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The Lukenya University Multidisciplinary Journal (LUMJ) Volume 1 consists of research articles that were taken through a double blinded review process following the 1st International Multidisciplinary Research Conference in Business, Education, Science and Technology held between 24th July 2020 and 28th August 2020 in six web series. The six web series were held on 24th July2020, 30th July 2020, 7th August 2020, 14th August 2020, 21st August 2020 and 28th August 2020

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Lukenya University Multidisciplinary Journal (LUMJ) is a Lukenya University publication whose scope includes internal research at the University, research by partner institutions and external researchers. It publishes scholarly work in English and Kiswahili. The views expressed in contributions are not necessarily the views of the editors of the LUMJ journal. Authors reserve the rights to their contributions.

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Editorial

Lukenya University Multidisciplinary Journal (LUMJ) publishes original research, review articles, commentaries, clinical case studies and clinical trials in a wide range of issues. The research spans through a wide range of subjects including Education and Social Sciences; Business and Economics; Health, Science and Technology; and Climate Change, Adaptation and Agriculture.

Review of Articles

Articles submitted are subjected through a double blind review process, where the identities of the authors and reviewers are not disclosed. The review process is confidential.

Medium of Language

The language used in publications is English and Kiswahili. A 250-300-word abstract is provided for each article.

Presentation of Manuscript

Manuscripts should be presented in Times New Roman, 12 point in single spacing, double column, size A4 paper. Soft copies should be sent to manuscripts@lukenyauniversity.ac.ke. They should include the title, author(s) full name(s), institutional affiliation and email of corresponding author. The page margins should be 2.54cm top and bottom and 1.91 on the right and left (moderate). Abstracts should include at most 5 key words at the bottom.

Paragraphs should be separated from preceeding texts by a double space. The APA referencing style should be used. Full reference to the publication should be contained in the reference list which should be arranged alphabetically. Only authors referred in the article should be included in the references. The details in the references include the author(s) full name(s), year of publication, title of the article, place of publication, name of publisher. Provide a Digital Object Identifier (DOI), if it is available, in place of a URL. You can obtain assistance on APA style using the links below:

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For short quotations within text, use single quotation marks. Ident longer quotations on both sides and type using single spacing. Set headings in bold on the left margin at the beginning. Do not number your pages since they will be stamped with a number when the full document is being assembled.

Translations should appear to the right hand side of the example. If longer, they should be in single quotation marks. Submitted articles should be edited,thoroughly proofread and having a proper flow of ideas. The editorial team shall not be obliged to consider articles requiring a high level of language editing.

Length of the Article

The word limit for the manuscript is 3000-5000 words. These number of words exclude tables and figures.

Scope

Lukenya University Multidisciplinary Journal (LUMJ) is based on thoughtful scientific research and analysis on green innovations aimed at improving service delivery and general living standards in all spheres of life. This is approached through a wide range of disciplines including Education and Social Sciences; Business and Economics; Health, Science and Technology; and Climate Change, Adaptation and Agriculture. Scholars and researchers within and outside Africa are invited to make their contributions.

Editorial

Lukenya University is committed to advancing research, innovation, collaboration and partnerships. In line with this, the virtual International Multidisciplinary Conference in Business, Education, Science and Technology was hosted jointly with Machakos University, Umma University), South Eastern Kenya University (SEKU), Garissa University and Inclusive Climate Change Adaptation for a Sustainable Africa (ICCASA. This was from 24th July 2020 to 28th August 2020, in six web series.

Insightful and innovative research was shared that is hereby published in support of our objectives: To facilitate sharing and engagement on current research areas with the research community; to make research a key activity that involves staff, students and society; to promote knowledge transfer of research outcomes and to provide quality research outputs for informed decision making. The articles were subjected to a double blind review process leading to this publication.

Our heartfelt appreciations go to all conference organizing committee members, peer reviewers, editorial team and advisory board members. We sincerely thank Prof. Mwenda Ntarangwi, Chief Executive Officer, Commission for University Education; Prof. Lucy W. Irungu- Vice Chancellor, Machakos University; Prof. Peter N. Mwita, Deputy Vice Chancellor (Research, Innovation & Linkages), Machakos University; Prof. Idle Farah- Vice Chancellor, Umma University; Prof. Osman Warfa – Vice Chancellor, Garissa University; Prof. James M. Njiru, Chief Executive Officer, Kenya Marine and Fisheries Research Institute (KMFRI); Eng. Raphael N. Ogendo**,** Deputy General Manager, Irrigation and Infrastructure Development Services, National Irrigation Board; Prof. Michieka Ratemo Waya- University of Nairobi Professor; and Joseph Njogu – Chief Executive Officer, Research Beeline Limited. We also extend our appreciations to Dr. Mary Nyasimi – Director, Inclusive Climate Change Adaptation for a Sustainable Africa; Prof. Geoffrey Muluvi - Vice Chancellor, South Eastern Kenya University; Stephen Mackenzie – Managing Director, Eduvod Africa Limited; Elvis Mgendi – Director, Cathy Fragment Media Limited; Prof. Constantine Nyamboga – Vice Chancellor, Lukenya University and staff members of the mentioned instititutions for their support in different ways including opening the web series, giving opening address and keynote speeches among other contributions made in making the conference successful.

We thank all presenters, session leaders and organizers of Web Series 1 to Web Series 6 for the sacrifices made. Finally, we appreciate the role of the Board of Trustees, Governing Councils, Senates, Management Boards of Lukenya University and Partnering Universities.

Dr. Judith A. Wafula

For Editorial Team

Message from the Vice-Chancellor, Lukenya University, Prof. Constantine M. Nyamboga

Let me take this opportunity to thank all those who participated in our first Annual International Multidisciplnary Conference whose theme was "Use of Innovative Technologies to Enhance Business, National Food Security, Climate Adaptation, Energy Sustainability, Universal Health and Education."

The conference focused on national, regional, and global issues whose solutions could spur sustainable socio-economic development and create more opportunities in all the key sectors. This was a forum that tackled many emerging issues that have greatly affected the world today.

More importantly, the conference provided enormous opportunities to network, build collaborative synergies and more meaningful partnerships for continual improvement of the world. This is turn would create opportunities like gainful employment, quality products, and better ways of conserving our environment. I wish to share with all the participants that Lukenya University is a world-class university that believes in collaborations and partnerships.

In a very special way, I wish to thank our key partners the South Eastern Block Universities namely; Machakos University, South Eastern Kenya University (SEKU), Garissa University, and Umma University for their material and moral support in making the conference a success. Further, I thank the management of Inclusive Climate Change Adaptation for a Sustainable Africa (ICCASA), a project of African Development Bank for their support and collaboration.

Our able researchers who participated in the conference I salute you. It is your input that made us have the successful research conference and this publication as an output.

I appreciate our guests, and participants for creating time from their busy schedules to be with us during the conference. Your research articles will be useful in providing direction for solving many problems experienced in the world today.

Thank you very much and God bless you all.

Prof. Constantine Nyamboga, PhD
Vice-Chancellor and Professor of Information Science

Message from the Director, Inclusive Climate Change Adaptation for a Sustainable Africa (ICCASA), Dr. Mary Nyasimi

I would like to express my heartfelt gratitude to each one of you who participated in the International Multidisciplinary Research Conference in Business, Education, Science and Technology hosted by six partners namely; Lukenya University in partnership with Umma University, Garissa University, Machakos University, South Eastern Kenya University, and the Inclusive Climate Change Adaptation for a Sustainable Africa (ICCASA).

The current COVID-19 pandemic has impacted on the way we live, learn and work. While the pandemic is creating untold suffering, it has also led to unique opportunities towards harnessing technology and innovation for a sustainable and climate resilient development. Therefore, the web conference came at an opportune time to share experiences on the use of Innovative Technologies to enhance Business, National Food Security, Climate Adaptation, Energy Sustainability, Universal Health and Education. This is of particular interest to ICCASA, whose mandate is to ensure multi-stakeholder engagement on a sustained basis, on the principles of an inclusive climate resilient economy that is driven by innovative technologies, investments, policies and regulations.

The primary goal of the web conference was to bring together academic, government officers and practitioners as well as friends and partners that aim to achieve Sustainable Development Goals (SDGs) outlined under Agenda 2030 by the UN General Assembly 2015 and national development agendas such as Kenya's Vision 2030. We believe that the diverse and dynamic group of speakers provided in-depth insights, as well as, actionable and practical tools for innovative technologies that can be utilized by different partners to be more effective and efficient in the on-going sustainable development efforts.

We hope that you find the published articles informative and worthwhile since they offer an opportunity for reflection and continuous engagement as a result of the high quality of the debate and discussions covered across the different disciplines of Business and Economics, National Food Security, Climate Adaptation, Energy Sustainability, Universal Health and Education.

Finally, I want to thank all the presenters and participants for bringing their expertise and experiences in the articles presented. Special thanks to the organizing committees of the different universities for their leadership and support, to the editorial team and the Advisory Board.

Thank you all.

MARY NYASIMI, PHD
DIRECTOR, INCLUSIVE CLIMATE CHANGE ADAPTATION FOR A SUSTAINABLE AFRICAN (ICCASA)

Message from the Vice-Chancellor, Machakos University, Prof. Lucy Irungu

I wish to congratulate Lukenya University and her partners, Machakos University, Ummah University, South Eastern Kenya University and The *Inclusive Climate Change Adaptation for a Sustainable Africa for embracing the "New Normal" in organizing and hosting the first virtual Conference.* The Conference provided a platform to take an in-depth reflection on the paradigm shift in the educational, business, scientific and technological arena, particularly in this COVID-19 Pandemic times and is the backbone to this publication.

As I have time and again said, conferences provide moments to network, build collaborative synergies, linkages, and partnerships that shall continue on, beyond the Conference period. I would like to take this opportune moment to encourage you to share your experiences and opportunities.

Machakos University prides in being a leading pillar in the Socio-economic transformation of our communities and we were glad to bring along our experiences and expertise. It is in this regard that I am happy to share with you that since its inception as a Technical School in 1957, the university has made a niche in Engineering and Technology especially in Mechanical Engineering, Electrical & Electronics Engineering Civil Engineering and Hospitality. In enhancing our research infrastructure, the University, together with Tianjin City Vocational College established the Kenyan Luban Workshop that hosts a world-class video conferencing facility. The Workshop boasts of excellent ICT infrastructure networks that now makes Machakos University the best provider of Cloud Computing and Cyber Security courses. It is my pleasure to welcome you to use the opportunities provided by the Luban Workshop, the only one in Kenya and East Africa.

Finally, I wish to once again thank the organizers, participants and sponsors of the Conference for finding time, resources and commitments to ensure the success of Conference: **The International Multi-Disciplinary Research Conference in Business, Education, Science and Technology,** and in making the publication possible.

Thank you and God bless you.

Prof. Lucy W. Irungu, PhD
VICE-CHANCELLOR & PROFESSOR OF ENTOMOLOGY
MACHAKOS UNIVERSITY

Message from the Vice Chancellor, Garissa University, Prof. Osman Warfa

I would like to appreciate the organizing team and participants from Lukenya University and other collaborating institutions for ensuring that the **International Multidisplinary Research Conference in Business, Education, Science and Technology** takes place despite the challenges presented by COVID-19 pandemic, and that this publication is delivered.

I appreciate the focused and timely collaborative conference themes leading to this publication. The theme: **'Use of Innovative Technologies to Enhance Business, National Food Security, Climate Adaptation, Energy Sustainability, Universal Health and Education"** with its four major strands namely; Business and Economics, Education, Health and Science, E-Learning in Education, Green Science and Technological Innovations, is key to the challenges facing sustainable development the world over. I am particularly glad to see the inclusion of terrorism and business in the presentations because it is one of the major issues since terrorism affects almost every aspect of our operations across the globe. The ideas and insights in these articles are importantt in tackling global development challenges.

I hope annual collaborative activities between Lukenya University, Machakos University, South Eastern Kenya University, Umma University, Garissa University and Inclusive Climate Change Adaptation for a Sustainable Africa will grow to create a regional hub for the exchange of ideas and experiences and ultimately spur development.

Conference delegates, it is now my singular honor and privilege to declare the **5th Web Conference Series of the International Multidisplinary Research Conference in Business, Education, Science and Technology** officially open.

Thank you. God bless you all

PROF. OSMAN WARFA

VICE CHANCELLOR, GARISSA UNIVERSITY

Message from the Vice Chancellor Umma University, Kenya, Dr. Idle Farah

We thank God that we came from far together as partners to the extent that we jointly organized the international Multidisciplinary Conference in Business, Education, Science and Technology, that led to this publication, at a time when COVID-19 interrupted systems, processes, actions and institution. The novel coronavirus (COVID-19) was a declared a public health crisis of international concern by World Health Organization (WHO). The family, religious, educational and economic aspects were interrupted. The conference was a new lesson, learnt as a result of COVID-19 Pandemic. Thanks to technology for facilitating virtual institutional management, scientific meetings, conferences and training. I thank Prof. Constantine Nyamboga-Vice-Chancellor of Lukenya University and other Vice-Chancellors of the partnering universities for providing excellent leadership in organising the international conference.

We have remained resilient together and determined to make the partnership a success. Where the spirit of hope, togetherness and determination exist, the flag of success cannot be threatened. I thank the Vice Chancellors of all southeastern universities block for promoting networking and other activities. Our first joint international conference on biodiversity, climate change and adaptation, which was hosted at South Esatern Kenya University (SEKU) in conjunction with Umma University in 2017. That collaborative partnership is encouraging and promising as our institutional scholars, scientists and stakeholders have the freedom to interact, innovate and share experiences.

The partnership has discovered opportunities to organise joint international conferences, trainings, scholarly exchanges and writing of grant proposals. All these lead to publication of articles that are useful for national and international advancements Indeed, we have formed a society for scientific advancements and stakeholder engagements. This development of partnership is in support of the devolution objective, Vision 2030, the Big Four Agenda and SDGs where knowledge and technology are sustainably transferred to the grassroots groups so that the skills and experiences generated by the higher learning institutions can contribute to the social transformation and hence, improved quality of life.

The theme of the 4th series of the conference was "Catalyzing change in education, health and green innovation: challenges and opportunities." This was extremely appropriate as millions of pupils, and students were at home not learning, many places of worship were closed due to the threat Covid-19 Pandemic. As you are aware, many lives, jobs and opportunities were lost. There was increased divorce, rape and domestic violence, all these setting in new levels of difficulties, vulnerabilities and impacts in societies.

Therefore, the research articles provide some interventions to threatened entrepreneurial, educational, religious and cultural activities by the Pandemic. These are important for improved policies and practices in support of businesses, education and technological innovations relevant to the situation.

Dr. Idle Omar Farah

Vice Chancellor

Umma University

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EDUCATION AND SOCIAL SCIENCES

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Meta-Analysis Model for Education in Pandemic Times

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ABSTRACT

During Pandemic times like the current COVID-19, response protocols pose challenges to researchers especially in regard to data collection. The guidelines such as restriction of movement, social distancing and age-related protocols that guide social groupings and interaction become constraints to research designs that rely heavily on human interaction/contact. The pandemic brings in a new normal for educational research in terms of approach to research design, data collection and data analysis. This necessitates two distinct ways in conducting educational research: The use of Meta-Analysis as an appropriate design; and, the availability of quick reference tools for Effect Size Calculation among studies already undertaken in related fields. This paper discusses ways in which educational research could exploit meta-analysis in achieving reliable results by: (a) Proposing meta-analysis as the most viable option for research design; (b) Recommending a set of tools for different options on Effect-Size Calculation and (c) Proposing a framework for mentoring postgraduate students on this new approach.

Keywords: Educational Research, Meta-analysis, Effect-Size, Sampling, Reliability, Statistics

1.0 INTRODUCTION

During Pandemic times like the current COVID-19, response protocols pose challenges to researchers especially in regard to data collection. The guidelines on social distancing and the introduction of age-related protocols that guide social groupings and interaction are a big hindrance to research designs that rely heavily on human interaction/contact.

This context has immediately created the challenge of accessibility to human sampling. Following this new normal, an approach to

Research Design and data analysis is inevitable to guarantee continued research without magnifying the effects of the pandemic.
This can be addressed in two distinct ways:
1. The use of Meta-Analysis as an appropriate design;
2. The availability of quick reference tools for Effect Size Calculation among studies already undertaken in related field.

By answering the question, 'In what way should researchers maximize the value of research without aggravating the effects of any given pandemic?', this study aims at mitigating pandemic exclusion by:
(a) Proposing meta-analysis as the most viable option for research design;

(b) Recommending a set of tools for different options on Effect-Size Calculation.

(c) Proposing a framework for mentoring post-Graduate Students on this new approach.

The paper proposes the use of the statistical technique of 'Meta-Analysis' (MA) as developed by Glass, McGraw and Smith (1981) to synthesize studies collected for meta-analysis. This approach has been adopted because of the many factors preventing movement and gatherings as measures against effects of pandemics like the infection and spread of COVID-19.

2.0 The Rationale and Procedures for Meta-Analysis

2.1 Rationale for Meta-Analysis

Every treatment has an effect. Researchers are usually interested in establishing the size of the effect and its statistical significance.

When an Experimental or a Quasi-Experimental Study is well-designed, the effect of a treatment condition on some defined outcome can be measured. Apart from the Statistical significance of the results, the size of the effect of the treatment condition on the outcome is more significant in making conclusions about future predictions.

The best approach to comparing several empirical studies is Meta-Analysis which consists in several systematic steps.

Meta-analysis procedures are expected to follow the Campbell Collaboration Statistical Analysis (2004) standards, and the Meta-Analysis Reporting Standards (MARS), as required by the American Psychological Association (APA) (2012):

- The technique uses a quantitative integration of various findings treating each study as a unit of analysis.
- The findings between studies are compared by transforming the results to a common standardized metric called an effect size (ES).
- The search strategy covers peer reviewed journal articles and open access publications for wider coverage of the main contributions in the intended field of study (Payne, More, Griffin & Autry, 2011).
- A search of various Electronic data bases for titles and abstracts of potentially relevant studies published in the English language is conducted.
- The main question of the analysis is to describe comprehensively the relationship between a treatment and quality learning outcomes.

In using MA, procedures, computations, and interpretation of results, the following steps are recommended:

(1) Studies with serious methodological flaws are excluded;

(2) One effect size is computed for each study pertaining to a well-defined dependent variable. (A measure of an observed effect relative to a control);

(3) Effect sizes of separate and independent studies are calculated using z-scores and the N (the total number of observations on which z is based) adopted from Rosenthal (1991, p.19); or other equivalent statistic;

(4) Hunter and Schmidt's (1990) corrections for sampling error, measurement error, range restriction, and other systematic artifacts are applied to the distribution of effect sizes;

(5) Effect sizes are then examined within each stratum and across all of the studies/strata**.**

3.0 Searching for Relevant Studies:

To guide the literature search and review, **a group of key related terms must be used.** The researcher must develop a conceptual framework identifying key components describing the treatment and its effects. The computerized searches of online databases and citations in prior meta-analyses of similar studies as well as an additional search in key journals may be done. The electronic library and inter-library data banks and services are scanned as well.

3.1 Data Extraction, Coding, and Selection of Final Set of Studies:

The PICO/ SPIDER: are the two principal approaches to meta-analysis.

PICO stands for **P**opulation, **I**ntervention, **C**omparison, and **O**utcome.

SPIDER stands for **S**ample, **P**henomenon**,** **I**ntervention, **D**esign, **E**valuation and **R**esearch type.

Once the principle is adopted, all studies are compiled into a master database (MDB), within a MS-Excel spreadsheet file (after being assigned a unique 'I.D. Number'). Data on variables of interest are extracted, recorded and appended to the MDB.

3.2 Selections of Effect Size Calculation Tools

The effect sizes for different studies can be carefully done by selecting relevant tools depending on the initial statistic used in the study to be analyzed. The tools are summarized in table 1.

Table 1: Tools for Effect Size Calculation

No.	Type of calculation tool
1	Cohen's, d
2	t-statistic
3	Chi-Square Statistic
4	F-Statistic
5	Regression Statistic

Source: (Authors' Summary, 2020)

3.3 Equations for Calculating Effect Sizes

Equations 1-5 can be selected in calculating effect sizes:

A standardized Beta coefficient compares the strength of the effect of each individual independent variable to the dependent variable…

$$\text{Cohen's d} = \frac{\bar{Y}_1 - \bar{Y}_2}{s_c} \quad (1)$$

$$\text{T-statistic, r} = \sqrt{\frac{t^2}{t^2 + df.}} \quad (2)$$

$$\text{Chi-square statistic, r} = \sqrt{\frac{X^2}{X^2 + df}} \quad (3)$$

$$\text{F-statistic, r} = \sqrt{\frac{f}{f + df.}} \quad (4)$$

$$\text{Regression –statistic, } r = ß \pm SE. \quad (5)$$

4.0 Interpretation of the effect size

4.1 Cohen's d

When Cohen's d is calculated the interpretation is treated as follows:

r=0.20(small effect), r=0.50(medium effect), r=0.80 (large effect).

4.2 T-statistic

When interpreting the effect size, the following is the guideline:

r=0.10(small effect), r=0.30(medium effect), r=0.50 (large effect).

4.3 Chi-square statistic

When interpreting the effect size, the following is the guideline:

r=0.10(small effect), r=0.30(medium effect), r=0.50 (large effect).

4.4 F-statistic

When interpreting the effect size, the following is the guideline:

r=0.10(small effect), r=0.30(medium effect), r=0.50 (large effect).

4.5 Regression –statistic

When interpreting the effect size, the following is the guideline:

r=0.10(small effect), r=0.30(medium effect), r=0.50 (large effect).

5.0 Conclusion and Recommendations

If our graduate students are guided on the procedure of Meta-Analysis and informed on the available tools to choose from, with illustrative mentorship; they can meaningfully survive the research challenges of pandemic periods.

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Education Sustainability as a Vehicle to Country Development

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ABSTRACT

According to the constitution of Kenya, 2010 and the Basic Education Act 2012, Education is a right that each child in Kenya must be given. It is on this premise that the government of Kenya spends more than five per cent of her GDP in Education. Every child has a right to free and quality education provided by the government. World bodies like UNESCO, USAid have played a major role in promoting access to quality education at all levels in the society in order to transform the society by reorienting education. Such bodies work with the government to ensure that students through the education system develop knowledge, skills, values and acceptable behaviors that are needed for sustainable development in the world. The Kenya government in her endeavor to give quality education for sustainability has changed the curriculum to ensure that a holistic student will be the end product. The curriculum known as the Competency Based Curriculum (CBC) is premised on different theories that are aimed at identifying the learner's' strength and ensuring that learners' talents are identified and nurtured. This paper discusses the links between education and sustainability with an aim of promoting learning that links knowledge that the students learn at school or within the society, their inquisitive skills developed through the education circles and their ability to perform different activities in order to help them build a healthy sustainable future for their communities and the world at large. The Vision 2030 has one of its objective aimed at transforming Kenya into a newly industrialized, middle-income country providing a high quality of life to all its citizens. It is envisaged that education sector will play a major role in the country's endeavour to industrialize by the year 2030.

Key words: Education, sustainability, curriculum, competency, development, Vision 2030

1.0 INTRODUCTION

Several reviews have been done to the Education curriculum in Kenya since the Ominde Commission in 1964. These have been described as curriculum reforms, curriculum change, curriculum review, and curriculum innovation. These reviews have been necessitated by various dynamics experienced in the world.

The education commissions and taskforces were formed and commissioned for a purpose. They were aimed at fulfilling Education for All (EFA) goals, MDG's (Millennium Development Goals), SDGs (Sustainable Development Goals) and Vision 2030. Despite various achievements, Kenya's education sector continued to face challenges which led to weak linkages between the education and the labor market. To a large extent, formal education has been focusing almost exclusively on academic specializations without proactively generating technical, vocational and other talents, skills and aptitudes to support the country's development agenda. The realization of these shortcomings led to the need for the change of the curriculum. The competence based Curriculum (CBC) is not only aimed at aligning education sector to the 2010 constitution but also to Vision 2030 which is aimed at turning around the country from being a developing one to a middle income country.

2.1 Government's Initiative: Why the government decided to change to CBC

The 8-4-4 (that is, 8 years in primary school, 4 years in secondary school and 4 years at university level) system of education which was over 30 years old was found not to be compatible with the labor market needs or employment which prompted the government and education stakeholders to come up with a new curriculum that would hopefully bridge the gap. The CBC (or 2-6-3-3-3) system that encompasses two years at pre-primary level, 6 years at primary and junior secondary level (3 years each), 3 years at senior secondary level and 3 years at university level came up as the identified alternative. The 8-4-4 system also proved to be broad and burdensome to learners.

The 8-4-4 system was criticized as having neglected the sectors which accelerate growth such as agriculture, construction and fishing among others resulting to skills imbalance in the job market causing unemployment among Kenyan youth which was at 40 % by 2020. Technical and Vocational Education and Training (TVET) was also included by the government as a key component of achieving Vision 2030. Therefore, the 2-6-3-3-3 system was identified as the ultimate remedy to limitations identified in 8-4-4 system of education as it is entirely skill based. The curriculum was piloted in May 2017 and September 2017 across 470 schools, 10 from each county in Kenya. Though an important exercise, the Kenya National Union of Teachers (KNUT) members raised concerns that, it was not the appropriate time for piloting and that the programme was being hurried. A better framework for implementation was required. Teacher's preparedness for the programme was also in question as well as provision of tools and workshops for art and craft.

According to the proposed new curriculum, there would be no examinations. However, children would be subjected to Continuous Assessment Tests (CATS) on skills acquired

as opposed to cramming for examinations. Children with special needs, wiould be incorporated in the curriculum which would integrate internet communication and technology (ICT) at all levels of education. Subjects in the new curriculum would include Kiswahili, English, Literacy and Mother tongue, Science, Social studies and agricultural activities. The first assessment was conducted in October 2019 to all the grade three learners across the country. The feedback from the assessment was shared by teachers within their respective schools. Grade four roll out started in earnest in January 2020. In Upper primary, children would take subjects including Kiswahili, English, Mathematics, Home Science, Agriculture, Science and Creative Arts, Moral and Life skills, Physical and Health education. Other subjects would be social studies (Citizenship, Geography and History) while there would also be an option of a foreign language such as French German Chinese and Arabic. Digital literacy, financial literacy and pertinent contemporary issues would be integrated across all learning areas. Children would then proceed to Junior secondary (grades 7, 8, 9) and then to Senior secondary which encompass grades 10, 11 and 12. Graduates of the system would later take vocational training or proceed to universities.

The new curriculum would however, require heavy spending to equip teachers with necessary skills and tools. This is because learning would incorporate practical sessions as opposed to oral teaching. Since teachers would be required to have small groups of students, shortage of teachers poses another challenge if quality education is to be maintained a major concern by the government. For example, by the year 2017, teacher deficit was estimated to be 87,000, though the Teachers' Service Commission (TSC) had promised to hire 5000 teachers by June the same year. Further TSC intended to deploy 2205 more teachers to primary schools. On the side of infrastructure development, the government was yet to invest adequately, while the intentions of having 100 % transition from primary to secondary schools by 2018 was yet to be achieved (Henry Wanyama February 1, 2017).

3.0 Challenges faced by African Governments in Education sustainability

The Ministry of Education, Science and Technology (MOEST) report (2015) outlined specific areas that constrained development of talents within the education curriculum. The areas mentioned included but not limited to inadequate training facilities and resource materials at all levels; over-emphasis on examinable subjects during delivery of curriculum at the expense of teaching of physical education, performing arts and other creative arts; parental and community attitude that de-emphasize co-curricular activities; low human resource capacity due to inadequate preparation of teacher trainees in co- curricular activities; and inadequate finance to implement, organize and coordinate the physical education , performing arts and creative arts competitions.

To respond to these challenges, the government came up with strategies which were aimed at ensuring that co-curricular activities harnessed learner's potential and developed them into all rounded individuals with requisite skills knowledge, competences, values and attitudes**.** The strategies included **i**mproving coordination of the co-curricular activities at the grass root levels, increase funding to manage and provide adequate facilities and materials for co-curricular activities, identifying and

equipping talent development centers and incorporating more partners to support co-curricular activities among others.

The Government developed the National Education Sector Plan (NESP) 2013-2018 programme for delivering the reforms required by the Basic Education Act of 2013; Sessional Paper No. 14 of 2012; Jubilee Manifesto (2012); Kenya Vision 2030; Medium Term Plan II (2013-2018) and the Constitution of Kenya 2010. Building on the achievements and lessons learnt from Kenya Education Sector Strategic Plan (KESSP) (2005 - 2010)**,** the NESP planning process incorporated the recommendations of the National Education Task Force, 2012. The sector plan as set out in NESP emphasizes a holistic and balanced development of the entire education sector. **T**he Basic Education Act (2013) on the other hand incorporated recommendations of the Taskforce on the re-alignment of education to the Constitution (2010) and Vision 2030 of 2013 (MOEST, 2015). The task force, curriculum change, sessional papers among others are all geared towards making the education in Kenya more competitive and a vehicle towards sustainable development

After the 7-4-2-3 (7 years at primary school, 4 years at ordinary secondary level (O-level), 2 years at advanced secondary level (A Level and 3 years at university) system of education, 8.4.4 system of education was introduced in 1985 to address the gap of transition from higher institutions of learning to the world of work. Though the system initially had noble intentions, it somehow proved expensive to be sustained, though, the aim was to shift education from being examination-oriented to a practical and technical curriculum which was to be enhanced through TVET. It is therefore evident that the government of Kenya had positive initiatives aimed at ensuring that children in Kenya have access to quality basic education through Free Primary Education (FPE) and Free Day Secondary School Tuition. Through this, students would access Free Day School Tuition. The FPE and Free Day secondary school education which were introduced by the NARC government in 2003, have come a long way in helping the needy and poor families in their education. The wing to fly initiative pioneered by Equity bank, the KCB and Cooperative banks provide support to the needy students. Other financial institutions provide assistance to those who secure good marks in KCPE. The efforts are all geared towards making the students to continue with their studies uninterrupted.

The new curriculum was aimed at identifying the multi-talents that are exhibited by learners from early age with an aim of nurturing them. The school curriculum therefore recognizes and accommodates a syllabus that includes the discovery of gifts and talents among the learners. The new curriculum ensures that the talented and gifted students are identified regardless of where they are schooling (public or private schools). The notion that the well-known talent schools are private and costly has been addressed of by the new curriculum.

Vision 2030 may not be fully accomplished without focusing and enhancing creativity and innovations that the young and energetic children and the youth display in a variety of disciplines. The Ministry of Education and all stakeholders have endeavoured to bring a new curriculum that is holistic and all-inclusive and has even accommodated all the groups in the society including the gifted and the talented. Efforts have been extended

further by the government by bringing to focus the recommendations made in MGDGs, SDGS, Vision 2030 and the Medium Term Plan II (2013-2018) strategies. According to African Population and Health Research Centre (APHRC), (2017), the changes proposed in the new curriculum (2 6 3 3) that the government of Kenya started to implement in 2018 are aligned to the vision of the new curriculum reform which aims at enabling every Kenyan to become an engaged, empowered and ethical citizen. This will be achieved by providing every Kenyan learner with world class standards in the skills and knowledge that they deserve, and which they need in order to thrive in the 21st century. However, with constrained resource provision in many public primary schools, the implementation process and sustainability of the new curriculum may find hindrances.

Another change in the new curriculum (CBC) is elimination of summative evaluation. This refers to examinations that are done at the end of 8 years of primary school, four years of secondary school, in the 8.4.4 system of education. Instead, it spreads out the evaluation throughout the duration of the child's stay in school. Children will be assessed based on their competencies, meaning their ability to apply knowledge and skills in performing various tasks within specific settings. This will help to determine the individual strengths and weaknesses of the learners. This initiative may probably raise hopes among the talented and gifted children though the preparation of assessment mechanisms of the same may prove to be a daunting challenge. Even though recommendations were made to train teachers on the identification of talents among children, fears have been raised that trainers/teachers may be unavailable ((UNICEF).

Life skills refer to both psychosocial and interpersonal skills that can assist people to make informed decisions, communicate effectively and develop coping and self-management skills that would lead to a healthy and productive life. Accordingly, children would also be exposed to life skills from pre-primary in addition to all the other subjects that they would be taught. This would ensure that from an early age, children would have the opportunity to acquire the necessary skills to help them navigate life's challenges as they progress with their education. African Population and Health Research Centre (APHRC) has documented that the school is just one place where the teaching of life skills occurs. In the home and family setting, parents shape the attitudes, skills, and values that young people acquire. The new curriculum therefore offers parents the opportunity to be involved in their children's education. These empowered parents will take the initiative to participate in school, at home and within the community. More importantly, the curriculum will help ensure the holistic development of children within a friendly learning environment.

There are eight learning areas for lower primary. They include literacy; Kiswahili/sign language, English, indigenous language; mathematics; environment (science, social and agriculture); hygiene and nutrition; religious moral; and life skills activities; movement and creative activities (art, craft, music, and physical education). ICT will be a learning tool. Upper primary grades 4, 5 and 6 have similar subjects; only that home science, physical education and agriculture appear as independent subjects.

4.0 Areas of development accruing from education

The education system in Kenya should strive to prepare the learners with global viewpoints. Students graduating from local universities should be globally competitive. Their job markets should cross the borders of Kenya. Global education opens the eyes and minds to the realities of the globalized world. It creates mobility of manpower from one region to the other. According to the Kenya Bureau of Statistics (KBS), 2019, the amount of remittance by Kenyans who work outside the country has now exceeded the amount earned from tourism, agriculture and all the other major sectors. Education offered in Kenya should awaken the graduates to bring about a world of greater justice, equity and human rights for all. To Kenya, higher education should be seen as a catalyst that promotes economic growth, reduced poverty and ensures sustainable development. The heart of globalized education is enabling young people to participate in shaping a better, shared future for the world. Global education emphasizes the unity and interdependence of human society, develops a sense of self, and appreciation of cultural diversity affirmas social justice and human rights, and buils peace and actions for a sustainable future in different times and places. Global education promotes positive values and assists students to take responsibility for their actions and to see themselves as global citizens who can contribute to a more peaceful, just and sustainable world.

Global education raises the awareness of global challenges like poverty, unfair distribution of opportunities and resources, environmental degradation and climate change, violent conflicts and non-respect of human rights. It creates a deeper understanding of the complex underlying issues. It aims at changing people's attitudes and encourages them to reflect on their own role in the world. It motivates and empowers people to become active as responsible global citizens.

Education for sustainability requires innovation in the education sector.

4.1 Basic education content

The basic education content was designed with a view of equipping the learners with the relevant knowledge that emphasizes on technology, innovation and entrepreneurship (Vision 2030). It incorporates the development of the full capacities, living and working in dignity, enhancing the quality of lives, making informed decisions and continuing with learning as a life-long engagement. The New curriculum (CBC) would ensure that learners are not graded as failures in their assessments as they have inherent strengths that should be identified. Learners will be allowed to move to the next level based on their competency in skills and knowledge gained. This model is in line with most African countries specifically South Africa. Students can choose STEM (Sciences, Technology, Engineering, and Mathematics) subjects or move to Arts and Music among others. The content of the CBC emphasizes on the need for acquisition of skills, attitudes and knowledge and applying them in real life situations. Learners who show competency in Art subjects would move along that line. The curriculum is in line with the government vision 2030 initiatives of transforming Kenya into a "newly industrializing, middle-income country providing a high quality of life to all its citizens in a clean and secure environment.

5.0 Conclusion and Recommendations

Education in Kenya has gone through many changes. To sustain these changes, there is need for consistence in funding the sector. Sustaining curriculum for the country's development will involve working closely with development partners, NGOs, Private sector among others. There is need to assess the CBC as it progresses in order to mitigate any shortcomings

Kenya has continued to use a big proportion of her GDP on education. Curriculum change, task force, sessional papers and various commissions that were formed since independence tried to look into ways in which education in Kenya can be a tool of National development. This has remained to be the main pillar of various changes in the Education sector in Kenya.

Vision 2030 is a government initiative that would transform the country into a middle income country. Education sector has been considered as one of the vehicles trhough which the required transformation would be achieved. The need to change the curriculum to CBC was as result of the Vision 2030 initiative.

Being part of the global village, Kenya should not lag behind in her thirst to embrace the new world advancements. Some of the initiatives taken by the government include:

Recruitment of more teachers: However, the teacher student ratio in Kenya primary schools stands at 1: 60. This makes it difficult for learners to achieve the instructions as envisioned in CBC. Quality education will ensure better output. The large number of students is not commensurate with the number of classrooms or other facilities in schools.

Provision of bursaries to the needy, FPF and Free Day Secondary Education to improve access to education: This would ensure the disadvantaged members of our society have access to quality education. Other iniiatives undertaken by the government include: working closely with international agencies and institutions like UNESCO, USAid among others.

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Understanding the Concept of E-learning: A Case study of the Kenya Methodist University University (KeMU) Mombasa Campus, Kenya

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ABSTRACT

The study interrogates types of e-learning modes, impact, successes and challenges of E- Learning at the Kenya Methodist University (KeMU), Mombasa Campus. E-learning involves programs that use the internet to allow sharing of instructional material beyond classroom walls, between educators and the learners. The study adopted a desk review approach that focuses on document analysis to get educators and learners' experiences on e-learning. The documents analyzed were journals, KeMU Internet Communication and Technology (ICT) website and students' registration records. The study aimed at improving knowledge on e-learning to universities, middle level colleges and Secondary schools. It also aimed at determining the place of e-learning in modern education and how best it can be improved. The study findings show that wider awareness creation was essential to educators, students and the general public on the need for e-learning.

Key words: Technology, Communication, E-learning, Learners, educators

1.0 INTRODUCTION

E-Learning or online learning is an education process in which instruction and course content is supported by the internet (Watson & Kalmon, 2005). The term online education is used interchangeably with virtual learning, cyber learning and e-learning. Crowther et al., (2014) proposes that e-learning is a broader concept encompassing a wide range of applications and processes which use all available electronic media to deliver vocational education and training more flexibly.

E-Learning is categorized into Synchronous and A synchronous eLearning. Synchronous e-learning involves the learners and the instructor interacting with each other in real time from different locations at a set time. In Synchronous eLearning, the learning

resources are delivered via mobile, video conference or chat and Webinars. The participants can share their ideas during the session and interact with each other and they get detailed queries and solutions. Synchronous eLearning is gaining popularity because of the suspension of in person classes due to COVID 19 and improved technology.

A Synchronous e- learning is when the learner and the teacher are not online at same time (Appana, 2008). Asynchronous eLearning uses technologies such as email, blogs, discussion forums, eBook's CDs, DVDs, etc. Learners can access materials, chat with teachers and also with co-learners at any time. It is a self-paced learning module in form of message boards and group discussions.

Educators and learners find synchronous and asynchronous online learning mode appealing. From the comfort of their homes, students can read materials submit their assignments and examinations papers on their cell phone or any Information Communication Technology (ICT) device from any location because there is no scheduled time of class. Similarly, educators can provide instruction and grade assignments from the comfort of their homes. The learners and instructors only need a desktop computer, laptop or smart phone and internet accessibility to take the online course.

In asynchronous online mode, learners can attend lessons and take their assignments at their discretion depending on the instructors' deadlines, unlike the traditional on campus classes where there is time schedule for each lesson, lasting for an hour or more.

Since on line learners have to plan their own schedule and are responsible for their learning, it makes students to be masters of their own learning. This helps in self-regulation and students can spend more time on courses or topics that they are weak in, and need to improve (Aslanian & Clinefelter, 2012). The self-regulatory virtue is very vital for a successful academic journey. The student puts more effort in studies hence enhanced involvement (Bransford, Brown & Cocking, 2000).

Students may feel comfortable talking and expressing themselves online with their instructors through emails, Skype, Imo, online chats and group discussion than face to face classroom interaction. Online classes help to remove any cultural barrier that might have existed in on campus studies, where students from different background meet. Additionally, students have the chance to respond to questions with confidence in writing without seeing the other source and respond well compared to the face to face classroom set up (Kassop, 2003).

The internet provides a variety of different materials which can be used by all people in online classroom irrespective of their age, economic status or social status. McNeely, (2005) mentions that use of technology in the classroom can increase the participation and inclusion of all students in the learning process. Students are free to say want they want to say and have much time to make comments when ready.

Online learning helps in cutting costs, since students will save money by not attending the classes in person. Costs of food, transportation and books will be reduced. Also books are available through the schools' e-library.

On the contrary, some online learning modes encourage monologue instead of face to face interaction with the instructor. The value of face to face interaction cannot be overlooked. For instance, in the classroom context, students exhibit body language and facial expressions which give the instructor an opportunity to gauge whether the students are grasping the content or not. The online learning does not give the instructor the opportunity to identify an academically challenged student for support.

Online learning offers lots of tasks and assignments such as reading and writing papers depending on the level of study. At times there is no daily supervision and monitoring of the task. Given the strict submission requirements of activities and assignments, students may compromise the standards of performance.

Online classes can be disrupted by technology failure or power outages. Since online learning relies mostly on power and internet efficiency, any disruption hinders the students' class access. As a result, the student's overall performance can decline.

Kasse and Balunywa, (2013) in their study revealed major infrastructural and technical incompetence, and attitudinal challenges (by staff and students). These challenges limit full-scale adoption of e-learning in institutions.

Plagiarism issues and lack of integrity can arise. There are high chances that a student can hand in another person's work. Futher, an imposter can attempt assignments on a student's behalf. In face-to-face classroom situations, the students physically undertake assignments and hand in their work. This minimizes chances of having imposters. Antiplagiarism softwares are handy in reducing chances of plagiarism in all situations.

1.1 Methodology

The study used a desk review approach that focused on document analysis of journals, KeMU ICT website and students' registration records as well as getting educators' and learners' experiences. This approach helped in creating a greater understanding of the concept of e learning in universities and colleges from the educators' and learners' experiences.

1.2 Findings

For effective learning, new educational technologies need to be supported by innovative pedagogical approaches which in turn enable collaboration, communication and mobility (Webster & Murphy, 2008). Most higher education institutions in Africa and Kenya have embraced e learning as a mode of instruction. However, Walimbwa (2008) points out that some universities in the East African region have not fully utilized e- learning as expected.

E- Learning is being practiced successfully by some universities in East Africa. Kasse & Balunywa, (2013) assessed the implementation of e-learning in Ugandan institutions of higher learning namely Makerere University of Kampala (MAK); Makerere University Business School (MUBS); Kampala International University (KIU), and Islamic University in Uganda (IUIU). The choice of these institutions was based on the fact that they are the highest-ranking institutions in Uganda in terms of the quality of education, student population, and ICT adoption. Findings of their study showed that e-learning was used mostly as a means of

delivering learning material (80%), minimally used to conduct discussions (12%), and to conduct assessment (2%).

To attract more students in the universities especially those already employed and interested in part time learning due to various reasons, eLearning is preferred (Hollow& ICWE, 2009). Hennessy, et al., (2010) reveal that educators' knowledge of online learning is key because the internet has increasingly become a source for resources needed for research and other academic requirements.

The KeMU Mombasa campus mostly uses asynchronous eLearning. Mayer (2001) avers that it is important to select online media that resonates with the students' needs. Consequently, with the suspension of in person classes, KeMU was focused on achieving synchronous eLearning.

Since 2006, when the Kenya government developed the Information Communication Technology (ICT) policy there was a great impact of IT in academia. Wong & Looi, (2010) state that most academic courses relay on IT to achieve the objectives of transmitting knowledge. As a result, Kasse and Balunywa (2013), point out that most universities in East Africa use e-learning forum to deliver learning material, conduct discussions and assessments. The use of e-learning has witnessed a massive registration of students in programs that use the internet to conduct classes, submission of examination results and course registration.

To be relevant within the higher education sector and to tap the distance education niche KeMU, developed the center for virtual learning (CVL) which hosts the digital campus. CVL gives the learner a feel of a physical campus environment. The educators and the learners are able to have a platform where communication flows freely. The instructor has a very important role in the success of e –learning by understanding pedagogy strategies, and content (Angeli & Valanides, 2009). Furthermore, Garrison & Vaughan, 2008; Jiang & Ting, 2000) mentions that the instructor and the technical staff has the responsibility of creating a free flowing learning environment.

The learners can access their portal at any time and any place once the internet is available. The KeMU digital campus is for those self –motivated learners who are constrained by work and time during the day or location among other factors, but can study from wherever they are after work or minus the constraining factors. Both postgraduate and undergraduate degrees in computer science, nursing, business, education, finance and economics can be administered through the digital campus depending on the student's choice (https://digital.kemu.ac.ke). The learners get the same level of knowledge as those on campus.

The KeMU Digital campus (Learning Management System) uses videos, presentations, simulations and textual instructions to disseminate information asynchronously. This reveals that elearning makes use of many technologies some of which have been developed specifically for it, whilst others are conveniently used to complement the learning process such as social media. Wenglisky, (1998) states that the main purpose of technology in schools should be to enhance the learners' performance, but not to make the schools have the state –of the-art device. Therefore,

learning should always be an impetus that drives the use of technology in school.

At the KeMU digital campus, the learners get their course outline and other requirements from their instructors on the portal. The learners post their assessments through the same mode. Assignments are carefully incorporated in each course to ensure that the instructors are able to evaluate learners and continuously offer reinforcements to them. The learners can present data, photographs, videos combined with verbal content as part of class assignments.

The learners on the online programme take the same course units and examinations as those on the regular programme. The course units are uploaded on the digital campus and have the same context as the regular class content. There is no difference in the course content between the two programmes except the mode of delivery. At the end of the semester examinations are administered both digitally and physically (face-to-face) following the course outline that is usually common to both, online and regular programmes.

With the Covid-19 pandemic and suspension of face-to-face classes, KeMU, end of semester examinations were switched to the online mode. Through the Learner Management Systems (LMS) students sit for examinations online via a link in their portals. The exam is divided into three sections A, B and C. To curb cheating, web camera students are used to monitor students during the two hours online examinations.

The students on the online programme interact through discussion groups and dash boards within their networks. The Digital Campus is packed with interactive features including chat rooms, discussions and micro-blogging tools that facilitate conversation amongst the user. The Centre has invested in modern learning and instructional resources and methodologies to cater for a self-instruction. The CVL coursework is packaged in High Definition multimedia and textual formats, presented in a structured fashion that allows a learner to smoothly progress through an academic term (https://digital.kemu.ac.ke).

The digital campus has an electronic library which huge volumes compared to the physical library. There is an online curator who guides students as would be in the physical library. The library is a key ingredient in any academic institution. The electronic library enables learners by a click of the button to access any required information with ease. With the advent of electronic library at KeMU Mombasa campus, there is reduced activity by students in the physical library.

This digital campus also allows students from all over the country to apply for courses and programs regardless of their location. Every application is received by the admission staff. Responses are communicated through e-mail.

The University fees at KeMU is determined by the mode of study. Programmes taken through the digital campus are relatively cheaper compared to on campus programs. The students can access elearning materials using their ipads, desk top computers, mobile phones or laptops.

The study revealed that eLearning is a preferred mode of study by students who are employed or busy elsewhere and cannot have time for physical class attendance.

Possibly, most of the students join eLearning class because of the flexibility (Aslanian & Clinefelter, 2012). In this regard, there was an increase in KeMU students' intake in the eLearning cohorts compared to the face-to face cohorts within the three intakes in Januaury 2019, May 2019 and September 2019 before Covid-19 struck. There was greater rise in online intake with the advent of covid-19. The registration process which hitherto was hectic for students was made easier and more flexible. This was also a catalyst to increased student admission.

By the click of a button, the students could easily access their examination results from any location through their portal. It lessened physical interaction between instructors and students especially in the era of social distancing.

2.0 Conclusion

The nature of education delivery is ever changing in the world today. Institutions of higher learning should always be kept abreast with the changes so as to reach out to those who due to work related, family and distance issues cannot attend the tradition face to face classroom set up. Institutions should always advice students on the advantages and disadvantages of online learning for an informed decision making on the choice of study.

2.1 Recommendations

The KeMU instructors in the digital campus and other universities in Africa need to have the Technological Knowledge, together with Pedagogical and Content Knowledge (TPACK). This gives them the ability to handle all the learners' concerns in the digital campus. Proper utilization of technology motivates learners' and educators' participation in tasks given. The instructor's knowledge of the online learning mode is key in influencing the learners.

The KeMU technical staff and instructors in other higher institutions of learning should be facilitated to access computers and have online presence. The technical staff should be ready to respond to the students' challenges such as on how to sign in the portal, check their grades or accessing e-books and the elibrary. Instructors should give timely answers to students' questions or relevant communication required by students to facilitate a smooth process. Subsequently, the instructor together with the technical staff should ensure a successful synchronous and asynchronous online learning.

KeMU and other universities in Africa should invest heavily in online learning technologies. Challenges such as frequent power outages, poor internet connectivity and limited trained ICT experts should be given priority in terms of funding by governments.

The university faculty in Africa should select media that is sensitive to all learners in their context. For instance, there should be tools that are friendly to those with learning difficulties. For instance, some learners may require special devices for auditory purposes or braille. The staff should know how to make the class notes easy to download so as to motivate learning. This is to ensure inclusivity of all irrespective of any learning challenges therein.

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The Influence of Institutional Pressures on Strategy Implementation in Public Secondary Schools in Selected Counties in Kenya

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Abstract

This study sought to investigate the influence of institutional pressures on strategy implementation in public secondary schools in the four selected counties in Kenya. The target population was all the public secondary schools in the counties of Meru, Embu, Tharaka Nithi and Isiolo. The Slovin's formula yielded a sample size of 250 secondary schools from the target population of 672. Data was collected from the sampled schools using a closed ended questionnaire. The results indicate that schools rated themselves moderately high in strategy implementation success, (mean = 3.50, Sd = .46). Further, the schools rated the strength of the institutional pressures they experienced as moderate (mean = 3.39, Sd = .40). Spearman's rank correlation analysis showed moderate, positive and a statistically significant relationship between institutional pressures and strategy implementation in public secondary schools in Kenya ($\rho = .476$, $p < .001$). The binary logistic regression test for the hypothesis showed that institutional pressures had a Positive and statistically significant influence on strategy implementation in public secondary schools in Kenya {(Exp (B) = 4.433, $p < .001$}. The study recommends that the various public secondary schools stakeholders that are the originators of institutional pressures should play their roles effectively to ensure successful strategy implementation in their schools since these pressures have a significant influence.

Key words**:** Institutional pressures, strategy implementation, public secondary schools

1.0 INTRODUCTION

Strategic management has been traditionally influenced by two dominant paradigms. In the 1980s the field of strategic management was dominated by the industry based view as advanced by porter (1980). The decade of

1990s was on the other hand dominated by resource based view (RBV) of the firm whose proponent was Barney (1991). Since then the two schools of thought have oscillated like a pendulum in trying to explain the fundamentals of strategy (Hoskisson et al., 1999). Recently a third paradigm that complements the two traditional paradigms has emerged; the institutional- based view (Peng et al., 2009).

This paradigm has its origins from both institutional economics (North, 1990, Williamson, 1985) and sociological-institutional theory (DiMaggio & Powell, 1993, Scott, 1995). This theory brings in the role of institutions in explaining why organizations have differing competitive advantages (Garrido et al., 2014).

According to Obeidat et al. (2017) strategy is implementation can be described as the action stage of strategic management process where the laid down plans are translated into actions geared towards the attainment of the organisation's goals and objectives. However, available literature indicates that globally many strategies fail at the implementation stage. For example, Gebczynska (2016) reported that strategy implementation phase is the most challenging phase of strategic management process among the Polish firms while a survey of organizations in China showed that 83% of organizations fail in implementing their strategies (Sial et al., 2013). Failure in strategy implementation has numerous undesirable effects on the organisation. Strategy formulation consumes organizational resources including the time spent in meetings and therefore failure to implement it successfully would translate into the loss of these resources. On the other hand such failures would cause negative psychological effects on subsequent efforts to implement other organizational changes (Sial et al., 2013).

Based on the foregoing, it is pertinent that factors influencing strategy implementation in various sectors are investigated and especially those factors that have not attracted sufficient empirical studies. This study sought to investigate the influence of institutional pressures on strategy implementation in public secondary schools in Kenya.

2.0 THEORY, OBJECTIVE AND HYPOTHESIS

2.1 Institutional theory

Institutional theory has its origins from both institutional economics (North, 1990, Williamson, 1985) and sociological-institutional theory (DiMaggio & Powell, 1993, Scott, 1995). According to Scott (2003) institutions are the forces that act on individuals and organizations such that they apply social pressures and restrictions on them. They determine what is acceptable or not.

Institutional theory seeks to comprehend organizations and management practices as a function of social and institutional pressures rather than economic and market pressures. These institutional forces that shape the behavior of organizations were grouped by Scott as cited by Calvalho et al. (2017) into three categories namely the regulative, normative and cognitive pressures.

The regulative pressures deal with both formal and informal pressures exerted on organizations by the government agencies and other organizations that have formal control or influence over the organization (Sutton et al., 2015). A critical characteristic of regulative pressure is their coercive enforcement mechanism (Peton & Peze, 2014).

Secondly the normative pressures represent the informal and uncodified rules and norms. That is how things need to be done around the organization in line with the values held by both the individuals and the organization that influence the behavior of the individual and the organization (Yousafzai et al., 2015). It consists of social guidelines limiting behavior that lack a coercive enforcement mechanism. In other words normative pillar concerns itself with social patterns regulating the behavior such as values and norms Sutton et al. (2015)

Finally, the cognitive pillar consists of knowledge and skills, and taken for granted beliefs. The cognitive pressures are a function of levels of education, skills, training and access to support services (Yousafzai et al., 2015).

2.2 Objective of the study

The objective of the study was to assess the influence of institutional pressures on strategy implementation in public secondary schools in Kenya.

2.3 Hypothesis of the study

H_0: Institutional pressures have no statistically significant influence on strategy implementation in public secondary schools in Kenya.

3.0 METHODOLOGY

3.1 Research Design

This study employed descriptive survey research design. This design was found to be the most appropriate for this study for two reasons: First, descriptive research design lends itself for collecting large amounts of research data from a representative sample of a target population using questionnaires (Lavrakas, 2008). Secondly the design is appropriate for collecting data without manipulation of the variables and reporting the issues as they are (Fraenkel and Wallen 2009).

3.2 Target Population

The target population was all the six hundred and seventy-two public secondary schools in the selected counties. The distribution of the schools by county was shown in the Table 1.

Table 1: Study Population

County	**Number of schools**
Meru	354
Embu	166
Tharaka Nithi	135
Isiolo	17
Total	**672**

Source: Ministry of Education Science and Technology (2014).

The respondents were the principals of the said secondary schools because they are the accounting officers of their respective institutions and therefore responsible for strategy implementation in the school.

3.3 Sample and Sampling Procedure

The sample size for this study was determined using the Slovin's formula that states as:

$$n = \frac{N}{1 + N e^2} \quad (1)$$

Where n = Sample size
N = target population
e = margin of error

Hence

$$n = \frac{672}{1 + 672(0.05)^2} \approx 250$$

Each county contributed to the sample in the ratio of its population as shown Table 2:

Table 2: Sample size

County	Ratio	Sample size
Meru	$\frac{354}{672} X\ 250$	132
Embu	$\frac{166}{672} X\ 250$	62
Tharaka Nithi	$\frac{135}{672} X\ 250$	50
Isiolo	$\frac{17}{672} X\ 250$	6
Study Sample Size		**250**

Source: Author

The simple random sampling technique was applied to obtain the respondents from each of the counties. This ensured that within the county all schools had equal chance of inclusion in the study sample.

3.4 Data Collection Instrument

This study used a self- administered questionnaire as the data collection instrument. This enabled the researcher to collect data from a large sample and realize a high response rate because the respondents could fill the questionnaire at their own free time. The questionnaire consisted of closed ended items on a five-point Likert Scale. The level of agreement with each of the statement was scored as follows 5=Strongly Agree, 4=Agree, 3= neither agree nor disagree, 2= Disagree and 1=Strongly Disagree.

3.5 Data Collection Procedure

The study exclusively used primary data collected from the respondents. The primary data was collected using a self-administered questionnaire. The questionnaires were hand delivered to the sampled respondents who were allowed time to respond to the items in the questionnaire after which they were collected for analysis.

3.6 Data Analysis

The Study used Statistical Package for Social Sciences (SPSS) for windows software for analysis. The analysis was done in two stages where the first stage dealt with descriptive statistics and the second stage involved the inferential statistical analysis. Descriptive statistics involved frequencies, percentages, means and standard deviations. On the other hand inferential statistics involved Spearman's rank correlation and binary logistic analysis.

3.5 Model Specification

Binary logistic regression was used to determine the influence of institutional pressures on strategy implementation.

To achieve this data was coded as:

$$X = \begin{cases} 1\ for \bar{X} \geq 3.5 \\ 0 otherwise \end{cases} \quad \text{and}$$

$$Y = \begin{cases} 1\ for \bar{Y} \geq 3.5 \\ 0 otherwise \end{cases}$$

The logit model took the form:

$$\text{Logit } Y = \ln\left(\frac{P}{1-P}\right) = Z \qquad (3)$$

Where

Y = strategy implementation

X = Institutional pressures

β_0 = the constant term

$\beta_{1,}$ = the coefficients of X.

e = the error term

$Z = \beta_0 + \beta_1 X + e$

4.0 RESULTS

4.1 Reliability of the instrument

The reliability of the data collection instrument was assessed using Cronbach's Alpha statistics as presented in Table 3.

Table 3: Reliability of instruments

Variable	Cronbach's Alpha	No. of Items
Strategy implementation	0.701	8
Institutional pressures	0.829	22

Source: Survey Data (2019)

According to table 3 the dependent variable (strategy implementation) returned an alpha value of 0.701 while institutional pressures had an alpha value of 0.829. This indicates that the instrument reliably measured the dependent and independent variable as argued by Olaniyi, A.A. (2019) cronbach's alpha value of 0.7 is an acceptable indicator of reliability of the instrument.

4.2 Response Rate

Two hundred and five questionnaires were returned representing a response rate of 82%.

4.3 Respondents' Characteristics

The distribution of the respondents based on gender, age, education and work experience were conducted and the results are presented in table 4.

Table 4: Characteristics of respondents

Variable		Freq.	%
Gender	Male	108	52.7
	Female	97	47.3
	Total	205	100
Age of respondents	Below 40 years	7	3.4
	41 - 50 years	105	51.2
	51 - 60 years	93	45.4
	Total	205	100
Level of education	Diploma	6	2.9
	Bachelor's degree	129	62.9
	Master's degree	69	33.7
	Ph.D.	1	0.5
	Total	205	100
Work experience	Below 5 years	40	19.5
	6 - 10 years	66	32.2
	11 - 15 years	70	34.1
	16 - 20 years	27	13.2
	Over 20 years	2	1
	Total	**205**	**100**

Source: Survey Data (2019)

According to the results in Table 4, majority of the respondents were aged between 41 – 50 years (51.2 %) followed by those aged between 51– 60 years at 45.4%. Respondents aged below forty years were the least at 3.4%. Majority of the respondents had a bachelor's degree (62.9%), followed by master's degree holders (33.7%). Diploma holders constituted only 2.9% of the respondents while Ph.D. holders were the fewest at 0.5%. Majority of the respondents had served as principals for a period of 11-15 years (34.1%) followed closely by those that had 6-10 years' experience (32.2%). The least were those that had over 20 years' experience as principals that stood at only 1%.

Summary Descriptive Results

Descriptive statistics for strategy implementation (dependent variable) and the institutional pressures (independent variable) were summarized as shown in the Table 5.

Table 5: Summary Descriptive Statistics

Variable	N	Mean	S. D

Strategy implementation	205	3.50	.46
Institutional pressures	205	3.39	.40
Valid N	205		

Source: Survey Data (2019)

Table 5 shows that the respondents perceived strategy implementation in their institutions as moderately successful (Mean = 3.50, SD = .46) the low standard deviation is indicative that the perception of the respondents regarding the level of success in strategy implementation approached homogeneity. The respondents further rated the amount of institutional pressures they experience as moderate (mean = 3.39, SD = .40). The low standard deviation shows near agreement on the extent of institutional pressures experienced.

4.5 Relationship between institutional factors and strategy implementation

In order to examine the strength and the direction of the relationship between institutional pressures and strategy implementation, Spearman's rank correlation on summated scores of the two variables was done. The results are presented in table 6.

From the results in Table 6, institutional pressures had moderate, positive and statistically significant relationship with strategy implementation (ρ =.476, $p < .001$). This implies that holding all other factors constant, a unit increase in institutional pressures would lead to an increase in success in strategy implementation by a factor of .476.

Table 6: Relationship between institutional pressures and strategy implementation

		1	2
Strategy implementation (1)	Correlation Coefficient	1.00	.476**
	Sig. (2-tailed)	.	.000
	N	205	205
Institutional pressures (2)	Correlation Coefficient	.476**	1.000
	Sig. (2-tailed)	.000	.
	N	205	205

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

Source: Survey Data (2019)

4.7 Effects of institutional pressures on strategy implementation

The logit tests for the effects of institutional pressures on strategy implementation were performed and the results presented in Table 7.

Table 7: Effect of institutional Pressures on strategy implementation

Variables in the Equation						
	B	S.E.	Wald	Df	Sig.	Exp(B)
Inst. pressures	1.49	.30	24.71	1	.000	4.43
Constant	-.62	.21	8.72	1	.003	.538

Source: Survey Data (2019)

The binary logistic regression analysis therefore specifies the model as:

$$\text{Logit (SI)} = -.169 + 1.489(\text{IP}) \quad (4)$$

From table 7 the results show that a unit increase in the institutional pressures increase the odds of strategy implementation success by a factor of 4 {(Exp(B) = 4.433, $p < .05$}. Therefore, the null hypothesis stating that institutional factors have no statistically significant influence on strategy implementation in public secondary schools failed to be accepted. This implies that institutional pressures have a statistically significant influence on strategy

implementation in public secondary schools in Kenya.

5.0 DISCUSSION

The study sought to investigate the influence of institutional pressures on strategy implementation in public secondary schools in Kenya. The results showed that the respondents perceived institutional pressures they experience to implement strategies as moderate while they rated the extent of successful strategy implementation in public secondary schools as moderately high.

Correlation between institutional pressures and strategy implementation was assessed using Spearman's rank correlation. There was a moderate, positive and statistically significant relationship between institutional pressures and strategy implementation in public secondary schools.

Finally the test of hypothesis showed that institutional pressures had a positive and statistically significant influence on the likelihood of successful strategy implementation in public secondary schools in Kenya. The finding is supported by Osewe (2019) who found out that there existed a positive statistically significant relationship between institutional pressures and organizational performance. Similarly, the finding agrees with Alkalbani et al. (2017) who found institutional factors to have a positive statistically significant impact on information security compliance in organizations.

6.0 CONCLUSION AND IMPLICATIONS

6.1 Conclusions

The study established that institutional pressures are positively associated with strategy implementation in public secondary schools in Kenya. Institutional pressures have a statistically significance influence on strategy implementation in public secondary schools in Kenya. Increase in institutional pressures increase the likelihood of successful strategy implementation in public secondary schools. Institutional pressures should therefore be considered among the factors that predict success in strategy implementation in public secondary schools in Kenya.

6.2 Implication

This study has both theoretical and practical implications. Theoretically, this study adds the limited empirical studies on strategy implementation hence narrowing the gap between studies on strategy planning and strategy implementation. The study also used institutional pressures that have scarcely been used before to predict success strategy implementation. For practice, the various stakeholders that originate the various types of institutional pressures should actively play their roles as these pressures have a significant positive influence on strategy implementation in public secondary schools in Kenya.

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Funding of University Students: The Case of Regular Students of Rongo University, Kenya

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ABSTRACT

The funding of learning in higher education is important towards increased access to requisite skills and knowledge for economic growth. This study investigated the adequacy of Higher Education Loans Board (HELB) funding in meeting the needs of Rongo University students in Kenya. The students' needs investigated include tuition, meals, learning materials, accommodation and travelling costs. HELB is mandated by the Government of Kenya to provide affordable loans towards students' education. A survey design was employed in the study. Questionnaires were used to collect data. Random sampling technique was used to select a sample size of 28 students from a population of 30 second year students. Findings suggest that majority of the students received inadequate HELB funds for meals, accommodation, learning materials and tuition fees. It is recommended that unequal loaning that is pegged on academic merit of students joining university education should be aradicated to avoid discrimination of other deserving needy cases.

Key words: Privately sponsored students, Government sponsored students, funding, regular, accommodation, meals, tuition fees

1.0 INTRODUCTION

University and college enrollment has grown rapidly since the mid-1980s, with over 20 million undergraduates presently enrolled in different institutions of higher learning in the whole world, (United States. Department of Treasury and Education, 2012**)**. Out of this enrolment, majority of students (73 percent) attend public institutions, ranging from local community colleges to large research institutions. This is because postsecondary education has become an increasingly important determinant of a worker's earnings (United States. Department of Treasury and Education, 2012**).** In 2019, Kenya alone had a total of 688,928 students who qualified for government support for higher education (KUCCPS, 2020).

While postsecondary education has become increasingly important, there has also been growing concern about the nature, quality, cost and affordability of higher education in the world. This is because the

rise in student population through adoption and application of different modes of learning, has raised concerns about quality of public university education (Mbirithi, 2013).

In Africa, student enrolment at higher learning institutions is equally on an upward trajectory, with many countries in the continent just as elsewhere in the world having resorted to asking students and their families to contribute to the ever rising costs of education. Education authorities in many African countries are apparently adopting the "cost sharing," options which is aimed at rescuing the foundering higher education systems and providing a basis for sustainable improvements (Bollag, 2004).

The primary weakness of both universities and colleges is their inability to help students from low income households to escape the impoverished conditions in which they grow up. The vast majority of students from low income households cannot make it to join colleges or universities. By the time they are sixteen or seventeen years old, either they have already dropped out of school or they lag well behind their peers educationally (Levine & Nidiffer 1996, p. 159 as cited by Kuh, Kinzie, Buckley & Hayek, 2006). Therefore, choices need to be made by governments, parents and students on who should pay the cost of college and university education. This brings to the fore the value that stakeholders place on higher education (Johnstone, 2009).

Cost sharing in Kenyan higher education was introduced in 1991 as a response to the Structural Adjustment Program that was spear headed by the Britton hood institutions to revive the world economy (Thomson, Kentikelenis & Stubbs, 2017). The ever declining Kenyan budget could not keep pace with high student intake when the first cohort of the 8-4-4 of students entered the university. Under this new policy, students and/or their parents were required to cover both modest tuition fees and contribute to the costs of maintenance. A student loan program was established to enable the needy students to access higher education institutions.

There was established in Kenya a fund known as the Higher Education Loans Fund, managed and administered by the Higher Education Loans Board in 2005 to fund students from public universities. The law was amended in 2015 to accommodate students from private universities and colleges. The object and the purpose of the Fund was to provide affordable loans to assist Kenyan students to pursue higher education at such institutions within and outside Kenya, recognized by the Commission for Higher Education (Education World News, 2014). Once HELB determines that a student should be awarded a loan, it pays Ksh 8,000 (US$ 80) directly to the student university account towards the tuition fee. The rest of the loan is spent on upkeep for the students while in college or univeresity. That is, accommodation, meals and travelling costs among other costs. The students' financial support ranges from kshs. 40,000 (US$ 400) to kshs. 60,000(US$ 600) once a year depending on the level of need of students. Some part of this loan is directly paid into the students' university accounts as fees while the rest of the money is channeled into students' private bank accounts for subsistence (Kenya. HELB, n.d.).

1.1 Statement of the problem

There seems to be a point of agreement among scholars and stakeholders that investment in university education is the bedrock of economic prosperity. The world's economy is therefore dependent on strong and sustainable higher education. Higher education is expensive and needs the intervention of governments, stakeholders

and parents to supplement where necessary. Rongo University, which was a constituent of Moi University in Kenya, admitted both government and self-sponsored students. Eligible students were receiving loans from Higher Education Loans Board while some other students opted not to go for the HELB loan thus, privately paid for their subsistence and tuition fees. The question that this study answers is: Is the funding for students' higher education adequate for their tuition, subsistence, accommodation and travelling costs?

1.2 Objective of the study

The objective of this study was to investigate the adequacy of funding of Rongo University students in meeting their needs such as tuition, subsistence, accommodation and travelling.

2.0 LITERATURE REVIEW

Student support in terms of support for fees, accommodation and travelling is a global concern. OECD research of 2012 suggested that student financial support systems that provide both loans with income-contingent repayments and means-tested grants not only promoted access and equity at the front end of higher education, but also led to better outcomes for students at the back end. A good example that was cited by OECD was Australia and New Zealand that used this approach to mitigate the impact of high tuition fees to encourage disadvantaged students to enter higher education and reduce the risks of high student loan indebtedness (OECD, 2012).

In Toronto Canada, the government in the year 2010 provided financial assistance to needy students to cover their tuition fee costs and/or living expenses thereby ensuring that qualified low income students were not precluded from attending higher education due to lack of resources. The Canadian Government also encouraged higher education participation by underrepresented minority groups. But in some countries access to financial assistance was not based on need, but on academic merit with qualified students paying no tuition fees or significantly lower tuition fees and often even having access to free or subsidized student housing (Marcucci & Usher, 2011).

Milburn (2012) in his independent review of a progress report on social mobility and child poverty in the United Kingdom found that majority of universities' access expenditure went on financial support to students, primarily in the form of bursaries. He noted that when students are facing financial pressures, lower-income families fear that a place at university for their child will incur a mountain of debt. The priority which universities accord to provision of financial support is understandable. Hence bursaries and loans for the disadvantaged young people and the marginalized group are inevitable.

In Nigeria the federal universities were expected to be granted increased autonomy under proposed legislation, which included the right to introduce tuition fees. Nigeria's university leaders were unanimous that such fees were necessary to improve the poor state of their institutions. They pointed to the growth of fee-charging at generally lower-quality private institutions as proof that many young people were willing and able to contribute to the cost of their education (Bollag, 2004).

In Kenya, the Higher Education Loans Board offers all eligible students a maximum allocation for tuition but the loan beneficiaries receive differentiated living allowances. The categories are developed on the basis of the parents/ guardians' financial ability, as described in the application form. Out of the university fees, the Higher Education Loans Board pays tuition fees of

Ksh 8,000 (US$348) direct to the universities for every student who is awarded a loan. The differentiated loan balances based on beneficiaries' economic needs are paid directly to their personal expenses through their respective bank accounts. In actual sense, the Government of Kenya's policy of cost-sharing allows for parental contributions as a supplement towards student's financial requirements (Otieno, 2004).

3.0 METHODOLOGY

3.1 Research Design

The research design used in this study was survey: A survey is an attempt to collect data from members of a population in order to determine the current status of that population with respect to one or more variables (Mugenda & Mugenda, 2003). The survey design was suitable because it was characterized by a systematic collection of data from members of a given population.

3.2 Target population

Target population is defined as all the number of a real or hypothetical set of people, events of objects to which a researcher generalizes the results of the research study (Borg & Gall, 1998). The target population for this study consisted of 30 second year regular students who were studying Bachelor of Education (Arts) whose one teaching subject was Business Studies. The target campus for this study was Rongo University, Town Campus.

3.3 Sample size and sampling procedure

To determine the sample size, both probability and non-probability sampling techniques were used. Convenient sampling was used to pick Rongo University and year two business class of Rongo University. The researcher settled on Rongo University because of its closeness and accessibility to the researcher. Again, Rongo University, like any other public university in Kenya was admitting government sponsored students. Year two business class students were also conveniently picked because the class was made up of all degree students that were eligible for HELB loans. Information generated from this group could be generalized for the entire beneficiaries of HELB loans because these students were admitted from all corners of the Republic of Kenya and the loan disbursement procedure was taken to be same for all other eligible applicants and beneficiaries in different institutions. For an appropriate sample size of business class students, a table provided by Krejcie and Morgan (1970) was used. The table gives the required the sample size for various population sizes. The total number of students in this second year regular business class at the Town Campus was 30. According to the table provided by Krejcie and Morgan (1970), the sample size for this study was 28 students. Since the population was not homogeneous and based on learner characteristics, the researcher used simple random sampling.

3.4 Research instruments

Questionnaires were used for data collection from the respondents on adequacy of HELB funding to meet the university students' needs of tuition fees, accommodation and subsistence. A questionnaire is a data gathering instrument used when factual information is desired (Best and Khan, 2003). It was important for this study because the researcher administering the instrument had an opportunity to establish rapport, explain the purpose under study, and as well explain the meanings of items that were not clear. The researcher used a closed questionnaire for this research.

3.5 Instruments validity and reliability

Face validity of the instruments was done by two experts based on the outcome of

the pilot study. Six students that constituted 20% of the sample size were used for piloting. Reliability was done by split half method whereby coefficient of 0.77 was realized from odd and even numbers in the questionnaires for students. To obtain reliability of the whole test, the Spearman Brown Prophecy formulae stated below was applied:

Rx = 2r / 1+r where:

r was the reliability coefficient resulting from correlating scores of the odd and even numbered items for part of the test; and

Rx was the reliability of the original (whole) test.

3.6 Data analysis techniques

The researcher used descriptive statistical methods to analyze the collected data. This included quantitative techniques. That is, percentages and total scores. Analysis of data was done on each and every question asked.

2.0 FINDINGS AND DISCUSSIONS

Questionnaires were randomly administered to 28 respondents by the researcher. A total of 27 questionnaires were duly filled and returned to the researcher. This was 96.4% response rate. According to Mugenda and Mugenda (2003), 96.4% response rate is accurate, excellent and representative.

From the analyzed research data, all respondents were second year students who were either government sponsored or self-sponsored. 21(77.8%) respondents were government sponsored while 6 (22.2%) were privately sponsored students. All government sponsored students were funded by Higher Education Loans Board managed by the Government of Kenya. The privately sponsored students opted to pay the cost of education. However, they were eligible to apply for HELB loans. The privately sponsored students received financial support for their education from other sources but the vote heads for their college expenditures on accommodation, fees and subsistence were not subsidized as those of government sponsored students. A good example is the cost of tuition which was ksh. 8000 (US$80) for government sponsored but kshs.50, 000 (US$500) for self-sponsored students in a semester. When respondents were asked whether the funds provided for their studies were adequate for their accommodation, 24 (88.9%) disagreed while only 3 (11.1%) agreed. This implied that many students could not access university accommodation due to high number of students in the university against very few hostels that were available at Rongo University. The majority of the students who could not be accommodated within the university resorted to commercial housing that levied very high fees that exceeded the amount that the sponsors left for students as subsistence. The cost of accommodation was relatively cheaper for students who resided in a university facility. This revelation showed that universities admit more students than their hostel bed capacities. When the self-sponsored students were asked about their ability to meet the cost of a commercial hostel, none could afford the rent. This suggested that the cost of housing in Kenya was above the reach of many university students despite the fact that most privately sponsored students were from rich families. When respondents were asked about their ability to meet the cost of meals, 21 (77.8%) respondents were unable to afford meals throughout the semester using the money they receive from their sponsors. Interestingly majority of the self-sponsored students, 3 (50%) could afford meals for the whole semester. This implied that the self-sponsored students were from rich families and hence their families were able to sustain their meals throughout the semester (Kuh, et

al.2006). However, the study noted that the cost of housing was unregulated in Kenya and equally underestimated even by the rich families that could afford the cost of university parallel studies.

Tuition that was paid by the Higher Education Loans Board into the students' account was said to be inadequate to majority of the students. This was noted by 19 (70.4%) of the respondents. However, 3 (50%) of the privately sponsored students had no problem with their sponsors over tuition fees. It showed that the pursuit of higher education was not only limited to those who could afford it because a few students who could not afford parallel degree fees still had their way to the university. The reason could be that the government fee of kshs 8000 (US$ 800) does not reflect the actual fees that different universities and colleges in Kenya levy government sponsor students. Additional levies such as statutory fees which were not uniform in different universities were charged at different rates. It therefore forced this category of students to look for additional money to top up their tuition fees. On the other hand, the privately sponsored students seemed to be working on a fee structure with no hidden costs and that could have been the reason for prompt payment of fees.

Extra money for acquisition of learning materials remained a big challenge for both privately sponsored and government sponsored students of Rongo University. 24 (88.9%) declared that they had very little money to spend on the purchase of learning materials such books, manila papers, mobile phones etc. This was viewed by the researcher as a stumbling block in the students' capacity to search and create knowledge in the ever rich knowledge society. When students were again asked what other specific areas of funding should have been considered by their sponsors, 8 (29.6%) respondents who were the majority cited travelling, this was followed by entertainment at 22% and finally food at 14.8%. The study asserted that the sponsors should put in a number of considerations before making a decision of the amount of money to disburse to students for their learning needs.

In overall when students were asked to register their satisfaction in the way the university used the tuition fees from both the government sponsored and self-sponsored students to improve their welfare, 1(3.7%) did not give any response, 25(92.6%) who formed the majority did not agree while 1(3.7%) agreed. This meant that an overwhelming majority were not convinced that the Rongo University was offering students service that commensurate the fees paid.

5.0 CONCLUSION AND RECOMMENDATION

Based on the findings of this study, it was concluded that Higher Education Loans Board was a brilliant idea and should be funded properly by the Government of Kenya to continue expanding its base so as to reach the ever rising numbers of beneficiaries. The Government through HELB should aim at providing quality university education to all deserving population. This could be done by proper assessment of students' critical areas of need such as meals, accommodation, tuition fees etc. It recommended that HELB should treat all deserving Kenyan students equally without discrimination. That is to say, universities or colleges should abolish the student categories of self-sponsored and government sponsored programs when it comes to fees payment.

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Policing Juvenile Delinquency in Criminal Justice in Kenya

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ABSTRACT

The role of the Police is to protect and serve in crime prevention, intervention and investigation. However, minors appearing before the juvenile courts in Kenya are mostly street children who have dropped out of school or are forced by poverty into the streets despite Free Primary Education (FPE) in Kenya. The study objective was to establish the treatment given to street children during arrest and to assess the training of the police officers on the process of separating children in need of protection from children accused of crimes. The study area were four counties in Kenya, which are, Bungoma, Kakamega, Vihiga and Busia. A sample of 113 was obtained from the target population that comprised of Police Officers, Children Officers, Probation Officers, Prison officers in charge of Borstal institution and any 5 juveniles present in the court in all the four Counties. Data was collected using questionnaires and interviews. Results indicate that children found breaking the law are meted with force and brutality during street arrests. It is recommended that intensive training is necessary in relation to arrest of children with deviant behaviours and identifying those in need of protection. The study is useful for policy making and adding to the body of knowledge in policing juvenile deliquency.

Keywords: Juvenile, Policing, Delinquent, Protection

3.0 INTRODUCTION

The concept of juvenile delinquency is a byproduct of econo-political, religious and social dynamism. These four thematic changes began during Renaissance era but were highly felt during the Enlightment and the Industrial Revolution. These thought-provoking transformations regarding offences by children led to legal changes at the end of the nineteenth century that created the legal status of juvenile delinquents and a separate legal system that included juvenile courts and reformatories. (Lawson & Heaton,

2010). By the early twentieth century United States, had a separate legal status and legal system for juveniles. These progressions led to the social construction of juvenile delinquency; the 'discovery' of childhood and adolescence, the doctrine of Parens Patriae and the rise of positivist criminology. As a product of these changes, the concept of juvenile delinquency came to signify a separate and distinct status for young people, both socially and legally (Wright & Beaver, 2005). The Middle Ages lacked awareness of the specific needs of children. Emergence of positivist thinker like Rousseau pointed to the distinctive human plight confronted by adolescents during the transition from childhood to adulthood. He provided cascading stages of development, emphasizing how these stages differ and how these differences influence learning and necessitate appropriate educational methods (Cloward & Ohlin, 2010). In Africa, the emergency of Juvenile delinquency is attributed to the scramble for Africa where African land was taken away by colonialists while in South Africa it is a recipe of Apartheid (Mugo, 2004).

Kenya has over 300,000 street children with more than 60,000 in Nairobi, (UNICEF, Report, 2017). This has necessitated the additional of remand homes from 3 to 11 (under the administration of the Children Department) with a reported capacity of 2500 children. The recent upsurge of juvenile delinquency cases in Kenya has forced the country to rethink its approach to juvenile policing. According to the Institute of Economic Affairs (2015) on their Compendium on youth's involvement in crime, 51% of all crimes reported to police were committed by Juveniles. As a result of the rising cases of juvenile delinquency law enforcement agencies have resorted to a more modern approach to address the menace. Some of the modern approaches adopted by most law enforcement agencies that have proved significant in solving crimes committed by juveniles in Kenya include, community policing and closely working with community organizations who embrace a more rehabilitative method (Mugo, 2004).

Pointedly, concerns have been raised on law enforcement officers who patrol the streets as they arrest street children. Police roundups are conducted with brute force and little regard of the welfare of the juveniles, who are often taunted, scolded, manhandled and beaten at the time of arrest (Omboto, 2013). Once arrested and taken to police station, their cases are referred to court whereby they encounter the Judiciary, Probation Department, Prisons Department and Department of Children's Services Department. Children enter into the revolving doors of the juvenile justice system and (Griffin 2010).

Although, the care and protection system are conceptually separate from the criminal justice system, the Department of Children Services institutions established under the Children Act 2001 work with the criminal justice system in addressing juvenile delinquency. These institutions are categorized into three; the Children's Remand Homes established under section 50 of the Children's Act; the Rehabilitation Schools formerly known as the Approved Schools established under section 47 of the Children's Act; and Children's Homes and Charitable Institutions established under section 58 of the Children's Act.

Despite the effort placed by government to provide care for delinquent children, some of juvenile non-criminal cases that police officers handle include truancy, loitering and curfew violations. In such instances police officers release the children to their guardians on free bond. Pointedly, on cases of serious crimes such as murder, juveniles are kept in remand homes' custody until they are arraigned in court (Mutavi, 2017).

1.2. Statement of the Problem

The rising cases of deviant behaviors by juveniles have led to social disorder and destructions of societal moral values. The increasing cases of juvenile delinquency in Kenya have posed a great challenge to the law enforcement. Some of the contributing factors to the rising cases of juvenile delinquency include, dropping out of school, truancy and poverty. According to NCCP, (2019), 80% of the children appearing before the juvenile courts are street children, some arrested for committing crimes.

Although, modern approaches of juvenile policing have seen more focus on the children's welfare taking care of the orphaned, abandoned, abused and other destitute children.

Little is a done to distinguish the minors on basis of their offences because there is neither a special section nor training on how to handle juveniles arrested in Juvenile criminal system. The ordeal is worsened by children spending inordinately long hours in Remand Homes under policing. It was in the view of this, that this paper attempted to assess policing juvenile delinquency in Kenya from the time of arrest, arraignment up to when the minor is released and whether the police have been trained to identify those in need of care and protection during street arrests.

1.3 Objectives

i. To establish the process of arrest of minors that are in conflict with the law and their arraignment in court.
ii. To assess ways in which Police Officers, distinguish between the children in need of protection from those accused of crimes in the Juvenile System.

1.4 Scope of the Study

The study area was Western part of Kenya between 2018-2019. The study was limited to police officers, Children Officers, Probation Officers, Prison Officers, Borstal institutions officers and rehabilitation schools in the 4 counties of Western Region of Kenya and Juveniles present in Court, remand homes and Borstal institutions.

2.1 Juvenile Delinquency

The word "delinquency" is a Latin word "delinquere" which means "de" i.e. "away" and "linquere" i.e. "to leave" thus, meaning "to leave" or "to abandon" (Clowad &Ohlin, 2010). A juvenile is considered to be a child who has not surpassed a specific set age as mentioned in the law of any country and does not bear resemblance as an adult person and who cannot be held legally liable for a criminal offense. The juvenile delinquent is a child who has violated certain laws which declare the act or the commission of an offence. A juvenile and a minor are used in different perspectives in legal terms. The term juvenile is generally used in reference to a young criminal offender (Lawson & Heather, 2010). According to the Kenyan Constitution, Children & Young Persons Act 141, the term juvenile refers to a person who is of 14 years or more and under 16years. According to the Convention of the Rights of a child, a juvenile is a person who is under the age of 18 years (UNICEF 2017). Juvenile delinquency, is also known as juvenile offending, that is, the participation in an illegal or antisocial behavior by minors.

The primary law in Kenya concerning children in conflict with the law is the Children and Young Persons Act 141 (CYPA). The CYPA establishes juvenile courts for the purpose of hearing all charges against persons less than eighteen years of age, except in cases where children are charged jointly with adults. Where children

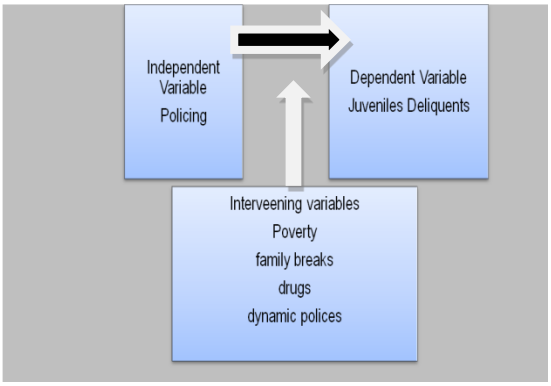
are charged jointly with adults, the cases are heard in regular adult courts. (Marun et al, 2015). In practice, the special protections accorded to children under the CYPA are often disregarded, as children are often tried in regular adult courts without cognizance of the fact that they are children.

2.2 Anomie and Social Learning Theory

The study was guided by two theories that explain the rising cases of Juvenile delinquency; The anomie theory was advanced by Robert Merton in the 1940s. Merton's theory of Anomie posits that juvenile delinquency occurs when juveniles are not able to achieve their goals in the cultural accepted manner and therefore some decide to deviate by adapting their own means of achieving the culturally accepted goals. As a result of the gap that exists between the need and the means to satisfy their needs. Notably, if their goals are unattainable within legal means, they find unlawful means by which to attain their goals. According to Du (2019) a juvenile who does not have food to eat and is not able to find a job to make money will either steal food or money to purchase food. This theory was not enough to explain the arrest of juveniles in conflict with the law hence it is backed by social learning Theory. Social learning theory is rooted on the belief that people are not born with the ability to act violently, rather they learn to be aggressive through their life experiences (Bandura, 1977). Social learning theory believes that mental or physical traits can predispose a child to violence. However, a person ‘s violence will rely on other factors in the society, a view supported by Siegel, (2004).

2.4 Conceptual Framework

The independent variables in this study is policing while dependent variable is juvenile delinquency. However, there are intervening variables affecting the achievement of reducing juvenile delinquency policing. This has been conceptualized in the framework below.



Source: Researcher, 2019

3.0 Research Design

A cross-sectional descriptive research design was used in this study to assess the ways in which juvenile involvement in criminal activities and those in need of protection and care were treated by the law enforcers during street arrests in town centres. The study area was the four counties of Bungoma, Busia, Vihiga and Kakamega in Western Kenya. A sample size of 113was obtained from the target population using purposive sampling method of key informants comprising of police officers, Children Officers, Probation Officers and prison officers in charge of Borstal institutions. Twenty respondents were interviewed comprising of five selected juveniles present in the court and Borstal Institution. Data collection instruments included questionnaires and interview guides. Both quantitative and qualitative data was analyzed, and results presented in tables and graphs with emphasis on graph analysis.

4.0 Discussion and Findings

Juveniles present in the court were interviewed. This study established that Juveniles from remand, may be committed by courts to approved schools if they are less that

Juveniles Response	Yes %	No %
Whether police record age whether need care during arrest	10.0	10.0
Whether they are arrested with adults	15.0	12.0
Whether in police cell for more than 48 hrs	14.0	10.0
Whether they are provided with legal representation	8.0	25.0
Whether they keep in touch with parents while in remand	10.0	10.0
Whether they receive medical treatment inside remand homes	10.0	14.0
Whether they are mixed with adult remandees	22.0	11.0
Whether they are provided with rehabilitation training	11.0	8.0
Total	100	100

Table 1. Juveniles Deliquency Policing Response

Source: Researcher, 2019

15years old or younger, while Borstal institution which in this study was Shikutsa is for boys at least 15 years old. This study established that there was no Borstal Institution for girls in Kenya instead they are confined to adult women prisons. Although a wide range of alternatives to custodial treatment are provided for under according to Children and Young Persons Act, special remedial measure for juvenile delinquency was farfetched. There are two Borstal Institutions in Kenya, Shikutsa and Shimo-Latewa in Mombasa County. This study established that from the two institutions were introduced by the British colonial and since then there is no additional Borstal institution despite increase in Juvenile delinquency.

A ray of questions was posed to the Juveniles to indicate Yes or No on how they are arrested and treated while in a custody. The results are recorded in Table 1.

According to Table 1, 14% of Juveniles present in the juvenile's courts stated that they spent more than 48hours in the police cells before being taken to court. Additionally, there was a tie of 10% on whether the police take their age records. Children in need of care and protection and those children accused of crimes were treated in the same manner. According to police officers handling the juveniles, 22% of the officers indicated that the minors were occasionally mixed with adults. Notably, Odongo (2004) in his study, found the same in his research on Juvenile Justice System in Kenya. Further, they were handled the same way with adults. This study established that Kenya does not have a separate professional prosecution service that specifically deals with children's cases. Criminal cases involving the juveniles are presented by police prosecutors. Some 25% juveniles lacked legal representation. A study carried out by Ojo (2012) established that children were less represented in a court of law

compared to adults. A study by Griffin (2010) found out that juveniles who were in custody in Kenya did not have legal representation and the police that handled the arrests needed further training on how to deal with juveniles in their custody. Commonly, most children are held in police cells for 48 hours between arrest and the first arraignment in court. Rarely do police contact parents or guardians during the first 48 hours after the arrest to inform them about the arrest and when their children will appear in court. According to Ombogo (2013), in a study carried out at Kamiti prison in Kenya, he established that some children were sharing remand homes with adults. Furthermore, Kakuvi (2014) linked the increase of recidivism in the western region to an influence of learned behavior among the street children.

Children rights in Kenya are concerned about the length of time taken between first appearance and conclusion of cases, whereby juveniles 15 years and older are held together with adults in remand center awaiting trial.

4.2 Training Juvenile Arrests

The Police officers were asked to indicate whether they have been trained on minor arrests. Responses varied with general reference to training received in police training college. However, this study established that non state actors have been offering trainings to police officers, probations, and children officers on the rights of arrested children. The police officers were asked to indicate if they have undergone training on Juvenile arrests. The results are indicated in Figure 2

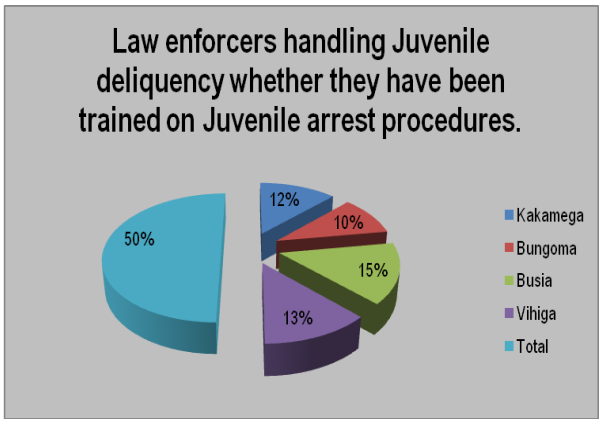


Figure1: Training on Juvenile Arrests

In Kakamega County 50% of police officers indicated that they had additional training on children's rights arrests while 13% in Vihiga reported that they had undergone training. Another 15 % in Busia County and 10% of police officers in Bungoma reported to have undergone children's rights training. This study established that there was a low percentage of officers who have been trained in Busia, Bungoma Vihiga and Busia. It was established that police officers had a healthy working relationship with children's officers and, probation officers. The Juveniles are assigned to probation officers in cases who usually issue a pre-sentencing report within a period of two to four weeks. This study established that there was no specialization within the police service regarding arrests of children.

5.0 Conclusion

Policing Juvenile delinquency in Kenya should take another strategy of bringing together State and non-State actors as partners to curb cases of children engaging in deviant behaviors and in this way reduce crimes committed in the streets and arrests. More trainings, advocacy on children rights during arrest and policy making is necessary in order to adequately address the current policing styles of juveniles in conflict with the law.

5.1 Recommendations

There is need for development of training manuals on courses related to arrest of children for all parties involved in the Juvenile Justice system.

Children who are in conflict with the law do not have access to legal representation, thus, it is strongly recommended that policy change to introduce legislations that makes it mandatory for juvenile to be provided with an attorney be made. The attorney should be paid by the government.

The children in need of welfare support in terms of food, clothing, shelter and health care, must not be put in the same custody with delinquent juveniles to avoid contamination and for effective rehabilitation.

Parents ought to exercise strict parental care to their children to prevent engagement in delinquent acts.

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Investigating Attitudes of Learners and Graduates to Blue Collar Jobs in Institutions of Higher Education in Kenya

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ABSTRACT

Based on the previous A-level education system in Kenya, students in colleges and universities still believe in being provided with "white-collar jobs" in the government sector or NGOs. Unfortunately, their dreams turn out otherwise, as this is not realized. Some end up sinking into confusion and eventually depression. Lack of "white collar jobs" affect their lives negatively.

This paper looks into the changing attitudes of learners on their future employment particularly in Kenya. According to the speech made by the Minister of Education in Kenya, Prof. George Magokha, some college and university graduates hold academic papers for disciplines that may be obsolete. Kenya's Ominde Commission Report 1963/64 recommended an "Education for self-reliance". However, there are setbacks in realizing this goal. According to the report, training of students should be focused on self-reliance, practical skills and converting acquired knowledge and skills to benefit self and the community. In this respect, universities should train learners on practical jobs "hands at work" such as engineering, construction, agriculture, plumbing, tailoring, housekeeping, grooming, among others. The paper provides insight into these issues.

The population of study consisted of university and college graduates; and continuing students. Research methods used were online google questionnaires. Findings showed that graduates spent a lot of time

applying to various institutions for employment with little or no success. Some opted for self-employment in cybercafés, hairdressing, grooming, cookery, agriculture, to name but a few. Others opted to retraining for manual jobs and these turn out to be time consuming and costly to parents sponsoring the students. Based on the findings, the following recommendations are suggested: Apart from adopting the Competence Based Curriculum (CBC) that was already on course, guidance and counselling programs should be emphasized in formal and non-formal education. Parents and other stakeholders should participate in moulding the youth to participate in development. This would reduce the costs of importing expertise into the country.

Keywords: Attitudes, Curriculum, Learners, Blue-Collar jobs, White-Collar jobs.

4.0 INTRODUCTION

Understanding attitudes and attitude change has been an area of interest to psychology and educators due to the impact of attitude on learning and an important component of the outcome of education.

In this study attitude change is discussed based on changing attitudes of leaners in higher institutions of learning in Kenya from white collar jobs to blue collar (hands - on) jobs. Attitude change is needed due to the problems learners face aftergraduating from institutions of higher education. This problem not only affects Kenya as a country but also other developing countries.

Attitude formation studies indicate that one's environment directly influences behavior and the formation of attitudes. The internal events to attitude formation are the outcome of observable actions. For one to change attitudes there must be reinforcement from reinforces.

Attitude predispose a person to take action for change. When positive attitudes occur they orient towards that idea though may not predict actions directly. Attitude impacts learning. For this, it is worth arguing that changing attitudes of learners is important. Learners must accept the need for changing of attitude towards certain concepts and actions.

Change of attitude motivates learners to develop more interest in the idea developed for change, for example, if the learners at university level are influenced to change attitude on self – employment or hands- on – job careers, they would spend more time practicing how to achieve the idea towards their area of interest. Attitudes produce observable actions in people.

Employment is a main factor to peoples' contribution to the economic growth of a country. The International Labor Organization (ILO) (2008) notes that youth particularly at one point in their lives will enter the world of life as a path towards social integration and as a means to earn income. Youth employment progressively emerges as a major problem in many developing countries. Many youths enter the labor market directly after completing school, this however, depends on the schools exit point in a particular country. In Kenya, the exit points are after primary education and attaining Kenya Certificate of Primary Education, Secondary education after attaining Kenya certificate of secondary education (KCSE) and then on attaining college training or university education. This exit points challenge youths as they normally hope to acquire white collar jobs as a means to earn a living.

United Nations Economic Commission for Africa (UNECA) (2002), states that unemployment is also characterized by poor

economic growth in many world regions, a continuous fast change in demand for skills, thus increases the need for on training or lifelong learning to raise employability and access to employment, the rapid population growth, sluggish economic growth, poor quality education are also factors to unemployment in African region and worldwide.

Verma (2004) cites youth unemployment as at the rate of 21% in Sub-Saharan Africa. ILO (2008) indicates the number of unemployed youths as at 40.2% of the world total unemployment.

In Botswana unemployment was at 23.8% in 2002 – 2003 (Siphambe, 2003). Still in Botswana unemployment rate was at 21.6% in 1994 and declined to 19.5% in 2001. Although the rate is fairly declining in Botswana, other developing countries Kenya inclusive, face the same problem.

Of great concern is that youth hardest hit by the problem of unemployment seem to shun certain jobs. In Botswana, a Member of Parliament, Lesego Motsumi (2008), observed that most youth in Botswana tend to shun blue- collar jobs, yet the country is faced with the problem of unemployment (Daily News, 7th February 2003) Mukamugambira and Osei-Hwedie (2007), noted negative attitude towards manual works/ blue collar as one of the reasons for youth unemployment, not realizing that blue-collar jobs can provide an equally excellent means of survival.

Manual work, referred to as hands-on jobs is defined by Kigwatalala Diana as 'the production of material goods through work activities that are predominantly physical in nature, the activities may be carried out in factories or outdoors. This kind of activities are also called blue-collar jobs (BNET, 2010).

Graduates from colleges and universities are victims of negative attitude towards blue-collar jobs due to attitudes such as low social status, poor-working conditions attached to such jobs. Firms that recruit graduates offer cheap, temporary labor. Such negative factors associated with blue-collar jobs, escalates unemployment. Also due to problems in maintaining self-respect among their peers and society, manual works being referred to as " trash jobs " (Smith 2002).

Covid-19 pandemic has led to workers' change of attitudes. This is more so due to increased job lay-offs. This led to an increase in unemployment in the young educated population.

5.0 Material and Methodology

2.1 Study Area Description

Research is described as a systematic and organized effort to investigate a specific problem to provide a solution (Sekaran 2000) and (Burn 1994). The Researcher used descriptive design. Descriptive design involves gathering data that describe events. It organizes, tabulates, depicts, and describes the data collected. This follows the view that description emerges following creative exploration, and then tests or validate those explanations (Krathwohl, 1993). In descriptive design, researchers do not have direct control over independent variables because their manifestations have already occurred or because they are inherently not manipulated (Kerlinger 2000). The purpose of descriptive research is to become more familiar with natural or psychological phenomena, to gain new insight, and to formulate a more specific research problem or hypothesis.

This research focused on learners and graduates of higher Institutions of education who had taken or were taking various courses at higher institutions of learning in Kenya. The sample population selected was 100

learners and 100 graduates from Institutions of higher education in Kenya.

The research method used was online questionnaires using Google Forms technology tool. Emails for both learners and graduates were obtained from institutions of higher education. Google Form questionnaires were sent to the respondents. Telephone Interviews were also conducted as an additional method of data collection. Previous related reports on attitude change were also studied and analyzed. Experts were also interviewed via Zoom video conferencing to obtain their opinions concerning the topic, attitude change. The use of online technology during the research stage of this study was due to the Covid-19 crisis which limited people's ability to meet face to face due to social distancing rules.

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2.2 Data Analysis

The process of collecting data via Google Forms online questionnaire technology allowed the respondents to fill the questionnaires online and the data was automatically analyzed and organized in the graphical form of charts and graphs which were later analyzed, interpreted and combined with the other data sources to gain new insights into the study.

6.0 Findings

This section includes data for both learners and graduates pertaining to gender, level of study, course of study, motivation for studying the course, job expectation after graduation, year of graduation, course taken at the university and the type of employment if any.

3.1 Response rate

The response rate is calculated from the number of people who were surveyed, divided by the total number of people in the entire sample, including those who refused to participate and those who were unavailable.

During data collection phase, 100 online questionnaires were distributed to learners and another 100 online questionnaires to the graduates. These questionnaires were sent to the participant's emails and the participants were asked to fill the online questionnaires and submit the results via the Internet. After data preparation stage which involved cleaning the data by carefully scrutinizing to ensure all questions were filled appropriately, 52 online questionnaires from learners were filled appropriately giving a response rate of 52%. A total of 55 online questionnaires were filled appropriately by graduates giving a response rate of 55%.

3.2 Gender of the respondents

The respondents were asked to indicate their gender and the results were as follows; for the learners 50% of the respondents were male and 50% were female giving a 1 - to - 1 ratio of gender disparity. For the graduates 55% of the respondents were female and 45% were male. This almost equitable distribution of the gender of the respondents ensures that there is no bias towards any one gender in the research study.

3.3 Level of study

The results for the level of study of the learners indicated that fourth year students constituted over 50% of the respondents. This could be attributed to their interest on job search given they are about to complete their studies.

Figure 1: Level of study. Source: Author (2020)

3.4 Course of study

This question was posed to the learners and graduates. Majority of the learner respondents were undertaking Bachelor of Education degree. Others were undertaking Bachelor of Computer Science, Business Management and Business Administration. The graduates indicated their fields of study were: Bachelor of Education, Bachelor of IT, Social Work and Community Development, Biochemistry, Human Resource Management and Business Administration. The results of the level of study for the learners were as indicated in Figure 2.

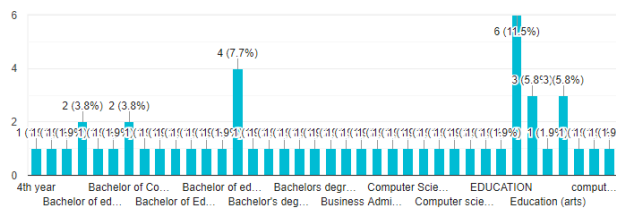

Figure 2: Course of study for learners. Source Author (2020)

3.5 Enjoying the course of study

Learners were asked whether they enjoyed their course of study, close to 60% indicated they were very much enjoying the course of study and a further 35% were enjoying the chosen course of study implying that the selected courses of study were consistent with their passion and professional goals after graduation. The results of data analysis were as depicted in Figure 3.

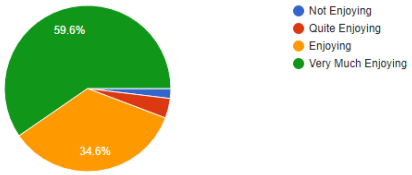

Figure 3: Enjoying course of study. Source Author (2020)

3.6 Motivation for choosing course of study

Various motivational factors were advanced as the chief reasons for the learners' choice of study. The main reasons included; the desire for radical changes in society, mentorship, availability of jobs, passion for teaching, love for technology and the desire to be a role model for the youth. The results of data analysis were as depicted in Figure 4 below.

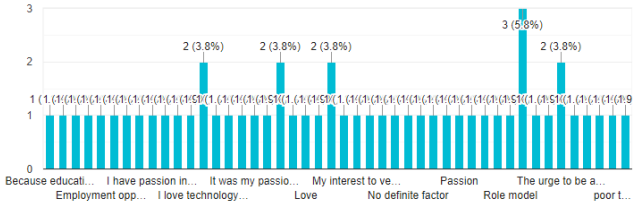

Figure4: Motivation choosing course of study. Source Author (2020)

3.6 Expectation after graduation

Learners were asked to state their job expectation after graduation. A total of 46% stated stated they would further their studies, 23% would go for blue collar employment, 19% for white collar employment and 11% stated they would start their own businesses. The reason why students still want to further their studies after graduation could be because they expect to get a good white collar job due to the high competition among graduates. This points to the attitude towards white collar employment as opposed to blue collar employment. The results of data analysis were as depicted in Figure 5 below.

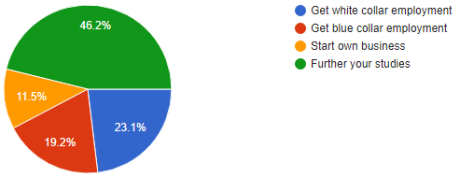

Figure 5. Expectation after graduation. Source Author (2020).

3.7 Jobs taken by peer graduates

The learners were asked whether they knew any graduates in their field and the type of job they had taken after graduation. The learners reported that close to 54% of the peer graduates they knew had opted for white collar employment and another close to 46% had taken blue collar employment. This indicates that the attitude of the graduates was skewed towards white collar jobs as opposed to blue collar jobs as shown in Figure 6 below

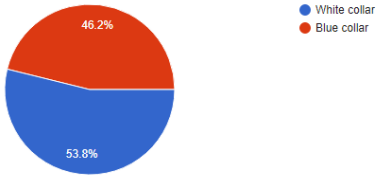

Figure 6: Jobs taken by peer graduates

Source Author (2020)

3.8 Year of graduation

The graduates were asked to state their year of study to determine how recent and relevant the data collected was. The results indicated majority of the respondents, over 44% graduated in the year 2017, giving relevance to the study undertaken and results depicted in Figure 7.

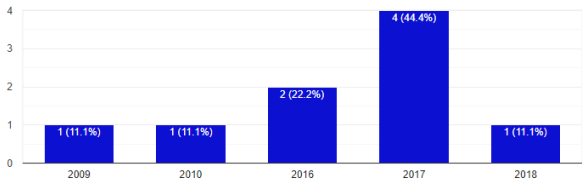

Figure7. Year of graduation. **Source Author (2020)**

3.9 Employment

The key feature of the online questionnaire sent to graduates was to capture data concerning employment and type of job taken after graduation. Over 66% indicated that they had been employed. When asked whether their employment was related to the course of study they undertook, 66% responded in the affirmative. 77% of the graduates indicated that they chose white collar job and 22% indicated they opted for blue collar jobs. Many graduates indicated the reason for going for the white collar jobs was the educational background, the experience in the field, internship opportunities, volunteering opportunities and personal skills such as effective interpersonal communication. Over 66% of the graduates cited frustration after unsuccessful search for white collar jobs as the main reason for opting for blue collar job. The duration for successfully securing a job among the graduates ranged between 6 months and 3 years. The results are shown in Figures 8,9,10 and 11.

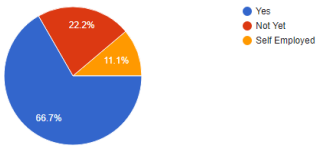

Figure 8: Are you employed. Source Author (2020)

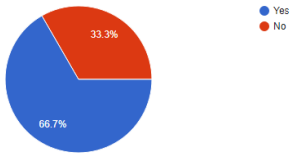

Figure 9: Job related to course of study. Source Author (2020)

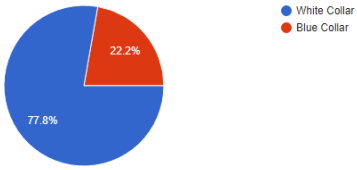

Figure 10: White Collar or Blue collar job.

Source Author (2020)

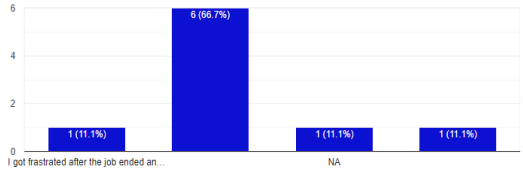

Figure 11: Reason for blue collar job. Source Author (2020)

7.0 Discussions

4.1. Course selection as a determinant for Job type

From the results of the analysis, the type of course chosen at the university is a strong determinant of the type of job chosen after graduation. This is because the current curriculum is more focused on training the students to get a formal job as opposed to acquiring the skills necessary to be able to work anywhere including blue collar jobs. As a result, the course selected in the university has a strong influence on the attitude towards jobs after graduating.

4.2 Learning environment as a factor of attitude

The results of the analysis also indicate that the learning environment of a student has a major influence on attitudes towards blue collar employment. Students exposed to blue collar jobs either through apprenticeships, mentorships or volunteer activities in or outside the university are more likely to opt for blue collar employment as opposed to students who do not have this kind of exposure.

4.3 Job competition affects attitude formation

Many of the respondents reported that frustration with job search for white collar employment led to shifting attitudes for blue collar employment. Competition for jobs is further escalated by technology and social media which makes it easy for any employer to list available jobs online and get thousands of applicants for the same job.

4.4 Motivation correlates to attitudes on job types

The respondents indicated that their motivating factors towards certain job types included: Passion, career goals, mentorships, love for teaching and wanting to transform the society. These motivational factors seemed to have a controlling effect on their attitudes toward jobs selected.

5.0 Conclusion and Recommendations

Based on the research findings above the study concludes that most graduates and learners have a negative attitude towards blue collar employment this affects their ability to secure employment after graduation. The predominant factors influencing attitudes towards the type of job chosen include the course of study, environment, job competition and motivational aspects. This can be corrected if the students and graduates start appreciating blue collar jobs as a viable way to apply the skills and competencies

acquired in school. Due to these it is recommended that:

1. The learning environment for students should offer technical skills, mentorship and apprenticeship programs to train students on blue collar jobs.
2. A comprehensive career advisor program to guide and advice students on the careers and skills in both formal and non-formal education systems.

6.0 Acknowledgement

I would like to thank all students who participated in this research and The Lukenya University for this conference program.

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Efficacy of Reinforcement as an Alternative to Corporal Punishment in Controlling Student Behaviour in Schools in Kenya

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ABSTRACT

Disruptive student behavior is of concern to schools, teachers, students and the society at large as it adversely affects education. Teachers in Kenya resorted to handling this behaviour through non corporal punishment methods, as recommended by the government. Use of corporal punishment was banned in schools in the year 2001. The Basic Education Act, 2013 spells out that pupils should not be subjected to degrading or inhuman treatment in any manner, whether psychological or physical. Despite the fact that alternative methods were used in dealing with unruly student behavior, the tendencies to such behaviour persists. The purpose of this study was to investigate the efficacy of reinforcement as an alternative method to corporal punishment in controlling unruly student behaviour in schools. Questionnaires, Interview schedules and document analysis guides were used to collect data from teachers, Heads of Departments of Guidance and Counseling and Deputy Principals. Findings established that reinforcement was significant in controlling unruly student behaviour, although some teachers did not think so. The study recommends the need to create awareness among teachers about the use of non-corporal methods in controlling student behaviour. The implementation of the recommendations are envisioned to lead to the realization of the 4th sustainable development goal which seeks to ensure inclusive and equitable quality education, and to promote lifelong learning opportunities for all. The study concludes that reinforcement plays a key role in controlling student behaviour.

Keywords: Efficacy, Reinforcement, Controlling, Student Behavior.

8.0 INTRODUCTION

Maintaining discipline among learners in the 21st century is the most challenging work in the teaching career (Yaghambe, 2013; Semali and Vumilia, 2016). The handling of students needs care and safety, and discipline assumes different forms in schools (Nakpodia, 2012). Numerous schools encounter unruly students' behavior like violation of rules and destruction of property (Osher, Bear, Sprague and Doyle, 2010). Despite the fact that teachers use alternative methods to corporal punishment, they maintain that they are less powerful compared to corporal punishment (Busienei, 2012).

In the United States, corporal punishment was outlawed in 30 states, though still used extensively in 20 states (Batul, 2011). The first European nation to outlaw corporal punishment was Sweden (Durrant, 1996). The United Nations stresses the need for legal reforms to create awareness about the hazards of corporal punishment use and enhance other non violent methods (UNICEF, 2001). In Africa, corporal punishment was banned in Egypt (Wasef, 2011). South Africa too adopted numerous steps of prohibiting corporal punishment (Soneson, 2005). In Kenya, corporal punishment was banned in 2001 by the introduction of the Children Act of 2001 (Government of Kenya, 2001) and the rights of children were enshrined in the Constitution of Kenya 2010, which shields them from all forms of punishment (Republic of Kenya, 2013). The Ministry of Education requires teachers to use non corporal measures to tackle indiscipline issues in institutions (Ministry of Education, Science and Technology, 2005). Consequently, teachers in Kenya have invented distinctive ways of managing student behaviour in the form of reinforcement, exclusion, manual punishment and guidance and counseling (Agesa, 2015; Ndembu, 2013). In Bondo Sub County, student behaviour problems persist (Bondo Sub county Office, 2015) as teachers try to control student behaviour through non corporal methods. The objective of this research was to interrogate the efficacy of reinforcement as an alternative to corporal punishment in schools in Kenya.

9.0 METHODOLOGY

Mixed methods approach with concurrent triangulation design was used in the current study. Target population comprised of 40 deputy principals, 40 Heads of Guidance and counseling and 351 teachers. Stratified random sampling technique was used to identify schools and their proportions. Krejcie and Morgan (1970) Sample Determination Table was used to obtain a sample size of 28 heads of guidance and counseling, 28 deputy principals and 196 teachers. Questionnaires, interview schedules and document guides were used to collect data. Validity of the instruments was ascertained by seeking the judgment of experts in the department of psychology while piloting of the research instruments was undertaken in 9% of the total population that did not participate in the study. Quantitative data was analyzed using correlational analysis and descriptive statistics while qualitative data was analyzed through thematic analysis (Braun & Clarke, 2006).

3.0 FINDINGS AND DISCUSSIONS

Table1. Descriptive Statistics on Reinforcement

	Indicator	SA A UD D SD
1	Reinforcement increases a feeling of belonging in the learners.	(42%)(16%)(11.5%)(33%)(14%)
2	Reinforcement inspires learners not to repeat un-acceptable behaviour.	(45%)(38%)(10%)(3.66%)(3%)
3	Reinforcement has made it possible for learners to prevail over behavioural and social problems	(40%)(38%)(16%)(04%)(2.1%)
4	Reinforcement makes learners have positive inclination towards school.	(65%)(28%)(7%)(0%) (0%)

Table 1 shows that respondents who believed reinforcement enhanced a sense of belonging in the students were 42% (Strongly Agree) and 16%(Agree) while those who believed it did not were 33% (Strongly Disagree) 14% (Disagree). The findings suggest that most respondents believed that reinforcement enhanced a sense of belonging in the students. Conversely, Brown (2013) in New Zealand argues that the use of reinforcement approaches effectively increased positive behaviour among the students. However, Reupert and Woodcock (2011) in their study in Australia maintain that corrective strategies used by teachers are of low level and are not effective in barring student misbehaviour.

Although some respondents believed alternative corrective measures do not enhance a sense of belonging, qualitative findings indicate that positive reinforcement has effect on student behaviour. Students who were reinforced behaved well, were more confident and closely related with their teachers. They developed a sense of belonging, which made them behave appropriately, as was noted:

'Reinforcement is instrumental and should be sustained since it brings learners to the teachers' [DP 16].

One Head of Department similarly remarked:

'*The learners get motivated and develop a sense of belonging that changes their behaviour'* [HOD 1].

The expressions of DP 16 and HOD1 suggest that reinforcement plays a role in controlling learner behaviour. Dasaradhi, Ramakrishna and Rayappa (2016) in India assert that teachers need to sustain learners' interest and Dodge (2011) in America equally maintains that there is need to appreciate learners for showing acceptable behaviour.

Additional findings from the minor occurrence book established that if learners' name did not appear in the list of noise makers, he or she was rewarded, and the learner reciprocated by sustaining good conduct. This indicates that positive reinforcement enables learners to maintain desirable conduct. Similarly, Brown (2013) in his study in America postulates that teachers depend on reinforcement

approaches that perpetuate student positive behaviour.

More quantitative findings confirm that reinforcement encourages students not to repeat undesirable behaviour. This was confirmed by majority 83% (Strongly Agree 45%; Agree 38%) of the respondents. These findings show that reinforcement has positive influence on student behaviour and encourages them to sustain desirable behaviour. The findings are similar to Reinke, Stormont, Herman and King (2014) study in America which suggests that raising the use of reinforcement upgrades the outcome of students, especially those who are vulnerable to undesirable behaviour. Additional qualitative findings suggested that praise was appropriate in controlling the behaviour of learners as depicted in the following excerpt:

'*A learner who is praised for behaving well sustains desirable behaviour and is likely to improve in academic performance too'* [DP10].

The statement from DP 10 seems to imply that praise makes learners gain acceptable behaviour and also makes their academic performance better. Rahimi and Karkami (2015) in Iran also agree that recognition has positive effect on the behaviour of the learner, just as Maphosa (2011) in South Africa conversely maintains that major forms of indiscipline require retribution. One other respondent who was interviewed said that praise positively changes the behaviour of a learner, as seen in the following excerpt:

'Learners who are praised for behaving acceptably sustain good behaviour '[DP 6].

The views of DP 6 indicate that praise has positive effect and encourages the learner to sustain good conduct. Bickford (2012) study in America concurs that praise is important in controlling student behaviour. Mohrbutter (2011) in USA argues that teachers should acquire professional development for managing student behaviour appropriately. Another interviewee believes that praise, however light it may be, has positive influence on learner behavior as shown in the narrative:

'*Students who often misbehave can be praised for any slight positive change they make.This leads to positive behaviour change in the learners'* (HOD 4).

The sentiments of HOD 4 imply that reinforcement impacts positively on the learners and those teachers ought to recognize positive change in learners and to reward them. Rahimi and Karkami (2015) in Iran too believe involvement and recognition are beneficial strategies of discipline. However, Dodge (2011) in America maintains that school administrators are not ready to face rising challenges of learning needs.

Findings from document guides revealed that student leaders who performed their duty efficiently were rewarded. This encouraged them to sustain the virtue of hard work and good behaviour, an indication that reinforcement sustains good behaviour. Guner (2012) study in Turkey agrees that rewards are effective in managing behaviour. On the contrary, Reinke, Stormont, Herman and King (2014) in America agree that rewards improve learner behaviour, although they are more effective on learners who are prone to misconduct.

Further quantitative findings confirmed that positive reinforcement helps students overcome behavioural and social problems. This was reported by majority 78% (Strongly Agree 40%; Agree 38%) of the respondents. Learners who were reinforced for good conduct behaved well. Rhodes (2014) in America also agrees that praising students helps in controlling their behaviour. Similarly, Dhaliwal (2013) in India agrees that teachers handle unwanted behaviour by motivating and encouraging students through establishing a personal relationship with learners who have challenging behaviour. On the contrary, Ajibola and Hamadi (2014) in Nigeria argue that the disciplinary measures to be undertaken are determined by causes and kinds of disciplinary problems.

One interviewee remarked that a learner who is recognized for good conduct positively influences others, and that material rewards cause good behaviour as depicted in the following remarks:

'A student who upholds desirable behaviour is awarded in public so that others can see and behave well too' [HOD 14].

The sentiments of HOD 14 indicate students who are rewarded publicly are emulated by their colleagues. Additional information from document analysis guides reveal that material rewards are useful in sustaining desirable relationship in the learners. Dodge (2011) study in America also believes that learners need to be rewarded by being given material rewards. The findings are similar to Foncha, Kepe and Abongdia (2014) study in South Africa that praising of good students during public gathering in school promotes student discipline. However, Bechuke and Debela (2012) in South Africa argue the behaviour of an individual doesn't depend on external stimulus.

Quantitative findings affirm that majority of respondents 93% (Strongly Agree 65%; Agree 28%) believe that reinforcement makes students acquire positive inclination towards school. Qualitative findings from interviews also show that reinforcement makes learners develop positive inclination towards school as was expressed by one respondent:

'*Learners who are reinforced have positive attitude towards school and would want to be associated with their school*'[HOD10].

The sentiments of HOD 10 suggest that learners who are reinforced have positive attitude towards school and would want to be associated with their school. Consequently, reinforcement is useful in changing the attitude of learners. Students who are positively inclined to their school are likely to develop desirable behaviour since they would want to uphold the standards of their institution. Reinke, Stormont and Herman (2014) in USA also believe that reinforcement boosts desirable student behaviour. However, Moyo, Khewu and Bayaga (2014) study in South Africa recommends that demerits should be used well to control student behaviour.

A correlation analysis of Pearson Product Moment Correlation Coefficient was used to test the hypothesis that reinforcement was not effective in controlling student behaviour. Table 2 shows results

Table 2: Correlation Analysis between Positive Reinforcement and Students Behaviour

Correlations	Positive reinforcement	Student behaviours
Pearson Correlation	1	.411**
Positive Reinforcement Sig.(2tailed)		.000
N	191	191
Pearson Correlation	.411*	1
Student Behaviors Sig.(2 tailed)	.000	
N	191	191

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

Table 2 shows a positive relationship between reinforcement and management of student behaviour. A Pearson`s correlation coefficient of r=0.411 was realized, showing that reinforcement is beneficial in controlling student behaviour. The findings agree with Roache and Ramon (2011) study in Australia that management strategies like reward make students accountable for their own behaviour and their peers too. Likewise, Ching (2012) study in Philippines concurs that sanctions and rewards are useful if applied according to the principles of the school. Contrarily, Reupert and Woodcock (2011) study in America argues that some teachers do not have confidence in certain strategies of behaviour management.

5.0 Conclusion and Recommendations

The study findings established that reinforcement plays a key role in controlling student behaviour, although some teachers believe otherwise.

Therefore, the study recommends the urgent need to create awareness about the importance of alternative methods like reinforcement in controlling student behaviour.

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Character Transformation of University Students in Covid-19 Era and Beyond: A Paradigm Shift on the Role of Lecturers in Emotional Intelligence and Transformational Leadership

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Abstract

Despite the extensive research on character development in students, a lot is required on the relationship between transformational leadership, emotional intelligence of lecturers and character transformation among students in universities. The objectives of this research were to assess the relationship between emotional intelligence of lecturers and transformational leadership in universities in Kenya, determine the relationship between emotional intelligence and character formation, and to establish the relationship between transformational leadership and character Transformation. The study was based on intelligence leadership theory advanced by Thorndike and Lewin Change Model. The research adopted cross-sectional survey design. Questionnaires were used to collect quantitative data from 200 lecturers and 70 Student leaders from 10 universities in Kenya that were purposively and randomly selected. Data was collected using Survey Monkey and analyzed using spearman correlation test. The results showed a significant positive correlation between transformational leadership and emotional intelligence ($r = 0.768$, $p < 0.001$), indicating high strength of relationship. The study also established a significant positive relationship between character formation of students and emotional intelligence of lecturers ($r = 0.48$, $p < 0.001$). The study further shows a significant positive relationship between character formation of students and transformational leadership ($r = 0.587$, $p < 0.001$). The rating of lecturers on emotional intelligence by the students was the lowest. The findings suggest that lecturers do not pay satisfactory attention to the students' character transformation. The findings support the emotional leadership theory that links leadership and emotional intelligence as integrated elements. Emotional intelligence compliments transformational leadership. Lecturers require more competency skills in emotional intelligence to stimulate character behaviour

in students. Universities should therefore conduct training needs for lecturers and student leaders on emotional intelligence and transformative leadership. This would enable lecturers to refreeze forces that maintain status quo and increase striving forces for change in students' behaviours for them to cope with challenges such as in the Covid-19 pandemic era and beyond.

Key Words: Character transformation, Emotional intelligence, Transformational leadership, University Students, Covid-19 Era

BACKGROUND TO THE STUDY

Thorndike (1920) advanced the theory of emotional intelligence that brings up beliefs in different forms of intelligence. The first form was abstract intelligence which was measured using IQ tests. The second is concrete intelligence that is used in understanding and manipulating objects and shapes. The third is social intelligence which was identified as the ability to understand and relate to people which is currently referred to as emotional intelligence and is anchored in this research.

Emotional intelligence is the ability to perceive emotions, integrate emotions to facilitate thought, understand emotions, and to regulate emotions to promote personal growth (Bar-On, 2010; Mayer and Salovey, 1997). It is the capacity of a person to identify his/her emotions that enable him/her to become sensitive to those that he/she perceives from the environment and the circle of people he/she interacts with (Khokhar and Kush, 2009).

The scale for assessing emotional intelligence is the multifactor emotional intelligence (Salovey *et al.,* 2003, 1999, and 1998) which requires the participant to complete tasks associated with emotional intelligence. Bar-On's (2002) model of emotional intelligence relates to the ability of being aware of oneself, understand and express oneself, understand and relate to others, ability to deal with strong emotions, the ability to adapt to change and solve problems. Mayer *et al.,* (2000) views emotional intelligence as competency expected to enhance positive attitudes towards work and drive positive behaviours and better outcomes. Goleman (1998) believes that social skills encompass influencing tactics; effective communication; conflict management skills; leadership abilities; change management skills; instrumental relationship management; collaboration and co-operation abilities; and effective team membership capabilities.

The key features of emotional intelligence are empathy, adaptability, and stress management skills (Doek, 2009); cited in Bii, 2016). Empathy is a process where a person understands how others feel and responds to others' situations in a caring way and acting to support the person. Swick (2005) says development of empathy is influenced by several factors, including environment, culture, and temperament. Zeece (2004), Strayer and Roberts (2004) show that children who fail to develop empathy are prone toward anti-social and self-destructive behaviors. Stress management is the ability to understand one's emotional state and individuals who are unable to regulate their own emotions frequently show poor emotional adjustment (Extremera & Pizarro, 2006). On the other hand, individuals who account for greater understanding and regulation of their emotions had higher levels of self-esteem. Swick recognized that lower emotional intelligence may inhibit the selection of adaptive and appropriate coping mechanisms. Surveys found that character education programs increase emotional intelligence in children (Ulutus & Omeroglu,

2007). Character development in higher institutions of learning is capable of creating new attitudes and self-perceptions that can stimulate independence, confidence, reliance and empowerment amongst the teams (Coetzee *et al., 2005*).

Avolio and Bass (2002) asserts that transformational leadership style ignites passion and evokes a spirit of hard work, challenging environment and room for innovators. Transformational leaders work on follower's capacity building by motivating them to create new ideas. Transformational leadership emphasizes having a shared mission and infusing a sense of purpose, direction and meaning to the followers (Bass, 1999). Transformational leadership is the engine and transmitter of innovative culture and dissemination of knowledge. Transformational leaders have charisma, provide inspiration, intellectual stimulation, pride, faith and respect (Allen, 2012).

Statement of the Problem

There has been debate that university graduates are decently ill prepared to take up jobs in the labour industry. Developing emotional intelligence in lecturers may transfer the traits to the students who failed to acquire it at earlier stages of education and deter antagonistic and offending behaviors in youths.

Career development majorly rests on curriculum implementers, though little attention has been given to the lecturers to spearhead it in the universities. University management is doing little to train lecturers on transformative leadership and emotional intelligence to be able to develop character formation in students. Thus, the need for the current study to unearth the messy business. The purpose of this study therefore was to investigate the relationship between transformational leadership, emotional intelligence of lecturers and character transformation of students in universities.

Objectives

The study was guided by the following specific objectives:

i. To assess the relationship between emotional intelligence and transformational leadership of lecturers in universities in Kenya.
ii. To determine the relationship between emotional intelligence and character transformation of students in universities in Kenya
iii. To establish the relationship between transformational leadership and character transformation of students in universities in Kenya

Hypotheses

The following hypotheses were tested:

H_{01}: There is no significant relationship between emotional intelligence and transformational leadership of lecturers in universities in Kenya

H_{02}: There is no significant relationship between emotional intelligence of lecturers and character transformation of students in universities in Kenya

H_{03}: There is no significant relationship between transformational leadership of lecturers and character transformation of students in universities in Kenya.

RESEARCH METHODOLOGY

Methodological Approach

The study embraced cross-sectional survey design with positivism philosophical paradigm. It employed structured questionnaires: Multifactor Emotional Intelligence Scale (Salovey et al., 2003, 1999, and 1998); Multifactor Leadership Questionnaire (MLQ)(Bass and Avollio ,1997) and Character transformation (Janssen (2000) The respondents were required to rate variables using Likert Scale

Sampling Method

The research used purposive and random sampling to obtain 200 lecturers and 70 students' leaders from 10 universities in Kenya. Survey monkey tool was utilized to administer the questionnaires

Data Analysis

Spearman correlation test was used in analyzing ordinal data collected from Likert-scale

RESEARCH FINDINGS

Emotional Intelligence

The responses for both the lecturers and the Students' leaders (raters) were used determine the mean emotional intelligence of the lecturers. The emotional intelligence had 7 constructs that form items in the questionnaire as follows: Self-management, Self-motivation; Change resilience; Interpersonal relations; Integration of head and heart; Emotional literacy and Self-esteem. The lecturer rate himself/herself and the student leader (rater) rate the lecturer. There was a total of 196 lecturers with 4 who filled questionnaire items incorrectly. There were 70 students' leaders (raters) drawn from 10 public universities.

Transformational Leadership

Transformational leadership was based on 5 constructs in the 7-point Likert scale as Individual Consideration, Inspirational Motivation, Idealized Attributes, Idealized Behaviors and Intellectual Consideration. The leadership style of lecturers was rated by the lecturers themselves and the students' leaders (raters)

Students Character Development

The character behavior of the students was obtained using responses from both the lecturers and the student leaders themselves (raters) on a 7-point Likert scale that were based on the items: enthusiastic, mobilization, Creativity, seek new knowledge, I look for opportunities and Explore new ways

RESEARCH FINDINGS

The three research hypotheses were subjected to both descriptive statistics and correlation analysis. There were only 4 lecturers whose questionnaires were invalid whereas all the students' questionnaires were valid. The results were tabulated in tables 1 and 2

Table 1:

Descriptive Statistics for the variables

Variable	Ratings Lecturers n=196	Students n=70	Average n=266
Emotional intelligence of the lecturers	3.7927	2.9719	3.5767
Transformational Leadership of the lecturers	3.6703	3.6386	3.6545
Character Transformation of the Students	3.0569	3.1453	3.0802

Source: Survey data (2020)

The statistics show the lowest rating of lecturers in Emotional intelligence by students as a mean of 2.979, equivalent to **59%**

Further, the lowest rating in character transformation of students was a mean of 3.0802, equivalent to **61%.**

The respective respondents rated themselves higher. These findings agree with Brett (2005) cited in Bii (2017) who postulated that people tend to view themselves more positively. Lecturers were rated the lowest by students which implies that students do not receive enough emotional attention from the lecturers.

High average rating (73%) of lecturers in transformational leadership, implies that lecturers provide inspiration and hope to the students. There was lower rating of students by the lecturers (61%) in Students character transformation which implies that there is need to fill the gap as far as students' morals and responsiveness are concerned.

Correlation Analysis

Spearman correlation analysis was done to determine the relationships among the variables. The results of the correlation test are tabulated in table 2.

Table 2

Spear correlation analysis Matrix (N=266) for the study variables

	Character formation	Emotional intelligence	Transformational Leadership
Character formation	1		
Emotional intelligence	.468**	1	
Transformational Leadership	.587**	.768**	1

Source: Survey data (2020)

***. Correlation is significant at the 0.01 level (2-tailed) with p =0.000*

**. Correlation is significant at the 0.05 level (2-tailed).*

Discussion of Correlations Results

H_{01}: Emotional intelligence and transformational leadership (r =0.768, p<0.001). P-value indicates a highly statistically significant relationship (at 99% confidence level), while r=0.768 shows a strong positive correlation between emotional intelligence and transformational leadership. Overall, there is a highly statistically significant strong positive relationship between the two variables.

H_{02}: Emotional intelligence and character transformation of students (r =0.468, p<0.001). P-value indicates a statistically significant relationship and r=0.468 shows a positive weak correlation between emotional intelligence and character transformation of students. Generally, there is a statistically significant positive weak relationship between the two variables

H_{03}: Transformational leadership and Character Transformation of lecturers (r =0.587, p<0.001). P-value indicates a statistically significant relationship and r=0.587 shows a positive moderate correlation between transformational leadership and character transformation. On the overall, there is a statistically significant positive moderate relationship between the two variables

Conclusion

The findings support the emotional leadership theory that links leadership and emotional intelligence as integrated elements in emotional leadership. Leaders influence their followers to a common goal with the help of emotional intelligence. There is low attention by lecturers on emotional intelligence to stimulate character behaviours in students' intelligence and to stimulate character behaviour in students

Recommendation

Universities should conduct training needs assessment for lecturers and student leaders on emotional intelligence and transformative leadership. This will enable lecturers to unfreeze restraining forces that maintain the status quo, and increase striving forces for change in students' behaviours. Consequently, students can better cope with

challenges, moreso in the wake of Covid-19 pandemic and beyond.

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Athari Za Vita Vya Ukabila: Tathmini Ya Chozi La Heri

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IKISIRI

Nchini Kenya, kumekuwepo na vita vya wenyewe kwa wenyewe huku vikijikita katika misingi ya kikabila. Fasihi ni kioo cha jamii na hali kadhalika ni chombo ambacho kinaweza kutumiwa katika kuangazia masuala halisi katika jamii. Makala haya yanakusudia kubainisha jinsi mwandishi Assumpta Matei alivyoangazia athari zinazotokana na vita vya kikabila katika riwaya ya *Chozi la Heri*. Makala haya yataongozwa na nadharia ya uhalisia iliyoasisiwa katika karne ya 19 na E. Goffman. Kulingana na nadharia hii, mwandishi husukumwa na nia ya kuusawiri uhalisia katika ukamilifu na wakati wake maalum. Riwaya ya *Chozi la Heri* (Matei, 2017) iliteuliwa kimakusudi kwa kuwa maudhui yake yanahusiana moja kwa moja na mada ya makala haya. Kazi hii ni muhimu katika kuthibitisha kuwa fasihi ina uwezo wa kuelimisha jamii juu ya athari zinazotokana na vita vya kikabila na hatimaye kuihamasisha ili kuleta amani na mshikamano katika nchi. Data ilichanganuliwa kwa kufuata lengo la makala na misingi ya kinadharia. Imebainika wazi kuwa mwandishi ameangazia athari za vita vya kikabila ambazo ni; vifo, uharibifu wa mali ya umma, kusambaratika kwa familia, kuwepo kwa watoto wa mitaani, ulanguzi wa dawa za kulevya, ubakaji, ukosefu wa chakula na mahitaji mengine ya kimsingi.

Istilahi Muhimu: Athari, Vita, Ukabila.

1.0 Utangulizi

Kulingana na *Cooke (2009)*, ghasia za baada ya uchaguzi wa Kenya mwaka 2007-2008 zilidhihirisha jinsi ambavyo ukabila unaweza kuitumbukiza nchi katika vita vya wenyewe kwa wenyewe. Kuna baadhi ya waliosema kuwa ukabila unatokana na mipaka ya kikoloni iliyowagawanya watu katika mafungu ya kikabila. Takriban watu zaidi ya elfu moja waliaga na wengine kama 350,000

waliachwa bila makao. Vita vya 1992 na 1997 vilikuwa sawa na vya 2007-2008. Watu waliuawa na wengine kuhamishwa ndiposa makala haya yanalenga kutathmini athari za vita vya kikabila katika riwaya ya *Chozi la Heri* ya Assumpta Matei.

1.1 Wasifu wa Mwandishi Assumpta Matei

Assumpta Matei ni mtafiti na mwalimu mwenye tajriba pana katika ufundishaji wa ondoalugha na fasihi ya Kiswahili katika shule za upili na vyuo vikuu. Ameshiriki katika majopo mbalimbali ya ukuzaji, utekelezaji na tathmini ya mitaala. Riwaya yake ya *Chozi la Heri* (2017) inatumika kufundisha katika shule za upili nchini Kenya. Ilitahiniwa kwa mara ya kwanza 2019 katika mtihani wa kitaifa.

1.2 Muhtasari wa Riwaya ya *Chozi la Heri*

Riwaya hii inasimulia kisa cha Ridhaa ambaye aliishi vyema na majirani wake hadi pale walipoamua kuchoma nyumba yake na kuwaua baadhi ya wanafamilia wake ila tu Mwangeka aliyekuwa amesafiri kwenda kulinda usalama ughaibuni. Kuna kisa pia cha msichana Umukheri ambaye kutokana na vita, familia yao ilitengana na ndugu zake kupotea baada ya kutoroshwa na mfanyikazi wao. Hatimaye, Umu, Dick na Mwaliko walipatana na kwenda kumtafuta mama yao ila walimpata keshaaga.

2.0 Msingi wa Kinadharia

Makala haya yaliongozwa na nadharia ya Uhalisia iliyoasisiwa katika karne ya 19 na kufafanuliwa zaidi na E. Goffman aliyeishi kati ya mwaka (1922- 1982). Baadhi ya wataalamu wengine wanaotoa mchango wao ni Gustav Flaubert (1846-1854), George Lukacs (1963), Rene Wellek (1960), Macdowall Arthur (1918) na Hegel G. (1979). Lukacs (1963) anaeleza kuwa mwandishi anasukumwa na njia ya kuusawiri uhalisia katika ukamilifu na wakati wake maalumu. Mwandishi anapaswa kupenya chini ya picha za kijuujuu na kudhihirisha mifanyiko ya mabadiliko yaliyopo. Uhalisia wa maisha katika jamii unapewa msingi mkubwa wa uandishi kuhusu jinsi mambo yalivyo. Tukio, mhusika au mandhari huelezwa kama vya kihalisia ikiwa vinafanana na sura fulani ya maisha.

Wamitila (2002) anaeleza kuwa uhalisia unasisitiza usawiri wa maisha ya jamii kwa uaminifu na usahihi mkubwa. Waaandishi wa kazi za kihalisia wanatoa picha za wahusika, matukio na mandhari ambayo yanaoana kwa kiasi kikubwa na uhalisia wa jamii ya mwandishi anayehusika. Aidha, fasihi yoyote lazima ionekane kama kioo cha jamii. Hivyo basi, lazima jamii iweze kujitazama na kujiona kupitia fasihi ambayo ni zao la jamii. Msingi wa nadharia hii ni kuwa sanaa iwakilishe ukweli na kuwakilishwa kwa maneno halisi, iwe aminifu na ionyeshe hali halisi ya mazingira. Kutokana na maelezo hayo, nadharia ya Uhalisia itasaidia katika kuangazia jinsi ambavyo Matei katika riwaya ya *Chozi la Heri* amesawiri uhalisia wa athari za vita vya kikabila.

Makala haya yanaongozwa na mihimili ifuatayo:

(a) Kazi ya fasihi inajitosheleza. Kazi ya sanaa sharti iwe na msuko, mtindo, wahusika na ujumbe.

(b) Kazi ya msanii inapaswa kuwasilisha ukweli kama ulivyo katika mazingira yake. Uhalisia sharti ujihusishe na mambo halisi yanayotokea katika mazingira halisi kupitia kwa wahusika.

(c) Wahusika ni vielelezo yakini vya binadamu wa kawaida kwa vile wao hutumia lugha ya binadamu wa kawaida. Hali halisi ya wahusika na lugha wanayoitumia humwezesha mwanadamu kujifafanulia uwezo wake wa kutenda mambo na mtazamo wake kuhusu maisha.

(d) Msanii anaangalia matatizo na kuchunguza chanzo chake. Anachunguza

mabadiliko ambayo hutokea kwa kipindi fulani cha historia na kuyatumia kuwasawiri wahusika wake.

3.0 Mbinu za Utafiti

Data ya makala haya ilipatikana kwa kuipitia riwaya ya *Chozi la Heri* (Matei, 2017) na kisha ilichanganuliwa kwa kufuata lengo la makala na misingi ya kinadharia.

4.0 Maana ya Vita

Kulingana na TATAKI (2014), vita ni mapigano baina ya watu, wanyama na mataifa. Makala haya yatajikita katika vita baina ya makabila. Baada ya kuipitia riwaya teule, imebainika wazi kwamba kunao athari za vita zinazotokea iwapo makabila tofauti yatajihusisha na mapigano baina yao.

4.1. Athari za vita vya Kikabila

Riwaya hii imesheheni athari za vita vya ukabila kama inavyodhihirika.

4.1.1 Vifo

Riwaya inaanza kwa kutoa maelezo ya familia ya Ridhaa (uk 1). Waliishi vyema na majirani wao hadi pale walipotofautiana na majirani wao baada ya kupiga kura na kiongozi mpya mwanamke Mwekevu kuteuliwa. Bibiye Ridhaa aliyeitwa Terry na watoto wao Tila na Mukeli walichomwa. Aidha, familia ya Mwangeka iliyowahusu Becky na bintiye Lily waliangamia wakiwa ndani ya nyumba. Jirani yao Mzee Kedi alitekeleza kitendo hicho (uk 3). Ukatili wa majirani ulitendeka kwani walimwona Ridhaa kama mgeni baina yao (uk 12) hata ingawa alikuwa ameishi na wao kwa miongo mitano. Baadaye, Ridhaa aliugua ugonjwa wa shinikizo la damu kutokana na kupoteza jamaa na mali yake (uk 36). Hatimaye, alikufa.

Katika ukurasa wa 20, mwandishi anasema kuwa baada ya kiongozi mpya kuchukua usukani, vita baina ya makabila ya nchi ya Wahafidhina vilizuka na nchi yenyewe ilitwaa sura mpya. Misafara ya watu waliohama bila kujua waendako ilishuhudiwa. Isitoshe, mizoga ya watu na wanyama ilitapakaa kila mahali. Askari pia walihusika katika kuwaua vijana waliojaribu kupinga uongozi mpya. Mwandsihi anasema:

> “Baada ya muda mfupi vifua vyao vilikabiliana na risasi zilizorashiwa vifua hivyo kama marashi, vifua vikawa havina uwezo dhidi ya shaba, vijana wakaanguka mmoja baada ya mwingine, wamekufa kifo cha kishujaa, wamejitolea mhanga kupigania ‘Uhuru wa Dhati’ kama walivyouita” (uk 24).

Mhusika Lunga alipopoteza mali yake katika Msitu wa Mamba (uk 79), mkewe Naomi alimwacha na watoto awalee pekee. Ilimbidi Lunga kuwalea Umu, Dick na Mwaliko bila usaidizi wa mama yao. Jukumu hili lilimsababishia Lunga uwele wa shinikizo la damu na kufariki. Aliwaacha watoto wake chini ya kijakazi Sauna ambaye baadaye aliwalangua (uk 81).

Msichana Kairu anawaeleza Umu na wenzake wakiwa katika shule ya Tangamano kuwa walipofurushwa kutoka kwao kwenda Msitu wa Mamba, mama yao aliwaelekeza msituni ambapo kitinda mimba wao alishindwa kukamilisha safari. Alifia mgongoni mwa mamake. Mama alimzika huko msituni kwa kutumia kiserema (uk 91).

4.1.2. Uharibifu wa Mali ya Umma

Kiongozi mpya wa nchi ya Wahafidhina alipoteuliwa, vita vilizuka baina ya koo. Ridhaa alipoteza familia na mali yake.

> “Familia yangu na mali yote hii kuteketea siku moja? Bila shaka hili ni zao lingine la husuda” (uk 4).

Ridhaa anakumbuka jinsi alivyotazama katika runinga majumba yake matatu yakibomolewa na matrekta ya Baraza la Jiji (uk 13) kwa kisingizio cha kujengwa mahali

palipokuwa pametengwa kwa ujenzi wa barabara. Familia zilizohusika hazikufidiwa.

Baada ya Kiongozi Mwekevu kuchaguliwa, wapinzani wake walipinga ushindi wake. Waliomuunga mpinzani wake wa kiume walisema kuwa:

> "Hakuna amani bila kuheshimu mwanamume. Hatuwezi kukubali haya. Hata mizimu itatucheka" (uk 20).

Tukio lililofuata lilikuwa ni magari yaliyokuwa barabarani kuchomwa.

4.1.3 Kusambarika kwa Familia

Vita vya kiukoo vilisababisha familia kutengana. Ridhaa anasema kuwa alipoteza familia yake baada ya majirani kuwachoma Terry, Tila, Mukeli na mkaza mwana Becky pamoja na mjukuu Lily (uk 3). Aliachwa pweke hadi pale Mwangeka aliyekuwa ughaibuni aliporudi na kujiunga naye. Familia ya Mzee Kaizari aliyekuwa shemejiye Ridhaa, ilitengana na majirani wa miaka mingi (uk 26). Ridhaa, Kaizari, Subira na watoto wao Lime na Mwanaheri walikuwa wakimuunga mkono Kiongozi Mwekevu aliyekuwa akikataliwa na koo zingine. Mwandishi anasema kuwa Mwangeka alipokuwa amesafiri ughaibuni kwenda kulinda usalama, vita vya wenyewe kwa wenyewe vilizuka katika nchi yake ya Wahafidhina. Katika mtafuruku huo, alipoteza bibiye Becky na mtoto wao Lily (uk 3).

Familia ya Kang'ata na mkewe Ndarine waliishi kama skwota katika shamba la Kiriri, mwajiri wao. Shamba hili lilikuwa katika Msitu wa Mamba (uk 63). Kiriri alikufa kutokana na upweke baada ya bibiye Annette kumwacha na kwenda kuishi ughaibuni pamoja na watoto walipopata *Green Card*. Kiriri alimsihi bibiye asimnyime ushirika wa wanawe akakataa. Watoto walipokamilisha masomo walikatalia kule. Hatimaye alikufa kutokana na kihoro cha kufilisika na ukiwa aliokuwa ameachiwa na mkewe Annette.

Familia ya Lunga ilihamishwa na uongozi wa nchi kutoka Mlima wa Mamba hadi Mlima wa Simba (uk 79). Moyo wake ulikataa kuyakubali mazingira hayo mapya hata ingawa serikali iliwajengea nyumba. Naomi, mkewe Lunga aliikataa nyumba yenyewe kwa kusema kuwa:

> "Haya siyo niliyotaka. Hivi sivyo nilivyotaka kuwakuza Umu na wanuna wake" uk 80.

Asubuhi moja Lunga aliamshwa na mlio wa rununu yake na kupata ujumbe mfupi kutoka kwa mkewe Naomi. Alikuwa ameondoka na kumwachia malezi ya Umu, Dick na Mwaliko. Lunga alilazimika kuwa baba na mama wa watoto wake. Kabla ya mwisho wa mwaka Lunga alifariki na kuwaacha watoto wake mikononi mwa kijakazi wao Sauna. Sauna aliishia kuwalangua Dick na Mwaliko kwa Bi Kangara na Mzee Buda mtawalia (uk 82) ili kutumiwa kuuza dawa za kulevya.

Bibiye Mzee Kaizari, aliyeitwa Subira na watoto wao Lime na Mwanaheri ilisambaratika. Mwandishi anasema kuwa, baada ya kurudishwa nyumbani kutoka Msitu wa Mamba hadi Msitu wa Simba uhasama ulizuka baina ya Subira na mama mkwe. Alichukiwa kwa kutoka katika jamii ya Bamwezi na kuolewa kwa Wanyamvua. Mama mkwe alimwona kama chanzo cha kuharibiwa kwa mali yao (uk 94). Siku moja Subira alimwandikia Mwanaheri barua akimwambia kuwa kachoka na kubaguliwa, kufitiniwa na kulaumiwa kwa asiyoyatenda na wakwe zake. Alimwomba Mwanaheri kumtunza Lime kisha akajiondokea. Mzee Kaizari alipoamua kwenda kumtafuta Subira mjini, alipata amejifia chumbani mwake (uk 97).

4.1.4 Watoto wa Mitaani

Kutokana na vita vya wenyewe kwa wenyewe, watoto huishia kujipata mtaani kwa kukosa makao baada ya familia zao kusambaratika. Katika riwaya husika baadhi ya watoto wamo mitaani wakiombaomba kutoka kwa wapita njia. Umu anaelezea kisa cha watoto wa kuombaomba (uk 86) walioishi karibu na kanisa la Mtakatifu Fatma. Kutokana na huruma yake kwao, Umu alimwomba mamake shilingi 20 kisha akaongezea zake mia mbili na kumpa kijana aliyeitwa Hazina.

Katika kutembea kwake baada ya Sauna kuwatorosha nduguze; Dick na Mwaliko, Umu alikumbana na kundi kubwa kama wingu la nzige la vijana nje ya mkahawa. Vijana hawa walikuwa na macho mekundu ya kutisha huku wameshika gundi. Alipatana na Hazina akiwa mfanyikazi katika hoteli hii. Hazina alimpeleka katika makao ya watoto alimoishi. Mama Julida aliyekuwa msimamizi wa makao hayo alimpokea Umu (uk 89). Julida alimhakikishia Umu kuwa Wizara ya Elimu ingempa uhamisho kutoka Shule ya Mtende hadi Shule ya Tangamano ambapo angejiunga na kidato cha pili.

4.1.5 Ulanguzi wa Dawa za Kulevya

Vita vya kikabila baina ya koo za Wahafidhina vilisababisha maovu kutendeka katika jamii. Baadhi ya wanajamii walipata fursa ya kulangua dawa za kulevya kwa kuwatumia watoto wadogo. Hawa ni wale ambao walikuwa hawana wazazi wa kuwashughulikia baada ya familia zao kutengana. Watoto wengine walijipata mtaani bila makao na hatimaye kuanza kutumia dawa za kulevya kama vile gundi. Mwandishi anamrejelea Hazina, kijana aliyewahi kusaidiwa na Umu kwa shilingi mia mbili na ishirini walipopatana kwa mara ya kwanza (uk 88), aliokolewa na serikali kwa kumtoa mtaani alikokuwa akivuta gundi na kutumia mihadarati kisha akapelekwa shule.

Kutokana na mwandishi, inafahamika kwamba Dick akiwa miaka kumi alikuwa tayari keshalazimishwa kujiunga na biashara haramu ya kuuza dawa za kulevya (uk 119). Kijakazi Sauna ndiye aliyemtosa katika biashara hii baada ya baba yao kufa. Dick anasema kwamba amesafirisha maelfu na maelfu ya vifurushi vya dawa hizi kwa kuzimeza na kwenda kuzitapika ughaibuni. Sauna alipomwiba Dick, alimpelekea baba tajiri-Mzee Buda aliyejitia kumpeleka shule na badalake alimwigiza katika biashara hii.

Lunga alikufa baada ya kuachiwa jukumu la kuwalea watoto na mkewe Naomi. Watoto wake Umu, Dick na Mwaliko waliachwa katika mikono ya kijakazi Sauna. Sauna aliwabadilika watoto hawa kwani alijiunga na Bi Kangara na kuwa wakala wake katika biashara ya kulangua watoto (uk 157). Kwa kumtumia Sauna, Bi Kangara aliwapata wasichana wa kuuza katika madanguro na kwa wavulana wa matajiri ili washiriki katika ulanguzi wa dawa za kulevya. Wawili hawa walimweka Mwaliko ambaye alichukuliwa na polisi na kupelekwa katika kituo cha watoto mayatima cha Benefactor (uk 158) baada ya kugunduliwa na polisi kwani hakuwa na makao.

4.1.6 Ukosefu wa Chakula

Mzee Kaizari alijipata akinga'ang'ania chakula na wenzake bila kujali matabaka yao katika Msitu wa Simba walikohamishwa baada ya vita. Anasema kuwa:

> "Mipaka ya kitabaka imebanwa. Kwa kweli haipo kwani hata sasa nisemapo nang'ang'ania chakula-uji hasa-na aliyekuwa Waziri wa Fedha miaka mitano iliyopita. Hilo usilione dogo kwani unajua kuwa wenzetu hawa katika hali ya kawaida ni watu wenye shughuli na hali zao. Ila sasa inabidi waniite ndugu; hasa Ndugu Kaizari" (uk 15).

Ridhaa hata ingawa alikuwa daktari, alilazimika kula mizizimwitu kutokana na kukosa chakula (uk 16). Wakimbizi walisaidika tu kwa mgao wa chakula kutoka kwa vikundi kama; *Mothers Union*, *CWA*, *Woman's Guild,* na *Ansaar Mwangaza* (uk 32). Magunia ya mahindi na maharage, bandali za unga na madebe ya mafuta ya kukaangia yaligawiwa kila familia kwa vipimo sawa. Hata hivyo, baadhi ya wakimbizi walifisidi wakapata kiwango zaidi cha chakula. Kwa mfano, aliyekuwa diwani wa kina Mzee kedi; Bwana Kute alifanya ujanja ili apate mafungu zaidi. Familia moja ilijigawa ikazaa familia nyingine mbili na hata tatu. Hatimaye, Bwana Kute alipata mara tatu ya posho (uk 33).

4.1.7. Ubakaji

Mzee Kaizari alikuwa akimuunga mkono kiongozi mpya aliyetawazwa-Mwekevu ilhali jamii yake ilikuwa ikiunga mkono mpinzani wake. Siku ya nne baada ya 'mapinduzi', genge la mabarobaro watano lilifika kwake ili kulipiza kisasi kutokana na Mzee Kaizari kumpigia kura mpinzani wao. Genge hili lilimpiga Subira kwa shime hadi akazirai. Kilichofuata kilikuwa ni kitendo cha kuwabaka wasichana wa Mzee Kaizari-Mwanaheri na Lime. Mzee Kaizari anasema:

> "Sikuweza kuvumilia kuona unyama waliotendewa. Nilijaribu kwa jino na ukucha kuwaokoa lakini likawa suala la mume nguvuze! Mahasimu hawa walitekeleza unyama wao na kuniacha bila kunigusa, niuguze majeraha ya moyo" uk 25.

4.1.8 Ukosefu wa Mahitaji ya Kimsingi

Vita baina ya koo za Wahafidhina vilisababisha watu kuhamia katika Msitu wa Mamba ambapo mto wa Mamba ulipitia (uk 27). Mzee Kaizari anasema kuwa walijenga vijumba vilivyoezekwa kwa nyasi na kuta zake kukandikwa kwa udongo. Walikosa maji safi ya kunywa na waliyoyapata yaliwasababishia homa ya matumbo baada ya kuyatumia.

Ukosefu wa misala ulipelekea kuzuka kwa vyoo vya kupeperushwa. Serikali iliwaahidi kuwajengea nyumba za hadhi kwa gharama nafuu, kutahamaki nyumba zenyewe zilichukuliwa na ao hao waliotoa ahadi (uk 28).

Msichana Kairu anamwelezea Umu na wenzake wakiwa katika shule ya Tangamano kuwa, walipofurushwa kutoka kwao kwenda Msitu wa Mamba, mama yao aliwaelekeza msituni ambapo kitinda mimba wao alishindwa kukamilisha safari. Alifia mgongoni mwa mamake. Mama alimzika huko msituni kwa kutumia kiserema (uk 91). Walipokuwa wametembea hadi wakashindwa na safari, waliketi kando ya njia ili kungojea kifo. Mara walikuja watu wa *IDR* ambao waliwasomba na kuwatia kambini, watoto kwa watu wazima wakawa wamejazana. Watoto walilala katika kibanda kimoja na wazazi wao. Miiko ilivunjwa (uk 92).

5.0 Hitimisho

Makala haya yamebainisha kwamba mwandishi Assumpta Matei ameangazia athari za vita vya ukabila katika riwaya teule. Athari hizi ni pamoja na vifo, uharibifu wa mali, kusambaratika kwa familia, watoto wa mitaani, ulanguzi wa dawa za kulevya, ukosefu wa chakula, ubakaji na ukosefu wa mahitaji ya kimsingi. Ili jamii yoyote ile iwe na amani, mshikamano na uchumi kuimarika, kuna haja ya makabila tofauti kuishi bila kuwa na mzozano baina yao.

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Matumizi ya Mbinu ya Weusi na Uwili: Tathmini ya Riwaya ya Kidagaa Kimemwozea

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IKISIRI

Kulingana na Wamitila (2008), matumizi ya mtindo katika kazi za fasihi ndicho kipengele ambacho humtofautisha mtunzi mmoja na mwingine. Hii inatokana na ukweli kwamba kila mtunzi anao mtindo wake wa kuwasilisha jambo mbele ya hadhira yake kwa namna ambayo yeye binafsi anaona kuwa ni sahihi kufanya hivyo. Basi, lengo la makala haya ni kubainisha matumizi ya mbinu ya weusi na ya uwili katika riwaya ya *Kidagaa Kimemwozea* ya Ken Walibora. Isitoshe, makala haya yataeleza dhima ya weusi na uwili katika riwaya hii. Makala haya yametumikiza nadharia ya Elimu-mtindo kwa mtazamo wa Leech na Short (1981). Data ya makala ilipatikana maktabani kwa kusoma riwaya teule kisha ikachanganuliwa kwa misingi ya nadharia iliyoteuliwa na lengo la makala. Ilibainika kuwa mwandishi ametumia mbinu ya weusi ili kuashiria kukosa tumaini, matatizo ya wahusika, dhuluma dhidi ya Waafrika kutoka kwa Wakoloni, hatari, kutoshughulikiwa, ukali, na pia tisho. Mtafiti alibaini kuwa sababu zilizomfanya mwandishi kutumia mbinu ya uwili ili kuashiria ubunifu na uhuru wake katika utunzi.

Istilahi Muhimu: Weusi, Uwili, Elimu-mtindo.

1.0 Utangulizi

Kulingana na Wamitila (2002), mtindo ni kipengele cha fani ambacho huelezwa na wataalamu wa fasihi kama namna au jinsi mtunzi wa kazi ya fasihi anavyoiunda kazi yake na kuiwasilisha kwa hadhira iliyokusudiwa kwa ujumbe na dhamira ile ile aliyotaka hadhira iipate. Naye Msokile (1993) katika kufafanua dhana ya mtindo, anaeleza kuwa mtindo unaweza ukabainishwa katika makundi matatu ambayo ni namna msanii anavyoyawasilisha mawazo yake kwa hadhira, namna ya uandishi kwa kipindi fulani cha kihistoria, ufundi, umahiri na hisia za mtu binafsi katika

kutenda kazi yake. Wamitila (keshatajwa) anasema kuwa uhuru wa msanii kwa kawaida hubainika katika vipengele vya fani na maudhui ambavyo humpa upekee wake. Wachambuzi wengine wa kazi za sanaa huita mtindo. Ni kutokana na maelezo haya ambapo makala haya yalikusudia kubainisha sababu kuu za mwandishi za kutumia mbinu ya weusi na ya uwili katika riwaya ya *Kidagaa Kimemwozea*.

1.1. Wasifu wa Mwandishi Ken Walibora

Kulingana na Mbati (2020) na Cheruiyot (2020), Ken walibora alizaliwa Januari 6, mwaka 1964 kama mtoto wa tatu (kitinda mimba) wa Peter Wafula na Ruth Nasambu Makali na kuitwa jina la Kennedy Walibora Waliaula huko Baraki, kaunti ya Bungoma magharibi mwa Kenya, kisha wakahamia Kitale akiwa na miaka minne na baadaye Cherangany. Mamake aliaga 1984 akiwa miaka 51 kutokana na ugonjwa wa muda mrefu. Ken alikuwa na umri wa miaka 20. Naye babake aliaga mwaka wa 2006. Mwandishi alikuwa na majina mawili ya Kiingereza, Kenny na George. Alichagua kutumia jina Kennedy. Baadaye alibadili jina lake na kufahamika kama Walibora, ambalo lilikuwa linamaanisha kuwa ni bora kwa Kiswahili na kufupisha jina lake la kwanza kuwa Ken. Baada ya mamake kuaga, Ken alilelewa na mamake wa kambo Eunice Wafula.

Kulingana na tawasifu ya Ken Walibora katika riwaya ya *Nasikia Sauti ya Mama* (Walibora 2014) walihama Baraki baada ya kifo cha ndugu yake ambaye inaaminika alitiliwa sumu na mke wa ndugu wa kambo wa babake. Baada ya kakaye Ken kufa na kuzikwa yule muuaji alipania kumuua Ken Walibora ambaye alikuwa bado hajafikisha mwaka mmoja. Mtuhumiwa anakisiwa kuwa alienda akamchukua Ken kutoka kwa dadake ambaye alikuwa amempakata, akaenda naye nyuma ya nyumba kisha dadake kumfuata ndiposa akashuhudia akimlisha kitu cha ajabu. Baada ya hapo afya Ken ilidhoofika lakini kwa bahati nzuri akaokolewa na wataalamu wa kuganga matatizo ya aina hiyo.

Alipofikisha umri wa kwenda shule mwaka wa 1971 alijiunga na shule zifuatazo: Shule ya msingi ya St. Joseph- Teremi, Shule ya upili ya Suremi, shule ya upili ya Ole Kajiado, Chuo Kikuu cha Nairobi na chuo kikuu cha Ohio-Marekani. Aliaga dunia baada ya kugongwa na gari tarehe 10 Aprili 2020. Ken Walibora aliandika vitabu kama vile *Siku Njema* (1996), *Ndoto ya Amerika* (2001), *Kufa Kuzikana (*2003), *Kidagaa Kimemwozea* (2012), *Ndoto ya Almasi* (2012) na *Nasikia Sauti ya Mama* (2014). Alishirikiana na Said Mohamed katika kuandika kitabu cha hadithi fupi cha *Damu Nyeusi na Hadithi Nyingine* (2013).

Gikambi (2020), anasema kuwa Ken alifariki tarehe 10 Aprili 2020 baada ya kugongwa na gari, Nairobi kama polisi walivyoripoti. Alizikwa Jumatano tarehe 22 Aprili 2020 nyumbani kwake Makutano kwa Ngozi, jimbo la Cherang'any huko kaunti ya Trans Nzoia magharibi mwa Kenya.

1.2 Muhtasari wa Riwaya ya *Kidagaa Kimemwozea.*

Riwaya hii inawahusu wahusika wawili Amani na Imani ambao wako safarini kwenda Sokomoko ili kusaka ukweli kuhusu changamoto za familia zao. Wanapata ajira kwa Mtemi Nasaba Bora na Majisifu mtawalia. Hatima ya safari yao ni kuwa wanapata hatimiliki za ardhi za wazazi wao zilizokuwa zimechukuliwa na Mtemi Nasaba Bora. Amani aliamua kuwagawia vijisehemu baadhi ya wahusika waliokuwa wamepokonywa ardhi na waliokuwa bila kama Matuko Weye. Amani alishirikiana na

Madhubuti, mtoto wa Nasaba Bora ili kuunda jamii mpya ya Wanasokomoko.

2.0 Nadharia ya Utafiti

Makala haya yametumikiza nadharia ya Elimu-Mtindo. Fasili ya mtindo bado ina utata kwa maana ziko namna tofauti za kuifasili dhana hii ya mtindo. Ila kwa mtazamo wa hivi karibuni yaani karne ya 20, wataalamu kama Leech na Short (1981), Halliday na Hassan (1971) na Enkvist (1973) wanauona mtindo kuwa ni uchaguzi au ni utofauti. Elimumtindo ni nadharia ambayo hutumia njia na utafiti wa sayansi ya lugha kuchambua kazi za fasihi. Nadharia hii ilianzishwa katika karne ya ishirini kwa lengo la kuonyesha namna mbinu za lugha zinavyotumiwa katika kazi za fasihi na athari yake katika maana ya kazi hizo. Mtindo pia huimarisha uwezo wetu wa kufikiri kuhusu lugha katika kuangalia uelewa wetu kuhusiana na kazi za fasihi. Hivyo elimu-mtindo inahusiana na namna ambavyo maneno hupangiliwa ili kuelezea ubinafsi wa mzungumzaji au mwandishi katika kutoa hisia au mawazo yake. Pia inajishughulisha na matumizi ya lugha katika mawasiliano, yaani ubunifu katika utendaji kazi wa lugha. Kila mwandishi ana namna ya pekee katika kutoa mawazo yake tofauti na waandishi wengine. Kwa kutumia msingi wa elimu-mtindo ambao ni ubunifu katika nyanja za lugha, makala haya yalichunguza namna mwandishi alivyotumia mbinu ya weusi na uwili katika riwaya ya *Kidagaa Kimemwozea*.

2.1 Mtindo kama Utofauti

Kulingana na Enkvist (keshatajwa), mtindo ni kama kanuni za utofauti katika kazi ya mwandishi. Kazi mbalimbali za kisanii huwa na utofauti hususan riwaya, tamthilia na ushairi. Kwa ujumla, mtindo unaweza kutafsiriwa kuwa namna lugha inavyoweza kutumika kiutofauti kutegemea hadhira, muktadha na lengo.

Mtindo hujumlisha lugha ya mazungumzo pamoja na ya maandishi. Aidha, unahusu kazi za kisanii zilizoandikwa na zile ambazo si za kisanii. Ni kutokana na haya ambapo Leech na Short (keshatajwa), wanadai kuwa:

> "Katika uwanja wa uandishi, kuna fasili mbalimbali kama vile upekee wa mwandishi kwa namna alivyoamua kuitumia lugha. Kwa upande mwingine, ni jinsi lugha inavyotumika kulingana na aina ya kazi, kipindi au kiwakati ilipotungwa, shule ya kitaaluma na mjumuiko wa yote kwa pamoja" (1981).

Maelezo haya yanaashiria kuwa kwa sababu lugha ina sifa ya kuweza kunyambulika, msemaji au mwandishi ana uwezo wa kuinyambua lugha kwa namna yake mwenyewe na hatimaye kuwa mazoea. Mazoea hayo huweza kufungamanisha naye katika mpito wa wakati. Kutokana na kule kutumia vipengele mbalimbali vya lugha, hivyo ndivyo hutumiwa ili kuonyesha mtindo wa msemaji au mwandishi.

3.0 Mbinu za Utafiti

Data ya makala haya ilipatikana kwa kuipitia riwaya ya *Kidagaa Kimemwozea* (Walibora, 2012) na kisha kuichanganua kwa kudondoa mbinu za uandishi za weusi na uwili kulingana na lengo la makala.

4.0. Matumizi ya mbinu ya Weusi na ya Uwili katika *Kidagaa Kimemwozea*

Baada ya kuipitia riwaya teule, mtafiti amegundua kuwa kunao matumizi ya mbinu ya weusi na ya uwili.

4.1 Mbinu ya Weusi.

Ndonye (2017), anasema kuwa rangi mbali mbali katika kazi za kifasihi hutumiwa kuashiria mambo mbalimbali ambayo yana uhalisia katika maisha ya banadamu. Kulingana na Kamusi ya Kiswahili Sanifu ya

TATAKI (2014), weusi ni rangi yenye giza kama vile ya makaa au lami. Rangi hii huweza kuashiria giza au majuto. Aidha, rangi nyeusi inaweza kuashiria matatizo au shida, mauti au kifo, uovu au hatari fulani na hata siri. Siri ni mambo yasiyotamanika kujulikana kwa watu au kwa wale wasiohusika kwayo. Isitoshe, rangi nyeusi huashiria kutokuwa na matumaini na hata kuwa katika hali ya taharuki.

Ifahamike kuwa, kila mwandishi anapoandika kazi yake hukusudia kuwasilisha jambo jipya katika ulimwengu wa utunzi (Ndonye, 2017). Kutokana na maelezo haya, mtafiti anakusudia kubainisha lengo la mwandishi la kutumia weusi katika uandishi wake.

Katika uk 1, mwandishi anaeleza kuwa Amani alikuwa na mkoba mdogo mweusi uliobeba kila kilichokuwa chake. Hii ina maana kwamba mhusika huyu alikuwa kijana asiye na tumaini kwani alikuwa ametoka kwao Ulitima (kumaanisha umaskini) akiwa amevaa sharti lililodondosha vifungo. Suruali yake ilikuwa na viraka viwili vikubwa vilivyochungulia makalioni kama vazia.

Katika safari yake ya kwenda Sokomoko, Amani alipatana na msichana Imani aliyekuwa na ngozi iliyokoza weusi kiasi cha watu kumwita “cheusi dawa” (uk 1) Mwandishi ameitumia rangi hii kwa nia ya kuonyesha machungu aliyokuwa nayo Imani baada ya watu wasiojulikana kuchoma nyumba yao na kumpiga mamake.

Kijana DJ alipokuwa akiogelea bila kujali, fahali mmoja mkubwa mweusi aliyekuwa analishwa karibu na kaptula moja kuukuu, aliizoa kinywani na kuanza kuisagasaga (uk 7). DJ alibaki bila nguo. Machozi yalimtoka njia mbili mbili tu ishara ya kukosa tumaini. Ilimbidi Amani kumpa lake ili kujisetiri.

Kulingana na mwandishi, eneo la Sokomoko lilikuwa limetengewa Wazungu peke yao katika enzi ya ukoloni (uk 12). Watu weusi nao walitengewa sehemu kama vile Ulitima na Mabondeni. Hata hawakuruhusiwa kumiliki walau ndama wala mwembe mmoja huko Sokomoko. Watu weusi walitakiwa kufuga mifugo ya kienyeji na iwe ni nje ya Sokomoko. Aidha, ilikuwa ni haramu kwao kupanda mazao yaletayo faida. Rangi nyeusi kwa Mwafrika iliashiria unyanyasaji kutoka kwa wakoloni kwa sababu ya rangi yake. Waafrika walidhulumiwa kwa njia zozote zile.

Katika maskani ya Mtemi Nasaba Bora, kulikuwa na majibwa mawili meusi ambayo yaliwabwekea Amani na Imani (uk 20). Mtemi aliwatumia ili kuwatia hofu wote waliomtembelea. Mwandishi anasema kwamba jibwa moja liitwalo Jimmy liliishia kumng’ata DJ. Lilikuwa likiugua ugonjwa wa *rabbies* (uk 104).

Mtemi Nasaba Bora alimiliki gari la aina ya *Nissan Sunny*. Amani na Imani walipomtembelea walimsaidia kulisukuma huku likitoa wingu kubwa la moshi mweusi (uk 22). Kitambo likiwa nzuri lakini Mtemi mwenyewe hakutaka kutumia hela nyingi kulifanyia matengenezo yahitajikayo au kununua jipya. Moshi huu mweusi ulikuwa na ishara ya gari hili kutoshughulikiwa basi kuwa na matatizo anuwai.

Katika ukurasa wa 36, mwandishi anaelezea jinsi Amani alivyokipata kitoto cheusi kivulana chenye siha nzuri na miguu ya matege kimeachwa mlangoni mwa kibanda chake. Hakujua asili wala fasili yacho. Weusi huu ulikuwa na ishara ya kukosa matumaini kwani kilikuwa kimekataliwa na wazazi wake waliokuwa Mtemi Nasaba Bora na Lowela, msichana wa Maozi aliyekuwa mwajiri wa DJ. Hatimaye, kitoto hiki kilikufa

kutokana na ugonjwa wa homa ya matumbo (uk 77).

Amani anaeleza kuwa baada ya kutoka kifungoni alipokuwa amefungwa kwa masingizio ya wanafunzi wenzake, alitembelea familia ya Fao waliyesoma naye na kukutana na dadake Fao, msichana mnene mweusi aliyekuwa kazaa mtoto ingawa alikuwa hajaolewa hata chuo kimoja (uk 36). Msichana huyu alikuwa kakosa tumaini katika maisha.

Baada ya kitoto Uhuru kufa, Amani na Imani watiwa ndani na Mtemi Nasaba Bora kwa tuhuma za kumuua. Walipotiwa seli walipatana na askari mmoja mrefu kama twiga na mweusi kama usiku ambaye aliukomolea mlango kwa nguvu (uk 83). Nia yake ilikuwa ni kuwatia hofu na kuwaonyesha kuwa hawakuwa na matumaini ya kutoka pale. Alitumiwa kuwatisha kwa kuwaita wauaji waliostahili kifo kama kitoto Uhuru.

Mzee Matuko Weye alimwambia Imani walipokutana seli kuwa mkoloni Mzungu alikuwa afadhali kuliko mkoloni mweusi (uk 85). Mhusika huyu alikuwa ameshuhudia unyanyasaji wa watu weusi kutoka kwa wenzao weusi kama Mtemi Nasaba Bora ambaye alikuwa ameyanyakua mashamba ya raia wa Sokomoko kama lile la kina Imani na kumuua babuye Amani aliyeitwa Hamadi Chichiri. Aidha, Mtemi alikuwa amemchumbia Lowela, msichana mdogo wa Maozi. Raia walikuwa wamekosa tumaini chini ya utawala wa viongozi weusi.

Mtemi Nasaba Bora aliwatembelea Amani na Imani katika seli na gari lake lilipoondoka, mwandishi anasema kwamba liliacha nyuma wingu kubwa la moshi mweusi (uk 89). Mara tu alipoondoka mahabusu Imani na Amani walianza kufanyiwa kazi. Askari waliwapiga bila huruma. Moshi huo uliashiria ukatili waliokabiliana nao Imani na Amani katika mikono ya askari.

Kwa jumla, mwandishi ametumia mbinu ya weusi ili kuashiria taharuki, kutoshughulikiwa, kukosa matumaini, hofu, matatizo, ukatili, giza na hatari.

4.2 Mbinu ya Uwili

Mwandishi anaonekana kupanga wahusika wake katika jozi. Katika kuzungumzia suala hili, Wamitila (2003) anasema kwamba, dhana ya mtindo hurejelea jinsi ya kujieleza katika kazi ya kifasihi. Aidha, ni jinsi mwandishi fulani anavyojieleza katika kazi yake. Kila msanii hujitahidi kubuni ili kujitofautisha na wasanii wengine.

Katika ukurasa 1, kunao vijana wawili Amani na Imani ambao wako safarini kwenda Sokomoko ambako wanapata ajira kwa Mtemi Nasaba Bora na nduguye Majisifu mtawalia. Mwandishi amewatumia wahusika hawa wanne kama wahusika wakuu katika riwaya husika.

Riwaya hii inahusu hadithi mbili. Mojawapo ni hadithi kuu *Kidagaa Kimemwozea* na kuna mswada wa *Kidagaa Kimemwozea* ambao unasemekana kuibiwa na Majisifu ukiwa umeandikwa na Amani. Riwaya ya pili inaibua mgogoro wa wizi wa miswada huku ikitumika kama hadithi ndani ya hadithi. Hadithi kuu nayo inaangazia kuharibikiwa kwa mambo kwa wahusika wake.

DJ alipokutana na Imani na Amani kando ya Mto Kiberenge (uk 3), kando ya kichaka kulikuwapo na tumbili wawili, mmoja jike na mwingine dume. Mwandishi anaeleza kuwa wakazi wa karibu na Mto Kiberenge, wa ng'ambo zote mbili walitunga wimbo uliotangaza mwiko wao wa kutoyanywa maji yake. DJ na wenzake walishangaa walipowaona Amani na Imani wakivunja mwiko huo kwa kuyanywa maji yale.

Baada ya ng'ombe kusagasaga nguo ya DJ, machozi yalimtoka njia mbili mbili (uk 8). Kijana huyu hakuwa na nguo nyingine. Ilimbidi Amani kumpa nguo yake ili kujisetiri. Miaka miwili baada ya DJ kukutana na Amani na Imani, mguu wake wa kushoto ulikuja kung'atwa na mbwa. DJ alilazwa hospitalini. Amani na Imani walipoenda kumtembelea walimkosa. Walidhania kuwa katoroka. Kumbe, alikuwa ametoroka kwenda kutafuta matibabu kwa waganga wa dawa za kienyeji. Hatimaye, alipona na kukutana na Amani na Imani.

Mbinu ya uwili imetumika pia katika kuashiria watoto wawili wa Mtemi Nasaba Bora; Madhubuti na Mashaka. Aidha, Majisifu alikuwa na mapacha wawili huku mhusika Maozi akiwa na watoto Lowela na Ben Bella. Mwandishi anaeleza kuwa Imani alikuwa na kakake wawili; Oscar Kambona na Chwechwe Makwechwe ilhali kuna wahusika wawili waliosomea ughaibuni; Fao na mtotoe Mtemi ambaye ni Madhubuti. Mwandishi amewasawiri wahusika walio wawili wawili ili kuonyesha ubunifu na ustadi wake katika kuandika kazi yake.

Kabla ya Amani na Imani kufungwa jela bila hatia, mwandishi anasema kuwa walikuwa wamefanya kazi kwa waajiri wao Majisifu na Mtemi Nasaba Bora kwa miaka miwili miwili. Wahusika hawa walikuwa wamefungwa kwa kisingizio cha kukiua kitoto kilichokuwa kimeachwa nje ya kibanda cha Amani. Kitoto hiki kilikuwa cha Lowela na Mtemi ila kiliachwa nje ya kibanda kisicho cha wazazi wake. Mwandishi anaeleza kuwa, baada ya Fao kumringa msichana wa shule alikataa kumuoa. Alipoondoka kwenda kusomea ng'ambo, kitoto kile kililetwa nje ya nyumba ya wazazi wake na kuachwa pale.

Kinachodhihirika ni kwamba mwandishi ametumia mbinu ya uwili ili kuonyesha ubunifu wake. Hii ni ishara kuwa kila mwandishi ana namna ya pekee katika kutoa mawazo yake tofauti na waandishi wengine.

5.0 Hitimisho

Makala haya yamebainisha kuwa katika riwaya ya *Kidagaa Kimemwozea* kuna matumizi ya mbinu za uandishi za weusi na uwili. Kila msanii hujitahidi kubuni ili kujitofautisha na wasanii wengine. Ubunifu katika kazi za sanaa husababishwa na athari alizozipata msanii kutokana na elimu aliyonayo, mazingira alimo au aliyokulia. Mwandishi ametumia mbinu ya weusi ili kuangazia kukosa tumaini, matatizo ya wahusika, dhuluma dhidi ya Waafrika, hatari, kutoshughulikiwa na pia tisho. Mtafiti alibaini kuwa sababu zilizomfanya mwandishi kutumia mbinu ya uwili ni kuashiria ubunifu na uhuru wake katika utunzi.

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The Use of Social Media Applications on Business Performance in the Covid 19 Era: A Study of Selected MSMES in Nairobi Central Business District

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ABSTRACT

The use of social media applications in business and marketing is not new, yet it has not been fully embraced by most organizations. The reason is that it is still misunderstood and taken as a campaign tool for publicity rather than marketing for purposes of business growth. However, society has no choice especially in the wake or pandemics such as the Covid 19; where traditional methods of business are no longer popular due to disease outbreak. As such, organizations that have embraced social media marketing are making profits. The general purpose of this study was to investigate the use of Social media applications on business performance among Micro, Small and Medium Enterprises (MSMEs) in Nairobi Central Business District (CBD). With the increasing level of entrepreneurial activities in the country, the pandemic issue and client knowledge base, the work of training and improving business networking cannot be left only to academic staff or trainers, but to the whole society. The study sought to address the following objectives: To determine the use of social media applications for marketing among MSMEs and to investigate the effects of Social media applications on business performance among MSMEs in Nairobi CBD. The study was conducted in Nairobi CBD and made use of a descriptive research design approach. The study population was business owners/entrepreneurs in Nairobi CBD and a sample size of 270 was used for the study. The data was collected by use of semi-structured online questionnaires and analyzed by use of descriptive statistics and presented in the form of tables. Findings indicated the following: That there was a statistically significant influence between social media use and business performance

represented by a p-value of 0.001. Those who used social media to conduct business during the Covid era between March and July 2020 reported improvements.

Keywords: Covid 19, Business Performance, MSMEs, Social media applications.

10.0 INTRODUCTION

Internet use is common in almost every sphere of life today and businesses have not been left behind. It allows many functions to run despite geographical locations and distance. People are not limited to one location and hence business activities can be transacted with relative ease. Of paramount importance is the use of social media marketing which has now become a common tool in advertisement campaigns and marketing activities worldwide. Facebook has been recorded to be more attractive in social media marketing than the other Social media applications due to its ability to support multiple applications and provide several links (Stavrova, 2012). Despite the growth and excitement for social media use, many organizations are unable to fully utilize social media applications in marketing and advertising. The returns from social media advertisement are also not fully quantifiable making it difficult to truck purchases and profits against hits made on the applications (Ahlberg, 2010).

In the current business environment, firms are in great competition for consumers' attention. If customer attention is well captured, it may translate to actual sales. Many factors play a role including but not limited to consumer knowledge, changing times, pandemics (such as the current Covid-19), globalization, liberalization among others. Competition has made it necessary for marketers to try more innovative and untraditional methods to get the customers' attention and hence make purchase. There is a lot of competition for customers online and companies are now turning to friends and colleagues for advice on the use of online platforms and social media platforms to advertize their products (Scarborough &Norman, 2015). It is for this reason that this research sought to examine the use of social media applications for marketing in the Covid-19 era

Statement of the Problem

The world was at the height of a crisis that had not been experienced before, known as Covid-19 pandemic. The pandemic was affecting every sector of the economy and society at large. The pandemic, was in the form of a virus that had no known cure. It was spreading easily through droplet infection and contamination of surface areas (World Health Organization, 2020). The virus attacked the respiratory system, and if in severe form, could be fatal; hence the need to stay indoors and isolate. It was for this reason of staying under mandatory lockdown that businesses that were traditionally stable, (i.e. through face-to-face purchase and selling) had difficulties in operating. Some ended up closing shop, (United Nations Development Programme, 2020).

The outbreak of the Covid 19 pandemic exerted pressure on the economy and in particular the Kenyan economy which was relying heavily of physical marketing and trading (Odhiambo, Weke, & Ngare, 2020).

The Kenya shilling, due to the curfew and lockdown could no longer stand against the dollar. This in turn led to poor business between foreign countries and Kenya. There was shortage of products in the country due to lack of exports making the Kenya shilling very vulnerable to the dollar especially from March, 2020 when the 1st case of Covid 19 was detected in the country. However, for businesses that had adopted online marketing and use of social media in advance, operations continued unhindered. It is due to the above reasons that this study sought to investigate the use of social media marketing in business performance in Nairobi County.

1.2 Objectives of the Study

i. To examine the use of Social media applications for marketing among MSMEs in Nairobi CBD
ii. To investigate the effects of Social media applications on business performance among MSMEs in Nairobi CBD

1.3 Null hypothesis

$H_{0:}$ There is no significant influence of social media application usage on business performance among MSMEs in Nairobi CBD

2.0 LITERATURE REVIEW

2.1 Theoretical Review

Technology Acceptance Theory of Adoption

Technology Acceptance Model (TAM) according to Chau and Hu (2001) explains how the user can select innovations from a broad range of technologies and apply them in their daily activities. Some individuals will more readily adopt certain innovations than others due to past experiences, ease of use, ability to learn etc. (Frambach &Schillewaert, 2002). The model is therefore important for this study since it will explain acceptance for different social media.

Social Network Theory

Kadushin (2004) explains that communication comes from a network of relations and interactions. The customer or client is able to access information concerning a product and goes ahead to purchase it or understand the functions that the product may offer. The marketer is able to disseminate information in a way that the customer will understand the product, its use and make an informed choice to purchase and consume it. Social media makes it possible for this communication to be relayed quickly, far, cheaply and almost at the same time.

2.2 Empirical Review

Challenges Facing MSMEs

The MSMEs in Kenya have faced a number of constraints that need to be addressed to enable them to improve and grow. A major concern for microenterprises is lack of business cushioning in times of crisis or during accidents among others. Kenya lacks specific legislation and set of regulations to guide or govern the operations of business sectors and specific mechanisms to support small micro enterprises during crisis. This makes most of the businesses unable to carry out operations effectively, advertisements, or proper marketing and diversification or opening of branches. The businesses are also unable to grow or expand to international

markets, hence remain local in most part of their existence (Bowen, Morara, & Mureithi, 2009)

Social Media as a Marketing Tool

People are now able to communicate widely with one another concerning many issues on life, organizations and products (Lewis, 2010). Social networking has become an everyday business idea hence the need for involvement in this area for purposes of purchases and selling (Kaplan & Haenlein, 2010). The Social media applications can be used because they enable companies to communicate directly with customers about their products and with one another in the shortest time possible.

This type of communication has created customer freedom and improved consumer knowledge on products. The customers are now in control of information and can decide what to purchase without undue influence or much persuasion but through easy navigation of gadgets (Keller, 2009). It is therefore up to the firm/organization to know how to productively engage the consumer to be able to drive sells and to be able to manage the information sent as well as the information received.

Social networking forums are also good platforms where free responses from users to advertising campaigns can be freely exchanged to create value for the firm. Most perceptions on products and services are however influenced by group norms, celebrity opinions and group identity, and could be misleading. It is for this reason that the marketer and the firm has to be careful on how to handle, comment, inform the public or place advertisement campaigns (Barnes & Barnes, 2009). As Traditional channels and methods of marketing are gradually being dissolved and replaced by more modern and technical methods fuelled by the internet, firms have to be careful on how to go about this particular social network forums (Pugh, 2010).

Measures of Business Performance

Many factors have been used to measure business performance such as: Business turnover**,** number of employees in a firm, number of branches, international presence, capital invested, market share, adoption of innovation and existence of business in the community among others. The turnover is that which indicates improved profits in the subsequent year as compared to previous years. The increase in number of employees in an organization also signifies growth of a business as well because the company is able to pay salaries and wages as explained by Mason, Bishop and Robinson (2009).

The more money a firm invests in the business, the larger the business and this includes the market share of the firm (Marram, 2003). Growth needs to be measured not just by market share and firm presence but also by the economic activity these firms are generating through the flexible use of people, technology and services. Companies that use their existing assets improve business performance and indicate a mark of continuity as described by Mark Hart and Colin Mason (2010). Idle assets are an indicator of poor performance and lack of adequate work or struggle in the

business. Mason, Bishop and Robinson (2009) also explain that adoption of innovation or new product development is considered as an indicator of improved business performance.

The age of a business or number of years of existence of a business is a good indicator of business performance. If the business has been in existence for some time, then it means it is performing well. Most high-growth firms are aged more than five years and are well known by their brand or business names by their customers (Sen & Willem te Velde, 2007)

3.0 METHODOLOGY

The study was descriptive in nature. The respondents were a random cohort selected from within Nairobi CBD consisting of 270 business owners/representatives. The respondents represented MSMEs in Nairobi between the period of March 2020 and July 30th 2020. The 270 clients were arrived at by use of the Cochran sample size formula: $N_0 = Z^2pq/e^2$. Hence $N_0 = (1.645)^2 \times (0.5)\ (0.5)/(0.005)2 = 270$. The questionnaires were circulated through an online platform to different groups and business forums and 191 responses were received; which was a70.3% response rate

4.0 KEY FINDINGS AND PRESENTATION

4.1 Demographic information of respondents

Majority of respondents (97%) had above 'O' level education qualification. They were certificate holders, diploma holders or university education; an indication of highly qualified business owners. Respondents were above 18 yrs of age and 58% were between the ages of 30 years to 40 years of age; signifying a youthful population of business owners.

Type of Businesses Owned by the Respondents

The study established that the respondents sampled by the study were involved in various business activities. According to the results, majority of the respondents were operating businesses in; catering / baking and hotel management, supplies; Clothing/ uniforms/boutique, Salon and hair accessories, agri-business, Insurance, Mpesa outlets, Building and construction/hardware, photography, Jewelry and beauty products and sale of groceries as was presented by the percentages of 27.1, 25.0, 6.25, 10.25, 6.3, 8.3, 6.3, 2.1, 2.1, 2.1, 4.2 respectively.

4.3 Forms of Business Ownership

The study established that the most respondents operated legalized businesses as indicated below. Business name (37.5%), Group business was represented by 12.5% (either self help group of registered support group), family owned businesses were represented by 12.5% and still all were also registered either as a company name or business name; companies were represented by 12.5%; and sole proprietors (not registered or registered as business name were represented by

Table 1: Forms of Business Ownership

Business ownership	Number	Frequency %
Business name	71	37.5
Group business	24	12.5
Family business	24	12.5
Company	24	12.5

Sole proprietor	48	25
Total	191	100

4.4 Business Location

Responds had both online and physical business locations. Majority of respondents represented by 73.5% used social media platforms on frequent basis as well as physical locations. The rest represented by 26.5% were purely online businesses most of which were not more than 3 years old.

4.5 Social Media Applications commonly used by respondents for Marketing

The researcher sought to find out the commonly used social media tool use by respondents and got the following responses: Watsup (62.5%), Instagram (50%), Facebook (25%), Twitter (25%), LinkedIn (12.5%), snap chat (0%) and Youtube were at 0%. Respondents used a combination of two or more of the tools at any one time but Watsup app was highly preferred as an application for marketing.

Extent to which use of Social media applications Influenced Business Performance

The study sought to establish the respondents' level of agreement on whether use of Social media applications improved business performance and 70.9% of respondents were in agreement that social media had improved business performance.

Table 2: Social media applications Influence on Business Performance

	Frequency	Percent	Cumulative Percent
Yes	134	70.2	70.9
No	31	16.2	87.3
Not sure	24	12.6	100.0
Total	189	99.0	
Not indicated	2	1.0	
Total	191	100.0	

4.7 Measures of Business Performance

The respondents agreed that there were benefits of using the Social media applications in improving business performance as indicated below: The respondents were able to reach target audience at 27.7%, online orders improved (38.7%), home deliveries improved as represented by 25.7% and communication with clients improved as reported by 6.8% of respondents.

Table 3: Measures of business performance

	Frequency	Percent	Cumulative Percent
Not indicated	2	1.0	1.0
Reached target audience	53	27.7	28.8
Online orders improved	74	38.7	67.5
Home deliveries improved	49	25.7	93.2
Communication with clients improved	13	6.8	100.0
Total	191	100.0	

4.8 Statistical analysis

Regression analysis was used to predict the value of Y for each given value of X. Correlation was used to analyze the degree of relationship between individual factors and business performance.

Correlation Analysis

Table 4 below shows the correlation matrix between use of social media and business performance. According to the result, there is a highly statistically significant positive

relationship between use of social media and improved profits (r=0.238, p<001) at 99% confidence level, even though the relationship is weak.

Table 4: Correlation matrix on use of Social media applications on business performance

Correlation			
		Use of social media	Improved profits
Use of social media	Pearson Correlation	1	.238**
	Sig. (2-tailed)		.001
	N	191	191
Improved profits	Pearson Correlation	.238**	1
	Sig. (2-tailed)	.001	
	N	191	191

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

Regression Analysis on use of Social media applications on business performance

The study conducted regression analysis to establish the relationship between the study variables which were influence of Social media applications on business performance. The information on table 5 below shows the adjusted R square of 0.052 means that the variables studied contribute to 5.2% of the factors that influence business performance hence other factors contribute to 94.8 %. Since the R square is 0.057, a conclusion can be made that Social media applications are positively correlated with business performance but the relationship is very weak since R is close to 0.

Table 5: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.238[a]	.057	.052	.876

a. Predictors: (Constant), Use of social media apps

ANOVA results

From the ANOVA table 6 below, the p<0.001; meaning rejection of the null hypothesis that there is no significant influence of social media use on business performance. This implies that there is a statistically significant influence of social media use on business performance.

Table 6: ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.749	1	8.749	11.392	.001[b]
	Residual	145.156	189	.768		
	Total	153.906	190			

a. Dependent Variable: Improved business performance

b. Predictors: (Constant), Use of social media

Regression Coefficients

From the coefficient model below (table 7) we can conclude that on average, a unit increase in use of social media leads to a 0.305 increase in business performance.

Table 7: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.674	.142		11.753	.000
	Use of social media	.305	.090	.238	3.375	.001

a. Dependent Variable: Improved profits

5.0 Conclusion and Recommendations

5.1 Conclusion

The study concludes that the innovative use of several social media platforms and applications influenced business performance significantly. The hypothesis test was significant which led to rejection of

the null hypothesis that there was no significant influence of social media on business performance ($p<0.001$).

Roles played by entrepreneurs had an influence on the adoption of innovation, especially during the Covid-19 period when businesses were not fully operational physically. Of great influence was the ability of the business owners to engage clients online as well as revive old communication networks which saw past clients accessed. The owners reported improved business as well as use of multiple communication channels to deliver goods to clients both at homes and work places. Business people who were able to use social media to reach clients and customers reported improved profits and business operations during the period.

Marketers reached clients and were able to address their needs beyond selling. Some of the needs that were met include the following: Getting feedback on training programs that would be beneficial during the pandemic period; feedback on business activities that would be beneficial during the Covid-19 period, methods of improving profitability and ability to retain the customers. Others include access to financial investments; how to improve customer satisfaction and reduce customer complaints among other benefits. The study concluded that there was need to promote social media training to staff and usage at all levels of business.

5.2 Recommendations

The study recommends that there is need for the members to adopt and equip themselves with more innovative and recent social media applications. Businesses should make use of faster friendlier applications for the purpose of cutting costs while at the same time, meeting customer satisfaction during the period.

There is need for entrepreneurial and social media training programs to improve social media usage. However, since social media is cheaper and accessible, it should be fully adopted by all businesses since it is a cheap way of conducting business.

Customers should be part of the social media adoption processes and be encouraged to give feedback since they are the 'owners' of the products. Training for staff should go beyond the class room mode or face to face mode but should be done online as well so that all employees of the organization are up to date concerning current innovative ideas.

The study should be run over a period of 6 months to one year for the purpose of collecting information that can be quantitative in terms of financial returns from social media usages/applications or hits made to quantify business performance on capital invested.

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Deployment of Block Chain Technology on Supply Chains: Opportunities during Emergencies. Insights from Related Literature

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ABSTRACT

Corona Pandemic, Covid-19 as was declared by the World Health Organization was a worldwide disaster. It closed off countries and destabilized businesses. Corona pandemic had unprecedented effects on global trade with many countires on lock down. With the 2nd wave hitting quite a number of countries, the worst was expected. Interestingly Africa was not as adversely affected in terms of infections as earlier predicted. However the cross border business was affected. The aim of this paper was to find out the ripple effect of the Covid-19 pandemic on the global supply chain with a focus on Kenya and the business opportunities that the pandemic offered to Africans. Being a very new area, this research was an analysis of trends and opportunities in order to create knowledge. This was done through review of available information. Aspects like e-commerce and blockchain analysis were the focus of this paper. Supply chains were facing uprecedented challenges from Artificial Intelligence (AI) . With the 4th industrial revolution also coming in, then businesses having to think outside the box to come up with solutions that would stand the test of time. Technology was seen as inevitable in such circumstances.

Keywords: BlockChain, Covid 19, Supply Chain, Internet of Things.

11.0 INTRODUCTION

The financial crisis of 2008, made a group of activists to develop a decentralized, stable, autonomous and sustainable financial system that would not be influenced by any institution. Bit coin as both a payment and a

digital currency, Cryptocurrency was launched in 2009 (Leemon, 2017) and by 2018, they were over 1300 digital currencies and 500 tokens. The concept of blockchain is evolving, and while the future of Bitcoin remains unclear (as it is for the most elements of the economy) it is evident that the blockchain holds enormous potential for large-scale improvements of many different areas of economic system. (Jirenuwat, Bayatsogt, Ewing, Su-Hyun, & Bradsher, 2010)

Blockchain technology, as a source of total supply chain efficiency is important in eliminating the dependence on trust-based business transactions. A supply chain built on block chain technology would reflect efficieny in every stage of the chain thus improving efficiency. (Wangui, 2017). Nakamoto, (2008), defined Block chain as a decentralized shared network of ledgers that have many other uses. Reijers, O'Brolchain, & Haynes, (2016), stated that first applied in the design of Bitcoin in 2008, emerged from a movement of anarchists, computer scientists and crypto-enthusiasts who saw the potential of the technology as a breakthrough in the long-awaited realization of an old "cypherpunk" dream of money that is free from the control of the state and other third parties, such as commercial banks.

Dujak & Sajter, (2019), state that Blockchain technology promises overpowering trust issues and allowing trustless, secure and authenticated system of logistics and supply chain information exchange in supply networks. The new implementations within supply chain are shifting from blockchain to a wider notion of distributed ledger technologies. Paper presents description and rationale behind current and possible future applications of blockchain in logistics and supply chain. Blockchain has found its applications and is under development in logistics and supply chain activities as well. Radio-frequency identification (RFID), telematics, barcode and 2D codes, sensors-enabled technologies, Internet-of-things (IoT) and numerous other technologies are used for tracking products through the supply chain. (Dujak & Sajter, 2019).

However, until recently their true potential was not fully exploited as the underlying data was available only within an institution, a company, or perhaps exchanged with limited groups of trustworthy partners. Typically, there are numerous supply chain members each with their own information systems, but communication between these systems is limited at best. The main barrier was (and still is) the lack of trust in exchanging information. Based on these features and blockchain development in general, the pace of new implementations within supply chain is accelerating rapidly. Pilot projects are launched worldwide and supply chain industry is expecting changes. (Dujak & Sajter, 2019)

This paper aims to introduce and present the concept of blockchain and its current applications in supply chain management, current applications and future trends, the goal is to provide basic material for academics and practitioners when considering its application in supply chain activities.

This paper is structured in five sections. After the introduction, the second section presents the current state of the progress in supply networks. Third section analyses the features of blockchain as it came from the cryptocurrency universe, while the next one presents its current implementations and

advantages in supply chain and logistics. The fifth section concludes.

1. Supply chain Networks

Supply chain networks are a network of facilities and activities that deal with procurement of raw materials, transform them into intermediate and final goods, and finally ensuring that the products are delivered to the final consumer through the distribution channels. There are quite a number of relationships in these networks which include relationships with suppliers, distributors and customers at different levels and with different objectives. Thus activities in the networks include planning the activities, managing the activities, controlling the activities and managing the complex relationships that come with the supply chains.

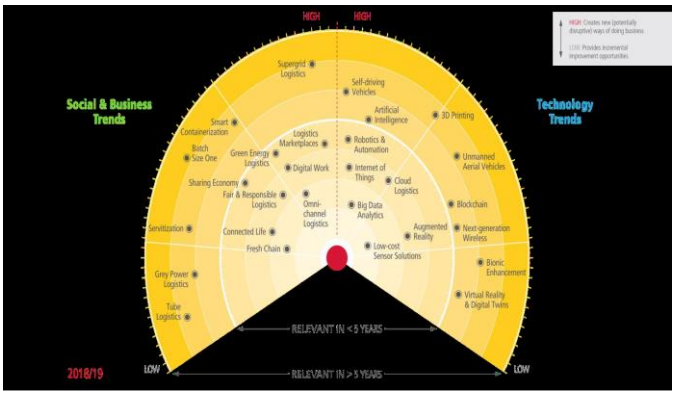
As stated by Christopher, (2011), materials management is part of supply chain networks that actually deals with upstream suppliers and the end product deals with down stream suppliers. These networks are quite complex and are gaining competitive advantage by competing among themselves and not organizations competing by themselves. Successful performance in supply networks requires ensuring proper supply network design and continuous optimization of processes that occurs within. Design of the supply network is primarily a strategic, long-term concern. Therefore, when designing a supply network, it is necessary to ensure that the supply chain configuration is effective in relation to the expected conditions, but also robust and flexible to adapt to unexpected changes in the surrounding conditions. (Dujak & Sajter, 2019). Facilities in supply network (factories, warehouses, distribution centers, stores) constitute its structure and influence its performance and cost at the same time. While adding facilities enables better customer service (shorter lead time, increased product variety and availability, improved customer shopping experience, increased visibility of supply chain order and increased product return capability), it also means increase in inventory holding and facility costs, and decrease in transportation costs. Therefore, the goal of optimizing the design of the supply or distribution network is to find a trade-off between minimizing the total cost of holding inventory, warehouse costs and transportation costs, while satisfying customer demand related primarily to delivery time. Simply put, network is optimized, “when a minimum of distribution facilities that will meet the customer’s response time is reached” (Christopher, 2011).

The 4th industrial revolution that is taking place can only work if supply chains are competitive and work efficiently and effectively. This in collaboration with the use of Artificial Intelligence and Block chain technology can then ensure that the opportunities that will come in will change the way business are done. World Economic Forum, (2018) conference on block chain stated that block chain solutions in supply chain can increase GDP’s of countries by upto 5% due to the unexplored opportunities of blockchain in supply chain. The report also stated that global trade will improve by upto 15% due to the ripple effect of the expansion of the trade from introduction of block chain in supply chain. The digitization of important documents in supply chain like bill of lading, packing lists, voyage report, voyage tracking, insurance etc rely on the effectiveness of technology to ensure that the activites are not

affected. The advent of 5G mobile network technology ensures that there is greater bandwidth and lower latency. This coupled with Google baloons ensures that even the most remote areas have access to internet and technology, all they need is software and hardware to ensure that the supply chains use the technology.

Boschi, Regero, Raimundo, & Battochio, (2018), stated that supply chains need to ensure that the ledgers in the blocks are well maintained in a trustless environemnt and this can only be achived through having smart contracts. Accordingly, a smart contract is a requisite condition in the operation written on a code. The smart contract automatically executes the transactions and record the information onto the ledger without any human intervention. The aim of smart contracts is to provide security, which is superior to traditional contract law and to reduce other transaction costs associated with contracting. It is explained as cutting costs to near-zero with a smart contract. Networked members mutually agree on the smart contract. It is a key component for establishing trust and efficiency between parties. Smart contract eliminates all the paperwork, streamlining the entire process and saving time and money.

A report by Kukelhaus, (2019), analysed the trends of how supply chains will have to adapt in both the short term and the long term through various scenarios. He summarised it in a diagram as stated below.



(Source Kukelhaus, 2019)

And from the diagram, we can see smart conternarization, wireless technology, blockchain, servitization, artificial intelligence and value chains as being quite important in ensuring that the supply chains adapt and tap into the next big things in the 4th industrial revolutions that is coming up.

2. Features of Blockchain

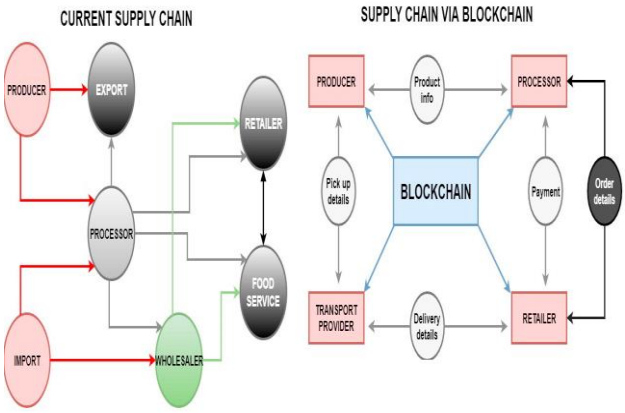
The economic meltdown of 2008 led tech gurus to develop the block chain technology through bitcoin so to avoid the impact of large banks and other companies holding institutions hostage. According to Nakamoto, (2008), the developer of bitcoin and blockchain bitcoin was evolved due to third party mediation, increase in costs, and trust issues that were erupting on the use of technology. He further stated that the cost of mediation increases transaction costs, limiting the minimum practical transaction size and cutting off the possibility for small casual transactions, and there is a broader cost in the loss of ability to make non-reversible payments for nonreversible services. A certain percentage of fraud is accepted as unavoidable. These costs and payment uncertainties can be avoided in person by using physical currency, but no mechanism exists to make payments over a

communications channel without a trusted party. (Nakamoto 2008).

Since 2008, the development of Bitcoin became the first example of a Blockchain application. Valid transactions are collected into blocks that are permanently sealed. In the report by Swinburne University (2018), they further stated that Today, applications of Blockchain technology are emerging across all sections of society and industry. For example, in the finance sector, Blockchain can simplify business processes while creating safe, trustworthy records of agreements and transactions.

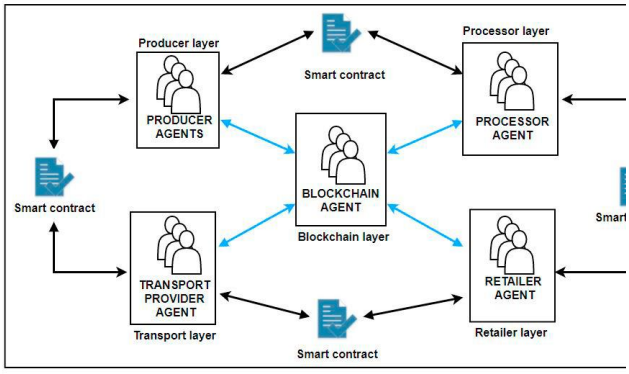
A global consortium of more than 80 institutional members has formed to develop proof of concepts and prototypes of finance systems that are disrupting the finance sector by automatic execution of finance transactions in real-time. Furthermore, in case of food supply chains for example, a Blockchain-enabled ecosystem can facilitate an end-to-end service that alleviates interruptions in supply chain occurrence of fraudulent products. By integrating supply chain management with an Internet of Things (IoT) system that supports an automated machine-to-machine communication an optimal and safe value transfer can take place across the entire process. (Swinburne 2018). Succeeding in the next industrial era requires manufacturing companies to define and shape their core value drivers enabled by digital technologies. Industry 4.0 will drive operational efficiencies through Smart Factories and Smart Supply Chains as well as grow opportunities through innovation and bespoke solutions to increase customer value. They will ultimately lead to completely new business models and service-offerings enabled through digitalization.

In the context of Casado-Vara, Prieto, De la Prieta, & Corchado, (2018), they stated that current supply chains are linear economy models in nature and as such directly or indirectly fullfil the supply chains needs. Accordingly, this model was not quite adequate. In this regard, they did a comparative model as shown below which shows the integration of block chains into supply chains. Below is the comparative model as developed by Casadro-vara *et al* (2018)



Casadro-vara *et al* (2018)

Thus the new model is non-linear but interactive and simple in its context of implementations. According to the model, blockchain uses multi agency approach so as to achieve its objectives vs a linear economy to a circular economy. Smart contracts are at every node so as to ensure that the data is viable and realtime. Below is a model that also shows how blockchain can be used in multiagency approach with different levels of smart contratcs across the chain.



Sadouskaya, (2017).

One model of understanding blockchain is through comparing it to the new application layer for Internet protocols because blockchain can enable both immediate and long-term economic transactions, and more complicated financial contracts. It can be a layer for transactions of different types of assets, currency or financial contracts. Moreover, a registry and inventory system for recording, tracking, monitoring, and transacting of all assets could be managed with blockchain. No one can change the information in blocks because they are chained to each other

Thus, we can say that the fundamental concepts of block chains are; -

Node. Peer or Node is a computer with the special software that maintains a Blockchain. All nodes are connected to the Blockchain network so they can receive and submit transactions.

Network. It is a result of cooperation of all nodes that run Blockchain software to communicate with e-*Smart contracts*. These are contracts converted into codes to be carried.

Submit transaction. When users submit transactions, they are sent to the nodes on the network who subsequently send them to other nodes.

Transaction Validation. All transactions are cryptographically validated by the nodes on the Blockchain network. Invalid transactions are ignored.

Block. It is a group of transactions collected by nodes into a bundle. To be valid blocks must be formed according to pre-determined set of rules: They must not exceed a maximum size in bytes, contain more than a maximum number of transactions, and must reference to the most recent valid block.

Blockchain. It is a chain of blocks that is organized by the following system: Each new block is attached to the most recent valid block.

Consensus. It is an agreement of all nodes in the Blockchain. To enable distributed system operation, multiple processes cooperate with each other. Faults in such systems can occur anywhere, that is why they use consensus protocols.

Hash function. It is a one-way function that reflects an input of selectable size to a fixed sized output called hash. Properties of a cryptographic hash function: 1) easy to generate the hash given the input, 2) infeasible to generate the original input given the hash, 3) virtually impossible for two similar inputs to have the same output in a so called “collision”. SHA256 – example of cryptographic hash function.

A smart contract should provide:-

a. Autonomy: can be developed by anyone, no need of intermediaries such as lawyer, brokers or auditors.

b. Efficiency: removing process intermediaries often results in significant process efficiency gains.

c. Backup: a Blockchain and smart contract deployed to it can provide a permanent record, allowing for auditing, insight, and traceability even if the creator is no longer in business

d. Accuracy: replacing human intermediaries with executable code ensures the process will always be performed the same way.

e. Cost saving: replacing intermediaries often provides significant cost reduction.

Block chain technology will now drive the 4th industrial revolution and change the dynamics of the industries through which supply chains operate. They will destabilize traditional methods of financial transactions setting an unprecedented use of artificial intelligence in the world at large.

There are basically three types of block chains as stated by Dujak & Sajter, (2019). These are:-

a) Permisionless Block chain – these include bitcoins and Etherium, that are decntralized and institutionless, fully public peer to peer netwoks where any members can join.
b) Permisionned block chains – this is almost like a federation where members form a group and new members have to be refeered to by old members – almost like a members club
c) Private block chain – where permissions are centralized with one organization which manages all the chains.

3. Opportunities of block chains in supply chain

Since supply chains deal with ensuring the 12 rights of supply chain are adhered to, which are the right price, right quality, right time, right place, right source, right quantity, right attitude, right contracts, right materials, right transportation, right condition and right customer. For these services to be well delivered, then a number of activites and processes need to take place and a trusted system of suppliers and consumers in place.

a) Track product flow visibility

Due to the increase transparency and automation of documents and activities, it is quite possible to track product flow from supplier through the transporation schedule to point of delivery covering a number of principles. As such, clearing and forwarding agents cannot lie, or delay in service delivery as the procurement officer can know when to start which process depending on the service level agreements that have been set. Thus product loss is minimized or eliminated compeletely leading to an efficient supply chain process.

To increase tracking of products through the supply chain, radio frequency identification technology (RFID), and transponders (Tags) are used to carry the information required. They can be read through the scanners and the information that is shared will vary depending on the size of the tag on the product.

b) Demand Forecasting

Demand forecasting is one of the most important things in supply chain as it helps in knowing what to buy and when to buy, to ensure that there is constant flow of materials during production taking into consideration consumption patterns, distribution, upstream supply chains and lead times. While forescasting, environemtal issues and risk management are taken into consideratons so as to ensure that the forecast is as accurate as possible. Proper forecasting ensures that the bullwhip effect in supply chain is eliminated and efficiencies and effectiveness mantained

By being able to use Enterprise Resources Planning softwares and integrating them with materials management and manufacturing requirements planning will enable prompt demand forecasting. This coupled with effieicent tracking of products means that product turnover will be quite high in the stores, and that means less losses in terms of obsolescence and less stock being held. At the end of the day efficiency and effectiveness in demand forecasting and usage of stock will be achieved leading to lean supply chain. Exchange of data between upstream suppliers, buyers and downstream suppliers is essential for demad forecasting to be effective.

c) Open Access to Information

Being a technology enabled activity means that there are threats of cybercrime among others. On the other hand, it's transactional activites allow access to information among the nodes or blocks in the block chain. This access to information ensures that the suppliers know whom they are dealing with and so do the customers. Access to information normally leads to longterm collaborative realtionships that help build competitive advantage of the supply chains. This collaborations can be in product development, research among other partnerships.

Digitization of documents and tracking of activities avoids communication between supplier and buyer as they can access the information in the block chain ledgers that is secure, authentic, and verified. This is one aspect that is most important in any business and any supply chain as a whole. Information wil be accurate and realtime as it is updated frequently within the blocks.

d) Decrease in fraud and counterfeit risks

Since the information made in these chains cannot be changed, it is easy to track who made the information, source of the products among all the information required to trace authnenticity of the products and services. Accounting activities are approved using digital signatures and as such there will be reduction in fraud and counterfeit risks. Trustless transcations that are authentic will ensure that there is legitimate businesses going on that have an audit trail of all activities and information that cannot be erased once entered.

By using the distributed ledgers, information is verified and secure throughout the chain as it is stored in a manner similar to RFID. This means security, authenticity, regulated, visibility, and verifiable information on products, documentation and services related to blockchain technology. Drugs are most prone to counterfeits and by use of this technology it is possible to track the drugs through the ledgers from point of origin to

point of consumption thus reducing fraud and counterfeits.

e) Transaction automation

Blockchains uses technology and Internet of Things and as such any organization will have to automate before it can embrace it. Integrating ERP with block chain means that automation is mandatory. By using technology, efficiency and effectiveness will be improved. The initial cost of automation may be high but the lifetime costs will be lower. Tax rebated and carbon footprints are reduced due to the fact that the paper documentation is reduced and electronic documentation is increased.

Block chains also work with smart contracts that are already incorporated in the system. This then cascades to all others, and there is no need for third parties like banks in the contracts. Aspects like fuel consumption, fuel reimbursesments, fleet management can all be automated and block chain used in their activities. It is also important to know that you can work with organizations that offer environmetal friendly products and services. Since their information is available, it can be verified then the tripple bottomline, people, planet and profits principle used in the supply chain.

f) Environment conservation

Since automation of most, if not all activities is done, paper trail is not there, leading to conservation of the environment in many ways. The blue and green technology is used alongside sustainability. Use of blockchain opens diverse opportunities in many areas including telecommunication, and thus focus can be on all aspects of the tripple bottom line, people, planets, and profits. Other principles in use include reuse, reduce and recycle concepts in the supply chain, both upstream and downstream.

Being able to track all products from source to consumption, the reverse is also possible. This is to ensure that the carbon footprints are reduced and work with companies that ensure proper environmental conservation is maintained.

g) Smart Contracts

All Block chains have smart contracts embedded in them that govern what organizations do. The first successful implementation of a blockchain-based smart contract was Bitcoin Script, a purposely not-turing-complete language with a set of simple, pre-defined commands. As simple forms of smart contracts, standard types of Bitcoin transactions, such as pay-to-public-key-hash (P2PKH) and pay-to-script-hash (P2SH), are all defined with Bitcoin Script. In addition, there also exist platforms that enable more complex contractual functionalities and flexibilities, e.g., Ethereum, which adopts a turing-complete language for smart contracts. Newer blockchain platforms such as Neo and Hyperledger Fabric allow smart contracts to be written in various high-level languages. (Hu, Liyanage, Manzoor, Thilakarathna, joujon, & Seneviratne, 2019).

There are many areas of usage for block chain and they include health care records where patients records can be accessed by health providers across the chain. Another area is identity management by countries, counties and organizations where records of an individual are kept at a central point and used by those who require. Banking is another area

where smart contracts can be used to help in financial transcations and eliminate the need for third party partners. Electronic voting is also another area where smart contracts can be used and information remain safe. Finally though not limted to the mentioned areas, smart contracts can be used in instituting insurance agreements.

h) Smart containerization

As an underlying technology, blockchain lends itself to processes that involve multiple participants, contracts, transactions, levels of approval, legal contracts, and security requirements. Supply chains are perfect examples of these complex, multi-party processes. Supply chain partners can use blockchain-based applications to meet different business needs. Smart containers are the only equipment that offers visibility into transport execution and cargo conditions from door to door. They generate valuable real-time physical tracking and monitoring data. For example, smart containers can generate data about events such as a door opening or closing, arrival or departure at a geofenced area, or temperature, humidity, and shock events occurring during the journey. This raw data is collected and processed according to the parameters of a specific use case. Attributes such as provenance, volume, timing, content, correct labeling, and others are critical for accurate supply chain analysis.

Unlike traditional business intelligence (BI) tools that cannot control data collection, require skilled users, and take extended periods of time to deliver meaningful information, AI-based analysis provides insights that matter in real time. With unprecedented insight into the cargo's journey, AI based services provide a lever for supply chain stakeholders. When this information is secured in a blockchain, it is "fingerprinted" and can be trusted by all stakeholders. The powerful combination of AI and blockchain technologies enables stakeholders to automate and accelerate decision-making with trusted information. Smart container physical data, AI, and blockchain bridge the physical world with document flows and enhance distributed business processes. Smart container analytics can be shared with shippers and other members of the supply chain to: Reduce cargo loss, damaged goods, packaging costs, and non-quality costs Levy fines (or reduce them) and assess legal costs or insurance fees, accelerate investigation processes, quickly remediate deficiencies, and minimize the impact of unavoidable delays Reduce back orders, cancelled orders, and delivery of defective products

i) Financial Transactions.

Financial institutions around the world find themselves continually barraged by external innovations they are often unable to absorb and internalize. The emergence of innovative digital financial technologies has challenged traditional players in the sector by demonstrating new ways to deliver value across the entire financial value chain. Blockchain, or distributed ledger technology, is just such a disruptive and possibly game-changing innovation. Distributed ledger technology is still in an early stage of development and deployment, yet it is widely thought to have the potential to deliver a new wave of innovation to the financial technology, or fintech, ecosystem by providing a ‘trustless’ distributed system to exchange value. Established financial

institutions are more likely to use blockchain for intra-organizational projects intended to reduce organizational complexity, improve efficiency, and reduce costs.

Banks and major financial institutions are working both collaboratively and independently to develop blockchain technology, as seen in the proliferation of global consortia. (International Finance Corporation, 2018). Blockchain's potential to disrupt the financial services ecosystem has been widely discussed, including its capacities for operational simplification, regulatory efficiency improvement (real-time monitoring of financial activity between regulators and regulated entities), counterparty risk reduction (agreements are executed in a shared, immutable environment), disintermediation for clearing and settlement of transactions, and transparency and fraud minimization in asset provenance and capital raising.

Other areas include anti money laundering and customer identification programs, trade finance and global payments, risk analysis and risk management programs, capital markets and derivatives transactions, and financing and cryptocurrency activities among others. A Kenyan company bitpesa was established in 2013 and is making inroads in this arena in Kenya and East Africa and has been able to raise venture capital to expand its territories.

j) E-commerce

The increasing spread of information and communication technologies, specifically the Internet; the global business community has been able to move towards electronic commerce. It is providing many new features such as the possibility of providing all goods on electronic platforms, providing detailed information of goods, about the products offered. Through the technologies of blockchain distributed ledger, consensus mechanism, identification, smart contract, encryption algorithm, etc., system optimizes the e-commerce business model, improves operational efficiency, and ensure financial security. A blockchain-based business service platform, has the features of distributed data storage, time series and tamperproof data, intelligent execution of smart contract, security and privacy protection. The distributed ledger uses consensus mechanism to negotiate the contents of the ledger, uses cryptographic algorithms and digital signatures to ensure the integrity of e-commerce, finance, and energy transactions. (Zhu & Wang, 2019).

Based on the blockchain architecture, the transaction system, payment system and trust system in ecommerce, it realizes the interconnection and intercommunication of e-commerce information value chain. Undoubtedly, the technology will be a crucial part of business or e-commerce in upcoming time which will lead the market world. (Sheikh, Azmathullah, & Rizwan, 2019)

k) Inventory management

A very good opportunity to control the inventory was presented during Blockchain Summit in April 26th, 2019 in San Francisco by Ernst Young (EY), where the visibility of inventory was demonstrated and how it can be used to improve supply chain management. The supply chain operations efficiency impacts an organization's competitiveness and is shaped by numerous factors. Information sharing methodologies

such as vendor managed inventory (VMI) create efficient replenishment models without the need for traditional orders (Boschi, Regero, Raimundo, & Battochio, 2018).

In theory, the blockchain can work, but supply chains are very hard to change and adapt. (Mougayar & Buterin, 2016). Mougayar thinks, that companies spend years putting supply chains in place and refining them. It is not very easy to insert a new technology inside established supply chain systems because the integration challenges are not to be underestimated." (Mougayar, 2016).

l) Vendor managed inventory

Vendor-managed inventory (VMI) is a very common supply chain (SC) management approach for improving multi-firm SC performance while establishing a mutual beneficial relationship between a vendor and a retailer. The main idea behind VMI is that the vendor is authorized to oversee product inventory for the retailer; therefore, the vendor is responsible for tracking, monitoring and replenishing the retailer's agreed-upon inventory. VMI is a streamlined approach to inventory management and order fulfillment in which both the retailer and the vendor may smoothly and accurately control the availability and flow of goods across the SC. (Casino & Dasaklis, 2019). Sometimes VMI is called Just in Time (JIT) II. For VMI to be successful, there is need to understand its requirements.

STRATEGIC	OPERATIONAL
• Information sharing • Long term Collaboration • Management Commitment • Quality of Information • Communication systems • Relationship quality • Trust • Systems Integration	• Automated data transfer system • Product Identification and tracking • Simple logistics flow and distribution channels • Low customization • Demand is easily forecasted • Data accuracy • Low variations in stock

From the above figure we see that implementation of VMI is in tandem with blockchain and it ensures that all the atributes of blockchain are also with VMI at both the operational and strategic levels. Thus, this implementation will see a reduction in stock held, capital held in stock, cost of stock, cost of obsolescence among other stock holding issues and streamline operations to ensure lean supply chain and JIT operations.

Conclusions

With the world crisis that has shut down most operations in production and finance and seeing stock markets crashing, we need to think outside the box and look for solutions to make sure that the systems do not crash or get disrupted. The supply chain, being the

active area that ensures supply of goods, services, information and people during these challenging times are faced with complex obstacles in achieving intended goals. Dimensions such as blockchains are useful in the context of "working at home" to ensure continuity of services without crashing of business activities such as stock markets among others. There is a lot more to be looked into in research and entrepreneurship in trying new things in new ways. One may have inventions that solve business problems in easier ways. However, the technology world is the way to go. Different ways of using technology ensure that businesses stay afloat in the dynamic and unpredictable world full of risks and uncertainties.

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Modelling a Forecasting Platform for Small and Medium Enterprises in Kenya

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ABSTRACT:

Small and medium enterprises' contribution to Kenya's GDP growth is vital. The use of technology to predict business operations and performance is the next frontier in ensuring business sustainability, job security and a generally good business environment. The study aimed at dealing with this information gap and equipping SME owners and managers with the right information to make informed decisions based on their data and experiences. Predicting business operations is a critical task for small and medium enterprises. With increased unpredictability in the business environment, small enterprises find themselves in the receiving end simply because they do not have the tools in decision making like their counterparts who have well established business decision-making tools. SMEs can now tap into the power of data to support decision-making. Data on sales and purchases collected by SMEs is readily available and SME owners can now benefit from the use of predictive analytics to forecast sales and purchases. The data allows SME owners to have added confidence in decision making to help propel their businesses to success.

Keywords: SMEs, Data-driven-decisions, Sales, Purchase, forecasting

1. INTRODUCTION

SMEs in developing economies experience unique sets of challenges towards attaining success (Juma & Han, 2018). In developing countries, SMEs are important pillars of the economy as they serve as a means for people's life sustenance and survival. By the fact that SMEs are owned or managed by single or few owners/managers, they bear a high cost in getting the relevant information as a base for rational decision-making. Therefore, possessing high level technology and financial literacy can greatly enhance the firm's decision-making process (Aremu & Adeyemi, 2013). The Annual Report and Financial Statements

2017/2018 by the Central Bank of Kenya indicate that SMEs constitute 98 percent of all business in Kenya. Within the 4.7% increase in GDP, 3% was attributed to SMEs. However, according to the National Bureau of statistics micro, small, and medium establishment survey report of 2016, SMEs in Kenya contributed about 40% of Kenya's GDP as at 2008. Nevertheless, 62% of these SMEs close in less than 4 years. 2.2 million SMEs closed shop between 2011 and 2016 alone. These closures were attributed to the SMEs' lack of access to adequate market information, unlike the well-established businesses. This information gap leads to unpredictable market trends, which in turn hinders the SMEs' ability to plan their sales. (Bowen & Mureithi, 2009). In this light, SME owners and managers who are able to accurately forecast their products demand and supply are in a better position to grow their businesses.

1.1.FORECASTING METHODS

Predictive analytics is a broad term used to describe a variety of statistical and analytical techniques used to develop models that predict future events or behaviors (Nyce, 2007). There are two broad forecasting approaches: -

Qualitative method, in this type of forecasting approach where decisions are based on judgments, opinions, intuition, emotions, or personal experiences and are subjective in nature. They do not rely on any rigorous mathematical computations.

Quantitative Method, in this type of forecasting decisions are based on mathematical (quantitative) models, and are objective in nature. They rely heavily on mathematical computations. Quantitative methods are further categorized into associative methods and time series models which is the focus of this research. Figure 1 below summarizes the forecasting methods.

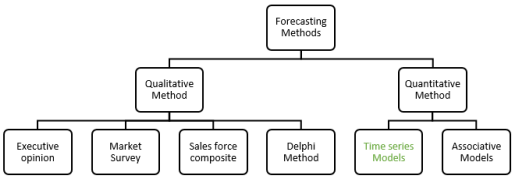

Fig 1. Forecasting Methods

1.1.1. SEASONAL NAÏVE FORECASTING

A forecast that is equal to the latest observation in a time series is known as a no change or "naïve 1" forecast. Because of its simplicity naïve forecasts is often used as a benchmark to determine if the costs and effort of applying methods that are more sophisticated are justified by their increased accuracy (McLaughlin, 1983).

A similar method is useful for highly seasonal data. In this case, we set each forecast to be equal to the last observed value from the same season of the year (e.g., the same month of the previous year). Formally, the forecast for time **T+hT+h** is denoted as follows: -

$$\gamma T + h|T = \gamma T + h - m(k+1)$$

Where ***m = the seasonal period***, and ***k is the integer part of (h−1)/***m. (i.e., the number of complete years in the forecast period prior to time **T+h).** This looks more complicated than it really is. For example, with monthly data, the forecast for all future February values is equal to the last observed February value. With quarterly data, the forecast of all future Q2 values is equal to the last observed Q2 value (where Q2 means the second quarter). Similar rules apply for other months and quarters, and for other seasonal periods.

Date (t)	Sales (A)	Forecast (F)
Month 1 D1	31	30
Month 1 D1	37	30
Month 2 D1	40	31
Month 2 D2		37

Table 1. Seasonal Naïve Example.

In R simple naïve is achieved by the following function on time series data.

snaive(y, h)

1.1.2. NAÏVE FORECASTING

I naive model, the forecast is equal to last observed value. Naïve forecasting is denoted by the formula: -

$$yT + h|T = yT$$

Date (t)	Sales (A)	Forecast (F)
1	31	30
2	37	30
3	40	37
4		40

Table 2. Naïve Example

In R, naive forecasting is achieved through the function

naïve (y, h)

1.1.3. SIMPLE EXPONENTIAL SMOOTHING FORECASTING

Exponential smoothing uses a weighted average procedure with weights declining exponentially as data age. The forecast for next period (period t) is calculated as follows:

$$\mathrm{Ft} = \mathrm{Ft}-1 + \alpha(\mathrm{At}-1 - \mathrm{Ft}-1)$$

Another way to calculate this is

$$\mathrm{Ft} = \alpha\mathrm{At}-1 + (1-\alpha)\mathrm{Ft}-1$$

Where α is is the smoothing coefficient whose value is between 0 and 1. A is the actual observation and F is the forecast value. A popular feature of exponential smoothing method is that forecasts made include a portion of every piece of historical demand. In addition, there are different weights placed on these historical demand values, with older data receiving lower weights.

Date (t)	Sales (A)	Forecast (F)
1	31	30
2	37	30.1
3	40	37.1
4		40.3

Table 3 Exponential Smoothing Calculation Example

The calculation for the forecast for day 2 is as follows 30+ 0.1(31-30) = 30.1

where $\alpha = 0.1$. Note that the Forecast for Day 1 is a guess because there is no historical data for the calculation. In R, exponential smoothing plot is achieved through the function

ses(y, h)

1.2.FORECASTING RESIDUALS

The residuals in a time series model are what is left over after fitting a model. For many (but not all) time series models, the residuals are equal to the difference between the observations and the corresponding fitted values. Residuals are useful in checking whether a model has adequately captured the information in the data. A good forecasting method will yield residuals with the following properties: -

The residuals are uncorrelated. If there are correlations between residuals, then there is information left in the residuals which should be used in computing forecasts (Cryer & Cha, 2005).

The residuals have zero mean. If the residuals have a mean other than zero, then the forecasts are biased (Cryer & Cha, 2005).

2. METHODOLOGY

For this research, a prototyping approach was used to assess the usefulness of a prediction model. Iteration was done based on the performance of the model. Prototyping in this research, is a software engineering 'process' (Floyd, 1984) that encourages the efficient development of applications by breaking complex problems down into several clear, smaller and simpler parts (Kaushaar & Shirland, 1985). A prototyping development approach helps in building, and subsequently refining, a product to meet end-user or market expectations. (Gomaa H., 1983)

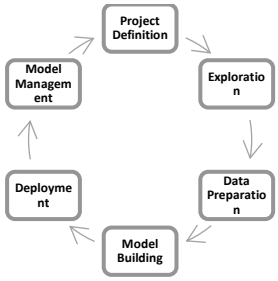

Figure 2 Predictive modeling

2.1. DATA

We solicited for one month sales orders and Purchase orders from Two SMEs in Kenya and used the data received to model a data acquisition tool that will be used in forecasting Demand and supply. The following data was identified as necessary for the forecasting of Supply and demand irrespective of the forecasting method in use.

Custom_Category – This can be a merchants' own categorization, or categorization of the business or products. Examples of possible values are [Product Names, Product Codes, Store Names, Sales person Names]. This option provides flexibility for classification

Date – This takes the format Day, Month, Year e.g (1, April 20). This records when the sales, refunds, purchases and purchase occurred.

Sales – Sales captures a complete sale order and does not take into account the products within the sales order. If users need to capture product-wise sales, then the sales here have to be in conjunction with having the product code or product description in the ***custom_category*** field

Sales_Refund – A sales return is an adjustment to sales that arises from actual return by a customer of merchandise he/she previously bought from the business.

Custom_Category	Date	Sales	Sales_Refund
Store A	01/04.2020	10	0
Store B	01/04.2020	5	3

Table 1. Example of Sales Grouped per Store

Custom_Category	Date	Sales	Sales_Refund
Product A	01/04.2020	7	2
Product B	01/04.2020	8	1

Table 4. Example of Sales Grouped per per Product

Sales and sales refunds represents demand forecasting from the perspective of the SME managers and owners. Ideally, a business will strive for high sales and low sales refunds.

Purchases – Purchases by the SME from its suppliers. The unit of measurement here is independent of the sale quantity

Purchase_Cancelation **–** Purchase-cancelation refers to when an SME returns purchased products back to its suppliers.

Custom_Category	Date	Purchases	Purchase_Cancelation
Store A	01/04.2020	10	0

Store B	01/04.2020	5	3

Table 5. Example of Sales Grouped per Store

Custom_Category	Date	Purchases	Purchase_Cancelation
Product A	01/04.2020	10	0
Product B	01/04.2020	5	3

Table 6. Example of Sales Grouped per Product

Supply- Ideally, a business will strive to have just enough quantities to fulfill its sales commitments. Having a high supply and low demand implies that a business has stock that it cannot sell, while having high sales and low supply means that a business cannot fulfil its customers demand. If the manufacturers supply goods at a rate equal to the consumer demand, the static classical theory would propose that the market is in equilibrium. However, what if there is a tremendous surplus in the store supply rooms? The manufacturers will lower the price and/or decrease production to return inventory to a desired level (Whelan & Kamil, 1996)

Location – The Location from which business operate can result in different behavior in terms of demand and supply, for this research this considered the following possibilities, Rural Area, Urban Area, and Both Rural and Urban Area.

Service – Service refers to the type of undertaking the SME carries out. The possible options here are; Merchandising, Service, Manufacturing and Hybrid Business,

Company_Size – Under the Micro and Small Enterprise Act of 2012, micro enterprises have a maximum annual turnover of KES 500,000 and employ less than 10 people. Small enterprises employ 10-49 people. Medium enterprises employ 50-99 employees (National Council for Law 2012)

Category – Categorization here refers to sectors in which an SME can belong to, according to the Global Industry Classification Standard, the possible values for this field are Energy, Materials, Industrials, Consumer Discretionary, Consumer Staples, Health Care, Financials, Information Technology, Communications services and Utilities.

2.2. ARCHITECTURE

R shiny was used to implement the seasonal naïve forecasting model. Shiny is a reactive framework that allows building of interactive web apps straight from R.

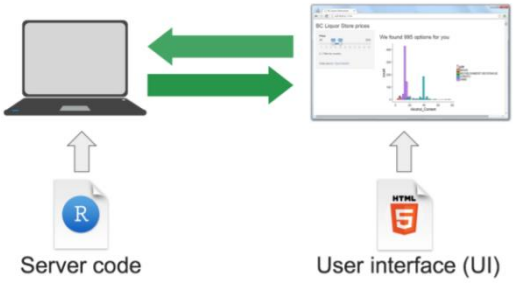

Fig 3 Reactive web framework

Data - The data folder holds the template .csv file that users and download and use it for prediction

Rsconnect - Holds a file in the Debian Control File (DCF) that contains the details about the application and the server hosting details

www- this directory is the directory expected by a Shiny application to locally store the elements that will be rendered in the web browser and are not the output of the scripts. This includes images, HTML, .js, .CSS Style sheets etc.

Server.R - The function helps **Shiny** build a distinct set of reactive objects for each user. As users interact with the widgets and

change their values, **Shiny** will re-run the **R** expressions assigned to each reactive object that depend on a widget whose value was changed.

ui.R - Shiny uses the function *fluidPage* to create a display that automatically adjusts to the dimensions of the user's browser window. The user lays out the user interface of the app by placing elements in the *fluidPage* function.

3. FORECASTING ACCURACY

There are many possible ways to measure how well the forecasting models perform. The most general practice is to compare mean absolute error (MAE) or root mean square error (RMSE), which are scale-dependent measures [Gelažanskas & Gamage, 2015]

$$nMAE = \frac{mean(|et|)}{sd(yt)}$$

$$nRMSE = \frac{\sqrt{mean(e^2t)}}{sd(yt)}$$

4. IMPLEMENTATION & RESULTS

Based on the described architecture, the implemented model provides for users to be able to download the desired data format, fill it with their own data, upload the data through an interactive web page and forecast their sales, sales refund, purchases and purchase cancelations. Through the user interface, users are given an option to choose which forecasting model they are interested in. The application also provides for the ability of users to decide the number of days that they need to forecast.

RMSE	MAE
16.8357	9.271186

Fig Naïve Forecasting Accuracy

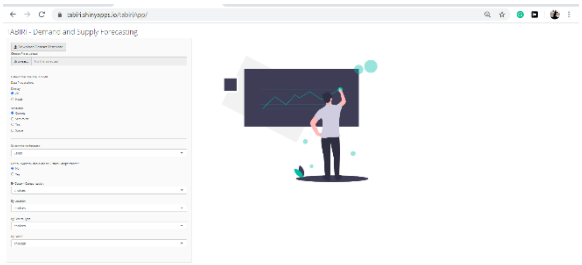

Fig 4 Forecasting Platform

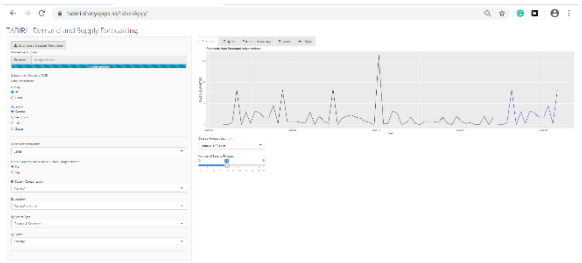

Fig 5 Seasonal Naïve Forecast

5. CONCLUSIONS & RECOMMENDATIONS

The main objective of this research was to research on the baseline forecasting models that can be used by SMEs in forecasting their daily sales, cancelled orders, purchases and canceled purchases. The baseline forecasting algorithms indicate that seasonal naïve forecasting is more accurate of the models explored. This Research forms the basis for further exploration of Seasonal Naïve Forecasting as a favorable forecasting model for Kenya's SMEs. The SME owners can take advantage of this predictive analytics to position their enterprises at an advantage and spur growth.

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Determining the Popularity and Effectiveness of Green Marketing in Kenyan University Students Market Group

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ABSTRACT

Green Marketing comprises building lucrative customer relationship with care and concern on the environment. It aims at reducing the undesirable effects of the organization's activities on the environment and making the entire process of production to supply of products eco-friendly. Nearly all the institutions, organizations, and companies across the globe are engaging in the process but unconscious of the results which the green marketing campaigns are generating. This research aimed at studying the effectiveness of green marketing by firms on specific consumer group. The study explores Kenyan University students-market age group 20-25. Excel was used in the study to bring out the required information and make conclusions. The findings revealed a high degree of unawareness amongst Kenyan University market group under study regarding the green marketing. Besides, majority of the University students-market age group 20-25 were concerned about the value of brand of the product rather than the product's price and its impact on the environment. A similar pattern was seen from students in all the universities studied. The study concludes that green marketing was not popularly and effectively used among university students as it was thought to be.

Key words: Green marketing, Sustainability, Green advertising, sustainable development

12.0 INTRODUCTION

The previous decades were characterized by increased threats of climate change. As a result, there were increased concerns in relation to degradation of the environment, and misuse of natural resources globally (Han & Hwang, 2017). In response to these augmenting concerns, companies increasingly resolved to incorporate

"green-practices" into their businesses and advertising efforts.

Amongst such efforts, green marketing or advertising has stimulated the promotion of environmental sustainability for regulators, consumers, educators, NGOs, and other stakeholders. It has quickly expanded across numerous industries. This was evident in the United States of America where the consumers started to pay more and closer attention to the ecological impacts of their actions, (Leonidou et. al., 2011). In a report by the International Trade Centre of 2017, 88% of the Americans affirmed that it is important to take care of the earth and, besides, 52% suggested that the government should be responsible for the protection of the environment.

These sentiments served to encourage businesses and corporations to use green marketing. The most effective highly ranked method of communicating green messages to consumers was found to be green advertising (Atkinson and Kim, 2015). Consequently, green marketing has been growing exponentially during the past 15 years. TerreChoice (2009), indicated that green advertising characterized over 10 percent of all the advertisements in the US in 2009 which had tripled amid 2006 and 2008. Therefore, green advertising has played an essential role in the promotion of the environmental image of companies and corporations besides the eco-friendly attributes of their commodities (Leonidou et al., 2011).

The market for sustainable commodities has constantly grown in parallel to the rise in ecological problems globally (Wang, Kirillova, and Lehto 2017). Consequently, green practices have become increasingly common in the marketing field. Amongst the practices, green marketing is often used to bridge the gap between pro-environmental attitudes among consumers and their pro-environmental intentions and behaviors according to Wang et. al., (2017). However, green marketing's effectiveness and popularity to that end varies depending on the use of specific marketing tactics. Green marketing as one of the green innovations which has fostered numerous opportunities in the business environment today is faced with a major challenge in Kenya and the rest of the world. There is lack of standard or public consensus about what constitutes "green". The lack of consensus by consumers, activists, regulators, marketers, and other influential people has slowed the growth of green products in Kenya and the rest of the world. This is because companies are often reluctant to promote their green attributes and thus consumers are often skeptical about the claims.

Although researchers have explored how the accessibility of green commodities impacts consumer behavior, research investigative of the ways to promote the commodies remains limited (Dahl et. al., 2016). Despite the growth in the number of green products, green marketing is on the decline as the primary sales pitch for products. To market effectively, green businesses need to market to three different audiences; Deep Green, Lazy Green, and Non-Green and the ideas must be approached differently. This is because each will have different trigger points that would move customers to buy.

Statement of the Problem

In recent decades, marketing researchers have progressively concentrated on studying sustainable and pro-social ecologically friendly behaviors (Mick, 2006), frequently in response to the

challenge of encouraging consumers to behave in sustainable ways (Luch et. al., 2010). There exists a gap in the study of green marketing in Kenya and especially in measurement of the effectiveness and awareness of green marketing and green products in the country's population respectively. As a result of the deficit of information relating to effectiveness of green marketing in Kenyan markets this paper sought to establish the popularity and the effectiveness of green marketing in the Kenyan market compared to other markets in the globe. The research studied Kenyan universities students market group.

Research objectives

The following research questions guided the research to determine the popularity and effectiveness of green marketing in the Kenyan Market: (i) what percentage of the Kenyan Population can be identified as True Green or Light Green? (ii) What percentage of the Kenyan Population is willing to pay more for ecologically compatible products? (iii) What factors determined whether a new idea will be adopted or not adopted including the idealism of the shift towards "green"?

2.0 LITERATURE REVIEW

2.1 Global Sustainability

According to Mangari et. al. (2016), the current unprecedented population growth and the consequent burden on food, energy, and natural resources has mirrored the complexity of the global economy. Environmental stability has significantly been affected by the increased consumption and nearly every consumer is conscious of his/her collective impact on the planet (Han and Yoon, 2015). According to Goodland (1995), sustainability was found to impact on the expansion of human welfare through preservation of natural resources. For example, the sources of raw materials used for human needs and wants are not depleted, to prevent harm to humans. Response to consumer's awareness, initiatives that promote sustainability and ecological protection is receiving considerable attention and is shaping corporate, consumer, and personal behaviors (Jones et. al., 2016). Consumers and organizations alike are seeking to address the ultimate sustainability-related challenge that face current firms: striking a balance between maintaining the wellbeing of the ecosystem and fulfilling the needs of consumers and economic growth (Lozano 2015).

A worldwide paradigm shift in economic development has progressively underwritten the conception of sustainability as the interest in reducing the use of resources has increased tremendously in the 21st century (Stone and Stone, 2011). In the late 20th century, sustainability was introduced and since then it has paved way for emergence of the idealism in sustainable development. Idealism is a concept that is officially recognized in the World Conservation Strategy according to the International Union for the Conservation of Nature and Natural Resources (1980). Generally, sustainability has taken a holistic viewpoint of the environment, cultural, and social wellbeing of the local economies while assessing the success of development; which includes development in the business world (Aronson, 2000).

With the 1987 Brundland Report that was officially titled "*Our Common Future*" which was seeking to establish a new era of sustainability, considering conservational issues, global debate on sustainability has, encountered a watershed moment (United Nations Commission on Sustainable

Development, 2007). The United Nations and the World Commission on Environment and Development, (1987) has defined sustainable development as social and economic growth that is able to meet the current needs without becoming unable to meet future needs. The report has paid exceptional attention to the responsible harvesting of marine and forest resources and has encouraged development that would not deplete the natural resources.

Following the publication of the report the United Nations organized summits and meetings aimed at promoting the sustainability of all key industries (Milne and Grey, 2013). Several of the meetings focused on particular industries such as the tourism industry and the transport industry as the prime sectors for more sustainable globalized development according to Barkemeyer et. al., (2014). In Rio de Janeiro United Nations Conference on Environment and Development in 1992, the United Nations Commission on Sustainable Development was formed to continue the work started by the Brundland Commission. The Rio summit anchored the Agenda of the 21 Global Action Plan that delivered a framework for attaining sustainable development (Mowforth and Munt, 2009).

Industry and academic professional have reframed the sustainability concept to make sense at the corporate level. Particularly, they emphasize that internal, besides, external stakeholders should be accountable for ensuring sustainability in political, social, economic, and cultural environments (Dyllick nd Hockerts, 2002). With this viewpoint, therefore, corporate sustainability refers to the level of corporate ability of business activities to conserve the environment while at the same time improving the standards of living for the people both inside and outside a certain company (van Marrewijik 2003). With this goal in mind, strategies to attain the corporate sustainability have emerged in education, business and economic agenda and have become significant guidelines as companies and institutions increasingly seek to integrate sustainability as a primary source of long-run competitive advantage (Jones et. al. 2016). Several institutions and companies are emphasizing sustainability-oriented efforts as a way of differentiating themselves from competitors and to reinforce their brand and corporate reputations (Jones et. al. 2016). Subsequently, the concept of sustainable firms reflects the increasing trend among stakeholders to evaluate the performance of an organization regarding not only economic prosperity but also the organization's contribution to environmental quality and social justice (Elkington, 2014).

Green Marketing and Advertising

As worldwide sustainability and interest in change of climate increase, corporations encounter the challenge of integrating environmental issues into their business strategies as indicated by Nidumolu et. al., (2009). Once a company has achieved this, the company must ensure it conveys it to the consumer. Subsequently, environmental and green marketing strategies now rank among the frequently discussed topics in academic research on advertising (Hartmann et. al., 2015). The green marketing concept has significantly evolved and has even sparked significant social movement. Peattie, (1999), described green marketing as a holistic management process that seeks to identify, predict, and meet goals profitably while constantly addressing the needs of consumers and society.

Globally, companies and organizations have considered environmental issues as part of their business strategies while accounting to government regulations and other forces (Do Paco et. al., 2009). Such a consideration has responded to the heightened sense of accountability among consumers and the increasing tendency to make environmentally friendly purchases (Haanpaa, 2007). Ghosh, (2011), argued that effective marketing for green products can, however, appeal to consumers by applying good marketing principles. Green marketing messages universally address at least an environmental issue of interest to consumers besides the needs of the environment (Gheorghiu et. al. 2013).

3.0 METHODOLOGY

A survey method was deemed fit for the study given the constraints during the period of the research. A random sample of 80 university students from 10 randomly selected Universities in Kenya took part in the study. The sample was representative of the target population by considering various population charateristics to eliminate bias. Therefore, the findings of this research could be generalized for the entire population.

The study employed structured questionnaires to collect data from the respondents. The questionnaires were sent to the selected individuals via WhatsApp. Primary data collected by questionnaires was sorted, organized, analyzed, and presented using Microsoft Excel. Percentages, visual presentations, and descriptive statistics were computed and conclusions drawn from the analyzed data. The study was carried out with the following objectives in mind:

i. To determine whether Kenyan university students were environmentally aware, and whether green marketing affects the buying behavior of the consumers.
ii. To investigate whether Kenyan university students were conscious of the green marketing.
iii. To examine whether the environmental efforts of companies convert into sales, and if not, what steps should be taken to make sure the efforts convert into sales.

DATA ANALYSIS and FINDINGS

The data that was collected during the study was analyzed using Excel. The results are presented in this section.

Demographic Profile of Respondents

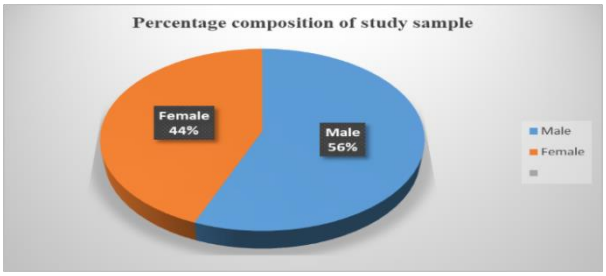

Figure 1: Demographic Profile of Respondents

Figure 2 above shows that 56% of the respondents in the study were male while 44% were female. A similar study conducted in India had 67.5% male respondents and 32.5% female respondents.

Geographical Profile of Respondents

Table 1

Distribution of Respondents with respect to University and Gender composition

University	***Number of students***	***Male***	***Female***
Lukenya	8	62.50%	37.50%
SEKU	8	50%	50%

Machakos	8	75%	25%
Garissa	8	62.50%	37.50%
Nairobi	8	50%	50%
Strathmore	8	37.70%	62.50%
Nairobi	8	62.50%	37.50%
JOOUST	8	75%	25%
KU	8	37.50%	62.50%
Chuka	8	50%	50%
		56.25%	43.75%

Table 2 shows the distribution of male and female respondents from the 10 Kenyan universities studied. In South Eastern Kenya University (SEKU), University of Nairobi and Chuka University, there were 50% male and female respondents. The institutions included both private (Not owned by the government) and public universities (Government owned). Generally, these were students from different cultural background and counties.

Order of Priority of Factors while purchasing of goods

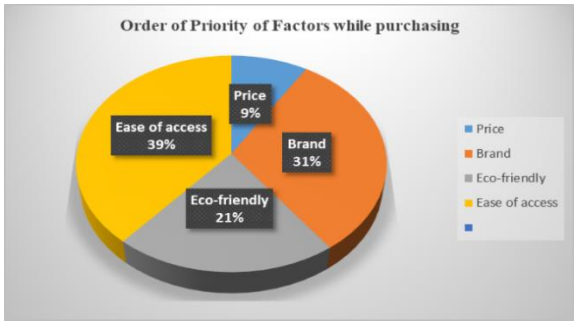

Figure 2: Order of Priority of Factors while purchasing of goods

The respondents were asked, which factor they considered as first priority while making purchases of any product. The factors were listed as Price, Brand, Eco-friendliness, and Ease of Access. Figure 3 shows that approximately 79% of the university students did not consider the ecological friendliness of the product as a first priority in their purchases. In this study, most of the students considered brand (39%) as the top decision factor for their purchases. Only a small proportion (21%) considered environmental sustainability. A similar study in India established that 75% of young adult university students in did not consider environment friendliness of products while deciding on purchases. The same study revealed that 45% of the students considered brand as the first decision factor of their purchases while 37.5% considered price. This research agrees with the findings of the study that only a small proportion of university students consider environmental factors to their purchasing decision.

Use of Green Products in Life

The respondents were asked the question, "Do you use green products in your daily life?" The options for the responses were, Yes, No and I don't know. The results of the responses are shown in Figure 4.

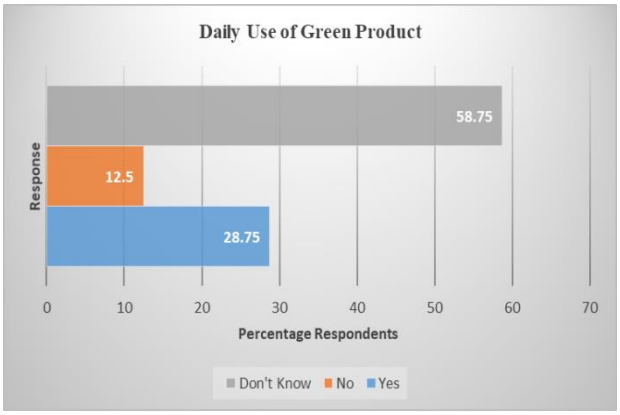

Figure 3: Daily Use of Green Products

From these statistics it is revealed that more than half (58.75%) of the respondents were unaware if they use green products in their daily life or not. This was found to be consistent with earlier research of comparative population in India that concluded that 52.5% of respondents was unaware of their daily use of green products.

4.0 Preference of Eco-friendly Products

The respondents were asked if given a choice between an environmentally friendly product and a non-environmentally friendly product, which one they would buy. While responding to the question, the respondents were asked to assume that the eco-friendly product was more expensive compared to the non-eco-friendly product. The pie chart below illustrates the results of the responses.

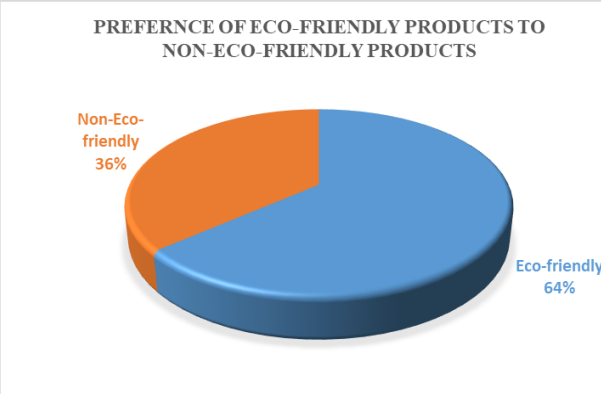

Figure 4: Preference of Purchase

Figure 5 reveals that given an opportunity to buy the products, 64% of the population would buy the environmentally friendly goods despite the price. 36% of the respondents would buy the non-eco-friendly products if they are cheaper compared to the eco-friendly one. This showed that a higher number of the respondents was willing to buy the eco-friendly goods despite irrespective of the price compared to non-eco-friendly products. A study carried out in America revealed that Americans were willing to pay 5-10% more for ecologically friendly products in 1989. By 1991, the ecologically conscious individuals were willing to pay 15-20 percent more for green products. Currently, 33.33% of Americans say that they would pay a little more for green products.

Green Marketing Awareness

The respondents were asked whether they were aware of the concept of green marketing. The responses were stated as Not Fully Aware, Fully Aware, and Not Aware. The results are shown in Figure 6.

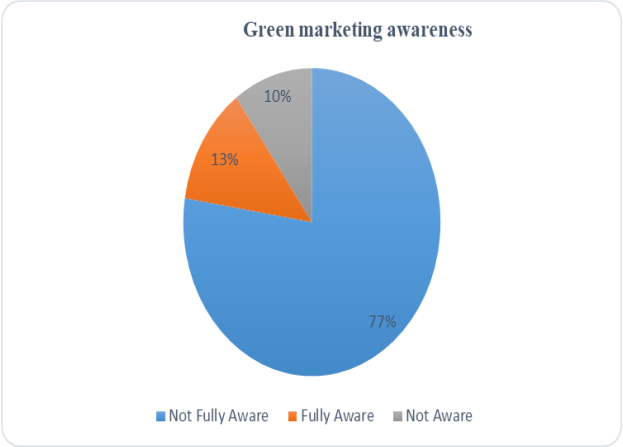

Figure 5: Green Marketing Awareness

Approximately three quarters (77%) of the surveyed population is not fully aware of green marketing. The population has just an idea about it. It is known that incomplete and insufficient information leads to a lot of questions in mind which will ultimately prevent the consumer from purchasing green products. According to Mintel, a market researcher, around 12% of United States population is identified as True Greens. These are consumers who are fully aware and seek out and frequently buy green products. Another 68% is categorized as Light Greens, consumers who are fully aware of green products and buy them sometimes.

Awareness on Companies involved in Green marketing

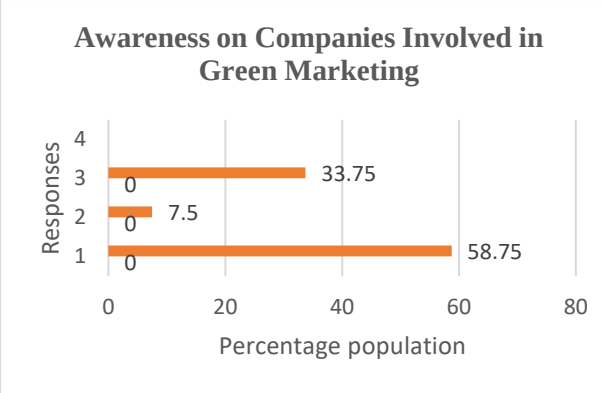

Figure 6: Awareness on Companies involved in Green Marketing

Figure 7 displays that above half of the surveyed population is not aware about the companies involved in green marketing. Most of the population uses quite a number of products from morning to night but the populations are highly unaware of the being eco-friendly or not.

Awareness on Benefits of Green Products

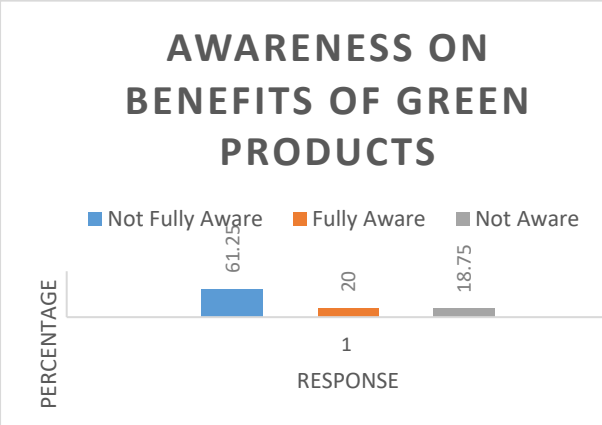

Figure 7: Benefits of Green Marketing

Figure 8 reveals a very high degree of unawareness amongst the university students about the benefits of ecological marketing. Majority of the target population have a perception that green product just involves only recycling waste or old goods and using them and taking care of environment. However, it has been observed that marketing is a very huge concept much beyond the above mentioned notions. More than 60% of the population is not fully aware of the benefits of green products.

Effect of Green Marketing on Purchasing Behavior

The respondents were asked the question, "Is your purchase behavior affected by green marketing campaign?" The responses were categories as Yes, No, Can't say, and May be. The pie chart below illustrates the outcome.

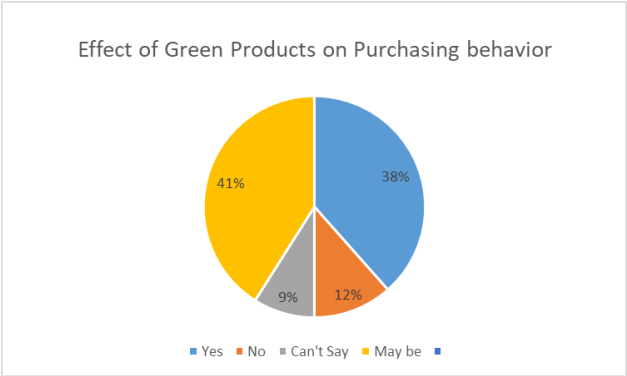

Figure 8: Effect of Green Marketing on Purchasing Behavior

About 38% of the respondents got influenced by the campaigns on green marketing by companies. Over 40% of the respondents were unaware about the effect generated on their purchase behavior by the green marketing campaigns by companies.

Effect of Green Products on Costs

The researcher sought to find out the effect of green products on costs. This was to determine whether green products have unnecessarily higher costs. The results are shown in the pie chart below.

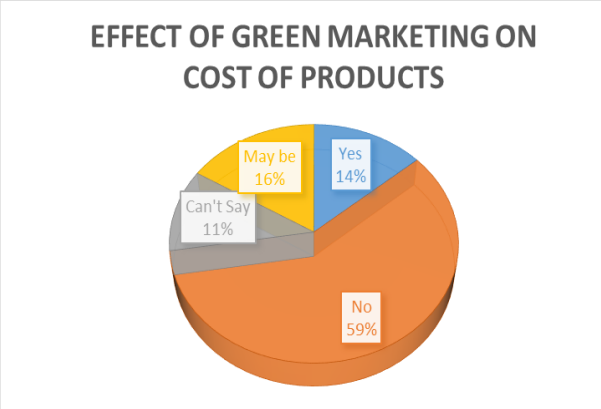

Figure 9: Effect of Green Products on Costs

Nearly 60% of the respondents did not allude to the sentiments that green products unnecessarily had higher costs. This implies that the majority of the students did not have that perception.

5.0 CONCLUSION AND RECOMMENDATIONS

From the analysis of data presented above, the following findings have been made. Firstly, there was a high degree of unawareness amongst Kenyan University students market group regarding the idea of green marketing, its impacts in society and the benefits. This gross unawareness reveals the need for more environmental campaigns by organizations to be done. This is because unless a person is conscious of the green marketing concept, and its benefits, they cannot reap its benefits. Consequently, the purchase behavior of about 50% of the population surveyed was not influenced by the ecological marketing campaigns of the companies.

Secondly, there is more concern for brand than prices of commodities and eco-friendliness. Majority of the target population was concerned about the value of brand of the product rather than the product's price and its impact on the environment. Additionally, the population that cares for nature (eco-friendliness) would rather go for environmental friendly products than prices. This implies that once the big brands undertake green marketing on a large scale, they can create massive awareness among the university students. In this way, the big brand corporation can encash on this if they give preference to the factors in the order brand > Price > Ease of access/ Eco-friendliness.

The Kenyan Green Market needs to be more vigilant and effective to enhance the shift towards Green Innovation to provide quality, green products to improve the wellbeing of the consumer and achieve development.

Lastly, all the students in the 10 universities studied had similar patterns in relation to purchase of eco-friendly products. This shows that students in the same age group demonstrate comparable patterns regardless of their geographic locations and culture.

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Strategic Direction and Organization Effectiveness of Savings and Credit Cooperative Societies in Kenya

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ABSTRACT

Organizations of all types have an imperative to post performance results that are satisfactory to their stakeholders. To achieve such results, organizational leadership is important since it determines the direction the organization takes. However, some organizations post poor output and this has attracted attention from scholars in order to establish the causes of poor output. Cooperative societies play an important role in socio-economic development of a country through economic empowerment and poverty alleviation. The study examined strategic directions of organizations and the prediction of organizational effectiveness through a quantitative survey of 133 senior managers in Savings and Credit Cooperatives (SACCOs) across Kenya. Drawing from the transformational leadership theory and strategic leadership model, the study respectively assessed vision and business development (as observed through exploration of opportunities). Findings of the study show that whereas business development significantly increased the probability of organizational effectiveness (B = 1.189, Wald = 14.706, exp (B) = 3.284, $p < .001$) organizational vision did not (B = .055, Wald = .041, $p = .839 > .05$, exp (B) =1.056). However, both vision and business development had a positive significant ($p < .05$) linear relationship with organizational effectiveness. Study results show that the managers were slightly more visionary than they explored and pursued more business opportunities. It is recommended that managers of SACCOs emphasize strategic leadership through active exploration of new markets and recognition of potential new clients (strategic leadership) even as they maintain clarity of vision (transformational leadership) for their organizations.

Keywords*:* Strategic direction, Organizational effectiveness, Kenya

2.0 Introduction

The essence of strategy is to ensure that organizations perform to the expectations of its stakeholders. To achieve such results, leadership of these organizations is important because it has implications in clarifying the direction that the organization takes. In this regard, strategic leadership continues to draw interest from practitioners and scholars alike as an area of practice and further empirical investigation. One of the conceptualizations of strategic leadership comprises strategic direction, human capital focus and strategic control. While strategic direction involves vision and exploration (for new businesses opportunities), human capital focus is predominantly a transformational leadership concern, namely "consideration: while strategic control is a strategy concern, notably effective exploitation of opportunities through internal organizational focus on efficiency.

Strategic leadership (SL) has become important for organizations due to heightened competition and an ever-discerning customer. This leadership ensures that there is a balance between internal organization consideration and the demands of the external environment; and between the need for exploitation of available opportunities while exploring other opportunities as they unfold. Through strategic leadership, organizations can remain competitive in an ever- increasingly competitive operating environment (Duursema, 2013). This type of leadership draws from the strategic leadership model which essentially combines leadership and strategy. While leadership is about clarifying direction through vision, strategy is about focusing on both the internal and external factors that face the organization. From the external environment perspective strategy is concerned with exploring for new opportunities through business development initiatives and actions while effective exploitation of existing opportunities is the internal focus of strategy. With regard to leadership, the focus is looking beyond the present and providing direction through a vision, communicating the vision and cultivating buy-in from the followers. In this study two constructs were used to measure strategic direction with a dimension of strategic leadership and organizational effectiveness.

It is noted that while strategy is about the tension between the internal organization and the external environment demands environment, leadership is about maintaining stability at the present moment, exploitation and having a focus on the future exploration and vision. According to Davies and Davies, (2014, p. 30), "strategic leaders have the organizational ability to be strategically orientated; translate strategy into action; align people and organizations; determine effective strategic intervention points; and develop strategic competencies". They also "display a dissatisfaction or restlessness with the present; absorptive capacity; adaptive capacity; and wisdom" (p. 30).

Further, transformational leadership influences change in individuals and collective systems in communities and organizations (Ogola, 2019). This leadership approach creates and builds valuable and positive transformation on the followers with the purpose of developing followers into similar leaders (Burns & Avolio, 2006). Moreover, strategic leaders have the ability to be strategically oriented. Strategic orientation involves the ability to consider both the long-term future, seeing the bigger picture, as well as understanding the current contextual setting of the organization. We thus conceptualized strategic direction as comprising vision of the leaders and their exploration of new opportunities from their business environment. In this study "business development" is used to mean exploration and the two: vision and business

development form what is referred to strategic direction.

Given the scarcity of empirical literature on strategic leadership and particularly its relationship with organizational effectiveness, this research examined the relationship between strategic direction (the extent to which leaders articulated their organization's vision and pursued new business opportunities: vision and business development) on a Kenyan sample drawn from deposit taking SACCOS. Consequently, the study attempted to answer the question: what is the relationship between strategic direction and organizational effectiveness of SACCOs in Kenya?

3.0 Theory and hypothesis

This study was anchored on the strategic leadership model (Duursema, 2013) which combines aspects of strategy (exploitation and exploration) and transformational leadership theory (vision and human capital focus) (e.g., Bass & Avolio, 1994). In this study vision and exploration (as observed through business development) as two descriptors of strategic direction were tested against organizational effectiveness.

According to Covey, (2011), "the goal of transformational leadership (TL) is to "transform" people and organizations in a literal sense that is to change them in mind and heart; enlarge vision, insight, and understanding; clarify purposes; make behaviour congruent with beliefs, principles, or values; and bring about changes that are permanent, self-perpetuating, and momentum building. The following two hypotheses were tested:

Hypothesis 1. Vision has no significant influence on organizational effectiveness of SACCOs in Kenya

Hypothesis 2. Business development has no significant influence on the effectiveness of SACCOs in Kenya.

3.0 Methodology

A positivist paradigm was adopted because the aim of the study was to test hypothesis by objectively colleting a large amount of quantitative data, analyzing it and making inferences (Easterby-Smith, Thorpe & Lowe, 1991). Consistent with this paradigm, a crosssectional descriptive survey of 133 respondents was conducted using a structured questionnaire for data collection. The questionnaire was tested for reliability using Cronbach alpha static where a threshold of 0.7 was achieved. Vision was measured by three items, four items for business development, and three items for organizational effectiveness. The items were internally consistent considering the Cronbach (1951) alpha reliability test statistic. Each one of the constructs was measured by multiple items than wee anchored on a 5-point Likert scale where the respondents responded by providing their extent of agreement with statements regarding strategic direction and organizational effectiveness. The questionnaire was self-administered and distributed by both drop-and-pic-later method and through Google forms. The contacts of the respondents were obtained from the SACCO Societies Regulatory Authority (SASRA). The respondents were either a manger, or the CEO or their representatives who were senior managers, one from each of the SACCOs. The target population was all the 175-deposit taking SACCOs registered by SASRA, to whom questionnaires were sent out, from which 133 responded.

4.0 Results and discussion

Table 1: Descriptive Statistics

Descriptive Statistics									
	N	Min	Max	M	SD	Skewness		Kurtosis	
						Statistic	SE	Statistic	SE
My supervisor has a clear understanding of where the organization is going	133	2	5	4.45	0.74	-1.291	0.21	1.236	0.42
My supervisor has a clear sense of where he/she wants our team/unit to be in 5 years	133	1	5	4.17	0.82	-1.326	0.21	3.227	0.42
My supervisor has no idea of where the organization is going (R)	115	1	5	4.30	1.19	-1.733	0.23	2.064	0.45
Vision (TL)	**133**	**2.3**	**5**	**4.11**	**0.86**	**-0.663**	**0.21**	**-0.954**	**0.42**
My supervisor actively explores new markets	133	2	5	4.11	0.90	-0.603	0.21	-0.685	0.42
My supervisor recognize/s potential new clients	133	2	5	4.09	0.82	-0.92	0.21	0.731	0.42
My supervisor makes innovative proposals to penetrate new markets	127	2	5	4.05	0.75	-0.416	0.22	-0.215	0.43
My supervisor seeks entrance at new potential clients	133	1	5	4.03	1.08	-1.234	0.21	1.046	0.42
Business development (SL)	**133**	**2**	**5**	**4.02**	**0.76**	**-0.758**	**0.21**	**-0.089**	**0.42**
My organization has introduced innovations of new products/services	133	1	5	3.93	1.07	-0.888	0.21	0.014	0.42
My organization has improved its coordination of the development efforts of different units	133	1	5	3.93	1.00	-1.076	0.21	0.687	0.42
My organization is adapting quickly to unanticipated changes	130	1	5	3.65	0.94	-1.144	0.21	1.338	0.42
Organizational effectiveness	**133**	**1.7**	**5**	**3.81**	**0.80**	**-1.039**	**0.21**	**0.158**	**0.42**

From the survey results of the 133 SACCOs that responded, data analysis was done.

These included descriptives, correlation and regression results that are presented in this section. First the descriptive results are presented in Table 1 followed by the inferential results.

4.1 Status of strategic direction and organizational effectiveness

The descriptive results on vision, business development disposition, and organizational effectiveness are given in Table 1. The results on individual item measures and for the composite scores of the variables are also presented.

There was more clarity of vision (M = 4.11, SD = 0.86) for the organization than there was exploration (M = 4.02, SD = 0.76 of new business opportunities by SACCOs in Kenya. Further there was moderate level of organizational effectiveness (M = 3.81, SD = 0.80). While an example of the items that measured vision was "My supervisor has a clear sense of where he/she wants our team/unit to be in 5 years", an item for business development was "My supervisor makes innovative proposals to penetrate new markets". Further, organizational effectiveness was assessed by asking the respondents about "introduction of new products/ services" (M = 3.93, SD = 1.07) and "quick adaptation to changes by the organization" (M = 3.65, SD = 0.94)

4.2 Relationship between strategic direction and organizational effectiveness

The relationship between strategic direction and organizational effectiveness was assessed using correlation analysis and the results are presented in Table 2

Table 2: Correlation Analysis

Table 2: Correlation coefficients

Correlations

	1	2	3
Vision (TL)	0.675		
	133		
Business development (SL)	.465**	0.847	
	<.001		
	133	133	
Organizational effectiveness	.305**	.568**	0.693
	<.001	<.001	
	133	133	133

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

The Cronbach alpha reliability statistics are presented in the leading diagonal. As seen from Table 2 the Cronbach alpha is within 0.7 threshold; in particular alphas greater than 0.6 are acceptable. With regard to the relationship between strategic direction (vision and business development) and organizational effectiveness, there was a stronger relationship between business development disposition (strategic leadership model dimension: exploration) ($r = .568$, $p < .001$) than between vision (transformational leadership variable) and organizational effectiveness ($r = .305$, $p < .001$). This result suggests that strategic leadership is more predictive of organizational effectiveness than transformational leadership. It means that besides articulating the vision of the organization, in this case deposit taking SACCOs in Kenya, leaders should actively explore new business opportunities.

4.3 Influence of strategic direction on organizational effectiveness

A binary logistic regression was run with vision and business development (exploration) as predictors of the probability of organizational effectiveness Table 3a-b. The results of the analysis are presented in Table 3 a-c.

Table 3a: Logit

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	139.793[a]	.147	.209

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Table 3b: Logit

Classification Table[a]

			Predicted Performance _bin		
	Observed		.0	1.0	Percentage Correct
Step 1	Organisational effectiveness _bin	.0	12	27	30.8
		1.0	12	82	87.2
	Overall Percentage				70.7

a. The cut value is .500

Table 3c: Logit

Variables in the Equation

		B	S.E.	Wald	Df	Sig.	Exp(B)
Step 1[a]	Vision (TLT)	.055	.269	.041	1	.839	1.056
	Business development (SLM)	1.189	.310	14.706	1	.000	3.284
	Constant	-3.997	1.300	9.460	1	.002	.018

a. Variable(s) entered on step 1: Vision (TLT), Business development (SLM)

Results in Table 3c show that whereas business development significantly increased the probability of organizational effectiveness (B = 1.189, Wald = 14.706, exp (B) = 3.284, p < .001) organizational vision did not (B = .055, Wald = .041, P = .839 > .05, exp (B) =1.056). However, from the correlation results, both vision and business development had a positive significant (p < .05) linear relationship with organizational effectiveness. Findings also reveal that the managers were slightly more visionary compared to the way they explored and pursued (exploration) more business opportunities. On the basis of the findings of the logistic recreation analysis and at 5% level of significance (p < .05) of hypothesis testing,

Hypothesis 1: Vision has no significant influence on organizational effectiveness of SACCOs in Kenya was not rejected since the Wald = .041 had a p –value greater than .05 indicating that vision did not significantly predict the probability of organizational effectiveness.

On the contrary, Hypothesis 2: Business development has no significant influence on the effectiveness of SACCOs in Kenya was rejected since the Wald = 14.706 had a p – value less than .05. It was thus concluded that, business development significantly increases the probability of organizational effectives in SACCOs in Kenya.

5.0 Discussion

In a study of firms in India, Wadhwa (2016), found that vision and mission significantly influenced organizational performance and further that "it is not just the formation of vision and mission statement but its content, communication, implementation and contribution … are equally important" (p.165). Though the finding of the current study did not should a significant influence of vision on the probability of organizational effectiveness, when tested together with exploration, it had a significant relationship on organizational effectiveness in the correlation results. The finding of the current study is thus consistent with previous studies regarding the relationship between vision and performance – in this study, performance was measured by observing organizational effectiveness I SACCOs in Kenya. The role of vision in leadership effectiveness which is related to organizational effectiveness has been demonstrated in previous studies (e.g., Senaji et al., 2014).

With regard, to exploration, which is essentially opportunity seeking, our finding

relates in some way to the results from 206 Finnish software firms which indicated that strategic learning fully mediated the relationship between exploration, exploitation, and profit performance (Sirén, Kohtamäki & Kuckertz, 2012). This is so because we used logistic regression and found a significant odds ratio for organizational effectiveness. Further, though previous empirical studies have provided evidence of the positive performance impacts of ambidexterity—the joint pursuit of exploration and exploitation strategies (e.g. Gibson & Birkinshaw, 2004), some studies suggest that these strategies do not necessarily guarantee performance and that the connection between ambidexterity and performance is more complicated (Sirén et al, 2012, p. 20). There is no empirical support for the relationship between ambidexterity and performance (Venkatraman, Lee & Iyer, 2007). Further, some other studies have provided empirical evidence that exploration and exploitation are not linearly related to performance; instead their relationship with performance is curvilinear (Sirén et al, 2012). Based on the previous studies and our findings, it is suggested that the relationship between exploration (such as opportunity seeking) is not linear and may be mediated by strategic learning (see also Siren et al., 2012).

6.0 Conclusion and Applied Implications

While SACCOs practice strategic direction as shown by the level of articulation of vision and business development by the leaders (M => 4), they are not sufficiently effective enough (M = 3.81, SD = 1.07). Further, business development (exploration) has a higher predictive power for organisational effectiveness than articulation of vision of the organisation. It is recommended that managers of SACCOs emphasize strategic leadership through active exploration of new markets and recognition of potential new clients (strategic leadership) even as they maintain clarity of vision (transformational leadership) for their organisations. Specifically, the leaders need to emphasize more on exploration (business development) through exploration of new markets, recognition of potential new clients and penetration of new markets even as they focus on the vison of the organisation such as through clear understanding of where the organization is going and communicating the same throughout the organisation; and maintaining a clear sense of where they want the organisation to go. Similarly, though vision did not have a significant influence on organisational performance in the presence of exploration, it individually had a significant relationship on it. Consequently, SACCOs should continue emphasizing the vision, communicating it and be committed to it, since it has a positive effect on effectiveness.

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Exploring the State of Virtual Business Incubation in Kenya: A Survey of Selected Business Incubators

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ABSTRACT

There remains a significant level of unemployment in Kenya especially among the young generation of under 35 years of age. The Government of Kenya, its development partners and private sector continue to put efforts to alleviate this problem. One of their major focus points is entrepreneurship especially at micro and small levels. Unfortunately, these micro and small enterprises have continued to record high mortality rates hence persistence of the unemployment problem. To reduce startup mortality rates business incubation has been evidenced by some studies as a viable solution. However, most incubation activities are done in on-site brick and mortar business incubators requiring face-to-face interactions between the incubators' staff and facilities and incubates. Unfortunately, this model of operation is under serious threat particularly with the advent of COVID 19 pandemic globally. This study aimed at finding out the state of virtual business incubation in Kenya. It was anchored in Schumpeter's Theory of Creative Destruction as improved in the Simon's Model. It employed a descriptive survey research design whereby a semi structured questionnaire was electronically issued to six randomly selected business incubators spread across six counties in the country. The main finding was that business incubators in Kenya had not taken up virtual incubation within a majority of their services, except in training and networking. Lack of reliable ICT infrastructure and failure by the incubators to re-package their services in a manner that would facilitate online delivery were cited as the main challenges facing virtual business incubation in the country. Nevertheless, the study noted that business incubators appreciate the benefits posed by

virtual incubation and were optimistic about its future adoption. The study recommends that larger scale in-depth studies be carried out to identify specific factors influencing effective virtual business incubation in Kenya.

Key Words: Virtual Business Incubation, COVID 19, Start-up, SMEs

1.0 INTRODUCTION

Unemployment especially among the youth in Kenya remains fairly high. As established in the country's 2019 census it stood at 38.9% (KNBS, 2020). As acknowledged in various studies, entrepreneurship remains an important tool for job creation. Therefore, to deal with unemployment, researchers have recommended entrepreneurship support particularly at micro, small and medium levels. Business incubation is a concept based on the need to support startups at their most vulnerable stage and increase their survival chances. Li, Ahmed, Qalati, Khan & Naz (2020) noted that business incubation can not only provide resources such as financing, networking services, office space, training programs, consultancy, and other essential services for start-ups, but it also aims to promote intranets and knowledge transfer among start-ups. Business incubators can provide incubated firms with a suitable work environment and help emerging businesses to survive (Tilana, 2015). Marimuthu and Lakha (2015) describe a business incubator as guidance to newly established organizations, the main purpose of which is hatching to minimize small and medium enterprises failure rate and unemployment.

Business incubation continues to gain prominence globally. In Africa, Afrilabs & Brighter Bridges (2019) reported that there were 643 entities specializing in providing early startup business support in one form or another. Further the report noted that four nations namely Nigeria, South Africa, Egypt and Kenya were hosts to the largest number of such entities at 90, 78, 56 and 50 respectively. In Kenya, business incubation entities go by different names including innovation labs, technology labs, co-working spaces, business incubators, hives or simply hubs. Regardless of the variations in naming, these entities main goal is to support entrepreneurial initiatives from idea to market (Wachira, 2020). Omweri (2016) established that incubation centers in Kenya provide a fundamental ecosystem that allows entrepreneurs to experiment, start up, grow and find the right strategic investors for their businesses to be able to compete at national and global levels. The study concludes that incubation is an essential bridge to solve the challenge of youth unemployment and set the country to achieve its strategic plan, the Vision 2030.

Some studies have however found that business incubation has negligible or no positive effect on startups. Lukes, Longo & Zouhar (2019) in their longitudinal study on 2,544 Italian startups found that incubator tenancy had a negligible effect on start-ups' job creation and found no evidence justifying public spending on business incubators. Further, they note that incubator tenancy had a negative short-term effect on start-ups' sales revenue. While examining the survival of 352 firms from five German business incubators after their graduation Schwartz (2009) suggested that graduation causes an immediate negative effect on survivability that lasts up to 3 years after leaving the incubators.

1.1 Virtual Business Incubation

In their traditional form, business incubators operate in physical facilities where incubates are accommodated in the incubator premises as either paying tenants or free of charge. In this model the incubate goes to find incubation services from a centralized facility. Conversely, in virtual incubation the services find incubates at their premises through the internet and other technology tools as the incubation is decentralized. Virtual business incubation can also be defined as an incubation program that provides incubation services electronically, with little or no face-to-face interaction (InfoDEV, 2011).

This term is also used to refer to any program that delivers incubation services to off-site clients (Colbert, Adkins, Wolfe & LaPan 2010). InfoDEV (2011) considers virtual business incubation as one that is location-independent. As cited by AlFattouh & Alsalloum, virtual incubators are also known as "incubators without a roof" because they don't provide physical space or office services. From the technical aspects it can be as a portal that allows user interaction, information exchange in the bank of knowledge, discussion forums by online chat rooms and videoconferencing, single interface for easy data retrieval and obtaining required information, coordinating virtual seminars in cooperation with a number of incubators online at the same time (Zorni, Bećirović, Ujkanovi, & Plojović, 2011).

The main advantages of virtual business incubation over traditional on-site business incubation are that the services can reach more beneficiaries and at a lesser cost (Zorni, et al., 2011). These are over and above some of the advantages associated with physical incubation. However, some studies have found that overall traditional face to face incubation services are better than those offered virtually (Shepard, 2013).

1.2 Statement of the Problem

Business incubators in Africa are mostly physical; they operate off-line with a physical office environment (Gain Incubator, 2019). With the advent of COVID 19 pandemic many business models have been and will continue to be disrupted. As noted by Afrilabs in their annual learning week conference 2020, business incubators will be forced to review how they operate if they are to survive beyond the pandemic. Some of the pandemic's mitigation measures such as lockdowns and social distancing directly and negatively influence the operation model of traditional business incubators hence limiting their effectiveness. Reduced effectiveness of business incubators can only increase the mortality rate of startups and SMEs, which was already high in Kenya even before the pandemic struck. As indicated by Douglas, J., Douglas, A., Muturi, & Ochieng (2017) 70% of Small-to-Medium sized enterprises (SMEs) in Kenya fail within their first three years of existence. Central Bank of Kenya warned that SMEs failure rate is bound to get worse in the near short term due to the adverse effects of the pandemic, the economic recovery stimulus put in place by the government notwithstanding (Amadala, 2020). This would be a major problem that would continuously put the country under recurring unemployment considering that the informal sector contributed 83% of employment in 2019 (KNBS, 2020).

Numerous studies have been conducted on business incubation activities in Kenya (Wachira, Ngugi & Odhiambo, 2017; Omweri, 2016; Mungai & Njeru, 2015 and Marima, 2013). However, the aspect of

virtual incubation has largely been neglected despite its potential advantages. The current study aimed to fill this knowledge gap and set a foundation for further research in the area.

1.3 Study Objectives

The overall objective of this exploratory study was to find out the state of virtual business incubation in Kenya. Specifically, it aimed to find out the level and kind of incubation services offered virtually, virtual collaboration platforms in use by Kenyan business incubators and the main challenges facing virtual business incubation in Kenya.

2.0 THEORETICAL FRAMEWORK

This study was anchored on Schumpeter's Theory of Creative Destruction. Schumpeter (1942) argued in "Capitalism, Socialism, and Democracy" that capitalism is never stationary and always evolving, with new markets and new products entering the sphere. This theory was further expanded by Simon (1982) as cited by Andersen, Dahl, Lundvall & Reichstein (2006) who argued that the potential threat to the survival of firms that leads to the change of routine behavior. According to Simon's model firms follow given routines as long as they are able to uphold a satisfactory performance. When this is not the case, for example because of competitive pressures, they start an innovative or imitative search for better routines. If successful, they scrap their old routines and, thereby, they might avoid the destruction of their organizations. This view seems to fit virtual operations of business incubators in Kenya. With onset of COVID 19 pandemic which disrupted their existing operational routines, business incubators are under pressure to seek better routines which will ensure they survive and continue delivering on their mandate of supporting startups.

3.0 STUDY METHODOLOGY

This study employed a descriptive survey research design. The design is used in preliminary and exploratory studies to allow researchers to gather information, summarize, present and interpret findings for the purpose of clarification (Orodho, 2003). According to Afrilabs & Brighter Bridges (2019) there are about 50 business incubators/hubs/accelerators in Kenya. This formed the study's population. A semi structured questionnaire was electronically issued through a Google Forms link to 6 randomly selected business incubators. This represented 12% of the study's population. In a descriptive research, a sample size of 10-50% is acceptable (Mugenda & Mugenda, 2003). The founders/operational managers of the selected incubators were requested to complete the questionnaire on behalf of their respective incubators since they are the most informed about the current and possible future operations of the incubators.

The respondents were reached out through their two industry associations, Association of Startup & SMEs Enablers of Kenya (nationwide) and Association of Countrywide Innovation Hubs (for innovation hubs outside Nairobi). Social media pages and accounts of individual business incubators were also helpful in reaching out and following up on questionnaire response with the respondents. This data collection method was found suitable as it was quick, efficient and most applicable considering that the study was conducted in the months of May and June 2020 when there was a government imposed

curfew and cessation of movement in Kenya due to COVID-19 pandemic.

4.0 RESULTS

The respondent business incubators were from six different counties across Kenya namely Nairobi (1), Mombasa (1), Kisumu (1), Nakuru (1), Nyeri (1) and Kakamega (1). The distribution was especially useful in giving a fair perspective on the state of virtual incubation across the country and not just in one particular region of the country. The period of operation for the six incubators was as shown figure 1 below:

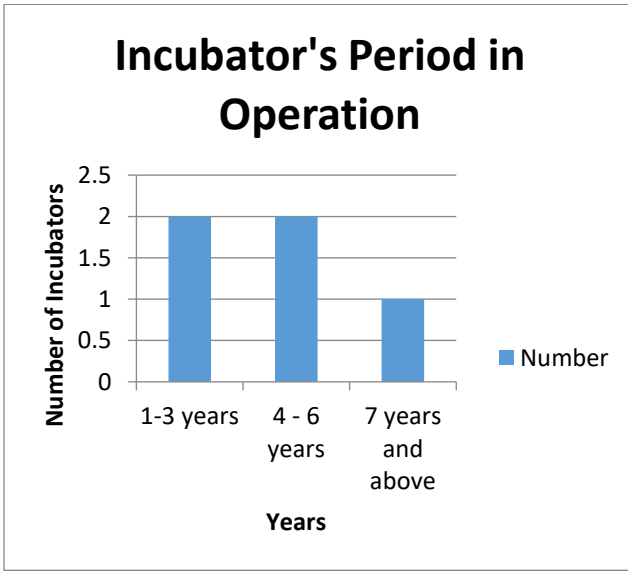

Figure 1: *Incubator's Years in Operation*

Incubators are a fairly new concept in Kenya with the earliest business incubators in the country having emerged around 2010. As confirmed in this finding only one incubator had been in existence for more than seven years. All the incubators had however, been operational for at least one year.

The studied incubators focused on various economic sectors with each incubator giving attention to more than one economic sector. The most preferred economic sectors were education/training (66.7%), agriculture and food security (50%), computer software/mobile application (50%), water and sanitation (33.3%), manufacturing (33.3%) with transport/mobility, sports/entertainment and health each taking 16.7%.

An overwhelming majority of the respondents at 83.3% noted that they had experienced physical space constraints in the last one year. This could be construed to mean that even prior to the COVID 19 pandemic there was need for incubators to extend their services beyond their concrete walls and reach out to more start-ups. The pandemic therefore only came to reaffirm the need for the incubators to take their services to incubates rather than incubates coming to the physical incubator to seek services. The respondents were further asked to quantify the volume of their services that were being offered virtually at the time of this research. The findings were as indicated in figure 2 below:

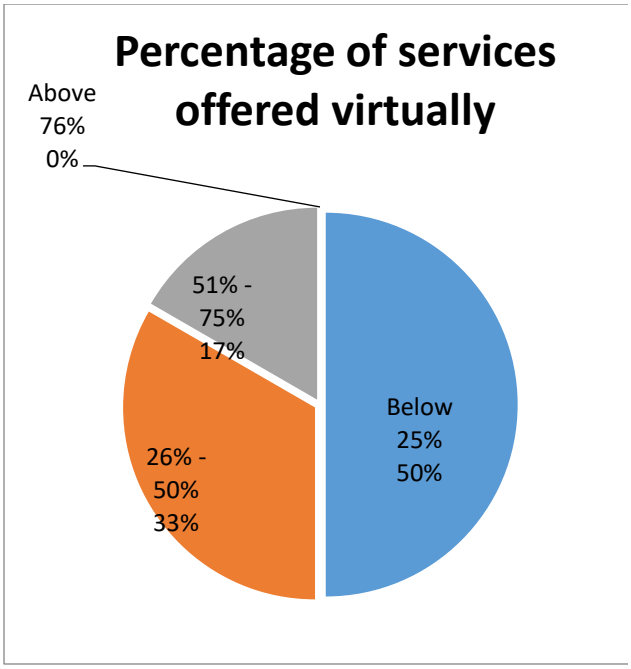

Figure 2: *Percentage of Services Offered Virtually*

From the findings the study concludes that most business incubators in Kenya were majorly not offering virtual business incubation with only 17% of the respondents offering more than half of their services virtually while the overwhelming majority 83% having more than half of their services offered on a face to face on-site basis. This finding is in line with that of Gain Incubator (2019) who opines that business incubators in Africa are mostly physical.

However, the study found that all the incubators had in place some of the infrastructural requirements for virtual business incubation. First, all the incubators had a desktop computer and/or laptop at their disposal. Secondly, 66.7% of them had access to reliable high speed internet and thirdly, 50% of the respondents had an office smart phone. Further all the incubators used at least one online document sharing tool while 83.3% of the respondents used email and also at least one web conferencing platform to engage their incubates and other stakeholders. 66.7% of the respondents had organized at least one virtual meeting with their respective incubates since the advent of COVID 19 pandemic while 33.3% had not. For those incubators that had organized virtual meetings, the meetings mostly involved brainstorming of ideas and coaching. Half of the respondents had also organized virtual engagement meetings with their other stakeholders (excluding incubates).

The incubators offered several services virtually. Training was the number one service offered virtually by the business incubators (83.3%) followed by mentoring and coaching (66.7%), idea pitching (16.7%) and networking (16.7%). This is perhaps because these services may not involve physical activities especially where training is for soft skills. Unsuitability of online delivery of incubation services/content was cited as the greatest challenge facing virtual business incubation in Kenya. This was especially for technical services such as fabrication and manufacturing which require face to face interaction. Lack of reliable ICT infrastructure was also cited by 33.3% of the respondents.

On the question of which operational mode is superior between on-site and virtual modes, 50% of the respondents indicated that onsite incubation and virtual incubation were complementary in nature while 33.3% indicated that onsite incubation yielded better results than virtual incubation. A further 16.7% reported that onsite incubation provided for better interaction between the incubator and incubates. None of the respondents were of the view that virtual

incubation yielded better results compared to onsite incubation. This finding is in agreement with that of Shepard (2013).

All the incubators used one or more form of social media to reach out to their respective incubates and other stakeholders. All the incubators had active Twitter accounts, 83% used WhatsApp, 66.7% used Facebook while 50% were on LinkedIn. This is a clear indication that business incubators in Kenya have embraced social media as their main mode of communication with their stakeholders.

5.0 CONCLUSION AND RECOMMENDATIONS

In conclusion, while virtual business incubation was not yet significantly adopted in Kenya, there were indications that local business incubators appreciate the advantages it poses such as lower costs and wider reach. The challenges of unreliable ICT infrastructure and failure to package incubation services in a mode that they can be delivered virtually requires to be dealt with prior to the Kenyan startup ecosystem to fully benefit from virtual business incubation.

Kenyan business incubators and their umbrella associations should consider gradually introducing virtual incubation services as demand for incubation services rise and as it increasingly became more difficult to feasibly host all incubates in an onsite facility in post COVID 19 pandemic era. Virtual interactions between incubators and incubates should go beyond soft skills trainings and networking meetings to yield real business opportunities for market access and financing.

This was an exploratory study necessitated by abrupt change in business environment because of the COVID 19 pandemic. It focused on gaining insights and familiarity for later in-depth studies on virtual business incubation in Kenya. Further larger scale studies need to be carried out to identify specific factors influencing effective virtual business incubation in Kenya. Such studies would be useful going forward especially when done in the context of other wider factors such as the future of work and virtualization.

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Covid-19 and Business: The Paradigm Shift in Doing Business in Kenya

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Abstract

A case report was released looking into effects and paradigm shifts during the emergence of the Novel Coronavirus (Covid-19) in 2019, which came with mixed fortunes. This paper was guided by two objectives: To examine the effects of Covid-19 on business operations in Kenya; and to identify business paradigm shifts experienced as a result of Covid-19 in Kenya. The emergence of the Covid-19 crisis, to some businesses was a blessing in disguise, while to others a curse. A curse in the sense that it changed most of the things that used to be usual to unusual, normal to abnormal. Some of those areas may not be the same again especially in conducting businesses. Similarly, it was a blessing in disguise to some businesses because many realized their agility, flexibility, the power of digital technology adoption, and change management. The disease caused a lot of misery world-over in terms of the plethora of human deaths and collapse of enterprises. In that respect it caused massive disruptions in production, supply chain and liquidity shortages. As a result, a new normal of conducting business came in force. Businesses realized that employees could work remotely, from home and still deliver results desired by the company. Thus the need to have physical infrastructure for some organizations especially in the service industry are predicted to be a thing of the past. In their place, Virtual Companies are predicted, a paradigm shift in doing business in the future, due to the impact of Covid-19. Findings from this research reveal that things will never be the same again even after Coronavirus is contained. Therefore, only those who are resilient in managing the change are likely to survive in the new normal market environment necessitated by the Covid-19 pandemic.

Key Words: Coronavirus Pandemic; Covid-19; Businesses; Change Management; Flexibility; Agility; Technology Adoption; Virtual Company; Paradigm Shift.

1.0 Introduction

It is no longer a hearsay, it is real, that businesses have been greatly affected and continue to suffer due to the covid-19 crisis. The pandemic in question caught many organizations unawares. Even Company professionals, researchers, strategists, futurists and planners alike failed to predict its appearance. World over, businesses suffered in devastating different ways as a result of the pandemic. Most business sectors were not spared and this points to the fact that only those that are zealous and agile enough will survive this turbulent period. Unfortunately, nobody can tell with precision when the pandemic will end or be contained.

According to the Policy Brief of the United Nations (UN 2020), on 31st December 2019, the World Health Organization (WHO) was informed of the first cases, which were like pneumonia of unknown cause detected in Wuhan City, China. This was proven as the start of the Coronavirus, also known as Covid-19 disease. It was the beginning of a colossal change in world of business, to which many organizations did not fathom the future. Many thought it was just a flu like that would disappear after a short while.

The first case of Covid-19 in Kenya was confirmed on 13th March 2020 and as of Saturday, 13th June 2020, four months later, the confirmed cases stood at 3,457 (GOK Report, 2020). Thereafter the Ministry of Health in Kenya kept Kenyans posted on a daily basis on new infections that figures of which were alarming. The high growth in figures of confirmed cases meant immediate action was required to forestall potential catastrophic proportions. The government took measures to avert the pandemic by assigning more resources to the Ministry of Health and addressing water inadequacy in informal settlement. There was a high rate of employee layoffs, and Kenyan citizens' stack abroad in different locations among other emerging issues. As the pandemics threw the government into a spin, a wave of reactions and counter measures were instituted to mitigate the impact of the novel disease with an objective of reducing its spread.

Generally, the emergence of the Novel Coronavirus drastically threw the world market environment into disarray. This consequently changed the playing field, heralding in a downturn effect on the world economies. Many jobs were lost in some sectors as businesses were shut down due to non-performance of the economy. A good example is the tourism industry, horticulture and education, especially private schools, both primary and secondary, to name but a few were hard hit by the pandemic. In some sectors like Media, Transport, Hospitality, and Civil Service and Government Departments, Sports and Manufacturing have also uniquely experienced the challenges generated by the pandemic. In the few situations highlighted and many more, productivity and revenues to organizations were disrupted (GOK Report, 2020).

Kenya's economic growth projections remained rather uncertain as the pandemic devastated and crippled world economies that symbiotically related to Kenya. In the last three months of the fiscal year 2019/2020 revenue collection dropped by US$ 658 million and the account deficit was estimated to drop to between 5% and 6% of GDP in 2020 (Deloitte Report, 2020). GDP growth in Kenya was expected to contract significantly with the Central Bank of Kenya revised estimate for 2020 from the initial 6.2% to 3.4%, which was still an optimistic assumption compared to McKinsey & Company's more recent report that placed growth expectations for Kenya at 1.9%, after analyzing the impact of the virus on Africa. By end of 2020, the flower sector was projected to loss Kes.60 billion and have massive layoffs of 30,000 temporal employees, (Deloitte Report 2020). All these put the Kenyan economy on the path of failure.

Financial and technical advice was offered by development partners (World Bank and IMF, among others) to strengthen the government capacity and cushion the economy (GOK Report, 2020). This did not yield much as the social impact of the pandemic continued to demand for greater economic measures as a way of mitigation. The Kenyan government with its already fragile economy took bold fiscal reform measures to alleviate the impact of the disease, especially to business entities. The Civil Service and businesses referred employees to work at home and other social measures put in place as a means to curb Covid-19 spread. In the long run businesses were negatively affected. They had difficulties in meeting their statutory obligations, in a fast changing uncertain business environment.

The scenario in businesses called upon consideration of actions that would enable sustainability and survival of business entities. Firms had now to reassess their customer-demand scenario as they grappled with changing supply chain situations. Re-evaluation of crisis management plans had to be done, with activating of some existing plans or upgrading some to uniquely address Covid-19 pandemic crisis. To stabilize demand, advertising and business communication in many business entities had to shift to online platforms. These challenges inevitably transformed the way business operations were to continue and therefore a big paradigm shift in a range of diverse business activities. Paradigm shifts have been witnessed in the workforce mobility, operations and supply chain, view of business finances and liquidity, tax regulations, and business strategy and branding, among others. Given the said scenario, therefore, this paper is set to address the following objectives:

1.1 Objectives:

i. To examine the effects of Covid-19 on business operations in Kenya.

ii. To identify business paradigm shifts experienced as a result of Covid-19 in Kenya.

1.2 Literature Review

1.2.1 Effects of Covid-19 on Business Operations in Kenya

To address the first objective of this paper, as par the Policy, Research and Statistics Department, United Nations Industrial Development Organization, (UNIDO, 2020) indicate that if comparison is made on the spread rate of Coronavirus with other viruses that have hit the world before such as the Hong Kong Flu (1968), SARS (2003), MERS (2012), and Ebola (2014), and Zika (2016), just to mention a few, Covid-19 penetrated the globe so widely and quickly. To that end, on average, many countries' GDP growth were affected to about 2.4% slightly below that of unaffected countries, (UNIDO Report, 2020). This was a clear manifestation that any business that used to operate in a well performing economy, for instance, and experiences sudden changes, it would definitely experience shocks on earnings. Kenyan businesses saw profits dwindle on daily basis since the first case of Covid-19 in the country. As profits declined businesses reduced employees' salaries in many industries like the case of media houses, while others laid off employees like the case of flower firms, education (private schools) and tourist hotels.

The World Economic Forum (WEF, 2020) in reference to the United Nations Conference on Trade and Development (UNCTAD report, 2020) posits that the main fear apart from the massive loss of human life, this disease had the ability to slowdown not only the economies of underdeveloped countries but even the superpowers like China, Japan, and America and European states. Therefore, when such disruptions are experienced in countries like China, that are the central manufacturing hub of many global

businesses, dire consequences are expected in other parts of the world. For example, some European auto manufacturers are facing the shortage of critical components for their operations. Companies in Japan for instance, may find it difficult to obtain parts necessary for assembly in their plants (WEF, 2020).

In Kenya, many small and medium enterprises were had difficulties maintaining their supplies as they depended on China. Due to this skyrocketing of product prices was witnessed. So what was experienced in reality in the world in such a situation was massive production and supply chain disruptions, and liquidity shortages to certain areas of the globe due to the Covid-19 crisis as (UNHABITAT, 2020) put it. In agreement with this, (WEF, 2020) in reference to the World Trade Organization (WTO, 2020) report, remarked that they expected a drop in volume of merchandise trade of between 13% and 33% in 2020, and worse in the service industry. This came to pass, where a number of service providers were hard hit by the epidemic like tourism and hospitality, transport and media to mention but a few. They had mass lay-offs and/or pay cuts and even others have closed down shops. For example, a good number of tourist and beach hotels like Norfolk and Serena were shut down in April 2020 because of containment measures.

It Due to these containment measures that were enforce in many countries in the world, transportation was greatly affected. This made movement of goods and people difficult and impossible. As a result, businesses were hugely affected by lower demand for consumer goods and services, job losses and weaker financial markets, (UNHABITAT, 2020). This forced many to look for alternative means of earnings or survival. In United Kingdom, for instance, it said that 98% of manufacturing enterprises admitted that the pandemic would halt business operations (Nicolaa, *et al,* 2020). Kenya's transport sector was equally hit especially with halting of international flights and minimal of sea cargo arrivals at the main port of Mombasa. This prompted the Kenya Ports Authority to extend free storage period for import and export containers largely due to the business dynamics. The intension was to support businesses during the tough times and encourage more import and export trade.

In the same breath, health sector for instance, in its report (UNHABITAT, 2020) revealed that women were in great danger for opting to deliver from their homes due to fear of contracting the virus. They avoided medical facilities due to lockdown and cessation of movement or due to misconceptions about the virus. A classic example is the closure the biggest maternity medical facility in East and central Africa, Pumwani in July 2020. People were opting not to go to hospitals as some of these facilities, both private and government, had suspended their services. The fear of the unknown was affecting businesses in the health sector. Further (Jean, 2020) agrees that the health crisis is much bigger than it is thought as it generated confusion and non-cooperative responses, among member states either directly or indirectly through export restrictions. Some private hospitals could not access supplies, limiting their ability to offer proper services. They ceased to attract clients and were on the verge of closer.

1.2.2 Paradigm Shifts Experienced as a Result of Covid-19 in Kenya

In the second objective, the emergency of Coronavirus brought forth Virtual Companies, that is, from "offline" to "online" operations. There was a shift in service provision and operation of many firms worldwide Kenya included. Many service provider organizations realized their employees could still work efficiently and effectively remotely (from home). A case in point is the giant Microsoft, which closed its doors in March 2020 and sent all

its workers home until January 2021. Surprisingly, they began working from home. Similarly, some organizations recruited new staff and provided virtual training. They started working remotely, for instance, Zoom, Google, Universities among others. All this was possible due to digital technology (Laszcz-Davis, 2020 & WEF, 2020). When the president of Kenya directed that public servants work from home, it meant that they would continue providing services from remote locations. This was adopted by private business entities as well and for several months the employees were able to deliver from home.

Employee's view of taking up salaried work has shifted. This was so especially with younger employees who found themselves unemployed. The ultimate thought was how they could avoid a similar experience in future. Most were keen on securing earnings that would guarantee their survival. The past experience also indicates that once one was outside the job market, it was very difficult to get back in as they would face more competition (Deloitte Report, 2020). The younger employees began moving away from seeking employment to entrepreneurial ventures. Business entities would have to change their relationships with employees as they may turn out to be competitors by setting up similar businesses.

A shift was witnessed in the payment modes in many organizations. With the emphasis on not using notes to make payments for services or products, as risks of infections were inherent. Most businesses began using electronic money transfer modes. The main telecommunications companies in Kenya (Safaricom and Airtel) removed charges on transfer of less than Kshs.1000, a fact that increased mobile money transfers in small business transactions. Similarly, under the directive of Central Bank of Kenya (CBK) all commercial banks collapsed tariffs of mobile money transfers of up to Kshs. 100,000. This was with the aim of reducing risks associated with handling of fiat money Deloitte Report (2020). It was likely that most business would continue their financial transactions in this mode.

Paradigm shifts occurred in company locations and office spaces. Company executives and managers, in a matter of time found no need to occupy large spaces, and pay rent because of physical evidence or business visibility (Liguori & Winkler, 2020). What mattered was the company's visible in the minds of the target customers and the potentials through the internet and the like. Thus, virtual companies were here to stay much more in the service industry. Software developers and consulting firms were some of the companies that shifted from large office spaces to either online or smaller office spaces. What mattered was the model design or approach of such a firm. Most small companies managed to fold office and maintain their presence online via a website. Further, new businesses launched online and avoided big office spaces. What was witnessed was small offices maintained as call centres or coordination points for these firms (Deloitte Report, 2020).

Liguori & Winkler, (2020) observe that Covid-19 generated opportunities for businesses, some of which entailed entrepreneurship education. The integration of online learning in higher education has been embraced more than ever before over the last 20 years. People believed in physical or face-to-face delivery of content, and this shifted as well. However, the born of contention still remains on the quality standards and handling of practical lessons, where hands-on concept or approach to learners was missing. First thinking companies like Google, Zoom, Microsoft, Yu-tube, Amazon and Viusasa, M-Elimu and others came up with platforms to achieve and enhance the online delivery. Both public and private universities in Kenya were engaging students and staff on online platforms. Private primary and secondary schools were also busy having

online classes with the students. Simply put, these companies were the greatest beneficiaries out of the Covid-19 crisis, (GOK Report, 2020).

Finally, a shift in the view of business environment was witnessed. Coronavirus gave an opportunity to company executives and management to sharpen their art and to always think about the ecological environment and its change (Laszcz-Davis, 2020 & WEF, 2020). Most firms were caught off guard as the virus decapitated their operations and employee relations. Talented employees were lost as businesses were unable to maintain payrolls and meet their (firm's) obligations.

1.3 Methodology

The study adopted a desk top research, where various policy papers and other studies were reviewed.

1.4 Conclusion

The Covid-19 epidemic affected economies world over and would permanently reshape the business environment as it continues to unfold. No one knows with precision when this situation would change or end. It caused unprecedented disruption to the economies and world trade, as production and consumption were scaled down. It was not "business as usual" anymore, but "business unusual" because of the "new normal" experiences. Due to these changes enterprises had to follow suit into the paradigm shift experienced. Any amount of resistance to change would not work as it would be more injurious to adopt.

1.5 Recommendations

From the discussions alluded in this paper, the following was recommended to businesses;

Due to a paradigm shift experienced in transacting business in the Kenyan market environment, there was no short-cut except manage change. If there is any constant factor in doing business that does not change is change. Hence it has to be managed well so as to remain afloat in turbulent times.

Businesses should be resilient and flexible. Business enterprises should be agile enough and flexible in order to fit well in the new normal.

Finally, businesses should embrace the digital technology in order to enable them work from any point and fit with the changing times. The rate at which technology was changing was an imperative indicator to enterprises that the market environment was never static but very dynamic. It was only those who were very dynamic, agile and flexible enough that would always rule the business environment.

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Evaluation of Mulch Types on the Distribution and Diversity of Insect Pollinators and Pests in Tomato (*Solanum Lycopersicum*)

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ABSTRACT

Insect pollinators play an important role in most agricultural ecosystems, where many species of plants and animals would not survive if they were missing. Insect bees, butterflies, moths, flies, beetles, wasps and thrips maintain the ecosystem biodiversity through pollination of flowering plants. Tomato (*Solanum lycopersicum*) is a pollinator dependent plant with brightly coloured and scented flowers evolved to attract insect pollinators. Tomato production heavily involves the use of synthetic pesticides with detrimental impact on insect pollinators. This study employs mulching technologies to mitigate this problem. Four mulch treatments of white transparent polyethylene, maize stalks, grass clippings, guava leaves and no mulch as control, with three popularly cultivated tomato varieties, were arranged in a completely randomized block design (CRBD), replicated three times in the experimental plots at Masinde Muliro University of Science and Technology ($0^{0}17^{1}$N, $34^{0}45^{1}$E). The field experiment was conducted under rain fed conditions during the short rains and long rains season of 2016-2017. Distribution data obtained was analysed using SAS software, version 9.3 at $p<0.05$ confidence level. The means were separated by least significance difference (LSD). Mean incidence of insect pollinators was significantly highest in mulched (77.86%) and lowest in control plots (22.14%) while pest mean incidence, was significantly highest in control (67.99%) than

mulched plots (32.01%). Integrated use of mulches promotes distribution of insect pollinator diversity pollinating tomato crops. This technology selectively deters landing of some virus disease causing pests/vectors, hence significantly reduces synthetic pesticide and herbicide application, thereby conserving biodiversity.

Keywords: Insect Pollinators; Mulching; Pests; Solanum lycopersicum.

13.0 INTRODUCTION

Solanaceous crops such as tomato (*Solanum lycopersicum*), sweet pepper (*Capsicum annum*), chillies (*Capsicum frutescens*), tobacco (Nicotiana tabacum), eggplant (*Solanum melongena*), potato (S. *tuberosum*) and tamarillo (*Cyphomandra betacea*) originated in the Americas (Milfont *et al*., 2013). They mostly have pendulous flowers that produce no nectar for foraging bees. Bees visit the flowers to gather pollen, which has the highest protein and nitrogen content among pollen varieties. Flowers are self-fertile and may self-pollinate through the action of wind or shaking, but cross-pollination is favoured by stigmatic receptivity before anthers dehisce (Bispo *et al*., 2009). Parthenocarpic tomato fruit is sometimes produced. *Solanum quitoense* is pollinated by bumblebees of the *Apidae* family in the native Andes. This research brings in new skills of establishing the impact of different mulch types on the distribution and diversity of insect pollinators, to complement existing research on high-throughput genetic sequencing, Next Generation Sequencing (NGS) technologies, novel techniques in epidemiological intelligence, ecological modelling and expertise in the pollinator research community.

Tomato (*Solanum lycopersicum)* production in Kenya is faced with many constraints including damage by insect pests and diseases, poor crop husbandry, low quality seeds and post-harvest losses among other factors (Mabele & Ndong'a, 2019a; Sigei *et al*., 2014). Tomato yield losses in East Africa can be as high as 88% of which pests account for 56% (Kiatoko *et al*., 2014). The tomato plant is attacked by a wide range of pests such as leaf miners (*Lyriomyza* spp), African bollworms (*Helicoverpa armigera*), whiteflies (*Bemisia tabaci*) thrips (*Ceratothripoides brunneus*) and aphids (*Aphis gosypii*), Red spider mite (*Tetranychus evansi*) and the tomato russet mite (*Aculops lycopersici*). Mites have been reported to cause high tomato yield losses through crop damage by sucking cell sap from underside of leaves, stems and fruits. They also cause leaf defoliation, flower abortion, fruit russeting and cracking. The seriously affected leaves turn pale and chlorotic, curl upwards and downwards, wither and die. Consequently, only small bunches of the new growth remain at the apical meristems of the plant. When infestation is severe, mites cause stunted growth, drying and falling of leaves, hence resulting to total crop failure (Anderson *et al*., 2012; Mabele & Ndonga, 2019b).

Insect pollinators which at times double up as pests, utilize flowers for food in the form of nectar and pollen, and in some cases oils and resins, as well as for shelter and mating rendezvous sites (Sajjat *et al*., 2008). Some pollinators also use flowers as brood sites hence mutualisms between plants and their floral visitors sustain plant diversity. The great majority of flowering plants (87.5%) are adapted for pollination by animals with the remainder of species being either wind-pollinated or completely reliant on

autonomous seed production (Kiatoko *et al*., 2014). The degree of ecological dependence of plants on pollen-vectors for seed production depends on their breeding systems. This study looks at the threats to insect pollinators and develops appropriate mitigation technologies, through different mulch types to provide a solid evidence based research, to inform new policies and approaches to reverse the decline in pollinators. It is clear at present that there is no single factor causing the problem. Insect pollinator decline causes are complex and involves interaction between pollinators, the environment, the pest parasitoids and diseases affecting these insects. However, because of the vital role that pollinating insects play in pollinating a range of agricultural crops grown globally and by extension wild plants, it is absolutely crucial that we generate knowledge through mulching technologies that can be applied to strategies aimed at reversing the declining trend. Some factors may affect all pollinating insects while some affect only one or two species.

Mulching inhibits the disease triangle pattern in tomato (S. *lycopersicum*) production by reducing pest infestation through promotion of clean field sanitation, improvement of water and nutrient absorption (Nunes-Silva *et al*., 2013; Mabele & Ndonga, 2019a, 2019b). The dangers associated with pesticides especially insecticides on pollinators, are well documented and understood (Chelelat *et al*., 2009). Recent trends in many parts of the world towards reducing the use of pesticides in agriculture and forestry, have lessened the overall incidence of pollinator poisoning. However, the problems are still severe in developing countries within sub-Saharan Africa where Kenya is included (Kiatoko *et al*., 2014, Mabele & Ndonga, 2019a). Although pesticides constitute an integral part of integrated pest management practices (IPM) for crop protection in modern agriculture, the dangers involved must still be kept in mind and a constant vigilance maintained.

The broader a spectrum of pest species a pesticide potentially controls, the more devastating its effect will be on the total fauna, both pests and beneficial insect pollinators alike. Its longevity in the environment and application timing and methods may further contribute to its destructiveness. Although many broad-spectrum pesticides have been banned from the markets of industrialized countries for health and environmental safety reasons, many if not most of them are still being used in tropical and subtropical countries (Depra *et al*., 2014). Low levels of farmer and consumer education, and strong political and economic interests, permit the continued use of these often cheaper but more dangerous toxins. Integrated pest management (IPM) methods that will reduce pesticide use, require very disciplined and well-educated farmers, with more technical assistance than is available in most rural areas, western Kenya included. Organic farming with the use of mulching types is an alternative solution that this study unravels to positively increase the abundance, distribution, diversity and health of insect pollinators within their ecological niche ecosystems emanating from the land-use change and climate change.

14.0 MATERIALS AND METHODS

2.1 Field experimental design

Completely randomized block design (CRBD) field experiment under rain fed conditions was done during the short rains season (August to December) of 2016 and long rains season (March to July) of 2017 at the Masinde Muliro University of Science and Technology (MMUST) ($N00^{o}$ 17.104; $E034^{0}$ 45.874^{1}). The tested soil nutrient composition was total Nitrogen (0.26%), Phosphorus (18.9 ppm), Organic Carbon (2.5%), Potassium (0.41 $cmolcKg^{-1}$), Sodium (0.1 $cmolcKg^{-1}$), Calcium (2.3 $cmolcKg^{-1}$), Magnesium (0.8 $cmolcKg^{-1}$), Zinc (1.9ppm) and Iron (0.37ppm), with acidic P^{H} of 4.2. The randomized experiment was replicated three times under the four mulch treatments of white polyethylene (0.18mm thick), maize stalks (18.0cm thick) grass clippings (18.0cm thick), guava leaves (18.0cm thick) and no mulch as control, with three determinate tomato varieties of Fortune Maker-F1, Cal-J and Monicah-F1. The four mulch treatments were arranged as factorial in replications of 15 experimental plots. Each experimental square plot size of 4m x 4m had a distance of 1m between the plots and 0.5m buffer zones along the edges of each plot. Each experimental plot had 32 plants (n) totaling to 480 plants (N). The tomato (*S. lycopersicum*) transplant spacing used was 0.5m both for intra row and inter row to avoid overcrowding and reduce the confounding influence of the intended pollinator objective. The tomato (S. *lycopersicum*) sub-treatments were also randomized in the plots to minimize non–experimental bias during sampling for insect pollinators and pests.

2.2 Tomato crop farm management

The determinate tomato seedlings were raised on the seedbed soil that had not been planted with *Solanaceae* family crops since 2010. Watering of the seedbeds was done regularly in the morning and evening during cool temperatures until the seedlings were hardy for transplanting. Transplanting was done late in the evening after the rains, on fallow soils not planted with a solanaceous crop since 2012. The mulches were set one day before transplanting, in a loosely well tilted soil devoid of weeds. Pruning of side shoots and extreme flowers was done to boost the leaf mosaic pattern. Harvesting of ripe tomato fruits was done early in the morning when the temperatures were cool and packed in clean wooden containers for transportation.

2.3 Data analysis

The data collected on incidence and diversity of insect pollinators and pests, was scored according to Reddy (1991) using a rating scale of low incidence = 1-20%; moderate incidence = 21-49% and high incidence = 50-100%. The data obtained was subjected to one-way analysis of variance (ANOVA) to determine the most effective mulch types on mitigating beneficial insect pollinators and associated pests in tomato using SAS software, version 9.3 (SAS Institute lnc., 2004) at $P<0.05$ confidence level. Mean separation was done at 95% confidence level using Fischer's protected least significant difference (LSD).

3.0 RESULTS

3.1 Table of results for mean insect pollinator and pests' incidence and prevalence

Table 1: Mean insect pollinator incidence

Mulch type	Mean	LSD	P-value
PVC	113.2000[cb]	30.21206	0.1470
Grass	116.4000[ab]		
Maize	101.4000[b]		
Guava	96.3000[c]		
Control	19.8000[d]		
Average mean	89.42*		

The mean incidence that have a common grouping letter are not significantly different. The frequency of insect pollinator visitation varied significantly during the day among the mulch types.

Table 2: Mean tomato pest prevalence

Mulch type	Mean	LSD	P-value
PVC	5.524[a]	44.73157	0.0662
Grass	9.190[b]		
Maize	8.952[b]		
Guava	6.810[b]		
Control	64.721[c]		
Average mean	19.1852*		

Incidence of multiple insect pollinators and pests of whiteflies, thrips, aphids, caterpillars, moths, mites and leaf miners was highest in control with mixed flower colourations. The mean prevalence of pests for PVC was statistically lower and different from all the other mulch types. This is attributed to uniform bright yellow colouration of the tomato crop flowers and white PVC mulch.

4.0 DISCUSSION

Insect pollinators like bees increase productivity and the quality of tomato fruit. Although tomato produces fruit by self-pollination, pollinator visitation often increases the fruit number, size of fruit and number of seeds. The distribution (prevalence) and diversity (composition, richness and abundance) of insect pollinator species visiting tomato flowers, varied among the mulch types and hours of the day. Pollinator frequency varied significantly during the day when they arrived early in the morning. Their visitation started around 08:00 hours with a peak around 11:00 hours and a steep decline around noon upto 13:00 hours. The mean pollinator frequency was highest in grass mulch type followed by PVC, maize stalks, guava then control. Probably the grass mulch type ameliorated the soil humus supplement that significantly boosted the growth vigour of tomato flowers, becoming more brightly coloured with abundant pollen for attracting more pollinators. Tomato flowers have no nectar but their stamens have large yellow anthers with poricidal dehiscence, which need vibration for the pollen to leave them (Nunes-Silva *et al*., 2013). However, the pollinator efficiency was influenced by chemical ways through which bees among other pollinators, detected if a flower had very recently been visited by another bee before landing. This might mean that the pollen supply is temporarily low and some flowers changed colour when they had been fully pollinated (Bispo *et al*., 2009). The PVC mulch also due to their bright colour, attracted more insect pollinators which increased their incidence and prevalence. Studies of pollinator distribution in crop fields seem to indicate very limited foraging ranges of honey bees in situations with many more flowers than foragers.

The mean incidence of tomato pests was significantly highest in control and least in PVC mulch type. The sampled tomato pests included the leaf miners, tomato bugs, fruit worms, spider mites, white flies and thrips. The leaf miners damaged the leaves through feeding and egg-laying maggots which punctured while feeding/mining in readiness to pupate. The whiteflies (*Bemisia tabaci*) caused damage by sucking plant sap and transmitting virus diseases like the *Tomato yellow leaf curl virus* (TYLCV) while human contact and bumblebees (*Bombus terrestris*) transmit *Tomato brown lugose virus* (ToBLV). The tomato bugs caused damage by sucking plant sap causing brownish rings on stems, petioles, growing points and leaves making the leaves become brittle and crinkled. The fruitworms comprising the caterpillar of the African bollworm fed on both green and ripe fruits while the moths of the African bollworm damaged the green fruits. The spider mites of the red spider mite family on leaflets, severely damaged the plants and fruits through their extensive webbing pattern. The thrips caused severe damage on the leaves, flowers and fruits. They also acted as vectors of virus diseases like *Tomato spotted wilt virus* (TSWV). The risk to pollinators from pesticides arises through a combination of toxicity and the level of exposure, which varies geographically with the compounds used and the scale of land management and habitat in the landscape.

Insect Pollinators like honeybees, butterflies and moths are vital for the pollination of cultivated horticultural crops such as tomatoes (*Solanum lycopersicum*). Having a healthy population of pollinators is essential to maintain biodiversity in natural ecosystems. Pollinating insects are vulnerable to pests, diseases and environmental stressors that have threatened their decline, alternative mulching technology lowers pesticide use increasing the pollinator populations (Anderson *et al*., 2012).

5.0 Conclusion and Recommendations

In conclusion, this study used different mulch types to generate knowledge on extensive and multidimensional understanding of insect pollinators distribution, diversity and steps needed to protect pollinator populations with the values they produce in cultural (identity), financial (honey sales), health (pharmaceutical properties of bee products), human (employments in beekeeping), social (Beekeepers' Associations) and technology dimensions. Tomatoes have a herbaceous/shrubby habit and reach up to 2 m in height. Plants produce mature fruits 90 to 120 days after seed germination and 45 to 55 days after flowering. The availability of effective pollinators in tomato plant communities is an obvious requirement for successful seed production. The conservation of farmland biodiversity through reduction in pesticide application by encouraging mulch application technologies, sustains a higher frequency of insect pollinators on tomato flowers to boost productivity and reduce virus diseases.

6.0 Acknowledgements

This fieldwork experiment was conducted at Masinde Muliro University of Science and Technology (MMUST) agricultural research farm.

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Dynamical Convergence of the Effects of Tea Processing using Wood Fuel in Kandara, Central Kenya

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ABSTRACT

In the past, the implementation of forest policies was challenged by corrupt leadership in Kenya who failed to control tree cutting. The Tea Factories consume more wood fuel than the tea farmers could supply from their tea growing regions. Consumption of wood fuel happens depite the fact that the rate of consumption cannot cope with the rate of tree replenishment. There was need for research to establish the impacts of tea processing on the environment in Kandara Sub-County, Kenya. It was therefore against this background that this research investigated the effects of tea processing using wood fuel in Kandara Sub-County. Qualitative data was collected using questionnaires and analyzed in comparison to past studies carried out in the same field. The research findings indicated that the cutting of trees for wood fuel exceeded the rate of planting. The study recommends that the tea factories should explore cheaper alternative energy sources and extensive free seedlings, or obtaining subsidized seedlings. The tea factories should engage tea farmers in a program of continuous supply of wood fuel based on the crop production per farmer per year. Relevant organs should sensitize the community on the need to have agroforestry, with fast growing trees to close the gap and ensure sustainability of wood fuel business in the region.

Key Words: Climate, Energy Environment, Fuel, Trees, Tea

15.0 INTRODUCTION

Wood fuel plays a very important role in energy provision. It is predicted to remain dominant within the energy portfolio of the population in the coming decades. Past studies have shown that over 70% of the population relies on fuelwood as their primary household energy source, with an average per capita consumption of 0.69

m3/year in 2011, or 2.5 times the global average. Wood fuel plays a critical role in energy provision in Sub- Saharan Africa, Kebede, Kagochi & Jolly, (2010); Iiyama *et al,* (2014). Fuel wood consumption at large scale is therefore associated with severe environmental problems such as deforestation, land degradation, loss of biodiversity, climate change and adverse health effects.

It has been established that there are various characteristics which are considered while selecting types of wood to use as fuel (Leslie, Mencuccini & Perks, 2012). These include; heating value, chemical composition, moisture content, density, hardness, the amount of volatile matters, the amount of solid carbon, ash content and composition, the melting behavior of ash and the amount of impurities. Energy is a necessity for sustaining human lives. When energy cost increases, more money is directed to purchase energy. Over a long period, fossil fuel has been the main source of energy mainly due to availability of conversion technologies which are considered cheaper than for renewable energy sources. However, studies show fossil fuel consumption has negative environmental impacts (Erickson & Lazarus, 2016). Therefore, there has been a lot of interest in exploring and utilization of environment friendly renewable energy resources (Simion, Blarke & Trifa, 2012). Projections by World Energy Council (2004) show world primary energy consumption will grow by 60 % by the year 2020. In 2008, Africa had the least generation capacity of 2.65 % in the world of which 30 % was generation by South Africa (Osieni, 2012). This indicates most African countries have low per capita energy consumption which affects development in the continent.

In rural areas, tea industries are some of the most important fuel wood consumers with over 50 small-scale tea factories which are spread in most counties in Kenya and run by Kenya Tea Development Agency (KTDA). More than seventy percent (70%) of these factories have boilers that can use both furnace oil and firewood in curing tea. A significant number of these tea factories are using wood-fired steam boilers to generate heat in order to reduce cost in tea processing. The average cost of processing tea using furnace oil is significantly higher as compared to using the wood energy with a saving of up to 60% in the cost of fuel. In which finding, a survey report by Tea Research Foundation (2009) showed that traditionally, electricity and petroleum based products were the main sources of energy for tea processing factories. However, due to increasing costs, most of the factories changed to fuel wood as a source of energy.

In Kenya, like in most African countries, the energy sector is characterized by high dependency on biomass, frequent power outages, low access to energy and overreliance on hydropower and oil imports (Kimuyu, Mutua & Wainaina, 2011). The Kenya Tea Development Agency (KTDA) through its tea factories have come up with tree planting programs in trying to close the gap of limited supply and high demand for wood fuel. A study done by Osawa and Muchunku, (2013) shows that the cost of processing 1 kg of tea using heavy fuel oil stands at USD$ 0.10 (Kshs 8) as opposed to USD$ 0.04 (Kshs 3.50) when processed using wood fuel. Tea Research Foundation of Kenya (TRFK) acknowledges and recognizes that its operations and those of the tea industry have an impact on the local and global environment.

16.0 LITERATURE REVIEWS

Fuelwood collection is a major cause of deforestation in many developed and developing countries. For instance, Kumar, *et al* (2016) did a study on the adverse effects of fuel wood exploitations on the environment in Nasarawa Local

Government Area, Nigeria. The specific objectives of this study were to find out the major sources of domestic energy and its effects on the environment. The study sample comprised of 150 respondents who were randomly selected to participate in the study. A structured questionnaire was used to collect data from the respondents. The study established that fuel wood was the major source of the energy in the households. The main environmental factors were vegetation changes due to deforestation leading to vegetation losses dictating the human behavior towards the use of the affected environment.

In a different setting, Bouget, Lassauce & Jonsell (2012) conducted a research on effects of fuelwood harvesting on biodiversity. The study found out that large-scale fuelwood removal may, jeopardize the amounts and diversity of substrate that saproxylic organisms require as food and habitat. Besides, bioenergy-related forest practices also affect non saproxylic biodiversity through physical (e.g., soil compaction and disturbance) and chemical changes in soil properties associated with fuelwood removal and increased machine traffic. In addition, the extended density of internal edges threatens interior trees species populations. These affect the food chain for animals and human beings resulting to changes in livelihood. Food and income fluctuation or reduce drastically due to environmental impacts affecting types of trees on farm and dictate planting behaviours.

Tesot (2014) aimed at assessing the socio-economic impacts of charcoal enterprise in Narok-South Sub-County, Narok County. The specific focus of this research was to find out the sustainability of the charcoal business, to examine the environmental implications of charcoal production in the Sub-County, and to come up with recommendations on sustainable management of charcoal business in Narok-South-Sub-County. The findings of the analysis showed that the charcoal enterprise activities as currently practiced in Narok South Sub County is unsustainable. The annual estimation was informed by the response of majority (76%) of the charcoal producers, who engage in production at all times throughout the year. According to the 50 charcoal producers surveyed, an estimated 28,800 bags of charcoals each weighing 50 kg on average are produced over the course of the year, this is equivalent to 1440 tones. This has led to trees cover reduction and environmental degradation which is a threat to biological diversity in the area which attracts tourists. The main factors which may be driving the fuel wood enterprise are land clearance for settlement as well as farming and the socio-economic benefits associated with wood fuel industry.

3. FINDINGS OF THE STUDY

Nduti Tea Factory wood fuel consumption for the period between years 2015 to 2019 incrased to a total of 63860m^3 of wood fuel in volume. The study found out that there was a stiff competition for wood fuel with other factories from the neighboring Sub Counties. The consumption of wood fuel over the five-year period was found to be on the increase with reference to tea production. The demand for such large quantities of wood fuel from the region had attracted a lot of people from consumers, suppliers, farmers, brokers, local experts and local administration.

The study found out that cutting down of trees in the region was a common phenomenon, and its impacts have accelerated environmental degradation. Cutting down of trees in the region has exposed farms to adverse weather conditions. This led to reduced crop yields, low income among the farmers increasing their poverty levels and influencing negatively their livelihood.

Indiscriminate cutting down of trees affected all trees species from indigenous, exotic and fruit trees in the region. Farmers in the region could not cope with the high rate of trees cutting because of demand levels for the same commodity among the tea factories. The cutting led to shortage of mature trees starting from tea zones and slowly creeping into the lower zones under coffee where the wood fuel business was booming.

The study established that sustainability of the wood fuel business was not attainable. The relevant stakeholders were not fully engaged in increasing the tree cover. The study found out that initially the tea factories had tried to meet the pace of cutting down trees by planting through seedlings provision to tea farmers. This changed at some point as they provided seedlings to tea farmers at a cost resulting to discouragement of farmers from planting more trees to beat the pace of trees cutting. The study established that the tea factories were limited since the factories only involved them and left out very critical stakeholders such as groups of suppliers external to the tea catchment zones. This created a big gap where the rate of tree cutting and replenishment rate could not match, resulting to loss of tree coverage in the region.

The study also established an attempt by the tea factories to acquire land outside the catchment area for planting trees to close the gap of high demand. Exotic trees species were preferred due to their fast growth, hence taking a shorter time to mature. Indigenous trees suffer the loss due to the time they take to mature confirming the reason why their number had reduced in the region. It was established that planted woodlots in this purchased land had not matured to enable harvesting. Their viability was left questionable. The dry conditions of the purchased land did not also favor fast growth of trees.

The study found out that the farmers in the region were aware of negative effects of trees cutting on the environment. The study shows that 95.0% of the respondents agreed that the wood fuel demand by tea factories affected negatively their environment. The need for income blind folded many from acknowledging the dangers to the environment.

The study findings show that the demand for wood fuel by tea factories may not be sustainable in future due to the time taken by trees to mature versus the rate of cutting. The study established that planting of new trees took place during the long rain season, while the cutting was throughout the year. The following solutions were suggested: The factories through innovation are to come up with cheaper alternative sources of energy to supplement the use of wood fuel, and reduce the pace of cutting down the growing trees in the farms. The respondents suggested more exploration on renewable source of energy like solar, wind, and geothermal, while the factory heads confirmed continuous process of innovation in saving the energy used by boilers. Majority of the respondents recommende that tea factories should support the farmers by giving them subsidized seedlings irrespective of the zone of origin. This would encourage afforestation programs on the farm through agroforestry and on farm tree production for sustainability purposes.

4.0 CONCLUSION

The study concluded that the wood fuel consumption by the tea factories in the region were high in terms of quantity volume and posed environmental challenges in the region. The study concluded that though the sale of wood fuel to tea factories was limited to individual farmers, the impacts affected the whole community and region. The impacts of sale of wood fuel were beyond age, level of education and occupation. Sale of wood was mainly done by males in support of

family livelihoods in the region. Agroforestry and on-farm tree production was viable in the region but required the support of all the stakeholders from consumers, farmers, local administration, agricultural officers and environment officers in the region.

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Impacts of Climate Change, Adaptation and Mitigation on Maize Production in Kenya

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ABSTRACT

Agriculture is the backbone of Kenya's economy contributing significantly to food security, provision of employment and supporting both rural and urban livelihoods with maize as a staple food. Global warming is a significant challenge in maintaining food security and aggravates decline in agricultural productivity; with rapid growth in population across the world, and more specifically in developing and undeveloped countries. This paper uses the Ensemble Average General Circulation Model (GCM), at 50% probability and SRES High Emission A2 Scenario to assess the impacts of climate change on maize farming in Kenya; synonymous with other sub-Saharan African countries. The model predicts general increase in temperature throughout mid-century 2020's-2050's to end of century 2080's -2100's. Kenya will have a general accelerating rise in temperature at an average of 3.03^0C by 2050 and 4.53^0C between 2080's and end of the century, with warmer drier seasons; average minimum temperature of 24.1^0C and average maximum temperatures of 34.1^0C. This will increase the rate of evapotranspiration; hence reduce soil moisture and water availability for maize crop. Wetter conditions are projected during short rainy seasons in the Arid and Semi-arid agroecological zones between mid-century and end of the century. Additionally, warmer seasonality with trends of weather

extremities such as Elnino, hence floods that destroy crops are expected. Severe droughts characterized by La Nina extremities are likely to intensify in upper highlands and lowland regions. To adapt and mitigate the long-term effects of climate change on maize production as a staple food, there is need to develop appropriate infrastructure, policy framework and financial systems. This will support small scale irrigation development, research to quantify the impacts of climate change in specific agro-ecological zones with focus on the climatic requirements for different developed maize varieties, and other food crops suitable for changing future climates.

Keywords: climate change, maize production, adaptation strategies, Ensemble Model (GCM).

17.0 INTRODUCTION

Global average temperature has risen by 0.8^0C within the past century and by 0.6^0C within the past three decades largely caused by human activities (IPCC, 2007). Intergovernmental Panel on Climate Change (IPCC) has projected a further global mean temperature rise of between 1.4^0C to 5.8^0C at the end of 21st century if greenhouse gas emission continues to rise (Cairns, et al., 2012). Impacts of climate change will significantly undermine or undo major socio-economic progress achieved so far in many African countries, if appropriate adaptation measures are not embraced to mitigate these effects (MCSweeney et al., 2008). Agriculture is a major socio-economic activity affected by climate change and variability across the globe, with Africa's tropical, subtropical and sub-Saharan regions exhibiting most vulnerability due to projected impacts, multiple agricultural stressors, low adaptation capacity, widespread poverty, high population density and human diseases (Morton, 2007). With demand for water, food, and forage for livestock projected to double in the next 50 years due to increased population, East Africa countries continue to be prone to severe floods and drought events leading to tough economic times and wide spread famine (Mati, 2000). Evidence suggests that future climate change including increases in average mean temperature, variation in seasonal and annual rainfall and potential rise in sea level will alter severity and frequency of these weather extremities. This will potentially worsen impact on all social and economic sectors, such as agricultural production, suitability of crops, water availability, ecosystem services, biodiversity, and health status (MCSweeney et al., 2008).

Climate change and variability is predicted to increase incidents of droughts, food insecurity, deepen poverty, reduce herd sizes, and cause significant fall in crop yields in Sub-Saharan Africa. This is as a result of decreased precipitation, seasonality in rainfall, and severe recurrent droughts (Morton, 2007). Kenya's economy is highly dependent on agriculture which contributes an average of 36 percent to the GDP and provides an important source of livelihood to a large part of its population especially in rural areas (Mati, 2000).

This study will conduct an in-depth analysis of the impact of climate change on agricultural production in Kenya, focusing on projected future climatic scenarios and subsequent impact on Maize farming. Additionally, explore modalities in agricultural planning and improve adaptive capacity for sustainable production.

2.0 Agriculture and Maize Farming in Kenya

2.1 Agro-climatic Zones in Kenya

Kenya lies within the East Africa rift valley and the equator, with generally warm and humid tropical climate extending from Lake Victoria to the East, Lake Turkana to the North, and the Indian Ocean Coast line to the South (Figure 1) (Mati, 2000). The major climatic factors that affect growth of crops in Kenya are: duration and intensity of rainfall;

Figure 1: Map location of Kenya in Africa and East Africa

relationship between potential for evapo-transpiration due to temperature changes, and annual rainfall variations that determine growing seasons (Morton, 2007).

Based on the amount and reliability of annual rainfall, vegetation characteristics and ecological potential, the country is divided into 7 distinct agroecological zones (Table 1) (Mati, 2000). These zones are identified as those with high to medium agricultural potential including: humid, sub-humid, semi-humid to semi-arid areas; and those with low production potential comprising of arid and very arid areas. High to medium potential regions cover 20% of the country where most agricultural crops are cultivated and harbors 80% of the total population (Morton, 2007). The remaining agro-ecological zones cover 80% of the land where livestock rearing and tourism are the main economic activities and hosts most of the country's national reserves and game parks (Ojwang et al., 2010). The agroecological zones present a complex climate in Kenya with wide variations from one region to another. The coastal region has a narrow belt which is generally hot and wet, boarded by the larger semi-arid and arid areas that is hot and dry, thereafter forming temperate highlands spreading from central Kenya through the Rift Valley region (DFID, 2008). This complex climate is largely influenced by proximity to the Indian Ocean coastline; Lake Victoria and other Lakes within the Rift valley; the equator and topography of the land (Ojwang et al., 2010). Conversely, the equator leads to formation of the Intertropical Convergence Zone (ITCZ), which is a low-pressure region in which trade winds from the tropics and the Indian Ocean converge. This alters the position of thermal equator, and hence temperature and rainfall variability shifting north and south of the equator (Mati, 2000).

Table 1: Agro-climatic zones in Kenya relative to rainfall and land cover (Somboroek et al., 1982).

Agro-climatic Zone	Classification	Moisture Index	Annual rainfall (mm)	Mean Temperature (^{0}C)	Altitude (feet)	Land Area (%)
I	Humid	> 80	1100 - 2700	<12	>10,000	<5
II	Sub-Humid	65 – 80	1000 – 1600	12 – 14	9000 - 10,000	12
III	Semi-Humid	50 – 65	800 – 1400	14 – 16	8000 – 9000	15
IV	Semi-humid to Semi-Arid	40 – 50	600 – 1100	16 – 18	7000 – 8000	5
V	Semi-Arid	25 – 40	450 – 900	18 – 20	6000 –	10

2.2 Importance of Agriculture and Maize Farming in Kenya

Kenya's population depends directly or indirectly on agriculture to derive their livelihood with more than 80% living in rural areas and more than half of total agricultural output being none market subsistence production (Kabubo-Mariara & Karanja, 2007). The sector generates 60 percent in foreign exchange earnings, providing 70% of

informal employment (Table 2) (Kenya National Bureau of Statistics, 2012). Agricultural production in Kenya is entirely rain fed, thus crop yields are highly susceptible to extreme climatic events and changes in mean values of climatic factors including rainfall, minimum and maximum temperatures, evapotranspiration, and changes in rainfall seasonality (Morton, 2007). Equally, early cessation and irregular distribution of rainfall coupled with drought characteristics such as false or late onset of rains, and prolonged breaks during growing cycle explains variability in yield and growing conditions (Kabubo-Mariara & Karanja, 2007). Kenya's agricultural climatic zones are located in Western, Central and Rift Valley regions. Farming is primarily rain fed and in small scale, where land owned by farmers averages between 0.3 and 3 hectares (RoK, 2007b), which contributes about 75% of total output from agriculture (Kabubo-Mariara & Karanja, 2007).

Table 2: Agriculture contribution to the Agricultural Gross Domestic Product and Export (Ministry of Agriculture, 2009).

Agricultural Subsector	% Contribution to GDP	% Contribution to Export
1. Industrial crops (Tea, Coffee, Sugarcane, Tobacco)	17	55
2. Food Crops (Maize, Wheat, rice, beans & peas)	32	0.5

Maize is a major crop in Kenya's agricultural sectors; it is most widely consumed and grown crop with about 1.4 to 1.6 million hectares under maize cultivation with 1.1 t ha^{-1} potential yield (Hassan et al., 1997). It stands out as the staple food crop with 125kg per-capita consumption for 96% of the country's population providing 40% of the required calories intake. It is the main source of income in maize surplus growing regions: including North Rift and Central Kenya. Most maize is grown on small scale basis, producing 75% of total production (Hassan et al., 1997). The trend of maize production has been dwindling, which is evidence that the country is not self-sufficient amidst the increasing population. This is because of low technological adoption, high pests and diseases incidents, and unfavorable or variability in climatic conditions; thus, the country is a net maize importer due to domestic demand outweighing local supply (Kabubo-Mariara & Karanja, 2007). Future projections suggest need for Kenya to double its domestic production to meet its demand; as most available arable land for farming is already cultivated (Sombroek et al., 1982). Future increase in production will rely on improving yields instead of area being cultivated (Omoyo et al., 2015).

The crop sector in Kenya has significantly been affected by climate change; apart from wheat and rice most cereal crops recorded decline in productivity between 2008 and 2012. Additionally, years of below average rainfall resulted, 2011 being one of the driest periods since 1956 (Ngigi, 2009). Maize production recorded a decline from 39.7 million bags in 2012 reaching a low of 38.9 million bags in 2013. This was a drastic short from the 2013/2014 projected production of

43.4 million bags, reaching 28.9 million bags in 2014 (USDA, 2014; The East African, 2013). This 33.4% decline was largely attributed to lower rainfalls. The stagnation in maize production in Kenya is synonymous with trends across sub-Saharan Africa stagnating at about 1 ton per hectare, while in other countries across the world with low income productivity is at 2 ton per hectare per year; whereas the worlds average is 3.5 ton/ha/yr (Amwata et al., 2014).

2.3 Climatic Conditions Suitable for Maize Farming in Kenya

The major climatic variables influencing production of maize in Kenya include: rainfall, temperature, humidity, solar radiation, and day length (Allan, 1971). Proximity of Kenya to the equator has resulted to a 5^0C variation in mean monthly temperature per year, with the minimum and maximum temperature closely correlated with altitude of the area (Omoyo et al., 2015). Maize farming in Kenya being largely rain-fed, the crop requires not less than 300 mm of rainfall and optimum rainfall of above 750mm; and does well in areas with higher rainfall of up to 2200mm per annum (Sombroek et al., 1982). Warm temperature from 13^0C and not above 25^0C are desired throughout its growing period, with ranging temperature responses at different growth stages but sensitive to frost conditions. Rate of crop development after germination is significantly influenced by temperature as photosynthetic activity is affected by day temperature, while growth rate is determined by variations in night temperature (MCSweeney et al., 2008). The country has a bimodal rainfall pattern, hence two maize growing cycles dependent on two main rainy seasons experienced due to monsoon trade winds and moist air from the Indian Ocean meeting at the Intertropical Convergence Zone (Omoyo et al., 2015). The long rains season starts from March to June followed by a dry season to permit harvesting and drying of maize (Amwata et al., 2014). The short rains run from October to December followed by another dry period between January and March (Fig. 2) (MCSweeney et al., 2008). The highest rainfall is experienced in highland areas, Lake Victoria region and

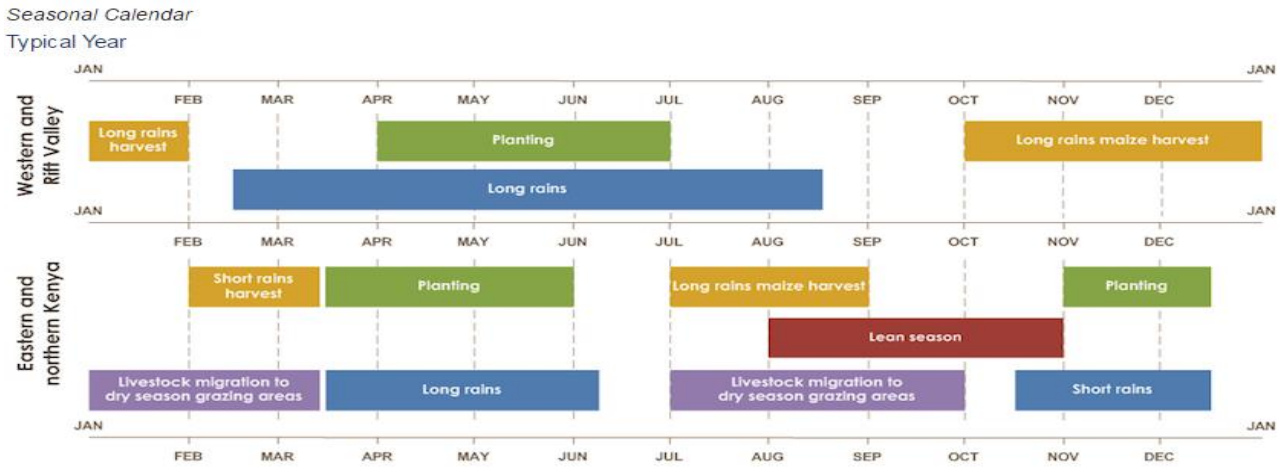


Figure 2: Seasonal distribution of yearly rainfall for maize farming in Kenya (World Resource Institute, 2007)

the Coastal belt; while low rainfall is experienced in the North-eastern parts of Kenya and Lake Turkana region (Figure 2) (Maina, eat al., 2013).

Maize production capabilities of different regions depend on their respective agro-climatic zones with zones II, III, and IV having highest maize production potential due to the wetter conditions present; hence higher yield than drier regions (Fig.3) (Maina, eat al., 2013). This suggests that the amount and distribution of rainfall is the most limiting factor for maize production in Kenya, as different varieties are best suited for each zone (Fig. 3). In the recent past, expansion of population in marginalized areas has prompted spread of maize production to zone V; however, poor soil conditions and frequent incidents of droughts have hampered good yields (MCSweeney et al., 2008). Kenya and East Africa in general is highly affected by extreme weather

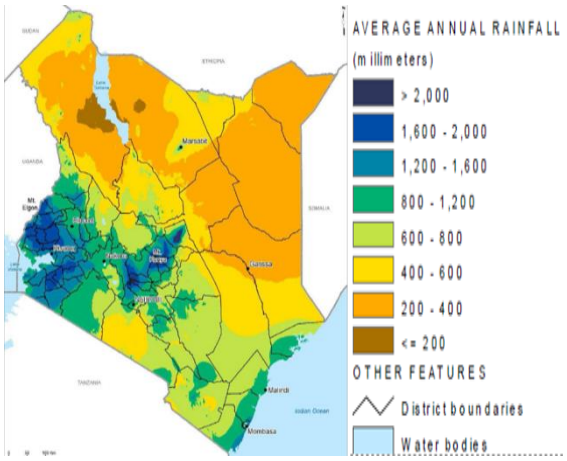


Figure 3: Average Rainfall Distribution in

patterns that occur spontaneously caused by Southern Wind Oscillation (ENSO). ENSO has two extremes, thus Elnino characterized by very wet conditions and flooding during short rains season leading to massive losses of crops; and La Nina: associated with unusual dry conditions during short rains, hence severe droughts are experienced (Maina, eat al., 2013).

3.0 Future Projected Climatic Trends for Kenya

Table 3: Projected future temperatures for Kenya Midcentury (2020's – 2050's) to End of century (2080's -2100). (Climate Wizard. http://ClimateWizard.org)

Temperature Description	2020 – 2039 (^{0}C)	2050's (^{0}C)	(2080's) (^{0}C)
Average change in Temperature	2.1	3.0	4.5
Mean maximum Temperature	32.7	33.5	34.0
Mean minimum	19.8	21.0	23.9

The future projected Climatic trend for Kenya was assessed using the Ensemble Average General Circulation Model (GCM), at 50% probability and SRES High Emission A2 Scenario to determine projected changes in temperature and rainfall variables (Climate Wizard, 2007). The evaluated temperature change scenarios simulated are presented in Table 3 below.

Results from Ensemble Average model predict general increase in temperature throughout midcentury 2020's-2050's to end of century 2080's -2100's. All agro-climatic zones will have a general accelerating rise in

temperature at an average of 3.03^{0}C by 2050 and 4.53^{0}C between 2080's and end of the century, with warmer drier seasons; average minimum temperature of 24.13^{0}C and average maximum temperatures of 34.02^{0}C. In the rainy cooler seasons, the mean maximum temperature will increase by 3.24^{0}C, and by 4.78^{0}C in the hot drier seasons relative to the location and agroecological environment (Climate Wizard, 2007). Maximum temperature is predicted to increase by 2.5^{0}C in wet-upper mid altitudes, by 2.6^{0}C in wet lowlands and wet lowland mid altitude, by 2.7^{0}C in dry lowlands and by 2.8^{0}C in dry mid-altitude environments (Fig. 5). These increases in temperature especially during short rainy season between October and January will increase the rate of evapotranspiration, hence reduce soil moisture and water availability for the maize crop (Sarris et al., 2010).

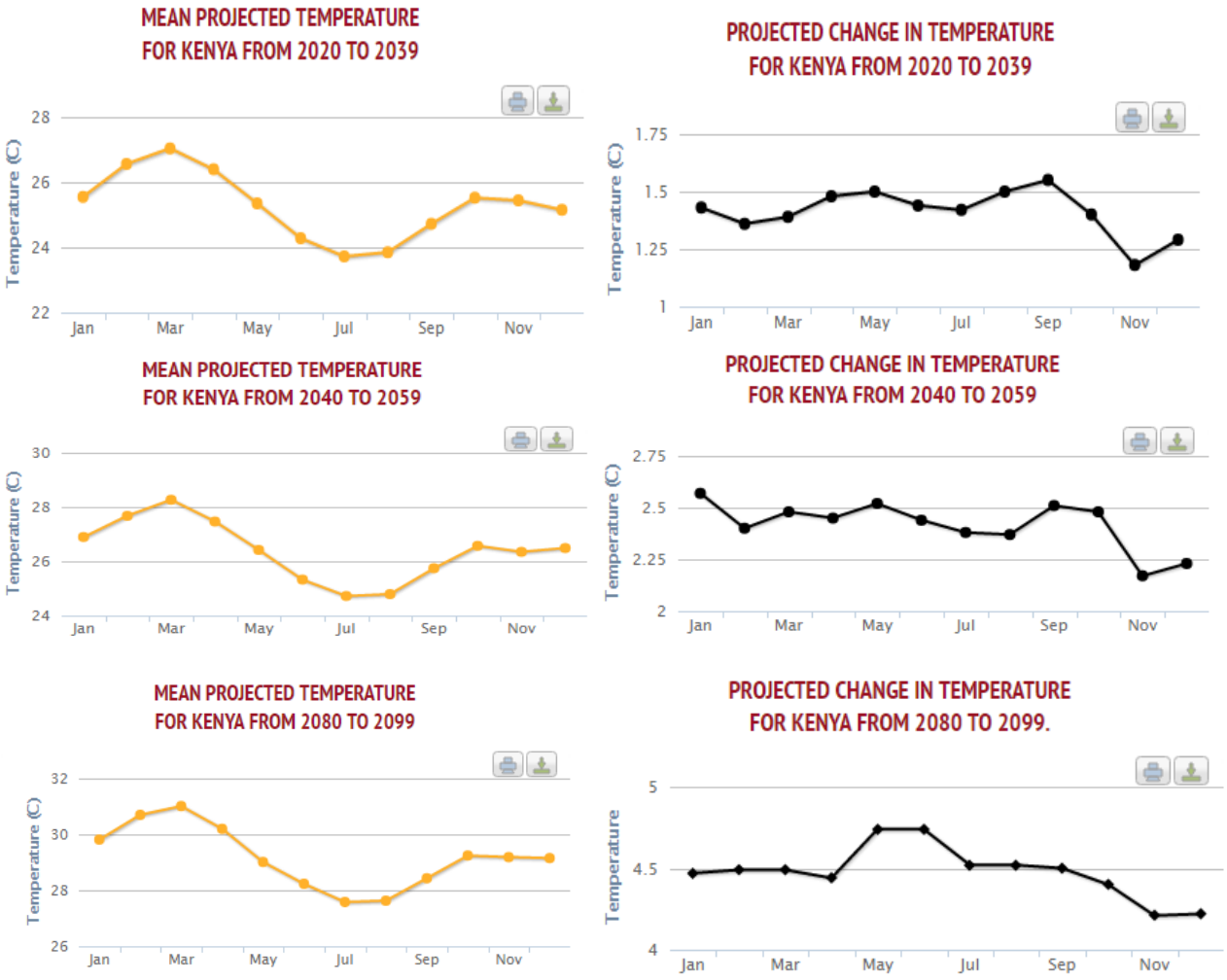


Figure 4: Graphical representation of projected Mean temperature and Change in temperature for Kenya Mid-century (2020's – 2050's) to End of century (2080's -2100) Using Ensemble Average General Circulation Model (GCM), at 50 % probability and SRES High Emission Scenario A2 (Climate

The model predicts increased total rainfall received between October and January

during short rainy seasons for all agro-ecological zones in Kenya. By 2050, rainfall is projected to increase by 5 to 20% during wetter months of both short and long rainy seasons, and 40% increase in precipitation towards end of century. Drier months: between June and August, are projected to receive even lower rainfall with a decrease of 5 to 10 % (Climate Wizard, 2007). This is presumed to be 35.05mm increase in precipitation during the short rainy season, with -20.12mm decrease in long rainy seasons by midcentury, and 87.94mm increase in short rains with -35.44mm decrease in long rains at end of century (Table 4 & Fig. 6) (Climate Wizard, 2007).

Low levels of rainfall predicted between the months of May and July will occur during maize filling growth stages especially for humid, semi-humid and semi-arid agro-climatic zones known for high maize production. Therefore, there will be expected shift in maize growing seasons specifically during the short-rains between October and January, which will be preferable rather than current growing cycle where long-rains period fall between March and July (Schlenker & Lobell, 2010). The predicted 40% increase in precipitation during short rains in drier agro-ecological zones is attributed to increase in rainfall extremities characterized by Elnino occurrences (Shongwe et al., 2009). Droughts are also projected to be as extreme and increase in intensity towards end of 21st century. Rainfall is expected to start later in the season, with 6% increase in days experiencing long rains and 4% increase in days experiencing short rains (Schlenker & Lobell, 2010).

Table 4: Projected Future Rainfall for Kenya Midcentury (2020's – 2050's) to End of Century (2080's -2100) (Climate Wizard. http://ClimateWizard.org).

Precipitation (mm)	Projection 2020-2039 (mm)	Projection 2050's (mm)	Projection 2080s - 2100s (mm)
Average daily change in rainfall	Short rains increase by 25 mm Long rains decrease by -14.3 mm	Short rains increase by 35.1 mm, Long rains decrease by -20.1 mm	Short rains increase by 87.9 mm Long rains decrease by -35.4mm
Average annual rainfall	Long rains: 600 mm in Humid, semi-humid, and semi-arid zones short rains: 300mm during in drier zones	Long rains: 1000 mm Short rains: 500mm Drier zones: 200mm	Long rains: 1200 mm Short rains: 500mm Drier zones: 300mm

IPCC 4th assessment suggests that there is projected decrease in diurnal temperature range in all agroecological zones characterized by increase in nighttime lows more than highs in daytime. Extreme events of Elnino and La Nina are predicted to intensify over the next 100 years in Kenya occurring every 7 years or so (Schlenker & Lobell, 2010). Even without extreme events, risk of droughts and floods are expected due to global warming (Ziervogel et al., 2008). This is largely influenced by projected warming of the Indian Ocean and the Pacific Sea surface, thus prompting an Eastward shift in precipitation and rise in sea level (Schlenker & Lobell, 2010).

4.0 Impacts of Climate Change

The projected changes in climate will significantly decrease maize yields in Kenya through shortening the length of maize growing season, extreme weather events such as floods and drought. This is characterized by increased Elnino and La Nina occurrences, amplified water stress, and increased outbreaks of pests, weeds and diseases (Schreck & Semazzi, 2004). Water and heat stress are the most limiting factors for maize growth. Heat stress leads to smaller and fewer plant organs, altered process of carbon-assimilation, and reduction in inception of light by the maize plant; which ultimately affects respiration, photosynthesis and transpiration. Heat stress experienced during flowering stage and grain filling phase decreases grain weight and count; lowering crop quality and yield (Pachauri & Reisinger, 2007). Increased temperatures cause saturation in air vapor pressure and evaporative demand, thereby plants respond by closing their stomata, which reduces the rate of photosynthesis and increase vulnerability to heat injury or heat shocks (Schlenker & Lobell, 2010).

Water stress often accompanied by dehydration shortens the reproduction stage, causes leaf area reduction, pollen sterility and stomatal closure. 1.2^0C temperature rise coupled by changes in precipitation, soil moisture, and irrigation water demand will render most arable land unusable. This substantially shifts high value maize growing zones to lower value zones (Schreck & Semazzi, 2004). In this light, agroecological zones with the optimum rainfall of above 300 mm will be more suitable for maize farming (Fig. 5). This is more so the case with increased rates of soil erosion caused by heavy rainfall and drought conditions that threaten productivity (Pachauri & Reisinger, 2007).

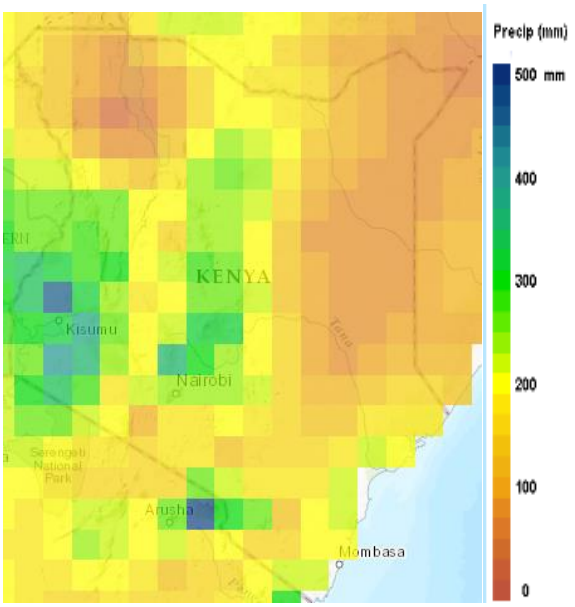
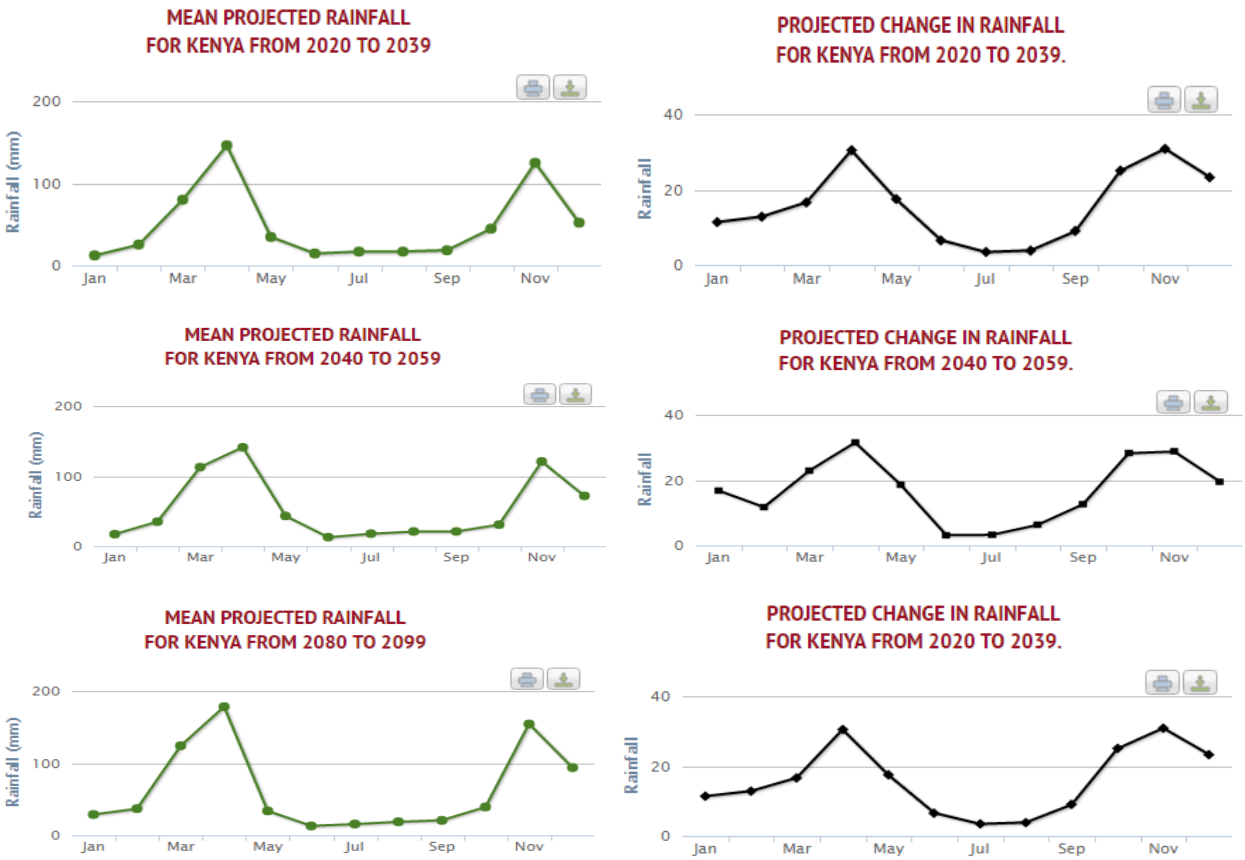


Figure 5: End of Century (2080's - 2100) Projected rainfall distribution map of Kenya showing future geographical location of maize producing zones with rainfall above 300mm (Climate Wizard:

In areas projected to have excess heat and water such as Northeastern, Western and Coastal Kenya, it is expected that pests and weed prevalence, and emergence of new pathogens will further damage crop and alter agricultural systems (Pachauri & Reisinger, 2007). The infection cycle, survival of inoculums, latency periods, infection dispersal and production of new propagules are influenced by environmental conditions, and play a critical role for biotic stressors on maize crop (Schlenker & bLobell, 2010). Projected high relative humidity following increased wetter conditions will increase fungal and bacterial infections such as the gray leaf spot *Cercospora zeae-maydis* and maize necrosis disease respectively; that are already problematic in upper highland and lowland zones (Pachauri & Reisinger, 2007). Seasonal changes in maize growing conditions often cause severe outbreak of fungal mycotoxins that destroys yield quality due to poor moisture storage conditions. This leads to massive losses as witnessed in Kenya in 2004; where 125 people died after eating aflatoxin B1 maize. Such incidents are expected to occur more frequently with the prolonged moist conditions projected during the short rains (Schreck & Semazzi, 2004). Increased droughts and global warming will increase severity of damage by insects including maize stock borer, fall army worm and fusarium that are already prevalent in arid and semi-arid zones in Kenya (Schlenker & Lobell, 2010). It is estimated that a 2^0C increase in temperature could increase the number of insect pest life cycles up to five times during the crop growing season (Schreck & Semazzi, 2004).



4.1 Adaptation and Mitigation Technologies and Practices for Maize Farming in Kenya

Optimum prioritization of successful agricultural adaptation technologies to climatic eventualities must be geared towards helping farmers minimize or eliminate climatic risks. Effective adaptation strategies for the projected impacts of climate change should be aimed at improving soil health, capacity of local institutions and farmers' knowledge, water conservation, livelihood diversification, and effective land management (Cairns, et al., 2013). Additionally, increase in CO_2 levels causing global warming will benefit C3 crops including soybeans, rice and wheat, but no substantial impact on C4 crops such as sorghum, millet, maize and sugarcane (Adger, et al., 2007). Farmers in Kenya have started selecting crop combinations based on prevailing climatic conditions such as moving away from growing maize and wheat that are affected by heat and water stress. Farmers are switching to more drought tolerant and heat resistant crops such as millet and sorghum, which would reduce crop failure caused by temperature stress (Cairns, et al., 2013). With current uncertainties on the shift of location and quantitative impact of climate change, development of good and pragmatic long-term programs and policies are important mitigation investments for the projected impacts (Nhemachena, & Hassan, 2007). A pro-poor and pro-growth development agenda supporting sustainable agricultural practices contributes to improved production and food security. Policies and

programs have to be inclined towards providing more access to resources and conducive socio-economic environment that is flexible and responsive to agricultural challenges.

To reduce future water related stress, there is need to rehabilitate existing irrigation schemes and construct new larger schemes. However, this is limited by social and natural constraints such as water availability, land geography, affordability, and environmentally unsustainable (Bryan, et al., 2013). Development of small-scale irrigation facilities and technology is a better approach to ensure sustainable use and conservation of water resources to maintain productivity of crops in future (Fujiie et al., 2011). Small scale holders have to employ shallow hand dug wells to supplement limitations relating to scarcity of water particularly during drier seasons (Ngigi, 2009). Efforts already underway such as rain water harvesting from rooftops and drainage ditches with subsequent storage should be enhanced to cope with variability in rainfall (Fujiie et al., 2011). Increased rainfall due to impacts of near-term climatic changes in western Kenya highlands, rift valley and central Kenya regions predicts increase in runoffs and groundwater availability. This provides alternative sources of water for major agroecological regions. There is need for hydrological studies on the feasibility of ground water irrigation methods and systems.

Modern maize cultivars characterized by shorter heights, little photoperiod sensitivity, and shorter growing cycle with higher yields have proven to be more robust for future climates, compared to traditional cultivars evident by their higher yield in current climates (Nhemachena, & Hassan, 2007). Switching from traditional to modern cultivars will be a major adaptation in ensuring water use efficiency, resistance to incidences of pest and disease and timely harvest in readiness for drying conditions to minimize post-harvest losses (Sultan et al., 2014). Drought tolerant maize varieties have a central role in ensuring sustainable food availability in Kenya. A niche for adequate investment in research for development and dissemination of such cultivars is presented here-in, that can significantly minimize impact of climate change in drought prone regions.

Soil health improvement and water conservation are particularly important with practices that enhance effectiveness of irrigation, fertilizer use, improved seeds, and conservation agriculture: minimum tillage, agroforestry, rainwater and ground water harvesting, and storage for use during dry seasons playing center stage (Adger, et al., 2007). Improved agronomic practices significantly improve soil health quality by reducing evaporation and improving infiltration; which ultimately develops resilience on crop systems for changing climatic conditions (Cooper et al., 2008). Afforestation and reforestation using climate smart species is essential in improving soil resource, as well as discouraging deforestation. It is critical to encourage crop rotation, and sensitize farmers to retain adequate levels of crop residues on the farm; which maintains soil surface cover and minimize water stress (Cairns, et al., 2012).

Breeding for insect pests and disease resistance has been a point of focus in agricultural research, and improving resistance to biotic stressors as a result of climate change. This is best achieved through

government funding and promotion of research and development of biotechnology and plant breeding technology (Schlenker & Lobell, 2010). With extreme poverty levels, hence challenges related to affordability of modern technologies, the government should subsidize development of irrigation schemes; both small scale and large scale, and finance mechanization, technology and technical knowledge dissemination (Cairns, et al., 2013). Greater advancement in agricultural science, innovation and technology is necessary in meeting demand for maize by the growing population shifting into urban industrial cities. Many of these people desire diverse diets because of higher income (Nhemachena, & Hassan, 2007). Investing in agricultural science and dissemination of food and nutritional knowledge is an important pillar in meeting these needs (Cairns, et al., 2012). Developing rural infrastructure provides a solid foundation for maize farmers to take advantage of improved farming management techniques and new cultivars. Ensuring higher yields and more areas under maize cropping requires maintenance and increased density of rural road networks for easier access to markets, extension services and facilities, and reduced costs in transport of inputs and products (Nelson et al., 2009).

Investment in agricultural research including facilitation of laboratory scientist and providing infrastructure for extension services is needed (Nelson et al., 2009). Partnership between national government systems and seamless interaction with international centers form a significant part of implementing adaptive solutions. This must involve collaboration with local farmers, consumer groups or markets, input suppliers, and traders who are vital in maize farming value chain for effective development and dissemination of information. Such collaborative approach ensures cost effective, appropriate, and adaptive techniques or cultivars information and communication is revitalized among farmers and scientists to meet production demands and address challenges (Schlenker & Lobell, 2010). Within agroecological zones, extension programs play key role in sharing information through transfer of technology, building capacity, facilitating interactions, and encouraging farmers to establish their own support network (Nhemachena, & Hassan, 2007). Extension services help in climate change adaptation by; disseminating local cultivars, drought, disease and pest resistant maize varieties and information, teaching on improved and sustainable farmland management systems or practices, and collecting information to support and guide national research. Farmer organizations are an effective avenue for sharing information and provide cost effective linkage between government efforts and implementation activities (Nelson et al., 2009).

5.0 Conclusion and Recommendation

Kenya's climate is projected to become wetter particularly in short rainy seasons between October and December especially in the Arid and Semi-arid agroecological zones in Northeastern Kenya and Coastal region between mid-century and towards the end of the century (Hassan et al., 1997). This will be accompanied by warmer seasonality with trends of extremely wet seasons in both long and short rainy seasons as a result of weather extremities such as Elnino, hence floods that destroy crops are expected. The projected drought characterized by La Nina extremities

are likely to intensify notwithstanding the projected wetter conditions especially in upper highland areas and lowland region. Incremental adaptation measures should be embraced to minimize impact of climate change by fine tuning existing systems through changing planting dates, use of more resistant and improved cultivators for respective agro-ecological zones, and alter plant densities, nutrient and embrace on-farm water management practices (Cooper et al., 2008). To formulate better climate change mitigation and adaptation measures, there is need for further research to quantify the impacts of climate change in specific agroecological zones with focus on the climatic requirements for different developed maize varieties, as well as other food crops such as sorghum, cassava, potatoes and banana; cash crops including tea, coffee, sugarcane and cotton (Cairns, et al., 2012). There is need for keen interest in food production factors such as land use, market demand, disease, pests and weeds. Agriculture in Kenya is mostly rainfed which necessitates development of small-scale irrigation technologies or practices to ensure future food security is achieved. However, affordability and technical know-how remains a key challenge for farmers to manage agricultural productivity and build resilience against impacts of climate change (Hassan et al., 1997). It is critical to support participation of communities and stakeholders in national and community adaptation planning processes, development of mitigation strategies, establishment of agro-ecosystem management, and agricultural production policies (Berrang-Ford et al., 2011).

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Livestock Production and Food Security Determinants in Kitui County: A Case of Kyangwithya East and Mutomo Wards

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ABSTRACT

Livestock is a major source of livelihoods contributing 40-50% of total household income in Kitui. A cross-sectional study was conducted in semi-arid farming zone and arid pastoral zone in Kitui County to understand livestock production constraints and factors influencing food security. Households were calculated proportionately. Simple random sampling was used to select households. Data was collected using a semi-structured questionnaire. Descriptive and multiple linear regression analysis was done using SPSS. A total of 110 households were selected, 64 in Kyangwithya East and 46 in Mutomo Wards. Mean age of respondents in years was as follows: Kyangwithya East 53.6 and Mutomo 51.8. Drought was mainly (100%) the major problem in Kyangwithya East and Mutomo. High cost of treatment/input (98%), low price of the livestock (98%) pest and diseases (43%) in Kyangwithya East. Similarly, high cost of treatment/input (89%), low price of the livestock (74%) pest and diseases (56%) were challenges in Mutomo. In Kyangwithya East (97%) and Mutomo (89%) farmers received climate forecast information mainly through radio with only 20% in Kyangwithya East and 33% in Mutomo trusting the information. Livestock sales were seasonal, December, January, May and September at 60% - 90% while livestock feed was available in January, April, May, June,

November and December. Only 23% in Kyangwithya East and 22% in Mutomo were food secure. Age of the household head and TLU owned had a positive significant influence on food security at $p \leq 0.05$. Livestock development decision makers, planers and policy maker should develop interventions that aim to improve livestock productivity and food security.

Keywords: Livestock, productivity, challenges, Kitui

1.0 INTRODUCTION

Livestock plays an important economic and socio-cultural role among many Kenyan communities. The livestock sub-sector contributes 7% to the gross domestic product (GDP), 17% to the agricultural GDP and provides employment to about 10 million people (Ministry of Livestock Development, 2008). Livestock contributes to food security, impacting on poverty, livelihoods, health and nutrition as well as environment (Nkonki-mandleni *et al.,* 2019). However, this contribution to the economy has always been underestimated due to lack of knowledge on the total livestock population (Roy Behnke and David Muthami, 2011).

Climate characteristics such as temperature and rainfall patterns influences pasture and fodder availability while pest and parasites affects livestock productivity reducing the farmer income (Lamy *et al.,* 2012).This calls for livestock support systems such as veterinary services and extension services to provide continuous learning, transfer of technologies and solve problems in livestock communities (Danso-Abbeam, *et al.,* 2018). Others services such as access to credit help to offset financial constraints while markets serve as information exchange centres (Mutunga *et al.,* 2017).

In Kitui County, livestock is a key source of income (Kitui County Integrated plan, 2018). Different livestock species are kept in different production systems as described in other studies (Kaveva, 2013, Kanui, *et al.,* 2016, Kivunzya *et al.,* 2018).

Livestock sector was devolved with the promulgation of 2010 constitution of Kenya (The Republic of Kenya, 2010) and given the importance of livestock in the county, challenges affecting livestock and factors influencing food security at household level has not been assessed yet. Therefore, it is essential the County to conducts studies to explain gaps that need to be addressed to ensure livestock contributes optimally in improving food security.

2.0 METHODS

A cross-sectional study was conducted in Kyangwithya East and Mutomo Wards. A sample size of 110 of both livestock owning and non-livestock owning households were calculated assuming 95% confidence level and $p = 0.05$. Using proportionate to size formula where 64 households in Kyangwithya East and 46 households in Mutomo were sampled. Simple random sampling was used to identify households to be enrolled in each Ward and data collected using a pretested semi-structured questionnaire. Information on household demographics, livestock holdings, and sources of income, livestock market, livestock support systems and climate information were collected.

2.1 Data Analysis

Descriptive analysis was done. Household sizes were standardized to adult equivalent (AEs) concept based on the differences in nutritional requirements per age and sex. It was assumed that daily food energy requirement of one Adult African Man Equivalent (AAME) is 2250 kcal. The standardized consumption weights used by ages were 0-4 years 0.24 AAME; 5-14 years 0.65 AAME and above 15 years 1.00 AAME (Amwata *et al.,* 2016).

Livestock holdings were also standardized into Tropical Livestock Units (TLU) which converts different ages and species of livestock into homogenous unit; One TLU is equivalent to 250 Kgs and equals to 0.8 cattle, 0.5 donkey, 0.1 goat/sheep, 0.2 pigs, 0.01 chickens, 0.01 rabbits (Njuki, *et al.,* 2011).

Income per adult equivalent approach was used to estimate household vulnerability to food insecurity using data on household total income and the number of individuals present in that household. Poverty lines for Kenyans in rural areas used were Kshs 1,250/month/adult equivalent (KPHC 1999). Kenyans living below these standards were thus considered to generate inadequate income levels to meet basic needs for their families. Total income per household per month divided by the sum of AAME gave the income per adult equivalent per month.

VFIt= Ya/Yr; was used to calculate vulnerability to food insecurity

Vulnerability to food insecurity (VFI) at time t = Actual average income/adult equivalent/month for a household (Ya) divided by the required average income/adult equivalent/month for that household (Yr)(Amwata *et al.,* 2016). Households with a ratio falling below one (1) were termed as food insecure.

Multiple linear regression analysis was used to assess the effect of a number of variables on food security in Kyangwithya East and Mutomo Wards. The model was as follows.

$$\gamma = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 \dots\dots + \beta_n x_n + \epsilon n$$

Where α = constant term

ϵ = Error term

$\beta_1\, \beta_2 \dots\dots\dots\dots\dots \beta_n$= regression coefficient

$x_1 x_2 \dots\dots\dots\dots\dots x_n$ = Independent variables

The specified model used;

$$F = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 \dots\dots + \beta_n x_n + \epsilon$$

Where;

F= Household monthly income/adult equivalent

ϵ= Error term

X_1=Gender of household head

X_2=Herd size in TLU

X_3=Age of the household head

X_4=Access to extension services

X_5=Access to climate information

X_6=Member of a group

3.0 RESULTS AND DISCUSSION

3.1 Socio-demographics characteristics of respondents in Kyangwithya East and Mutomo Wards

3.1.1 Age of the household head

The mean age of respondents was 53.6 and 51.8 years in Kyangwithya East and Mutomo respectively. Only 6.3% of the respondents in Kyangwithya East and 2.2% in Mutomo aged ≤ 35 years of age showing that youths were less involved in livestock farming. Although, most of the household heads were within the active working category and have accumulated knowledge, wisdom and experience over the years, there is a gap in passing this knowledge from generation to generation. This has been associated with rural-urban migration (Adesehinwa, *et al.*, 2004). The findings agrees to other studies across Africa and in Kenya (Adesehinwa, *et al.,* 2004, Amwata, 2004, Kyalo, 2009, Mutunga *et al.*, 2017).

3.1.2 Education level of the household head

In Kyangwithya East, 44% attained primary level, 34% secondary level and 13 % tertiary level. In Mutomo 34.7% had gone up to primary level while 28.2% had gone up to secondary and the same (%) tertiary. This high level of education in the two levels shows the high likelihood of positive perception in adopting good strategies in livestock production. Similarly, high level of education was also reported in Kaveta and Mikuyuni in Kitui (Mutunga *et al.,* 2017). However, this differed with a study in Katulani in Kitui, were majority had low level of education, most having attained primary level (Mwobobia *et al.,* 2016).

3.1.3 Household size

Household size was grouped into two; Small households (< 5 persons) and large households (>5persons). Most (65.6%) households in Kyangwithya East had small families with an average household size of 4.2 while in Mutomo, 69.6% had large families with an average of 5.5 persons. Household size is proxy to labor needed in livestock production. This was in line with Mwobobia, who reported that, households in the rural areas had large families than those in urban areas (Mwobobia *et al.,* 2016). This was further supported by Mutunga & others who reported average household size of 5.29 and 4.89 persons in Kaveta and Mikuyuni respectively where the population is rural based (Mutunga *et al.,* 2017).

3.1.4 Herd size

The mean Tropical Livestock unit (TLU) in Kyangwithya East was 4.48, majority (84%) with small TLU. Mutomo had an average of 5.04 TLU with 58.7% having small TLU. This indicates most respondents were small-holder farmers as described by food and agricultural organization of united nations that small holder farmers have less than five TLU (FAO, 2015).

3.1.5 Land Size

Land size in this study was grouped into two; small land size; farmers with < 5ha small land size while farmers with ≥ 5 ha had large land sizes. Seventy (%) in Kyangwithya East and 60% in Mutomo had large land sizes. Land is an asset and an increase in land size leads to increases in livestock production (Amwata, 2004). Large sizes of land by most of

households have also been reported in agro-pastoral areas (Amwata, 2004).

3.1.6 Income

Livestock sources provided 80% of the income in the two Wards with 2.6% in Kyangwithya East reporting crops as source of income. Kyangwithya East and Mutomo had monthly average income of Ksh.4, 053 and Ksh.3, 183 respectively. Livestock sales contributed 82% and 79% of the total income in Kyangwithya East and Mutomo respectively. Similarly, in Kajiado livestock was reported as the main source of cash income in both transhumance and agropastoralist with a monthly income of Ksh.4,607 in transhumance and KSh.3,711 in agro-pastoralist (Amwata, 2004). However, a baseline survey in Kitui reported nearly equal contribution of household income from livestock and crops (Ministry of Agriculture, 2014).

3.1.7 Food security

Only 23% in Kyangwithya East and 22% in Mutomo were food secure. Households with high income are usually expected to be food secure for they have improved food production and increased ability to purchase food. Angela Simel, (2015) reported food security level of 44% in Kitui. However, the Kitui household survey, reported 71% household food security. The survey however, indicated food availability was seasonal with food scarcity experienced in the months of July to November (Ministry of Agriculture, 2014).

3.2 Support System for Livestock Production

Livestock support services can enhance the role of livestock production in rural livelihoods by determining the quality of animals kept, hereafter improving the quality and quantity of livestock products and high prices in market.

3.2.1 Extension services: In Kyangwithya East Ward, about 63% of the respondents had received extension services within the past year with the services mainly being delivered by government officers and non-governmental organization (NGOs) 75%. In Mutomo, approximately 77% of respondents used farmer to farmer peer learning as a method for extension services in addition to government officers (39%), NGOs (23%) and community based organizations (CBO) (13%). Extension services helps farmers to improve their knowledge and aids in making informed decisions (Mutunga *et al*., 2017, Danso-Abbeam *et al.*, 2018). It is important to note that NGOs and CBOs complement the government in provision of extension services.

3.2.2 Access and source of credit: Credit facilities were available to about 59.4% and 47.8% of the respondents in Kyangwithya East and Mutomo Wards respectively. Increased access to credit has been associated with indirect benefits to farming, offsets financial challenges and helps improve production and works in complementary with the extension services.

3.2.3 Animal health care providers: It was observed that, one respondents would use different service providers. In Kyangwithya East, about 91% of respondents received veterinary services from government officers, 14% from private veterinarian and equal proportion of 13% from neighbours and herbalist each while 14% of the respondents treated their own animals. In Mutomo 56.5%, received services from both government and private officers, 20% treated their own animals, 9% from neighbours and 7% used herbalist. Treatment of livestock by unqualified persons leads to drug resistant strains in livestock which can be passed to human through food chain. Kanui and others reported community health workers as the main veterinary service providers in Kitui and Makueni Counties (Kanui *et al.*,2016).

Table 1: Characteristics of respondents in Kyangwithya East and Mutomo wards

Variable	**Classification**	**Kyangwithya East (n=64)n(%)**	**Mutomo(n=460) n(%)**
Age	≤ 35	4 (6.3)	1 (2.2)
	36-50	28 (43.7)	17 (36.9)
	>50	32 (50)	28 (60.8)
	Mean age	53.6 years	51.8 years
Education level	No formal education	6(9.3)	4(8.6)
	Primary	28(43.8)	16(34.7)
	Secondary	22(34.4)	13(28.2)
	Tertiary	8(12.5)	13(28.2)
Household size	Small (<5)	42 (65.6)	14 (30.4)
	Large (≥5)	22 (34.4)	32 (69.6)
	Mean	4.2	5.5
Land size	Small(<5ha	19(29.7)	17(40)
	Large(≥ 5ha)	45(70.3)	28(60)
Herd Size	Small(≤5 TLU)	54 (84.3)	27 (58.7)
	Medium (>5- ≥10 TLU)		15 (32.6)
	Large(>10)	4 (6.25)	4 (8.7)

		6 (9.4)	
	Mean TLU	4.48	5.04
Income	0-1000	47 (73)	33 (72)
	1,000-2000	7 (11)	8 (17)
	2000-3000	5 (8)	5 (11)
	3000-4000	2 (3)	0 (0)
	4000-5000	3 (5)	0 (0)
Food security	Food secure	15 (23)	10 (22)
	Food insecure	49 (77)	36 (78)

3.2.4 Farmer groups/cooperatives: Thirty-six (%) of the respondents in Kyangwithya East and Mutomo Wards were members of self-help group. with 9.4% in Kyangwithya East, being members to a cooperative group as compared to Kitui household survey where 21% of the respondents were members to agricultural group (Ministry of Agriculture, 2014). Groups/cooperatives facilitates easy access to market information, resources farming services and extension services.

3.2.5 Livestock marketing: In the two wards, the proportion of respondents selling livestock were increased in January, May, August, August and December and ranged from 30% - 90%. The proportion dropped to <5% in March, June, July, October and November (Figure 1.

Livestock marketing was seasonal in the two study areas. Studies have stated that, livestock marketing are determined by type and magnitude of expenses, environmental and climatic conditions (Pavanello, 2010).

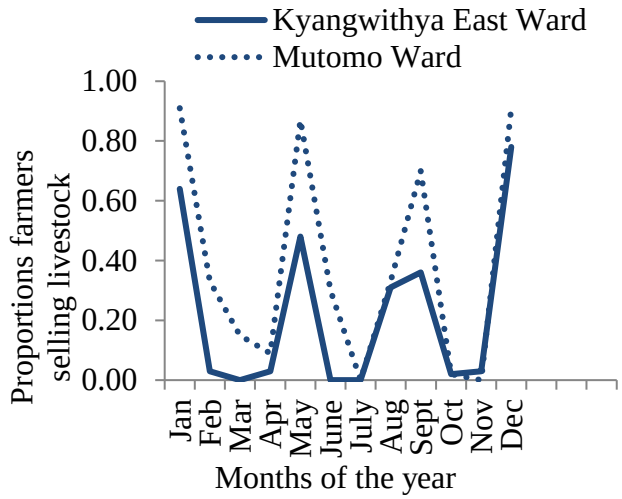

Figure1: The trend of selling livestock in Kyangwithya East and Mutomo Wards

Respondents sold livestock for school fees, during festive seasons, drought to destock or to buy food in the two Wards. Livestock is an asset for cash/income generation. Pavanello, (2010) reported that livestock were sold mainly to meet basic needs in Ethiopia. While in Congo, respondents sold animals for school fees and during chrismas seasons (Maass *et al.*, 2012).

3.3 Challenges to livestock production as perceived by farmers

Drought was mainly (100%) the major problem in Kyangwithya East and Mutomo Wards. Other challenges were; high cost of treatment/input (98%), low price of the livestock (98%) pest and diseases (43%) in Kyangwithya East. Similarly, high cost of treatment/input (89%), low price of the livestock (74%) pest and diseases(56%) were challenges in Mutomo similar to other studies (Maass *et al.*, 2012).

3.4 Climate Information and Livestock Production

In the study areas, 92.7% of the respondent acknowledged that climate was changing overtime, drought being the extreme event similar to Mutunga *et al.*, (2017) who reported temperature increase and rain decrease in the years. Drought damages natural resources impacting negatively on feed and water availability (Tiruneh & Tegene, 2018). Climate information was received by 96% of the respondents in the two wards mainly through radio in Kyangwithya East 97% and Mutomo 89%. Similar to Kitui household survey, radio 81%- 83% and traditional indigenous knowledge (88%-90%) were the main source of climate information (Ministry of Agriculture, 2014).

In the two Wards, only 28.2% of the respondents trusted the climate information using it in planning their livelihood activities. Climate information is a useful tool for minimizing climate risk among rural households. It can be assumed that in the media, climate information was not clear and respondents could not ask questions for clarification. This finding agrees with other studies in Makueni and Kitui. (Amwata, 2013,Mutunga *et al.*, 2017).

3.5 Livestock feed Availability

Kenya experience rain in March-April-May and October-November-December. It is within this seasons when pasture and fodder is available. Climate change and variation directly impact on livestock feeds influencing the body weight and livestock price (Pavanello, 2010). Strategies such as reduce herd size hay harvesting, storage of crop residues, forage development and change of herd composition considering goat rearing which feeds less and has short life cycle to maturity and marketing cushions farmers during dry period (Tiruneh & Tegene, 2018) (Figure 2).

3.6 Factors influencing food security in livestock production

A multiple linear regression analysis was carried out to show variables contributing to food security. A correlations among the independent variables were tested before running the regression analysis to show the relationship between the independent variables and to guide on the variables to be included in the analysis as shown in table 2.

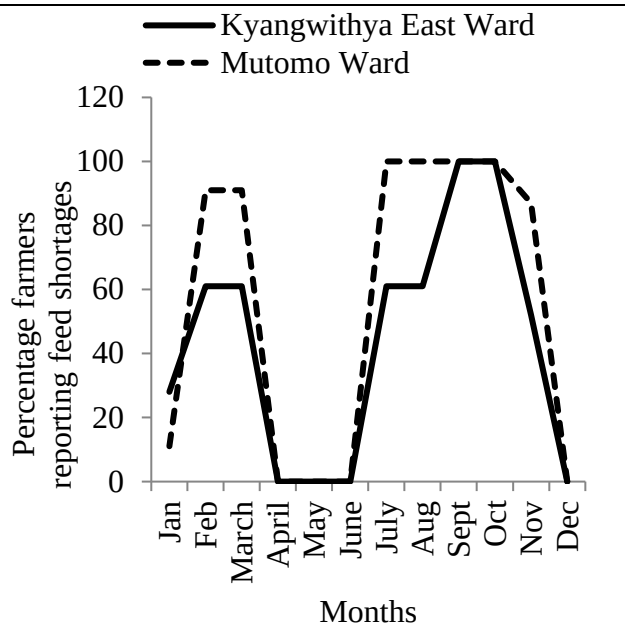

Figure 2: Seasonality of feed shortages in Kyangwithya East and Mutomo Wards

Table 2: Correlation coefficients

	Extension availability	Age of household head	Gender	Climate information	TLU Owned	Member of a group
Extension availability	1.000					
Age of household head	.016	1.000				
Gender	.073	-.020	1.000			
Access to climate information	.081	.049	.039	1.000		
TLU owned	-.242	.025	-.018	.054	1.000	.056
Group member	.208	-.075	.101	-.079	.056	1.000

Age of the household head and TLU owned had a positive and significance influence on food security at $p \leq 0.05$. However, gender and being a member to a group was significant at 90% level of confidence ($p \leq 0.10$) (Table 3).

Table 3: Results of regression analysis

	Unstandardized coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.089	.232		.384	.702
Gender	.100	.055	.161	1.834	.069*
Age of household head	-.094	.047	-.176	-2.019	.046**
TLU owned	.165	.042	.352	3.883	.000**
Access to information	.173	.132	.115	1.310	.193
Group member	-.097	.057	-.154	-1.699	.092*
Access to extension	-.055	.070	-.073	-.785	.434

***Significance at 95%, level of confidence; n=110: Adjusted =0.177; F=4.901*

It is assumed that one can only access enough food if he/she can produce or have adequate income to purchase the food. In African countries, TLU owned is a source of wealth, asset and can be translated into cash easily (Pavanello, 2010). Similarly, Amwata, (2004) found that food security in developing countries can only be achieved by increasing household income in-addition to wisdom and experience in farming and increasing income of women (gender). In other studies, land size and household size in an agro-pastoral community determined of household food security. This can be explained that, large land size is assumed to have more farm produce however; land production is directly influenced by income and other factors such as rainfall. Similarly, large households are only food secure if the dependency ratio is

less than 70.8% (Amwata *et al.*, 2016). Again in Kajiado, a pastoral community, food security was a factor of accessibility to climate information, herd size and off-farm employment (Amwata, 2004). This variations demonstrates that, factors contributing to food security may vary based on geographical area, production systems and socio-cultural practices.

4.0 CONCLUSIONS AND RECOMMENDATION

The study established that, youth was less involved in livestock farming. Livestock production is experiencing gaps in extension services, accessibility and availability to credit facilities and quality animal health services. Climate information is available but not trusted by livestock farmers. Pasture is available during rain seasons while farmers increase livestock sells during dry season. Drought, high cost of treatment, low market livestock price, livestock pest and diseases were the main constraints to livestock production. The area is food insecure while age of the household head, TLU owned, gender of the household head and membership to a group influenced food security. Therefore, livestock development decision makers should develop strategies that increase the number of livestock owned at household level targeting women to enhance food security coupled with provision of livestock production support services.

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Propagation Abilities of an Overused Clerodendrum Plant Species from Garissa and Tana-River Counties

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ABSTRACT

The use of plants in herbal medicine is as old as humankind. In Africa and Kenya in particular, plants' ethnomedical information and the diseases they treat have been orally passed on from one generation to the other. The increasing human population, inappropriate harvesting methods, lengthy and recurrent droughts, and overuse of plants as medicines, fodder, and firewood compounded by limited natural regeneration threaten the existence of these important plant species warranting urgent intervention. Furthermore, the high costs, insufficiency, and inaccessibility to modern medicine have forced over a million rural community members in Tana River and Garissa Counties to use *Clerodendrum rupicola* synonym *Rotheca rupicola* (Verde) Verde (*Tiire/Harmale* – Somali and *Marasisa* – Boran languages) to treat various ailments. Considering these challenges, this study documents the propagation abilities of *Clerodendrum rupicola* from big and small stem and root cuttings. Half of the cuttings were treated with Anatome rooting hormone, while the other half were planted without hormones in a randomized complete block design at the Garissa University Memorial Botanical Garden.

Germination percentage, number of shoots, shoot length and number of leaves were observed for two months. The results showed that 57% and 50% respectively of the big stems that were treated with rooting hormone and those without the hormone sprouted. Moreover, 50% of small stems with or without rooting hormone sprouted. The roots recorded the lowest germination percentage of 6%. The results suggest that the stems of the *C. rupicola* have a higher propagative ability than the roots. Though the small stem were able to sprout, the study shows that big stems are the most appropriate for propagation with or without hormone.

Keywords: Clerodendrum rupicola, medicinal value, propagation, sustainability, overuse, extinction

1.0 INTRODUCTION

Since ancient times, humans have used plants for several purposes ranging from food to medicines (de Sousa *et al.*, 2016). Most importantly, medicinal plants have played a crucial role in promoting health as they offer valuable medicines (Othman and Farooqui, 2015; World Health Organization - WHO, 2013). As a result, herbal remedies are currently being scientifically explored to establish their healing potential (Magwede *et al.*, 2019; Moriasi *et al.*, 2020).

Indeed, traditional medicine remains to be a crucial component of healthcare, especially in the low-income earning countries in Sub-Saharan Africa (James *et al.*, 2018; Mukungu *et al.*, 2016). Due to abject poverty, inadequacies of conventional medicine, and underdeveloped healthcare systems, over 80 % of the world population almost entirely depend on traditional medicine for their primary healthcare needs (WHO, 2005; 2013).

In Kenya, 70% of the population, mostly rural dwellers, utilize herbal medicines as they are reliable, easily available, trusted, affordable, and culturally acceptable to meet their healthcare needs (Okumu *et al.*, 2017). One of the most used medicinal plants is *C. rupicola*, a plant belonging to the Lamiaceae family. Residents of North-East Kenya, especially those living in Tana River and Garissa Counties largely depend on traditional medicine for their healthcare needs (Kaingu *et al.*, 2013; N'Gbichi *et al.*, 2019). Since these counties' residents are pastoralists, their mode of life drifts them from the conventional healthcare system due to inaccessibility and unaffordable costs (ELCI, 2006). This plant is also exploited for firewood, fodder for animals, among other purposes, by the nomadic pastoral and agro-pastoral communities of the arid region. Consequently, overuse of the multipurpose *C. rupicola* as medicine, fodder and firewood without proper documentation and conservation has led to its reduced density, cover and regeneration. As a result, if interventions are not made, the plant may be threatened, endangered, and subsequently become extinct, thereby adversely impacting the livelihoods of the communities and future generations (Hamilton, 2004). Furthermore, there is no known attempt to conserve the plant through planting and other conservation methods threatening its existence and sustainable use (Cunningham, 2014).

In this study, the propagation abilities of the plant's vegetative materials (roots and stems) and the effect of rooting hormones on these plant parts to catalyze growth were investigated.

2.0 MATERIALS AND METHODS

2.1 Study sites

The study sites were Garissa and Tana River Counties, Kenya (Figure 1), a natural habitat for *C. rupicola*. Tana River County is one of the six counties located in the Coastal Region of Kenya. It boarders Kitui, Garissa, Isiolo, Lamu, and Kilifi counties to the West, North East, North, and South East, respectively. It has three sub-

counties, namely, Bura, Galole, and Tana Delta. The county lies between latitudes 0^0 0'53" and 2^0 0'41" South and longitudes 38^0 25'43" and 40^0 15' East. The county has a low altitude range of 0m - 200m above sea level, and flat and low-lying terrain and receives a mean annual rainfall amount of 300mm to 500mm and an average annual temperature of 30^0 C (Government of Kenya - GoK, 2018a). This county has an area size of 37,950.5 Km^2 with a population of about 315,943 people (GoK, 2018a).

On the other hand, Garissa County is located in in the North Eastern Region. It covers an area of 44,753 km^2 with a population of 841,353 (KNBS, 2019). The county borders the Republic of Somalia and Lamu, Tana River, Isiolo, and Wajir counties on the east, south, west, northwest and to the north, respectively. The county lies between latitude 1^0 58' N and 2^0 1' S and longitude 38^0 34' E and 41^0 32' E. The county has a low altitude range of 20m - 400m above sea level, and flat and low-lying terrain (GoK, 2018b)

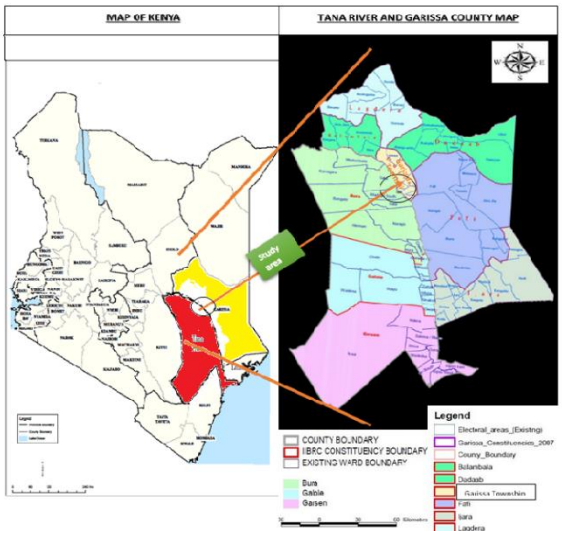


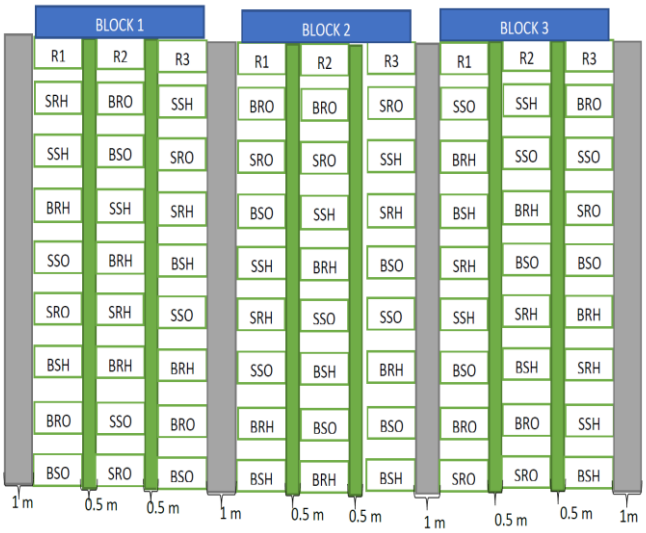
Figure 1 Map of Garissa and Tana River Counties showing the study sites (GoK, 2018a and GoK 2018b)

2.2 Sample collection

The roots and stem cuttings of *C.rupicola* were harvested from the parent plants in their natural habitats with support of a herbalist, and identified at the National Museums of Kenya and immediately placed in cooler boxes with ice. The stems and the roots were then transported to the botanical garden at Garissa University for immediate direct planting in a field prepared in advance (Figure 2). The stem/root cuttings for planting consisted of two types; big stems and roots (with a diameter of 2cm) and small stems and roots (with a diameter of 0.5cm) and both vegetative planting materials were 6cm long. Each of the stem cuttings had two to three active buds. The cuttings were directly planted to imitate nature and fast track its growth performance.

2.3 Study design

A Randomized Complete Block Design (RCBD) (Figure 2) was used in this study. Intra and interspacing (between the plantings and plots) was 0.25m. Each plot consisted of line plantings of six stems or roots. Three blocks comprised of three replicates (R1, R2 & R3) (Figure 2). Thus, each treatment was replicated three times per block. The study was based on 432 stem and root cuttings.



SSH: Small stem with hormones; SSO: Small stem without hormones; BSH: Big stem with hormones;

BSO: Big stem without hormones; SRH: Small root with hormones; SRO: Small rot without hormones; BRH: Big root with hormones; BRO: Big root without hormones.

Figure 2 Sketch of complete block design for vegetative propagation of *C. rupicola* at the Garissa University Botanical Garden, Kenya.

Throughout the study period, watering was done twice a day (morning and evening), and weeds were removed daily to avoid nutrient and water competition with the cuttings. The plots were covered with partial shading to avoid the adverse impact of heat.

2.4 Treatment of the cuttings

The cuttings (stem and roots) were planted under four different treatments (Figure 2). Anatome rooting hormone was applied to half of the cuttings (stems and roots), while the other half were not treated with the hormone.

2.5 Data collection

Germination percentage, number of shoots, growth rate of shoots and leaf number were recorded during the 2-month of the experiment.

3.0 RESULTS AND DISCUSSIONS

The need for conservation strategies towards overused, threatened, and endangered valuable plant species is paramount. Overuse, harsh climatic conditions, and inaccessibility and high costs associated with conventional medicine have posed a threat to medicinal plant biodiversity (ELCI, 2006). One such overused plant is *C. rupicola*, which has diverse uses among the locals of Northeastern Kenya (Hamilton, 2004). Therefore, this study sought to evaluate the propagation abilities of stem and root cuttings of a *C. rupicola* as a strategic approach towards its conservation.

3.1 Regeneration ability of the cuttings (germination percentage)

The results showed that both stem and root cuttings whether treated with hormones or not germinated except for cuttings from small roots. Being tender, the non-germination from the small stems could be related to its susceptibility to stress upon detachment from the parent plant. However, there was a significantly higher percentage regeneration in both the small stem and big stem cuttings than those of big root cuttings whether treated with hormone or not ($p<0.05$) (Table 1; Figures 3, 4, 5 and 6). But regeneration among the hormone-treated and the untreated big stem and small stem cuttings were not significantly different ($p>0.05$). The regeneration of stem cuttings was at least 50% though it was highest with the big untreated stems (57%).

Table 1 Propagation abilities of a C. rupicola, Garissa University Botanical Garden, Kenya

Cutting and treatment	Sprouting	Number of Shoots	Length of shoots (cm)	Number of leaves
BRH	0.500 ± 0.500^{b}	14.000 ± 0.000^{a}	18.000 ± 0.000^{a}	42.000 ± 0.000^{a}
BRO	1.500 ± 0.500^{ab}	6.000 ± 1.000^{b}	13.500 ± 0.500^{b}	26.000 ± 2.000^{b}
BSH	3.000 ± 0.553^{a}	2.667 ± 0.289^{cd}	6.056 ± 0.429^{c}	10.560 ± 1.500^{c}
BSO	3.444 ± 0.556^{a}	2.778 ± 0.401^{c}	6.278 ± 0.345^{c}	7.330 ± 1.140^{d}
SSH	3.000 ± 0.441^{a}	1.889 ± 0.309^{cd}	2.722 ± 0.465^{d}	4.333 ± 0.928^{de}
SSO	3.000 ± 0.471^{a}	1.778 ± 0.324^{d}	2.056 ± 0.194^{d}	3.444 ± 0.452^{e}

BRH: Hormone-treated big root cutting; BRO: Untreated big root cutting; BSH: Hormone-treated big stem; BSO: Untreated big stem cutting; SSH: Hormone-treated small stem cutting; SSO: Untreated small stem cutting. Values are presented as $\bar{x} \pm SEM$; Values sharing a similar superscript alphabet within the same column are not significantly different ($p>0.05$; One-Way ANOVA with Fisher's LSD *post hoc* test).

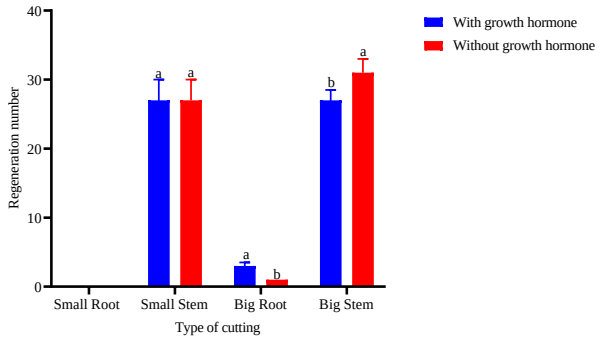


Figure 3 Growth performance of *C. rupicola* cuttings, Garissa University Botanical Garden, Kenya. Bars with dissimilar letters at each cutting type are significantly different (unpaired student t-test; $p<0.05$)

The results revealed that stem cuttings do not necessarily require hormonal treatment to regenerate. This is in consistence with a study by Inoti *et al.* (2016). It indicates that the stem cuttings especially big stems are capable of independent regeneration upon planting and hence saves costs. Therefore stem cuttings could be the best option for regeneration and restoration of biodiversity and cover, especially by the locals (Pence, 2011).

Although hormone-treated big roots and its untreated counterpart also grew. percentage regeneration of roots was very low (<26%). No significant difference was observed in germination between the untreated and the treated big root cuttings ($p>0.05$) (Table 1). This implies that roots could be ideal for the current use as herbal medicine.

Figure 4: Sprouting of *C. rupicola* from big root cutting, Garissa University Botanical Garden, Kenya

Figure 5: Sprouting of *C. rupicola* from big stem cutting, Garissa University Botanical Garden, Kenya

Figure 6: Sprouting of *C. rupicola* from small stem cutting, Garissa University Botanical Garden, Kenya

3.2 Shooting and leafing abilities

In this study, the number of shoots that sprouted, their length and number of leaves in each sprouted cutting were determined. The results revealed that, the big root under hormonal treatment presented significantly more shoot count, shoot length, and leaves than all the other cuttings ($p<0.05$) (Table 1, Figure 7). This could be related to the fact that the hormones encouraged growth of leaves than roots.

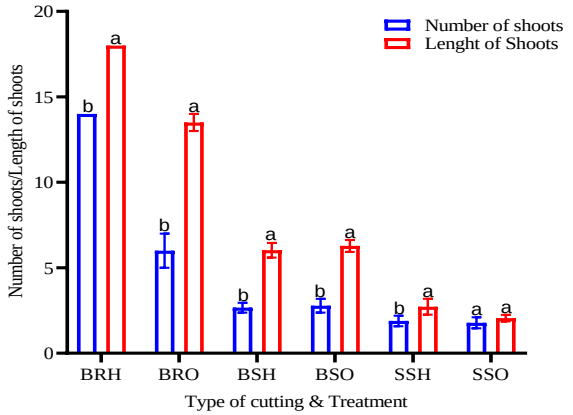


Figure 7 Shooting and leafing abilities of *C. rupicola* species, Garissa University Botanical Garden, Kenya. Bars with dissimilar letters at each cutting type are significantly different (unpaired student t-test; $p<0.05$)

The findings indicate that the Anatome hormone significantly improved shooting and leafing in the big root cuttings. Even though root sprouting was low, the few sprouts grew longer and produced more leaves than other cuttings. This suggests that the Anatome hormone functions better as a shooting and leafing booster than a rooting enhancer. This is contrary to the findings of Sharma *et al.* (2018) where IBA rooting hormone catalyzed the germination of root cuttings to 81%. The difference could be related to the type of growth hormone used. It seems that IBA enhances growth in root cuttings while Anatome hormone encourages shoot growth and leaf production.

Lower number of shoots shoot lengths and number of leaves were recorded in small stems than all other cuttings. Specifically, the number of shoots, shoot lengths and number of leaves in the hormone-treated or untreated small stem cuttings were significantly different from those of big stem cuttings could be due to the tenderness of the cells of the small stem cuttings and therefore may require more time to establish.

Big stem cuttings whether treated with hormones or not had similar number of shoots and shoot lengths ($p<0.05$) but the treated cuttings had slightly more leaves. It could mean that the hormones encouraged growth of leaves on big stems.

Nevertheless, this study's findings demonstrate the potential of regeneration of *C. rupicola* to restore its cover, density and regeneration in homesteads, on farms and in the wild.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

Based on the obtained results, the following conclusions were drawn:

i. The propagation of *C. rupicola* big stem cuttings does not require Anatome hormone and, therefore, will save money and time for farmers/clients by directly planting big stem cutting boosting agroforestry practices
ii. The germination of root cuttings was poor and therefore their use is ideal for herbal medicine than for propagation.
iii. Big stem cuttings had more shoots than small stems, further justifying the need to promote it as vegetative propagation material.
iv. Treatments with Anatome hormone encourages shoot and leaf development and boosts growth rate of shoot length, especially with root cuttings.
v. Although regeneration of roots was low (4%), the number of shoots from the cuttings treated with Anatomehormone was significantly higher (14 shoots) than those from untreated cuttings (6 shoots).

Similarly, the growth of shoots from treated cuttings was 29% (18 cm in two months) more than the untreated cutting (14cm in the same period). This means that the application of Anatome hormone on cuttings from big stems and big roots affected the production of the number of shoots and their growth.

vi. The plant cuttings were directly planted in the field to imitate nature and on-farm conditions for faster adoption.

4.2 Recommendations

Further studies aimed at regenerating *Clerodendrum rupicola* using different hormones and hormone concentration, and under different environments such as soil media, nursery containers, different shade intensities, among others, should be conducted. Additionally, genetic characterization to reduce consequences of inbreeding and germplasm preservation of this plant should be conducted for conservation. Besides, communities should be sensitized and educated to plant using big stem vegetative materials. Awareness should also be created to protect, and conserve the plant in homesteads, farms, and their natural environment to ensure sustainable utilization and avoid extinction.

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Comparison of the Elemental Patterns of Beef and Vegetable Meals with Chicken Meals, and the Apple Effect

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Abstract

This paper compares the elemental content of meals that were categorized as vegetable, beef and chicken based for 4-6, 7+ and 10+ months sold on the market. In one category, the chicken based meals contain apple while the other is free from apple. A summary of the trace elements and minerals for which each meal category shows higher levels in contrast to the rest was determined. This follows a previous study by the researcher where ICP-AES and ICP-MS were used to determine the levels of trace elements and minerals. The trace elements namely: cadmium (Cd), copper(Cu), iron(Fe), lead(Pb), manganese(Mn), nickel(Ni), selenium(Se) and zinc(Zn) and minerals: calcium(Ca), magnesium(Mg), phosphorous(P), potassium(K) and sodium(Na) in a brand of baby food were analysed. The findings showed that levels of the trace elements and minerals in the foods were below the Recommended Nutrient Intakes (RNI). In this paper, an analysis of the trace elements and minerals for which each meal category shows higher levels in contrast to the rest indicated that vegetable based foods (W1, X1 and Y1) were richer in Ca, Na and Zn compared to the other categories of meals. Similarly, chicken based foods (W2, X2, Y2) had higher values in Cd, K, Mg, Mn, Ni, P and Se in relation to the rest. The beef based meals (W4, X4, Y4) were higher in Cu, Fe and Pb. However, synergistic and antagonistic interactions were suggested whereby, chicken based meals with added apple (W3, X3, Y3) were lower in Cd, K, Mg,

Mn, Ni, P and Se compared to those without added apple (W2, X2, Y2). On the other hand, the levels of Cu, Fe and Pb in the chicken meals containing apple were higher than in the meals without apple and surpassed levels in the beef meals. These findings emphasize the role of synergistic and

antagonistic interactions depending on the composition of the meals in determining the level of trace elements and minerals. It is recommended that manufacturers consider these interactions in declaring nutrient levels. The same level of nutrients found in beef can be achieved using different food ingredients. Commercial baby food manufacturers should explore this to facilitate in developing foods for infants that may be reactive to beef based foods. Further research is recommended to examine the interactions in the chicken meals with and without apple.

Key words: Baby foods, nutrients, trace elements, minerals, beef, vegetarian, chicken, commercial meals, ICP-AES, ICP-MS

1.0 Introduction

It is important to acknowledge the crucial role that trace elements and mineral play in the body as well as the adverse effects that may arise if not consumed as required. This calls for a keen interest in the elemental patterns of diets as well as the synergistic or antagonistic effects that can result from the levels present. For example, studies have shown that the bioavailability of copper is closely linked with that of iron and zinc ((Silva de Lima, et al., 2014). Iron works with copper in haemoglobin formation while zinc is involved in the metabolism of proteins, lipids, nucleic acids, and in neurotransmission (Maret & Sandstead, 2006). For infants and toddlers, high requirements for Iron and Zinc is stressed, to support rapid growth (Gibson, Heath, & Szymlek-Gay, 2014).

Potassium in conjunction with sodium are responsible for osmotic regulation in the body. For a healthy body, the level of sodium in plasma is expected to be equal to the amount of water and potassium (Ingelfinger & Sterns, 2015). Phosphorous helps to maintain the body pH. However, excess amounts reduce calcium uptake.

Different methods were used by researchers ((Saracoglu, et al., 2007; Zand, et al., 2011; Pandelova, Lopez, Milchalke, & Schramm, 2012 ; Zand et al., 2012; Chevallier et al., 2015) previously to determine the levels of trace elements and minerals in baby foods. These include ICP-AES, ICP-MS; ICP-AES/MS, flame and graphite furnace atomic absorption spectometry and Orthorgonal Acceleration Time-of-Flight Mass Spectromentry (ICP-Oa-TOF-MS). In a research to optimise and validate a process for determining 31 elements in a French Infant Total Diet Study (iTDS) using ICS-MS, it was determined that the concentration of the elements could be verified. Nevertheless, elements such as Hg and Pb required a more sensitive method necessitating the use of sector field ICP-MS which has high sensitivity, accuracy, selectivity and precision ((Quarles, et al., 2014). ICP-AES was employed to determine Ca, Cd, Cu, Fe, Hg, Mn, Ni, Pb, Se and Zn in infant beverages, formulae and solid foods in the EU market (Pandelova, et al., 2012). Results suggested levels within the limits set by European Food Safety Authority (EFSA) except Se which was beyond. In another study to determine the nutritive values of Ca, Cu, Fe, K, Mg, Na, Se and Zn in vegetable and fish based foods for 6-12 months infants, ICP-AES and ICP-MS were employed ((Zand, et al., 2012). The findings suggested a need for increase in the levels of essential elements.

Further findings from a multicenter study comprising five countries, namely, Belgium, Germany, Italy, Poland and Spain showed that on overall 25% of infants start weaning at 4 months and 90% at 6 months (Alvisi, et al., 2015). World Health Organization recommends proper diet to keep a strong immunity. In the advent of Covid-19 pandemic, businesses were temporarily closed up to stop the spread of the disease leading to lower supply of fresh foods. This has a direct impact on the nutrient levels consumed. In Kenya a report on National Guidelines for Healthy Diets released by MoH in 2017 shows the following: 26% of children under the age of five were

stunted; 4% were wasted; 11% were underweight; Consumption of a minimum acceptable diet among children aged 6-23 months dropped from 39% to 31% between 2008 and 2014.

Consequently, the determination of the elemental content of infant meals is important to ensure they get all the required elements and minerals for growth. In this connection, the paper, compares the levels of trace elements and minerals in baby meals that were categorized as vegetable and beef based in relation to chicken based meals with and without apples. This was done for meal categories (Beef, chicken and vegetarian based), for corresponding age groups of 4-6 months old, 7+ and 10+ months. The research also examines the patterns in the elemental content of the meals categorized as vegetable and beef based in relation to chicken based meals with and without apples. It also highlights the effects of ingredients on elemental content considering two chicken based categories, one containing apple and another without.

This investigation follows a previous study by the researcher to determine the levels of trace elements and minerals. Trace elements namely, cadmium (Cd), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), nickel (Ni), selenium (Se) and zinc (Zn); and minerals, calcium (Ca), magnesium (Mg), phosphorous (P), potassium (K) and sodium (Na) in a brand of baby food for 4-6, 7+ and 10+ months sold on the market was analysed, using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES) respectively.

2.0 Materials and Methods

Twelve baby food samples from a popular brand were purchased in the market. Table 1 shows the age range for the foods, weights and sample identification. The samples comprised of vegetable, chicken and beef based diets for three age ranges 4-6 months, 7+ and 10+ months. The foods were placed under normal conditions (4^{o}C) in the fridge.

Table 1: Food samples and main ingredients declared

Food brand	Age in months	Sample ID	Ingredients	Nutritional information
Baby Cauliflower cheese: Pureed cauliflower and cheese	4-6	W1 Vegetable based	Baby grade cauliflower (33%), ground rice, skimmed milk, cheddar cheese (9%), cooking water	Typical values per 100g: Energy 329kcal/78kcal; fat 2.8g of which saturates 1.8g; carbohydrates 8.2g of which sugars 1.6g; fibre 0.9g; protein 4.5g; salt 0.2g
Grandpa's Sunday lunch: pureed chicken and vegetables	4-6	W2 Chicken based	Baby grade vegetables (43%) consisting peas, carrots, tomato, sweetcorn; potatoes; cooking water; chicken (10%); corn starch; rapeseed oil. No added egg, gluten free	Typical per 100g: Energy 309kj/74kcal; fat 2.2 g; saturates 0.4g; omega 3 (ALA) 0.11g; carbohydrate 9g of which sugars 2.5g; fibre 2.5g; protein 3.3g; salt 0.05g
Creamy cauliflower cheese: cauliflower and cheese	7+	X1 Vegetable based	Baby grade cauliflower (36%), cooking water, skimmed milk, cheddar cheese (8%), rice, corn, starch, parsley. No added egg, gluten free suitable for vegetarians.	Typical values per 100g: Energy 263kj/63kcal; fat 2.7g; saturates 1.6g; carbohydrates 5.8g of which 1.5g is sugars; fibre 1g; protein 3.3g; salt 0.18g.

Grandma's Sunday lunch: vegetable with turkey	7+	X2 Chicken based	Baby grade vegetables (34%) consisting parsnip, tomatoes, carrots, onion, garlic; cooking water; potato; turkey (9%), wheat starch (gluten free) rapeseed oil, corn starch, sage, black pepper. No added milk or lactose.	Typical values per 100g: Energy 289kj/69kcal; fat 2.4g; saturates 0.1g, omega-3 (ALA) 0.18g; carbohydrates 8.5g of which 1.5g is sugars; fibre 1.3g; protein 2.5g; salt 0.06 (contains naturally occurring sodium).
Broccoli cheese: Broccoli, cheese with rice	10+	Y1 Vegetable based	Baby grade vegetables (30%) consisting carrots, broccoli (8%), onion, potato, skimmed milk, rice, cooking water, cheddar cheese (contains milk (9%), tapioca starch, black pepper. No added egg, gluten free.	Typical values per 100g: Energy 349kj/83kcal; fat 2.8g; saturates 1.7g; carbohydrates 9.9g of which 1.7g is sugars; fibre 1.3g; protein 3.9g; salt 0.2g.
Chicken Sunday lunch: chicken with potatoes and vegetables	10+	Y2 Chicken based	Baby grade vegetables (43%) consisting carrots, broccoli, parsnip, onion, green beans, peas, garlic; cooking water, chicken (10%), potato, apple puree, corn starch, rapeseed oil, wheat starch (gluten free), parsley, sage, black pepper. No added milk, lactose or egg, gluten free.	Typical values per 100g: Energy 272kj/65kcal; fat 2.1g; saturates 0.2g, omega-3 (ALA) 0.19g; carbohydrates 7.1g of which 2.1g is sugars; fibre 2.3g; protein 3.1g; salt 0.03g.

2.1 Reagents

Ultrapure water was prepared in the laboratory (18.2 MΩ/cm at 25ºC) using a Millipak 2Φ Millipore (Direct-Q® 8UV, 0.2µm) equipment. The ultrapure water was used to make solutions in the experiment. Analytical grade nitric acid (70% concentrated, Sigma Aldrich, Poole, UK)) was used for sample digestion. Mixed calibration standard solutions of the analytes were made from dilutions of individual 1000mg/L stock solutions (supplied by Sigma Aldrich (Poole, UK) of cadmium, calcium, copper, iron, lead, magnesium, manganese, nickel, phosphorous, potassium, sodium, selenium and zinc.

All the glassware and plastic ware were cleaned in an acid bath made up of 5% nitric acid (laboratory grade, Fischer Scientific, UK), for 24 hours to remove impurities, rinsed with deionised water and dried before use.

2.2 Sample preparation and digestion

The food samples were put in 50ml falcon tubes and weighed on an analytical balance to determine the fresh weights. Para film was used to seal the falcon tubes with holes made to allow evaporation of water during the freeze drying process. The food samples were put in a freeze drier (Labconco FreeZone[6], Fischer Scientific, UK) at -50ºC and a pressure of 0.100mbar for 36 hours. The samples were freeze dried to a constant weight to ensure they were fully dry, weighed to confirm the dry masses then stored at room temperature, away from direct sunlight in the falcon tubes.

The freeze dried samples were each homogenised to a fine powder in individual pestle and mortar that had been cleaned in the acid bath for 24 hours. About 0.5g of each sample was weighed separately into five XP-1500 microwave vessels (CEM, UK)

transferred into the fume hood before adding 4ml of concentrated nitric acid Blank samples consisted of 4ml of nitric acid (70% analytical grade, Sigma Aldrich, Poole, UK). Both the samples and blanks were left in the fume hood for one hour with their caps left loose in order to allow any gases generated to escape. This was to reduce excess pressure build-up in the microwave vessels during digestion. The caps were tightened, and the samples and blanks vessels were transferred to the carousel, and arranged as recommended by the manufacturer. The carousel was placed securely on the turntable in the microwave oven, and the samples were digested using the conditions given in Table 2.

Table 2

Conditions for CEM MARS 6® microwave digestion

	Conditions
Sample weight	0.5 g
Vessel type	XP-1500
Nitric acid (HNO_3)	4 ml
Pressure	Max 350 psi
Power	1500 W
Temperature programme	Step 1: Ramp to 210°C for 20 minutes Step 2: Hold at 210°C for 15 minutes Step 3: Allow cooling for 30 minutes to room temperature.

The vessels holder was transferred to the fume hood and the vessels opened slowly to release the built-up pressure. Acid droplets on the stopper and the interior sides of the vessel were washed down with the minimum volume of ultrapure water and then the whole sample solution was transferred into a 50ml volumetric flask. The vessel was then rinsed twice with 10ml of ultrapure water, and each rinse was carefully transferred into the flask. The volumetric flask was made up to mark with ultrapure water. A 5ml aliquot of the sample was transferred into a 20ml volumetric flask, and 25µl of 1000mg/L stock solution of indium used as the internal standard was added to give a concentration of 1.25µg/ml.

2.3 Calibration standards for ICP-MS measurements

Mixed standards for ICP-MS (NexIon 350X, Perkin Elmer, US) calibration were prepared by transferring 1ml each of the 1000mg/L stock solutions of cadmium, copper, iron, lead, manganese, nickel, selenium and zinc into a 50ml volumetric flask. The solution was made up to mark with ultrapure water. This 20mg/L intermediate mixed standard was used to prepare calibration standards between 0-100µg/L in 20ml volumetric flasks each containing the same concentration of indium (1.25µg/ml) as in the samples.

2.3.1 Analysis by ICP-MS

The samples were analysed using the conditions shown in Table 3.

Table 3

Analysis Parameters for ICP-MS

Parameter	Condition
Nebulizer gas flow (ml/min)	0.94
Auxiliary gas flow (ml/min)	1.20
Plasma gas flow (ml/min)	18.00
ICP RF power (W)	1600
Sample flush	55seconds (24rpm)
Read delay	35 seconds (20rpm)
Analysis	-20rpm
Wash	60seconds (rpm)
Number of sweeps	25
Number of readings	1
Replicates	3
KED gas used	Helium

Kinetic Energy Discrimination (KED) mode was used in the analysis. In this mode, helium is used instead of argon in the collision cell to avoid interference by ArO, which interferes with ^{56}Fe.

2.4 ICP-AES

Five minerals (calcium, magnesium, phosphorous, potassium, sodium) were analysed by ICP-AES.

2.4.1 Preparation of Mixed Standards for ICP-AES

Mixed standards for ICP-AES ACTIVA system (Horiba JobinYvon, UK) were prepared by taking 10ml aliquot of 1000mg/L stock solution of each standard (Ca, Mg, K, Na and P) into 100ml volumetric flask. Ultrapure water was added to make up to the mark. Calibration standards between (0-75µg/ml) were prepared in 20ml volumetric flasks to which indium internal standard (1.25µg/l had been added.

2.4.2 Analysis by ICP-AES

The analysis was carried out using radial ICP-AES ACTIVA system (Horiba JobinYvon, UK). (Include this information in the table). The analysis parameters for ICP-AES are given in Table 4 that follows.

Table 4

Analysis parameters for ICP-AES

	Condition
Mode of analysis (s)	Normal
Rinsing time (s)	20
Pump	High speed
Transfer time (s)	15
Stabilisation (s)	10 seconds
Pump speed	High speed

2.5 Recovery Experiments

In order to establish the accuracy of the analyses, similar concentrations of each element as was in the original sample were added. The recoveries were above 60% which was an indication of accurate results. There were low recoveries in lead for the samples due to the low concentration of the spike used with respect to the low levels of the element. The results of the replicate spiked samples were also reproducible. Therefore, it was unlikely that the results were affected by the sample preparation procedure.

2.6 Precision

Precision of the process was ensured by an initial test of a different type of baby food sample three times in five replicates on different occasions. The replicates were initially not homogenised and the results were compared with those from homogenised samples. The findings enabled a decision to homogenise the samples to be taken owing to reproducible results that were recorded from the process. The initial test also enabled an early determination of the range of calibrations to use in the experiment. The calibration range was then reviewed after the initial run of the actual samples. This process enabled the results recorded in this experiment to have high precision as shown by the standard deviations most of which were below 1.0 µg/100g.

3.0 Results and Discussions

3.1 Beef and vegetable based meals compared with chicken meals without apples

Findings on the levels of nutrients in the beef and vegetable based meals for corresponding age groups of 4-6 months old, 7+ and 10+ months suggested that Cu, Fe and Pb were higher in the beef based meals than the vegetable based meals. On the other hand, the vegetarian meals showed higher levels of Ca, Cd, K, Mg, Mn, Na, Ni, P, Se and Zn than the beef based meals. A further comparison of

the chicken meals without apples and vegetable based foods for corresponding age groups of 4-6 months old, 7+ and 10+ months indicates that the chicken based meals without apples tend to have higher levels of Cd, Cu, Fe, K, Mg, Mn, Ni, P and Se than the vegetarian meals. However, vegetarian meals were richer in Ca, Na and Zn compared to the chicken based meals without apples. These findings are illustrated in Table 5 that follows. The brands W1, X1 and Y1 were vegetable based for 4-6, 7+ and 10+ months respectively. W2, X2 and Y2 were chicken based without apples while W4, X4 and Y4 were beef based.

Table 5

Mean concentrations and standard deviations per 100g of fresh food samples

FRESH WEIGHT (µg/100g)									FRESH WEIGHT (mg/100g)				
	Cu	Mn	Fe	Zn	Cd	Ni	Pb	Se	Ca	K	Mg	Na	P
W1	2.9± 1.3	14.2±0.1	28.0±1.7	66.7± 4.4		0.5± 0.5	0.2± 0.3	0.4± 0.2	33± 0.3	39± 0.4	4± 0	28± 0.3	29± 0.2
W2	24.7±1.2	38.4±1.7	170.1± 8.6	125.5± 7	0.4± 0.2	4.2± 0.5		1.2± 0.6	15± 0.4	202± 4	15± 0.1	13±1	52± 0.5
W4	12.5± 0.6	18.8± 0.4	112.5± 2.7	82.2± 1.2		2.5± 0.5	0.2± 0.1	0.6± 0.2	9± 0.1	110± 1	8± 0.1	7± 0	21± 0.2
X1	4.4± 0.1	27.0± 0.3	74.5± 5.4	134.8± 2	0.1± 0	1.2± 0.2		1.2± 0.1	37± 0.4	47± 0.7	4± 0	31± 0.1	30± 0.1
X2	19.0± 1.2	19.1± 0.5	141.7± 2.6	111.7± 2.9	1.1± 0.6	1.7± 0.3		1.2± 0.3	16± 0.3	193± 5.2	10± 0.2	18± 0.5	39± 0.5
X4	6.7± 0.3	10.1± 0.1	58.2± 0.6	49.0± 0.6		0.6± 0.2	0.1± 0.1	0.4± 0.2	4± 0.1	47± 0.5	3± 0	6± 0.2	10± 0.1
Y1	13.4± 0.5	38.0± 1.8	91.5± 6.8	156.3± 3.7	0.4± 0.1	1.2± 0.4		1.1± 0.2	40± 0.3	68± 1.2	5± 0	28± 0.5	31±1.9
Y2	19.8± 0.6	48.1± 1.1	195.5± 4.5	93.7± 8.9	0.5± 0.2	2.5± 0.4		1.4± 0.6	21± 0.9	197± 7.7	13± 0.3	13± 0.5	51± 0.6
Y4	8.9± 0.4	13.9± 0.2	93.5± 1.3	91.7± 0.8		0.9± 0.5	0.1± 0.1	0.6± 0.2	5± 0.2	62± 0.6	4± 0.1	7± 0.1	16± 0.1

Table 5 blocked cells had concentrations below the detection limit of the instruments. The Table 5 has vegetable based meals (W1, X1, Y1), chicken based meals with no apple (W2, X2, Y2) and beef based meals (W4, X4, Y4)}

Table 6 below summarises the trace elements and minerals for which the meal categories that were beef and chicken (with no apples) based tend to have higher levels in contrast to the vegetable meals. The general pattern shows that vegetable based foods (W1, X1 and Y1) were richer in Ca, Na and Zn compared to the other foods. Similarly, chicken based foods with no apple (W2, X2, Y2) had higher values in Cd, K, Mg, Mn, Ni, P and Se in relation to the rest. The beef based meals (W4, X4, Y4) were higher in Cu, Fe and Pb.

Table 6

Summary of trace elements and minerals for which each meal category had higher levels

Beef based food	Chicken based food (No apple)	Vegetable based food
Cu, Fe and Pb	Cd, K, Mg, Mn, Ni , P and Se	Ca, Na and Zn

Table 6 summarises the trace elements and minerals that each meal category {Chicken based with no apple (W2, X2, Y2) and beef based (W4, X4, Y4)} had higher levels in comparison to the vegetable based (W1, X1, Y1) meals

3.2 Beef and vegetable based meals compared with chicken meals containing apples

The Table 7 that follows shows the levels of trace elements and minerals in the beef, chicken with apples and vegetarian meal

categories. The brands W1, X1 and Y1 were vegetable based for 4-6, 7+ and 10+ months respectively. W3, X3 and Y3 were chicken based with added apple while W4, X4 and Y4 were beef based. Results suggest that chicken based meals with added apple (W3, X3, Y3) were lower in Cd, K, Mg, Mn, Ni , P and Se compared to those without added apple (W2, X2, Y2). In a twist to these findings, research (Skodas, Papastergios, & Filippidis, 2013; Cindric, Kroppi, & Stingeder, 2011) shows that apples are rich in calcium, magnesium, phosphorous and potassium. Hence, the findings in this study affirm the existence of synergistic and antagonistic interactions between elements.

Table 7

Mean concentrations and standard deviations per 100g of fresh food samples

FRESH WEIGHT (µg/100g)									FRESH WEIGHT (mg/100g)				
	Cu	Mn	Fe	Zn	Cd	Ni	Pb	Se	Ca	K	Mg	Na	P
W1	2.9± 1.3	14.2±0.1	28.0±1.7	66.7± 4.4		0.5± 0.5	0.2± 0.3	0.4± 0.2	33± 0.3	39± 0.4	4± 0	28± 0.3	29± 0.2
W3	14.6± 0.3	33.1± 0.5	81.3± 5.8	59.0± 0.9	1.2± 0.7			0.9± 0.2	7± 0.2	64± 0.4	5± 0	5± 0.2	13± 0.4
W4	12.5± 0.6	18.8± 0.4	112.5± 2.7	82.2± 1.2		2.5± 0.5	0.2± 0.1	0.6± 0.2	9± 0.1	110± 1	8± 0.1	7± 0	21± 0.2
X1	4.4± 0.1	27.0± 0.3	74.5± 5.4	134.8± 2	0.1± 0	1.2± 0.2		1.2± 0.1	37± 0.4	47± 0.7	4± 0	31± 0.1	30± 0.1
X3	17.1± 1.7	24.4± 0.7	106.9± 7	64.2± 1.6	0.2± 0	0.6± 0.4	0.3± 0.1	0.7± 0.2	8± 0.1	84± 2.3	5± 0.1	8± 0.3	15± 0.4
X4	6.7± 0.3	10.1± 0.1	58.2± 0.6	49.0± 0.6		0.6± 0.2	0.1± 0.1	0.4± 0.2	4± 0.1	47± 0.5	3± 0	6± 0.2	10± 0.1
Y1	13.4± 0.5	38.0± 1.8	91.5± 6.8	156.3± 3.7	0.4± 0.1	1.2± 0.4		1.1± 0.2	40± 0.3	68± 1.2	5± 0	28± 0.5	31±1.9
Y3	15.2± 2.1	39.7± 1.9	116.0± 16.9	77.5± 5.3	0.5± 0.7	1.6± 0.3	0.5± 0.4	1.0± 0.2	4± 0.2	55± 0.8	4± 0.4	7± 0.3	14± 0.2
Y4	8.9± 0.4	13.9± 0.2	93.5± 1.3	91.7± 0.8		0.9± 0.5	0.1± 0.1	0.6± 0.2	5± 0.2	62± 0.6	4± 0.1	7± 0.1	16± 0.1

Table 7 blocked cells had concentrations below the detection limit of the instruments. The Table 7 has chicken based meals with apple (W3, X3, Y3), beef based meals (W4, X4, Y4)} and vegetable based meals (W1, X1, Y1)

Interestingly, the levels of Cu, Fe and Pb in the chicken meals containing apple were higher than in the meals without apple. In addition, the mentioned elements generally surpassed levels in the beef meals. As a contrast, the levels of Ni, P and Se lowered in the chicken diet containing apple.

These findings are summarised in Table 8 that follows:

Table 8

Trace elements and minerals as affected through elemental interactions

Table 8 summarises the trace elements and minerals that each meal category {Chicken based with apple (W3, X3, Y3) and beef based (W4, X4, Y4)} had higher levels in comparison to the vegetable based (W1, X1, Y1) meals

Beef based food	Chicken based food (With apple)	Vegetable based food
-	Cd, Cu, Fe, K, Mg, Mn and Pb	Ca, Na , Ni, P, Se and Zn

Synergistic and antagonistic interaction between elements in the meals affect the bioavailability of the elements. For instance, high levels of P affect the bioavailability of Ca, Fe, Mn and Zn since the phytates, which store phosphorous in plants, bind to the mentioned elements decreasing their absorption (Hirawan & Beta, 2014). These

findings imply that the bioavailability of elements may be affected by the presence of other constituents in the meal. Fortification is a remedy for the arising mineral deficiencies in meals.

Nevertheless, in a review that looked at the balance between nutrition and health in red meat, it is advocated that the benefit and risks of meat be assessed so as to have moderate amounts in diets (De Smet & Vossen, 2016). Table 8 results shows that the nutrients that were high in the beef meal could as well be supplied by the chicken meal containing apple.

4.0 Conclusion

Ingredients play an important role in the level of elements in baby foods. Synergistic and antagonistic interactions between elements in the meals was evidenced. For instance, the beef based meals were higher in Cu, Fe and Pb compared to chicken meals with no apples. However, these levels were lower compared to those of chicken meals containing apples. The findings suggest that it is possible to obtain the same of higher levels of nutrients found in beef using different food ingredients. This information is useful to facilitate in developing foods for infants that may be reactive to beef based foods.

Secondly, whereas the levels of Ni, P and Se were higher in the chicken diets without apples, the levels were lower in chicken meals with apples. These levels were comparable to those in the vegetable meals. These findings suggest antagonistic interactions in the chicken meals with apples in relation to the elements Ni, P and Se. Vegetable based foods were richer in Ca, Na and Zn compared to the other foods. Owing to the fact that infants early in life have rapid growth requiring more energy, which may lead to a higher rate of food consumption relative to their body weight, it is important that correct portions of meals are fed to them to meet the RNI. In light of these findings declaration of information on the levels of the trace elements and minerals by manufacturers on the labels is essential. This is important in determining the portions of foods to give the infants depending on the diet.

5.0 Recommendations

It is important for commercial baby food manufacturers to look into the ingredieents of infants meals and any synergistic or antagonistic relationships that may affect the bioavilability of nutrients. Information declared by manufacturers on the labels should consider such interatctions to ensure that adequate levels of the trace elements and minerals are given to infants.

Owing to the suggestion that the same level of nutrients found in beef can be achieved using different food ingredients, commercial baby food manufacturers should explore this to facilitate in developing foods for infants that may be reactive to beef based foods.

Quality check on baby foods supplied in the market to ascertain that they meet approved levels of trace elements and minerals should be maintained. High supply of fresh foods in the market should be is maintained to ensure that levels of trace elements and minerals are not compromised.

Further research is recommended to examine in detail the interactions that occurs in the chicken based foods with and without apple.

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Relationship between the Behavior of Kenyan Smartphone Users and Awareness of Information Security Practices

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ABSTRACT

People are becoming increasingly dependable on their phones to accomplish day to day activities, such as getting information and money transfer. Yet, smartphones hold a lot of personal information that can cause tremendous effect on user privacy and security, if exposed. Consequently, there is a need to understand users' awareness and behavior when using their mobile phones. Unfortunately, most smartphone users in Kenya lack a proper mobile awareness model which can be used to raise and maintain awareness about information security. This study explored the awareness level of 393 Kenyan smartphone users on information security threats that face them and the behavioural choices that leaves them vulnerable. An online structured survey was used to investigate the relationship between the behavior of Kenyan smartphone users and awareness of information security practices. The results showed that users are aware of smartphone threats yet they continue to make wrong choices that leaves them vulnerable to attacks. An awareness model might improve security awareness and hence reduce the amount of risk associated with use of smartphones.

Keywords: Information Security, Users, Threats, Behavioral Awareness.

1. INTRODUCTION

Seventy five percent of mobile transactions in Kenya happen through mobile phones (Communications Authority of Kenya, 2018). In addition, the rise in the youth population of Kenya with a higher purchasing power has a great impact on the number of smartphones they purchase. The high purchasing power has also contributed to a tremendous reduction in the cost of the gadget (Jumia, 2019). Also, three quarters of the population are under the age of 30 hence they are deemed comfortable utilizing all the features in smartphones.

The high proliferation of smartphones means that many mobile

phone users may be at risk of various attacks and prone to misuse of these communication gadgets, which may affect their privacy and security. For example, the cost of cybercrime in 2017 through mobile use was 25 Million Kenya Shillings (Serianu, 2017). Such examples of attacks may be because the amount of personal data, sensitive documents, and credentials stored and processed by smartphones makes them an appealing target for attackers.

Unfortunately, recent research also shows that the lack of privacy and security on mobile phones is caused by lack of user awareness (Androulidakis, 2016). Further, the study also shows that mobile phone users tend to assure themselves that mobile phones are secure, and therefore are less cautious about the security practices that they should take (Androulidakis, 2016). In addition, research has shown a rise in the reported cases in Kenya to the police, on cybercrime and cyberattacks (Cyber & Report, 2018). This may imply that security awareness among Kenyan technology users is still low and hence they become easy targets for hackers. Also, a study carried out among 281 students of Slovenian faculties, investigating threat perception on mobile devices (Markelj & Bernik, 2015), showed that the sample student population had a low awareness of security threats and security measures, and the authors suggest that education and awareness levels must be increased in Slovenia to counter this development. Therefore, for mobile phone users to better protect themselves, there may be a need for increased awareness of potential risks that are associated with smartphone use. Consequently, user awareness may improve privacy and security among Kenyan smartphone users.

This paper presents research conducted to investigate the relationship between the behavior of users while utilizing mobile phones and their awareness of information security practices.

The paper is divided into six sections. Section two discusses the related work and Section three presents the theory that underpins this research. Section four illustrates the methodology used, and Section five presents the results and discussion. The paper concludes with recommendations and acknowledgement.

2.0 RELATED WORK

Previous research has been done on how smartphone users security and privacy-related decisions are influenced by their attitudes, perceptions, and understanding of various security threats (Alsaleh, Alomar, & Alarifi, 2017). Further, smartphone users who download apps tend to be unaware of security risks associated with downloading from online repositories (Mylonas, Kastania, & Gritzalis, 2013). Users believed that the controlled app market, for example Google Play, is secure (Mylonas et al., 2013).

To understand if users are concerned about their security threats, a survey revealed that a high percentage, over 65% of smartphone users, are concerned about their privacy and security although they continue practicing risky activities like giving application permission to access their data (Symantec Corporation, 2015). This is further pointed out among Middle East smartphone users who need urgent measures to improve their security practices (Das & Khan, 2016).

Despite the numerous studies showing that users do not have good security awareness, some research has proved otherwise by showing different results when research subjects and environment varies. For instance, a study to show security awareness and adoption of security controls by smartphone users, found that university students in Rutgers, United States, are aware of risk in smartphones and have adopted authentication controls like anti-theft control (Parker, Ophoff, Van Belle, & Karia, 2016) .This means knowledge awareness varies with subjects and

environment. The results explain why there is cybercrime in Africa that taps into a low awareness population that saw five East African countries lose 245 Million dollars to online fraud (Osborn Quarshie & Martin-Odoom, 2012). In addition, cyber security is listed as an emerging threat in Kenyan national security (Kiboi, 2015). Therefore, there is a need to understand the behavior of smartphone users versus the awareness level while they use mobile phones. This research addresses this need, specifically for mobile phone users in Kenya.

3.0 THEORETICAL FRAMEWORKS

Theorizing is a process containing assumptions, accepted principles, and rules of procedures to explain or predict the behavior of a specified set of phenomena (E. Weick, 1995). Protection motivation theory (PMT) and Unified theory of acceptance and use of technology (UTAUT), underpin this work.

PMT predicts how people cope with and make decisions to protect themselves after receiving fear-arousing recommendations. It suggests that when faced with a threat people react in two assessment processes, one is focused on the threat itself and another the knowledge to act against the threat. It is mainly used to explain decisions behind threats. The theory has been widely used in Cybersecurity in designing of nudges to improve online behaviors (van Bavel, Rodríguez-Priego, Vila, & Briggs, 2019), online virus protection behavior (Lee, Larose, & Rifon, 2008), information privacy concerns on social networks (Adhikari & Panda, 2018) and security activity among users who know to protect organizations systems but fails to do so (Workman, Bommer, & Straub, 2008).

UTAUT seeks to explain user intentions to use information systems and later used to explain usage behavior (Venkatesh, Morris, Davis, & Davis, 2003). UTAUT identifies four key factors which are: performance expectancy, effort expectancy, social influence, and facilitating conditions. It also identifies four moderators: age, gender, experience, and voluntariness related to predicting behavioral intention to use a technology and actual technology used. This theory gives us more insight on behavioural intentions of smartphone users.

UTAUT contributes in refining current context effect-legacy system habit to feature-level use. It has also contributed on adding a library of focal events that can be remembered, for example, to rate job performance (Viswanath Venkatesh et al., 2016). This theory explains the choices the user makes in using their smartphones.

UTAUT has contributed in this research to explain how users interact with their phones and explain some user choices. Whereas, PMT explained user choices when they understand they are faced with security threats.

4.0 STUDY METHODOLOGY

4.1 Metric of research

Participants were chosen from an urban and rural background to eliminate any bias on awareness due to their level of exposure based on geographical location.

To understand user awareness on information security practices, the research investigated the following: (i) awareness about the access of private data on smartphones; (ii) Security measures used on their phones; (iii) Threat awareness

To understand users' level of awareness we asked questions to know if they are aware that some applications require users to allow them to access private data on their phones, such as contacts, photos, location and device information.

To also investigate security measures on users' phone, we asked questions like listing the security features they use. We also asked whether they have installed antivirus, this is to further understand their behavior. UTAUT contributes in explaining users' choices as it explains their behavior basing it on the security choices.

Lastly, we examined whether they are aware of threats on their phones. Questions on common threats were asked to determine awareness level. This question is such as, if they are aware that phone updates improve security.

4.2 Participants

In order to investigate the relationship between the behavior of Kenyan smartphone users and awareness of information security practices, an online structured questionnaire was used and some questionnaires printed. To calculate the sample size, we considered the total population of Nairobi and Eldoret cities, estimated at 3 million people. To calculate the sample size, we used the formula below;

$$\text{Finite population: } n' = \frac{n}{1+\frac{z^2 \times \hat{p}(1-\hat{p})}{\varepsilon^2 N}}$$

where
z is the z score
ε is the margin of error
N is population size
p̂ is the population proportion

This is considering a confidence interval of 95%. Where z or 95% confidence level is 1.96 and population proportion of 0.5. The sample size was to be at least 384 random smartphone users to reduce bias. However, the final number of participants was 430.

The demographics are as shown in Table 1. According to the Table, there were almost a 50-50 representation of male and female. The age group with a higher representation was between the age of 20 and 30 at 53 percent, followed by 30-40 years with a percentage of 30 percent. Additionally, 71 percent of the sample were working or self-employed with 18 percent as students. The participants also used android smartphones and displayed moderate to excellent IT knowledge with only 3 percent without IT knowledge. Finally, the majority of the participants lived in urban areas and from Kenya.

4.3 Data Collection

An online questionnaire was chosen as it allows questions preview before sharing, collecting of data in Google Spreadsheets, provides a friendly interface, and can be used to reach many respondents irrespective of their geographical location. The questionnaire was designed using Google forms and consisted of two parts: (i) demography; and (ii) User Awareness on information security practices. Offline questionnaires were also utilized where the questions were printed for any user who had no access to the Internet. Participation in the research was open to users of any mobile operating system.

In this study, to alleviate any potentially ambiguous questions, a pilot survey was sent out to 20 individuals. This process was important to solicit feedback and ensure that respondents would not have problems in answering the questions and eliminate ambiguity.

A total of 520 questionnaires were sent out by sharing a Google form link via email, WhatsApp, and printing the form. Of the 520 questionnaires sent out, 430 smartphone users responded. This represents an 83% response rate.

The survey contained questions categorized into two sections; the first section was on user demographics that asked user gender, age group, profession, IT Knowledge and the type of setting they live in. The second sections on user awareness included; firstly, gaining

insights on the type of smartphone the user owned. Secondly, what they used their smartphones for and what type of data they stored on it. Thirdly, knowing where the user downloaded applications from and the factors they would consider when installing an application and finally, whether they believed applications they downloaded underwent a prior security review.

4.4 Data Analysis

The data collected using the forms was converted to a spreadsheet. The data was then cleaned using Microsoft Excel. Data cleaning involved identifying and correcting the inaccurate record. The data contained a mixture of qualitative and quantitative research. Analysis of 91 percent (393 Users) of the population, who were Kenyans was performed. Data was then represented through text, graphs and in tabular format.

In this study security threat awareness acts as an independent variable while user behavior is the dependent variable.

5.0 RESULTS AND DISCUSSION

The results considered 393 users, who form 91 percent of the population as per table 1 below.

5.1 User Awareness

Outlined in Figure 1 below, the findings infer that almost all users are aware that some applications require them to allow access to private data. This finding may explain why most of the users erase their phones when handing it over to the next user and have also set a pin or password on their phones. Moreover, users also update their phones regularly, and they tend not to click on any link or QR code that they receive.

Conversely, the same users tend to forget to disable GPS after use. This might be because most users in this research use android phones, where users don't have options on the use of

Table 1: Smartphone users Demographics

Characteristics	Category	Overall	Percentage
Gender	Male	223	52%
	Female	198	46%
	Prefer not to answer	8	2%
	Not responded	1	0%
Age Group	Less than 20 years	4	1%
	20-30 years	229	53%
	30-40 years	130	30%
	40-50 years	39	9%
	Above 50 years	16	4%
	Prefer not to answer	11	3%
	Not responded	1	0%
Profession	Working/Self Employed	305	71%
	Student	78	18%
	Retired	1	0%
	Unemployed	37	9%
	No answer	9	2%
Phone Operating System	Android by Google	374	87%
	IOS by Apple	38	9%
	BlackBerry	2	0%
	Windows Phone	3	1%
	I am not Aware	5	1%
	Not responded	8	2%
Phone Monitored by employer	Yes	20	5%
	No	372	87%
	Not responded	1	0%
IT Knowledge	Good	97	23%
	Moderate	173	40%
	Excellent	144	33%
	knowledge	12	3%
	Not responded	4	1%
Settlement Setting	Rural	53	12%
	Urban	372	87%
	Not responded	5	1%
Country	Kenya	393	91%
	Outside Kenya	31	7%
	Not responded	0	0%
Smartphone Ownership	Yes	429	100%
	No	1	0%

GPS. Apple for example, have options of reminding users the applications using locational services and if they want to disable them (Apple Inc., 2018).They also have the option of only allowing locational services while the app is in use.

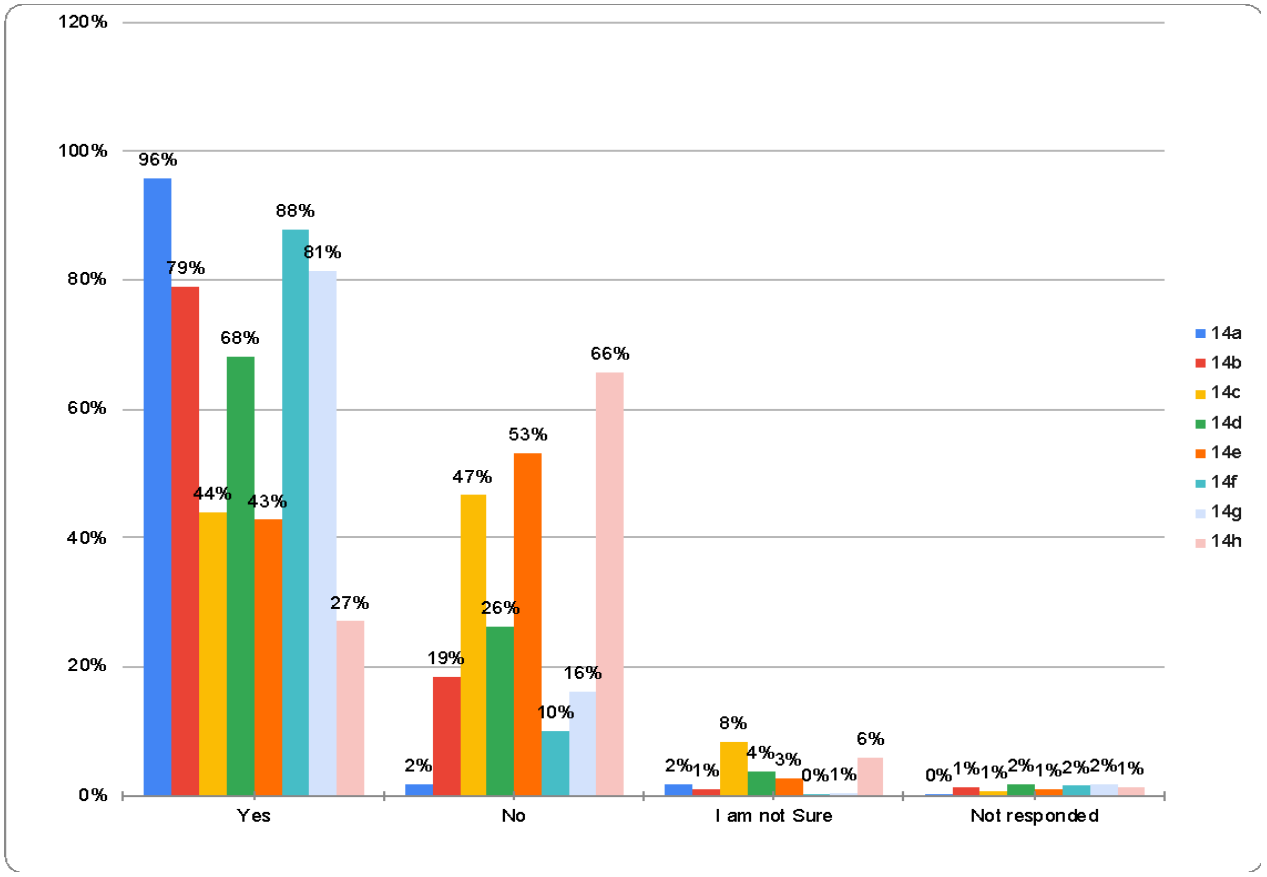

Figure 1 An illustration of User Threat Awareness

Where the following numbers stand for;

14a, Are you aware that some applications require you to allow them to access private data on your smartphone, such as, contacts, photos, location, device information and more

14b, Do you sometimes forget to disable locational service GPS, on your phone after use?

14c, Do you know/have stored your smartphones IMEI (International Mobile Equipment Identity) number?

14d, Do you erase your smartphone before you give it to the next user?

14e, Do you sometimes connect to public WIFI when performing transactions?

14f, Have you set a pin, password or any physical control on your phone?

14g, Do you update your phone and mobile applications regularly?

14h, Do you click on any link or scan QR code shared?

Additionally, users tend to connect to public WiFi when performing bank transactions which may expose them to hackers. This can mean that users trust public connection. Finally, these users don't have their phone IMEI number. IMEI number assist in tracing a mobile identity and hence can be used to locate a lost phone.

5.2 Security Measures on Phones

Figure 2 depicts that approximately half of the users lock their phones using password, pin or fingerprint, update their phones and back-up their phone data. However, more than half of the users do not use Antivirus neither nor do they encrypt their phone data. This may infer that password and pin use is the best practice they have learned through an incidence experienced such as data loss or unauthorized access of their mobile phone. This may also be because, we use pin or password often in our daily lives like in the bank, emails and mobile service providers. These entities remind us often of putting these measures either through social media, radio or TV. That means if people get information constantly, they change their habits. In Brazil for instance, to control population the government through media exposed societies to soap operas specifically of families with few children. Admittedly, the fertility rates declined (Ferrara, Chong, & Duryea, 2012).

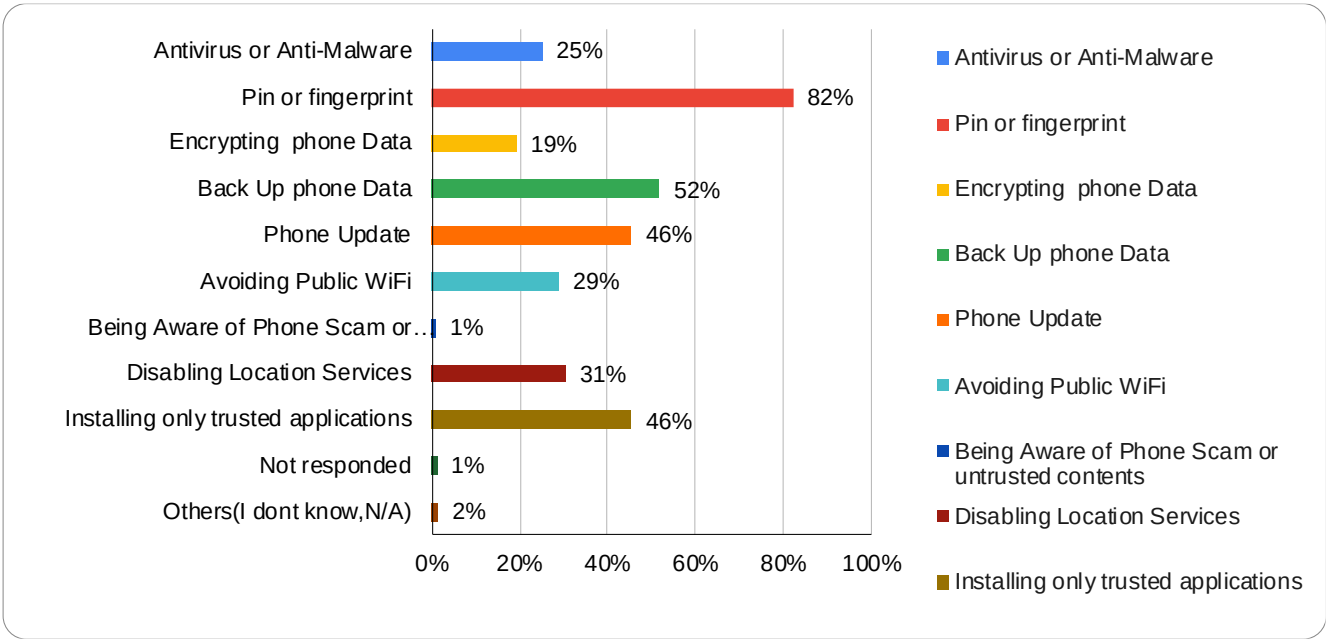

Figure 2: An illustration of security features utilization on user smartphones

Also, users utilize public WiFi, are unaware of phone scam or suspicious contents, and have active locational services and install untrusted applications. This might mean that they are less aware of these media of data loss or have never experienced data loss through these means. This gap can be bridged by training as suggested by a user "Information Security lessons should be introduced to everyone at their early life so they can grow into it. This will reduce rates of data privacy violations."

5.2.1 Antivirus Installation and Use

We can interpret from Figure 3 and 4 that most smartphone users do not install antivirus on their phones and instead install it on their Personal Computers or Laptops. This might mean that users think that laptops are more vulnerable to attacks than smartphones or that PCs need more protection than mobile phone

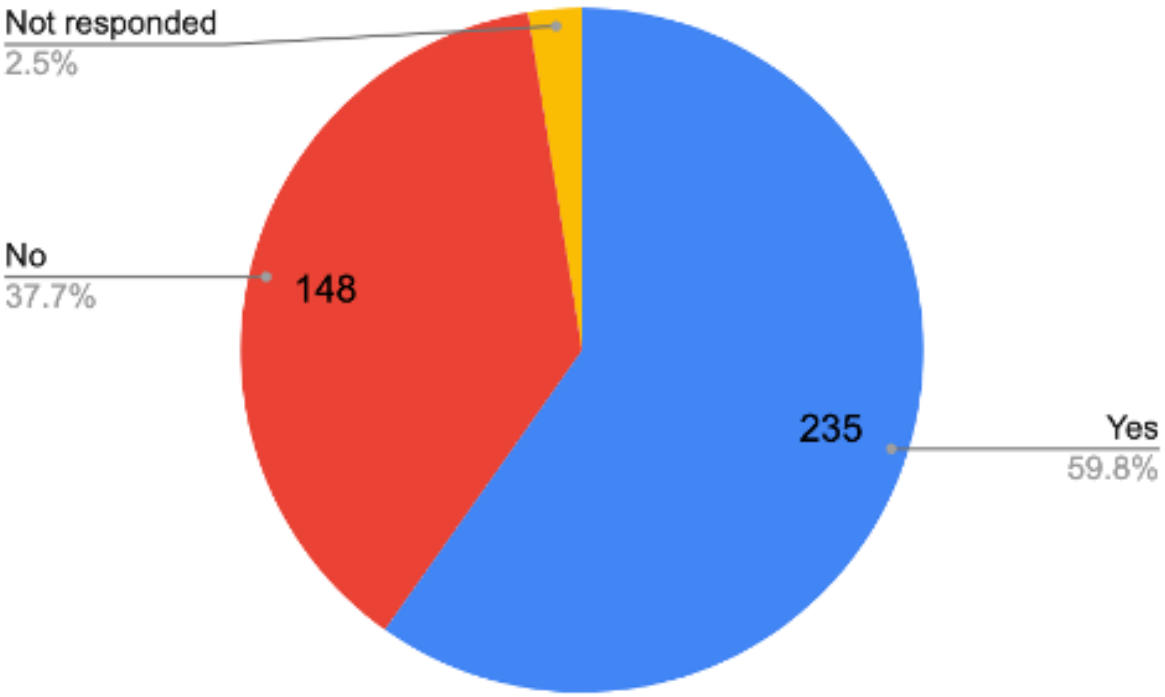

Figure 3: An illustration of Importance of Antivirus

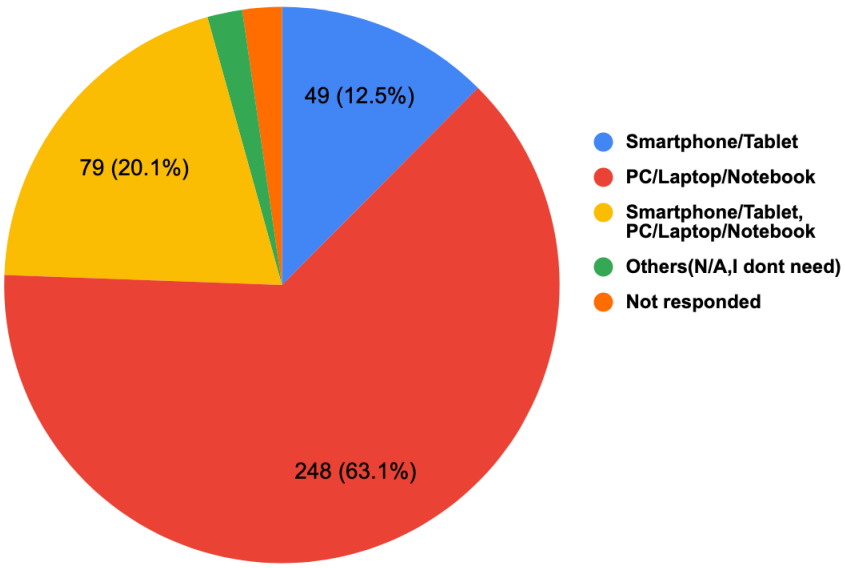

Figure 4: An illustration of Antivirus Installation on Various Gadgets

5.3 Awareness on Potential Threat

Figure 5 below shows that a high number of users are aware that;

i. Applications updates improves phone security.
ii. They are aware that some links shared or QR codes to scan are not legitimate.
iii. Applications may contain spyware that can access private information on smartphone.
iv. Some banking application pose as legitimate but instead steal banking information.
v. Smartphone sensitive data can be transferred to a new user.
vi. Smartphone connected to open public WiFi hotspots hence exposing personal and financial data.

These findings show that awareness level is high as most users are aware of common security risks. Users are generally aware of most potential threats to their phones. Hence there is an awareness gap on smartphone users' action rather than knowledge. For example, users are aware that open public WiFi is risky, yet they still connect to it.

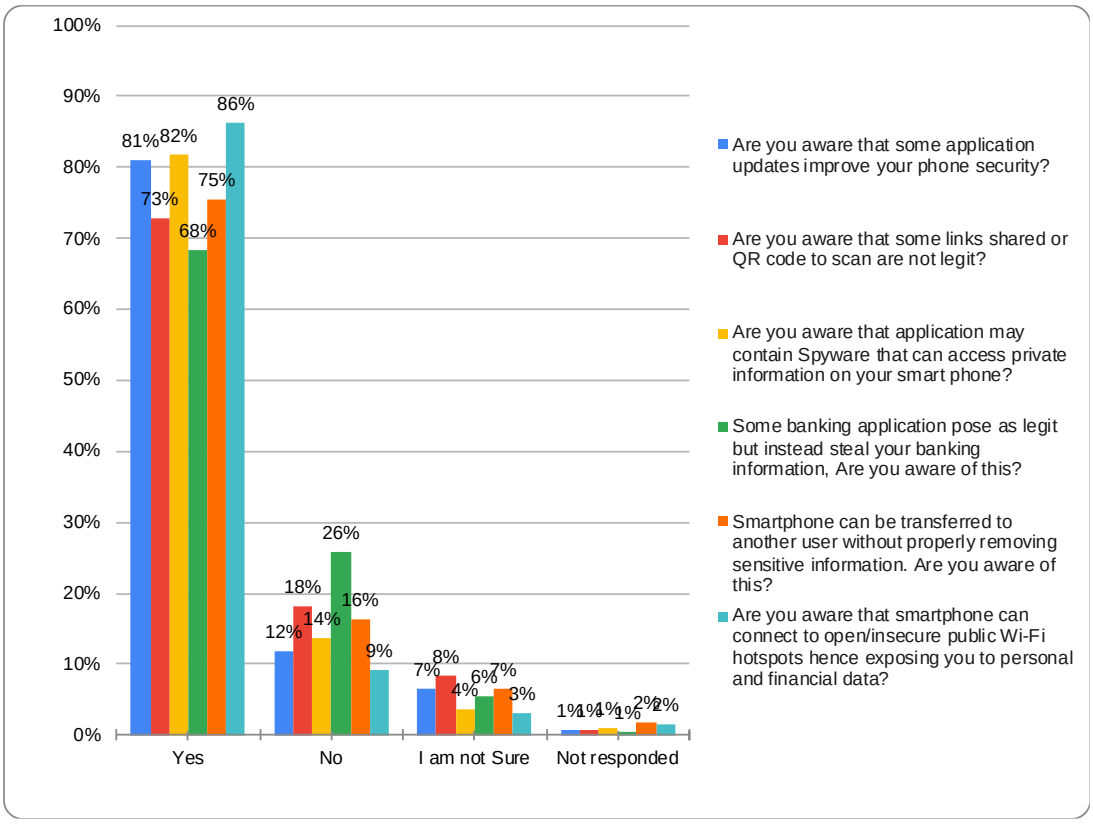

Figure 5: An illustration of Awareness of consequences on potential Threats

5.0 CONCLUSION AND RECOMMENDATIONS

Smartphone users are aware of security threats facing them, although they still make choices that make them vulnerable. This might show that users leave security responsibilities to other institutions like the owners of smartphone applications for example a bank, which compensates in case of breach, or the creator of applications. Or worse, they are aware and just do not care much unless these applications force them to access

some of personal resources on the phone. This might also mean that some users are aware and that they need constant reminders.

The recommendation is that applications be regulated and apps be ranked on the basis of user security. In addition, software developers develop more apps where by default the user data is protected. As a user suggested "You help us to protect our privacy".

For security awareness to be fully accomplished, having discovered that Kenyan mobile users are knowledgeable on user security, future work will need to come up with a model that addresses the gap identified in this research. The gap being user behavior depicted by their actions and also, to address user attitude on mobile security. This is because information security awareness model on an individual should be based on three dimensions, namely knowledge (what users know), attitude (what users think or feel) and behavior (what users do) (Kruger & Kearney, 2006).

Finally, the future work of this research would be to design a model addressing the knowledge gaps in information security awareness among smartphone users identified on this research. Future work on this study will study user perceived risk level and the countermeasures that can be used to protect smartphone users.

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Exploring the Psychosocial Effects of Obstetric Fistula among Women in Kenya

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ABSTRACT

Women in the global south continue to experience the pain of Obstetric Fistula (OF), despite the increased use of new technology in the health sector. Obstetric Fistula is a medical condition in which a hole develops between the rectum and vagina (recto-vaginal fistula) or between the bladder and vagina (vesico-vaginal fistula) after a long and obstructed childbirth where medical care is not available. The World Health Organization shows that 50,000 to 100,000 women globally develop obstetric fistula each year. In the SubSaharanAfrica, about two million women have the condition with about 75000 new cases developing yearly. In Kenya, approximately 1% of women suffer from chronic illness due unavailable medical care. This causes untold suffering and stigma among the affected women. This paper attempts to examine the persistent occurrence of the condition among the affected women, the psychosocial effects and the strategies the Kenyan government has put in place to eradicate it. This paper is based on a systematic review of the past literatures that examined the psychosocial effects of OF. The studies analysed are both qualitative and mixed method primary studies**.** The paper found out that the psychological effects are real and traumatizing in the sense that victims lack control over body functions, leading to anxiety, low self-esteem and depression. The affected women are mainly young girls and women who are illiterate, poor with little or no access to obstetric care, compounded by weak referral systems.The paper recommends the need for more awareness to be created especially on community perceptions, put and enhance the structures in place to facilitate access to health care. A

strong emphasis on the urgent need to develop a positive attitude towards those affected is critical for reintegration. A collaborative approach that involves the community; medical institutions and development partners should be adopted to enhance effective sustainable solutions.

Keywords; Obstetric Fistula, Psychosocial Effects, Women, Communities, Kenya.

1.0 INTRODUCTION

Globally, Obstetric Fistula (OF) afflicts women from settings with limited resources. Studies indicate that approximately 3.5 million women suffer from the condition with at least 50,000 up to a possible 130, 000 new cases that emerge yearly especially in South Asia and Sub Saharan Africa (Adler, Ronsmans, C, Calvert, C. & Filippi, 2013). About one million women live with Fistula in Nigeria and 1/1000 births are complicated by OF in Kenya and Nigeria as well (Wall, Wilkinson and Arrowsmith, Miller 2005). Although research shows that Uganda and Ethiopia have the largest number of women who have suffered OF, developed countries have managed to eradicate it totally (Maheu et al. 2015). The current study attempts to explore the persistent occurrence, the psychosocial effects often ignored and the strategies that have been put in place to eradicate OF condition.

The developing countries especially the global south have unique characteristics that predispose young women to OF. African women naturally have narrower pelvises putting them at risk during childbirth in addition to poor nutrition that further causes stunted pelvic growth (Adler et al 2013, Wall, L. et al 2008). The natural condition is exuberated by socio cultural factors such as early marriage and Female Genital Cutting (FGC), putting the young women at risk. Early marriage has health implications on the young brides, approximately 800 women die from preventable diseases related to pregnancy and are predisposed to OF. The married girls are under pressure to seal the marriage by giving birth (UNFPA, 2012). Research consistently shows that countries where the mean age at marriage is 15 or below, such as Nigeria, Ethiopia and Bangladesh, display high rates of fistula. Most women who were affected by fistula were found to be shorter, weigh less, have less education and of lower socioeconomic status than women who had given birth without complications. Some communities have cultural barriers such belief in evil spirits, traditional healers and diviners that hinder women from seeking medical care while in others a woman is not allowed to access healthcare without the husband's permission (Wall, 2008, Mulleta, 2006).

Additional findings link OF to poverty, where women who have no access to medical care are adversely affected. In the Sub Saharan Africa, one of the poorest countries is Malawi, living below US$2 poverty line (World Bank Group 2018). About 80 per cent of the population in Malawi live in rural areas, where poverty, distance and poor infrastructure make it difficult for people to access health care services (National Statistical Office [NSO] and ICF 2017). Maternal mortality is still among the highest in the region at 439 per 100,000 live births (NSO and ICF 2017). Obstetric fistula has been one of the neglected conditions in Malawi, receiving attention only after the launch of the End Fistula Campaign by the United Nations Fund for Population Activities (UNFPA) in 2003 (UNFPA and Engender Health 2003).

2.0 METHODOLOGY

Secondary sources of literature have been used in this paper. The Search, Appraisal, Synthesis and Analysis (SALSA) approach was adopted to review the literature. The method guided in identifying the most relevant information. About 40 articles were reviewed guided by key words.

2.1 RESULTS

Studies show that women adversely affected by Obstetric Fistula had less education, lower socioeconomic status, weigh less, shorter, majority live in rural areas where poverty and poor infrastructure is a challenge in accessing health care facilities World Bank (2018).

3.0 PSYCHOSOCIAL EFFECTS OF OBSTETRIC FISTULA

Among the West Pokot in Kenya, one out of every 1000 women suffer from OF, the most affected being young girls and women who are illiterate, poor with little or no access to obstetric care, compounded by weak referral systems (McFadden, et al.2011). The women who suffer from Obstetric Fistula experience rejection, seclusion from the family, stigma, loss of social network and support (Khisa et al, 2019; Kabir, 2004). Besides, the affected marital relationships lead to divorce or separation. The smell of urine and feaces predispose the woman to social isolation, abandonment and divorce (Khisa, 2010; Yeakey et al, 2009). This is exuberated by the loss of the foetus, which has a potential of reducing the woman's chances of bearing children especially in societies where children seal the marriage (Yeakey et al. 2009, Miller et al 2005; Curdie, Moffat and Jones, 2018). The psychological effects are real and traumatizing in the sense that victims lack control over body functions, leading to anxiety, low self-esteem and depression (Wall 2006). Many women manifest feelings of hopelessness about their status and are not empowered to seek treatment. They are desperate, anxious and sad about the uncertainty of the future (Siddle, Mwambingu, Malinga and Fiander, 2013).

A study carried out in Nigeria shows that about 33% of women suffering from Fistula suffered depression, while 51% were angry with life. There was reported low self-esteem, stress and anxiety. The support provided by the husband is noted, the study showed that women who received such support were optimistic about life (Kabir, et al 2004).

Obstetric fistula has serious economic repercussions for affected women and their families. Studies show that the cost of treating Obstretic Fistula is high, it includes time taken away from income generating activities to seek medical attention, inability to work because of poor health and stigma and the need to constantly observe hygiene. This strains family resources and a potential cause of financial hardship, disagreements and lack of support that causes poverty (Ahmed and Holtz 2007). Women in Kenya too go through feelings of shame and severe disruption of their economic, physical, psychological and social lives and have to deal with moral and hygiene challenges (Khisa et. al, 2019).

In order to end Obstetric Fistula, several strategies have been put in place at the global, regional and national levels. The aim of the 2030 Agenda for Sustainable Development is to change the world by realizing 17 sustainable development goals. It pledges to achieve gender equality and securing health and well being for all, ending poverty and eradicating obstetric fistula. It is important to note that various interventions have been put in place.

3.1 INTERVENTIONS AT THE GLOBAL AND REGIONAL LEVEL

The aim of Global Strategy for Women's, Children's and Adolescents' Health (2016–

2030) is to end fistula. Its main goal is to end preventable maternal and newborn mortality, reduce the rate of global maternal mortality to less than 70 per 100,000 live births and to support countries in implementing the goals. Through the operational framework adopted by the sixty- ninth World Health Assembly in 2016, it emphasizes the significance of developing a sustainable, health financing, evidence-based strategy, strengthening health systems and building strategic multisectoral partnerships (United Nations, 2018).

In 2015, the World Health Assembly adopted a resolution on "Strengthening emergency and essential surgical care and anaesthesia as an element of universal health coverage, calling for access to emergency and essential surgery for all, including the prevention and treatment of obstetric fistula. During the 2015 meeting in Geneva of the World Health Organization (WHO) Global Initiative for Emergency and Essential Surgical Care in Geneva, a blueprint towards the implementation of the resolution was drafted. Following up on the resolution at the recent seventieth World Health Assembly held in 2018, a two-year report was presented and a decision adopted calling for continued reporting at least every two years (Fistula Foundation, 2016 annual report)

Regionally, the African Union task force for maternal, newborn and child health required Heads of State and Government to declare the ending of obstetric fistula and female genital mutilation in 2018. The task force advocated for the usage of advocacy platforms and reporting mechanisms, which involved Campaign on Accelerated Reduction of Maternal, Newborn and Child Mortality in Africa and campaigns against child marriage to increase accountability on continental commitments and speed up the eradication of female genital mutilation and fistula (United Nations, 2018)).

3.2 INTERVENTIONS IN KENYA

Nationally, countries are making advancement in reducing maternal and newborn mortality and morbidity (WHO, 2015). Kenya too has adopted several steps towards the elimination of obstetric fistula through the introduction of The Kenya National Obstetric Fistula Training Curriculum for Health Care Workers, which was adopted in 2006 through funding and technical support from United Nations Population Fund (UNFPA). In Kenya, this service is provided in Kenyatta National Hospital, Cherangany Nursing Home, Women and Development Against Distress in Africa (WADADIA) in West Pokot, Mt. Elgon and Siaya, Jaramogi Oginga Odinga Teaching and Referral Hospital (formerly known as Nyanza Provincial General Hospital) in Kisumu, Gynocare Fistula Centre in Eldoret and jamaa Mission Hospital (Mogambi, 2016).

Other initiatives have been implemented in collaboration with the international partners like UNFPA. Working with Direct Relief International (DRI) and the Fistula Foundation, the Global Fistula Map provides information on the state of fistula treatment capacity around the world. DRI uses mapping technology and Geographic Information System (GIS) tools in Western Kenya to explain the spatial distribution and key characteristics of women receiving fistula treatment. The map locates the patients and where additional outreach and resources for treatment are as well as the use of mobile phones. In 2010 Women and Health Alliance International (WAHA), distributed 10 all-terrain motorbikes ambulances in Kenya to help in the prevention and treatment of obstetric fistula. Another Campaign Partner, One by One in Kenya has developed a network of fistula survivors and community volunteers to educate their own communities about fistula and bring fistula patients in for

care and provide reintegration support for women when they return home following treatment (United Nations, 2012)

Despite the efforts that have been put in place, evidence from the field shows there is need to make follow up on obstetric fistula clients after treatment and discharge and to address the issues that emerge thereafter (Corodhia, 2015). In addition, Khisa et. al (2019) in the study of 'A grounded theory of regaining normalcy and reintegration of women with obstetric fistula in Kenya' suggests the need for a model of care that involves social, psychological, economic and physical elements of care after surgery and discharge.

Since Obstetric Fistula exposes women to poverty, illiteracy and sociocultural factors, there is need to promote girl child education. Studies show that in Nigeria, illiteracy contributed to 96% of cases, while in Cameroon 81% of patients who lacked formal education were affected by Obstetric Fistula (Pearson, DeBernis, and Shoo, 2009).

Creating awareness and giving education to the local community on the social cultural factors and psychosocial effects reduces OF and facilitates the rolling out of community programs tailored to meet the needs of the community. Research shows that patients who have been treated have acted as community advocates for Fistula in Kenya and other countries (Wegner et al, 2007).

The efforts to eradicate Fistula will not be effective without looking at the Psycho social scars that the affected women have gone through.

Women who suffer from low self esteem, anxiety and depression require psychological help in the form of counselling for self development. The process of counselling helps the women to rediscover their strengths and appreciate themselves again.

Khisa (2015) in the study among the Pokot of Kenya found out that women benefit from counselling that focusses on getting back to normalcy, possible return to fertility or dealing with permanent infertility and couple counselling. In addition, access to information, education and communication on lifestyle change such as exercises, adequate intake of water and improved nutrition is important. This implies that the intervention should be tailored to meet the needs of the affected women.

Relating to the above, family and community support is critical for healing and integration. Women come from a social environment and they need to be settled back to their previous gender roles. A study conducted in Tanzania shows that 68% of women who had gone through surgery found support from the family. Consequently, they were able to fit in, started businesses and felt a sense of belonging. They were mainly supported by the members of the natal family (Pope, Bangser, & Requejo, 2011).

Training and equipping women with skills enhances their economic empowerment and independence. In Kenya, a study among the West Pokot shows that 22% of women did not go back to work after surgery whereas 75% went back to their previous work (Khisa, 2015, Pope et al 2011, Nielsen et al. 2009). This shows that empowering women boosts their self esteem, and they are not considered a burden to the family. The need for promotion of sexual of sexual and reproductive rights remains and should be enhanced by county governments (Kimani,Ogutu and Kibe, 2014)

4.0 CONCLUSION AND RECOMMENDATIONS.

The various interventions are commendable. However, more needs to be done to deal with the psychosocial scars that the women have gone through.

The study recommends women to have access to information, knowledge about Fistula care and treatment. The National government should provide support to the county governments to strengthen and equip the health care systems with a view to cater for the needs of Fistula survivors.

It is also important to understand the psychosocial needs of women and that of the community, this will facilitate the interventions that are tailored to meet the needs of the affected women which include psychosocial support in form of counselling and continuous linkage of OF survivors to social support programmes for effective rehabilitation. Family and community support are critical for healing and integration.

As mentioned above, the paper further recommends training and equipping women with skills to enhance their economic empowerment and independence. The education of the girl child should be strengthened. This is due to the fact that OF can be prevented by avoiding early and teenage pregnancies and discouraging harmful sociocultural practices such as Female Genital Cutting and Early Marriage. The fistula survivors should be encouraged and equipped with skills to act as community advocates.

In conclusion, a collaborative effort between the community and all the stakeholders should be adopted for sustainable solutions.

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Standardization of Light Emiting Diode Feedback on Solar Home Systems (A Review)

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ABSTRACT

Light Emitting Diodes (LEDs) are used in a variety of devices ranging from watches to solar home systems, as status indicators or communicative tools. They are typically designed to produce light in different colors and intensities. However, the communicative output varies across devices of similar or different functions. This variation and the sense that there is a wide array of expressions that can be employed, makes it hard for users of the devices to deduce the feedback easily. To address this gap, this paper looks at researches that highlight the importance of LEDs, their incorporation in various devices especially solar home systems and the challenges that arise from lack of standardization of their expressivity. The findings show that LEDs are a dominant lighting technology and that through Internet of Things (IoT) they are going to become even more prevalent in user devices. The study also finds that solar home systems have become a lifeline for many people not covered by grid electricity, but their adoption can be affected by user perception. It is also found out that with their limited iconography these systems can be challenging to use and so this not only affects usability but also distribution because of the level of support needed. This paper also investigates how Human Computer Interaction (HCI) frameworks can be employed to solve the identified usability challenges concludes that using a HCI framework to standardize the interface design of LED-touting devices can increase expressivity and user understanding of feedback relayed by these devices. Thus, manufacturers and industry governing bodies need to consider a universal vocabulary of light-based design that can be widely adopted to solve device usage challenges.

Keywords: *Human-Computer Interaction, Light Emitting Diodes (LEDs), Metered Solar Home Systems, Communication, Interface*

INTRODUCTION

Many electronic devices employ small communication lights, called Light Emitting Diodes (LEDs) to relay feedback or state to users, for their action or awareness (Figure 1). These devices that incorporate feedback interfaces have rapidly increased over the years in various iconic forms (Morgan et al., 2018, Harisson et al., 2012). It has become commonplace to see LEDs in a variety of devices ranging from watches to solar home systems, as status indicators or communicative tools. Additionally, the proliferation of the Internet of Things (PEW Research, 2017) continues to heighten product diversification. Even so, the diversification of these devices into different molds and shapes has resulted in a variety of lighting behaviors across different devices and designs (Morgan et al., 2018, Bauman, 2001). This variation and the sense that there is a wide array of expressions that can be employed, makes it hard for users of the devices to easily deduce the feedback. Further, interfaces that require memorization or repetition to grasp make for a cumbersome user experience, especially considering the number of LED-touting devices now available.

Figure 1: Small single-color lights in some electronic devices (source Harrison et al., 2012)

This research focuses on small to medium sized technically enforced solar home systems that have emerged as a sustainable lifeline for rural African communities who still lack access to grid power (World Energy Outlook, 2014). Indeed, 80% of those not served with grid electricity are those that occupy Sub-Saharan Africa and Rural Asia (Rolffs et al., 2014). To fast-track development and the achievement of Millennium Development Goals (MDGs), governments have had to approve and start proactively promoting solar home systems as the most feasible and cost-effective alternative for rural electrification (Nieuwenhout, 2001). Over the years, such devices have adopted the use of LED point lights riding on the wave that made LEDs the dominant lighting technology such that by 2012, the lighting technology accounted for 97% market share (Lighting Africa, 2012).

The biggest hurdle to the adoption of these solar home systems has been established as their high initial cost (Urmee, 2009), which seems to have been countered by the advent of Pay-As-You-Go (PAYG) technology. This technology enables customers to pay over a period of time, at much lower costs than traditional microfinance. Even so, it

necessitates that the systems have some form of technical enforcement and hence the need to include LEDs as a cost-effective feedback mechanism on the units (Tippenhauer et al., 2012). The problem with this approach is that most users of these systems have had limited exposure to many of these iconographic devices for them to build an understanding of the different feedback mechanisms. Multiple distributors of solar products have also bemoaned the difficulty they face with addressing customer complaints mostly because of communication difficulties and limited technical expertise (Off-Grid Practitioners Stimulus report, 2018). Low literacy levels, combined with the technicalities of the devices tend to necessitate agents to be sent to the field to address customer issues, and this can be expensive and time-consuming which is unsustainable.

Evidently, LEDs are highly efficient in the design of low-cost consumer electronics. However, product diversification has not allowed for standardization of the feedback design. This gap has led to different lighting feedback mechanisms on similar products such as solar home systems, leading to most consumers not being able to expressively comprehend the various communications. The inability of consumers to understand feedback from these high utility home systems leads to user frustration, product returns, default in payment and sometimes customers reverting to non-renewable and pollutant sources of energy. Therefore, solving the technical understanding of such systems could potentially help current users and owners of these devices, and also push for greater adoption of the solar systems in general.

LITERATURE REVIEW

Solar Systems

According to International Energy Agency, the number of people who remained unserved with basic electricity connections, as of the year 2010, stood at around 1.2 billion people (International Energy Agency, 2016). Energy Progress report showed that despite doubling the international financial injection from $10.1 billion (2010) to $21.4 billion (2017), the number of people without electricity in 2018 remained higher than it needed to be at 789 million people. This points to how big a gap there still is to be filled by solar systems.

The role of solar especially in developing countries is huge, when you consider that in Sub-Saharan Africa only 41% of middle to low income countries' health facilities have reliable electricity (Cronk and Bartram, 2018). This is even worse for schools because only 35% of them in Sub-Saharan Africa and about half Southern Asia had access to electricity as of 2017 (UNESCO, 2018). With such big institutions being lacking essential energy, it is not surprising to see that households are also facing similar challenges. In a study looking at the growth of the solar market in Kenya, it was found out that 76% of the population was living in rural areas with 43% of the population living in poverty (CIA, 2009). Consequently, it was found that most of the Kenyan households used kerosene as the main source of afterhours illumination (Jacobson, 2013) which had harmful effects. To show the how solar systems would reduce these harmful effects, another study carried out in Cote d'Ivoire showed that using solar systems improved household consumption by about 42% and schooling by 1.79 years (Diallo and Moussa, 2020). Most importantly the study showed that illnesses reported by family members reduced by 2.3 times.

Solar Home Systems

According to the Renewables 2017 Status Report, as of 2016, there were more than 25 million people benefiting from solar home

systems and the number is expected to grow (Renewables Global Status Report, 2017). In Kenya, sales of these systems was shown to have increased to establish the country as one of the leading markets for solar lighting products second only to Vanuatu in small solar home systems in 2018 (Energy Progress Report, 2020).

Even with this positive trend, the biggest hurdle to the adoption of these solar home systems has been established as their high initial cost (Urmee, 2009). This is why the International Energy Agency points out that there have been several social enterprises that have received great funding and subsidies to facilitate the distribution and uptake of solar lanterns and home systems that can be acquired through easy-buy loan arrangements (International Energy Agency, 2016). This has led to the rise of Pay-As-You-Go (PAYG) distribution companies that have raked in lots of investment to year after year. The Renewables 2017 report showed that between the year 2015 and 2016, PAYG companies raised $223 million which represented about 40% increase. Nieuwenhout and team also acknowledge that there is need for design standards for these systems because consumers are mostly drawn to cheap under-designed systems that may lack or have low quality replacement parts. For this reason, leading manufacturers have tried to meet the consumer needs by making industrial design compromises such as building PAYG solar home systems that are simple as possible but also stripped of many useful features such as displays and audio feedback. The most common design trend for simple solar systems is including LED point lights as the only source of feedback to the client (Heimgartner, 2014). As much as this helps with the overall goal of cutting down cost to make it worthwhile for the off-grid customers, the lack of a standard language of light communication leaves a utility gap that customers have to fill on their own.

PAYG technology works in such a way that credit paid either through mobile money or cash activates the product with an equivalent amount of energy duration. Once the energy or credit duration is exhausted or the time elapses, then the unit goes off awaiting the next top-up and this goes on until it is fully paid off. This behavior makes it vital that the customers know how the product works and get to understand the light feedback. Even though many product manufacturers will argue that they include user manuals in the device packaging, studies have shown that, in many instances, the user guides exceed the reading capacity of the target population (Wegner & Girasek, 2003).

Light Emitting Diodes

The main purpose of designing iconographic devices or interfaces is nothing more than consistently relaying meaning to users for their knowledge or action (Harrison et al, 2012). There are many iterations of iconic designs including visual forms, auditory, textural forms and even vibro-tactile forms. This means that devices that only employ simple point lights in their design, like the solar home systems, are rather limited in their expressive power.

According to the IESNA Lighting Handbook, there are generally two types of LEDs AllnGap and InGaN which broadly produce between red and green lights with reasonable luminous efficacy (IESNA Lighting Handbook, 2000). These are also the least expensive implementation of the LED lights from a manufacturing standpoint and appear as the most widely used in most of the devices employing LED point lights such as traffic lights, signages, smartphones and even solar home systems. This study focuses on these solar home systems as the best example

of devices that rely on low output LED lights to compensate for their very limited design.

Challenges Faced by Non-Standardized LEDs

Lack of standardization is not a new problem and has been talked about by many researchers who have highlighted some of its problems. Narrowing down to LEDs and their use, it is important to appreciate the fact that small LED Lights have been in use for a long time in many electronic appliances and interfaces to convey various meanings to users (Harrison et al, 2012). Liu and team explored how smart IoT powered products were being used and discovered that there are consistent frustrations due to unexpected behaviors and this was not because of failure but rather a result of failed communication (Liu, 2017). In most cases, when point lights are applied to large systems, they serve a great purpose because their expressiveness is properly factored in the design process. In a car dashboard for example, the lights are more iconographic since designers have much more room to work with than on a handheld mobile device (Bauman, 2001). Bauman mentions quite several factors that impact interface design in a way that does not allow for maximization of the potential of point lights. Things like the lack of standards and guidelines, unlimited target user groups and peripheral constraints for small appliances do not help with the designs. For point lights to be meaningful, they need to be either recallable or repeated and, in some instances, presented in sensibly varying intensity. This means that even if users of these metered solar home systems get to read the included manuals, they will always be creatures of habit who will potentially try to relate one behavior with another similar behavior. This is backed by Off-grid Practitioners Stimulus Report, that points out how many distributors of solar products have lamented about distribution and support challenges (Off-Grid Practitioners Stimulus Report, 2018). According to the report, most of the issues faced by users of solar home systems have been a result of communication difficulties compounded by limited technical expertise. This basically means that users have a hard time understanding the feedback of these devices and so keep requesting for help when in actual sense it's just some clarification that is needed.

Such issues can easily be fixed through application of Human-Computer Interaction (HCI) principles in design. HCI provides the building blocks for improving human-computer interactions and consequently the usability of their interfaces (Grudin, 1992). If we take an example of the recent fad of Small Unmanned Aircraft systems, the lack of standardized human computer interfaces for setting geo-fencing parameters among devices from different manufacturers has led to various input and interpretation errors (Thirtyacre et al, 2016). Thirtyacre and team note that these errors can be both of omission (such as failure to enable the geofence) or commission (such as setting incorrect parameters) and can lead to serious safety-of-flight problems. They also point out that standardization through HCI has already helped a lot in areas such as cockpit displays of today's manned aircrafts which mostly have similar layouts from decades of refinement.

CONCLUSION

As seen from the studies above, solar home systems play a vital role globally and an even bigger role in Sub-Saharan Africa. Kenya has been shown as a market leader in solar distribution and therefore serves as a great study location for this research. When looking at solar home systems specifically, their design and purpose show a tight balance between cost effectiveness and practicality but their proliferation leaves a big usability hole that can only be plugged through

standardization. Similarly, the great benefits of LED technology have been widely publicized but their deployment in products has not really been driven by user experience. Most researches mentioned above have shown that manufacturers and adopters have been drawn to the value or cost savings but have given little weight to the efficiency or usability.

The related studies have pointed out a number of issues that non-standardized LED interfaces have brought about, not limited to solar home systems. This provides an opportunity for study in the sense that, if devices with better iconography present the user with some usability issues, then the ones that do not have any other form of iconography would provide even more headache.

The good thing about all of this is that HCI has proven to be a valuable research tool for evaluating these issues and therefore provides a good opportunity to evaluate and propose a solution.

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Assessment of Information Literacy Skills of Undergraduate Medical Students in Selected Public Universities in Kenya

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Abstract

This study was conceived with the aim of investigating information literacy skills (ILS) of medical undergraduate students in selected public universities in Kenya, with a view of proposing a framework to enhance delivery and utilisation of the information literacy skills in institutions of higher learning. Baro (2013) assert that for a medical practitioner or student to derive maximum benefits from information he/she must possess information literacy skills. However, literature reveals that in Kenya, there is no national policy on ILS. Information literacy skills-related training is an individual institutional matter. Further, medical practitioners prefer using human sources instead of online databases or print sources that are readily available because of low information literacy skills. In this line, most medical students do not know how to refine search strategies, lack of skills on how to deal with information explosion and on appropriate use to avoid plagiarizing published scientific work. Majority of learners do not know how to evaluate the credibility of online information sources and the teaching of ILS is inadequate. The objectives of the study were to: Examine the status of information literacy skills offered to medical undergraduate students at University of Nairobi and Moi University and ascertain the usefulness of these skills; examine the information literacy skills curriculum and assess the methods used in delivering the programme to undergraduate medical students in the two universities; analyze the adequacy of policies and regulations supporting information skills literacy programmes in the two institutions; determine the perceptions of undergraduate medical undergraduate students towards ILS;

assess knowledge, skills and training possessed by staff engaged in facilitating ILS among medical undergraduate students; examine the role of ICT in facilitating and promoting information literacy skills among medical undergraduate students at the University of Nairobi and Moi University; and find out the challenges in ILS delivery and develop a framework to enhance ILS among medical undergraduate students in the University of Nairobi and Moi University. The study was guided by both the Sauce Model as developed by Bond (2009) and the Six Frames of Information Literacy Education Model as developed by Bruce, Edwards & Lupton, (2015). The study utilized the pragmatic research paradigm with mixed method approach. Additionally, multiple case design and convergent parallel design were adopted in data collection. The two universities were purposively selected that is University of Nairobi and Moi University. The students were stratified into their area of specialization and purposive sampling applied in selecting 182 respondents in 6th year medicine, 4th year nursing and 5th year dentistry. A sample size of 182 lecturers were selected through purposive and simple random sampling strategy. Purposive sampling techniques was utilized to select 2 university librarians, 2 medical librarians, and 6 Heads of Department (HODs). Data was collected using interviews, questionnaires and document reviews. To ascertain validity, triangulation of different data sources was carried out. Reliability of the study was tested through internal consistency technique and Cronbach's alpha. Finally analysis of data was carried out quantitatively and qualitatively. The findings indicate that the two universities which were sampled had initiated information literacy skills programmes in form of communication skills unit, with varied goals and objectives, majority of the students had not earned information literacy skills, meaning that they would experience problems in retrieving and utilizing information resources. However, most respondents indicated that the information literacy programmes should be designed to ensure that all users are literate in the use of both printed and electronic resources in the library. It is envisaged that the findings will enable public and private universities develop a befitting information literacy skills curricula that would benefit students to become effective users of information resources. The recommendations will inform the librarians, lecturers, university administrators, curriculum planners and education administrators on the importance of information literacy skills in the learning and training process.

Key Words: Assessment, Communication skills, Curriculum, Electronic Information Resource, Information and Communication Technology, Information literacy, Information literacy program, Information skills / Library skills, Information Professional/ Specialists, Information Seeking Behavior, Information Sources, Library User Education

Introduction

Information is a vital resource needed by human beings in different walks of life. Information can be defined as processed data, which helps in decision making, increase an individual's knowledge and mental thinking and overall change in the societal status of the nation (Badween, 2001). Similarly, Madden, (2000) defines information as the resolution of uncertainty which answers the question of "what an entity is" and thus defines both its essence and nature of its characteristics. For an individual to derive maximum benefits from information he/she must possess information literacy skills. Bruce (2004) defines Information Literacy as a set of skills needed to find, retrieve, analyze, and use information. Consequently, American Library Association (ALA) (1972) defines information literacy skill

as the ability to recognize when information is needed as well as the ability to locate, evaluate and effectively use it.

Information literacy in the 21st century is considered as a tool to individual empowerment and community development. Kavulya (2003), Hall (2010), Scott (2012) and Diehm & Lupton (2014) describe information literacy as the people's ability to know when there is need for information. Knowing when there is need for information enables one to identify, locate, retrieve, evaluate and effectively use it to solve the problem it was intended for or carry out more research. There is information deluge in various study fields especially medical sciences. Nonetheless, access to this dense information, demands for information literacy skills. Medical, dentistry and nursing students develop these skills by participating actively in information literacy instructions and enquiry-based learning. It is necessary for them to become effective information seekers and users in order to successfully negotiate their ways and become knowledgeable in medical research process. Thus, information literacy skills are no doubt significant determinants for active and result-driven engagements in the research process, especially in medical field.

In medicine, there are two methods of training that is the problem-based learning approach and conventional approach. These two methods of training are intensive hence there is need for students to be well grounded on information literacy skills. In addition, there is need to integrate ILS into basic sciences and clinical practice to enable medical students to identify, locate, evaluate, organize, and effectively use medical information to foster their training and future assignments in the medical field. (Vainiomäki 1995; Barrows 1996; Boud and Feletti 1997).

To cope up with medical training curriculum in an information overloaded environment, it is inevitable for medical students to be information-literate, to develop set of abilities to extract the appropriate information from the sea of information in the shortest possible time, and to critically evaluate the authenticity, validity and accuracy of the information. These sets of abilities needed for the information seeker is known as Information Literacy skills (ILS). If the students lack the ILS needed to find and use information effectively, they can be burdened by information overload (Andretta, 2005). Hence, the need for ILS training which is pivotal in the development of independent learner in academic environment such as the students on PBLC (Peters et al., 2007).

In light of the statements above, this study seeks to investigate information literacy skills of undergraduate medical students in selected public universities in Kenya, with a view, of proposing a framework to enhance delivery and utilisation of information literacy skills. The research objectives are to; explore information literacy skills offered to undergraduate medical students at the University of Nairobi and Moi University, determine the perceptions of medical undergraduate students towards the content and delivery methods of ILS and assess knowledge and skills possessed by staff engaged in facilitating ILS to undergraduate medical students. This study findings will provide a more practical way of integrating and utilizing ILS into medical training curriculum and also assist in developing more effective pedagogic approaches of imparting ILS to students at institutions of higher learning. In addition, the recommendations of this study will go a long way in helping universities to re-engineer ILS programmes in relation to course structuring, developing course contents, crafting methods of delivery and establishing assessment and evaluation strategies.

THEORETICAL FRAME WORK

Kerlinger (1979) states that a theory is a set of unified variables, descriptions, and propositions that elicit a systematic view of phenomena by specifying relations among variables with the purpose of explaining natural phenomena. There are various theories that are relevant for the study on information literacy skills that include among others; Sauce Model, Six Frames information education theory i-skills, SCONUL's Seven Pillars of Information Literacy, Information Literacy Standards Model, Five-Part Model of instruction, Kuhlthan's theory of information search process, the Bloom Taxonomy and Eisenberg and Berkowitz (1988) Big6 Skills

Model for Information Problem-Solving. This study will primarily be underpinned by Sauce Model (Bond, 2009) and the Six Frames of Information Literacy Education Model (Bruce, Edwards & Lupton, 2015).

Sauce model was advanced by Bond in 2001 and subsequently revised in 2009 (Bond, 2009). It is a research and problem solving process aimed at providing information literacy skills for learners to use in problem solving and research (Bond, 2011). Sauce model has six key facets/variables, which are Information literacy, collaborative and individual learning, essential skills, higher thinking skills, problem solving and ICT integration. Additionally, Bond(2011) avers that the six facets of the Sauce Model can be practiced through a five-step process that begins with task setting, information acquire, information use, information communication and information evaluation. Sauce model is anchored on the premise of projecting and leading students to higher-order thinking skills and developing learners into independent information-literate people (Bond, 2001). Therefore, the model will help in the realization of the aim of study.

Additionally, the six frames for information literacy education model will be utilized to bridge the weakness identified in the Sauce model. The six frames for information literacy education was developed by Christine Bruce in 1997 as a learning oriented approach to ILs (Bruce, Edwards & Lupton, 2015). as a theoretical tool to help partakers in the ILS education arena reflect on, and analyse, the varying implicit or explicit theoretical influences on their contexts. The frames have brought a paradigm shift on ILS teaching, learning and ILS curriculum design (Pratt et al, 1998 and Toohey, 1999). The six frames of information literacy education are ;The Content Frame, Competency Frame, Learning to Learn Frame, Personal Relevance Frame, Social Impact Frame and the Relational Frame. Each frame brings with it a particular view of ILS, information, curriculum focus, learning and teaching, content, and assessment. Some elements of the frame apply to both the substantive content and to the ILS component where these are taught together.

LITERATURE REVIEW

The Status of Information Literacy Skills training in Universities

Scholars like Kavulya (2003), Amunga (2007), Joseph (2005), Kingori (2015) Mundave (2016) & Gatero (2016) in their various studies agree that the following are problems of information literacy skills training in Kenyan institutions of higher learning: Over-dependence on one day orientation program; Lack of collective curriculum for user education program in Nigerian universities; Use of unqualified personnel to teach the course. Edom (2007) itemizes the problems as follows: Inadequate time, large number of students, inadequate number of instructors/lecturers, inadequate facilities/equipment, high cost of audio visual materials, the attitude of lecturers, the attitudes of students, and use of library combined with use of English

Ogunmedede and Emeahara (2010) in their study observed that no matter how large the stock of a library is, if the services and its resources are not fully utilized, such a library will be a white elephant project. Further they posit that Information literacy skills can be imparted in the form of orientation/training programmes, workshop, and seminar, “know your library programmes” occasionally organized by the library for both new and old library users. These activities may be packaged in hard copies, i.e. manuals, handouts or in soft copies i.e. compact disc. The fundamental objective of user education is to expose, acquaint and inculcate in the clients, the basic

knowledge or understanding and skills which are necessary for effective and efficient use of the library services and resource. On the same breath, Uwakwe (et al, 2016) argue that the advent and advancement of technology as well as the development of computer systems, have given rise to unprecedented increase in volumes of published materials, both in print and non-print forms and compelled modern libraries and the librarianship profession to pursue and adopt new age tools and methodologies in the discharge of its activities. These sentiments are echoed by Aligu (2011) who states that changes brought about by the use of ICT facilities in storing, retrieving and dissemination of information poses challenges on the library users hence the need to instruct them on how well to use them to retrieve information. He insists that the application of ICT into library system demand from an exposure to ICT facilities and be taught on how to use them. Onyeneke (2017) observes that many ILS studies in Nigeria have shown that many students do not use the library. Onyeneke (2017) further, alludes that some students are not even aware of the existing information materials in the library. Those who use the library find it difficult locating needed materials because they lack the knowledge of the search tools which would help them locate information materials needed. Consequently, the library resources are underutilized and this seems to account for students' inability to do meaningful research which ultimately results in poor academic performance.

Policy and Regulatory Framework Available to Facilitate ILS in Universities

IFLA in 2014 developed a comprehensive document regarding policy and regulatory framework to facilitate ILS in Universit**ies.** This documentation points to standards and regulations set in teaching and application of ILS. Moreover, Taylor (2006) acknowledges that information literacy standards are broad student outcomes that describe an information literate student. Similarly Kingori (2015) alludes that performance indicators, levels of efficiency and examples are provided with the standards to enable library media specialists to measure students' competencies at various levels.

Mokhtar and Majid, (2008) in their study entitled Information Literacy Standards, Guidelines and Their Implementation, found out that universities and institutions of higher education worldwide have implemented different ILS standards and guidelines. The guidelines list the ILS competencies that students ought to possess and exhibit, and how these competencies can be integrated within the curricula and also the various strategies that can be implemented in order to effectively impart these competencies to students.

Mundave (2016) avers that lack of ILS policy framework at institutional or national level was another hindrance to underdeveloped ILS among undergraduate students in Kenya. These sentiments concur with Katundu (2004) who carried out a study on information literacy skills in two public universities in Tanzania, and found out that policy framework on ILS training were lacking and that efforts of integrating some form of library instruction, orientation or user education have not been able to create a workable policy to enable develop an all-round individual user who can find, evaluate, use, create, organize or share information. Additionally, scholars such as Kavulya (2003), Kingori (2015), Mathangani and Irura (2005) assets that lack of home grown standards and policies are a great challenge to provision of information literacy skills in Kenya. In support of these sentiments. Esterhuizen and Kuhn, (2017) acknowledge that it is only as recently as 2016 that the CHELSA developed draft guidelines for use in SA. Other than these, he explained further, most academic libraries in Kenya and Africa at large use standards

developed in the Western developed countries which may not properly fit in the local context.

Information Literacy Skills Curriculum

Since the dawn of the information age, it has increasingly become clear that students cannot learn everything they need to know in college from the recommended textbooks. They need additional information from other sources which appear in various formats. Therefore, students should be trained on ILS so that they can continue learning independently long after they are out of university campuses (Baro et al, 2013). Over the years a variety of different types of user education programs have been established worldwide and the information literacy literature is full of studies regarding these programs. The prevailing theme in these studies is how to provide better information literacy skills programs, rather than whether to provide them or not. Lanning (2002) assert that ILS instruction enables students to become information literate, hence able to recognize when information is needed and have the ability to locate, evaluate and use effectively the needed information.

Lwehabura (2008), argue that most of the ILS programmes and initiatives have been introduced under the influence of librarians because they are the experts in most ILS activities which are in the information domain. Katundu (2004) observes that efforts of integrating some form of library instruction, orientation or user education have not been able to create an all-round individual user who can find, evaluate, use, create, organize or share information. Katundu (2004) suggests that in order for students to acquire these skills, it is necessary to undertake a user information literacy needs survey before any information literacy programme is instituted. In support of these assertions, Kavulya (2003) avers that library instructions are library-centered rather than information centered and that ILS instructions are presented in an abstract way because the knowledge acquired cannot be used immediately. It is therefore necessary to determine the students' level of competence before commencing ILS training. Although students can get information faster than before due to the automated data bases in libraries, they are still unable to identify bias, differentiate between fact and opinion, recognize authority (authorship), broaden or narrow the search/topic as necessary, or evaluate the resources they have found. Further Katundu (2004) assert that in many institutions of higher learning ILS programmes lack relevance and importance in the learning process due to the fact that they are not credit bearing courses. Odini (2000) states that there are different kinds of information literacy skills programs provided by Kenyan universities. They include library orientation, library instruction courses, individual instruction or reference service, and use of library manuals and guides. Kavulya (2003) states that in all of the four universities his study examined, library orientation is mandatory and takes place in the first and second weeks when new undergraduate and post graduate students report to the university.

Knowledge, Skills and training possessed by staff in facilitating Information Literacy Skills (ILS)

Kavulya (2003); Nyamboga (2004); Kingori (2015) assert that a library, is the centre of excellence in any institution of learning, and as such it is expected to play a major role in equipping and facilitating its users with the appropriate information literacy skills. For new students specific library orientation courses may be run so that they are in a position to: write projects during their courses with very little assistance from the library staff and teachers; prepare term papers and retrieve the required references both from print and electronic sources (Gatero, 2010).

Such courses involve professional library staff in providing information about the catalogue, the classification scheme, the circulation service, reference and information services, periodicals, research and special collections, audio-visual materials and archives. Additionally, with ICT in place, the library professionals will also have to include information about the OPAC, CD-ROMs electronic information sources, and Internet browsing and searching. Both the traditional and modern skills have to be covered as demand increases and changes arise.

In a study conducted by Lwoga (2014) on the mapping of information literacy outcome and learning experiences of health sciences among undergraduate students, it was found out that students continue to use the skills gained during the IL course both in class and for purposes not related to class. However, it was further found out that there was low usage of scholarly databases and the library catalogue for academic and non- academic activities. These findings revealed that there was inadequate training on search strategies, information sources and evaluation of resources as a practical skill. Interestingly, the study recommended that there should be a study to validate differences between students' self-reports of their IL competency with their actual competence as measured by a strenuous post-test.

The above findings are echoed by a study conducted by Mbabu etal (2012) on information literacy skills among undergraduate students, found out that majority of undergraduate students were still using search engines, Wikipedia, and social media tools to find their information. This indicates students are not receiving adequate instruction in developing the information literacy skills required to conduct research using credible and viable resources. Students want the easy way or the "fast" way to find information because they are comfortable with searching the internet rather searching online databases. Also, the OCLC (2010) report indicates that there is a decline in students use of accredited online journals and databases, that students opt for faster ways of obtaining the information needed to complete their assignments. These sentiments are echoed by Mundave (2016) who contend that staff lack of adequate ILS hence one can't teach what one know not. Lwehabura (2008) in his study in Tanzanian universities indicated, lack of clear information literacy policy in the country, inadequate time on the part of librarians to teaching information literacy as a stand-alone programme on a voluntary basis, and non-involvement of teaching staff in promoting the action are some challenging factors for effective impacting adequate IL skills to students. Lastly, Idiodi (2005) mentions that, disruptions in the academic calendar, lack of space, and inadequate support from their parent institution constitute the challenges in teaching information literacy course in Nigeria.

Similarly, in a study conducted by Mundave (2016) on information literacy learning experiences of fourth-year psychology students in Kenyan universities found out that there were low number of qualified staff to teach ILS. The study further, established that the number of librarians and lecturers teaching ILS was low, especially in the public universities compared to the number of students they handled. This affected the quality of instruction, since attention to individual learners was almost absent (Baro & Zuokemefa, 2011).Consequently, Baro & Zuokemefa, (2011) in their study found out that lack of ILS training for lecturers and librarians resulted in poor teaching methods and incompetence in teaching ILS. Since some lecturers did not even comprehend the concept of ILS themselves, it can be concluded that they could not be competent to instruct students in an area whose concept they did not grasp. The study further

revealed that the learning approaches used lacked motivation to learners.

Table 1: Research Gap

Research Gap	**How the gap will be addressed**	**Research Question**
Steinert (2014); Kanguha (2014); Kimani (2014); Cornwall (2011); Shabi, Shabi, Akewukereke, and Udofia (2011); Hurwitz and Slawson (2010) ;Gatero, (2010); Lwehabura and Stilwell (2008); Ajuwon (2006); Lau, (2006); Kavulya (2003) recommends that further investigation is needed on the ILS possessed by students because majority of the students are unable to adequately access, use , cite information resources due to lack of understanding the various information searching strategies and techniques.	The study will explore information literacy skills offered to medical, dentistry, and nursing undergraduate students at the University of Nairobi and Moi University and ascertain the usefulness of these skills	What is the status of information literacy skills among medical, dentistry, and nursing undergraduate students in Nairobi and Moi universities?
Kavulya (2003); Nyamboga (2004); Mutula et al., (2004) ; Bury (2010); Baro & Zuokemefa, (2011); Mbabu et al (2012); Lwoga (2014) suggests that there is need to re-look at the knowledge, skills and training of librarians and teaching staff engaged in ILS.	To analyze the adequacy of policies and regulations supporting information skills literacy programmes in the two institutions	1. What information literacy skills policy and procedure are used in imparting ILS to medical undergraduate students at University of Nairobi and Moi University?

Arnold, (1998); Carder *et al.*, (2001); Cooney and Hiris, (2003); Dennis, (2001); Doherty *et al.*, 1999; Leadley, (1998); Hiscock and Marriott (2003); MacDonald *et al.*, (2000); Kingori (2015); Mundave (2015) recommendes that there is need for a pedagogic framework for delivering effective information literacy programs to undergraduate students	The study will seek to determine the information literacy skills programme and asses the methods used in delivering the programme to undergraduate medical, dentistry and nursing students in the two universities.	What is the adequacy of information skills curriculum offered to medical, dentistry, and nursing undergraduate students at the University of Nairobi and Moi University?
Pejova et al, (2002); Kavulya, 2003; Amunga, (2011) ; Adeyoyin, (2006); Farrell, (2007);Ganley, & Kraemer, (2005); Tilvawala and Myers (2009); concurs that computer illiteracy among students and staff is a major impediment to information literacy efforts in Kenya because of underutilization and digital illiteracy.	The study will assess the perceptions of undergraduate medical, dentistry and nursing undergraduate students towards ILS	What is the perception of staff and medical, dentistry and nursing undergraduate students towards ILS in Nairobi and Moi universities in Kenya?
Kavulya (2003); Nyamboga (2004); Mutula et al., (2004) ; Bury (2010); Baro & Zuokemefa, (2011); Mbabu et al (2012); Lwoga (2014) suggests that there is need to re-look at the knowledge, skills and training of librarians and teaching staff engaged in ILS.	The study will assess knowledge, skills and training possessed by staff engaged in facilitating ILS among medical, dentistry, and nursing undergraduate students	What knowledge skills and training are possessed by staff in facilitating ILS among medical, dentistry, and nursing undergraduate students of Nairobi and Moi universities?

METHODOLOGY

This study sought to investigate information literacy skills of undergraduate medical students in two selected public universities in Kenya, with a view, of proposing a framework to enhance delivery and utilisation of the information literacy skills. The study adopts a pragmatic research design which paradigm emphasizes the research problem and allows researchers to use available methods that enable them to address the problem (Creswell, 2009),

and is usually associated with a mixed methods approach (Creswell & Clark, 2011). Additionally descriptive survey design within a case study was used. Consequently a multiple case design was utilized whereby the two selected universities were treated as independent unit of analysis. The population for this study will consists of Medical, dentistry and nursing students; University librarians; Head of Medical librarians from the two institution; Lecturers and Departmental heads in the two colleges of health sciences of University of Nairobi and Moi University. The study targeted 6th year students in Medicine, 5th year students in Dentistry and 4th year students in Nursing from both institutions. The motivation behind this is that these students are at advanced/ final levels in their studies hence understands how ILS affect their studies and can best describe ILS experiences, perception, attitudes, notions. Simple random sampling was utilized in selecting a sample size of 182 respondents from 6th year medicine, 4th year nursing and 5th year dentistry respectively. The lecturers were stratified into the departments that they teach in then, simple random sampling technique used to select 182 lecturers. Purposive sampling was used as a sampling strategy for selecting the 2 university librarians, 2 medical librarians, and 6 HODs. Interviews, questionnaires, and documents analysis were used as means of collecting both qualitative and quantitative data. Interviews were used to collect qualitative data from university librarians, medical librarians and HODs, similarly questionnaires were used to collect quantitative data from students and lecturers, while document analysis was used to collect qualitative data. After the completion of data collection, all returned questionnaires were sorted and reviewed. Incomplete Questionnaires were excluded. The data was then coded and inserted in the statistical package for social sciences. Both descriptive and inferential analysis were deemed appropriate to answer the study's questions, including frequencies, percentages, means, and standard deviations for descriptive analysis

PRELIMINARY FINDINGS

ILS Training curriculum

The study sought to find out if there existed an official ILS curriculum and if yes, establish the ILS content that the curriculum covered. This was meant to help the researcher understand the adequacy of the ILS skills taught to the students would have acquired to help them utilize information resources.

The findings revealed that there existed no officially drafted ILS curriculum. What is available is the communication skills unit with some components of library skills. Additionally, the findings pointed out that majority of the respondents had not received information searching skills represented by (29%), while less than a quarter of the respondents had received user instruction and orientation represented by both (18%), a small percentage of the respondents (8%) had been trained on computer and information technology and also a small percentage of the respondents (19%) had gone through training on online databases, (17%) had acquired skills on how to evaluate information resources . The study findings are in line with Eisenberg, Lowe and Spitzer (2004) findings that established that embracing information literacy is more than a responsibility of library, it is an institutional concern. Therefore the researcher agrees with them that the faculty should play a vital role in defining the content and place of information literacy within the curriculum; it cannot avoid this issue if students are to be prepared effectively for the future. Every ILS training curriculum should emphasize and offer more training on user instructions, orientation, computer information literacy, research skills, problem solving skills, information evaluation skills, ethical use of information and online

databases for majority of the respondents felt they needed more training as reflected by the figure above.

The study findings were also in-line with National Forum on Information Literacy (2015) which noted that information literacy is a learner centric instructional template that, if applied strategically, can foster the development of independent, self-sufficient learners. In fact, information literacy skills instruction cuts across all disciplines, information literacy practice is not educator dependent. Parents and family members can apply this skill set in supporting student learning at school, at home, and in the workplace. Every learner should know how to demonstrate and utilize baseline information literacy skills. Having the abilities to define tasks and information needs as well as access and ethically manage a variety of information resources within a digital universe is key to producing the independent, lifelong learners in the 21st century. College and career readiness success is built on a platform of information literacy and digital literacy preparation. Without its specific inclusion in future educational and workforce development reform policies, our pathway to an effective economic and social recovery remains dim. According Eisenberg, Lowe and Spitzer (2004) to be information literate one requires a new set of skills. These include how to locate and use information needed for problem- solving and decision- making effectively and efficiently. From the above findings, it can be inferred that due to the inadequacy of ILS curriculum that is used to teach ILS in the two selected institutions, undergraduate medical students have not acquired adequate skills on information search and retrieval as well as the skills to evaluate information sources, and therefore they could not locate, access, evaluate and utilize the information resources.

Status of information literacy skills among medical students in University of Nairobi and Moi University.

The study established that (80%) of the respondents had not received information literacy skills, namely information search and retrieval, evaluation of information skills, information use, problem solving skills. the study further found out that the respondents were trained on user instruction and library orientation. A small percentage of the respondents (8%) had been trained on computer and information technology skills. Additionally, only (23%) of the respondents indicated that they had knowledge on how to access online databases. From the above findings it is clear that majority of the students had not earned information literacy skills, meaning that they would experience problems in retrieving and utilizing information resources. Further, less than a quarter had received user instruction and orientation therefore majority of the students had not been trained hence they could not identify, locate and access information resources, the study also noted that majority of the student had not received any training on computer and information technology and on online databases, therefore they would not utilize e-resources and this leads to underutilization of the electronic information resources.

The study sought further to understand the level of proficiency of students on plagiarism, knowledge of breach of the copyright law, acknowledging sources of information, evaluation of information on the internet and choice of search engine used

Copyright Law

On legal and ethical use of information, students' views were sought on issues relating to the copyright law of Kenya. The responses from the undergraduate medical students

indicated that a greater proportion 122(67.4%) considered photocopying an entire document infringement on the copyright law of Kenya. A significant proportion 30(16.0%) did not have an idea of the issue of the copyright law of Kenya related to photocopying. Table 2 demonstrates this better.

Table 2: Infringement of the Copyright Law in Kenya

Responses	Frequency	Percent
Seeking Permission From Authors	7	5.1
Photocopy Just A Page	19	14.0
Photocopy A Full Chapter	10	7.4
Photocopy The Entire Material	122	67
Total	**182**	**100.0**

Source: field study, 2020

Plagiarism

Information literacy skills helps students understand what constitute plagiarism and why they should avoid plagiarizing other authors' intellectual literary works, and as such the researcher asked the medical students from both institutions a 'Yes' and 'NO' question, to indicate whether they consider plagiarism as an academic dishonesty or not. According to the results, majority 104(57%) were of the opinion that plagiarism is an academic dishonesty. While on the other hand 72(43%) were of the view that plagiarism is not an academic dishonesty.

Table 3: Plagiarism an Academic Dishonesty

Responses	Frequency	Percent
YES	104	57.0
NO	72	43.0
Total	**182**	**100.0**

Sources: field study, 2020

Acknowledging Sources of information

Using someone's work without acknowledging the source is not considered an attribute of an information literate person. When respondents were asked whether they acknowledge their information sources, 34% of the respondents indicated 'yes' meaning, they use other people's work and acknowledge the sources, whiles 66% of the students indicated that they use people's works without acknowledging sources.

A follow up question was posed to those who answered 'NO' to the question above to give reasons why they don't acknowledge the sources of information that they have utilized in writing their academic work. The responses showed that the reasons student use someone's work without acknowledging were; they didn't know how to do it, they didn't consider it important, had no time to cite.

Table 4: Reasons for using someone's work without acknowledging

Responses	Frequency	Percent
Didn't know how to do it	130	71
They didn't consider it important	35	20
No Time To Cite	17	9
Total	**182**	**100.0**

Source: field study, 2020

Evaluation of Information on the Internet

It was established in the literature of the study that, internet use among students is on the increase in current times. To test how students evaluated information on the internet especially with search engines, a question was posed and Table 5 .illustrate the answers that the respondents gave.

Table 5: Techniques of evaluating information on the internet

Responses	Frequency	Percent
Author Experience	130	71
Year of publication	35	20
Host of the website	17	9
Total	**182**	**100.0**

Source: field study, 2020

Search Engine used

There are many search engines available to students on the web and therefore the researcher inquired from them the very type they used in searching for information. It was revealed that, majority 178(98%) of the respondents used Google search engine, followed by an insignificant number 4 (2%) who indicated they used yahoo very often. See Table 6.

Table 6: search engines used in browsing

Responses	Frequency	Percent
Google	178	98
Yahoo	4	2
Total	**182**	**100.0**

Source: field study, 2020

Students' perceptions on the information literacy skills

Table 7 summarizes students' responses on how they perceive ILS training. 76% of the respondents assert that ILS increased their ability to find information, 67% it enabled them to reduce time they spent to search for information, 63% it enabled them to accomplish their assignment on time, 62% it made them aware on plagiarism issues, 58% made information search easier, 55% it increased their ability to evaluate the reliability and accuracy of information found, 51% It provides useful information for my research

project/assignment , 47% developed strategies for planning my searching , 47% it enhances the quality of my research project/assignment, 43% Knowledgeable about what information is available through library-provided, 41% better grades following information searching training and 72% was useful and provided life-long skills, as shown on table 6 below. However, there were 109 negative replies to the question on whether they could use the databases on their own indicate a need for more extensive ILS training.

Table 7: Benefits of Learning ILS

	Frequencies	Percentages
Increased ability to find information (i.e., developed their searching skills)	156	76.0%
It enables me to reduce time that I would use to search information	142	67.3%
It enables me to accomplish my assignments more efficiently	132	62.8%
Understanding plagiarism issues	131	61.5%
Information is easier to find	98	57.8%
Increased ability to evaluate the reliability and accuracy of the information I find	97	54.5%
It provides useful information for my research project/assignment	96	51.6%
Developed strategies for planning my searching	88	47.3%
It enhances the quality of my research project/assignment	87	46.9%
Knowledgeable about what information is available through library-provided		
Better grades following information searching training	83	41.5%

Information literacy skills challenges

Participants from different institutions highlighted the lack of support from the administration, as well as the top university management, which has led to the unstructured teaching of ILS programme to students and these are done on a one-on-one basis or in groups.

Participants highlighted their experiences from their own institutions and indicated that there is no buy-in from the university stakeholders, which makes it even harder to implement IL in their institutions. Again, faculty librarians debated during the focus group discussion that institutional stakeholders are not forthcoming when it comes to library issues as they think IL is the library's responsibility. Baro, Seimode and Godfrey (2013) also discovered that a lack of cooperation and collaborative support from teaching staff concerning library services has become a threat to the library and its services.

Conclusion

The main purpose of this research study was to evaluate information literacy skills among medical students, in order to gather information on how information literacy skills training and learning might be improved. The results showed that there existed no officially drafted ILS curriculum, what is available is the communication skills unit with some components of library skills; majority of the students had not earned information literacy skills, meaning that they would experience problems in retrieving and utilizing information resources; evaluation of information skills was identified as moderate overall, with more emphasis given to the creditability and accuracy of information. Further the study revealed that

Information ethics received higher levels of information literacy among the respondents, proving recognition that information ethics contribute to strengthening the capacity of information societies.

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Comparative Analysis of the Composition of *Ocimum kilimandscharicum* (Mutaa) and *Ocimum gratissimum (*Mukandu) from Makueni County, Kenya

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ABSTRACT

A comparative analysis of the composition of two species of *Ocimum* found in Makueni County, Kenya was undertaken. These were *Ocimum kilimandscharicum* (Mutaa) and *Ocimum gratissimum (*Mukandu). They are locally known by the names, Mutaa and Mukandu respectively. The *Ocimum kilimandscharicum* and *Ocimum gratissimum* were analysed qualitatively for the presence of minerals and phytochemicals. The phytochemicals analysed include reducing sugars, proteins, alkaloids, tannins, flavanoids, terpenoids and anthraquinones. The possible health benefits of the *Ocimum* species from Kenya were determined in view of the composition.

Addition of a drop of aqueous sodium hydroxide and ammonium hydroxide till in excess, to test for minerals present showed no precipitate. The Fehlings' test for reducing sugars using 1ml Fehling's solution No.1 added to 0.5ml of extract gave a green solution with a brown precipitate at the bottom. The precipitate was more for *O. gratissimum* than *O. kilimansdcharicum*. The biuret test for proteins was negative. A Wagner test (dilute iodine) for alkaloids gave a red-brown precipitate. Tannins/phenols were analysed using Ferric chloride. A dark green-black precipitate was formed. An orange solution was formed in the flavanoid test using Magnesium metal and dilute hydrochloric acid. Salkowski test for terpenoids using 2ml chloroform with 3ml concentrated sulphuric acid was done. Red –

brown upper layer and lower layer with a colourless interface between was observed in *O. kilimandscharicum*. Similar observations were made in *O. gratissimum* with a pink lower layer and a red-brown top layer. The test for anthraquinones gave a brick-red layer at the bottom of the test tube with a black ring at the top. The brick red layer was slightly darker for sample B (Mukandu) compared to sample A (Mutaa).

In conclusion, the findings suggest the absence of proteins in both species of *Ocimum*. They point to the presence of calcium, magnesium, manganese, potassium and sodium minerals as confirmed by the flame test. Further, both species of Ocimum studied contain reducing sugars, alkaloids, tannins, flavanoids, terpenoids and anthraquinones. Variation in quantities of phytochemicals and minerals is suggested by the differences in colour intensities. In view of the findings Ocimum species in Kenya present great opportunities in the health sector that need to be explored. The phytochemical and minerals play significant roles in fighting microbes and ensuring a healthy body. A quantitative determination of the phytochemicals and minerals is required using Gas Chromatography-Mass Spectrometry (GC-MS) and Atomic Emission Spectrometry (AES) or Atomic Absorption Spectrometry (AAS) to determine the difference in the quantities between the two species. Further, isolation of active ingredients remains a great need.

Key words: *Ocimum*, basil, chemical composition, phytochemicals, minerals, reducing sugars, health, Kenya

1.0 Introduction

The species, *Ocimum kilimandscharicum* (local name, Mutaa) and *Ocimum gratissimum* (local name, Mukandu) among other species of Ocimum mostly grow in similar climatic conditions in tropical and subtropical warm temperature regions (Rahul, Kapoor, Sarkar, & Sabha, 2020). Kenya, being in the tropical region provides a conducive environment for the species to thrive, mainly in wild habitats. *Ocimum kilimandscharicum* (Mutaa) is mostly found in Nigeria, Ghana, Rwanda, India, Athens, Thailand, around Mt Kilimanjaro in Kenya, and other tropical and subtropical regions (Misra & Das, 2015). These species are part of the larger genius *Ocimum* L. a family of Lamiaceae commonly referred to as basil. Other species of *Ocimum* include O. *basilicum* L. (sweet basil, Ban Tulsi in India) and *O. sanctum* L. (holy basil, Tulsi in India), also *O. tenuiflorum*, *O. canum* (Dulal Tulsi in India), *O. obovatum*, *O americanum*, *O. lamiifolium* and *O. suave* among other more than 30 species known. It is noted that *Ocimum* species have varied chemical compositions and biological activities (Shanaida, 2020). This calls for more studies on the species of *Ocimum.* An understanding of the species will facilitate in characterizing the active molecules responsible for various functions, including healing properties and in maximizing its potentials.

In this study, the two species were obtained from Makueni County in Kenya, East Africa. They were analysed qualitatively for the presence of minerals and phytochemicals. Phytochemicals are chemicals of plant origin produced through primary or secondary metabolism that have biological activity (Ibid). They play a role in plant growth and defense against competitors, pathogens, or predators. A study by Adeogun, Maroyi, & Afolayan, (2017) in South Africa looked into the effects of the *O. gratissimum* leaf extracts on the quality of fresh cut Cucumis sativa.

Results showed that the microbe load in C. sativa that was treated with *O. gratissimum* was lower than for the untreated sample. The findings point to the bio-preservation potential of *O. gratissimum*.

In the human body phytochemicals act as antioxidants (Kim, Yang, Lee, & Kang, 2011). Antioxidants are substances that prevent damage to cells from highly reactive, unstable molecules called "free radicals." A balance between antioxidants and free radicals is required in our bodies for health. Other plants previously studied for antioxidant effect include rosemary, oregano and caraway (II- Suk, Mi-Ra, Ok-Hwan, & Suk-Nam, 2011). Phytochemicals and the compounds that form from them act in a variety of ways to protect health. Table 1 below gives a summary of the benefits of different phytochemicals to the human body:

Table1

Importance of phytochemicals in the human body

Phytochemical	Importance in the body
Reducing sugars e.g. glucose	Physical energy and brain function
Alkaloids	Antimalarial, antiasthma, anticancer, vasodilator, antiarrhythmic, analgesic and antibacterial
Tannins	Anti- carcinogenic and anti-mutagenic due to their anti- oxidizing properties
Flavonoids	Display antioxidant, anti-inflammatory and anti-allergy properties.
Steroids and terpenoids	Signaling molecules, control metabolism, immune functions, inflammation, salt and water balance, development of sexual characteristics, and the ability to withstand illness and injury
Anthraquinone	Anticancer agents, Antibacterial, anti-parasitic, insecticidal, fungicidal, and antiviral properties.

(Adeogun, Maroyi, & Afolayan, 2017; Kim, Yang, Lee, & Kang, 2011)

Anthraquinone is an important phytochemical with antioxidant properties. Natural antioxidants are known to protect the body from oxidative stress conditions such as cancer and other degenerative diseases (II-Suk, Mi-Ra, Ok-Hwan, & Suk-Nam, 2011). Apart from these, anthraquinone is useful in the manufacture of dyes, in the textile and pulp industries, (Hunger, 2003) and acts as a bird repellant. Anthraquinone is also called anthracenedione or dioxoanthracene. The phytochemicals analysed in this study include reducing sugars, proteins, alkaloids, tannins, flavanoids, terpenoids and/or steroids and anthraquinones.

Reducing sugars include glucose, galactose, glyceraldehdes, fructose, ribose and xylose. Glucoce is useful for physical energy and

brain function. These groups of compounds act as reducing sugars due to the free aldehyde group or ketone group that they possess.

Alkaloids have a wide range of pharmacological activities including antimalarial, antiasthma, anticancer, cholinomimetic, vasodilator, antiarrhythmic), analgesic and antibacterial effects. They can be used as protective substances against the animal or insect attacks. They may act as reservoirs for protein synthesis in plants. They also function as plant stimulants or regulators in growth, metabolism and reproduction. In a comparative analysis of the production of secondary metabolites against three bacterial pathogens, *E. coli*, *P. aeriginosa* and *S. aureus*, by *Oscimum tenuiflorom* and *Azadirachta indica* it was found that there was increased activity more so from *O. tenuiflorum* compared to *A. indica*. This reveals a high potential of *Oscimum* species in anti-bacterial activity, (Pandey & Singh, 2013). Examples of alkaloids are quinine, atropine, and strychnine, caffeine, nicotine, morphine, codeine, and cocaine among others. These are commonly used in the manufacture of medicine.

Tannins are anti- carcinogenic and anti-mutagenic due to their anti- oxidizing properties. Tannins are naturally occurring polyphenols. Flavonoids also exhibit high biological activity and display antioxidant, anti-inflammatory and antiallergic properties.

Steroids or terpenoids and their metabolites often function as signalling molecules. Steroids and phospholipids are components of cell membranes. Further, steroids such as cholesterol decrease membrane fluidity. Steroid hormones help control metabolism, immune functions, inflammation, salt and water balance, development of sexual characteristics, and the ability to withstand illness and injury. Steroid hormones are classified into five categories: glucocorticoids, oestrogens androgens mineralocorticoids, and progestogens.

Minerals are essential in the human body for different functions such as formation of hormones and maintaining normal body temperature Calcium is necessary for the formation of strong bones and teeth while magnesium helps to maintain bone health (Mary & Gavin, 2015). Potassium is required to ensure proper fluid balance, muscle contraction and nerve transmission

Previous studies on *Ocimum* dealt with the impact of weather variables on the incidence of lace bug *C. bullita* on *O. basilicum* L. (Ram Tulsi in India), *O. sanctum* L. (Tulsi in India) and *O. kilimandscharicum* Guerke in Jammu region of India (Rahul, Kapoor, Sarkar, & Sabha, 2020). It was found that the activity of the lace bug depended on environmental factors (temperature, relative, humidity and wind speed). In another study in India, the chemical composition of oil extracts of *O. basilicum* obtained by hydrodistillation and by different solvent extractions were analysed. Findings showed that the oils present were majorly monoterpenes and sesquiterpenes. Eugenol (61.76%) formed the highest percentage of oils in *O. basilicum*, (Dev, Das, Hossain, & Rahman, 2011). The characteristics of the *O.basilicum* leaves varied depending on the region of cultivation, for instance on a domestic plantation compared to the wild habitat. The chemical composition of *Ocimum americanum* in Sudan was also studied (Mustafa & El-Kamali, 2019). The study showed that *O.americanum* was a good source of nutrients, and could be of use in the

food and pharmaceutical industries, and for therapeutic purposes. Further studies on the cardio protective activity of an *O. gratissimum* fraction extracted using chloroform and other solvents showed that the chloroform extract prevented the extent of myocardial infarction (commonly known as heart attack) significantly (Dobhal, Parcha, & Dhasmana, 2013). The other solvents used for extraction were petroleum ether, acetone and methanol.

It is important to determine the chemical composition of the Ocimum species in Makueni, Kenya if gains are to be made out of it. A study by Bussman, Paniagua-Zambrana, & Njoroge, 2020 in Kenya revealed the local uses of *O. gratissimum* species for respiratory and antimalarial purposes, treating constipation, nose congestion, flu, low calcium and colds. Other uses of *O. gratissimum* include treatment of asthma, coughs and rheumatism (Paniagua-Zambrana & Bussmann, 2020). The same study also pointed to its use to treat diarrhea, dental problems, chest pains, placenta removal after birth and digestive problems. It is also serves as an antiseptic, diuretic, in postpartum recovery and as antiemetic agent.

O. kilimandscharicum leaves and stems are boiled and inhaled for coughs and colds. Infusions are used to treat sore eyes and as bath for measles (Bussman, Paniagua-Zambrana, & Njoroge, 2020). The uses of *O. kilimandscharicum* for traditional medicinal purposes are wide. The leaves are insecticidal, antiviral, antibacterial, ophthalmic, appetizers and deodorants (Misra & Das, 2015).

This study opens a new chapter in the discovery of the chemical composition of the species of *Ocimum* in Kenya and the inherent potentials in health.

Table 2

2.0 Materials and Methods

Leaves of *Ocimum kilimandscharicum* (Mutaa) and *Ocimum gratissimum (*Mukandu) from Makueni County were cleaned, put in clean separate beakers and dried naturally at room temperature for three days. The dried samples were ground into powder form. The powder of the species were each put in clean beaker, covered with aluminum foil and stored at room temperature.

Two empty beakers were weighed using a weighing balance. 4g sample each of *Ocimum kilimandscharicum* (Mutaa) and *Ocimum gratissimum (*Mukandu) were put into the empty beakers and weighed using the weighing balance. 70ml of water was added to each sample in the beakers and heated to boiling. The sample was cooled and filtered. (37ml extract of the sample A (Mutaa) was obtained, 33ml of sample B (Mukandu) extract was obtained). 40ml of chloroform was added to the filtrate in the separating funnel. The mixture was well shaken, releasing pressure by opening the cork on the separating funnel. Two layers were formed in the separating funnel. The lower (Aqueous layer) and upper (organic) layer were separated and collected in two different beakers. A second extraction was done using 40ml chloroform and the extract added in the beakers. The organic layer (chloroform extract) was concentrated and left to dry in a desiccator. 0.5g of the extract was obtained from each species. Qualitative analysis was done on the extracts.

The results following an analysis of *O. gratissimum* and *O. kilimandscharicum* are given in Table 2.

Results of the tests for the analysis of O. *gratissimum* and *O. kilimandscharicum* from Makueni County, Kenya

Test	Observation – Sample A; *O. kilimandscharicum* (Mutaa)	Observation- Sample B; *O. gratissimum* (Mukandu)	Inferences
Addition of a drop of NaOH to 0.5ml extract dropwise till in excess	No precipitate formed.	No precipitate formed.	Soluble ions present K, Na, Mg, Ca, Mn
Addition of ammonium hydroxide solution to 0.5ml of extract dropwise till in excess.	No precipitate	No precipitate	Soluble ions present: K, Na, Mg, Ca, Mn
Test for reducing sugars was done using Fehling's test. 1ml Fehling's solution No.1 was added to 0.5ml of extract. The solution was boiled in a water bath and solution observed for any change in colour.	Green solution with brown precipitate at the bottom. The precipitate is less compared to sample B- *O. gratissimum* (Mukandu)	Green solution with brown precipitate at the bottom. The precipitate is more compared to sample A- *O. kilimandscharicum* (Mutaa)	Reducing sugars are present. The quantity was higher in *O. gratissimum* (Mukandu)
Test for proteins using biuret reagent	Dark green solution formed	Dark green suspension, dark brown solution	Proteins not present
Test for Alkaloids using Wagner test (dilute iodine).	Red -brown precipitate formed	Red-brown precipitate formed	Alkaloids present
Test for tannins/phenols using Ferric chloride.	Dark green-black precipitate formed	Dark green –black precipitate formed	Tannins present
Test for Flavanoid using Magnesium metal and dilute hydrochloric acid.	Effervescence. Orange solution formed	Effervescence. Orange solution formed	Flavanoid present
Test for terpenoids using 2ml chloroform with 3ml concentrated sulphuric acid (Salkowski test)	Red–brown upper layer and lower layer with a colourless interface between.	Red-brown upper layer and pink lower layer with a colourless interface in between.	Terpenoid were present in higher levels in *O. kilimandscharicum* (Mutaa) from colour intensity compared to *O. gratissimum* (Mukandu)
Test for anthraquinones was done using 0.5ml extract. 5ml of dilute HCl was added to the extract	A brick-red layer was formed at the bottom with a black ring at the top. The brick red layer	A brick-red layer was formed at the bottom with a black ring at the top. The	Anthraquinones present. The quantity was higher in *O.*

and boiled on a water bath for 10minutes. The solution was filtered. Equal volumes of benzene and ammonia were added to the filtrate. The reaction mixture was observed for any change.	was pale for sample A- *O. kilimandscharicum* (Mutaa) compared to sample B- *O. gratissimum* (Mukandu)	brick red layer was slightly darker for sample B- *O. gratissimum* (Mukandu) compared to sample A- *O. kilimandscharicum* (Mutaa)	*gratissimum* (Mukandu) as shown by colour intensity

A flame test was done to confirm the minerals present. The results were recorded in Table 3 below

Table 3

Flame test

Test	Observation	Inferences
Burning of Sample A (Mutaa) Extract	Sample was brick red when hot. It burned with lilac/yellow/orange	Potassium, Sodium and calcium ions present.
Burning of Sample B (Mukandu) Extract	Sample was brick red when hot. It burns with a lilac/ orange/yellow flame. The flame had more lilac colour compared to that for Sample A- *O. kilimandscharicum* (Mutaa)	Potassium, Sodium and calcium ions present. More lilac colour suggest higher potassium ion concentration

3.0 Discussion

The *Ocimum kilimandscharicum* and *Ocimum gratissimum* were analysed qualitatively for the presence of minerals and phytochemicals. The phytochemicals analysed include reducing sugars, proteins, alkaloids, tannins, flavanoids, terpenoids and anthraquinones.

Addition of a drop of aqueous sodium hydroxide and ammonium hydroxide till in excess to test for mineral present showed no precipitate. The Fehlings' test for reducing sugars using 1ml Fehling's solution No.1 added to 0.5ml of extract gave a green solution with a brown precipitate at the bottom. The precipitate was more for *O. gratissimum* than *O. kilimandscharicum*.

The biuret test for proteins was negative. A Wagner test (dilute iodine) for alkaloids gave a red-brown precipitate. Tannins/phenols were analysed using Ferric chloride. A dark green-black precipitate was formed. An orange solution was formed in the flavanoid test using Magnesium metal and dilute hydrochloric acid.

Salkowski test for terpenoids using 2ml chloroform with 3ml concentrated sulphuric acid was done. Red –brown upper layer and lower layer with a colourless interface between was observed in *O. kilimandscharicum*. Similar observations were made in *O. gratissimum* with a pink lower layer and a red-brown top layer. The colour intensities suggest that terpenoids were present in higher levels in *Ocimum kilimandscharicum* (Mutaa) compared to *Ocimum gratissimum* (Mukandu). A previous study undertaken by Mustafa & El-Kamali, (2019) in Sudan on *O. americanum* in relation to its chemical composition revealed that terpenoids

(sesquiterpenes at 4.80% and monoterpenes at 7.29%) were a major component. However, alcohols and fatty acids had the highest levels (38.87% for octanol and 39.09% for octyl acetate) in the species. It is noted that terpenoids are key in producing therapeutic effects (Shanaida, 2020).

The test for anthraquinones gave a brick-red layer at the bottom of the test tube with a black ring at the top. The brick red layer was slightly darker for sample B (Mukandu) compared to sample A (Mutaa).

4.0 Conclusion

In conclusion, the findings suggest the absence of proteins in both Ocimum species. *Ocimum kilimandscharicum* (Mutaa) and *Ocimum gratissimum (*Mukandu) contain phytochemicals which include reducing sugars, proteins, alkaloids, tannins, flavanoids, terpenoids and anthraquinones. These are useful to human health. The variation in colour intensities suggest differences in the quantities of the phytochemicals and minerals present between *Ocimum kilimandscharicum* (Mutaa) and *Ocimum gratissimum (*Mukandu).

The findings point to the presence of calcium, potassium and sodium minerals as confirmed by the flame tests.

5.0 Recommendations

A quantitative determination of the phytochemicals and minerals is required using Gas Chromatography-Mass Spectrometry (GC-MS) and Atomic Emission Spectrometry (AES) or Atomic Absorption Spectrometry (AAS) to establish the difference in the quantities between the two species. Secondly, isolation of active ingredients is required to maximize the benefits of Ocimum species in obtaining solutions to health issues.

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