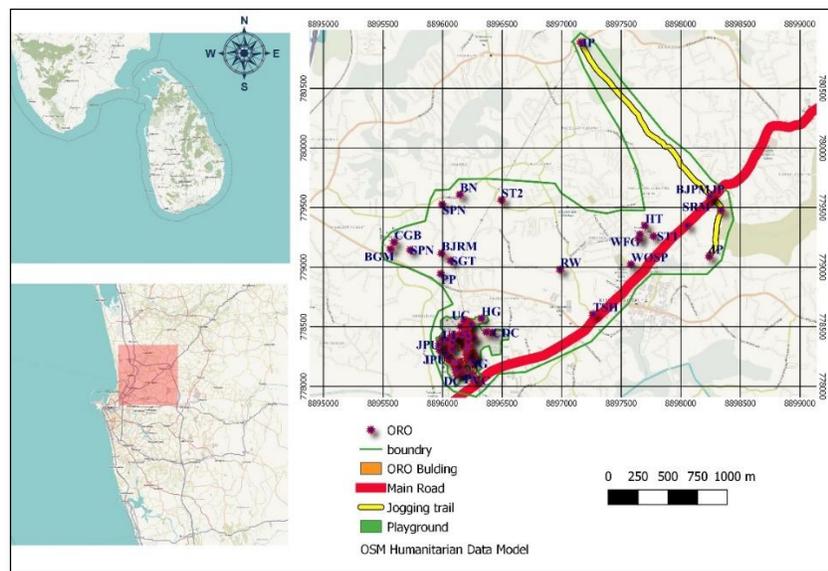
GIS software simply lets users convert a table with information into a map (Wier & Robertson, 1998). Migration is therefore important for understanding regional differences between different ethnic groups, and it can lead to social and economic changes, changes in destination population, and origin (Kim, Lee, Shin, & Choi, 2012). Accordingly, visualisation of spatial relationships through the use of geographical maps is an important step in understanding and explaining these migratory recreational phenomena, whether during travel or travel (Kim et al., 2012).

Recreation Opportunity Spectrum (ROS) is a tool used to define and manage various outdoor recreation opportunities (Pettengill & Peter, 2011). Developed by researchers in the United States of America academic and Forest service, the ROS concept was introduced to address issues such as national park management (Van Oosterzee, 1984). Its main purpose is to provide quality entertainment in a variety of settings (Van Oosterzee, 1984). The ROS hypothesis is that individuals can provide a range of possible settings and make choices about what experiences they want through awareness (Van Oosterzee, 1984). ROS interacts with six factors. Those are: accessing, other non-

recreational resource use, onsite management, acceptability of visitor impacts, an acceptable level of regimentation (Van Oosterzee, 1984). Accordingly, the area used in this study is three parts, according to ROS. Namely, Rural, concentrated, and modern urban (Pettengill & Peter, 2011).

## II. METHOD

The area belonging to Eriyawetiya, Wewelduwa, Dalugama, Kiribathgoda, and Mahara in the Gampaha District of Sri Lanka was used for observing outdoor recreation opportunities in this study. The researchers observed the data and stored those on the phone through GEO Tracker software. Temples, churches, jogging lanes, reading benches, loving benches, all viewing areas, playgrounds, sports courts, summer huts, shopping centres, ponds, small rivers, canals, gardens and recreational gym halls (dramas, movies, music events) were named and saved with the location through GEO tracker software. Three files containing the data were later transferred from the phone to the laptop. It was then mapped through QGIS software installed on the laptop. The area (about 3.534km<sup>2</sup>) was mapped using the GIS software. All the waypoint obtained from that Gpx tracker software could create a named map. The figure below shows the map created with that selected area. It shows the selected area.



**Figure 1: Map with the Total Study Area.**

**Source - Constructed by the Researchers Using QGIS, 2020**

According to the case studies, a qualitative methodology was found to be suitable for this research. Primary and secondary data were used for this article. Primary data were collected through the observation process, and the researchers had to face huge difficulties. Data were obtained by observing the selected area from the main municipal road and then up to the small roads. The researchers went inside the area and identified all outdoor areas, even in uninhabited areas.

Further, secondary data for this article was obtained from the Taylor & Francis online web page. Before walking in the area, a variety of dimensions were used, from the crowded area to the

uninhabited area, the population distribution, and the opportunistic recreational spectrum. Due to a lack of time, the sample size was limited. This area was therefore selected for the study.

The zone used was always confined to the south of the road that began with the University of Kelaniya. It took about three days to observe the area. If the area was consulted with the public and the data collected, the researchers could have missed the data needed to retrieve and map the wrong data. Therefore, the observation method was used. When collecting data, it was a fresh experience for the software researcher and caused problems with data error. Another challenge was to learn about QGIS software

for map creation. Youtube videos helped with that. However, using the software eventually created a variety of maps. Similarly, the ROS used in the world has been divided into two main categories, concerning Sri Lanka. Namely semi-urban and urban. finally, all outdoor recreational opportunities were storage as a category the spiritual, social and health and that were shown in this article

### III. RESULTS

In this study, the selected sample found different types of outdoor and recreational opportunities. As a consequence of the spread of the people, it is clear that they can benefit from the moment they migrate to the area, welfare and commercially. However, there has been a difference in participation in outdoor recreation, whether commercial or private, from the state Mechanism. That is, in this segment of semi-urban and urban areas, such commercial enterprises were seen as urban. Accordingly, people with money have come to these places in their valuable vehicles and enjoy urban opportunities. Ordinary people enjoy the opportunities developed by the government as welfare. Accordingly, the results of the outdoor recreation opportunities obtained from the direct observation are shown in Table 01 below.

**Table 1: Outdoor Recreation Opportunities Classified by GPX Data and Activity.**

| Type    | Gpx named place             | Map places     | Categorized by OR Activity (Metin, Katirci, Yüce, Saricam, & Cabuk, 2017) |
|---------|-----------------------------|----------------|---|
| Art     | Art Gallery (AG)            | Art Gallery    | Basic Entertainment s   |
| Art     | Cristo Dancing Center (CDC) | Dancing Center | Basic Entertainment s   |
| Art     | Cristo Music Center (CMC)   | Music Center   | Basic Entertainment s   |
| Art     | Drama Center (DC)           | Open Theater   | Basic Entertainment s   |
| Art     | Dh Hall (DH)                | Open Theater   | Basic Entertainment s   |
| Sport   | Pavilion (P)                | Pavilion       | Basic Entertainment s   |
| Library | University Library (UL)     | Library        | Mental Activity, Relaxation, and Self-Awareness                           |

|      |   |                     |   |
|------|---|---------------------|---|
| Park | Benches -Hilton Canteen (BHC)           | Mini Park           | Mental Activity, Relaxation, and Self-Awareness |
| Park | Benches, Sarungale (BS)                 | Mini Park           | Mental Activity, Relaxation, and Self-Awareness |
| Park | Benches -Science Faculty (BSF)          | Mini Park           | Mental Activity, Relaxation, and Self-Awareness |
| Park | IT Gasa Bench (ITGB)                    | Mini Park           | Mental Activity, Relaxation, and Self-Awareness |
| Park | Summer Hut, GYM ( SG)                   | Garden (Summer Hut) | Mental Activity, Relaxation, and Self-Awareness |
| Park | Summer Hut, Hilton Canteen (SHHC)       | Garden (Summer Hut) | Mental Activity, Relaxation, and Self-Awareness |
| Park | Summer Hut, Management Faculty (SHMF)   | Garden (Summer Hut) | Mental Activity, Relaxation, and Self-Awareness |
| Park | Summer Hut, Mee Ambee (SHMA)            | Garden (Summer Hut) | Mental Activity, Relaxation, and Self-Awareness |
| Park | Summer Hut, Near Hunduwa Canteen (SHNH) | Garden (Summer Hut) | Mental Activity, Relaxation, and Self-Awareness |
| Park | Summer Hut, Tharuwa (SHT)               | Garden (Summer Hut) | Mental Activity, Relaxation, and Self-Awareness |
| Park | Summer Hut Front K1 (SHFK)              | Garden (Summer Hut) | Mental Activity, Relaxation, and Self-Awareness |
| Park | Under The Naagasa, Bench (UNB)          | Garden              | Mental Activity, Relaxation,                    |

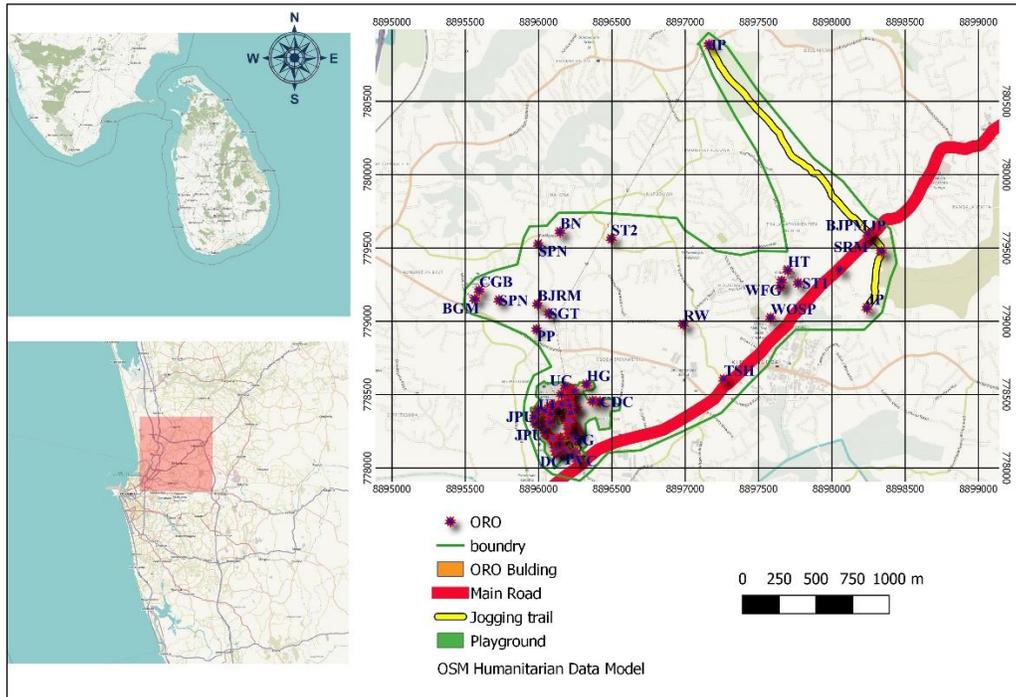
|               |  |               |   |
|---------------|--|---------------|---|
|               |  |               | and Self-Awareness                              |
| Shopping Mall | Thilakawardna, Shopping Hall (TSH)             | Shopping Mall | Mental Activity, Relaxation, and Self-Awareness |
| Temple        | Budumadura, Gamunu Mawatha (BGM)               | Temple        | Mental Activity, Relaxation, and Self-Awareness |
| Temple        | Budumadura, Jagath Ranaweru Mawatha (BJRM)     | Temple        | Mental Activity, Relaxation, and Self-Awareness |
| Temple        | Budumadura, Naheena (BN)                       | Temple        | Mental Activity, Relaxation, and Self-Awareness |
| Temple        | Budupilimaya and Jesus Pilimaya, Mahara (BJPM) | Temple        | Mental Activity, Relaxation, and Self-Awareness |
| Temple        | Hospital Temple (HT)                           | Temple        | Mental Activity, Relaxation, and Self-Awareness |
| Temple        | Rathnasara Wiharaya (RW)                       | Temple        | Mental Activity, Relaxation, and Self-Awareness |
| Temple        | Sri Ghanwimalaramaya Temple (SGT)              | Temple        | Mental Activity, Relaxation, and Self-Awareness |
| Temple        | SRMG Budumadura (SRMB)                         | Temple        | Mental Activity, Relaxation, and Self-Awareness |
| Temple        | Sudarshanaramaya Temple (ST1)                  | Temple        | Mental Activity, Relaxation, and Self-Awareness |
| Temple        | Sumanaramaya Temple (ST2)                      | Temple        | Mental Activity, Relaxation, and Self-Awareness |

|                       |  |                                      |   |
|-----------------------|--|--------------------------------------|---|
| Temple                | University Temple (UT)                 | Temple                               | Mental Activity, Relaxation, and Self-Awareness |
| Park                  | Botanic Garden, Science Faculty (BGSF) | Botanical Garden                     | Nature Activities/Open Air Recreation           |
| Park                  | Hurble Garden (HG)                     | Hurble Garden                        | Nature Activities/Open Air Recreation           |
| Park                  | Small River, Mahara (SRM)              | River                                | Nature Activities/Open Air Recreation           |
| Park                  | Udyana Center (UC)                     | Udyana Garden                        | Nature Activities/Open Air Recreation           |
| Pond                  | A small pond, Nahena (SPN)             | Pond                                 | Nature Activities/Open Air Recreation           |
| Pond                  | In University Science faculty (PUSF)   | Pond                                 | Nature Activities/Open Air Recreation           |
| Jogging Path (Mahara) | Jogging Path (JP)                      | Jogging Trail                        | Sports and exercises                            |
| Jogging Path          | Jogging Path, University (JPU)         | Jogging Trail                        | Sports and exercises                            |
| Sport                 | College Ground, Bandaranayke (CGB)     | Playground                           | Sports and exercises                            |
| Sport                 | GYM Old, University (GOU)              | Gymnasium                            | Sports and exercises                            |
| Sport                 | Main Ground, University (MGU)          | Playground                           | Sports and exercises                            |
| Sport                 | Netball Court (NC)                     | Play Ground-Netball Court (Specific) | Sports and exercises                            |
| Sport                 | New Gym (NG)                           | Gymnasium                            | Sports and exercises                            |
| Sport                 | Weight/fitness GYM (WFG)               | House of Sport GYM                   | Sports and exercises                            |
| Sport                 | People's Playground (PP)               | Public Playground                    | Sports and exercises                            |
| Sport                 | Playground, Kiribathgoda(PK)           | Public Playground                    | Sports and exercises                            |

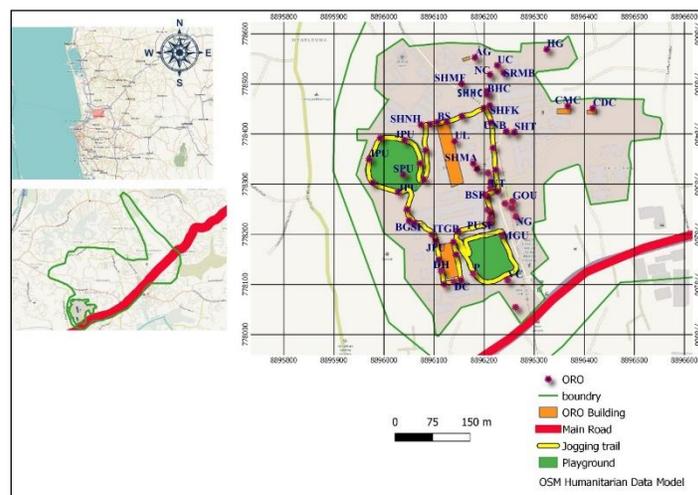
|       |  |  |                      |
|-------|--|--|----------------------|
| Sport | Syebbe Playground, University (SPU)      | Playground                             | Sports and exercises |
| Sport | Volleyball Court (VC)                    | Playground Volleyball Court (Specific) | Sports and exercises |
| Sport | Wiharamahadevi Open Swimming Pool (WOSP) | Swimming Pool                          | Sports and exercises |

Source: Observation Data

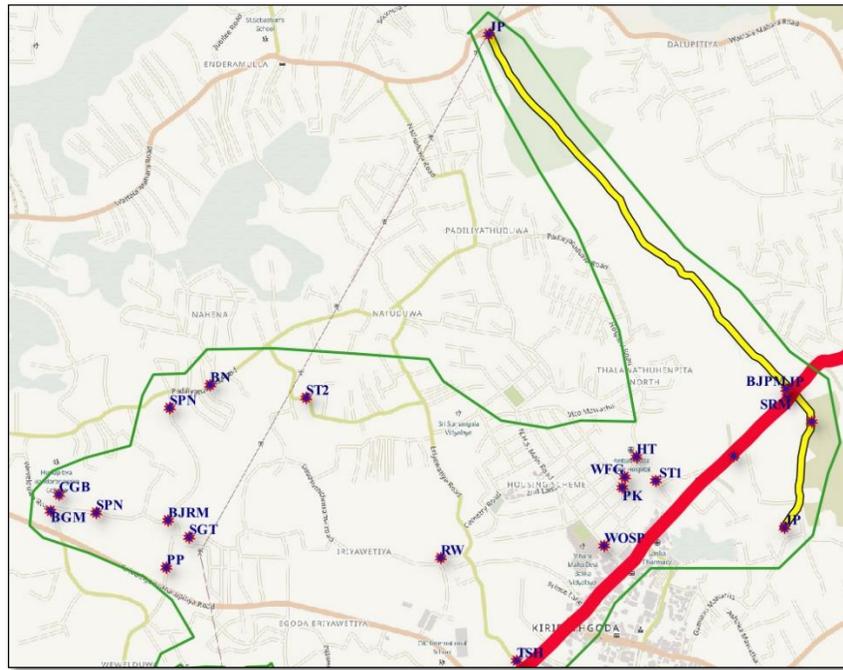
Below is a map created using locations such as the whole area, the campus boundary of the University of Kelaniya and the selected area outside the University via QGIS. Accordingly, the whole area is presented in three maps. That will help users learn more about OR opportunities. The map below shows the selected area of the Gampaha District of Sri Lanka.



**Figure 2: Map with Areas that Represent the Total Outdoor Recreation Opportunities.**  
 Source - Constructed by the Researchers Using QGIS, 2020



**Figure 3: Map with Outdoor Recreation Opportunities Represented on Campus.**  
 Source - Constructed by the Researchers Using QGIS, 2020



**Figure 3: Outline Map of Results Outside the University**  
 Source - Constructed by the Researchers Using QGIS, 2020

All outdoor recreation opportunities can be categorised into different varieties. Accordingly, all these outdoor recreation opportunities can be divided into four main categories. Table 02 shows the OR Opportunities and their variants in the selected area.

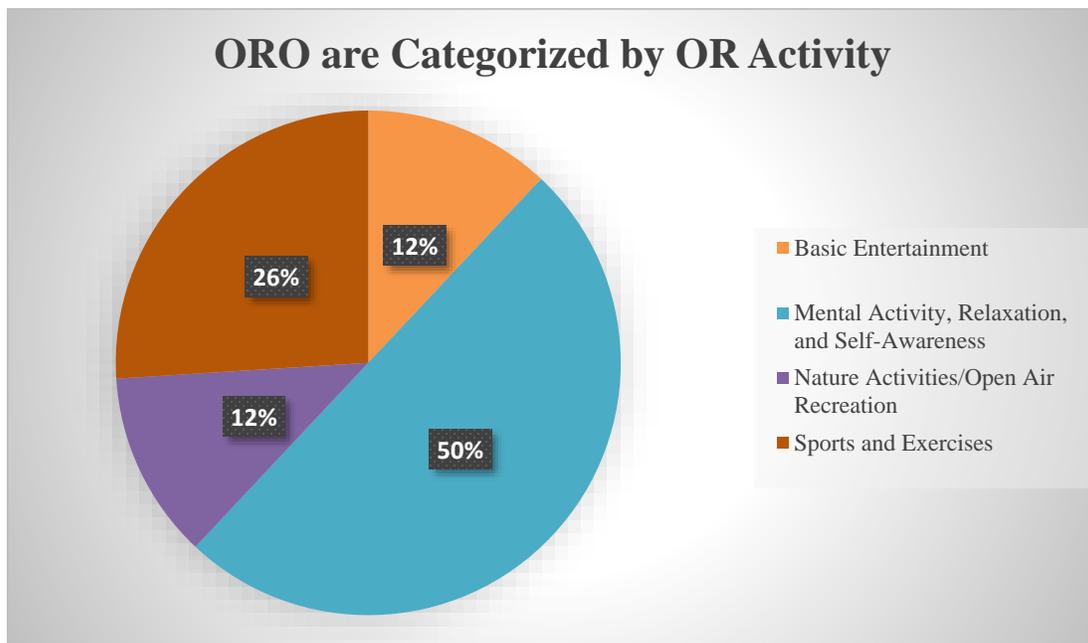
**Table 2: Outdoor Recreation Opportunities, Sorting by Activity, and Its Outcome Activities**

|  |    |
|--|----|
| 1. Basic Entertainment                             | 06 |
| 2. Mental Activity, Relaxation, and Self-Awareness | 25 |
| 3. Nature Activities/Open Air Recreation           | 06 |
| 4. Sports and exercises                            | 13 |

Source: Constructed by the researchers, 2020

| ORO: Categorised by OR Activity (Metin et al., 2017) | Number of Instances |
|--|---------------------|
|--|---------------------|

The researchers next examined how these cases are based on the variants shown in Table 1 and 2. The percentages for the sub-variants of each of the categories were built through figure 05.



**Figure 4: Percentage Showing of Outdoor Recreation Opportunities by Activity.**  
Source: Survey Data, 2020

According to figure 05, the results of the pie chart show that about 50 per cent are engaged in mental activity, relaxation, and self-awareness. Accordingly, the above cases are relatively higher than the others. The next highest percentage is sports and exercise. The second category shows the next most likely scenario. The next two main categories are basic entertainment and nature activities/open-air recreation. It shows an equal percentage of 12 per cent. When selecting this variant, attention was paid to the activities involved. The following three tables show some of the activities for each of the varieties with those. Some insights into the activities underlying that segmentation can be obtained.

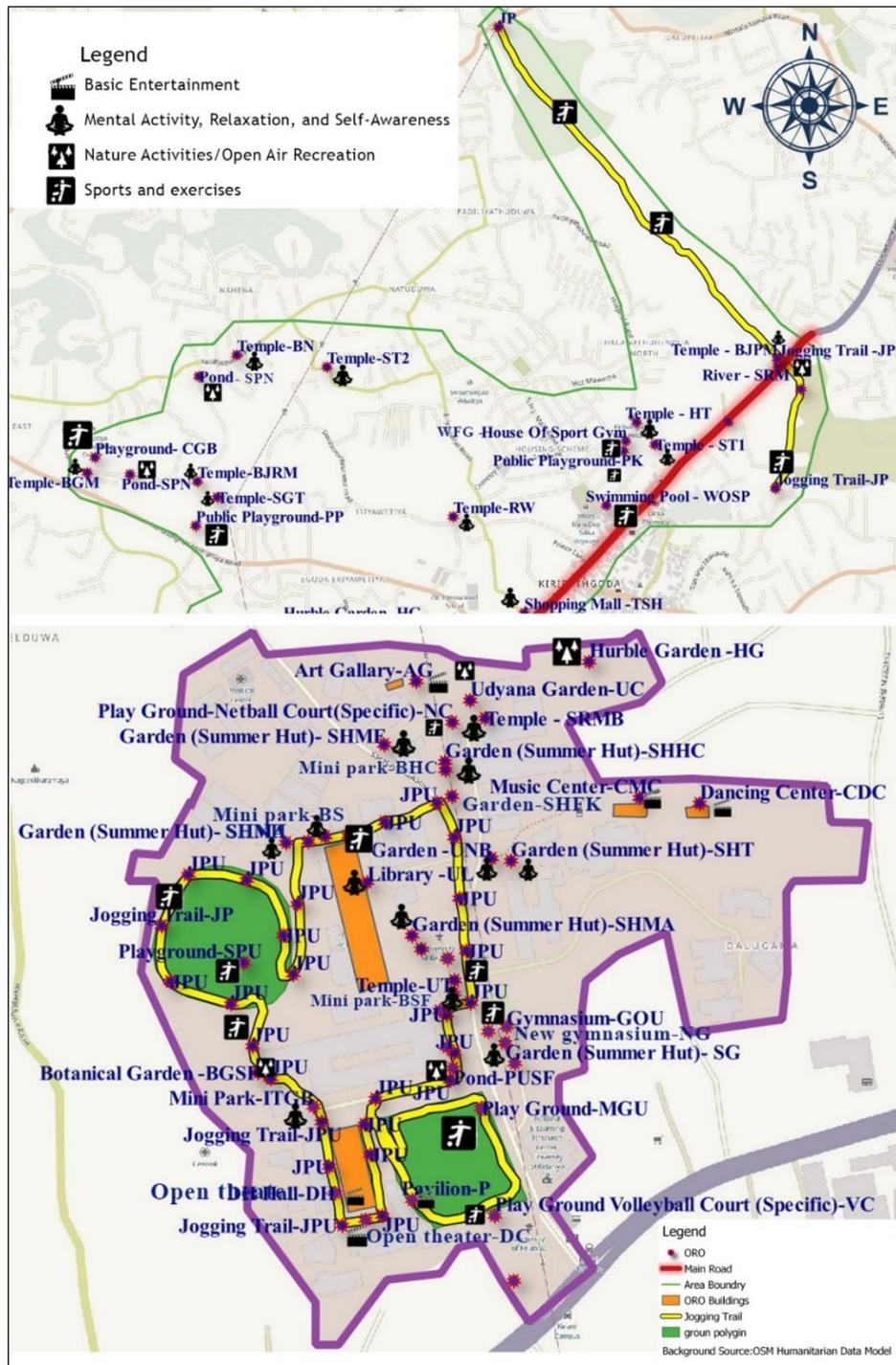
**Table 3: Outdoor Recreation Opportunities Category Activities with Assorted Activities.**

| ORO Category by activities (Metin et al., 2017)    | Related activities   |
|--|--|
| 1. Basic Entertainments                            | Sports having spectators (baseball, football, formula), Dance shows, Telling stories, Theatre Films/Cinema-shows |
| 2. Mental Activity, Relaxation, and Self-Awareness | Travel/ Trip/ Visit (by walking), Writing/reading,   |

|  |  |
|--|--|
|  | Listening to music, Meditation   |
| 3. Nature Activities/Open Air Recreation | Walks, Walks made for identifying plants, Walking near the river, fishing (freshwater), Garden works, Discovering the wildlife, Walking in nature (with accommodation), Learning in nature |
| 4. Sports and exercises                  | Badminton, Baseball, Diving, Basketball, Football, Rugby, Swimming, Running, Throwing discs, Judo, Table tennis, tennis, Volleyball, Weight lifting, Wrestling                             |

Source: Constructed by the researchers, 2020

According to above, all the data for this segmentation can be visualised on a separate map. That way, people can quickly identify and access instances by using separate symbols to sort opportunities on the map



**Figure 5: Map Showing Outdoor Recreation Opportunities, Grouped by Activity.**  
 Source - Constructed by the Researchers Using QGIS, 2020

In addition to the above variants, these outdoor recreational opportunities are divided into two categories: active and passive. There they can choose what kind of activities people want. All people who struggle to live in a dynamic social system must have some leisure time. They should be able to relax and enjoy themselves, whether active or passive. For these reasons, the type of recreational opportunities they enjoy can be categorised as active or passive. It can be seen in the following table 04.

**Table 4: Categorizing Outdoor Recreation Opportunities into Active and Passive.**

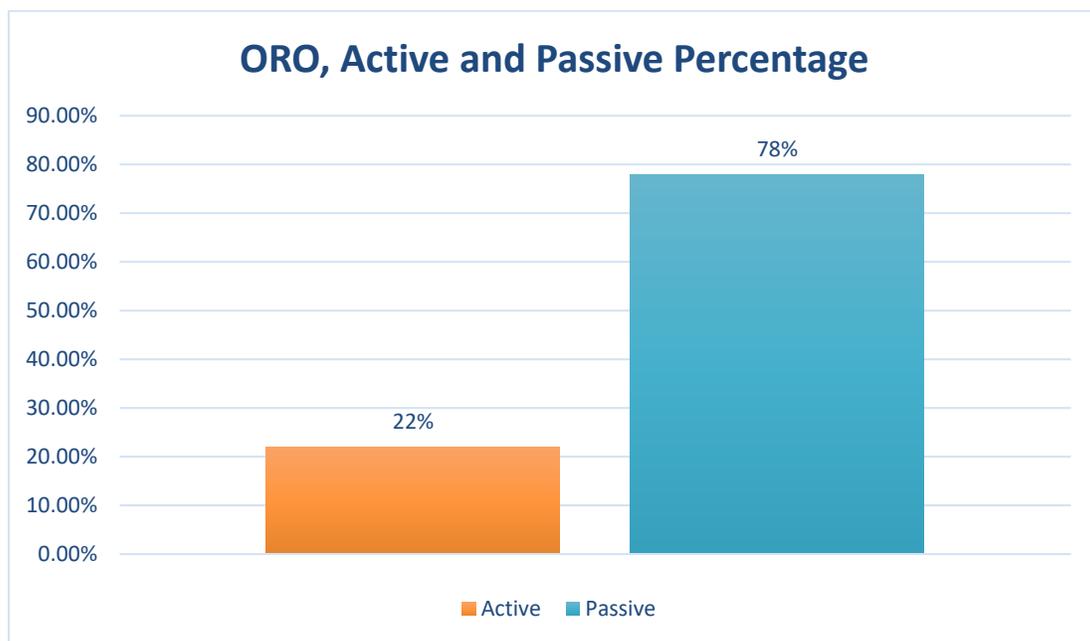
|   |   |
|---|---|
| <b>Passive ORO</b> (Lee & Graefe, 2010) | <b>Active ORO</b> (Lee & Graefe, 2010; Ulrich & Addoms, 2018) |
| AG - Art Gallery                        | CGB - Playground  |
| CDC - Dancing Center                    | GOU - Gymnasium   |
| CMC - Music Center                      | MGU - PlayGround  |

|                            |   |
|----------------------------|---|
| DC - Open Theater          | NC - Play Ground-Netball Court (Specific)   |
| DH - Open Theater          | NG - Gymnasium                              |
| P - Pavilion               | PP - Public Playground                      |
| UL - Library               | PK - Public Playground                      |
| TSH - Shopping Mall        | SPU - Playground                            |
| BGSF - Botanical Garden    | VC - Playground Volleyball Court (Specific) |
| SRM - River                | WOSP - Swimming Pool                        |
| UC - Udyana Garden         | WFG - House of Sport GYM                    |
| SPN - Pond                 |   |
| PUSF - Pond                |   |
| JP - Jogging Trail         |   |
| BHC - Mini Park            |   |
| BS - Mini Park             |   |
| BSF - Mini Park            |   |
| ITGB - Mini Park           |   |
| SG - Garden (Summer Hut)   |   |
| SHHC - Garden (Summer Hut) |   |
| SHMF - Garden (Summer Hut) |   |
| SHMA - Garden (Summer Hut) |   |
| SHNH - Garden (Summer Hut) |   |

|                            |
|----------------------------|
| SHT - Garden, Summer Hut   |
| SHFK - Garden (Summer Hut) |
| UNB - Garden               |
| HG-Hurple Garden           |
| BGM - Temple               |
| BJRM - Temple              |
| BN - Temple                |
| BJPM - Temple              |
| HT - Temple                |
| RW - Temple                |
| SGT - Temple               |
| SRMB - Temple              |
| ST1 - Temple               |
| ST2 - Temple               |
| UT - Temple                |
| JPU - Jogging Trail        |

Source: Constructed by the researchers, 2020

Accordingly, it can be shown quantitatively which types of instances are installed for the most part. Accordingly, outdoor recreational opportunities were actively and passively distributed, and the results were as follows: That is, the active and passive categories can be expressed as a percentage. It can see in figure 07 below



**Figure 6: Outdoor Recreation Opportunities, Active and Passive Classification Percentage**  
 Source: Survey Data, 2020

In terms of the OR opportunities, 50 scenarios were placed on the map as either active or passive. More insight can be gained about those OR opportunities as well as classifications. There are

two parts to the map. Those are the University Limits and the Selected Area outside the University (Figure 8)

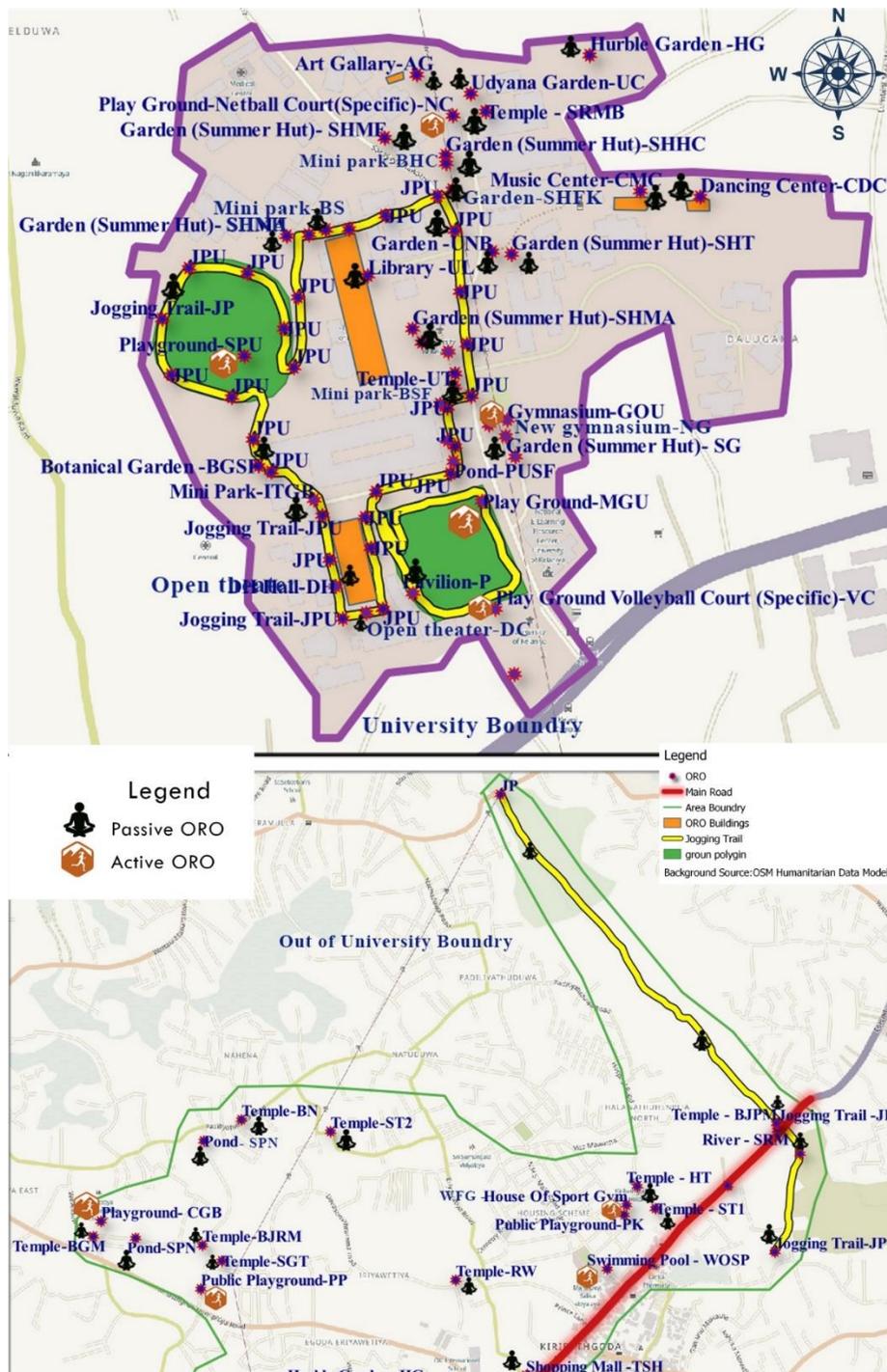


Figure 7: Outdoor Recreation Opportunities, Active and Passive Classification Map.  
 Source - Constructed by the Researchers Using QGIS, 2020

Individuals in society receive the benefits of recreational, either intentionally or unexpectedly. They are also important in analysing the data obtained and how the individual benefits. Here are some of the benefits that outdoor relaxation can get to people. It is social, spiritual, and health. The scenarios for the three sections can be seen in the following table 05

Table 5: Outdoor Recreation Opportunities Classification by OR Benefits and Semi-Urban or Urban.

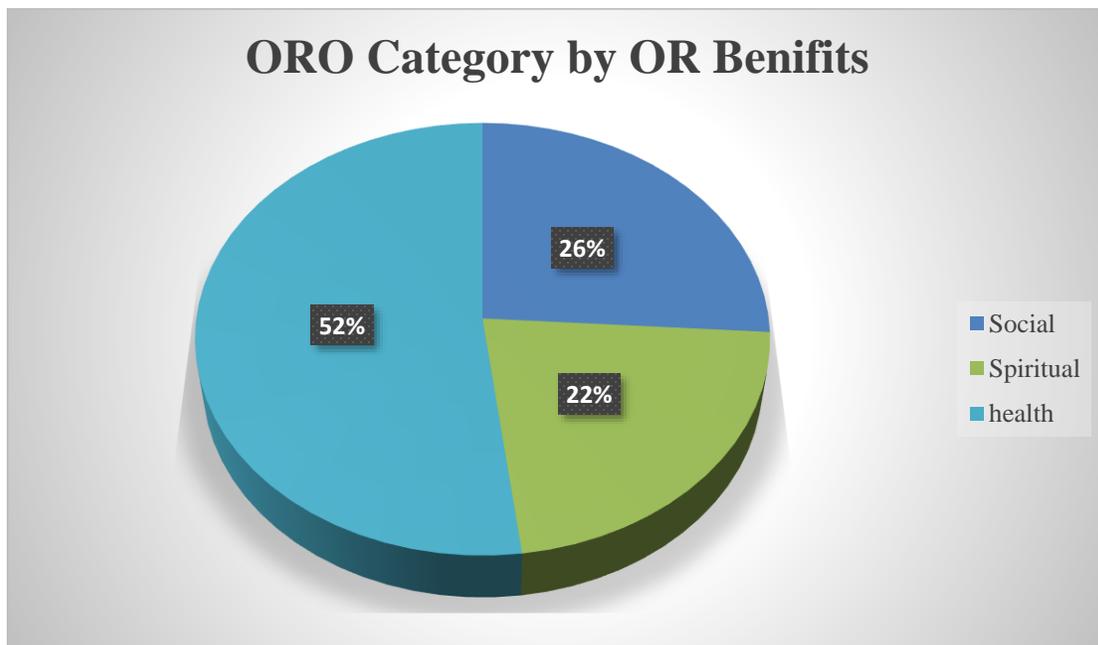
| Final places | Classification by OR benefit (Lee & Graefe, 2010; Nordh, Vistad, Skår, Wold, & Magnus Bærum, | Semi-urban or Urban (Lanka, n.d.; Pettengill & Peter, 2011) |
|--------------|--|---|
|              |  |   |

|                            |                           |            |
|----------------------------|---------------------------|------------|
|                            | 2017; Parry et al., 2014) |            |
| AG - Art Gallery           | Health                    | Semi-urban |
| CDC - Dancing Center       | Health                    | Semi-urban |
| CMC - Music Center         | Health                    | Semi-urban |
| DC - Open Theater          | Health                    | Semi-urban |
| DH - Open Theater          | Health                    | Semi-urban |
| P - Pavilion               | Health                    | Semi-urban |
| UL - Library               | Health                    | Semi-urban |
| TSH - Shopping Mall        | Health                    | Urban      |
| BGSF - Botanical Garden    | Health                    | Semi-urban |
| SRM - River                | Health                    | Urban      |
| UC - Udyana Garden         | Health                    | Semi-urban |
| SPN - Pond                 | Health                    | Semi-urban |
| PUSF - Pond                | Health                    | Semi-urban |
| JP - Jogging Trail         | Health                    | Urban      |
| BHC - Mini Park            | Social                    | Semi-urban |
| BS - Mini Park             | Social                    | Semi-urban |
| BSF - Mini Park            | Social                    | Semi-urban |
| ITGB - Mini Park           | Social                    | Semi-urban |
| SG - Garden (Summer Hut)   | Social                    | Semi-urban |
| SHHC - Garden (Summer Hut) | Social                    | Semi-urban |
| SHMF - Garden (Summer Hut) | Social                    | Semi-urban |
| SHMA - Garden (Summer Hut) | Social                    | Semi-urban |
| SHNH - Garden (Summer Hut) | Social                    | Semi-urban |
| SHT - Garden, Summer Hut   | Social                    | Semi-urban |
| SHFK - Garden (Summer Hut) | Social                    | Semi-urban |
| UNB - Garden               | Social                    | Semi-urban |
| HG - Hurple Garden         | Social                    | Semi-urban |
| BGM - Temple               | Spiritual                 | Semi-urban |

|   |           |            |
|---|-----------|------------|
| BJRM - Temple                               | Spiritual | Semi-urban |
| BN - Temple                                 | Spiritual | Semi-urban |
| BJPM - Temple                               | Spiritual | Urban      |
| HT - Temple                                 | Spiritual | Urban      |
| RW - Temple                                 | Spiritual | Semi-urban |
| SGT - Temple                                | Spiritual | Semi-urban |
| SRMB - Temple                               | Spiritual | Semi-urban |
| ST1 - Temple                                | Spiritual | Urban      |
| ST2 - Temple                                | Spiritual | Semi-urban |
| UT - Temple                                 | Spiritual | Semi-urban |
| JPU - Jogging Trail                         | Health    | Semi-urban |
| CGB - Playground                            | Health    | Semi-urban |
| GOU - Gymnasium                             | Health    | Semi-urban |
| WFG - House of Sport GYM                    | Health    | Urban      |
| MGU - Playground                            | Health    | Semi-urban |
| NC - Play Ground-netball court(specific)    | Health    | Semi-urban |
| NG - Gymnasium                              | Health    | Semi-urban |
| PP - Public Playground                      | Health    | Semi-urban |
| PK - Public Playground                      | Health    | Urban      |
| SPU - Playground                            | Health    | Semi-urban |
| VC - Playground Volleyball Court (Specific) | Health    | Semi-urban |
| WOSP - Swimming Pool                        | Health    | Urban      |

Source: Constructed by the researchers, 2020

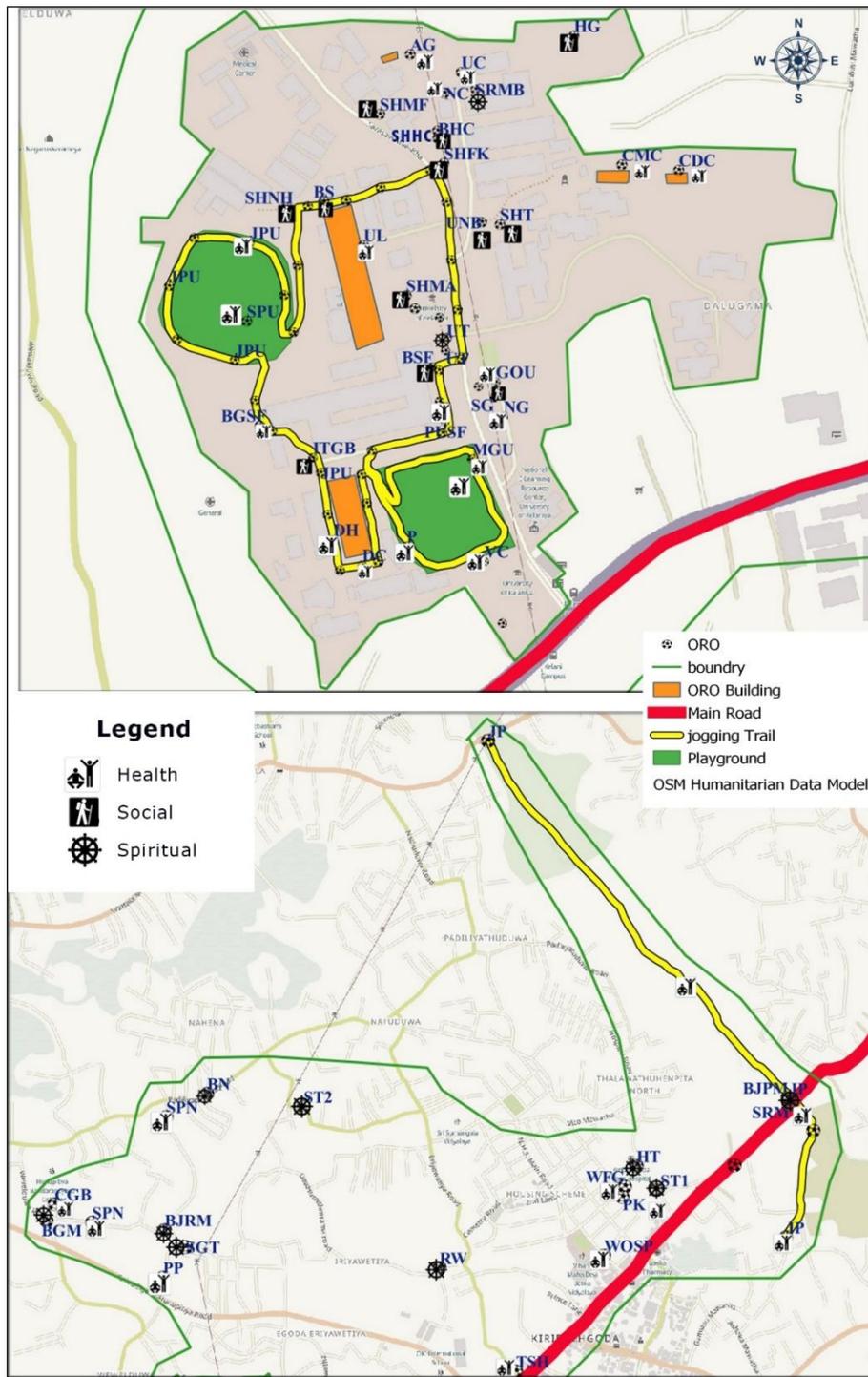
Accordingly, the health benefits in the area are very high compared to the other two. That appears to be 52%. The next 26% appear to be Social benefits and 22% Spiritual benefits. The results for these categories are displayed as a percentage under figure 09.



**Figure 8: Percentage of Outdoor Recreation Opportunities by Benefit**  
**Source: Survey Data, 2020**

Thus, the classification of the identified benefits into a map may provide greater clarity. That enables people who consume the entirety of these opportunities to access those places quickly.

Accordingly, beneficiary mapping can be seen in the following figure



**Figure 9: Results Map with Outdoor Recreation Opportunities, Benefit Classification.**  
 Source - Constructed by the Researchers Using QGIS, 2020

According to ROS can also be divided into another category. These can identify the urban and semi-urban areas where these opportunities are spread. The vast majority of these Cases are based on what region and what they are. People who travel to those areas will be asked what recreation opportunities are easily

accessible. Table 5 shows the relevant information. Similarly, the data obtained for the ROS type were analysed and subdivided into urban and semi-urban. A map created using the category of instances can be used to identify areas of opportunity. The diagram below shows the map.



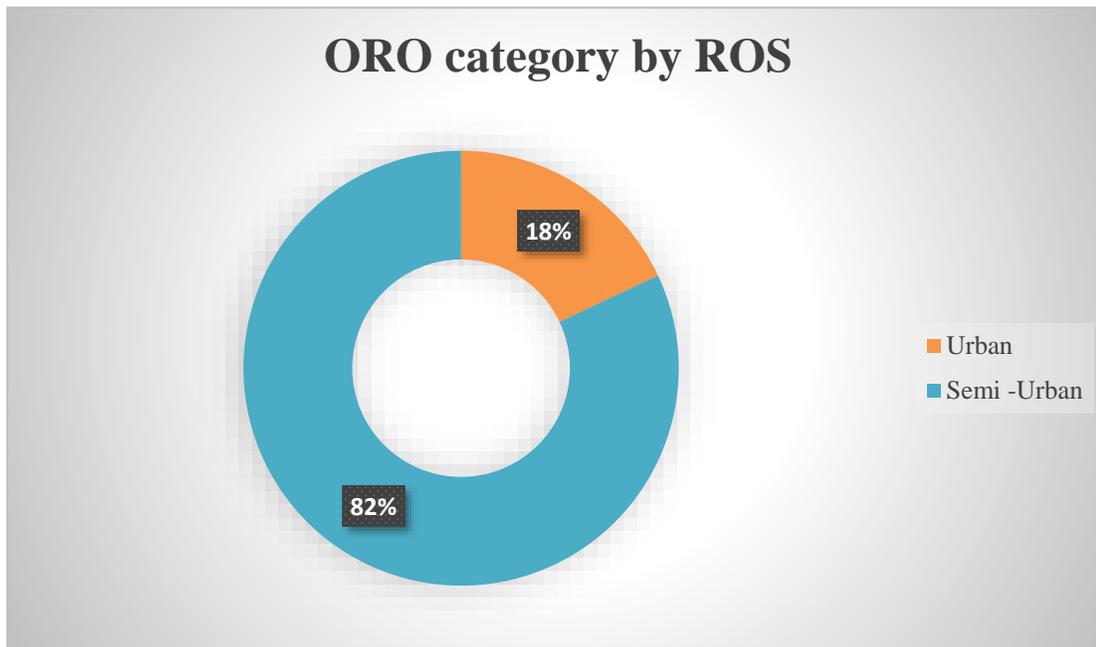


Figure 11: Percentage of Opportunities in the Categories of ORO According to ROS  
Source: Survey Data, 2020

Also, according to Table 05 above, its urban and semi-urban data can be surveyed using the above doughnut chart. Furthermore, doughnut pie-chart 12 shows the percentage of results obtained. Similarly, 18% of the ORO is considered urban, and 82% is semi-urban. Accordingly, all the results can be discussed above.

#### IV. DISCUSSION

What are the current outdoor recreations in Eiriyawetiya, Dalugama, Kiribathgoda, Mahara, and Wewelduwa in Gampaha District? About 50 opportunities were taken in all areas of these areas. Classifying them can be divided into different categories. There can see an OR opportunities classification by activity. It is very important to classify it. Every time there is an outdoor recreational activity to be found. By identifying them and viewing them accordingly, the relevant personnel can access those locations. Accordingly, in Table 1, these are further described in terms of the type of activity. Table 2 also shows the extent of their spread, and Figure 1 shows the percentage of them. Table 3 also gives some clarification on the functions of each of the categories. These cases are categorised as active and passive (Table 4) recreation activities.

The map with the categorisation enables a person in the area to understand what part of the area allows moving on to their respective locations. It is easy to get there if you have a passive place where you need it Or if it is active, it will provide quick access to it. Percentages are identifiable, and the two groups are identified. The most visible is the passive group, which can lead to people who are not good at working hard. Also, people who like the action type can refer to those situations. It can also be classified based on the benefits of all of these identified opportunities. It is social, spiritual and health. This is important for a community

because they need to understand what kind of benefits they get from each situation. Anyone looking for benefits will be benefited with OR opportunities. Accordingly, the result can be seen here. Also, the percentage of such returns can be seen in figure 3. There are more health-related benefits out there, and people are more likely to get emotional and physical health benefits.

Social and spiritual OR benefits also come with these OR opportunities. In the RO spectrum, two main segments can be separated into regions of opportunity. There are semi-urban and urban categories, that classified as such situations as such. Accordingly, the prevalence of these events gives us an idea of whether it is urban or semi-urban. It is very important. That is because you want to see areas where these opportunities are present. In the map, individuals can see their respective zones separately and move quickly. As a result, the percentage explanation for these opportunities is that there are more opportunities for semi urbanisation. Many religious sites and playgrounds were found in this semi-urban area. In the course of a review of other articles, an article assessing how many children could have access to summer breaks and recreational opportunities were also attracted. Previous articles have also explored the spatial dimensions of recreational opportunities for children and youth in an estimated media-sized city for social, economic, and publicly provided entertainment spaces. That has been studied from different age groups and weather-dependent limits. This study expected to have a particular area in a different view of a point such as; to understand the demographic profile of a selected area, to explore the capacities and utilities of the existing ORO in the area, to understand the new avenues for created new ORO in the area and motivation and attitudes towards ORO of the area.

## V. CONCLUSION

Entertainment opportunities are the ability to provide different management settings and to convince people that they exist. It is important to educate the public about the outdoor recreation opportunities in the urban and semi-urban RO spectrum of the Gampaha District. Various outdoor recreational activities and rewards have been found to offer health, social and spiritual benefits. The area of this area consists of Dalugama, Mahara, Eriyawettiya, Kiribathgoda, and Wewelduwa. The Geographic Information System (GIS) is a tool that can do justice to evidence-based activities. Likewise, mapping has a long history. There is also evidence that this is a reflection of the early Paleolithic civilisation. Similarly, GIS technology has become a tool for the management of employees in society.

This GIS mapping has also been a major factor in travel. And ROS has become another tool that can be used to define and manage fun situations. Introduced by the Forest Service's inspectors, the concept was sought after as a solution to problems related to those areas. GEO Tracker software helps you to collect data related to the selected area and store many opportunities. After collecting the data, the area of 3.534km<sup>2</sup> maps has been mapped. The mapping was helpful to identify the ORO of the area. The research is done using secondary and primary data, and it is important to use the method of observation through the qualitative methodology to collect the data of the research.

The ORO has been categorised into different types of research, using data analysis. It has also helped to educate people. The categories are important in terms of outdoor recreation activities, active or passive, OR benefits, and ROS's semi-urban or urban. Also, the category of activities under the activities shows how the community can experience-related activities. It is a question of whether communities are aware of the activities that need to be addressed in their respective communities in Sri Lanka. Therefore, it is necessary to take these opportunities to the masses and promote them to the present. It is through such knowledge that they are given. Also, there is a need to promote ORs by addressing the challenge of developing these opportunities and intervening with governments. It also leads to development and opportunities for the people to create healthy, satisfying, united and loving people. There will also be exchange inflows through increased tourist attractions. Also, it is rare that also the pollution of the rural environment has become a victim of urbanisation and semi-urban Areas have become victims of urbanisation. Accordingly, if people are not happy with the country's recreation, and that opportunities not being developed or newly created, then what is seen future is selfish, united, broken family environments and happily poor communities. The country only leads to competition, and the absence of a moral and spiritual community is causing the country to collapse without human satisfaction.

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# Indonesian Consumer Behaviour Model in Choosing Halal Food

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**Abstract-** This is an analysis of the model of Indonesian consumer behavior in choosing halal food, that some researcher found various influencing factors there. Legal theory is using in this paper that was describe There is no standard model for choosing halal food, religion is not the main reason for a Muslim, even though devout Muslims tend to really consider the halalness of a product. Healthy and hygienic is also important for them.

**Index Terms-** Halal food, behavior and law on guarantee of halal products

## I. INTRODUCTION

Behaviour is a manifestation of the complexity of the struggle to influence in individual. Every single thing the person does is the image of the domination of one or more factors that influence, which if it is not, the result of a compromise of multi influence factors. The values and norms of social, cultural and personality systems that are behind behaviours or actions are often referred to as internal and external factors.[1]. There are numerous concepts with many different kinds of terms describe two kinds of factors that could elaborate on human behaviour models in various aspects of the life they lived. [2].

One of the aspects is the fulfilment of food needs. Food and drink cannot be separated from everyone and even many people act and behave inappropriately because of this. Moreover, the criteria that are being discussed here is halal food and drinks that require more than usual standards. These have certainly been absorbed by society and international community so that they almost comply with reasonable standards. Since 14 years ago, *Codex Alimentarius* acknowledged the use of halal terms in a product.[3]. Therefore, various models of behaviour that related to halal food have developed nowadays, including in the Muslim community in Indonesia.[4]

Generally, based on research in the several country find that people's behavior in choosing halal food can be influenced by many factors. The main Factor that focus on in this analysis is religion's factors, since provisions halal food is determined based on the teaching and religious law, whether Islam or not. At American Orthodox Jews known as the term *Kosher Meat* since the 60s. *Kosher Meat* means halal meat. The halal criteria for "Kosher Meat" are determined based on the religious teachings. [7] Their restrictions on ingredients from the type of

meat caused initially many vegetarians to consume products labeled kosher meat. While on the type of meat is recognized over, it guarantees the quality of her and healthier.

The selection of food, can be affected by factors Personal Including culture and ethnicity.[8] It is mainly on people in urban areas with cultural and ethnic diversity, causing factors personally more prominent into consideration. Religion can also be influential, but according to Dindyal, the influence is not large due to the level of acculturation in certain religious groups. A diversity is in connection with the limit individuals to follow the teachings of their religion, where individual's interpretation in religion contribute so that in reality there are some individuals who are religious and religiously follow them strictly in accordance with the rules and teachings her. This individual is committed to always maintaining his behavior so as not to conflict with religion. Meanwhile, there are also some people who may not be religious and will tend to follow their religion more loosely and less strictly. Other influencing factors are social groups, culture, physical appearance, values and customs. While culture on the other hand actually refers to a set of shared values, assumptions and perceptions. [9]

In connection with this, Bonne and Verbeke also found a similar situation in Belgium.[10] The motivation of Muslims there to consume meat has grown over time. In general, health, confidence, enjoying life or form of awareness in the family becomes the main goal they buy meat. This belief in halal is also shown by the place where they buy the meat. Some even do not buy meat with a halal label in a supermarket Because it is not sure d halal label there. Some are willing to drive far just to get a place for slaughtering animals from among Muslims. Although in contrast, some are not strict in requiring them. By understanding the belief held by consumer are not disturbed and feel simply by visiting a supermarket.

Almost the same as Belgium, Munyaradzi Mutsikiwa and Clay Hutama find Muslim consumers in Zimbabwe have high sensitivity to the orientation of social Reviews their culture to consume kosher food. While overall the people there assumed by Munyaradzi and Clay that education, religion, occupation and stratification affect consumers. However, when proven, fax turns social culture that can not be Categorized effect on multi-religious society there. [12]

In contrast to Belgium and Zimbabwe with various religious backgrounds, Pakistan, which firmly calls the "Islamic Republic of Pakistan" does not guarantee that its people's behavior has a high awareness of

halal food. Faryal Salman and Kamran Siddiqui [13] Showed that there is no correlation between the idea of the identity of the self awareness of food halal in spite of belonging to a collective society. [14] The attachment with the behavior is makeup religion is private so the buying behavior is a form of decision was taken by value intrinsic and not extrinsic. Salman and Kamran also found that for the people of Pakistan :

- a. Religion is the source of the almighty on Muslim consumers
- b. Faith is closely knit with religious commitment.
- c. A very religious person does not necessarily have a high level of awareness about halal food.
- d. The attitude towards halal food is very close to the idea of belief
- e. Identity dogma has more to do with intrinsic k than extrinsic forces.[16]

The image of awareness in Pakistan about food products above shows that subjective norms, attitudes towards halal food and personal religiosity do have a correlation with the intention to choose halal products.[17] Thus, the role of religion as a rock fonda si for men in shaping the attitude to be clear and visible. However, if this intention is related to behavior, there is a difference as stated by Salman and Kamran

The United Arab Emirates even feel concern for halal products in circulation in the country. This concern is also triggered by distrust of the halal label originating from outside countries that are not Islamic countries. This situation is strengthened by the misuse of halal labels for non-halal food. One of them was reportedly exported food from Britain which was placed in a row of halal food in a supermarket in Dubai. This public attention and concern demands certification of the halal label used by institutions that have high credibility. In John Ierland research and Soha Abdollah an expert R Also reported in Malaysia Gulf News that 95 percent of kosher food exported from the *United State* are not really kosher. [18] This situation is made possible by the corruption and ignorance of producers. But there are interesting from public concerns the United Arab Emirates this, that the issue of halal food are not restricted merely from non-kosher materials on the basis of purely religious understanding. But the health element is also their concern. So concerned they are Also associated with non-kosher food, the which will lead to Certain diseases such as heart disease, diabetes and obesity.[19] Based on this, the meaning of halal food has expanded to the area of health, not only from raw materials.

The phenomenon above, is possible in Indonesia, Endang S. Soesilawati found several big issues that show the factors that influence the behavior of Muslims, especially in Banten related to the consumption of halal food. First, the community of Muslims in Banten have the awareness that high against halal and haram food, specifically when choose the food they want such as meat, fish and vegetables. This awareness also causes them to consistently put high priority on halal issues when they want to determine a restaurant. Second, the role of the government in promoting and controlling religious behavior in terms of consumption of halal food is not yet adequate. So that what drives their decision to act is religious law and religious leaders. Third, that diversity is also influenced by religious experience and educational background. Those who have lived in

Islamic boarding schools tend to have *control* and *concern* regarding halal consumption. So that there is a correlation between the level of individual religiosity and consumption of halal food. [20] Although the relationship between education level and consumer behavior is relatively weak. Fourth, the most important criterion for halal food for consumers in Banten is that their food is free from pork and alcohol. Therefore, a certificate from the Indonesian Ulema Council is not that important to some of them. Some circles still believe in the halal label attached to products and those found in restaurants. Although basically they still found that the MUI halal label more believe than others. [21] However, they object to the halal mechanism and procedures both in terms of time and costs. [22]

There are similarities in the behavior of Indonesian people (the results of Endang Sosilawati's research) with Pakistan, that public awareness is quite high regarding halal food. The non-kosher food for the people of both nation clearly drawn to the terms in the text that are forbidden in a Islamic law such as pork or alcohol. They do not seem to be *concerned* about processed food, which is an additive to food production. In fact, the additive material - it is also processed by synthetic or non synthetic methods - is very vulnerable to using non-halal materials. Term of flavor (*flavoring*) [23], gelatin[24] and enzymes[25] is one of the most frequently used ingredients. Bread that is often encountered, many contain flavor so that the bread has a more special and delicious aroma and taste. In addition, it is possible to use white butter[26] (*shortening*) while white butter is prone to the use of lard in the manufacturing process through certain chemical reactions.

In Indonesia, there is no single model of behaviour that can be applied to all places in Indonesia, (or even in the world), situations and conditions or the environment, including the parts that stimulate differently than individual factors and psychological factors in these places. The religious factor, namely the Islamic law that is attached to halal food, does not automatically become a dominant factor that stands alone in the formation of a behaviour model for buying and consuming halal food. Moreover, religion is only a sub-culture part of some of the factors of Kotler's Culture Model Behavior.[5] It is also influenced by the taste and nutrition of certain products,[6] Knowledge of general Islamic law which is not cover all the details, has the potential in creating a model of behaviour that does not pay attention to even the details of halal food. Some Muslim consumers rely on food laws on the people who make and/or sell them. If the foods are made by Muslims, or neighbours and relatives they know well, they believe those are halal. [7]

On the other hand, the level of knowledge and understanding affects the behaviour model of consuming halal products in synergy with the religious activities people are joining. Knowledge is obtained through non-formal channels, not on the basis of formal religious education background, Islamic boarding schools or others. Some activities like recitation, *majelis taklim*, religious lectures via television/radio have played an important role.[8] In the case of Banten that emphasized the halal label from The Indonesian ulema council (MUI) and the existence of a

special halal meat market, members of the community have a minimal religious knowledge background. Sufficient knowledge of religious law is considered to be able to independently determine halal food.[9] However, it cannot be elaborated in more detail, whether with adequate religious knowledge, the process or supplementary food ingredients that develop rapidly with various processes (chemical or genetic engineering) can also be determined easily. While certain environments can provide a strong religious knowledge search stimulus by supporting the basic assumption of the theory which states that society will become more religious when the security of its existence is compromised.[10] Bali is a predominantly non-Muslim area. In the field of halal food, they are in an unsafe condition, therefore, Muslim consumers in Bali are more alert, more sensitive and try hard to secure their existence so that they can still consume halal food. Trust in religious institutions, namely The Indonesian ulema council (MUI), has increased, so they check the halal label of packaged food before buying it. Likewise, The Indonesian ulema council (MUI) and LP POM The Indonesian ulema council (MUI) have played a good role in providing information and mentoring the community. The effort in providing free certificates are even carried out by establishing cooperation between related agencies, in this case also the Ministry of Industry.[11] Moreover, ethnicity and cultural aspects such as the identity of restaurant owners are as important to this area as in Manado.[12]

In addition to factors that are categorized as psychological or internal factors, there are external factors or social factors that also shape Muslim consumer behaviour models. These are the same as the factors of knowledge and religion. There is no uniform determination to shape consumer behaviour. In the context of non-food, which in this case is cosmetics, the *peer group directly influences* the consumer's decision to buy cosmetics halal labelled.[13] It is possible that cosmetics are often discussed among peers, which in turn result in the formation of the same knowledge or perception of a product. In terms of food, there are also differences, which do indicate the influence of social factors. Today's social environment is influenced by the global situation with a fairly precise marketing strategy. One of the food products, namely Indomie instant noodles, has gone global and consumed by the people worldwide. This situation proves that social factors have a significant effect on purchasing decisions.[14] However, for packaged foods in general (not limited to Indomie only) that are labelled halal, social factors do not have a significant effect.[15] In contrast to Indomie that has gone global, packaged food labelled halal is still developing, so it has not become the knowledge, understanding and perception of the wider community yet and neither a lifestyle.

Meanwhile, neither the environment nor the pressure of the surrounding community will significantly affect the formation of consumer behaviour models if consumers have a strong attitude and behavioural controls.[16] With this power, the consistent behaviour model of consuming halal food everywhere can be predicted. This attitude and control are not limited to religious knowledge or religious law alone, but the health and benefits of food are also considered. This confirms that social factors are less influential. The benefits of food refer to knowledge, as well as health refers to the consumer's personal self-awareness.

There is also a pattern of behaviour that shows a degradation in the intensity of daily application, where there is a gap between knowledge and awareness of the importance of halal certification and labelling and the applied behaviour. Approval of halal certification and labelling is not always followed by taking actions that only buy and select food labelled halal. Some people still consume products without labels, as they also continue to enjoy eating in restaurants that do not have halal certificates.[17] Yet some products that are expressly stated without halal label are still overrun by the consumers who want to consume them.[18] It is possible that there are facilities that provide the opportunity to select these products. The availability of a special halal meat market automatically affects the consumption pattern of halal meat.[19] Specifically, the people of Jakarta and Melbourne who were studied by Yusmaliany, apart from facilities, behaviour control is also an important determinant of the behaviour of consuming halal meat.

In order to put the behaviour of choosing halal food in the realm of law, Friedman categorized at least several models of legal behaviour.[20] The first is the *cost-benefit model*, which is a model on the basis of rational, profit-loss, reward and punishment (sanctions).[21] Punishment and sanctions prevent a person from committing a prohibited act. [22] In relation to halal food, besides religious sanctions[23] and specific sanctions for producers[24], the benefits or rewards that are taken into consideration are the convenience and safety of consuming the product and the assurance of product health. The second model of behaviour is based on social factors, which are "social relationships" in the form of environmental culture and *peer groups*. [25] Next, the third model is behaviour based on norms within the person, which has been internalized in the form of conscience.[26] Meanwhile, the fourth model was not elaborated by Friedman even though it claimed that has been doing by many people, which is behaviour based on laziness and habit because of limited knowledge and the opportunity that can not be refused. [27] Most people follow their habits without thinking about anything else they can do.

Friedman's legal behaviour model can be seen clearly in the models of halal food consumer behaviour above. Still, each model has interconnections with each other. There is no behaviour that is solely thinking about profit and loss, worrying about sanctions, even though the sanctions contribute to the prevention of behaviour that violates or deviates. Subsequently, there is no single behaviour is completely controlled by peer group determination, in certain cases, peer-group dominance occurs. People have consciences that can not separated from themselves when there are influences or decisions to take action.

On the other hand, obedience to a law or non-compliance is also related to legacy or authority. Tyler categorized these two related perspectives, namely *instrumental* and *normative*. [28] External factors are quite dominant in instrumental, where incentives and punishments and/or personal gains and losses become the basis for shaping behaviour. Meanwhile, the normative perspective leads to norms internalized by society in the form of justice and morals which may contradict personal interests. In this case, Tyler saw the connection normative commitment to the authority of the law and law-abiding behaviour, so when there is conformity between the law and their norms and attitude, people will accept and follow the rules of

law. In relation to halal food, for the Muslim community, it must be in accordance with the internal norms that are believed. On this basis, behaviours that show obedience by consuming halal products should be voluntarily done by the people without coercion or from any other sides, abide the law due to necessity or compulsion in the case as the manifestation of the commitment of normative through personal morality (*normative commitment through morality*). In addition, normative commitment through legitimacy (*normative commitment through legitimacy*) that related to the existence of the authority or those who stipulate the law, having the right and authority to dictate behaviour.[29] In this case, those who stipulate halal have absolute authority over all Muslims, but in determining the mandatory certification and labelling, the authority of the The Indonesian ulema council MUI is indeed disputed.

In the context of Indonesia as a country, where the issue of halal products has been accommodated from Islamic law into national law, the application of the law is highly dependent on the legal system which consists of legal structure, legal substance and legal culture. The legal structure in Indonesia includes the structure of the law enforcement institutions such as the prosecution, police and courts. The legal process in court, judiciary, how to cover judicial instruments. With the existing structure, the presence of the law on guarantee of halal products (JPH) as a legal substance has shown which legal structure will be elected in cases related to this Law. Substantially law on guarantee of halal products (JPH) wants to implement Islamic Law. At this level, the Islamic Law that is discussed here has become a formal juridical law, and no longer as a normative law that lives in society, is obeyed and implemented in relation to the provisions of the religion being held.

Before law on guarantee of halal products (JPH) exists, compliance or behaviour that follows Islamic religious law through halal certification and labelling The Indonesian ulema council (MUI) is influenced by the awareness of religious sanctions and the legitimacy of The Indonesian ulema council (MUI) as a religious institution that has authority. After this law has passed, formal legal sanctions and legitimate are binding and cannot be ignored without consequences, even if only specifically for entrepreneurs or producers. These two factors are indeed the dominant factors in academic fields. Friedman and Tyler's theories also attached the important attention to these factors, which is further added by Richard Adams, with the expressive power of law in order to coordinate behaviour and inform beliefs. The coordination function is related to the actual benefits that will be received simultaneously by each individual through the behaviour of obeying a law. There is hope in each individual to get benefits from the other individuals. [30] Information is very important to change a belief. Information about a certain law that reaches individuals or society is possible to change beliefs in certain actions which in turn can change behaviour. Information about smoking and its dangers to health, for instance, can change the belief that heavy smokers stop their habits without coercing others. Coordination and information on legal functions that should be applied at the empirical level as a form of legal expression so that legal mechanisms do not just generalize sanctions or legitimacy.

At the level of the *usul al-fiqh*, the term *mahkum fih* or *mahkum bih* refers to the deeds or behaviour of *mukallaf*. An act

is only labelled as law if it fulfils three conditions, namely the existence of perfect knowledge regarding the action, its legitimacy from God as a form of obedience, and any action that may be realized, with the understanding that it falls into the category of human ability.[31] In the context of halal food, basically, the public already knows about halal food even though within certain limits. At the level of application, their behaviour varies not only based on knowledge of Islamic law but is influenced by other things, as illustrated in the behavioural models above.

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# Introduction to the 3W Theory in Multidisciplinary Advanced Research from the Qur'ānic Perspective

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**Abstract-** This paper presents introduction to 'the 3W Theory in Multidisciplinary Advanced Research from the Qur'ānic Perspective'. Researchers may use advanced relevant theory and high quality methodology that formulated based on the divine knowledge in order to apply research ethics, to do research based on characteristics, valid objectives as well as importance of research. The '3W theory' therefore, has been formulated from the Holy Qur'ānic viewpoint. A research will be appreciated as a fruitful research if its researcher(s) can attain at least an objective from the Qur'ānic objectives of research. For instance, discovering new facts, unique information, reaching a new understanding, identifying problem, recognizing cause(s) of problem and factual consequence of identified problem, finding solution to the problem as well as obtaining *ma'rifatullah* (gaining knowledge about Allah). It is a theory, which aims to fulfil abovementioned objectives of research. The main objective of this introduction is to introduce 'the 3W theory' with researchers in multidiscipline of study. This theory will guide to attain the Qur'ānic objectives of research, motivate to respect a person, community and nation as we all are humans. The natural and human ecosystems will be fortified instead of expensive disaster; societies could be peaceful by gaining everybody their justified rights regardless.

**Index Terms-** Qur'ān and sciences, solar system, research methodology, multidisciplinary research, natural ecosystems, research theory, Qur'ān and research

## I. INTRODUCTION

Each philosophical thought denotes there has a philosopher of it, each research is evidence on its researcher(s), and each

discovery's has an inventor. Philosopher claims it is his philosophy, likewise researcher(s) as well as inventor. People have curiosity to extend knowledge about inventor of universes. Scientists have presented some difference information about the age of solar system and earth in scientific literatures. The age of the earth is  $4.54 \pm 0.05$  billion years based on evidence from radio-metric dating of meteorite material, which is similar to the ages of the oldest known terrestrial and lunar rocks<sup>1, 2, 3</sup>. The solar system, formed between 4.53 and 4.58 billion years ago. The age of the solar system and earth found for 4.54 billion years. However, recent research shows the age of the earth 4.55 billion years<sup>4</sup>. The origins of life appeared early in the history of the earth, probably before 3.5 billion year ago<sup>5</sup>, some research results suggest that life appeared as early as 4.1 to 4.28 billion year ago<sup>6</sup>. Animals have existed for around 600 million years before humans ever existed on earth<sup>7</sup>. Since first era of humans' existence in the earth still now from them nobody claims that he did create the solar system and earth, the sun or the moon or a star or a plant even a single ant. The reality is that Who is the Creator He says that He creates universes and all resources into them. Almighty Allah says: "*Verily, your Sustainer is Allah, who has created the heavens and the earth in six aeons, and is established on the throne of His almightiness. He covers the day with the night in swift pursuit, with the sun and the moon and the stars subservient to His command: oh, verily, His is all creation and all command. Hallowed is Allah, the Sustainer of all the worlds!*" (Al-Qur'ān 7:54).

Transliteration of the Qur'ānic text of the verse '*Istawa 'ala al-arsh*' (established on the throne of His almightiness), Muhammad Asad states that the term '*al-arsh*' refers to 'throne' or 'seat of power'. Almost all Muslim commentators both classical and modern are unanimously of the opinion that its metaphorical

<sup>1</sup> Ciner, A., Sarıkaya, M. A., & Aydar, E. 2013. Comments on "Monitoring soil erosion in Cappadocia region (Selime-Aksaray-Turkey)" by Yilmaz et al. (Environ Earth Sci 2012, 66: 75-81). Environmental Earth Sciences, 70(4), 1927-1931.

<sup>2</sup> Dalrymple, G. B. 2001. The age of the Earth in the twentieth century: a problem (mostly) solved. Geological Society, London, Special Publications, 190(1), 205-221.

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<sup>7</sup> Clarence Sherrick. 2018. works at Psychic Eye, Las Vegas Were animals here on Earth before humans? <https://www.quora.com/Were-animals-here-on-Earth-before-humans>

use in the Qur'an is meant to express Allah's absolute sway (power, control, authority, mastery, rule, dominance and so on) over all His creation. It is noteworthy that "established on the throne of His almightiness" has been mentioned in different seven chapters (Qur'an 7:54, 10:3, 13:2, 20:5, 25:59, 32:4 and 57:4), this expression is connected with a declaration of His having created the universe. The word '*yawm*' usually interpreted as 'day' but rendered above as 'aeon' is used in Arabic to mean any period, whether extremely long (aeon) or extremely short (moment): its application to an earthly 'day' of twenty-four hours is only one of its numerous connotations<sup>8</sup>.

There has relationship between the Creator and creatures. All resources are creations of the Creator. Resources are playing their important role in natural ecosystem by following the command of the creator. Each species of biodiversity has its own role, work and vital contribution. In fact, humans are most honorable creation over the other all creation. Nevertheless, results of disobedient of the command of the Creator a large number of people lost their conferred honorable stage, their evil deeds causes for contamination of the social and natural environment. A number of scientists are inattentive to apply their reason and intellectuality in order to achieve knowledge about the Creator through their researches.

Synthesis between sciences and religions is utmost important. Aims and objectives of a research have to be comprehensive. Research aim have to include knowing the Creator and His Abilities, Supremacy, Lordship, Attributes, Beauty, Greatness, and Oneness and so on.

Hence, justified research theory is essential to know purpose of life, responsibilities, to know the creator through research and to get back their original value as human as well as redevelop better relationship with the Creator. Research theory can play a significant role if it being formulate from the divine knowledge perspective. 'The 3W theory' is a newly developed research theory based on the divine knowledge that can guide researchers to attain abovementioned goals. An article is not sufficient to present the overview to 'the 3W Theory in Multidisciplinary Advanced Research from the Qur'anic Perspective'. Nonetheless, researchers have tried to present summary of the theory in this article.

## II. KEY CONCEPT OF 'THE 3W THEORY'

In 2013, Muhammad Sirajul Islam (1981-) has formulated 'The '3w theory' in multidisciplinary advanced research from the Qur'anic perspective'. Consequently, his attention to research oriented verses in the Holy Qur'an the researcher has found that these verses denote to three question types – "what", (Al-Qur'an 2:29, 7:185, 96:1-2, 30:8), "why" (Al-Qur'an 2:29, 15:85, 21: 16, 30: 8) and "what" (Al-Qur'an 7: 56, 13:11, 8:53, 29:69). In addition, the researcher has found What, Why and What in a verse (Qur'an 30:41) which are all associated with multidisciplinary research. Therefore, it has been entitled '3w theory'. The 1<sup>st</sup> (w) is

for "what", the 2<sup>nd</sup> (w) is for "why" and the 3<sup>rd</sup> (w) is for "what" in research.

To an initial explanation of this theory, researcher has developed three Models from the Qur'anic perspective. In Model 1, 'the 1<sup>st</sup> w 'what' is the research subject; in Model 2, 'the 2<sup>nd</sup> w 'why' do the research subjects; and in Model 3, the 3<sup>rd</sup> w 'what'. It means after finding the results of research (by using the 1<sup>st</sup> w what and 2<sup>nd</sup> w 'why'), the 3<sup>rd</sup> w "What" recommends to discover the method to improve and utilize of the result(s) in research, to take justified initiative, valid and appropriate decision and so on.

## III. WHY THE CREATOR CREATED US?

The Holy Qur'an is a divine knowledge that motivates humans to know about them, purpose of human life, their duties and responsibilities. It is indispensable and appropriate guideline in each and every task including research activities (Qur'an 2:2). Indeed, most of the times we forget to remember who we are, why the Creator created us, and what our responsibilities are. We are human; the Creator created us for His worship (Qur'an 51:56). It is humans' obligatory duty performing the commands of Almighty Allah and His Messengers (Qur'an 59:7). A number of people in the current world have not comprehended this truth yet. Even those people who believe that an instrument cannot be invented without an inventor; some of them unfortunately do not believe in their Creator. Those who believe it is essential a user guides of an instrument; unfortunately, some of them disagree with the complete guidelines of human life. Over and above, those who believe that a user guides of an instrument expect from the inventor; however, some of them remain in doubt about the complete guidelines of human life that comes from the Creator.

'The 3W theory' therefore has been formulated in understanding this truth. People who showing disobedience through their wrong activities, they should know that there is no way to escape from punishment such as punishment in the form of social disasters, natural disasters, various forms of pandemic, economic meltdown, physically and mentally harassment and so on. Moreover, in the hereafter the fire of hell for their negligence. Hence, humans have to perform the complete acceptable worship of Almighty Allah Who is only One, there is no any partnership with him<sup>9</sup>.

## IV. HUMANS ARE DEPENDENT ON THE SOCIETY AND RESOURCES FOR WORSHIPING OF THE CREATOR

Naturally humans dependent on the society and resources to fulfil their needs and completely worship of the Creator. They cannot survive if be isolated from social and natural ecosystems. Better-justified relationships with humans, biodiversity, social and natural ecosystems help to fulfil worship of the Creator and develop a relationship with Him. Person cannot be a good slave of the Creator if he misuse resources and misconduct with people in society. For these reasons, they must enlarge their research in each

<sup>8</sup> Muhammad A., 2007. The e-text version of the book The Message of The Quran.

<sup>9</sup> Islam, M. S., & Samsudin, S. Concept in Formulating the '3w Theory' in Multidisciplinary Research from the Qur'anic

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and every subject interrelated to the natural and social ecosystems in order to extend knowledge about what is misuse and better use of resources and what is misconduct and best conduct with humans regardless, and finally to know the divine creativities.

#### V. KNOWING THE CREATOR THROUGH RESEARCH

It is obvious that in the contemporary research world researchers are not conducting research into natural resources to know the Creator and Mastery of the Creator in creating resources. Unfortunately, also, they do not feel this core issue; consequently, they ignore the possibility to increase knowledge about the Creator by basic research in resources. Scientists' contributions in understanding resources, the natural phenomena as well as technological development by basic and applied research are highly appreciate. Nevertheless, they are missing gaining knowledge about the Creator by the same research topic, cause of not using methodology and theory that developed in light of the divine knowledge. Hence, it is essential formulate theory and methodology from the divine knowledge prospective. This paper is an introduction of such theory 'the 3W theory in multidisciplinary advanced research from the Qur'ānic prospective'. It encourages scientists to conduct their researches by using 'the 3W theory' in order to attain both answers of their research questions and knowing the divine creativities by the same research alike. For example, realizing the reality to show the signs of the Creator, understanding the *tawhid*-belief in oneness of Allah through realizing the truth, relationship among the Creator, His creatures and humans and so on.

#### VI. ESSENTIALITY OF INTEGRATION BETWEEN SCIENCE AND BELIEF

Science continues to make significant strides in terms of nature, technology and overall quality of life change. However, with these revolutionary and innovative technological advancements, science appears to have failed to help man regain his lost balance, happiness, and peace in face of the complex moral and ethical dilemmas, escalating environmental crises, and deepening confusion on the purpose of life, morality, destiny of human societies and consciousness of the universe. This state of affairs calls for critical re-evaluation of the philosophy of science, scientific education and instructional pedagogy; the relationship between science and belief, and the potential role spirituality can play in the process of tapping inner human capabilities in the understanding of universe. It was to these conditions that Barbour referred to when he noted that the prevailing views that support the hypothesis of independence or conflict between religion and

science that characterized Western narratives were in need of reconceptualization, particularly in view of the complex dilemmas and challenges presented by the contemporary era, with respect to the advancements of secular sciences<sup>10</sup>.

In order to better serve nationalism ideologies, secular education seeks to fulfil material learning goals and also seeks to divorce the propensity of belief, religiosity and spirituality from the business of life, education, economy, politics, arts and other fields of knowledge<sup>11</sup>. The secular philosophy of knowledge that influences the definition of science and the methods of scientific teaching, alters these critical conceptualizations of worldview and destiny of science, man's interests, life values and ethics, limitations and ideologies<sup>12</sup>.

Nature is built as a symbol of the Creator, with different forms of knowledge ranging from mathematics, physics, metaphysics, spirituality, aesthetics and so on<sup>13</sup>. Early Muslim scientists and non-Muslim faithful scientists managed integration between science and spirituality. For example, (scientist Muhammad ibn Mūsā al-Khawārizmī (d. 850), otherwise known as the father of algebra, a polymath with many contributions to the fields of mathematics, astronomy and geography, and the history of sciences. In his master work, *Al-Jabr Wal-Muqābalah* (The Algebra), al-Khawārizmī clearly ascribes spirituality a high position: Praised be Allah for His bounties towards those who deserve it by their virtuous acts; in performing which, as by him prescribed to His adoring creatures. we express our thanks, and render ourselves worthy of the continuance (of His mercy), and preserve ourselves from change<sup>14</sup>. Relationship between science and belief is timely issue to protect humans' natural disposition, unity on truth and reality, develop moderation, mortification, self-discipline, self-control to enjoy real happiness and holistic life style. Reviving science and spirituality essential to proper resource management, environment friendly scientific research.

#### VII. RESEARCH SUBJECTS OF RESEARCHERS

According to the Holy Qur'ān all types of resources are research subjects. The Creator says in the Holy Qur'ān, "*It is He who created for you all that the earth contains.*" (Holy Qur'ān 2: 29). Scientists have to research to know information related to three major questions: the earth contains what type of resources; why these resources and what way resources can be better utilized. More recently, scientists reported that 1 trillion species are estimated to be on earth currently with only one-thousandth of one

<sup>10</sup> Machouche, S., Bensaid, B., & Ahmed, Z. 2019. Crossroads between Islamic Spirituality and the Instruction of Science. KEMANUSIAAN: The Asian Journal of Humanities, 26.

<sup>11</sup> Machouche, S., Bensaid, B., & Ahmed, Z. 2019. Crossroads between Islamic Spirituality and the Instruction of Science. KEMANUSIAAN: The Asian Journal of Humanities, 26.

<sup>12</sup> Bakar, O. 2008. Tawhid and science Islamic perspectives on religion and science. (2nd ed.). Kuala Lumpur: Arah Publication.

<sup>13</sup> Bakar, O. 2008. Tawhid and science Islamic perspectives on religion and science. (2nd ed.). Kuala Lumpur: Arah Publication.

<sup>14</sup> Machouche, S., Bensaid, B., & Ahmed, Z. 2019. Crossroads between Islamic Spirituality and the Instruction of Science. KEMANUSIAAN: The Asian Journal of Humanities, 26.

percent described<sup>15,16</sup>. It is estimated that there are up to 1 trillion species of these microorganisms, which include bacteria and archaea, and we have only classified a few thousand so far. The reason for this slow progress is that prokaryotes are hard to isolate<sup>17</sup>. Klein, A. states that earth could contain nearly 1 trillion species, with only one-thousandth of 1% now identified<sup>18</sup>. Botanists have been found almost 375,000 plant species, with additional being discovered every year. All plants are photosynthetic, consuming carbon dioxide, water and light energy to produce oxygen and sugars<sup>19</sup>. About 91 of the 118 elements in the periodic table are metals or metalloids. Some metals are ubiquitous in the environment of human life. The most significant exposure to metals occurs in industrial use<sup>20</sup>. According to birds researchers the number of bird species in the world somewhere between 9,000 and 10,000 thousand<sup>21</sup>. There are about 18,000 bird species in the world – nearly twice as many as previously thought, new research suggests<sup>22</sup>.

There are nearly 20,000 known species of bees worldwide<sup>23</sup> in seven to nine recognized families, though many are undescribed and the actual number is probably higher<sup>24</sup>, they are scattered in habitat that has flowering vegetation where they can consume on nectar and pollen<sup>25</sup>. There are over 150 species of roses<sup>26</sup>. More than 90,000 samples of cultivated rice varieties and wild species are stored at the International Rice Gene Bank and these are used by researchers from the world<sup>27</sup>. It has been recently estimated that between 700,000 and one million species live in the world's oceans<sup>28</sup>. According to new analysis which also estimated that between one-third and two-thirds of those species have yet to be named and described<sup>29</sup>. I have mentioned these items of subjects as an example. Hence, according to the Qur'anic encouragement uncountable subjects and issues are research subjects in the natural resources.

## VIII. MULTIDISCIPLINARY RESEARCH

Multidisciplinary means that a particular (policy) problem or an (other) observable phenomenon is considered from different disciplinary viewpoints. This eventually involves a confrontation of different scientific approaches (concepts, models, methods, findings), in the hope that together the multidisciplinary research team succeeds in producing a coherent picture of the relevant problem, possible explanations for (parts of) it, and potential solutions. Since about 1990, when sustainability became a key concept for a wide range of scientific disciplines, the need for multidisciplinary collaboration has increased<sup>30</sup>.

Corbeil, M. C. defined "A multidisciplinary approach involves drawing appropriately from multiple disciplines to redefine problems outside of normal boundaries and reach solutions based on a new understanding of complex situations"<sup>31</sup>. The multidisciplinary research is the best method to be used especially in the contemporary world. In addition, in contemporary research world, before establishing a new idea it is essential for experts from different fields to examine and identify appropriately its positive and negative effects. The universe is multifaceted; there is coherence among humans, animals, and the nature and so on in the universe. Furthermore, to obtain the beneficial expected result of research there is a need for an integrated research by experts from different fields in light of their own discipline, methodology as well as research outlook and methodology based on the divine knowledge. The Creator says,

<sup>15</sup> Staff. 2016. "Researchers find that Earth may be home to 1 trillion species". National Science Foundation. Retrieved 11 December 2016.

<sup>16</sup> Ghazal Aswad, N. 2018. Portrayals of Endangered Species in Advertising: Exercising Intertextuality to Question the Anthropocentric Lens. *Environmental Communication*, 1-17.

<sup>17</sup> Klein, A. 2018. Reading the book of life. *New Scientist*, 237(3172), 40-43.

<sup>18</sup> Guloglu, Y. 2017. National and International Conservation of Biological Diversity in Terms of Administrative Law "Sample of Turkey". In *Genetic Diversity*. InTech.

<sup>19</sup> Md. Sirajul Islam and Sofiah Bt. Samsudin. 2014. Discover the Miracle of Fruit Plant Species Mentioned in the Holy Qur'an and Their Folk Medicinal Importance. *Aust. J. Basic & Appl. Sci.*, 8(9): 287-303.

<sup>20</sup> Pałczyński, C., & Kupczyk, M. 2018. Metal Allergy and the Lungs. In *Metal Allergy* (pp. 533-544). Springer, Cham.

<sup>21</sup> Blackburn, T. M., & Gaston, K. J. 1994. The distribution of body sizes of the world's bird species. *Oikos*, 127-130.

<sup>22</sup> May, W. T. 2016. The Number of Bird Species Just Doubled.

<sup>23</sup> Zayed, A. 2009. Bee genetics and conservation. *Apidologie*, 40(3), 237-262.

<sup>24</sup> Abrol, D. P., Shankar, U., Nitin, K. S., & Gowda, G. B. 2016. Honeybees and Beekeeping: The Global Scenario. In

*Arthropod Diversity and Conservation in the Tropics and Sub-tropics* (pp. 345-372). Springer, Singapore.

<sup>25</sup> Haris, A. 2013. Ants And Bee As Quranic Allegory Within Al-Quran Semut Dan Lebah Sebagai Alegori Qurani Dalam Kitab Suci Al-Quran. *taklim*, 354.

<sup>26</sup> Chavada, J. R., Thumar, B. V., Vihol, A. N., Patel, V. S., & Padhiyar, B. M. 2017. Effect of Potting Media on Growth, Flower Yield and Quality of Rose (*Rosa hybrida* L.) CV. Top Secret under Protected Condition. *Int. J. Pure App. Biosci*, 5(5), 821-827.

<sup>27</sup> Abraham, A., Mathew, A. K., Sindhu, R., Pandey, A., & Binod, P. 2016. Potential of rice straw for bio-refining: an overview. *Bioresource technology*, 215, 29-36.

<sup>28</sup> Cutignano, A., Nuzzo, G., Ianora, A., Luongo, E., Romano, G., Gallo, C., & Fontana, A. 2015. Development and application of a novel SPE-method for bioassay-guided fractionation of marine extracts. *Marine drugs*, 13(9), 5736-5749.

<sup>29</sup> Two-Thirds Marine Species Remain Unknown, <https://www.seeker.com/two-thirds-marine-species-remain-unknown-1766300637.html>. Retrieved 20 July 2018.

<sup>30</sup> Uiterkamp, A. J. S., & Vlek, C. 2007. Practice and outcomes of multidisciplinary research for environmental sustainability. *Journal of Social issues*, 63(1), 175-197.

<sup>31</sup> Corbeil, M. C. 2015. Conservation institutions as agents of change. *Studies in Conservation*, 60(sup2), 32-38.

“For each of you We have made a law and a method”. (Holy Qur’ān)<sup>32</sup>.

To every one of you, O communities, We have appointed a divine law and a way, a clear path in religion, for them to proceed along. If Allah had willed, He would have made you one community, following one Law, but, He separated you one from the other that He may try you in what He has given to you, of the differing Laws, in order to see who among you is obedient and who is disobedient<sup>33</sup>.

The expression "every one of you" denotes the various communities of which mankind are composed. The term *shir'ah* (or *shariah*) signifies, literally, "the way to a watering-place"<sup>34</sup> (from which men and animals derive the element indispensable to their life), and is used in the Holy Qur’ān to denote a system of law necessary for a community's social and spiritual welfare. The term *minhaj*, on the other hand, denotes an "open road", usually in an abstract sense: that is, "a way of life"<sup>35</sup> [22].

## IX. CONCLUSION

If researchers conduct researches, by applying the ‘3w theory’ can be achieved the objectives of this theory and researchers and readers and realize that Almighty Allah creates all resources for many vital purposes. As a result, people might further realize the value and stage of humans. They could respect and show sympathy to others without discrimination as we all humans are vicegerent of the Creator in the earth, we all are creation and slave of the Creator. People will be careful and sensible about humans’ rights and biodiversity. Researchers will can invent new method to reduce abusing resources. Natural ecosystems and social environment will be fortified instead of disaster. Novice researchers will be skillful to identify issues and causes in their problem area then discover solutions as advancement of research in the contemporary world. Researchers will be more attentive in worshipping Almighty Allah. Thus, a new generation will be developed that is knowledgeable about the Creator. This generation will lead and guide other future generations. Thus, *tawhid* - belief in the oneness of Almighty Allah might be established in all sectors of societies and humans will perform their daily activities, jobs, research and so on following their Creator’s guideline and goals. As a result, societies might be peaceful by receiving deserved all rights without discrimination. The first model of this theory will be useful especially for novice researchers to choose research area then select research subject. In addition, the first model motivates senior researchers to choose research area and unique research subject in order to conduct individually, interdisciplinary as well as multidisciplinary high quality advanced research.

<sup>32</sup> Taqi U. 2013. English Translation of the Holy Qur’ān

<sup>33</sup> Jalaluddin, M. & Jalaluddin, S. 2007. Tafsir al-Jalalayn, translated by Feras Hamza, edited and with an introduction by Ghazi bin Muḥammad bin Talat. Royal Aal al-Bayt institute of Islamic Taught: Amman, Jordan.

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#### APPENDIX

##### **Divine creativities:**

Creativities, Mastery, Abilities, Supremacy, Lordship, Attributes, Beauty as well as Greatness of the Creator.

##### **Story and acknowledgement of Formulating 'the 3W Theory':**

Muhammad Sirajul Islam has formulated this theory. He is one of PhD candidates in Islamic Revealed Knowledge and Human Sciences (Qur'an and Sunnah Studies), International Islamic University Malaysia. He has obtained honors in exegesis of the Glorious Qur'an and its Sciences, Al-Azhar University-Cairo, and obtained his Masters in Islamic Revealed Knowledge and Human Sciences (Qur'an and Sunnah Studies) from International Islamic University Malaysia. I have supervised him in Masters dissertation. In addition, I have supervised his PhD thesis entitled 'Foundations of Research Methodology in the Holy Qur'an'. This research is aimed to contribute in the formulation of research methodologies in multidiscipline from the Qur'anic outlook. The main motivation of his PhD thesis is this theory as well as he applied this theory in his PhD thesis.

However, after accomplishing the Masters dissertation of Muhammad Sirajul Islam in 2013, he had submitted the proposal of 'the 3W theory' to me. I had appreciated and recognized it is a unique idea; timely, potential and very useful theory for contemporary research world. Then I have supervised this theory. It is an outstanding result of his mainly basic research and focus on the Qur'anic verses related to research.

In addition, few renowned Professors of IIUM highly appreciated this idea. Senior Scientist Prof. Dr. Md. Zahangir Alam one of them, he is a Professor and Coordinator of Bioenvironmental Engineering Research Centre (BERC), Faculty of Engineering at IIUM, He has received a prestigious international award (1st runner up) on Scopus Young Scientist award in Asia Pacific for 2010. He comments that "it is a pure research; unique idea; the university is seeking such theory in order to attain novel contribution in research and development (R&D). It will play a vital role to forward the present research world". Moreover, Prof. Dr. Jamal Ahmed Bashier Badi who is the author of a famous book 'Creative Thinking in Islam: Concepts and Issues'. He states, "The 3w Theory is a unique theory, idea is a comprehensive that will be a Mega Research Project.

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# Basic Research and Its Importance to Enhance Fundamental Knowledge in Resources and Environment Friendly Technological Advancement: The Holy Qur'anic Prescription

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**Abstract-** This article emphasizes on basic research which is a basic foundation of research and development. As results, the article has found that basic research is groundwork in attaining fundamental knowledge about natural, social and human ecosystems, a unique method to enhance basic knowledge about resources and natural phenomenon. It leads to generate innovative idea, to formulate theory that emphasizes on knowing and analysing the laws of nature as well as the divine creativities in creating biodiversity and natural resources. In fact, today's achievements, technological advancement, emergence of new technologies are grants of successful basic research. Definitely, scientists rely on the results of basic research to continue and sustain applied research in order to solve problems and develop new technology. In addition, motivation and funding in conducting basic research means deposit, expectation and waiting for inevitably pivotal results for surviving in future.

**Index Terms-** Basic research, pure research, theory, type of research, resources, environment, technological advancement

## I. INTRODUCTION

In the 20th century, both Bernal (1939) and Bush (1945) pointed at the importance of basic science for national security, health and economic growth and emphasized on the potential economic impact of investments in science<sup>1,2</sup>. The importance of Bush's

pivotal report science: The endless frontier cannot be overestimated, because it was the guide to capture the scientific momentum of the Second World War and transfer it into the paradigm for post-war science policy<sup>3, 4</sup>. By doing this, Bush introduced the terms of inquisitiveness driven basic research and use or product directed applied research. This distinction take place the grounds for the linear model of innovation and legitimated the public involvement in basic science funding<sup>5, 6</sup>.

Definitely, basic research plays an utmost role to a substantive contribution to the productivity development of the economy<sup>7</sup>. If we look at research grants, we see most big amount grants have been provided in basic research. For example, in the United States, the federal government in the years since the Second World War has provided the huge majority of all funds devoted to basic research<sup>8</sup>.

In fact, the distinction between basic and applied research then seems enormously to be whether a practical or a purely intellectual, academic, rational as well as scholarly results is the conscious goal of contribution. The discovery of new information such as new laws of nature, which eventually benefits mankind almost all over the modern world, is more likely to arise from basic than from applied research. However, fundamental discoveries that change basic physical laws are so rare that these events are hardly useful either as a distinction between basic and applied research or as a justification for support of basic research<sup>9</sup>.

<sup>1</sup> Neumann, M., 2014. External Effects of Basic Research Infrastructure (No. PUBDB-2015-04244). European XFEL.

<sup>2</sup> Lundvall, B.-A. and S. BORRÁS, 2005. "Science, technology and innovation policy". In: The Oxford handbook of innovation. Oxford University Press.

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<sup>5</sup> Neumann, M., 2014. External Effects of Basic Research Infrastructure (No. PUBDB-2015-04244). European XFEL.

<sup>6</sup> Pielke JR, R., 2010. "In Retrospect: Science - The Endless Frontier". In: Nature 466.7309.

<sup>7</sup> Rosenberg, N., 2010. Why do firms do basic research (with their own money)? In Studies On Science And The Innovation Process: Selected Works of Nathan Rosenberg (pp. 225-234).

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Material and natural data of basic research are natural resources. The divine message regarding natural resources in the holy Qur'an. Almighty Allah says, "He it is who has created for you all that is on earth" (Al-Qur'an 2: 29). The verse informs all resources are beneficial and playing important role in natural ecosystem. Basic research is the best method to discover unique information and facts in resources. Hence, importance of basic research always demandable. There is no any possibility to underestimate the basic research. It is not only research but also a foundation of research and its methodology forever in the research world.

## II. CONCEPT OF BASIC RESEARCH

The foundation of research generally has been established on two levels: basic level and applied level. Trevers has defined basic level as basic research. "Basic Research is designed to add to an organized body of scientific knowledge and does not necessarily produce results of immediate practical value"<sup>10</sup>.

In addition, basic research has been defined by the National Science Foundation (NSF) as "original investigation for the advancement of scientific knowledge which does not have immediate commercial objectives"<sup>11</sup>. Such a research is time and cost intensive<sup>12</sup>.

Moreover, research and development (R&D) consists of three main activities: basic research, applied research, and development. Basic research is where it all starts: new ideas, fundamental theories, unanswered questions, and investigation into something that does not quite make sense. The basic researchers have been motivated by curiosity, motivation and a desire to explore unknown territory to reveal basic information and facts. Some ideas have been developed, some do not, and that is all part of the process. This research includes theoretical research, but it also includes early-stage examinations, investigations, recognize in the laboratory or field<sup>13</sup>.

The results of basic research are not generally sold but are usually published in peer reviewed scientific journals according to the scope of publication. Generally, in basic research, scientists have some freedom to set their own goals based on the research subject and duration of research project. Such research is usually

performed in the higher education sector but also to some extent in the government sector<sup>14</sup>.

Basic research is the research to find the basic and fundamental knowledge or to refine the basic knowledge. The main purpose of this research is enhance our understanding by attaining pure knowledge about all subjects, issues, facts, resources and so on.

## III. OTHER TERMS OF BASIC RESEARCH

Basic research also called pure research or fundamental research<sup>15</sup>. This type of research tends not to be directly applicable to the real world in a direct way, but enhances our understanding of the world around us. Pure research can be exploratory, descriptive or explanatory<sup>16</sup>.

Researchers conduct this form of research for human welfare, animal welfare and plant kingdom welfare and so on. The main motivation here is to expand man's knowledge by discovering, not to create or invent something for commercial purpose<sup>17</sup>.

Only depend on laterally meaning of basic, pure and fundamental create misunderstanding about this research and its status, essentiality and importance. An adequate study in literatures of basic research enable to profound understanding the rationality of named this research as basic, pure and fundamental research.

## IV. FORMULATING HYPOTHESES, THEORIES AND LAWS TO ADVANCE IN SCIENTIFIC KNOWLEDGE

Basic research analyses properties, structures and relationships with a view to formulating and testing hypotheses, theories or laws<sup>18</sup>. Pure research has the scientific research aim<sup>19</sup> to improve scientific theories for improving understanding or prediction of natural or other phenomena<sup>20</sup>. It is a research which generates new ideas, principles, philosophies and theories in different fields of knowledge<sup>21</sup>.

According to Nelson, R. R. (1959) the significant advances in scientific knowledge, the types of advances that are likely to results from successful basic research projects, very often have

<sup>10</sup> Singh, Y. K., 2006. Fundamental of research methodology and statistics. New Age International.

<sup>11</sup> Mansfield, E. 1980. Basic research and productivity increase in manufacturing. The American Economic Review, 70(5), 863-873.

<sup>12</sup> Singh, R., 2017. Research and Its Types.

<sup>13</sup> Richard Gross, Kimberly Jackson, Ranjit Koodali, 2019. Basic Research, American Chemical Society, <https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/basic-research.html>. Retrieved 19 February, 2019.

<sup>14</sup> Gulbrandsen, M., & Kyvik, S., 2010. Are the concepts basic research, applied research and experimental development still useful? An empirical investigation among Norwegian academics. Science and public policy, 37(5), 343-353.

<sup>15</sup> Saslow, C. A., 1982. Basic research methods. Addison-Wesley Publishing Company.

<sup>16</sup> Bhome, S. M., Prajapati, N., Deshmukh-Ghate, D., & Ghosh, A., 2015. Research Methodology (Tools and Analysis), Himalaya Publishing House.

<sup>17</sup> Singh, R., 2017. Research and Its Types.

<sup>18</sup> Gulbrandsen, M., & Kyvik, S., 2010. Are the concepts basic research, applied research and experimental development still useful? An empirical investigation among Norwegian academics. Science and public policy, 37(5), 343-353.

<sup>19</sup> Saslow, C. A., 1982. Basic research methods. Addison-Wesley Publishing Company.

<sup>20</sup> Vafadar, A., & Ghadimvand, N. K., 2016. Advanced research approach.

<sup>21</sup> Bhome, S. M., Prajapati, N., Deshmukh-Ghate, D., & Ghosh, A., 2015. Research Methodology (Tools and Analysis), Himalaya Publishing House.

practical value in many fields. Consider the range of advances resulting from Boyle's gas law or Maxwell's equations. On Gibbs' law of phases rests the design of equipment in fields as diverse as petroleum refining, rubber vulcanization, nitrogen fixation, and metal ore separation. Few firms operate in so wide a field of economic activity that they are able themselves to benefit directly from all the new technological possibilities opened by the results of a successful basic research effort<sup>22</sup>.

Basic research is a method to develop philosophy and formulate theory, and to examine and anatomize the legitimacy of developed philosophy, and validity of formulated theory. Acquired pure and fundamental knowledge by basic research can justify and recognize between true and fabricated theory, and assay beliefs and traditional notions. Profound understanding about laws of nature by basic research demonstrates with valid arguments existence of the Creator clearly, and purpose of creating human, and motive of creating resources and so on.

## V. BASIC RESEARCH TEAM

Basic research projects usually involve teams. These can include a primary investigator and his or her students and postdocs, groups of researchers from same discipline, or researchers from several interrelated disciplines. Teams may involve with researchers in many locations around the world, communicating by videoconference and sharing data using online collaboration tools. For example, chemists may work with materials scientists, biologists, geologists, physicists, or medical doctors. They may also enlist the help of computer scientists, engineers, and instrument design specialists to help them develop the new capabilities they need<sup>23</sup>.

In addition, the basic research team is usually working on the frontiers of knowledge<sup>24</sup>. In conducting basic research in medical the basic research team collaborates with the clinical team to determine scientific relevance within the context of human health and disease, and practicalities in terms of sample collection, storage and handling as well as sufficient laboratory resources to perform the assays<sup>25</sup>.

Another collaboration is that between the clinical research team and the basic research team; everyone has different expertise, and without teamwork it is difficult to continue in-depth research, especially if the subject is seeing rapid progress, such as lung cancer study, many mechanisms need to be explored<sup>26</sup>. The basic research team includes the principal investigator, sub-investigators, and clinical monitors<sup>27</sup>.

In addition, there are enormous outstanding basic research have been done individually. Basic research individually or teamwork depend on subject, issue, project, area and goal and form of basic research. Generally, basic research project cannot be conducted individually. Similarly, issue or subject that need individual attention, examination, scrutiny, observation then anatomize the experience, collectively research in such issue or subject will not find expected pure results. However, it can be conducted research in same subject or issue by 5 or 10 or 20 or more individual researchers. Then can be compered and again evaluate 20 results of 20 individual researchers in a same subject to find various understandings, interpretations and information from a same subject or issue. Based on results and comprehend further philosopher and scientists formulate theory and identify laws of nature, cause and effect of a fact. These experiences might motivate and help to undertake further project and agenda in order to be successful in sustainable development by resource management.

## VI. IMPORTANCE OF THE BASIC RESEARCH IN RESOURCES AND TECHNOLOGICAL ADVANCEMENT

Basic research launched to affect technology significantly in the period beginning around 1900 with the introduction of the results from basic chemistry research. Electromagnetism, solid-state physics, and nuclear physics followed with dramatic impacts that have been documented repeatedly and convincingly. Thus, since starting around 1900, generally we see, acknowledge and appreciate the crucial contribution that basic research did indeed produce a rapid series of benefits for society. It is reasonable to state that nearly all of the technological achievements of our society rest solidly on a foundation of basic research<sup>28</sup>.

There are many examples on importance of the basic research. Moishe Pripstein and George Trilling gave an example among many, they stated that when the theory of quantum mechanics was introduced in the 1920s, it seemed to many people to have no relevance at all to the macroscopic world, and therefore to our lives. As a physical theory of the sub microscopic world, quantum mechanics is applicable only to the world of very small distances. But within two decades, quantum mechanics led to the invention of the transistor and the development of solid-state electronics, which dominate our lives today. No one could have

<sup>22</sup> Nelson, R. R., 1959. The simple economics of basic scientific research. *Journal of political economy*, 67(3), 297-306.

<sup>23</sup> Richard Gross, Kimberly Jackson, Ranjit Koodali, 2019. Basic Research, American Chemical Society, <https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/basic-research.html>. Retrieved 19 February, 2019.

<sup>24</sup> Hill, K. M., Brookes, L. G., & Hunt, H. 1969. How much basic research is enough?. *Long Range Planning*, 1(3), 38-43.

<sup>25</sup> Chowdhury, F., & Williams, A. 2009. From research to regulated: challenges in transferring methods. *Bioanalysis*, 1(2), 285-291.

<sup>26</sup> Zhang, K. P., & Ma, L. 2017. Prof. Yun Fan: persistence guarantees expertise, patience conquers difficulties. *Journal of thoracic disease*.

<sup>27</sup> Rico-Villademoros, F., Hernando, T., Sanz, J. L., López-Alonso, A., Salamanca, O., Camps, C., & Rosell, R. 2004. The role of the clinical research coordinator–data manager–in oncology clinical trials. *BMC Medical Research Methodology*, 4(1), 6.

<sup>28</sup> Dessler, A. J., 1969. The role of basic research in universities. *Eos, Transactions American Geophysical Union*, 50(9), 508-511.

had any such inkling or feeling in the 1920s. This is the power of basic/pure/fundamental research: hope for the future<sup>29</sup>.

Importance of basic research is strictly connected with the emergence of new technologies and knowledge that have the ability to change the direction or accelerate the economies development<sup>30</sup>. It is clear that for significant advances in knowledge we must look primarily to basic research; the social gains we may expect from basic research are obvious<sup>31</sup>.

#### VII. VARIOUS NOBEL LAUREATES' OPINION REGARDING IMPORTANCE OF BASIC RESEARCH

The importance of basic research is well-exemplified by some quotations of various Nobel Laureates, who have visited Thailand, as follows<sup>32</sup>:

- Sheldon L. Glashow, Nobel Laureate in Physics 1979 states "The curiosity-driven research for fundamental knowledge is at least as important to human health and welfare as the search for solutions to specific practical problems. Government support of undirected basic research must continue if there are to be further technological advances and economic spin offs"<sup>33</sup>.
- William N. Lipscomb, Nobel Laureate in Chemistry 1976 states "Since research is so expensive, can a developing country like Thailand afford to do basic research? Thailand cannot afford NOT to do basic research; otherwise it will never be able to compete"<sup>34</sup>.
- Aaron Ciechanover, Nobel Laureate in Chemistry 2004 states "There is no such thing as basic and applied sciences, only good science and bad science"<sup>35</sup>.
- Tsung Dao Lee, Nobel Laureate in Physics 1957 states "Without basic research today, there will be no applications of science and technology tomorrow"<sup>36</sup>.

Indeed, the importance of basic research is increasing with advances in technological innovation and knowledge-based industries<sup>37</sup>. The importance of basic research is paramount in all

scientific endeavours<sup>38</sup>. In addition, the development research team, which started product development based on articulated demand, frequently consults with the basic research team on difficult and fundamental questions<sup>39</sup>.

Basic research always plays very significant role to make researchers, and push them to forward with motivation, confidence and achievement towards advancement in knowledge and discover according to time and needs.

#### VIII. THE QUR'ĀNIC EVIDENCE ON BASIC RESEARCH IN RESOURCES AND TECHNOLOGICAL ADVANCEMENT

Researchers are increasing their knowledge by all types of research. The main motivation for basic research is to increase man's knowledge by discovering. In this meaning almost in all form of research has character, motivation and aim of basic research. There are more than 750 verses in the Holy Qur'ān related to research in natural sciences. A number of these verses are directly order, motivate and use interrogative approach to show importance of basic research<sup>40</sup>. For example, al-Qur'ān 2:29, al-Qur'ān 7:56, al-Qur'ān 10:101, al-Qur'ān 13:3, al-Qur'ān 14:34, al-Qur'ān 15:85, al-Qur'ān 19:25, al-Qur'ān 21:16, al-Qur'ān 22:46, al-Qur'ān 30:8, al-Qur'ān 80:24, al-Qur'ān 86:5-7, al-Qur'ān 88:17-26, al-Qur'ān 96:1-5.

Considering the length of this research the researcher has showed and explained only the verse 2:29 as evidence on the Qur'ānic motivation to undertake basic research. Almighty Allāh informs the humans all that is on earth are for humans' well-being. The Holy Qur'ān reads, "*He it is who has created for you all that is on earth*" (Al-Qur'ān 2: 29).

Ibn 'Abbas interpreted that the saying of Almighty Allāh "*He it is who has created for you*" means all creatures and resources have been subjugated for humans by the Creator. The saying of Allāh '*ma fil ard*' (all that is on earth) means animals, plants and other resources. In addition, the Qur'ānic word '*jamia*'

<sup>29</sup> Moişe Pripstein and George Trilling, 2013. The Power of Basic Science, symmetry dimensions of particle physics (an online magazine about particle physics). <https://www.symmetrymagazine.org/article/february-2013/the-power-of-basic-science> . Retrieved 19 February, 2019.

<sup>30</sup> Pohulak-Żołędowska, E. 2013. Industrial meaning of university basic research in modern economies. Managerial Economics.

<sup>31</sup> Nelson, R. R., 1959. The simple economics of basic scientific research. Journal of political economy, 67(3), 297-306.

<sup>32</sup> Boonsaeng, V., & Sobhon, P., 2007. Funding policy and strategies for basic research by academic division of the Thailand Research Fund. ScienceAsia, 33, 9-15.

<sup>33</sup> Boonsaeng, V., & Sobhon, P., 2007. Funding policy and strategies for basic research by academic division of the Thailand Research Fund. ScienceAsia, 33, 9-15.

<sup>34</sup> Boonsaeng, V., & Sobhon, P., 2007. Funding policy and strategies for basic research by academic division of the Thailand Research Fund. ScienceAsia, 33, 9-15.

<sup>35</sup> Boonsaeng, V., & Sobhon, P., 2007. Funding policy and strategies for basic research by academic division of the Thailand Research Fund. ScienceAsia, 33, 9-15.

<sup>36</sup> Boonsaeng, V., & Sobhon, P., 2007. Funding policy and strategies for basic research by academic division of the Thailand Research Fund. ScienceAsia, 33, 9-15.

<sup>37</sup> Kim, S. Y., Heo, C. H., & Min, T. S., 2007. An Analysis on Research Funding of Geosciences in Korea. Journal of Korean Society of the Economic and Environmental Geology, 40(6), 815-825.

<sup>38</sup> McDonald, R., 1991. Quantitative effects of skeletonizing processes on bone density.

<sup>39</sup> Takahashi, T., & Namiki, F. 2003. Three attempts at "de-Wintelization": Japan's TRON project, the US government's suits against Wintel, and the entry of Java and Linux. Research Policy, 32(9), 1589-1606.

<sup>40</sup> Islam, MD. Sirajul, 2020. Foundations of Research Methodology in the Holy Qur'an, PhD thesis, International Islamic University Malaysia (IIUM).

(all) means all types of favour from the Creator<sup>41</sup>. Muḥammad Sayyid Ṭanṭawī (1928 – 2010) interprets that the Creator creates all things in earth such as animals, plants, minerals, and mountains for humans. Almighty Allāh is benefactor upon humans as though they can be benefited by these favours in the world, and ordering for the help by these favours to His obedience. Moreover, scientists have received from this verse, as they are witness that all things in earth are utility, and they are authorized to utilize until the proof of their prohibited<sup>42</sup>.

Admittedly, scientists have proved in the light of basic research that each creature is playing a vital role in natural ecosystem. Almighty Allāh creates everything in this universe accurately and wisely, very beautiful in the whole appearance of creation, according to in their time, in place, in job, as required by the will and wisdom<sup>43,44</sup>. This Verse includes all creations, and informs the humankind that all creation is useful for humans, but it depends on the proper use<sup>45</sup>.

This verse is basis for basic and scientific research. It talks about all resources on the earth both resource on land and below water. How all resources for human is a research question. Hence, need basic research on natural resources to arrange acceptable answer to the question and to realize the divine information in the verse (2:29). In line with the information of the verse 2:29 all types of resources are research subjects and blessings. Hence, people have to proper use resources. Therefore, humans have to gain knowledge about these resources for proper using. Basic research is the best scientific method to gain pure knowledge, to reveal scientific facts, to identify new relationships among facts and describe phenomena. Novel information of resources can be

attained by undertaking basic research, and based on novel information could be attained timely technological development in order to cope the contemporary challenges. This verse encourages in gaining knowledge about all that is on earth and properly utilizing these blessings.

Hence, essential undertaking high quality advanced basic research to extend our understanding the earth contains what type of resources both visible and invisible; how way these resources are for humans' wellbeing; and to recognize how many ways resources have been misusing, and to discover the divine creativities in creating numerous and amazed characteristic resources. We have to find out the method of best utilizing of these resources and sustainable development by research. Thus, this verse encourages in conducting basic research as though resources might be best utilized by following environmental ethics, best resources management policy, biodiversity's' rights, ecosystem conservation, social justice, as well as human rights regardless.

#### IX. EXPENDITURE ON BASIC RESEARCH

America about \$435 million in 1953, was spent on "basic research." since 1953 expenditure on research and development has increased distinctly; \$10 billion in 1957. In addition, expenditure has increased at a rapid rate on basic research, about at a faster rate than all form of research and development expenditure. But basic research expenditure in 1957 was probably under \$1billion, less than one-quarter of 1 per cent of gross national product<sup>46</sup>.

**TABLE 1. U.S. R&D expenditures, by type of work: 1970–2016**

| Type of work             | 1970  | 1980  | 1990  | 2000  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015 <sup>a</sup> | 2016 <sup>b</sup> |
|--------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------------------|-------------------|
| \$billions               |       |       |       |       |       |       |       |       |       |                   |                   |
| All R&D                  | 26.3  | 63.2  | 152.0 | 267.9 | 406.6 | 426.2 | 433.6 | 454.0 | 475.4 | 495.1             | 510.0             |
| Basic research           | 3.6   | 8.7   | 23.0  | 42.0  | 75.9  | 73.0  | 73.3  | 78.5  | 82.1  | 83.5              | 86.3              |
| Applied research         | 5.8   | 13.7  | 34.9  | 56.5  | 79.3  | 82.1  | 87.1  | 88.3  | 91.9  | 97.2              | 100.3             |
| Experimental development | 16.9  | 40.7  | 94.1  | 169.4 | 251.4 | 271.0 | 273.3 | 287.1 | 301.5 | 314.5             | 323.4             |
| Percent distribution     |       |       |       |       |       |       |       |       |       |                   |                   |
| All R&D                  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0             | 100.0             |

<sup>41</sup> Ibn ‘Abbās, 2007. *Tanwīr al-Muq̄bās min tafsīr ibn ‘Abbās*, Translated By Mokrane Guezzou, Edited and with a brief Introduction by Yousef Meri.

<sup>42</sup> Tantawy, Muhammad Sayyad. 1997. *Tfsir al-Wasit*. Publisher: Dar Nahdatu Misr lit Tabaa’ wan Nashir wa lit Tawzi’, Cairo-Egypt, 1st edition. Vol. 1, P. 5.

<sup>43</sup> Tantawy, Muhammad Sayyad. 1997. *Tfsir al-Wasit*. Publisher: Dar Nahdatu Misr lit Tabaa’ wan Nashir wa lit Tawzi’, Cairo-Egypt, 1st edition.

<sup>44</sup> Samsudin, S. B., & Islam, M. S. 2014. Environmental Ethics from the Qur'nic philosophy. *Advances in Environmental Biology*, 1160-1169.

<sup>45</sup> Islam, MD. Sirajul, et al. 2015. Herbal Medicinal Importance of Citrullus Lanatus Mentioned in the Ahadith: A Precise Overview. *American Journal of Ethnomedicine*, 2(1), 39-45.

<sup>46</sup> Nelson, R. R., 1959. The simple economics of basic scientific research. *Journal of political economy*, 67(3), 297-306.

|                          |      |      |      |      |      |      |      |      |      |      |      |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|
| Basic research           | 13.7 | 13.8 | 15.2 | 15.7 | 18.7 | 17.1 | 16.9 | 17.3 | 17.3 | 16.9 | 16.9 |
| Applied research         | 21.9 | 1.7  | 23.0 | 21.1 | 19.5 | 19.3 | 20.1 | 19.5 | 19.3 | 19.6 | 19.7 |
| Experimental development | 64.4 | 64.5 | 61.9 | 63.2 | 61.8 | 63.6 | 63.0 | 63.3 | 63.4 | 63.5 | 63.4 |

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series).

#### X. WORKSPACE OF BASIC RESEARCH

University is a significant workspace for basic research<sup>47</sup>. Some 85 percent of the basic research funds allocated to universities have been placed by mission oriented agencies in support of their own missions<sup>48</sup>. Basic research chemists often work in laboratories, which they may share with other researchers. They may also use instruments in other local laboratories, or they may travel to national laboratories or international research centres to use specialized instruments and facilities. Some basic

researchers work outdoors, collecting samples or recording observations. Others may work mostly or entirely on computers, constructing theoretical models or building and maintaining databases. Senior researchers often work side by side with students, postdocs, or visiting scientists. They may be responsible for training and supervising others in their laboratory and for ensuring that everyone follows safety rules and research ethics protocols. Access to a good library is important, either in a physical space or online. Literature searches are an important part of planning and conducting research, and it is essential to stay current on published research in a given field<sup>49</sup>.

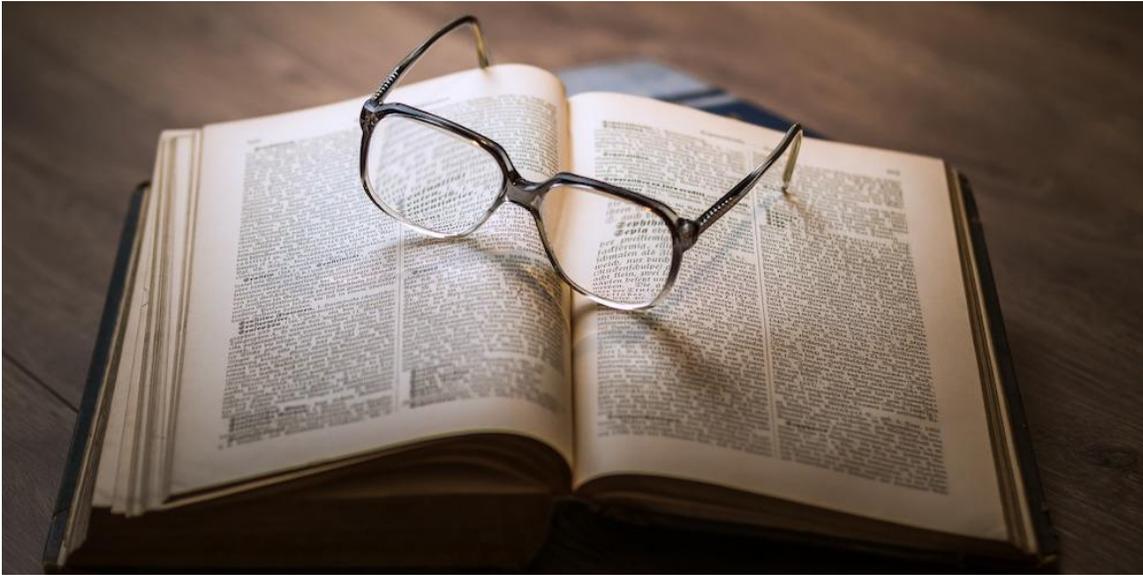


Basic research image in laboratory

<sup>47</sup> Dessler, A. J., 1969. The role of basic research in universities. *Eos, Transactions American Geophysical Union*, 50(9), 508-511.

<sup>48</sup> Dubridge, L. A., 1967. University basic research. *Engineering and Science*, 31(3), 9-12.

<sup>49</sup> Richard Gross, Kimberly Jackson, Ranjit Koodali, 2019. Basic Research, American Chemical Society, <https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/basic-research.html>. Retrieved 19 February, 2019.



Basic research image in library

## XI. CONCLUSION

Basic research is to increase our knowledge related to any branch of knowledge, natural and social ecosystems, natural and social phenomenon as well as natural and human resources to know what is what and why. In addition, recognizing problem and causes of problem is basic research. Scientists recognize upcoming problems related to biodiversity, environment, health as well as social ecosystem by basic research. Examining theory, testing hypothesis, formulating scientific theory, discover unique information in law of nature is prominent character of basic research. Hence, demand of basic research is evergreen forever until survive human in the earth. For example, actually establishment of human habitation in Mars is feasible or not we look forward to hear from basic research scientists. Hence, education ministry of a country and NGOs might generate Supplementary Grants for basic research to formulate Sustainable Scientific Development Theory (SSDT), and its scientific application in order to achieve the national goals that reinforce long-term ecological balance in both natural and social environment.

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# The Holy Qur'ān Talks the Rights of Persons with Special Needs

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**Abstract-** This research focuses on the Qur'ānic approaches in caring persons with special needs; their education, religious, health, moral, psychological as well as social rights. The aim of this research was discovering the rights of persons with special needs in the Holy Qur'ān. As a result, the research attains the verse 24:61 talks regarding rights of this group of people. It highlights what to care, who is responsible for caring them, what are the methods used, and the aspects of their care. The Qur'ān does not use the word 'disable'. It uses the blind, daft, lame, and sick to establish their rights in family and society in a country.

**Index Terms-** disability, human rights, education rights, social security, basic rights, persons with special needs

## I. INTRODUCTION

Persons with special needs are those people who are suffering from an illness, injury or condition that makes it difficult for them to do some work that other people do easily<sup>1</sup>. The World Health Organization (WHO) estimates that there are more than one billion people with disabilities. They present about 15 per cent of the total population<sup>2</sup>. The history of West shows the phenomenon of neglect and harassment to persons with special needs that culminated in killing the disabled babies in few ancient European societies. The superstitious beliefs were responsible for this setback. For instance, it was believed that people those were suffering from intellectual and disabilities were possessed by devil and evil spirits. Even philosophers and scholars held such belief<sup>3</sup>.

<sup>1</sup> Md. Sirajul Islam, Sofiah Samsudin (2020). People with Special Needs in Ancient Societies: A comparative Study between few Early Philosophers and Islam. International Journal of Scientific and Research Publications, 10(5). DOI:10.29322/IJSRP.10.05.2020.p10137

<sup>2</sup> Lebe, S. S., Mulej, M., Zenko, Z., & Sardi, V. (2014). Systemic thinking for socially responsible innovations in social tourism for people with disabilities. Kybernetes.

<sup>3</sup> Muhammad, M.Y. The Prophet's Care for People With Special Needs, Available in <http://www.usislam.org/islamiyouth/Muhammad/Prophet's%20Care%20for%20People.htm>, Retrieved on 5 September, 2013.

Before 2000 of the Common Era with the cult of the 'body beautiful', the infanticide of disabled babies becomes common. Likewise, in Rome children with special needs are drowned in the Tiber, and people who considered being 'mentally defective' are prohibited from marrying<sup>4</sup>.

Before revealing the Holy Qur'ān to the last Messenger of Allah (May Allah peace be upon him) there are persons with special needs were depriving from their fundamental rights; there was not life right for those group of people in ancient society<sup>5</sup>. People of Madinah used to prevent the lame and blind people from sharing food with them because they are deemed and repulsive<sup>6</sup>. Almighty Allah reveals in the Holy Qur'ān a legislative verse (24:61) to eradicate this discrimination among human as well as establish rights of persons with special needs.

## II. THE FOUNDATION IN CARING THE PARSONS WITH ESPECIAL NEEDS IN THE HOLY QUR'ĀN

Almighty Allah reveals legislative verse in the Holy Qur'ān to eliminate from society superstitious belief; discrimination; cruel act; harsh dealing; rude behavior; brutality towards persons with special needs. The divine legislation to establish rights of persons with special needs and to enhance interaction between persons and persons with special needs by eradicating the discrimination and over caution of few people. Almighty Allah proclaims the legislation:

*"There is no blame on a blind person, nor is there any blame on any lame one, nor is there any blame on a sick person,*

<sup>4</sup> Andrew H. (2013) A Disability History Timeline The struggle for equal rights through the ages.

<sup>5</sup> Muhammad Mus'ad Yaqu, The Prophet's Care for People With Special Needs, Available in: <http://www.usislam.org/islamiyouth/Muhammad/Prophet's%20Care%20for%20People.htm>, accessed on 05/September/2013.

<sup>6</sup> Md. Sirajul Islam, Sofiah Samsudin (2020). People with Special Needs in Ancient Societies: A comparative Study between few Early Philosophers and Islam. International Journal of Scientific and Research Publications, 10(5). DOI:10.29322/IJSRP.10.05.2020.p10137

*nor on yourselves in that you eat (something) from your own homes or from the homes of your fathers or the homes of your mothers or the homes of your brothers or the homes of your sisters or the homes of your paternal uncles, or the homes of your paternal aunts or the homes of your maternal uncles or the homes of your maternal aunts or from the places the keys of which you have under your control, or from (the home of) your friend. There is no sin on you if you eat together or separately. So when you enter homes, greet one another with Salam, a greeting prescribed by Allah, which is blessed, pleasant. This is how Allah explains the verses to you, so that you may understand”* (Al- Qur’ān 24:61)<sup>7</sup>.

### III. REASON OF REVEALING THIS VERSE

Al-Ṭabarī (839 CE - 923 CE) said that there are different concerning among the scholars about the interpretation of this verse in the sense in which reason was revealed in it. Some of them said, it was reveal on permit for Muslims in eating with the people with special needs such as the blind, lame, sick and so on. It is because they (non-special needs Muslim) were abstained from to eat with them from their food, fearing for they may come in eating with them of their food is something which Allah forbids them<sup>8</sup>. Almighty Allah says:

*“O you who believe, do not devour (eat) each other’s property by false means (unjustly) unless it is trade conducted with your mutual consent. Do not kill one another. Indeed, Allah has been Very-Merciful to you”* (Al- Qur’ān 4: 29).

Ibn Abbas said: when revealed the verse: “O you who believe, do not devour (eat) each other’s property by false means (unjustly)” (Qur’ān 4:29). Muslims said that Allah forbids us to eat our money, asset foods ourselves with injustice. In fact, food is the best funds; it is not permissible for one of us to eat at one without justified way. Therefore, the people abstained from that, afterwards Almighty Allah reveals the verse (24:61).

Al-Dihhaq said: Before coming the Prophet (may Allah peace be upon him) to Madinah, the people of Madinah were neither mixing in their food the blind nor the patient. Some of them said they are dirty and disgust. Some of them said, the patient does not meet the food as meet the healthy person, and the lame cannot competition on the food, and the blind cannot see the good food. Therefore, Almighty Allah reveals, “there is no sin on you” having food with patient and the blind and the lame. It means O people it is not blame upon you in blind, lame, and patient to eat with them and they with you<sup>9</sup>.

<sup>7</sup> Al-Qur’an, Surah an-Nur 24:61), Translator Mufti Muhammad Taqi Usmani.

<sup>8</sup> Al-Ṭabarī, Muḥammad ibn Jarīr ibn Yazīd Abū Ja‘far 2000. Jām‘i al-Bayān fī Ta‘wīl Al-Qur’an, Review by Aḥmad Muḥammad Shakīr, publisher: Muassasatu al-Risalah, 1st edition. Vol.19. P. 219.

<sup>9</sup> Al-Ṭabarī, Muḥammad ibn Jarīr ibn Yazīd Abū Ja‘far 2000. Jām‘i al-Bayān fī Ta‘wīl Al-Qur’an, Review by Aḥmad Muḥammad Shakīr, publisher: Muassasatu al-Risalah, 1st edition. vol.19. p219.

<sup>10</sup> Al-Nuhas, A.J (2001). Ma’ni al-Qur’an, Vol. 4, P. 557.

Abydullah Ibn Abdullah said: when the people were going to the battle, paid their keys to the persons with special needs, and led them to having the food from their house, but those did not do it. On this matter Almighty Allah reveals this verse<sup>10</sup>.

In addition, there were the *Ansars* those abstained from having the food together the blind, the lame and the patient. They were saying with ethically that we can see the good food but he (blind person) cannot not see the good food, and the lame do not able to sitting therefore he cannot take the food that can take the normal man, and the patient weakens in eating. Hence, they abstained from the persons with special needs in having food with them (in fearing may they (Ansar) eat more and good food then persons with special needs, and they may cannot eat with freedom<sup>11</sup>. In this case, Almighty Allah reveals this verse.

### IV. RHETORIC IN THIS VERSE

The renowned interpreter Wahbah Mustafa al-Zuhayli (1932–2015) shows vary important ‘*al-balāghah*’ (rhetoric) in this verse that is ‘*Itnāb bi takrār lafẓ al-Ḥaraj*’ (enlargement the issue by repeating the word ‘*al-Ḥaraj*’) <sup>12</sup>. As we see in the verse Almighty Allah says: “There is no blame on a blind person, nor is there any blame on any lame one, nor is there any blame on a sick person, nor on yourselves in that you eat (something) from your own homes or from the homes of your fathers.” (Al- Qur’ān 24:61). In addition, ‘*Itnāb bi takrār lafẓ al-Ḥaraj, ta’kīd lil hukmi shr’ā*’ (Enlargement by repeating the word ‘*al-Ḥaraj*’ a confirmation or authorization of the rule of Sharia)<sup>13</sup>. “*There is no blame on yourselves in that you eat (something) from your own homes*” (Al- Qur’ān 24:61). It mean there is nothing wrong you have to eat out of your houses, and including the homes of children, although has not mentioned them, because the house of son like the house of father as well as the wealth of son like father’s wealth <sup>14</sup>.

“*On yourselves*” to indicate that eating with those who are exempted without prejudice according to their well healthy and status, and there are required humbleness that expand on people and a statement as required by the bonds of love and relevant and affection among the people<sup>15</sup>.

<sup>11</sup> Al-Farrā’, Abū Zakarīyā’ Yaḥyā ibn Ziyād ibn ‘Abd Allāh ibn Maṣṣūr al-Daylamī al-Farrā’ (-207 H). Ma’āni- al-Qur’ān, Dār al-Maṣriyah- Miṣr. Vol. 3, P. 223.

<sup>12</sup> *Al-Ḥaraj* mean there is no blame.

<sup>13</sup> Al-Zuhayli, Wahbah Mustafa (1418.H). Tafsīr al-Munīr fī al- ‘Aqidah wa al-Sharī‘ah wa al-Manhaj. Dār al-Fikr al-Mu‘āṣar – Dimashq, 2nd edition, Vol.18, P300.

<sup>14</sup> Al-Zuhayli, Wahbah Mustafa (1418.H). Tafsīr al-Munīr fī al- ‘Aqidah wa al-Sharī‘ah wa al-Manhaj. Dār al-Fikr al-Mu‘āṣar – Dimashq, 2nd edition, vol.18, p301.

<sup>15</sup> Al-Zuhayli, Wahbah Mustafa (1418.H). Tafsīr al-Munīr fī al- ‘Aqidah wa al-Sharī‘ah wa al-Manhaj. Dār al-Fikr al-Mu‘āṣar – Dimashq, 2nd edition, vol.18, p304.

## V. DERIVING JUSTIFIED RIGHTS OF DISABILITY FROM THE VERSE

Although the Qur'ānic statement in this verse regarding having the food with persons with special needs or individual. According to the above-mentioned interpretation by al-Zuhayli, there has an implicit indication in this verse to establish other justified rights of disability in their family and social life. For example, sympathy, love, kindness, humbleness, and so forth those fortify the relationship of people with the persons with special needs in family and society. Moreover, it will not be overdo that this verse is referring to the inclusion of them in education, religious practice, health care, moral, psychological as well as social status with other persons.

Thus, the verse has been revealed as a complete mercy on the persons with special needs to console, relieve and support them. It saved them from the most dangerous psychological diseases that may affect them if they suffer from isolation and withdrawal from the social life. In addition, the Creator conferred dignity on the children (both male and female) of Adam. Nobody has right to neglect or unjust to any child of Adam. There is no any discrimination between person and person with special needs, rich and poor, white and black in Islam. The divine knowledge established this honor of human beings. Almighty Allah says:

*"We have conferred dignity on the children (both male and female) of Adam; provided them with transport on land and sea; given them for sustenance variety of good and pure things; and made them much superior to many of those whom We have created" (Al- Qur'ān 17: Verse 70).*

The early interpreter of the Qur'ān Imam al-Qurtubi (1214 AD-1273 AD) interpreted the verse *"We have honored the sons of Adam"* here "the intended of honor" is what Allah made them of the honors, virtues and beauties<sup>16</sup>.

Islam does not see disability as a barrier to total social inclusion. Islam encourages Muslims to deal with all people irrespective and equally regardless of their race, colour, language, gender and so on. This is reflected in the Holy Qur'ān that all people created from one person and there is no difference between them<sup>17</sup>.

*"O mankind, We have created you from a male and a female, and made you into races and tribes, so that you may identify one another. Surely the noblest of you, in Allah's sight, is the one who is most pious of you. Surely Allah is All-Knowing, All-Aware." (Al- Qur'ān , 49: Verse 13).*

Interpretation of the verse in Tafsir al-Jalalayn: O mankind! We have indeed created you from a male and a female (from Adam

and Eve). In addition, We made you nations (shu'ūb is the plural of sha'b, which is the broadest category of lineage). and (We made you) tribes (qabā'il, which are smaller than nations, and are followed by 'amā'ir, 'tribal districts', then butūn, 'tribal sub-districts', then afkhādh, 'sub-tribes', and finally fasā'il, 'clans'. For example, Khuzayma is the sha'b, while Kināna is the qabīla, Quraysh is the 'imāra, Qusayy is the batn, Hāshim is the fakhdh, and 'Abbās is the fasīla) that you may come to know one another (ta'ārafū: one of the two tā' letters (of tata'ārafū) has been omitted). You may acquire knowledge of the customs of one another. And not to boast to one another of (whose is the more) noble lineage, for pride lies only in (the extent to which you have) fear of God. Truly, the noblest of you in the sight of God is the most God-fearing among you. Truly God is Knower, of you, Aware, of your inner thoughts<sup>18</sup>.

In the life example of Prophet (May Allah peace be upon him) we see the Prophet how was justice and sensible to honor of human, impartiality regarding humans' dignity. It is a great lesson for whole human to apply the ethics without discrimination while dealing with people.

He says: 'Verily Allah does not look at your bodies or at your faces but He looks at your hearts'<sup>19</sup>. On the one hand, this hadith teaches that person who disabled he should not feel shy to participate to social gathering. On the other hand, people also should not avoid them because Allah does not look at appearance of body or face of human rather He looks at people' heart. Is it pure or corrupted. So, people whose hearts are pure, they are compassionate and merciful to people, they have humility, they not abhor the disabled people.

Prophet Muhammad (May Allah peace be upon him) was a great model for human honor in general. For example, narrated from Jabir Ibn Abdullah (may Allah be blessed upon them) said: There was passed us a funeral, so stood up the Prophet peace be upon him for that, and we stood up following the Prophet, and we said: O Messenger of Allah! It's a Jewish funeral, «the Messenger of Allah said: if you have seen the funeral stand up»<sup>20</sup>. In another *sanad*: «there was a funeral passed by the Prophet (may Allah peace be upon him) and He stood up. He was told by his companion that is a Jewish funeral. He said: Is not person?»<sup>21</sup>.

Thus, the Messenger of Allah (may Allah peace be upon him) had established the honor of human without discrimination between Muslim and other faith, even to the date body of human. In spite of this, on the one hand, it is anybody cannot deny that there are a lot of persons with special needs have been depriving from their fundamental rights till now, both in Muslim and non-Muslim societies around the world. On the other hand, we would like to acknowledge with pleasure that the modern world is

<sup>16</sup> Al-Qurtbi, Abu Abdullah Muhammad Ibn Ahmad ibn Abi Bakar, (2003). Al-Jami' li Ahkam al-Qur'an, review: Hisham Samir al-Bukhari, publisher: Dar Alam al-Kutub-Riyadh, Vol.10, p 293.

<sup>17</sup> Al-Zyoud, N., 2011. An investigation into the current service provision for students with learning difficulties in Jordan: Teachers' perspectives (Doctoral dissertation, Brunel University School of Sport and Education PhD Theses).

<sup>18</sup> Jalaluddin, M. & Jalaluddin, S. (2007). Tafsir al-Jalalayn, translated by Feras Hamza, edited and with an introduction by Ghazi bin Muhammad bin Talat. Royal Aal al-Bayt institute of

Islamic Taught: Amman, Jordan. Vol. 1, P. 624. Arabic version Tafsir al-Jalalayn, Cairo: Darul hadith, 1st edition, Vol.1, P. 687.

<sup>19</sup> Muslim, I. H., (2007). Shīḥ Muslim, review by Muḥammad Fu'ad 'Abdul Baqi, Publisher: Bayrūt - Daru Ahyau Turas al-Arabi, Vol. 4, P.1986, No. 2564.

<sup>20</sup> Al-Bukhārī, Muḥammad Ibn Ismail (1987). Ṣaḥīḥ Al-Bukhārī, review Mustufa Daib al-Baga, Publisher:Dār Ibn kasir- Bayrūt, 2nd edition, Vol. 2, P. 85, No.1312.

<sup>21</sup>Al-Bukhārī, Muḥammad Ibn Ismail (1987). Ṣaḥīḥ Al-Bukhārī, review Mustufa Daib al-Baga, Publisher:Dār Ibn kasir- Bayrūt, 2nd edition, Vol. 2, P. 85, No.1312.

starting research to safe and develop the life of persons with special needs. However, it is essential to enhance this effort according to rapidly increasing number of persons with special needs around the world especially in developing countries.

## VI. CONCLUSION

This verse is foundation of rights of people with special needs. It presents complete mercy to consoling, relieving, and supporting them. Hence, to be more sensible and responsible to the persons with special needs and to make sure significant improvements in their lives, we should to pay strong attention to the Holy Qur'an and the Prophetic dealings with those people in order to enhance their social, educational and financial integration with communities. As a result, they will be able to obtain their education, job opportunity, social status and security of life and so forth with others in our running society.

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