

**MZUZU
UNIVERSITY**

PROCEEDINGS OF THE FIRST MZUZU UNIVERSITY NATIONAL RESEARCH DISSEMINATION CONFERENCE

5-6 JUNE 2024

□ **THEME** □

**Research and Innovation:
A Catalyst for Social, Cultural and
Economic Transformation.**



Mzuzu University
CODEL Complex,
Luwinga Campus

Editors

Aubrey Chaputula
Precious Madula



PROCEEDINGS OF THE MZUZU UNIVERSITY FIRST NATIONAL
RESEARCH DISSEMINATION CONFERENCE

Theme

Research and Innovation: A catalyst for social, cultural and
economic transformation

Mzuzu University

CODeL Complex, Luwingu, Mzuzu, Malawi.

Copyright © 2025 by Aubrey Chaputula and Precious Madula

Published by Mzuzu University Directorate of Research
Along M1 Road, Luwingu, Mzuzu, Malawi.

Page Layout by Leo Chorwe

Page cover design by Chris Ngalu

TABLE OF CONTENTS

TABLE OF CONTENTS	i
Acknowledgements.....	iii
Introduction.....	iv
Foreword.....	vii
SCIENCE, TECHNOLOGY AND INNOVATION	1
Medicinal plant species used locally to treat COVID-19 in Rumphi District, Northern Malawi.	2
Relative abundance, habitat distribution, and infection rate of schistosomiasis vector snails at Bwanje Valley Irrigation Scheme in Dedza District, Malawi.....	18
HUMANITIES AND SOCIAL SCIENCES.....	31
Africanising language and communication in policy to meet the needs of majority citizens: A critical review of Malawi 2063	32
Oral literature and dissemination of maternal and antenatal/postnatal health issues in Livingstonia-Rumphi health centres	40
A mixed bag of identities: The British indirect rule policy in colonial northern Malawi, 1933 to the early 1950s.....	50
Salvaging Heritage in Soil Archives: Striking a balance between Development concerns and Heritage Preservation.....	66
The National Charcoal Strategy and Gender Dimensions among Zomba and Mzuzu City Market Charcoal Users. A Theological Reflection	79
Environmental Sustainability and Christian Stewardship: An Integrated Approach	93
Organisational legitimacy dimensions: perspectives from African managers	106
Perception of library services among level three nursing students at Ekwendeni College of Health Sciences	123
Support for smallholder farmers with climate change information in Rumphi District: Role of Bolero Agriculture Resource Centre	134
Improving access to information through library marketing in a private University in Malawi.....	148
The Malawi Access to Information Act: An Effective Tool to Control Government Corruption?.....	166
HEALTH SCIENCES	184
Covid-19 Vaccination Hesitancy among Malawians: A Scoping Review ..	185

Clinical Teaching Practices of Nurse Educators in Maternal Mental Health at St Lukes and Ekwendeni Colleges of Health Sciences in Malawi: A Mixed Method Study	199
A review of Malawi’s community-based management of acute malnutrition (CMAM): A model for reducing child mortality.....	211
OPEN, DISTANCE AND ELEARNING	224
Student support in distance education and the study circle innovation in Malawi: A case study.....	225
EDUCATION	237
Assessing the reliability of computer adaptive testing in college entrance communication skills examinations in Malawi.....	238
Towards business intelligence implementation in secondary education in Malawi from management perspective	254
ICT usage in secondary education management in Malawi: The case of Shire Highlands Education Division	270
Cultural fears towards the use of e-learning/blended learning (technology) amongst lecturers and students in medical institutions of higher learning post COVID-19.....	283
ENVIRONMENTAL SCIENCES.....	295
Contribution of agricultural donor-funded projects to rural women’s empowerment	296
Performance analysis of Zomba water users’ association in rural water supply schemes: A focus on financial, operational, and customer perspectives	306
Estimation of small hydropower potential using HBV hydrological model. A review article.....	321
Geospatial land cover change analysis using Ca-Markov Chain Model in Chikwawa District, Malawi.....	334
Developing an Integrated Flood Early Warning Model in the Shire River Basin, Malawi.....	357
Assessing water availability using remote sensing in South Rukuru and North Rumphi River Basin, Malawi.....	369

Acknowledgements

The editors would like to acknowledge the role played by a number of personalities and organisations in organising the Mzuzu University First Research Dissemination Conference that yielded papers that have made it into these proceedings. Firstly, we would like to acknowledge the leadership, logistical and moral support provided by the Vice Chancellor, Deputy Vice Chancellor and Director of Research. The conference could not have happened without their insights.

I would also like to appreciate the role played by the Research and Publications Committee and all members of the Main Organising Committee who worked tirelessly to ensure that the conference takes place. The editors would also like to appreciate the role played by various sponsors that included Energy Generation Company (EGENCO), Tobacco Commission (TC) including NORHED and SAVE Projects. The financial support rendered made the conference to take place.

Finally, the editors would like to thank all researchers who presented their papers at the conference, and those who have submitted full papers for inclusion in these proceedings. More thanks should go to Mr. Christopher Ngalu who designed the cover page and Mr. Leo Chorwe for good work in typesetting and page layout.

Introduction

Mzuzu University was established by an Act of Parliament in 1997 as Malawi's second public university. However, the University only became fully operational in January 1999 when it admitted its first students. Education was the pioneering faculty at the time of opening. However, the University has steadily grown from a single Faculty of Education to six faculties (Education, Environmental Sciences, Health Sciences, Humanities and Social Sciences, Tourism, Hospitality and Management, and Science, Technology and Innovation).

The University is home to several research centres namely African Centre of Excellence in Diversity and Under-utilised Biodiversity (ACENUB), Water and Sanitation (WATSAN) and Testing Centre for Renewable Energy Technologies (TCRET). In terms of human capital, MZUNI boasts of having slightly over 200 academic staff. The faculties offer a wide range of academic programmes at both undergraduate and postgraduate levels. Research and innovation is a key component of these programmes, implying that there is a lot of new knowledge that is generated as part of the study process. Moreover, the faculties and centres, on their own and at times through collaboration with industry, carry out groundbreaking research that is disseminated through research conferences, technical reports, and journal publications. Part of the research output will be presented at this conference.

Pillar 3 of the Mzuzu University 2021-2030 Strategic Plan recognises Research, and Innovation as a strategic goal whose aim is to generate new knowledge and innovations needed for the economic development of Malawi in line with Malawi 2063, MIP-1 2030, NESIP 2030, SDGs and AU 2063 by 2030. This is the reason why research and innovation have been embedded in the programming of the University. The aim is to develop human research capacity but also conduct research that will provide solutions to the challenges that affect the communities we live in and country at large.

This is the First National Research Dissemination Conference that Mzuzu University has ever organised under the theme: *Research and Innovation: A Catalyst for Social, Cultural and Economic Transformation*. Below is a detailed list of the sub-thematic areas:

i. Science, Technology and Innovation

- New advances in pure and applied mathematics
- Promoting renewable energy technologies
- ICT, Data Science and new innovations
- Biological sciences
- Chemistry and its applications
- Physics and its applications

ii. Environmental Sciences

- Agrisciences
- Urban and Regional Planning
- Estate Management
- Fisheries and Aquaculture
- Forestry
- Environmental Management
- Geosciences
- Water, Sanitation and Hygiene
- Waste Management and Recycling
- Climate Change, Adaptation and Mitigation

iii. Humanities and Social Sciences

- The role of linguistics, literature and creative arts in national development
- History, Heritage and Economic Development in Malawi
- Security and Public Sector Governance
- Religion and Environmental Conservation
- Information services for development
- Communication for Sustainability

iv. Health Sciences

- Innovative approaches and interventions to strengthen health delivery
- Healthcare access, delivery and outcomes
- Health technology and digital transformation
- Maternal, newborn, child and adolescent health
- Communicable and non-communicable diseases
- Biomedical and Health Informatics

v. Tourism, Hospitality and Management

- Sustainable tourism
- Tourism planning and development
- Cultural heritage tourism
- Transport and aviation
- Service quality and management in the hospitality industry
- Entrepreneurship
- Sports management

vi. Open, Distance and eLearning

- eLearning
- Student support
- Self-learning materials
- Copyright
- Open Educational Resources

vii. Education

- Education and Development
- Education, Society and Culture
- Critical Thinking and Reasoning Education
- Science, Technology, Engineering and Mathematics (STEM) Education
- Language Education
- Inclusive and/or Special Needs Education

It is expected that academics, scholars and practitioners in various fields will share their findings, engage in serious discussion and also network. Such engagements will lead to the sprouting of new ideas, professional growth, influence policy development and enhance good practice.

Foreword

Welcome to Mzuzu University's first Research Dissemination Conference! The need to share the results of scientific research work with a wider audience is crucial to the advancement of science and technology.

Dissemination plays a crucial role in ensuring that research results are widely available and accessible to both researchers and practitioners. This accessibility is vital, as it allows others to build upon existing work, fostering the development of new ideas and innovations based on research findings. Such collaborative advancement can lead to significant discoveries and breakthroughs, thereby driving progress within the field. Additionally, effective dissemination enhances the visibility and impact of research findings, ensuring that the insights derived from the study reach a broader audience and contribute meaningfully to ongoing discourse and practice. By facilitating knowledge sharing, dissemination not only enriches the academic community but also promotes practical applications that can transform industries and improve societal outcomes. By publishing the results of research in peer-reviewed journals or presenting them at conferences, researchers can reach a wider audience and generate more interest in their work. This can help to raise the profile of the research and its authors and increase the chances of securing future funding or collaborations. In addition, dissemination can also help to increase the impact of research work by bringing the results to the attention of practitioners, policymakers, and the public. This can help to ensure that the research is used to address real-world problems, and that it has a direct and tangible impact on society. Finally, dissemination is also important because it helps to ensure that scientific results are used effectively. By sharing the results with others, researchers can help to build partnerships, collaborations, and networks that can help to drive the field forward. This can help to ensure that the results are used in the most effective way possible and that they have the greatest impact on society.

The Mzuzu University Research Dissemination Conference is part of fulfilling the university's **mission statement** which is to provide high-quality education, **training, research** and complimentary services to meet the technological, social and economic needs of individuals and communities in Malawi and the world. We have deliberately selected scientific presentations that respond to the university's **vision** of becoming a premier provider of tertiary education, **adaptive research** and outreach in Malawi and the world. The Directorate of Research at Mzuzu University is anchoring the Dissemination conference with the overarching aim that hinges on the university's 3rd Pillar of its 2021-2030 Strategic Plan which is **Research and Innovation**.

The conference has gathered research papers from a wide coverage of thematic areas such as Open Distance and eLearning (OdeL); Education; Tourism, hospitality and management; Health sciences; Humanities and Social Sciences; Environmental Sciences; Science, technology and innovation.

Lastly, we would like to extend our appreciation to the conference organizing team and indeed those who supported this conference with resources such as the Electricity Generation Company (EGENCO) Malawi and the Tobacco Control Commission (TCC).



Prof. Fanuel Kapute PhD

DIRECTOR OF RESEARCH

SCIENCE, TECHNOLOGY AND INNOVATION

Science, Technology and Innovation is one of the thematic areas that were selected for the conference. The theme was chosen because of the role it plays in the social-economic development of any country. Malawi aspires to get out of poverty and become one of the upper-middle income countries in the short to long term hence this area is very pertinent. Papers that will be presented under this theme fall under the following areas:

- New advances in pure and applied mathematics
- Promoting renewable energy technologies
- ICT, Data Science and new innovations
- Biological sciences
- Chemistry and its applications
- Physics and its applications

Medicinal plant species used locally to treat COVID-19 in Rumphi District, Northern Malawi.

Twalibu N.G. Tandwe^{1#}, Saul Eric Mwale¹, Paul Munyenyembe¹, Master Chisale¹, Yankho Chapeta¹, Michael Mzirekelenge Nkosi¹, McLenelious Chimanya¹, John Kamanula²,

1. Department of Biological Sciences, Faculty of Science Technology and Innovation Mzuzu University, Mzuzu, Malawi
2. Department of Chemistry, Faculty of Science Technology and Innovations, Mzuzu University, Mzuzu, Malawi

#Corresponding Author:

Twalibu N.G. Tandwe: email: ttandwe@yahoo.co.uk / tandwe.t@mzuni.ac.mw

Abstract

Purpose

The study aimed to document the medicinal plants used by people in Rumphi District for treating COVID-19 and assess the perceived recovery rate among users of these plants.

Methods: Utilizing a cross-sectional design with a mixed-methods approach. Key informants were reached out purposively and then were randomly sampled. 87 respondents for were sampled for interviews and seroprevalence testing for SARS-CoV-2 IgG/IgM. Data collection was conducted using a semi-structured questionnaire, with medicinal plants collected and authenticated by a plant taxonomist. The Abbott Panbio™ SARS-CoV-2 IgG/IgM Rapid Test was used to detect antibodies in those reported to have taken herbal treatment. The fidelity index evaluated the significance and specificity of various plant species in treating COVID-19, and descriptive statistical analysis was used for seroprevalence data.

Findings: The study identified 32 plant species used for managing COVID-19 symptoms, with the highest fidelity levels assigned to *Eucalyptus sp.* (11.2), *Citrus sp.* (10.5), *Cassia sp.* (3.2), *Zingiber officinale* Roscoe (3.2), and *Plumbago sp.* (3.2). Among the participants who tested positive for IgM/IgG (53%, n = 87), 98% reported recovery following herbal treatment. The findings highlight the effectiveness of *Eucalyptus sp.*, *Citrus sp.*, *Cassia sp.*, *Zingiber officinale* Roscoe, and *Plumbago sp.* in managing COVID-19 symptoms and suggest that herbal remedies could be valuable supplementary treatments to conventional medicine.

Recommendations: To enhance their application, further research is needed to confirm the phytochemicals present, efficacy and safety of these treatments, and standardized preparation guidelines should be developed. Additionally, integrating herbal remedies with conventional therapies and increasing awareness among healthcare providers and patients could improve overall treatment outcomes.

Conclusion: The study documented plants used for treating COVID-19 by the local communities in Rumphi. There was a high recovery rate of participants who took the herbal medicine. The study underscores the importance of integrating traditional knowledge of medicinal plants into contemporary healthcare practices in managing COVID-19 and other viral respiratory-related illnesses in Malawi and Rumphi District in particular.

Value of contribution: The study has implications for policy and practice. Its recommendations, if implemented, would lead to the safe use of herbal medicines, drug discovery for COVID-19 and other related viral respiratory-related illnesses in Malawi.

Keywords: Medicinal plants, herbal medicine, perceived recovery rate, COVID-19, phytochemicals.

1.0 Introduction

COVID-19, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was declared a global pandemic by the World Health Organisation (WHO) in March 2020. By March 27, 2022, the pandemic had resulted in over 479 million confirmed cases and more than 6 million deaths worldwide (WHO, 2022). In Malawi, the first COVID-19 cases were confirmed on April 2, 2020, beginning with one index case and two local cases. Initially, the majority of cases were imported, but local transmissions quickly increased, leading to a higher number of deaths. The average age of those infected was 36 years, with a predominance of males (66.9%) (Mzumara et al., 2021). Among those who died, the average age was 56.7 years, with a significantly higher mortality rate among males (82.5%) (Mzumara et al., 2021).

The COVID-19 crisis, which ranged from asymptomatic to severe symptoms, highlighted the urgent need to address respiratory infections. While antiviral drugs like Remdesivir were recommended by WHO for treating COVID-19, their efficacy and availability were limited, especially in low-income countries such as Malawi. This situation spurred interest in alternative treatments, including medicinal plants, which are integral to traditional medicine practices.

Globally, medicinal plants have shown potential in treating respiratory infections, including those caused by SARS-CoV-2. Countries such as China, Brazil, Nepal, India, and Morocco have investigated and reported on the efficacy of various medicinal plants in this context (Hong-Zhi et al., 2020; Lu, 2020; da Silva et al., 2023; Zhao et al., 2019; Khadka et al., 2021; Ahmad et al., 2020). In Malawi, traditional medicine has been utilised for centuries, with over 80% of the population depending on it due to limited modern healthcare services (Robison et al., 2002). Common medicinal plants used for respiratory infections in Malawi include *Aspilia kotschii* and *Flacourtia indica* (Williamson, 2005; Robison et al., 2002; Manda et al., 2021). Despite their extensive use, there is limited comprehensive documentation on their application for treating COVID-19, except for a review by Chikowi et al. (2021).

As of May, 05, 2022, the Ministry of Health in Malawi reported 85,797 confirmed cases, and 2,634 deaths, representing a case fatality rate of 3.07% and with 814 active cases (COVID-19 - MOH MALAWI, 2022). The scarcity of effective antiviral drugs during the pandemic led many to seek alternative treatments through traditional medicinal plants. However, there is a paucity of studies documenting the medicinal plants used for COVID-19 treatment in Malawi, including verifying recovery claims and assessing their perceived efficacy among local communities. Conducting such studies is essential for creating a reliable database of medicinal plants, which could inform future research and support the development of effective treatments for COVID-19 and other respiratory diseases. This study, therefore, aimed to: 1) Document the medicinal plant species used by local inhabitants for treating respiratory ailments, specifically COVID-19; 2) Confirm whether local communities who claimed to have been infected by COVID-19 and used medicinal plants for treatment were genuinely infected; and 3) Evaluate the perceived recovery rate among participants who used these plants in Rumphi District.

2.0 Materials and methods

2.1 Study area and period

The present study was conducted in Rumphi District (11° 1' 0" S, 33° 52' 0" E), located in the northern region of Malawi. A reconnaissance survey of the study area was undertaken in March 2022, followed by data collection in May 2022. Community selection for the study was based on a list of confirmed COVID-19 cases from the District Health Office (DHO), as well as factors such as proximity to health facilities, availability of pharmacies, ease of movement, and accessibility. Prioritization was given to communities with higher numbers of COVID-19 cases. Additionally, the study considered the perceived willingness of traditional medicinal healers and other key informants to cooperate with the study's objectives. The study covered six Traditional Authorities—Kachulu, Mwalweni, Katumbi, Mwamulowe, Paramount Chief Chikulamayembe, and Sub-Traditional Authority Zolokere—and 24 villages: Chipendo, Munyangaumodzi, Cheranya, Ching'anya, Katowu, Tiketani, Njalankhutu, Mtumika, Bulawira, Mkandapasi, Masasa, Bwana Mwendelera, Kasabilira, Bongololo, Jino, Mwamtulira, Matchewe, Mdumuka, Mwachirwa, Bawoloka, Nkhowani, Zukumani, Mapeza, and Chatondawere. Figure 1 provides a map of Rumphi District, highlighting the Traditional Authorities included in the study.

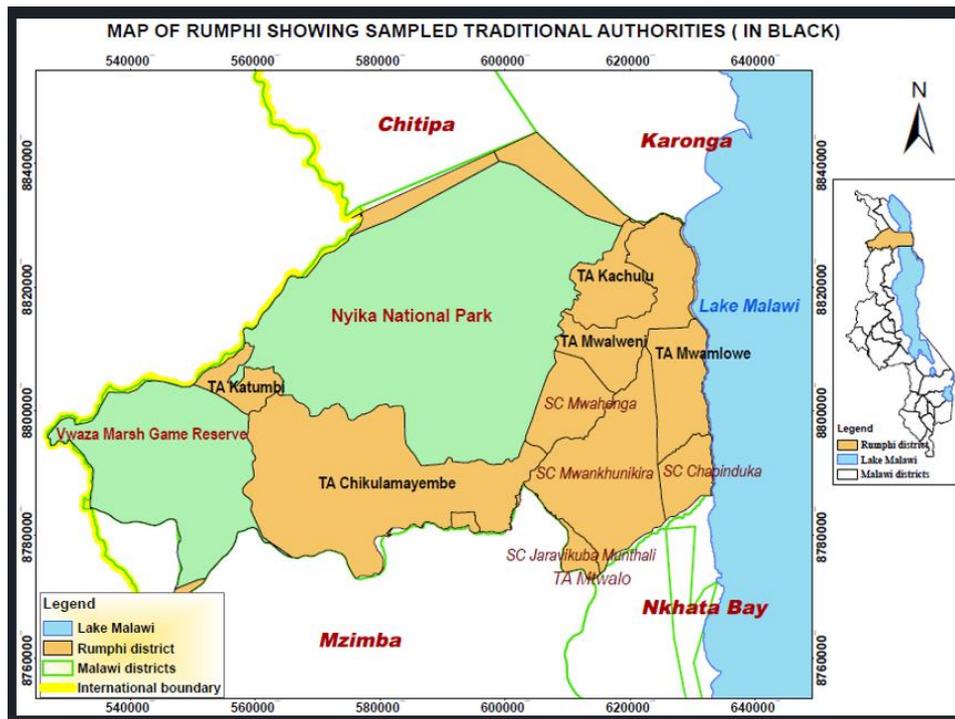


Figure 1: Map of Rumphi showing locations of Traditional Authorities in which the study was conducted. Take note that Sub Traditional Authority Zolokere was referred to as Traditional Authority, and therefore has not been shown here whereas TA Chikulamayembe status is Paramount Chief Chikulamayembe as per Rumphi District Council Socio-Economic Profile of 2017-2022 (Malawi Government (2020)).

2.2 Study design and data collection instruments

A cross-sectional design with a mixed-methods approach was employed, incorporating lateral flow immunoassay (Abbott Panbio™ SARS-CoV-2 IgG/IgM Rapid Test Device, with 96.7% sensitivity and 97% specificity) for detecting SARS-CoV-2 antibodies from whole blood (fingerstick). This approach utilised a pre-tested semi-structured questionnaire and key informant interviews to collect both quantitative and qualitative data from 100 purposively selected participants in Rumphi District. The study used a 30-item questionnaire adapted for this group, developed based on an analysis of existing COVID-19 research, with a particular focus on studies and reports from the WHO and other sources. Antibody testing was conducted by two members of the research team, supported by two trained fourth-year parasitology students. Additionally, onsite serological testing was performed during the participant recruitment process.

2.3 Target population

The study focused on local communities that claimed to have recovered from COVID-19 after using herbal medicines, as well as local key healers who are traditional experts with indigenous knowledge of medicinal plants. Community selection was based on a list of COVID-19 cases provided by the Rumphi District Health Office (DHO). Communities with higher numbers of

COVID-19 cases were prioritized. The selection process also considered the willingness of healers and other key informants to cooperate with the study's objectives. As of December 2021, the reported COVID-19 cases by the Ministry of Health were 33,458 for Malawi as a whole, 2,931 for the Northern Region, and 243 for Rumphi District (Worldometer 2022). Herbalists were identified and contacted with the assistance of the Chairperson of the Herbalist Association in the Northern Region of Malawi. Active practitioners were selected based on information from local communities regarding their sources of herbal medicine.

2.4 Inclusion and exclusion criteria

The local communities who got vaccinated and took other remedies other than herbal medicine were excluded from taking part in the study.

2.5 Sampling methods and sample size

A random sampling technique was employed to select 87 respondents, determined using a population proportion sample size formula. The calculation was based on the following statistical parameters: a confidence level of 95%, a margin of error of 5%, and a population proportion of 8.2 (representing the proportion of COVID-19 cases in Rumphi relative to the total number of COVID-19 cases in the Northern Region of Malawi). The initial sample size of 79 was adjusted for a 10% non-response rate, resulting in a final sample size of 88. This calculated sample size was used for both the administration of questionnaires and the performance of SARS-CoV-2 IgM/IgG antibody tests. Information on medicinal plants used for COVID-19 treatment obtained from the respondents was triangulated through a selected sample of herbalists within their communities. Local healers were automatically considered key participants due to their role as traditional experts and custodians of indigenous knowledge on medicinal plants.

2.6 Data collection methods on community knowledge of COVID-19 Symptoms, treatment taken and perceived recovery rate

The questionnaire was utilised to gather data on participants' knowledge of COVID-19 symptoms, the treatments they received, and their perceived recovery rates. Plants documented in the study were primarily identified at the species level; when species identification was not feasible, identification was made at the genus level. This process involved confirming the vernacular names of plants with traditional healers. Subsequently, the plant specimens were sent to a taxonomist at the Mzuzu Botanical Garden for the assignment of their scientific names. In cases where the vernacular name of a plant did not correspond to an established English name and, consequently, its scientific name could not be determined, the plant retained its vernacular name. This decision was made to allow for future verification, which included thorough observation by the researcher and confirmation from the National Herbarium and Botanical Gardens of Malawi.

2.7 Data collection to confirm SARS-COV-2 infection and recovery rate from COVID-19 subsequent to use of medicinal plants

To verify whether individuals from local communities who claimed to have been infected with COVID-19 and sought treatment with medicinal plants were indeed infected with the SARS-CoV-2 virus and subsequently recovered, participants' blood samples were tested for the presence of SARS-CoV-2 antigens or antibodies. The Abbott Panbio™ SARS-CoV-2 IgG/IgM Rapid Test Device was employed to perform serological tests to detect Anti-SARS-CoV-2 IgM and IgG antibodies in whole blood obtained via fingerprick. Approximately 5 mL of blood was collected through venipuncture for the detection of SARS-CoV-2 IgM/IgG antibodies using the Abbott Panbio™ SARS-CoV-2 IgM/IgG Rapid Test. Given the safety and convenience of this point-of-care testing method, qualified clinical laboratory personnel conducted the serological testing immediately during the participant recruitment process.

2.8 Statistical data analysis

Plant species were analysed using the plant species fidelity index to identify the most frequently used medicinal plants for treating COVID-19. The fidelity level (FL) indicated the percentage of informants who reported using specific plant species for COVID-19 treatment. The fidelity level was calculated using the formula: $FL (\%) = (N_p/N) \times 100$; where N_p represents the number of traditional healers who claimed to have used a particular plant for treating COVID-19, and N denotes the total number of informants who used the plant as a remedy for COVID-19. The seroprevalence of Anti-SARS-CoV-2 antibodies was analysed using descriptive statistics to determine the infection rate and assess the perceived recovery rate among patients who used these plants for COVID-19 treatment. The results were presented in tables, bar graphs, and pie charts.

2.9 Ethical consideration

Given that data collection occurred during the COVID-19 pandemic, when precautionary and preventive measures were in place, researchers were acutely aware of the risks associated with both questionnaire administration and blood sample collection, which could potentially expose participants or researchers to COVID-19. Consequently, the study protocol incorporated comprehensive strategies and methods to mitigate these risks, ensuring the safety and protection of the rights and welfare of study participants. In strict adherence to SARS-CoV-2 preventive measures, sample collection was conducted in compliance with the standards established by the Malawi Ministry of Health. Participation in the study was both voluntary and free of charge. All participants provided informed consent prior to their involvement. The study protocol was reviewed and approved by the Mzuzu University Research Ethics Committee (MZUNIREC), under approval reference number MZUNIREC/DOR/22/58.

3.0 Results

3.1 Demographic and clinical characteristics of the participants

A total of 87 participants who reported recovery from COVID-19 and the use of herbal medicines for treatment completed the study questionnaire and provided whole blood samples, resulting in a 99% response rate. The demographic and clinical characteristics of the respondents are detailed in Table 1. Among these participants, 56.3% were female and 43.8% were male. The respondents' ages ranged from 18 to 89 years, with the majority (43.7%) in the 18-29 age group. The participants' education levels included primary, secondary, and tertiary, with primary education being the most common, attained by 55.0% of the participants.

Table 1: Demographic and clinical characteristics of the participants

Variables	Freq. N; (%)	Variables Symptoms Experienced (Responses = 183)	FREQ. N;(%)
Gender (n = 87)			
Female	49(56.3)	Abdominal pains	1(0.55)
Male	38(43.8)	Anosmia	5(2.73)
Age Group (n = 87)			
18-29	38(43.7)	Arthralgia	1(0.55)
30-39	17(19.5)	Cough	49(26.78)
40-49	13(14.9)	Difficult breathing	20(10.93)
50-59	8(9.2)	Fatigue	14(7.65)
60-69	7(8.0)	Fever	30(16.39)
70-79	1(1.1)	Headache	14(7.65)
80-89	3(3.4)	Loss of appetite	1(0.55)
Education Level (n = 87)			
Primary	48(55.0)	loss of smell/taste	14(7.65)
Secondary	35(40.0)	Muscle ache	4(2.19)
Tertiary	4(5.0)	Nasal congestion	2(1.09)
		Pneumonia	1(0.55)
		Sore throat	26(14.21)
		Stomach ache	1(0.55)

3.2 Medicinal plant species utilised by local inhabitants for the treatment of COVID-19 and respiratory related ailments

Thirty-two out of 75 plant species, representing 43%, which were reported to treat and manage various respiratory ailments, were also reported to be used locally as remedies for COVID-19 (see Table 2).

Table 2: Medicinal plant species utilised by local inhabitants for the treatment of respiratory ailments including COVID-19.

S. #	Scientific name	S. #	Scientific name	S. #	Scientific name
1	<i>Allium sativum</i>	12	<i>Changwe_ sp1(Vn)</i>	23	<i>Pericopsis angolensis</i>
2	<i>Aloe vera sp</i>	13	<i>Citrus limon</i>	24	<i>Persea americana</i>
3	<i>Aristolachia pertersiana</i>	14	<i>Clerodendrum glabrum</i>	25	<i>Piloostigma thonni</i>
4	<i>Asparagus setaceus</i>	15	<i>Cymbopogon citratus</i>	26	<i>Plumbago zeylanica</i>
5	<i>Azadirachta indica</i>	16	<i>Dalbergia nitidula</i>	26	<i>Psidium guajava</i>
6	<i>Balanites aegyptica</i>	17	<i>Elephantorrhiza goetza</i>	28	<i>Rhus longipes</i>
7	<i>Brachystegia sp</i>	18	<i>Eucalyptus globulus</i>	29	<i>Sena sp</i>
8	<i>Carica papaya</i>	19	<i>Kigelia Africana</i>	30	<i>Solanum tuberosum</i>
9	<i>Cassia abbreviates</i>	20	<i>Mangifera indica</i>	31	<i>Zanha Africana</i>
10	<i>Cassia sp1</i>	21	<i>Mangifera indica</i>	32	<i>Zingiber officinale</i>
11	<i>Cassia sp2</i>	22	<i>Mluwiyi_ sp2(Vn)</i>		

Note; Vn = vernacular name (Tumbuka/Tonga)

The fidelity level (FL) index revealed that *Eucalyptus globulus* (11.2%), *Citrus limon* (L.) Burm. f. (10.5%), *Cassia sp.* (3.2%), *Zingiber officinale* Roscoe (3.2%), and *Plumbago zeylanica* L. (3.2%) emerged as the most commonly utilised medicinal plants (see Figure 3)

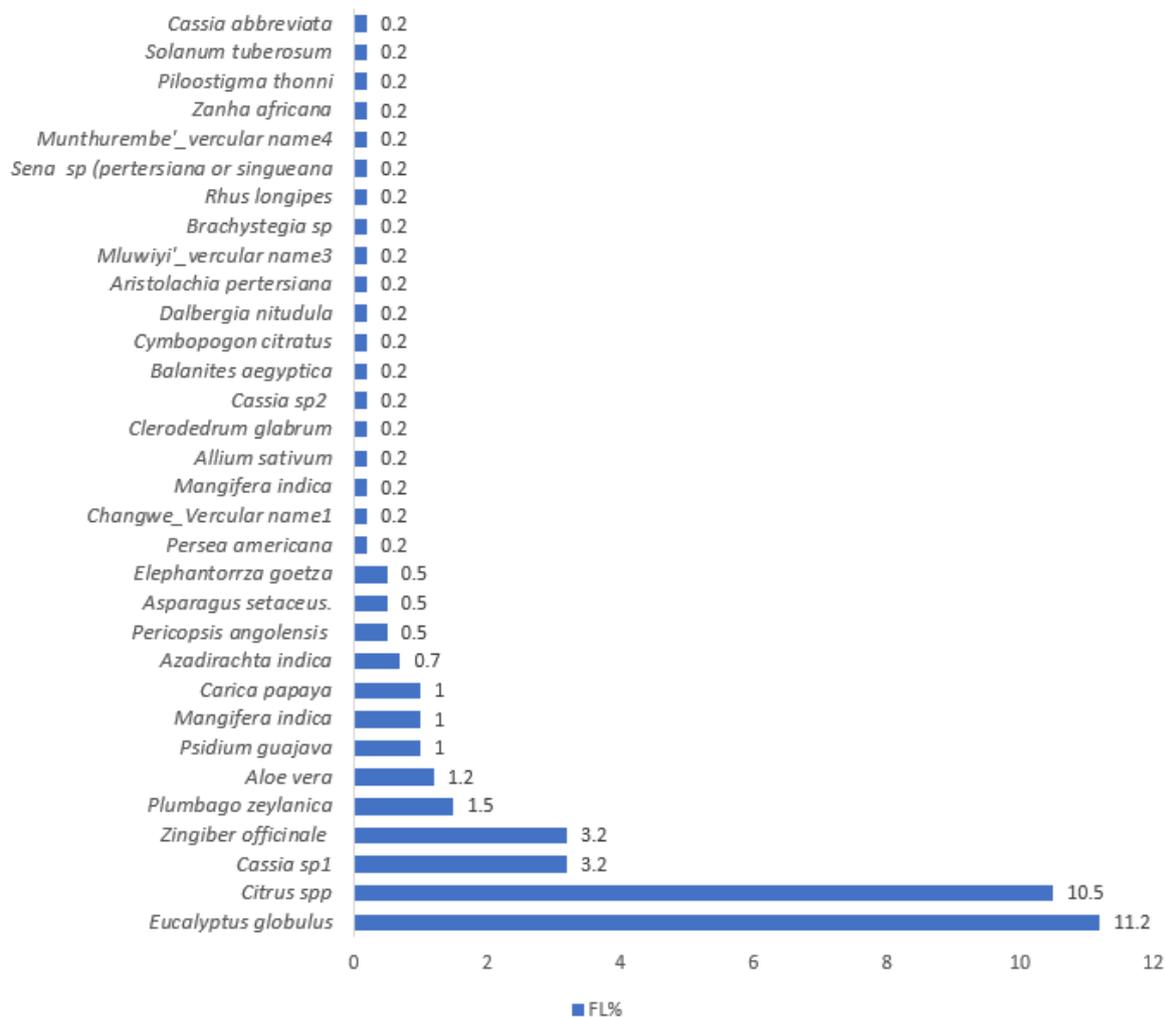


Figure 3: Fidelity Level (%) of informants claimed the use of plant species as a treatment for COVID-19

3.3 Confirmatory tests result of SARS-COV-2 in the suspected infected and recovered participants subsequent to use of medicinal plants

Results of confirmatory testing to ascertain whether participants who claimed to have been infected by COVID-19 and resorted to taking herbal medicine were really infected by the COVID-19 virus are presented in Table 3, Figures 4 and 5. Table 3 gives a summary of antigen/antibody participants results based on demographic characteristics; gender, age and education level. Figure 4 shows overall antigen/antibody participants' test results while Figure 5 shows COVID-19 infection status and perceived recovery rate. The results on seroprevalence on demographic characteristics tend to suggest that high number (25.3%) of females were IgM-/IgG+ compared to males (21.8) and (20.7%) of age category 18-29 had also high number of participants tested IgM-/IgG+ compared to the rest of age categories and (27.6%) of participants who attained primary school level of education were IgG+ compared to the rest of education level categories.

Table 3: Summary of antigen/antibody participants' results based on demographic characteristics

Variables		Seroprevalence Data			
		IgM+/IgG- n(%)	IgM-/IgG- n(%)	IgM-/IgG+ n(%)	IgM+/IgG+ n(%)
Gender (n = 87)					
Female	49	0(0.0)	22(25.3)	22(25.3)	2(2.3)
Male	38	1(1.2)	19(21.8)	19(21.8)	2(2.3)
Age Group (n = 87)					
18-29	38	1(1.2)	18(20.7)	18(20.7)	1(1.2)
30-39	17	0(0.0)	7(8.0)	7(8.0)	1(1.2)
40-49	13	0(0.0)	4(4.6)	9(10.3)	1(1.2)
50-59	8	0(0.0)	4(4.6)	2(2.3)	0(0.0)
60-69	7	0(0.0)	3(3.4)	4(4.6)	1(1.2)
70-79	1	0(0.0)	1(1.2)	0(0.0)	0(0.0)
80-89	3	0(0.0)	4(4.6)	1(1.1)	0(0.0)
Education Level (n = 87)					
Primary	48	0(0)	41(47.1)	24(27.6)	19(21.8)
Secondary	35	1(1.2)	33(37.9)	17(19.5)	19(21.8)
Tertiary	4	0(0)	2(2.3)	1(1.2)	1(1.2)

The results of the antigen/antibody tests reveal the following: 47% of participants had been infected with SARS-CoV-2 and were no longer infectious, as indicated by the presence of IgG antibodies (Figure 4). Additionally, 5% of participants exhibited a mixed infection status, suggesting a prolonged infection, as evidenced by the simultaneous presence of both IgG and IgM antibodies. Furthermore, 1% of participants were found to have an active infection as shown by the presence of IgM/IgG antibodies and remained infectious despite being asymptomatic. These findings suggest that not all individuals who believed they had COVID-19 were actually infected with the SARS-CoV-2 virus, and conversely, not all who thought they had not suffered from COVID-19 were necessarily free of infection.

The IgM/IgG test results indicated that 45 out of 87 participants (approximately 52%) who claimed to have suffered from COVID-19 were indeed infected with the virus prior to using medicinal plants. Of these 45 participants, 98% had recovered, while only 2% had not recovered but were asymptomatic, suggesting that they believed they had recovered. Consequently, the perceived recovery rate was 98%, indicating that the majority of individuals who were infected with the SARS-CoV-2 virus and used medicinal plants subsequently recovered from COVID-19.

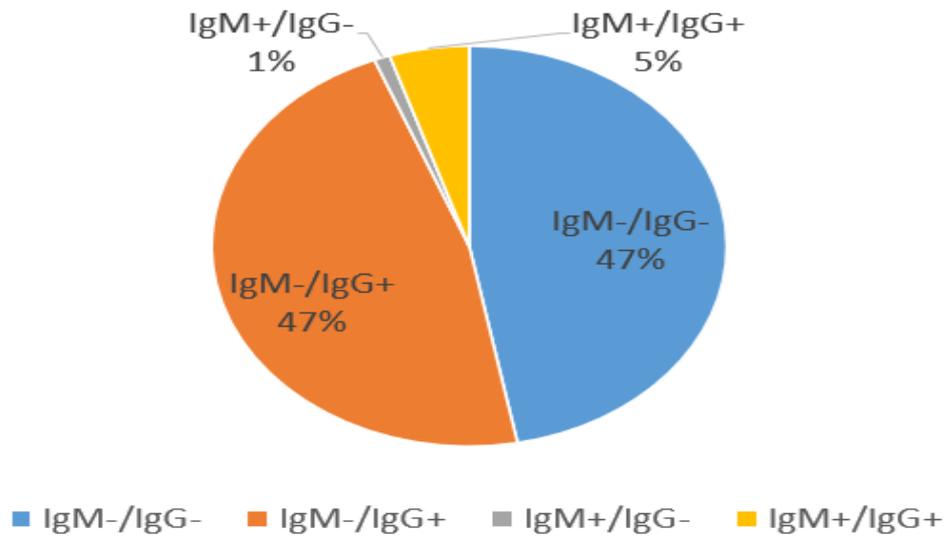


Figure 4: Proportions of IgM/IgG participants' test results

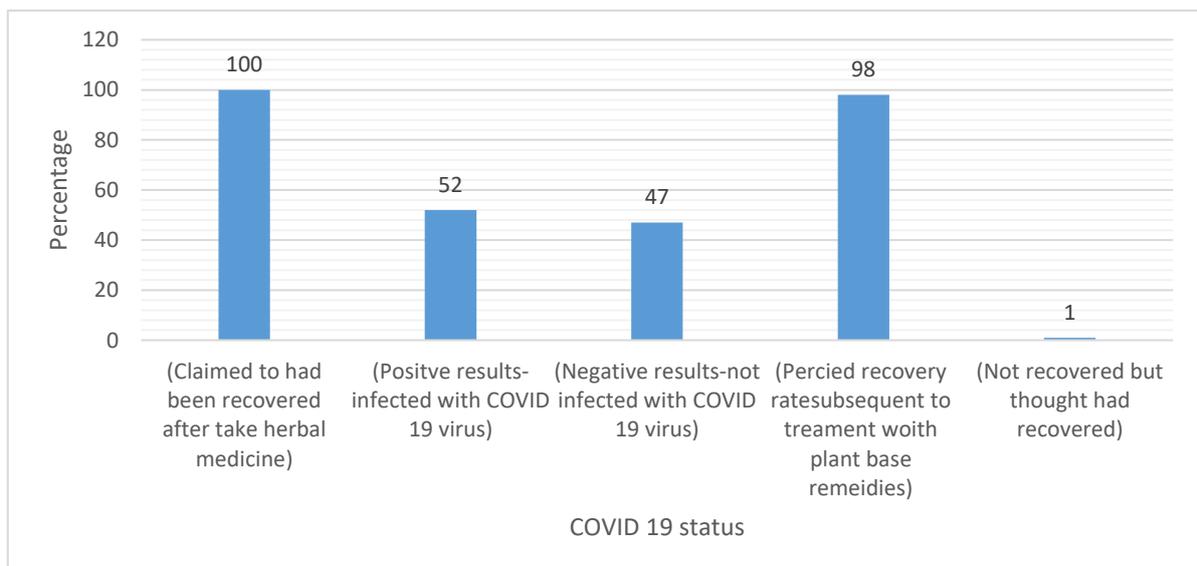


Figure 5: COVID-19 Infection and perceived recovery rate.

4.0 Discussion

The study found that 32 out of 75 plant species reported for treating viral respiratory disorders were also used to manage COVID-19 in Rumphi District, representing approximately 43%. This aligns with Chikowe et al. (2021), who identified 127 plants used for managing COVID-19 symptoms or viral infections, accounting for over 59% of the species reviewed across 11 studies from various countries. Similarly, Adeleye et al. (2022) identified twenty medicinal plants with potential bioactive compounds effective against coronaviruses. Despite differences in specific plant species at the genus and species levels, there may be similarities at higher taxonomic levels such as plant families. In addition, they might be similar in small molecules that target (Wu et al., 2004) severe acute respiratory syndrome human coronavirus. This study's findings complement those of Chikowe et al. (2021), who reported that 30 out of 127 plant species (23%) had potential for managing multiple diseases, including COVID-19 and related illnesses. This suggests that Rumphi District, and Malawi more broadly, may have a higher diversity of plant species with potential for managing respiratory illnesses, including those associated with coronavirus.

The study observed that 47% of the participants were infected with the COVID-19 Virus with the average age of 37 years and predominance of female of 53.7% (22 /41) and an overall of 25.3% (22/87. (Table 3). The average age of the infected from this study is not much far from the age of 36 years reported by Mzumara et al. (2021). However, they differ in terms of gender prevalence as this study observed a lower infection predominance in males of 46.3% as opposed to 66.9% reported by Mzumara et al. (2021). This disparity might due to many factors such demographic, cultural and occupational engagement characteristics between the areas the studies were conducted.

Additionally, the study revealed that not all participants who believed they had COVID-19 were actually infected, as 47% tested negative for SARS-CoV-2 antigens/antibodies. This discrepancy is expected, given that COVID-19 symptoms can overlap with those of other respiratory viral diseases. The perceived recovery rate among participants using herbal medicines was 98%, which aligns closely with the 95.66% recovery rate reported by the Malawi Ministry of Health as of May 2022 (Worldometer, 2022; COVID-19 - MOH Malawi 2022). However, this study's recovery rate surpasses the 90% reported by Hong-Zhi et al. (2020), who found some herbal medicines effective in COVID-19 treatment. This indicates that herbal medicines may be effective in managing COVID-19 symptoms.

The findings support previous research that certain plant species, such as *Azadirachta indica*, *Eucalyptus spp.*, and *Zingiber officinale Roscoe*, contain bioactive compounds with antiviral activity against SARS-CoV-2 (Adeleye et al., 2022; Chikowe et al., 2021). These compounds include curcumin, coriandrin, deoxynojirimycin, kuwanon G, mulberroside A, oleanolic acid, rosmarinic acid, ursolic acid, quinine, eucalyptol, and jensenone. The similarity in genome sequencing, life cycle, transmission modes, and clinical

manifestations among coronaviruses like SARS-CoV, MERS-CoV, and SARS-CoV-2 suggests that antiviral agents effective against one may be effective against others (Adeleye et al., 2022).

Thus, medicinal plants used for treating SARS-CoV may provide some relief from COVID-19. In some countries, medicinal plants proven beneficial for respiratory health are widely recommended and used. For instance, Europe, Britain, China, and Japan endorse herbs such as *Acorus calamus* (Bach), *Adhatoda vasica* (Adusa), *Boerhaavia diffusa* (Punarnaba), *Leucas aspera* (Guma), *Ocimum sanctum* (Tulsi), *Solanum surattense* (Kateli), *Tylophora indica* (Asthambuti), *Zingiber officinale* (Adarakh), *Mentha arvensis* (Mint), *Curcuma longa* (Haldi), *Ferula asafoetida* (Heeng), and *Verbascum thapsus* (“great mullein”) (Adeleye et al., 2022). Notably, *Zingiber officinale* was also reported as a remedy for COVID-19 in Rumph. Herbal formulations have significant antiviral, anti-inflammatory and immunomodulatory activity against corona viruses including COVID-19 virus (Huang et al., 2020; Liu, 2020; Runfeng et al., 2020; Yang et al., 2020).

This study highlights the significance of integrating traditional knowledge of medicinal plants with contemporary healthcare practices to manage COVID-19 in Rumph District. Further research into these plant species and their therapeutic properties could expand treatment options and improve healthcare outcomes in regions with limited access to conventional medical resources. Continued research is essential to enhance the identification and development of effective antiviral agents from plants to combat COVID-19

5.0 Conclusions and take-home messages

The current study documented 32 medicinal plants, representing 43% of the 75 plants reported in the area, which are used for the treatment of COVID-19 in Rumph. It was observed that not all individuals exhibiting COVID-19-related symptoms and using herbal medicine were infected with the virus, as only 53% tested positive for SARS-CoV-2 antibodies or antigens. Despite this, the study found a high perceived recovery rate of 98% among participants who used medicinal plants, suggesting significant potential for managing respiratory viral infections, including COVID-19, through medicinal plants if used cautiously.

This study provides a valuable list of plants that may contain bioactive compounds potentially effective against respiratory diseases, including those related to COVID-19. It is recommended that experts in biological and biomedical sciences collaborate on further research to investigate the appropriate dosages, preparation methods, and potential combinations of these medicinal plants. Additionally, future studies should assess their efficacy against SARS-CoV-2 and other respiratory viruses, evaluate their toxicity, and analyse the levels of inhibitory bioactive compounds. This research could lead to the development of new antiviral drugs for treating respiratory infections and other coronaviruses, including SARS-CoV-2.

Conflicts of interest

The authors declare no conflicts of interest.

Funding

This study was funded by Mzuzu University through the University Small Research Grant offered by Mzuzu University Directorate of Research.

Acknowledgments

We extend our sincere gratitude to Mzuzu University for their generous funding support. We also express our heartfelt thanks to Mr. Rashid Kugeseka and the students Christopher Nyondo, Eric Gowero, Mike Chirambo, and Chandamale Mwila, who contributed to the data collection process as part of their mentorship responsibilities under the grant. Additionally, we appreciate Twalibu Tandwe JNR for his valuable work in creating the map of the study sites.

References

- Adeleye, O. A., Bamiro, O. A., Bakre, L. G., Odeleye, F. O., Adebowale, M. N., Okunye, O. L., Sodeinde, M. A., Adebona, A. C. Mena, F. (2021), "Medicinal Plants with Potential Inhibitory Bioactive Compounds against Coronaviruses", *Advanced Pharmaceutical Bulletin*, 1. <https://doi.org/10.34172/apb.2022.003>
- Ahmad S, Zahiruddin S, Parveen B, Basist P, Parveen A, Gaurav, et al. (2020), "Indian Medicinal Plants and Formulations and Their Potential Against COVID-19-Preclinical and Clinical Research", *Frontiers in pharmacology*. 11:578970. <https://doi.org/10.3389/fphar.2020.578970> PMID: 33737875
- Chikowe, I., Mtewa, A. G., Tembo, D., Smith, D., Ibrahim, E., Mwamatope, B., Nkhungulu, J., Kumpalume, P., Kumpalume, P. and Maroyi, A. (2021a), "Potential of Malawi's medicinal plants in Covid-19 disease management: A review", *Malawi Medical Journal*, Vol. 33 No. 2, pp. 85 - 107. <https://doi.org/10.4314/mmj.v33i2.4>
- da Silva, A.M., Horsth, A.L., Timóteo, Ê.d. et al. (2023), "Use of medicinal plants during COVID-19 pandemic in Brazil", *Sci Rep*, Vol. 13, 16558. <https://doi.org/10.1038/s41598-023-43673-y>
- Hong-Zhi, D. U., Hou, X. Y., Miao, Y. H., Huang, B. S., and Liu, D. H. (2020), "Traditional Chinese Medicine: an effective treatment for 2019 novel coronavirus pneumonia (NCP)", *Chin. J. Nat. Med.*, Vol. 18 No. 3, pp. 226 - 230. doi: 10.1016/S1875-5364(20)30022-4.
- Huang, Y.F., Bai, C., He, F., Xie, Y., Zhou, H. (2020), "Review on the potential action mechanisms of Chinese medicines in treating coronavirus disease 2019 (COVID-19)", *Pharmacol. Res.*, Vol. 158, 104939.

Khadka D, Dhamala MK, Li F, Aryal PC, Magar PR, Bhatta S, et al. (2021), "The use of medicinal plants to prevent COVID-19 in Nepal. Journal of ethnobiology and ethnomedicine", Vol. 17 No. 1 No. 26. <https://doi.org/10.1186/s13002-021-00449-w> PMID: 33832492

Liu, L. (2020), "Traditional Chinese medicine contributes to the treatment of COVID-19 patients", *Chin. Herb. Med.*, Vol. 12, pp. 95 – 96.

Lu, H. (2020), "Drug treatment options for the 2019-new coronavirus (2019-nCoV)", *BioScience Trends*, Vol. 14 No. 1, pp. 69 - 71. <https://doi.org/10.5582/bst.2020.01020>

Manda, S., Missanjo, E., Tandwe, T. and Kamanula, J. (2021), "ANTIBACTERIAL ACTIVITY OF *Jateorhiza palmata* ROOT EXTRACT AGAINST *Escherichia coli*, *Salmonella* Species, *Enterococcus faecalis* AND *Staphylococcus aureus*".

MOH-Ministry of Health - Malawi (2022) *COVID-19 National Information Dashboard*.

Mzumara GW, Chawani M, Sakala M, et al. (2021), "The health policy response to COVID-19 in Malawi", *BMJ Global Health*, Vo. 6: e006035

Robison, L. M., Sclar, D., Pharm, B., Skaer, T. and Pharm, B. (2002), "MEDICINAL PLANT USE BY TRADITIONAL HEALERS IN MALAWI: FOCUS ON NEEM, TEPHROSIA, MORINGA, JATROPHA, MARULA AND NATAL MAHOGANY MAY 10-24".

Runfeng, L., Yunlong, H., Jicheng, H., Weiqi, P., Qin Hai, M., Yongxia, S., Chufang, L., Jin, Z., Zhenhua, J., Haiming, J., Kui, Z., Shuxiang, H., Jun, D., Xiaobo, L., Xiaotao, H., Lin, W., Nanshan, Z., Zifeng, Y. (2020), "Lianhuaqingwen exerts anti-viral and anti-inflammatory activity against novel coronavirus (SARS-CoV-2)", *Pharmacol. Res.*, Vol. 156, 104761.

Malawi Government (2020), "Rumphi District Council Socio Economic Profile of 2017-2022".

WHO (2022) *COVID-19 Weekly Epidemiological Update*. 22.

Williamson, E. M. (2005), "Interactions between herbal and conventional medicines", *Expert Opinion on Drug Safety*, Vol. 4 No. 2, pp. 355 - 378. <https://doi.org/10.1517/14740338.4.2.355>

Worldometer (2022) Worldometer Covid-19 for Malawi.

Wu CY, Jan JT, Ma SH, Kuo CJ, Juan HF, Cheng YS, et al. (2004), "Small molecules targeting severe acute respiratory syndrome human coronavirus", *Proc Natl Acad. Sci U S A*, Vol. 101 No. 27, pp. 10012-7. doi: 10.1073/pnas.0403596101

Yang, Y., Islam, M.S., Wang, J., Li, Y., Chen, X. (2020), "Traditional Chinese medicine in the treatment of patients infected with 2019-new coronavirus (SARS-CoV-2): A review and perspective", *Int. J. Biol. Sci.*, Vol. 16, pp. 1708 - 1717.

Zhao, J.P., Hu, Y., Du, R.H., Chen, Z.S., Jin, Y., Zhou, M., Zhang, J., Qu, J.M. and Cao, B. (2020), "Expert consensus on the use of corticosteroid in patients with 2019-nCoV pneumonia", *Zhonghua jie he he hu xi za zhi= Zhonghua jiehe he huxi zazhi= Chinese journal of tuberculosis and respiratory diseases*, Vol. 43 No. 3, pp.183 -184.

Relative abundance, habitat distribution, and infection rate of schistosomiasis vector snails at Bwanje Valley Irrigation Scheme in Dedza District, Malawi

Angel P. Chidalimba and Yankho Chapeta Nyirongo
Department of Biological Sciences
Mzuzu University
Mzuzu
Malawi.

Abstract

Purpose: The study was conducted in October 2023 at Bwanje Valley Irrigation Scheme in Dedza district to provide baseline data on vector snails. Irrigation Schemes create freshwater snail breeding sites, making the elimination of Schistosomiasis by 2030 challenging and in need of integrating interventions with vector control, to achieve SDGs and Malawi 2063.

Methodology: Purposive sampling was used to record snail habitats with evidence of human-water contact activities. 385 snails were collected using scoop nets using simple random sampling, put in perforated plastic bottles, and transported to Dedza district hospital for examination. Water temperature, pH, vegetation cover, and velocity were measured at each site. Snail habitats were mapped using Quantum GIS. Identification keys were used to identify snails by shell morphology. Snails were individually put in beakers containing water and exposed to the sun to induce cercaria shedding. Cercariae were identified by microscopy and the snail infection rate was calculated as a percentage. Descriptive statistics were used to estimate infectivity, and Pearson correlation($P=0.05$) was used to find the relationship between snail abundance/infectivity and environmental parameters.

Findings: 385 snails were collected from eight randomly distributed sites. *Bulinus globosus* snails($n=362,94.0\%$) were more abundant than *Bulinus pfeifferi* ($n=14,4.0\%$) and *Bulinus africanus* ($n=9,2.0\%$). Only *Bulinus globosus*($n=104$) snails were shedding cercaria, giving an infection rate of 27.01%. *Bulinus africanus* ($n=14,0.0\%$) & *Biomphalaria pfeifferi* ($n=9, 0.0\%$) were not shedding cercaria. Vegetation cover ($0.791, P= 0.05$), lentic water ($0.89, P=0.05$), and pH ($0.923, P=0.05$) positively correlated with snail abundance and infection rate.

Recommendations: Vector control and health education.

Conclusion: 385 (*Bulinus globosus*, *Bulinus africanus*, and *Biomphalaria pfeifferi*) were collected. Only *B. globosus*($n=104$) were shedding cercaria giving a 27.01% infection rate. The presence of infected snails indicates an active schistosomiasis transmission in the area.

Originality/value of contribution: The study provides baseline data for further research.

Keywords: Bwanje Valley, Schistosomiasis, Snail relative abundance, Infection rate, habitat. distribution.

1.1 Introduction

Schistosomiasis is a snail-borne neglected tropical disease caused by blood flukes of the *genus Schistosoma*. People become infected when larval forms of the parasite (cercariae), released by freshwater snails, penetrate the skin during contact with water bodies (Aula *et al.*, 2021). The disease results in hematuria, stunted growth, infertility, and bladder cancer (Kamudumuli *et al.*, 2020). Schistosomiasis is more prevalent in poor communities that rely on agriculture and fishing. Approximately, 779 million people are at risk of infection, and 240 million people are infected worldwide. Africa accounts for 90% of cases with 280,000 deaths annually (Mwai *et al.*, 2021; Tamir *et al.*, 2022). In Malawi, more than 50% of Malawians are at risk, and 8.4 million people are diseased (Nyangulu, 2022). *Bulinus globosus*, *Bulinus africanus*, and *Bulinus nyassanus* snails are intermediate hosts for urinary schistosomiasis, while *Biomphalaria pfeifferi* is an intermediate host for intestinal schistosomiasis common in Malawi (Webster *et al.*, 2019). Irrigation systems create conditions that favor the establishment of snails (Tamir *et al.*, 2022). Schistosomiasis control focuses on preventive chemotherapy through mass drug administration with praziquantel (Makaula *et al.*, 2014; Aula *et al.*, 2021). However, PZQ is ineffective against migrating schistosomula, and rapid re-infections are also common (Hailegebriel *et al.*, 2020). We conducted the study at the Bwanje Valley Irrigation scheme to provide baseline data for disease prevention towards the World Health Organisation 2030 goal (WHO, 2022).

1.2 Problem Statement and Justification

Bwanje Valley Irrigation Scheme covers an area of 800 hectares. It has a dam that provides water to over 2000 small-holder farmers year-round, creating breeding sites for freshwater snails. Although the scheme aims at increasing agricultural productivity, fishing, swimming & irrigation farming, put people at risk of schistosomiasis (Vildesch, 2009). The BVIS relies on preventive chemotherapy through mass drug administration of praziquantel but the intervention targets only human stages of the disease, and it is not effective alone due to re-infections in previously treated individuals and low coverage in adults. Health facilities around BVIS continue registering cases. On average, in the past 5 years, Kachindamoto dispensary, Mtakataka Health Center, Golomoti Health Center, Mtakataka Police & MUA Mission Hospital reported 112, 61, 50, 34 & 5 cases respectively (HIMS, Dedza DHO). Although Dedza district hospital has registered a decrease in schistosomiasis cases from 741 in 2019 to 551 in 2023 which may be attributed to MDA, integrating it with vector control can foster elimination by 2030 in line with the WHO goals. This will help in the realization of SDGs and the Malawi 2063.

1.3 Objectives of the Study

1.3.1 Main Objective

To assess the relative abundance, habitat distribution, and infection rate of Schistosomiasis vector snails at Bwanje Valley Irrigation Scheme in Dedza district.

1.3.2 Specific Objectives

1. To determine the snail species' relative abundance at BVIS.
2. To determine the snail habitat distribution at the BVIS.
3. To determine the snail species infection rate with schistosomes at BVIS.

2.0 Literature Review

2.1 Vector Snail Abundance, Habitat Distribution & Infection Rate

To assess the incidence and geographical distribution of *Biomphalaria* snails at Mwea Irrigation Scheme in Kenya, and Lower Moshi Irrigation Scheme in Tanzania (Onyango *et al.*, 2021), *Biomphalaria* snails were found at 23.07% (36/156) of the sites sampled. Streams were most preferred by *Biomphalaria* snails (50%), followed by rivers (20.6%), irrigation canals (8.8%), lake shores (8.8%), springs (5.9%), and dams (5.9%) with snail abundance increasing with increase in temperature and decrease in water depth. The study recommended vector control although it did not cover snail infection status.

In Sourou, Burkina Faso, irrigation schemes and small permanent water bodies were preferred breeding sites for snails. The older irrigated areas had higher transmission of urinary and intestinal schistosomiasis, with prevalences varying from 5-10% before the introduction of irrigation to 60-80% several years after the introduction of irrigation (Lund *et al.*, 2021). This means that snails find suitable habitats with the introduction of irrigation farming. This study targeted human stages of schistosomiasis and the distribution of snails, not snail infection status.

In Zimbabwe, the monitoring of schistosomiasis at the Mushandike irrigation scheme consistently showed higher levels of infection in the irrigation scheme where schistosomiasis control measures were not introduced compared to where schistosomiasis control measures, vector control inclusive, were introduced (Chimbari, 2012). The success stories from Zimbabwe may prove to work against the proliferation of snail vectors in irrigation schemes hence it is vital to know the relative abundance, habitat distribution, and infection rates to inform policies for vector control.

2.2 Integrating Vector Control in Irrigation Schemes in Malawi

The Shire Valley Vector Control Project (Shire-Vec), with a focus on research on the Shire Valley Transformation Program (SVTP), is investigating the effect of the new irrigation scheme on vector-borne diseases like schistosomiasis (Sakwa, 2022). Shire-Vec aims to conduct vector surveillance around irrigated farms to monitor changes to insect and snail populations and their distribution to explore their influence on vector-host contact (Sakwa, 2022; Jones *et al.*, 2023). This program recognizes the need to incorporate vector control in mitigating the prevalence of schistosomiasis in irrigation schemes.

3.0 Materials and Methods

3.1 Study Site and Period

The study was conducted in November 2023 at Bwanje Valley Irrigation Scheme in Dedza district. It is located in the central region of Malawi within the Mtakataka Extension Planning Area on the Lake Malawi lakeshore plain covering 800 hectares in size (Frake *et al.*, 2020). The scheme is located at -14.362° Latitude and 34.388° Longitude with an elevation of 1,200 meters above sea level (Veldwisch *et al.*, 2009). The scheme experiences a subtropical climate with distinct wet and dry seasons (Chidanti-Malunga, 2009). The rainy season starts from November to April, with an average annual precipitation of 800 to 1,000 millimeters. The scheme targets 12,000 households in 14 villages (Nkhoma, 2011) and it has an irrigation dam that supplies water year-round, creating favorable conditions for vector snails.

3.2 Study Type

This research employed a cross-sectional design where freshwater snails were collected using scoop nets and examined for schistosome infections using microscopy.

3.3 Study Population

Freshwater snails known to be vectors of schistosomiasis in Malawi or other tropical and subtropical regions formed the study population. These snails are from the genus *Biomphalaria* or *Bulinus*.

3.4 Sample Size and Sampling Techniques

Snail sampling was conducted at eight sites within the BVIS and it was done using a systematic simple random technique. The sampling sites were randomly selected after conducting purposive sampling during a pre-survey where breeding sites were chosen according to evidence of human-water contact activities. Using an expected prevalence rate of 50%, a Z-value of 1.96, a 95% desired level of confidence, and a 5% margin of error, the sample size (n) was calculated using Cochran's formula (Pourhoseingholi *et al.*, 2013);

$n = (Z)^2 P (1 - P)/d^2$ where n = sample size, P = an estimate of the disease prevalence, Z = z-value yielding the desired degree of confidence, d = the absolute size of the error,

$n = (1.962 (1-0.5) (0.5)/0.05^2 = 384. 2$. Therefore, a sample size of 385 snails was used for the study.

3.5 Data Collection

3.5.1 Snail Sampling

Snails were collected using scoop nets and hand-picking, and placed in perforated plastic containers with water from the same habitat (Min *et al.*, 2022). Snails were collected from 6:30 am to 11 am for 20 minutes at each site in eight sampling sites; the main dam at Njolo, main and drainage canals at KIA and Bwanamakowa respectively, outlet dam at Mthembanji, irrigation ditches at Mbangali, rice fields at Nchanja and Mlongoti, and river pond at KIA. The sampling effort was based on the size and accessibility of each water body (Onyango *et al.*, 2021). Water temperature, pH, vegetation cover, velocity, and depth were recorded at each sampling site during snail collection. Pictures of human water contact activities were captured using a camera and geographical coordinates of the breeding sites were recorded using a mobile device's geographical positioning system (GPS) application.



Figure 1: Snail sampling sites, from left to right; main dam, KIA main canal, drainage dam, rice field, river, and distribution canal.

3.5.2 Snail Identification, and Cercaria Shedding and Identification

Snails were rinsed using dechlorinated water at room temperature (25°C) to remove mud and debris. Snails were identified at species level using morphology, shell pattern, and taxonomic identification keys (Owiny *et al.*,

2019). Snails were examined for cercarial infections by the cercaria shedding method (Hailegebriel *et al.*, 2020). Snails were individually placed in plastic containers containing 10 mils of water and exposed to sunlight for three hours around mid-day to induce cercariae shedding (Aula *et al.*, 2021). The samples were frequently checked for cercariae shedding with a hand lens. Cercaria found in each container was transferred to slides using a dropper and stained with two drops of iodine for morphological identification to species level by microscopy at 40X magnification and standard identification keys (Mereta *et al.*, 2019). Snails that did not shed were dissected and visualized for the presence of other forms of cercariae. Cercariae were recorded and their pictures were taken by a digital camera fitting the eye lens of the microscope.



Figure 2: Cercaria shedding, and snails collected, from left-right; *B. africanus*, *B. globosus* & *Bio. pfeifferi*.

3.5.3 Data Management and Analysis

Microsoft Excel 2018 was used for cleaning and data coding. Microsoft Excel and Statistical Package for Service Solutions (SPSS version 27.0) were used for descriptive statistics (pie charts, graphs, and percentages). The snail infection rate was determined as a percentage (Mereta *et al.*, 2019) as below;

$$\text{Snails infection rate} = \frac{\text{Number of snails that shed cercaria}}{\text{Total number of snails examined}} * 100$$

Pearson correlation was used to find the association between snail abundance/infectivity & temperature, pH, vegetation cover, depth, and velocity. The distribution of snail breeding sites was mapped using the QuantumGIS application.

3.5.4 Ethical Approval

It was obtained from the Mzuzu University Department of Biological Sciences Research Committee, Dedza District Hospital research committee, Senior Chief Kachindamoto, BVIS Extension and Planning Area Manager, and village heads at BVIS before commencing the study. Proper sample handling and disposal methods were followed using the hospital's standard operating procedures (SOPs) and disposal protocols.

4.0 RESULTS

4.1 Snail Count, Relative Abundance and Species Diversity

A total of 385 snails were collected from eight sampling sites at BVIS. *B. globosus*(n=362), *Bio. pfeifferi*(n=14) and *B. africanus*(n=9) were recorded, representing 94.0%, 4.0%, and 2.0% relative abundance respectively. *B. globosus* snails, the intermediate hosts for *S. haematobium* were found in seven of eight sites making it the most abundant and widely distributed compared to *B. Africanus* and *Bio. pfeifferi*. Higher numbers of *B. globosus* species were found at Mthembanji(n=92), Njolo(n=71), and KIA(n=78). Bangali(n=49), Nchanja(n=36), Bwanamakowa (n=15), and Ndindi(n=21) had moderate snail abundance. No snails were recorded in the main canal. All snail species (*B. globosus*, *B africanus*, and *Bio. pfeifferi*) were cohabiting at Njolo. *B. globosus* and *B. Africanus* were also cohabiting at Mthembanji and at KIA.

Table 1: Snail species count by sampling site

Sampling site	<i>Bulinus globosus</i>	<i>Bulinus Africanus</i>	<i>Biomphalaria pfeifferi</i>	Total
Njolo (Main dam)	71(82.6%)	9(10.5%)	6(7.0%)	86
Bwanamakowa (Drainage canal)	15 (100%)	0(0.0%)	0(0.0%)	15
Mthembanji (Drainage dam)	92 (94.8%)	0(0.0%)	5(5.2%)	97
Nchanja (Rice field)	36 (100%)	0(0.0%)	0(0.0%)	36
KIA (Main canal)	0 (0.0%)	0(0.0%)	0(0.0%)	0
KIA (Pond)	78 (96.3%)	0(0.0%)	3(3.7%)	81
Mlongoti (Rice field)	21 (100%)	0(0.0%)	0(0.0%)	21
Bangali (Earthen canal)	49 (100%)	0(0.0%)	0(0.0%)	49
Total	362	9	14	385

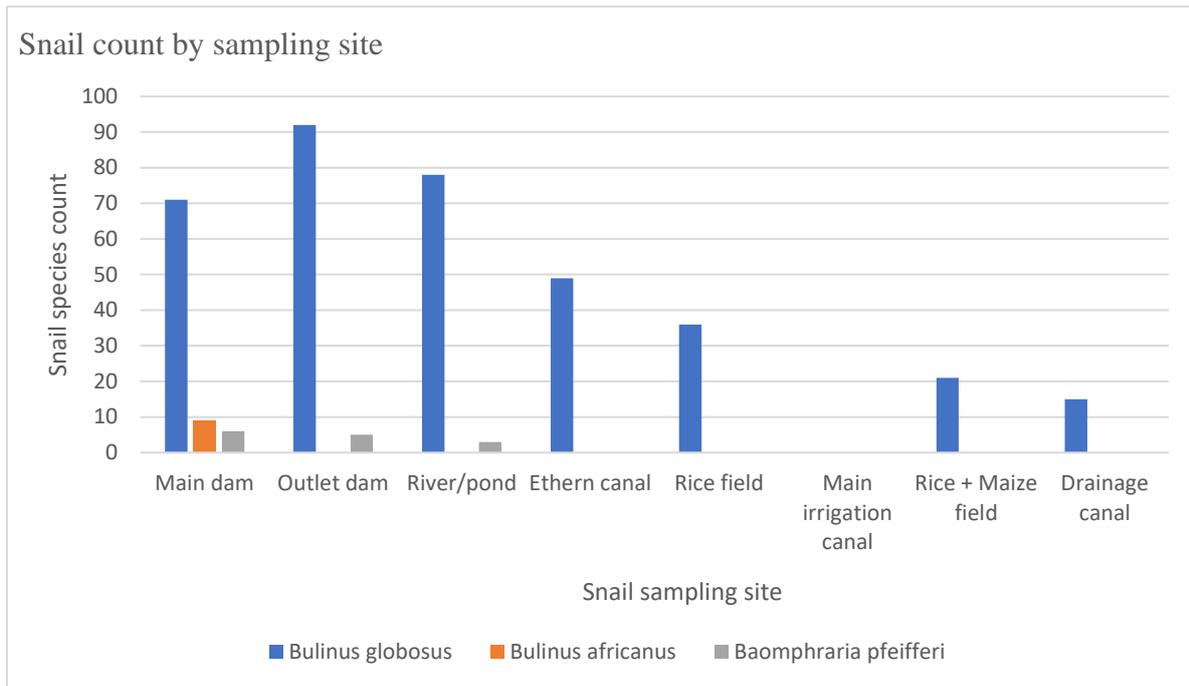


Fig. 3: Graphical presentation of snail count by sampling site

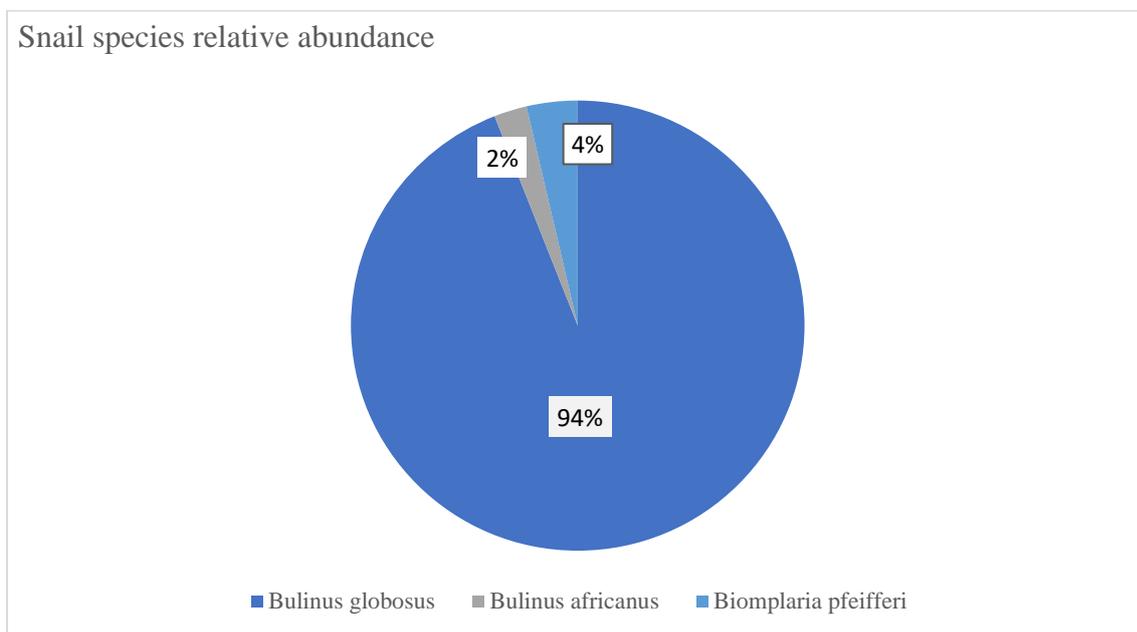


Fig 4: Snail species relative abundance

4.2 Distribution Of Snail Habitats

Snail habitats were widely distributed over the scheme. More snails were recorded in shallow sampling sites with lentic water, vegetation cover, temperature ranges of 21⁰ C - 25⁰ C, and a pH between 6.5- 9 (Mthembanji, KIA, and Njolo) compared to sites with lotic water without vegetation cover.

Snail abundance negatively correlated (-0.707...-0.980) with depth, temperature, and pH.

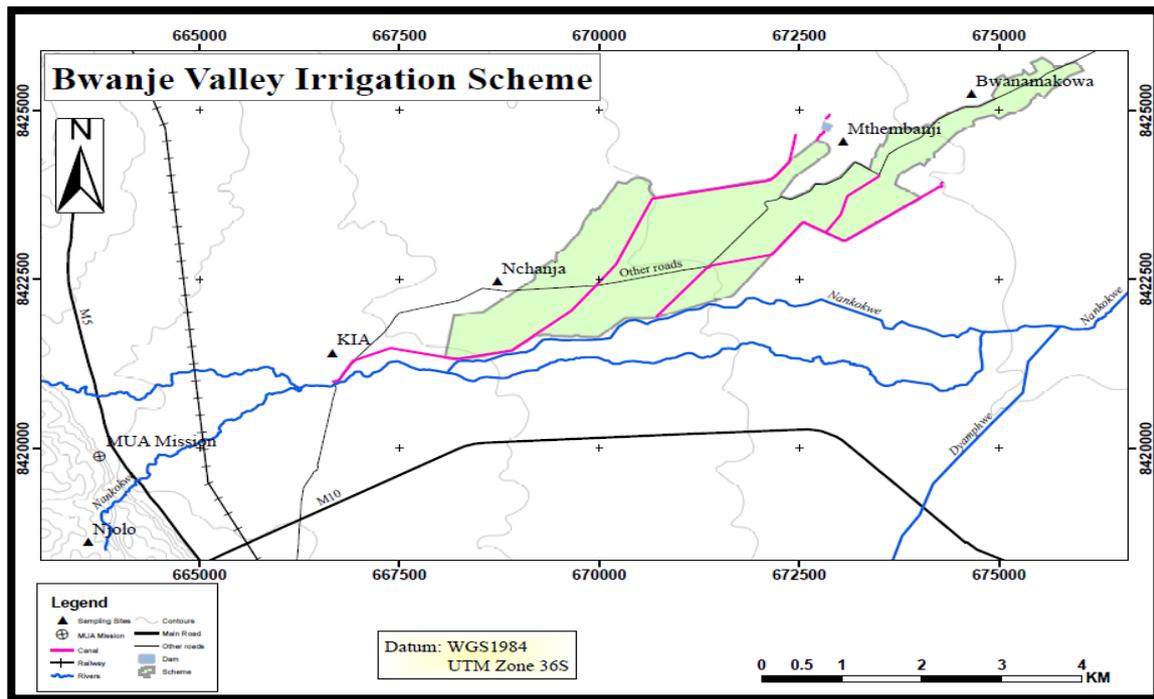


Fig 5: Study area map showing the distribution of sampling sites

4.3 Snail Infection Rate

Out of 385 snails collected, 104 snails were shedding cercariae giving a 27.01% infection rate. Only *B. globosus* snails were shedding cercariae. *B. africanus* and *B. pfeifferi* did not shed cercariae. *B. globosus* collected from Mthembanji exhibited highest cercaria shedding (n=38) compared to *B. globosus* collected at Njolo (n= 24), KIA (n=19), Bangali (n= 14), and Mlongoti (n=9) respectively. Snails from Bwanamakowa and Nchanja were not shedding cercariae. The infected snails were distributed in more than half of the sampling sites but there was no significant difference ($P < 0.05$) in infection rate among the sites.

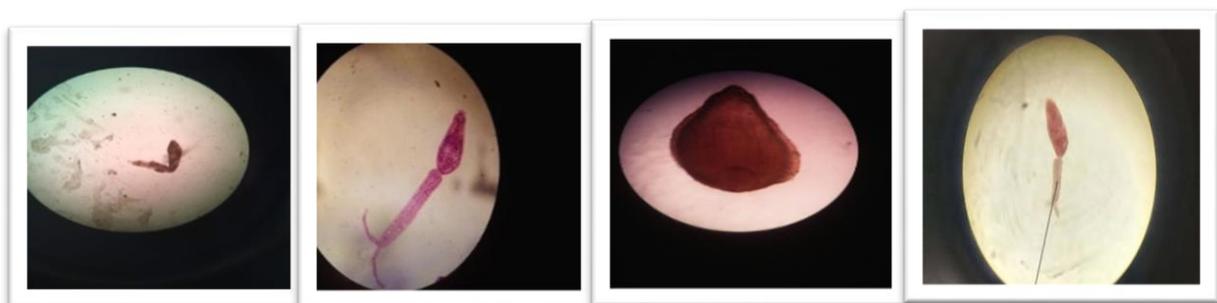


Fig. 6: The *S. haematobium* cercaria visualized at 40X.

Table 2: Snail species infection rates

Snail Species	Total collected	Infected	Not Infected	Infection rate
		<i>S. haematobium</i>		
<i>Bulinus globosus</i>	362(94.0%)	104(27.01%)	258(72.99%)	27.01%
		<i>S. mansoni</i>		
<i>Bulinus africanus</i>	9(2.0%)	0(0.00%)	9(100%)	0.00%
<i>Biomphalaria pfeifferi</i>	14(4.0%)	0(0.00%)	14(100%)	0.00%
Total	385	104	281	27.01%

5.0 Discussion

Bulinus globosus snails were more abundant (n=362, 94.02%) compared to *B. africanus* (n=9, 2.31%) and *Bio. pfeifferi* (n= 14, 3.63%). This agrees with (Nwoko *et al.*, 2023) where *B. globosus* were more abundant. The higher prevalence of *B. globosus* shows conducive temperature, vegetation cover, and water pH for snail breeding. According to (Diakit  *et al.*, 2017), *B. globosus* multiplies at temperature ranges of 21 C to 30 C and pH of 6.5 to 9. Lentic water bodies favored more snails than lotic sites as snails attach to substrates and do not get washed away. (Okoye *et al.*, 2022) also recorded more snails in sites with a temperature range of 22 C- 27 C. Vegetation cover at BVIS positively correlated (P= 0.782) with snail abundance and infection rate while water depth negatively correlated with snail abundance (P= -0.901), an indication that shallow water with vegetative cover may favor the multiplication of snails. Snail habitats were sporadically distributed at BVIS. The absence of snails in the main canal may be due to high water velocity and lack of vegetation cover. (Ismail *et al.*, 2021) also did not record snails in similar sites and they attributed it to high current speed, high depth, and lack of vegetation.

The only infected *B. globosus* snails where 104 of 385 snails shed cercariae gave a 27.01% infection rate, different from (Mereta *et al.*, 2023) with a 33.0% infection rate. The difference may be due to seasonal differences as the snails shed more cercaria towards the rainy season compared to the dry season (Augusto *et al.*, 2009). (Ezinna, 2023) also recorded declining infection rates from May to July, with July registering 33.6% as the lowest. The differences may also be due to differences in disease endemicity and low parasite pressure, reducing contact between snails and miracidia. The infected *B. globosus* snails indicate that urinary schistosomiasis is more prevalent at

BVIS. *Bio. pfeifferi* and *B. africanus* were not shedding, contrary to results by (Ngigi *et al.*, 2019) where infection status was 74%. This may be due to differences in snail resistance to infection and disease endemicity (Nwoko *et al.*, 2023).

6.0 Conclusion

A total of 385 snails were recorded belonging to *B. globosus* (n=362, 94.0 %), *B. africanus* (n=9, 2.0%) and *Bio. Pfeifferi* (n= 14, 4.0%). The distribution of snail habitats is sporadic and only *B. globosus* snails(n=104) were shedding cercaria giving a 27.01% infection rate. The results indicate a possible transmission of urinary schistosomiasis. Public health education and Vector control through environmental management should be done.

References

- Augusto, G. *et al.* (2009), "The influence of transmission season on parasitological cure rates and intensity of infection after praziquantel treatment of Schistosoma haematobium-infected schoolchildren in Mozambique", *Parasitology*, Vol. 136 No. 13, pp. 1771–1779. Available at: <https://doi.org/10.1017/S0031182009006210>.
- Aula, O.P. *et al.* (2021), "Schistosomiasis with a Focus on Africa", *Tropical Medicine and Infectious Disease*, Vol. 6 No. 3, p. 109. Available at: <https://doi.org/10.3390/tropicalmed6030109>.
- Chidanti-Malunga, J. (2009), "When government acts against the will of the people: The case of Bwanje Valley Irrigation Scheme in Malawi", *Journal of Applied Sciences Research*, Vol. 5, pp. 323 - 328.
- Chimbari, M.J. (2012), "Enhancing Schistosomiasis Control Strategy for Zimbabwe: Building on Past Experiences", *Journal of Parasitology Research*, p. 353768. Available at: <https://doi.org/10.1155/2012/353768>.
- Diakit , N.R. *et al.* (2017), "Dynamics of freshwater snails and Schistosoma infection prevalence in schoolchildren during the construction and operation of a multipurpose dam in central C te d'Ivoire", *Infectious Diseases of Poverty*, Vol. 6 No. 1, p. 93. Available at: <https://doi.org/10.1186/s40249-017-0305-3>.
- Ezinna E, E. (2023), "Fresh Water Snails (Bulinus and Lymnaea) in Canals in Imo State, Nigeria: Their Public Health Importance and Implications for Control", *Journal of Infectious Diseases & Case Reports*, pp. 1-6. Available at: [https://doi.org/10.47363/JIDSCR/2023\(4\)170](https://doi.org/10.47363/JIDSCR/2023(4)170).
- Frake, A. *et al.* (2020), "Estimating spatiotemporal distributions of mosquito breeding pools in irrigated agricultural schemes: a case study at the Bwanje Valley Irrigation Scheme", *Malaria Journal*, Vol. 19. Available at: <https://doi.org/10.1186/s12936-020-3113-3>.

Gwiyani-Nkhoma, B. (2011), "Irrigation development and its socioeconomic impact on rural communities in Malawi", *Development Southern Africa*, Vol. 28 No. 2, pp. 209 - 223. Available at: <https://doi.org/10.1080/0376835X.2011.570068>.

Hailegebriel, T., Nibret, E. and Munshea, A. (2020), "Prevalence of *Schistosoma mansoni* and *S. haematobium* in Snail Intermediate Hosts in Africa: A Systematic Review and Meta-analysis", *Journal of Tropical Medicine*, p. 8850840. Available at: <https://doi.org/10.1155/2020/8850840>.

Jones, C.M. *et al.* (2023), "Integrating vector control within an emerging agricultural system in a region of climate vulnerability in southern Malawi: A focus on malaria, schistosomiasis, and arboviral diseases", *Current Research in Parasitology & Vector-Borne Diseases*, p. 100133. Available at: <https://doi.org/10.1016/j.crpvbd.2023.100133>.

Kamudumuli, P.S. *et al.* (2020), "*Chronic Schistosomiasis, a Clinical and Laboratory Diagnostic Challenge in Malawi*". preprint. In Review. Available at: <https://doi.org/10.21203/rs.2.23939/v1>.

Lund, A.J. *et al.* (2021), "Land use impacts on the parasitic infection: a cross-sectional epidemiological study on the role of irrigated agriculture in schistosome infection in a dammed landscape", *Infectious Diseases of Poverty*, Vol. 10 No. 1, p. 35. Available at: <https://doi.org/10.1186/s40249-021-00816-5>.

Makaula, P. *et al.* (2014), "Schistosomiasis in Malawi: a systematic review", *Parasites & Vectors*, Vol. 7 No. 1, p. 570. Available at: <https://doi.org/10.1186/s13071-014-0570-y>.

Mduluza, T. *et al.* (2020), "Six rounds of annual praziquantel treatment during a national helminth control program significantly reduced schistosome infection and morbidity levels in a cohort of schoolchildren in Zimbabwe", *PLOS Neglected Tropical Diseases*, Vol. 14 No. 6, p. e0008388. Available at: <https://doi.org/10.1371/journal.pntd.0008388>.

Mereta, S.T. *et al.* (2019), "Environmental determinants of the distribution of freshwater snails and trematode infection in the Omo Gibe River Basin, southwest Ethiopia", *Infectious Diseases of Poverty*, Vol. 8 No. 1, p. 93. Available at: <https://doi.org/10.1186/s40249-019-0604-y>.

Min, F. *et al.* (2022), "Environmental Factors Affecting Freshwater Snail Intermediate Hosts in Shenzhen and Adjacent Region, South China", *Tropical Medicine and Infectious Disease*, Vol. 7 NO. 12, p. 426. Available at: <https://doi.org/10.3390/tropicalmed7120426>.

Mwai, J., Omogi, J.O. and Abdi, M.H. (2021), "Environmental factors influencing Prevention and Control of Schistosomiasis Infection in Mwea, Kirinyaga County Kenya: A cross-sectional study", *The East African Health*

Research Journal, Vol. 5 No. 1, pp. 99 -105. Available at: <https://doi.org/10.24248/eahrj.v5i1.656>.

Ngigi, D.M. *et al.* (2019), "The Susceptibility of Biomphalaria spp. from Mwea Irrigation Scheme in Kenya against *Schistosoma mansoni* Miracidia Infection", *Journal of Biomedical Science and Engineering*, Vol. 12 No. 11, pp. 477 - 486. Available at: <https://doi.org/10.4236/jbise.2019.1211039>.

Nwoko, O.E., Manyangadze, T. and Chimbari, M.J. (2023), "Spatial distribution, abundance, and infection rates of human schistosome-transmitting snails and related physicochemical parameters in KwaZulu-Natal (KZN) province, South Africa", *Heliyon*, Vol. 9 No. 2, p. e12463. Available at: <https://doi.org/10.1016/j.heliyon.2022.e12463>.

Okoye, C.O. *et al.* (2022), "Physicochemical Changes and Abundance of Freshwater Snails in Anambra River (Nigeria) During the Rainy Season", *Ecological Chemistry and Engineering S*, Vol. 29 No. 2, pp. 169 - 181. Available at: <https://doi.org/10.2478/eces-2022-0013>.

Onyango, V., Kisara, S. and Wade, C. (2021), "*Geographical Distribution of Biomphalaria pfeifferi* snails in East Africa", Available at: <https://doi.org/10.1101/2021.11.04.467236>.

Owiny, M.O. *et al.* (2019), "Prevalence and spatial distribution of trematode cercariae in vector snails within different agroecological zones in Western Kenya, 2016", *The Pan African Medical Journal*, Vol. 32 No. 142. Available at: <https://doi.org/10.11604/pamj.2019.32.142.14418>.

Pourhoseingholi, M.A., Vahedi, M. and Rahimzadeh, M. (2013), "Sample size calculation in medical studies", *Gastroenterology and Hepatology from Bed to Bench*, Vol. 6 No. 1, pp. 14 -17.

Sakwa, E. (2022), "Shire-Valley Vector Control Project (Shire-Vec) Consultant", *African Institute for Development Policy - AFIDEP*, 23 June. Available at: <https://www.afidep.org/usaaid-funded-project-director/> (Accessed: 17 June 2023).

Tamir, Z. *et al.* (2022), "Intestinal helminthiasis survey with emphasis on schistosomiasis in Koga irrigation scheme environs, north-west Ethiopia", *PLOS ONE*, Vol. 17 No. 8, p. e0272560. Available at: <https://doi.org/10.1371/journal.pone.0272560>.

Veldwisch, G.J., Bolding, A. and Wester, P. (2009), "Sand in the Engine: The Travails of an Irrigated Rice Scheme in Bwanje Valley, Malawi", *The Journal of Development Studies*, Vol. 45 No. 2, pp. 197 - 226. Available at: <https://doi.org/10.1080/00220380802265587>.

Webster, B.L. *et al.* (2019), "Schistosome Interactions within the *Schistosoma haematobium* Group, Malawi", *Emerging Infectious Diseases*, Vol. 25 No. 6, pp. 1245 - 1247. Available at: <https://doi.org/10.3201/eid2506.190020>.

WHO (2022) *WHO guideline on control and elimination of human schistosomiasis*, Geneva: World Health Organisation.

HUMANITIES AND SOCIAL SCIENCES

Humanities and Social Sciences is another thematic area that attracted a large number of submissions. Paper presented fall under the following sub-thematic areas:

- The role of linguistics, literature and creative arts in national development
- History, Heritage and Economic Development in Malawi
- Security and Public Sector Governance
- Religion and Environmental Conservation
- Information services for development
- Communication for Sustainability

Africanising language and communication in policy to meet the needs of majority citizens: A critical review of Malawi 2063

Ernest Longwe

Department of Language and Communication Studies, Malawi University of Science and Technology, Thyolo, Malawi.

Email: elongwe@must.ac.mw

Abstract

Africa's marginalisation is reinforced by its almost complete exclusion from knowledge creation and production worldwide. It consumes, sometimes, uncritically information and knowledge produced elsewhere through languages unknown to the majority of its population. Language is as powerful as the institutions it animates and which animates it in turn (Ngugi, 1986). This paper is a critical review of Malawi 2063 in terms of its language and communicative competency. The policy fails to communicate with target groups and has been tailor made for the elites and donors with minimal contributions towards relevant communities. Using framing and social exclusion theories, the paper argues that Malawi can develop well by investing in the linguistic, human and intellectual energies of its local languages which are used by the majority of the citizens, instead of only relying on the imperial languages used by an elite minority which renders its policies to be detached from the majority citizens. In order to buttress the purpose of the research, narrative interviews were conducted to 10 informants in Blantyre rural to get their views on how they understand the Malawi 2063. As a qualitative study, the paper delves into document analysis to decipher the communicative competency of the Malawi 2063. The paper recommends constant multilingualism as a solution to language problems in policy documents.

Key words: Language, Malawi 2063, language policy, communicative competency.

1.1 Introduction

As a developing country in Southern Africa, Malawi is implementing its latest development blueprint, called the Malawi 2063, as one way of attaining both economic and social prosperity in the country (Mthawanji, 2023). The Malawi 2063 as a policy document falls in the category of vision documents. According to the United Nations Development Program (2014), a vision is a picture of the future. UNDP (2014) further contend that "if the vision is the concept note explaining the desired future, the National Development Strategy (NDS) is the roadmap to get there" (7). As such, Malawi 2063 is a comprehensive roadmap with a clear set of goals and measures to achieve middle income economy by 2063. Malawi has had several development visions in the past, each with a specific focus and timeframe. The country is on record for designing good policies but is poor at implementation.

Historically, the colonisation of Africa by western countries during the late 19th century led to the imposition of foreign languages (Sibanda, 2019).

Colonial powers deliberately and systematically neglected indigenous languages as they reinforced linguistic hegemony (Shizha, 2013). Malawi was no exception. African leaders and policymakers have internalised western philosophical and ideological tenets via colonial education and this greatly impacted policy planning and implementation.

In order to root development in African realities and to keep pace with the demands of today's fast developments, internal and external resources should be pooled in a non-antagonistic way (Okombo, 2000). In this endeavour, African languages are the key to African realities. They are the means of communication for the majority of people in Africa and should be recognized, valued and developed as such. The promotion of African languages and literacy through formal and non-formal education has been continuously debated since the 1960s between experts and policy-makers in Africa. Most African governments would come up with a policy framework that has a foreign language which fail to speak to the majority of the people. One such document is the Malawi 2063. The Malawi 2063 is a blue print policy framework that Malawi government follows with an aim to address the structural challenges the low and volatile growth over decades.

In order to understand how the Malawi 2063 has been framed the study centres on framing theory. Framing theory is the study of how rhetorical devices can be used to convince people of the value of any given position. Frames select aspects of the perceived reality to make them noticeable, often simplifying the message to mobilise people and garner support. First and foremost, good public policy, such as the Malawi 2063, should work towards addressing inequality and inequity issues in society rather than perpetuating marginalisation and discrimination. The current policy (Malawi 2063) has been framed in such a way that promotes unfair access and use of language by denying the majority citizens their right to know and learn the development strategy of Malawi. Denying the majority citizens' local language in the Malawi 2063 is leaving a central part of who they are outside Malawi 2063. Local languages forms the basis and formation of an integral part of the philosophy of an individual since they hold the very essence of what defines one's humanity, one's culture.

Informed and guided by social inclusion theory, the main purpose of this paper is to critically analyse the Malawi 2063. To determine the nature and character of the Malawi 2063, the paper draws insights from the coloniality of power, knowledge and being as analytical lenses of understanding the Malawi 2063 and how it detaches itself from the citizenry. This paper discusses language and communication competence in Malawi 2063. It also discusses the manner in which the policy has been implemented and some of the findings on the peoples' perception and understanding of the policy.

1.2 Problem Statement

The Malawi government's framing of policy documents emanates from the colonial era. As such, most of its policies have not broken away from this ideological entanglement from the past. Ngugi (1994) states that African

scholars and writers remain trapped by the colonial era of language. Surprisingly, throughout the Malawi 2063 document, language is never even mentioned. The Malawi 2063 recaptures aspect of language from a colonial approach. The paper agrees with Kamwendo (2010) that this silence on language creates the erroneous impression that language is not relevant to matters of national development. If language is the medium through which human beings communicate, and if communication is a critical tool for national development, how can a nation genuinely prepare its vision without taking the language question on board? Hence, the paper analyse language and communication competence in Malawi 2063.

2.0 Literature Review

2.1 Revisiting the National Language Policy

The Malawi national language policy is rooted in colonialism. Mchazime (1996) contends that in 1918 Sir George Smith (Governor of Nyasaland) turned down the proposal to introduce local language as the official language. Smith was afraid that the introduction of an indigenous language as an official language would unite all the tribes of Nyasaland faster than he wanted (Chilora, 2000). However, in 1936 government resolved that Chinyanja should be the medium of instruction in government and assisted schools (Chilora, 2000). Centre for Language Studies (CLC, 1999) highlights that the language policies of the past had been implemented in Malawi without any prior “national socio-linguistic surveys carried out that would assist policy makers to assign judicious, rational and well-motivated functions to the various language of the nation”. This is the same case with Malawi 2063. It was implemented without carrying out national socio-linguistic surveys.

Kretzer and Kumwenda (2016) observe that Malawi’s language policy is also influenced by many international donors like the World Bank and many other agencies since the country is aid-dependent and cannot decide on issues independently. Mtenje (2004) further argues that lack of proper government structures to holistically manage language policy issues is a common phenomenon not only in Malawi but in many other African countries. In extrapolating Mtenje’s point, Matiki (2001) argues that current and past language policies in the country which have enabled the dominance of English in administrative and legislative spheres implies that nearly 90% of Malawians are excluded from making decisions that affect them. The framing of Malawi 2063 dominated by the English language excludes the majority of citizens from the development vision that the country aspires.

2.2 Linguistic Imperialism in Malawi 2063

Phillipson (2009) defines linguistic imperialism as “the notion that certain languages dominate internationally on others” (780). In the context of this study, the paper adopts Agyekum (2018) definition which defines linguistic imperialism as “a linguistic situation where the indigenous people are gradually conscientised to shun their indigenous languages and adopt foreign languages and adopt foreign languages because of the benefits they expect to

derive from them” (88). They are made to believe that their languages cannot be used in any transaction in education, economics, science and technology but instead, a foreign language is the best. This is the case with the Malawi 2063 Agenda which has in its entirety adopted English as the only language for this important document. According to the UNESCO Institute of Statistics (2019), Malawi’s literacy rate is 67.75 percent of the adult population (15 years old and above). This means that there are over seven million people in the country who cannot read nor write. This becomes difficult for the people to have access to the Malawi 2063.

2.3 Language as both “tool” and “symbol”

Language is considered as a symbol because it serves as a tool for expressing both our external and internal world. Language is considered a symbol-using system because it involves the arbitrary connection between sound and meaning, allowing the communication of complex ideas (Gak, 2000). Language is a development asset of society, particularly if its potential is fully recognized and exploited. It can be a key contributing force towards nationhood and national development if properly managed, (Bamgbose, 2000:30). The indigenous languages of Africa can therefore be vehicles of national development if put to proper use. Such languages need to be looked at not as stumbling blocks, but as potential national development resources. As with all other resources, they need to be allocated in areas where they can be of optimal utility.

3.0 Methodology

Methodologically rooted in a qualitative research approach, data for this study was collected through narrative interviews from ten participants in Blantyre City. The narrative interview is a technique not imposing strict discourse guidelines on the subjects, encouraging them to be the ones who decide what and how to recount (Scarneci-Domnisoru, 2013). Generally, participants were asked to narrate how they understand the Malawi 2063 and if they conversant with language used in the document.

The paper also delves into the qualitative research approach by using document analysis as its methodology. Document analysis pertains to the process of interpreting documents for an assessment topic by the researcher as a means of giving voice and meaning (Bowen, 2016). According to Bowen (2016), organisational and institutional documents have been a staple in qualitative research for many years. As a research tool, policy document analysis is a method for investigating the nature of a policy document in order to look at both what lies behind it and within it (Cardno, 2018). This paper reviews Malawi 2063 as a public document which is examined and interpreted to elicit meaning, gain understanding and develop empirical knowledge in line with the language coloniality. As Atkinson and Coffey (1997) refer to documents as “social facts” that are produced, shared and used in socially organised ways (47), this paper agrees with Ferdinand de Saussure that language is a social fact. This being the case, the Malawi 2063 as document

needs to resonate with the language of the people as a social fact. Saussure refer to language as a social fact because in language there are values, cultural norms and social structure shared by the members of a society.

4.0 Results

Interviewees were firstly asked how they understand the Malawi 2063, to get a sense of the vision context to the citizens. Five reported that they just hear it being mentioned on the radio, but they do not understand what it is. The other respondents reported that they have not heard about Malawi 2063. Having established the consensus about the citizens understanding of Malawi 2063, interviewees were asked if it was proper for Malawi 2063 document to be dominated only in one language (English). The respondents viewed that writing in English alone for such important document was not good. “*Ngati masomphenya a dziko lino, zimayenera kukhala mu chiyankhulo chokuti anthu ambiri akhoza kuwerenga komanso kumva osati mchizungu mokha*” (interviewee 3). [As a vision document for the country, it was supposed to be in languages that the majority citizens are able to read and hear, but not only in English]. Respondents generally agreed that language in policy documents is key to development if the people understand the context of the policy from their perspective. Another respondent reported; “*kulemba zinthu zathu mu chingerezi kumaonesa kuti zinthuzo sizathu koma za azungu*” [writing in English documents that are ours entails that the documents are not ours but for the whites] (Interviewee 8). The narrative interviews conducted suggest that the Malawi 2063 is there as a document but the citizens do not understand what this document is all about.

The interview results mirrored the document analysis, where othering mentality and social exclusion was postulated in Malawi 2063. Throughout consultative meetings to the framing of Malawi 2063 only development experts whether from the academia or corporate world are consulted leaving out the uneducated and common people. Using English as the only medium of communication means that the indigenous bodies are othered. One interviewee expressed concern that government may not listen to them because they are poor people.

5.0 Discussions

The Malawi 2063 presumes that the majority of the citizens are fluent enough in English to abide by its strategic pillars. The majority of Malawian citizens are illiterate. In its implementation, the communicative function of the language is unique. Therefore, not only within one society but also in intercultural and national relations, the culture of one ethnic group is reflected in another ethnic group through its linguistic symbols. The Malawi 2063 has visible evidence of erasure.

Matiki (2006) as quoted in Kretzer and Kumwenda (2016) observes that there is a need to open up the space for some indigenous languages to play their rightful part in education, administration, judiciary and other spheres of life

to mitigate the alienation of the majority of Malawians from national activities. This step is necessary because current and past policies have made the majority of Malawians not to participate adequately in the economic life of the country, especially women and the rural poor, most of whom are denied the opportunity to use their vernacular languages in economic and administrative spheres. For active utilisation of the mother tongue, there is a need to raise the teaching of vernacular languages in schools and broaden their usage.

The opening line of Malawi 2063 states that “Malawians have spoken”. This statement is problematic to the communicative competence of Malawi 2063. “Malawians have spoken” (1) this statement perpetuates a stereotype by attributing a single monolithic voice to an entire nation. Furthermore, the statement has the potential for manipulation: such statements can be used to justify decisions or actions potentially silencing minority voices or dissenting opinions. The paper has found out that Malawi 2063 is devoid of the afrocentric approach despite engaging local communities such as the chiefs, the leader of the youth and political leaders.

6.0 Conclusion

This paper has argued that the language framing in the Malawi 2063 detaches the majority of the citizens to the future aspirations of the nation. It was framed with an elitist and donor mind framework which excludes the majority citizens from it.

The paper also highlighted that the meaningful development that the Malawi 2063 entail can only be achieved through local language and communication. Development is a process which involves the entire spectrum of the society, with each individual making a contribution. A communication channel is, therefore, imperative in order to mobilise the whole society in the process of social change. It is an essential tool in ensuring the full participation of the masses in the political, socio-economic and cultural development. In other words, institutions, organisations and even governments cannot perform clearly and effectively to expectations unless they can understand and be understood by every citizen of a particular nation.

Today, use of African languages is seen as the best way of ensuring active participation of the African populations in the activities of national life and in particular in the planning and management of development projects. The paper concludes that evaluation of development policies has shown that one reason for the failure of development plans is that the populations concerned have not been actively associated with them, and this so because the plans are drawn up using a language and terminology the majority of the citizens do not understand, such as Malawi 2063.

References

Agyekum, K. (2018), “Linguistic imperialism and language decolonisation in Africa through documentation and preservation”, in Kandybowicz, J. Major, T. Torrence, H & Duncan, P. T. (2018), *African Linguistics on the*

Prairie: Selected papers from the 45th Annual Conference in African Linguistics, Berlin: Language Science Press.

Atkinson, P. A. and Coffey, A. (1997) *Analysing Documentary Realities*, London: Sage.

Bamgbose, A. (2000) *Language and Exclusion: The Consequences of Language Policies in Africa*, London: Transaction Publishers.

Bourdieu, P. (1991) *Language and symbolic power*, Harvard: Harvard University Press.

Bowen, G.A (2009) "Document Analysis as a Qualitative Research Method", *Qualitative Research Journal*, Vol. 9 Issue, 2, pp. 27-40.

Cardno, C. (2018), "Policy Document Analysis: A Practical Educational Leadership Tool and a Qualitative Research Method", *Educational Administration: Theory and Practice*, Vol 24, Issue 4, pp. 623-640.

Centre for Language Studies (1999) *Sociolinguistic Surveys of few Malawian languages: with special reference to education*, Zomba: University of Malawi.

Chilora, H. G. (2000), "Language Policy, Research and Practice in Malawi", Paper presented at the Comparative and International Education Society (CIES) 2000 Conference San Antonio, Texas, USA 8 - 12 March 2000

Freire, P. (1972) *Pedagogy of the oppressed*, New York: Herder.

Gak, V.G. (2000) Yazyk kak forma samovyrazheniya naroda [Language as a Form of Self-Expression of a Nation]. *Yazyk kak sredstvo translyatsii kultury*, pp.54-68.

Kamwendo, G. H. (2010), "Denigrating the local, glorifying the foreign: Malawian language policies in the era of African Renaissance", *International Journal of African Renaissance Studies – Multi-, Inter- and Transdisciplinarity*, Vol. 5 No. 2, 270 - 282.

Matiki, A. J. (2006), "Literacy, ethnolinguistic diversity and transitional bilingual education in Malawi", *International Journal of Bilingual Education and Bilingualism*, Vol. 9 No. 2, pp. 239 - 254.

Mchazime, S. H. (1996), "Mother Tongue as a Medium of Instruction in Malawi". Paper presented at the International Seminar on Language in Education in Africa held at the University of Cape Town - South Africa, 15-20 July, 1996.

Mtenje, A. (2004), "Developing a language policy in an African country: The case of Malawi", in K. Bromber and B. Smieja (Eds.) *Globalisation and African languages, Risks and Benefits, Trends in Linguistics* (pp. 147-163), Studies and Monographs 156, Berlin: Mouton de Gruyter.

Phillipson, R. (2009), "Linguistic Imperialism", in Mey, J.L. (Ed.), *Concise Encyclopedia of Pragmatics*, 2nd edition, Amsterdam: Elsevier Ltd, pp. 780-782.

Saussure, F. (1916) *Course of general linguistics: Anthology of thought*, Moscow: Yurayt Publishing House.

Scarneci-Domnisoru, F. (2013), "Narrative Technique of Interviewing", *Bulletin of the*

Transilvania University of Brasov, Vol. 6 No.No.1, pp. 21-28.

Shizha, E. (2013), "Reclaiming our indigenous voices: The problem with postcolonial

Sub-Saharan African school curriculum", *Journal of Indigenous Social Development*,

Vol. 2 No. 1, pp. 1- 18.

UNDP (2014) *Looking Beyond the Horizon: Guidelines and Best Practices in Formulating National Visions*, Uzbekistan: Centre for Economic Research.

UNESCO Institute of Statistics (2019) *SDG 4 Data Digest: How to Produce and Use the Global and Thematic Education Indicators*, Montreal: UNESCO Institute of Statistics.

Wa Thiong'o, N. (1994) *Decolonising the mind: The politics of Language in African Literature*, Nairobi: East African Publishers.

Oral literature and dissemination of maternal and antenatal/postnatal health issues in Livingstonia-Rumphi health centres

Manasseh Nyangulu

Lecturer, University of Livingstonia, Laws Campus, Rumphi, Malawi.

Email: mnyangulu@unilia.ac.mw

Abstract

Purpose: The study focusses on the usage of oral songs as a means of transmitting maternal, antenatal and postnatal health messages in some of the rural hospitals in Livingstonia-Rumphi health centres.

Methodology/approach: The study targeted the following rural health centres in Livingstonia-Rumphi area: Gordon Memorial hospital, Lura, Mhuju and Chinyolo. In the study, lead singers in maternal/postnatal clinics in the four health centres selected were engaged to record such songs because most of the women were inhibited by the researcher's presence in such sessions. In total, nine songs were collected and transcribed for analysis. The nine songs selected were sung in all the health centres visited and therefore met the selection criteria for analysis. In my analysis of such songs, I have engaged Julia Kristeva theory of abjection especially on the role of language and discourse in casting out others deemed to be out of sync with new social or world order. Kristeva has associated the abject with "all that is repulsive and fascinating about bodies and, in particular, those aspects of bodily experience which unsettle singular bodily integrity: death, decay, fluids, orifices, sex, defecation, vomiting, illness, menstruation, *pregnancy and childbirth*" (cited in Tyler, 2009, pp.79-80).

Findings: From my analysis, it was noted that some of the songs are satirical and caricature women who do not follow best health practices.

Discussion: The oral songs analysed have the potential of deterring others from attending such sessions in public hospitals because of the way the messages are presented.

Recommendations: The paper strongly recommends that elements that engender the construction of the "abject other" in the songs should be eliminated.

Conclusion: The results confirm previous studies that have pointed out that language, if not carefully used, has the potential to cast out others in texts.

Originality/value of contribution: Besides significantly departing from the usual way literature is studied, the paper adds to the body knowledge that brings together the intersection of oral literature and health especially maternal and antenatal/postnatal health issues.

Key words: Oral songs, dissemination, maternal, antenatal/Postnatal, abject other.

1.0 Introduction

Women in rural and urban centers rely on free antenatal/postnatal clinics health services offered by government and church run hospitals. Because of overwhelming numbers seeking such health services popularly known as “sikelo” (antenatal/postnatal clinics), group sessions are conducted so as give useful information to help healthy pregnancy including advice about healthy eating and exercise. For the “sikelo” (herein referred to as group antenatal/ post-natal clinics), the art of disseminating useful or relevant information is reinforced with the singing of songs led by nurses or sometimes ordinary women. In the oral songs, issues of child spacing, usage of new health interventions are promoted as nurses or midwives take turns providing maternal health-related teachings and interventions. Health practices like good nutrition, hygiene, family planning and prevention of diseases and maternal mortality are transmitted through such songs. The paper therefore analysed nine songs with the aim of showing how the songs unsettle the otherwise good message in the songs by rendering women seeking such services as abject other. The songs are: “Amake mwana Chidodo”, “Nifwenge ine”, “Wakwawo! Mbwa! Mbwa! Mbwa!”, “Tilere ana athuwa tilere”, “Mama! Kugeza, kuchapa ndiko nkhopwewera mwana”, “Rhoda iwe Kaone, Amama nikoleni-Nifwenge, and “tola mwana”. A content analysis approach was used in the analysis of the songs. The choice of the songs was informed by the fact that the nine songs were commonly sung in all the health centres in Livingstonia-Rumphu health centres. In the paper, I argue that some of the oral songs selected for analysis have the capacity to deter others from accessing such health services because of the way the pregnant mother is portrayed in the songs.

2.0 Literature Review

Research on maternal health in Malawi has extensively been done by health professionals. Their findings have largely exposed the gravity or magnitude of maternal health issues, the importance of maternal sessions and ways of averting maternal and child death. For instance, a study by Gaily Gresham Lungu *et al.* conducted in 2018 highlights that “Malawi’s maternal mortality rate is now projected to be 439 per 1,000 live births which is considered too high compared to Zambia, a neighbouring country in the Sub-Saharan region which was at 278 per 1000 births in 2018” (pp. 1). Further, Lungu *et al.* has also underscored the importance of Information, Education and Communication (IEC) programmes as vital in spreading awareness. In their article, Lungu *et al.* asserts that “whether provided individually or in groups during Antenatal Care (ANC) result in positive changes in people’s health practices resulting in a healthy mother and baby” (p. 2). From the findings, it has proved that “pregnant women who receive IEC as part of ANC are more able to recognize pregnancy hazard symptoms like vaginal bleeding (antepartum hemorrhage), convulsions, severe headaches with blurred vision, fever, difficulties in breathing, severe abdominal pains and backache and report to health facility once they suspect or experience any of the symptoms” (Lungu *et al.*, p. 2).

Maria Chikalipo *et al.* aptly underscores the importance of antenatal education in Malawi. She regards it as “one of the pillars of antenatal care which aims at improving the health of mothers, babies and their families (p.1). The health information “obtained from antenatal education sessions women and their families are prepared for pregnancy” (p. 1).

Elsewhere, in a study done by Stephen Titus Olusegun on Yoruba culture remarks that maternal songs “help the pregnant women to take daily actions on health issues during pregnancy, childbirth and baby care, believing that it will reduce the complications for delivery” (p.139). In Nigerian case, antenatal classes “are organized in hospitals and health centers for pregnancy women to intimate them with the necessary information needed on pregnancy and postnatal period (Taiwo and Salame, 2007, p.3). Just like what Malawian scholars have observed, the whole essence of organizing such sessions is to contribute to the wellbeing of the pregnant mother and the unborn child. Such songs “are usually about domestic hygiene, nutrition, breastfeeding, immunization and so forth” (cited in Olusegun, p. 140). In terms of composition, “most of the songs are composed choosing tunes of existing songs, while the lyrics are specifically chosen to reflect the thematic peculiarities of the lesson being taught” (cited in Olusegun, p. 140). Antenatal sessions are supposed to be live sessions and, in a bid, to make classes lively as stated by Taiwo “women are enjoined to accompany their songs with clapping and dancing” (cited in Olusegun, p. 140).

As shown in the reviewed literature, scholars mainly from health background have widely acknowledged the importance of conducting maternal health clinics. While a majority of the critics have underscored the importance of such sessions, it would be interesting to examine the role of oral songs in disseminating maternal related issues. My analysis of maternal songs focuses on the message that these songs intend to promote and show how some of the songs destabilize the otherwise good message in the songs.

3.0 Theoretical framework

The paper has engaged Julia Kristeva’s theory of abject criticism. Basically, abject criticism hinges on the emotional and psychological dimensions of rejection. In Stan Houston’s words the concept leads “to the enlarged notion of social abjection; that is, the ‘othering’ and shaming of social groups which are viewed as anomalous” (2022, p.2314). In my analysis of the songs, the focus will be on the elements that evoke feelings of disgust or discomfort especially on the pregnant woman or pregnancy in general.

4.0 Discussion of findings

The song titled “Amake Mwana Chidodo” literary translated to “A mothers’ delay” is accusatory in nature. Generally, the song is blaming a woman for not following or observing child spacing. Sarcastically, the line “Uku kuli mwana, kunthazi kuli nthumbo” literary translated as “This side, a child, in

front, pregnancy” brings in shame to woman as the only individual who does not take heed of advice given by medical personnel:

Amake mwana chidodo(x3)

Watangwanika(x2) wekha mama

Uku kuli mwana, kunthazi kuli nthumbo

Watangwanika wekha

[Mother of child delays (x3)

Look how busy you are

This side, a child. In front, pregnancy

You are just busy

As shown above, the woman is at the center of the blame game as if child bearing is the preserve of a woman. Generally, the song is able to give the necessary message of encouraging women to adhere to good health practices. As presented in the song, lack of proper child spacing can lead to unnecessary inconveniences to women. Unfortunately, the song portrays a woman feeling the pinch of having too many children because of not adhering to good reproductive practices.

In “Nifwenge ine” literary translated to as “I am dying”, the persona is battling with pregnancy and is afraid of dying. The nurse who is supposed to assist the woman casts everything bad on the pregnant woman. As stated in the song, pregnancy kills the one who is going to deliver not the nurse as the jingle goes:

Nifwenge ine

Nthumbo yukoma mzamba yayi

Nthumbo yukoma mweneko wakubaba

Nifwenge ine

Fwanga!

I am dying

Pregnancy doesn't kill the nurse

Pregnancy kills the owner

I am dying

Die!

The song by nature follows a call and response pattern where the lead singer pretending to be pregnant repeatedly calls out the line “nifwenge” and the audience responds by saying “nthumbo yikukoma mweneko not mzamba” meaning “pregnancy kills the owner not the nurse”. At the end of the song, the lead singer repeats the line “nifwenge” while the rest responds by singing “fwanga” meaning “die”. In the song, the woman is blamed for conceiving and nobody is remorseful in the event that the woman dies. Thus, as shown in the above song, the objective of the song may not be achieved as the content of the song may create unnecessary fear in women. To borrow Munkhondya’s words, (2020) *et al.* women are always “afraid of childbirth complications and uncertain about pregnancy outcomes” (p. 306). Further, “the experience of seeing someone die during childbirth makes them overly anxious” (p.306). One would have expected that through such songs would-be mothers would be equipped with a feeling of “wanting to have a baby and looking forward to the day they would become a mother” despite challenges that are associated with pregnancy (p. 306). However, with sentiments like pregnancy kills the owner not the nurse, “the positive feelings about becoming a mother could temporarily suppress the stress of impending pregnancy and childbirth” (p. 306). The song therefore does not give hope at all by saying pregnancy helps the one who is about to deliver.

Like “Nifwenge Ine” “Amama Nikolani” literary translated to as “Mum hold me, I’m dying”, also portrays a woman at the thick of labour pain is crying for help. In a desperate attempt, she calls out the mother and father for help.

Amama nikolani, nifwenge

Adada nikoleni-nifwenge

Nthumbo ikukoma mzamba yai

Nthumbo ikukana mweneko wa kubaba-nifwenge

Mum hold me, I’m dying

Dad hold me, I’m dying

Pregnancy doesn’t kill a nurse

Pregnancy kills the one who is pregnant-I’m dying

However, in the song, it is stated that pregnancy kills the one who is pregnant not the midwife or nurse. The song, to a large extent, is planting psychological fear in the would-be mother.

In “Wakwawo!” which literary means “Her relatives” it is still the woman that is criticized for bearing more children though the main focus in the song should have been on the woman’s meanness. It is shown in the song that when visitors from her husband calls home, she gives a lot of excuses by

saying that there is no relish but when her relatives visit her home, she provides everything:

Wakwawo! Mbwa! Mbwa! Mbwa! (x2)

Wakuchanalume, dende palije (x2)

Kumanya waka kubaba kweni mbantchewe

Wakuryesha wakwawo pela

[Her relatives! Excited! Excited! Excited!

For her husband's relatives, no relish

She only knows how to bear children but she is selfish

And feeds only her relatives

The issue, in the song, is not entirely about bearing children perse; it is all about how the woman welcomes or treats her husband's relatives. Instead of attending the issue at hand in the song, the song deliberately departs from the issue by sarcastically attacking the woman for bearing more children.

In the song titled "Tilere", meaning "caring children" pieces of advice are given to women to take good care of children because they are future treasures as the song goes:

Tilere (x3) Tilere ana athuwa tilere

Ndi chuma cha mtsogolo tilere

Kulera ine kulera(x2) ana onsewa kulera

Ndikhale wolera ine kulera

Let's observe child spacing

Children are future treasures

Since I have many children

I should observe child spacing]

Since she already has many children, she needs to follow child spacing practices. The woman therefore has no option but to start following modern ways of child spacing so as to take good care of her children. The song is able to live to its expectations as it is able to provide ideas to women a "natural capacity to give birth and instinctively cope, whilst at the same time acting responsibly, through interactions with experts and expert practices (Miller, p. 169)

“Kugeza kuchapa” translated to “Bathing and washing” is one of the songs that generally teaches and encourages mothers to take good care of children. If personal health is adhered to chances are high that diseases can be prevented. The song, even in the way it is sung, does not blame anybody. In the song, the woman is just advising a woman not to compromise on hygiene as stated in the song:

Mama! Kugeza, kuchapa ndiko nkhopwelera mwana

Pala wapwelera mwana nthenda zikuwa zichoko

Pala waleka kupwelera mwana nthenda zikuwa zinandi

Good care of children involves bathing and washing clothes

Diseases are controlled once you take care

Neglecting personal hygiene attracts diseases

In the song, the woman is encouraged to practice good hygiene practices at all times like bathing and washing clothes for the children. By adhering to such practices, the chances of contracting new infections will be minimized as well as focusing “on their children’s well-doing” (Triwahana, T. and Angelianawati, D. 2020, p.77).

There is a portrayal of motherhood in “Rhoda iwe Kaone mwako wakulira” literary translated to as “Rhoda, your child is crying” from an Afrocentric point of view. In the song, women are encouraged to take care of children when they are crying regardless of who the owner of the child is as shown in the lyrics:

Rhoda iwe kaone mwanawako wakulira

Parawakulira mwana wamnyako utole m’babe

Uchembere wako wachizungu ukamuonerenkhu

Zanayo wakulira wakulira

Rhoda-Your child is crying

Get her please, she is crying

If your friend’s child is crying, strap the child on your back

Eurocentric type of motherhood, you can’t see it anywhere

Bring your crying child

Further, as shown in the song, women are also discouraged from adopting European ways of raising a child. In Africa, a child belongs to the community not an individual. Thus, as shown in the song, Rhoda is discouraged from espousing individualistic elements emanating from western societies which do not resonate well with Ubuntu philosophy. According to Abdullah, A., *et al.* (2023), “the norms underpinning Ubuntu philosophy are: mutual support, respect, collective care, collective well-being and compassion (empathy)” (p. 99).

The song titled “Wachitila dala” literary translated as “That’s deliberate” is generally advising a woman to prioritize the welfare of the child than focusing on the needs of a husband when sleeping. It is reckless for a woman to place a man on her bossom/abdomen because chances are high that the woman can conceive as shown in the song:

Wachitila dala

Tola mwana

Tole mwana wike kumongo

Tole dada wike pamoyo

Wamama ni dala ilo

Wachitila dala

Lute ku labour kukababa

Amama ilo nidala ilo

That’s deliberate

Getting a child and placing her on the back

While placing a man on the bossom

That’s deliberate

Going to the labour to deliver

It's deliberate

As shown in the song, blame is on the woman for becoming pregnant. Blame is not well apportioned because the man is absent from the circumstances related to the birth of another child in the family. In line with Samuel Nambile Cumber *et al.* such thinking emanates from parochial thinking in African cultures where issues of pregnancy and maternal health “have predominantly seen and treated as belonging to the female domain, while resource provision belongs to the male domain” (2024, p 2).

5.0 Conclusion

Nine songs were analysed. All the songs carry the vital message of advising women attending antenatal/postnatal clinics on issues of motherhood, good hygiene, and taking good care of children. Out of the nine songs common in all the health centres, two songs do not carry the message of blame on women. These are “Rhoda Mwanawako wakulira” and “Kugeza, Kuchapa” (Personal hygiene). However, what is so disturbing/unsettling in the remaining songs is the way blame is pushed on mothers when there is no child spacing in the family as it is regarded as preserve of women. If the family is bearing more children, all the blame goes to the woman, not the entire family or husband. The woman, therefore is looked at as an abject, for failing to control situations like having more children. Using abject criticism as a focal lens in the study, the study concludes that darker aspects, more uncomfortable aspects of songs, flaws, shortcomings, and potentially off-putting elements in the oral songs sung by women are pushed on the women.

References

- Abdullah, A., *et al.* (2023), “Protective indigenous collective value of ubuntu and child neglect: implications for rural child protection practice”, *Child & Family Social Work*, Vol. 28 No. 4, pp. 1035 -1045. <https://doi.org/10.1111/cfs.13023>
- Chasweka, R., Chimwaza, A. and Maluwa, A. (2018), “Isn’t pregnancy supposed to be a joyful time? a cross-sectional study on the types of domestic violence women experience during pregnancy in Malawi”, *Malawi Medical Journal*, Vol. 30 No. 3, pp.191-204. <https://doi.org/10.4314/mmj.v30i3.11>
- Chikalipo, M., Chirwa, E. and Muula, A. (2018), “Exploring antenatal education content for couples in Blantyre, Malawi”, *BMC Pregnancy and Childbirth*, Vol.18 No.1. pp. 1-14. <https://doi.org/10.1186/s12884-018-2137-y>
- Geubbels E. (2006), “Epidemiology of Maternal Mortality in Malawi”, *Malawi medical journal*, Vol 18 No.4, pp. 206 - 225. <https://doi.org/10.4314/mmj.v18i4.10923>
- Malata, A. and Chirwa, E. (2011), “Childbirth information needs for first time Malawian mothers who attended antenatal clinics”, *Malawi Medical Journal*, Vol. 23 No.2, pp.42 - 47. <https://doi.org/10.4314/mmj.v23i2.70747>
- Miller, T. (2023), “References”, in *Motherhood: Contemporary Transitions and Generational Change*, Cambridge: Cambridge University Press, pp. 169 - 183.
- Munkhondya, B., Munkhondya, T., Msiska, G., Kabuluzi, E., Yao, J. and Wang, H. (2020), “A qualitative study of childbirth fear and preparation among primigravid women: the blind spot of antenatal care in Lilongwe, Malawi”, *International Journal of Nursing Sciences*, Vol. 7 No.3, pp. 303 - 312.

Ngwira, E. (2017), "Daughters of Eve: Portrayal of the female body in selected HIV/AIDS songs in Malawi", *Journal of Humanities*, Vol. 25 No. 1, pp.94 -111.

Nyondo-Mipando, A.L., Chirwa, M., Kunitawa, A. *et al.* (2023), "Uptake of, barriers and enablers to the utilisation of postnatal care services in Thyolo, Malawi", *BMC Pregnancy Childbirth*, Vol. 23 No. 271, pp. 1-15. <https://doi.org/10.1186/s12884-023-05587-5>

Cumber, S.N., Williams, A., Elden, H. and Bogren, M. (2024), "Fathers' involvement in pregnancy and childbirth in Africa: An Integrative Systematic Review", *Global Health Action*, Vol.17 No.1, pp. 1-17. DOI: 10.1080/16549716.2024.2372906

Triwahana, T. and Angelianawati, D. (2020), "Proposing asian and african motherhood through literature: a comparative analysis", *Indonesian Journal of English Language Studies (Ijels)*, Vol 6 No.2, pp. 77- 83. <https://doi.org/10.24071/ijels.v6i2.2859>

Tyler, I. (2009), "Against abjection", *Feminist Theory*, Vol. 10 No.1, pp. 77 - 98. <https://doi.org/10.1177/1464700108100393>

A mixed bag of identities: The British indirect rule policy in colonial northern Malawi, 1933 to the early 1950s

Jamu Nyirenda, PhD

Lecturer, History and Heritage Studies, Mzuzu University, Malawi.

Email: nyirenda.j@mzuni.ac.mw

Abstract

Purpose: This paper discusses the British indirect rule policy in colonial northern Malawi from 1933 to the early 1950s. Notably, the paper analyses the colonial interaction with various African ethnic groups in colonial northern Malawi during that period.

Methodology/approach: This paper relies on archival and written secondary sources.

Findings: The paper finds out that the British indirect rule policy in colonial northern was meaningless among Tonga-speaking people because, traditionally, they were not used to a communal life under chiefs as per the wishes of the colonial administrators while the Ngonde saw no problem with it. Yet for the Ngoni, the indirect rule allowed them to acquire their social identity and self-government status. At the same time, the Tumbuka felt it would help them revive their lost political identity by rallying behind the Chikulamayembe chieftainship.

Discussion: The paper argues that the British indirect rule policy was not uniformly accepted in the region by the major ethnic groups. The paper, thus, observes that African ethnic groups portrayed different identities when the British implemented the policy.

Recommendations: The paper recommends that there is a need to have an extensive understanding of how the British indirect rule policy contributed to multiple identities in colonial northern Malawi which might have a bearing on the present times.

Conclusion: The paper concludes that the British indirect rule policy produced a mixed bag of identities in colonial northern Malawi.

Originality/value of contribution: This paper adds significantly to the growing historical understanding of the complexities involved in identities by using the experiences of colonial northern Malawi as a case study, and in so doing, expanding the broader debates on the history of identities.

Keywords: British, Indirect rule, Colonial northern Malawi, Ethnic groups, Identities.

1.1 Introduction

The British colonised Malawi in 1891 and began administering it until 1964 when Malawi attained her independence. However, this paper focuses on the British colonial interaction with various African ethnic groups in northern Malawi during the indirect rule from 1933 to the early 1950s. The paper argues that African ethnic groups portrayed different identities when the British implemented the indirect rule policy. The paper finds out that the indirect rule policy was meaningless among Tonga-speaking people because, traditionally, they were not used to a communal life under chiefs as per the wishes of the colonial administrators while the Ngonde saw no problem with it. Yet for the Ngoni, the indirect rule allowed them to acquire their social identity and self-government status. At the same time, the Tumbuka felt it would help them revive their lost political identity. The paper, therefore, observes that the British indirect rule policy produced a mixed bag of identities in colonial northern Malawi.

1.2 Problem Statement

In the historiography of Malawi, most earlier scholars focused much on the one-party regime while many other contemporary writers shifted their attention to the multiparty era (Short, 1974) (Lwanda, 1993) (Vail and White, 1989) (McCracken, 2012) (Kayira and Banda, 2022). However, scholars have not focused on the regional identities that might have had a bearing on Malawi's history since the introduction of the British indirect rule policy in colonial Northern Malawi. This study, therefore, aims to fill the gaps regarding the reactions of different identities towards the British indirect rule in colonial Northern Malawi.

1.3 Objectives of the study

This study aims to understand various ethnic identities in colonial Northern Malawi concerning the British policy of indirect rule. Specifically, the study describes the British colonial interaction with various African ethnic groups in northern Malawi during the indirect rule from 1933 to the early 1950s. The paper also analyses the different reactions of those ethnic groups in colonial Northern Malawi to the British indirect rule policy.

2.0 Literature Review

The issue of identity was a dominant feature in the British colonies, not only in Africa but elsewhere in the world. For example, in Sri Lanka, the British policy over identities led to the division between the Sinhalese and the Tamils. The Sinhalese group represented the Christian families who were viewed as the indigenous aristocrats while the Tamils represented the Hindus as the recent immigrants from mainland India (Rogers, 2004) (Sivasundaram, 2010). Regarding Africa, there is now a significant debate among scholars on issues of identities in ethnicity. Some scholars maintain that African societies in pre-colonial times identified themselves based on certain valued customs that

were loosely defined and flexible (Mudenge, 1974) (Beach, 1980) (Isaacman and Isaacman, 2004). Other scholars argue that Europeans invented traditions and imposed them on African societies through Christian missionaries and colonial administrators (Oliver, 1965) (Rotberg, 1965) (Strayer, 1978). (Ranger, 1983, 1989) (Vail and White, 1989) (Ramsay *et al.*, 1996) (Bayart, 2009) (Gallejo and Woodberry, 2010) (Thomson, 2016). This led to the creation of inflexible Western-oriented African societies and traditions at the expense of the then-fluid African cultures.

Concerning Malawi, the colonial authorities worked with some African cultural brokers to create traditional identities throughout the colonial period. For example, the Livingstonia missionaries created a middle class based on Tumbuka identity (Vail and White, 1989) (Forster, 1989) (McCracken, 2012). This was despite some resistance, especially among the Ngonde in Karonga (Kalinga, 1985).

During one-party rule in Malawi from 1964 to 1994, scholars mainly fault Dr. Hastings Kamuzu Banda, Malawi's President, for his divisive politics by promoting Chewa identity at the expense of others (Moyo, 2002) (Mkandawire, 2010). In this regard, some argue that Banda's policies had a bearing on multiparty dispensation as the country was divided into regional lines (Kaspin, 1995) (Osei-Hwedie, 1998) (Thorold, 2000) (Posner, 2004). In the contemporary multiparty dispensation, scholars are concerned with national unity due to the formation of different ethnic associations and identities in Malawi (Kayira *et al.*, 2019) (Lusaka, 2020) (Kayira and P. Banda, 2022). Consequently, the identity issue has been of growing interest. This paper, therefore, focuses much on the struggle for identity during indirect rule in Northern Malawi.

3.0 Methods

This paper uses a historical approach and relies on archival and written secondary sources. On archival sources, the paper focused on the colonial administration files such as minutes, correspondences, and provincial annual reports, among others. Besides, the paper accessed secondary sources such as books, book chapters, and journal articles.

4.0 Results

4.1 The inception of colonial rule in Northern Malawi, 1889-1904

Malawi, formerly known as Nyasaland, came under British protectorate in 1891 just like colonial Botswana and Uganda (Ramsay *et al.*, 1996). Provincial administration in Nyasaland started in 1921 when there were three provinces. The southern province had eight districts, while the central had six and the north had four (MNA: PDA/2//21). By 1963, the Northern province had Karonga, Rumphu, Nkhata-Bay, and Mzimba districts (Haskard, 2005, p.6).

The initial British colonial administrative system in Nyasaland was direct rule (Pachai, 1975, pp. 189-190) (Cammack *et al.*, 2009, pp. 2-3). The direct rule system was also applied by the Germans in their colonies (Iliffe, 1968, pp. 290-311). A direct rule was a system where European administration commanded through levels of ranks of European officials with total control over African affairs such as jurisdiction, tax collection, and African traditional leadership. This was the opposite of an indirect rule where European administrators ruled through African authorities (Curtin *et al.*, 1978, p.475).

In colonial Northern Malawi, the Tonga were the first African community to agree with the British colonial government in 1889. The Tonga chiefs signed a treaty with Alfred Sharpe, a representative of Johnston because they had already noticed the benefits of European education and legitimate trade introduced by the Livingstonia missionaries in their areas. As things were unfolding among the Tonga, the Ngonde people in Karonga were busy fighting against the Swahili Arab slave traders. The Ngonde were helped by Europeans of the African Lakes Corporation who were later joined by the colonial forces sent by Harry Johnston from Zomba. This good gesture by the British colonial army made the Ngonde people easily accept the colonial administration in 1895 (McCracken, 2000). However, the northern Ngoni became the last group in Nyasaland to join the protectorate government in 1904(MNA: S1/61H/32, 1931).

The British colonial rule was delayed by more than ten years among the Northern Ngoni because the Livingstonia missionaries spoke well of the Ngoni's administration. On the other hand, the British colonial administration also feared endangering the lives of the missionaries (who had managed to pacify the Ngoni) if rushed to use force as it did with the Yao and the Maseko Ngoni in the southern part of Malawi (MNA: S1/89F/35, 1934) (MNA: *Periodicals*: 1904). As such, the M'belwa Ngoni were brought under colonial rule by mutual agreement. This was unlike their kinsmen in Tanganyika (modern Tanzania) who were forced to be under the Germans, whereas those under Mpezeni in Chipata (formerly Fort Jameson) became under the British South African Company's administration. Even the Zulu in South Africa were invaded by the British in the late 1800s (Haskins and Biondi, 1995) (Laband, 2009, pp. 51-52). But later, Ngoniland began experiencing some challenges such as the outbreak of the rinderpest disease in 1893 which decimated cattle, an economic livelihood of the Ngoni (MNA: S1/61H/32, 1931). This caused anxiety among the Ngoni, and some began migrating to other areas for economic advancements. For instance, Chief Chimtungwa (who ascended to the throne in 1898 following the death of his father M'belwa I in 1891) moved his villages some forty miles from Hora whereas Chief Mzukuzuku went to Embangweni, and Maurau moved southwards and settled just north of Dwangwa River (MNA: S1/89F/35, 1934). In addition, by October 1903, the colonial government was already eyeing the annexation of Ngoniland for hut tax collection purposes to fund its administration. Subsequently, this idea was facilitated by the Livingstonia missionary, Dr. Robert Laws who asked for the government takeover in Ngoniland in 1903 due to insecurity issues (MNA: *Periodicals*: 1904). As if this was not enough, during the early part of 1904

native police from Chintechi (Nkhata-Bay) entered Ngoniland and began collecting hut taxes and burning villagers (Fraser, 1970, pp.239-241).

The M'mbelwa Ngoni, led by Chimtunga Jere (son of M'mbelwa I) came under the British protectorate rule on 24th October 1904, following a meeting between the then Governor Sir Alfred Sharpe and Ngoni leaders at Ekwendeni, Mzimba district in September 1904. The Ngoni's entry into the treaty agreement with the British administrators can be compared to the British colonial rule in the Bechuanaland Protectorate (modern Botswana) where some Tswana groups incorporated the non-Tswana communities and began representing them to the British colonial government (Nyati-Ramahobo, 2008) (Molosiwa, 2013).

4.2 Indirect rule policy in Northern colonial Malawi

The European colonial masters instituted various political policies in Africa according to their convenience. For instance, the French, Belgians, and Portuguese opted for the assimilation policy where their African subjects were expected to be acculturated into Western values but with variations (Falola, 2002, pp. 189-195) (Parker and Rathbone, 2007, pp. 91-113) (Vanthemsche, 2012, pp.30-32). On their part, the British moved from direct rule to indirect rule policy. The British believed that indirect rule would be cheap and effective in administering large African populations with minimum European personnel (Shillington, 2012).

The British indirect rule policy was first developed in India before spreading to Malaya (Malaysia) by 1874, and thereafter, in Africa. The indirect rule in Africa was initiated by Lord Frederick Lugard who was born and worked in India (Fisher, 1984, pp. 393-424). In 1890, Lugard began experimenting with indirect rule in Uganda (Kiwauka, 1968, pp.312-313). Lugard's experimentation became effective in Northern Nigeria and later extended to other colonies such as the Gold Coast (Ghana), Sierra Leone, and the Gambia (Oliver, 1991, p.213) (Meredith, 2011). The indirect rule rested on the premise that European and African cultures were different, and the best way to govern African communities was through the local government system of administration (Lugard, 1922, p. 94). But powerful chiefs were created in areas without established centralized institutions such as among the Igbo of Nigeria or the Swahili of Tanganyika (Boateng, 2003, pp. 58-59) (Costa, 2000). Following the above context, the indirect rule was also introduced in Nyasaland.

Nyasaland adopted the indirect rule policy from Tanganyika (MNA: S1/539/31, 1931). Tanganyika embraced the policy in 1925 and applied it to stateless peoples by creating councils of headmen (Iliffe, 1979, pp. 207-208). The indirect rule in Nyasaland (especially in the Shire highlands) was a mechanism for the government's greater control over the African economy and society through their traditional chiefs (Power, 2010). However, the Provincial Commissioner of Southern Province on 28 Sept 1931, expressed problems in the application of the indirect rule to districts that had many private estates such as Cholo (Thyolo), Blantyre, Chiradzulu, and even Zomba. As such, he

recommended the indirect rule to Chikwawa, Port Herald (now Nsanje), Mulanje, Fort Johnston (Mangochi), and Liwonde (Machinga) districts but not to those with private estates (MNA: S1/539/31, 1931). The Provincial Commissioner for Northern Nyasaland also noted that application of the indirect rule would be made difficult in the area because the African population was largely detribalised. For example, no agreement could be reached as to how much of the Tumbuka/Henga land had to be occupied by the Ngoni while some Tumbuka/Henga refused to transfer their allegiance to Chikulamayembe from the Ngoniland (MNA: S1/1/33, 1933). The foregoing scenario was also noted by the District Resident of Kasungu where the federation of principal headmen proved to be difficult as people under principal headman Mwase spoke Nyanja while those of Yakobe Jere and Kaluluma spoke Tumbuka (MNA: S1/1/33, 1934). Despite these concerns, the indirect rule policy was enacted in Nyasaland in 1933, and the northern province was not spared.

5.0 Discussion

5.1 The Ngoni identity during the indirect Rule in Mzimba

The establishment of indirect rule in 1933 saw the adjustment of Mzimba district boundaries. For instance, Yakobe Jere (Maurau) now Mabilabo was taken out of Kasungu where he had been since 1922, and joined his brothers in Mzimba while Kaluluma refused to be under Mmbelwa and instead opted to be in Kasungu as was the previous case. On the other hand, Mwamlowe was taken from West Nyasa and Chikulamayembe from North Nyasa to join Mzimba district (MNA: S1/112F/34, 1933).

Politically, the Ngoni felt that indirect rule was a route towards attaining their self-independence status. Therefore, in August 1933, the Ngoni chiefs (through their Jere Council) requested the colonial government to put Lazaro Jere as Mmbelwa II and to be the sole Native Authority in the Ngoni-Tumbuka area. They also requested that Simon Nhlane be replaced by a Jere Chief and Amon Jere be the sole ruler of Ekwendeni and Ezondweni areas (MNA: NNMI/24/11, 1948). Thereafter, the Ngoni began making some political claims in Northern Rhodesia. In 1934, the Ngoni asked the two colonial governments to redefine the boundary between Nyasaland and Northern Rhodesia (now Zambia) so that their fellow Rhodesian Ngoni chiefs Magodi Ndhlovu, Pikamalaza Ziwa, and Mpamba be part of Mzimba. However, the three Ngoni chiefs refused to be reunited under M'mbelwa at a meeting held in Lundazi in Northern Rhodesia (MNA: NNM1/24/10, 1942). With the above experience, the District Resident lamented in the same year that Mzimba lacked a defined policy for guidance which would make it difficult to apply indirect rule (MNA: S1/89F/35, 1934).

In 1938, the Ngoni chiefs asked for self-government based on the 1904 promises after their acceptance to the Protectorate. In the same year, Chief M'mbelwa petitioned the Bledisloe Commission that the area of Northern Rhodesia between the Luangwa River and the Nyasaland border be ceded to

Nyasaland and placed under him based on the glories of the Ngoni's past (Pachai, 1975, pp. 209-212). The Bledisloe Commission was set up by the British government in 1938 for a possible close association between the two Rhodesias (Southern and Northern) and Nyasaland to promote rapid development in these areas (McCracken, 2012, p. 233). In 1939, M'belwa was recognised as Paramount Chief with six subordinate Native Authorities, and his court was constituted as the appeal court for their six courts. It was the same with Gomani of Ntcheu (part of modern central Malawi) and they were the only two rulers in Nyasaland with subordinate Native authorities under them (Read, 1956, p.11). Then in 1942, the Ngoni chiefs adopted their ancestral names such as M'belwa, Mtwaro, Mabilabo, and Mpherembe (MNA: NNM/1/24/11, 1948). In 1952, M'belwa became *Inkosi ya Makhosi* (literally meaning king of kings). In 1953, the Nyasaland protectorate government introduced a system of District Councils where chiefs became members of the district council presided over by a District Commissioner. But in Mzimba, *Inkosi ya Makhosi* M'belwa was recognised as the chairperson and not the District Commissioner (Phiri, 1982). As such, even the council in Mzimba became known as M'belwa District Council in 1962 (Pachai, 1975, pp. 198-200).

Socially, the Ngoni chiefs saw indirect rule as an opportunity to boost the declining Ngoni culture amidst other existing cultures such as those of the Tumbuka, Tonga, and Chewa. They, therefore, restricted all dances which were deemed foreign. Thus 1935, the Ngoni chiefs banned foreign dances like *Vimbuza*, *Mganda*, *Kamchoma*, *Ndolo*, and *Chitivini*. Instead, the Ngoni convinced the colonial administrators that their *Ingoma* dance was dignified. The Ngoni also disallowed any person living in their areas to tattoo-face or any part of the body with 'tribal' marks other than those of the Ngoni marks (MNA: S1/89F/35, 1934).

Economically, the colonial government felt that indirect rule would make chiefs effective in their areas of jurisdiction. As such, in 1937, the colonial administration in conjunction with the Livingstonia Mission conducted a course for selected chiefs at Livingstonia Institution in subjects such as history, governance, agriculture, and judiciary. In addition, in 1940 the colonial government established a ghee industry in the district to induce the Ngoni to exploit cattle resources for economic value. Despite all these efforts, the Ngoni chiefs were unwilling to act as colonial agents for development. Due to worsening economic conditions, many people emigrated from Mzimba to as far as South Africa, Southern Rhodesia, Northern Rhodesia, Portuguese East Africa, Congo, and even Uganda to find fortunes in those countries (MNA: S1/67F/37, 1936).

Generally, it can be argued that the indirect rule in Mzimba district was a mixed bag. For the colonial administrators, indirect rule policy was regarded as a mechanism for controlling Africans through their chiefs while the Ngoni chiefs viewed it as a device for championing their lost past. In short, indirect rule aided the Ngoni political structure to be revered not only by the colonial masters but also by various post-colonial governments.

5.2 The 'individualistic' Tonga in the Indirect rule

In the West Nyasa district (now Nkhata-Bay), the colonial administration struggled to impose an indirect rule policy over the Tonga people. Traditionally, the Tonga were compared with the Irish people who cherished independent life (MNA: S1/61D/32, 1931). It was, therefore, difficult for the colonial administration to manage Tonga as they were not used to being under the authority of anybody, be it a chief or village head (MNA: S1/541/33, 1932). Consequently, it took five years to appoint the Tonga principal headmen when the colonial government created the machinery of appointing principal headmen as their agents in 1912. Thus, in 1917, traditional leaders such as Kabunduli, Mankhambira, Mkumbira, Malenga, Mzoma, and Guru were selected not based on Tonga traditions but upon recommendations by European missionaries, colonial officials among others (Pachai, 1973, p. 192). The above strategy was also witnessed in Nigeria, especially among the Ibo where the British created the warrant chiefs (Cutin *et al.*, 1978, p. 481). Furthermore, in June 1930 the District Officer, H.C. Foulger resolved conflicts between Principal Headmen Guru and Marenga (Tonga representatives of the Kapunda Banda clans) by creating rotational chieftainship succession within the Banda clans (MNA: S1/61D/32, 1931). Later, in 1932, J. O'Brien (the district resident) formed a single native authority called the Council of Atonga Chiefs/Atonga Tribal Council consisting of thirty-two members to prepare the Tonga for the new colonial policy of indirect rule which became effective in 1933 (MNA: S1/80J/36, 1935). However, every year the Tonga chiefs elected the president of the Council on suspicion that he might become a sort of paramount chief (MNA: S1/89J/35, 1934). In this regard, West Nyasa became a good example of the colonial invention of traditions.

Moreover, Tonga chiefs struggled to control their subjects because of their individualism as observed above. Usually, the Tonga became resentful of discipline by moving from one village headman to the other. It was only in Kabunduli's area that people were law-abiding with exception of tax collection. Tax evasion was high among the Tonga as most hid themselves in forests or mountains. Kabunduli was even praised by the administrator, M. C. Hoole of West Nyasa in 1934 for his control over people. However, this was attributed to the fact that his father was a Ngoni and not a Tonga (MNA: S1/89J/35, 1934).

Concerning the above observation, an inference can be made that the colonial administration failed to execute its indirect policy among the Tonga. As a result, in 1948, the colonial government dissolved the Atonga Tribal Council. This led to the creation of two new Native Authority areas, one under Chief Mankhambira (North of Luweya River), while the other was under the District Commissioner working through several group councils. (Hailey, 1950, pp. 34-35). Therefore, indirect rule failed to impact the Tonga.

5.3 North Nyasa district and the Tumbuka problem in the indirect rule

In the North Nyasa district, the indirect rule policy brought a lot of complications. The Ngonde people accepted the indirect rule despite having sour relations with the non-Ngonde ethnic groups. The problems emanated from the pre-colonial period where some Tumbuka/Henga sought refuge among the Ngonde after fleeing from the Ngoni in the 1880s. Thereafter, these Tumbuka/Henga sided with the Swahili-Arab traders who were enslaving the Ngonde. The situation created deep enmity between the above groups (Thompson, 1981, p.27). There were also resentments from non-Ngonde traditional authorities such as sub-chiefs Mwenewenya and Nthalire who preferred the Tumbuka language over the Ngonde (MNA: S1/89G/35, 1934). On their part, the Ngonde chiefs were also hostile to the teaching of Tumbuka in schools (MNA: S1/54J/33, 1932). The above enmity was aggravated further by the Livingstonia missionaries who elevated the Tumbuka language to be the language of communication in the Northern region. To the Ngonde, it was unacceptable to learn and speak the language of the refugees.

The British colonisation of North Nyasa, however, provided an opportunity for the Tumbuka to assert their political consciousness. The Tumbuka began rallying themselves on the defunct Chikulamayembe dynasty of the Balowoka abolished by the Ngoni in the 1880s. Consequently, in 1907, the Tumbuka convinced the British colonial government and revived the Chikulamayembe dynasty. In this regard, two candidates were proposed, Chilongozi Gondwe and Peter Masanga, but the preference went for Chilongozi because he was educated and would understand Europeans (Pachai, 1973, p. 12). His appointment initiated the revival of Tumbuka consciousness through the Tumbuka-Nkhamanga empire. This consciousness was elevated by the Tumbuka history written by Saulosi Nyirenda whose relative was Chilongozi Gondwe's second wife (Vail and White, 1989, p. 155). Afterward, Andrew Nkhonjera wrote a similar history of the Chikulamayembe chieftainship. Subsequently, Thomas Cullen Young (a Livingstonia missionary) expanded Nyirenda's work and claimed that the Chikulamayembe dynasty ruled the Tumbuka from the Songwe River in the north to the Dwangwa River in the south (Forster, 2003). This history convinced the colonial government to form an independent Tumbuka district from North Nyasa and other surrounding districts.

In support of the above, in 1928, the land commission in North Nyasa recommended the formation of a new district (*boma*) in the Henga Valley under the Tumbuka leadership. As arrangement for the indirect rule was underway, the British government planned to create a Tumbuka/Henga district from the North Nyasa district especially southern Karonga (Mwafulirwa section), then northern parts of Mzimba district (sections of Mtwalo and Mpherembe) and West Nyasa (sections of M'bwana and Mlowe) (MNA: S1/1631/29, 1929). The climax of the Chikulamayembe's claims and identity continued after the death of Chilongozi Gondwe on 18 April 1931. John Gondwe (son of the deceased) succeeded his late father despite many Tumbuka elders supporting Gogoti Gondwe as per Tumbuka traditions of

rotational succession. However, Reverend Edward Boti Manda who was very influential in the Livingstonia Mission bulldozed John Gondwe's name (MNA: S1/61G/32, 1931). This made the new Chikulamayembe (John Gondwe) lose the confidence of his elders (MNA: S1/89F/35, 1934).

After John Gondwe became chief Chikulamayembe the tenth, he began claiming paramount chieftaincy over other Tumbuka chiefs (*mathemba*). Some Tumbuka chiefs such as Katumbi, Mwafulirwa, and M'bwana were put off by Chikulamayembe's claim of his seniority. This compelled the Mwafulirwa section to remain in Karonga with Kyungu despite the Mkandawire clan wanting to join Chikulamayembe. Even Chief M'bwana of Usisya and Chigwere of Ruarwe opted to be in West Nyasa (MNA: S1/89F/35, 1934). Katumbi pressed for autonomy and was granted his independence of Chikulamayembe in late 1933 (MNA: S1/67F/37, 1936). On their part, the Ngoni refused to give some of their areas to the new proposed district. Since the area under Chikulamayembe was too small to become a district, the colonial government transferred Chikulamayembe in 1933 from North Nyasa to Mzimba District where it remained until the 1950s when Rumphu District was formed (MNA: S1/112F/34, 1933) (MNA: S1/112G/34, 1933).

Conflicts within Tumbuka/Balowoka persisted following the creation of the Chikulamayembe dynasty. For example, in 1934, there was an advocacy to revert the chieftainship to the original owners, the Tumbuka, and not the Balowoka. In the Henga Valley, Chief Mwankhunikira claimed to be the primordial Tumbuka occupant of the land over the intruders of the Balowoka of the Hango clan under Mwahenga. Subsequently, Mwamlowe wanted to return to Chintheche (West Nyasa) district in 1936 (MNA: S1/67F/37, 1936). In addition, the Tumbuka continued pestering other groups, especially the Ngoni to resurrect the long-deceased Tumbuka chieftaincies. For example, in 1958 the agitation erupted in Ngoniland which led to the deportation of many Tumbuka to Northern Rhodesia's Lundazi (Vail, 1978, pp. 1-19). Tumbuka nationalism was revived again in 1959 by James Dokowe, the grandson of Baza Dokowe and others but failed (Pachai, 1975, pp. 206-207).

Despite all the above efforts, the Tumbuka people failed to form a unified political identity in colonial Northern Malawi. Consequently, the colonial administrators failed to invent the Tumbuka political system, but they only sustained the Tumbuka language identity, which was already propagated by their counterparts, the Scottish missionaries.

6.0 Conclusion

The paper has observed that the British policy of indirect rule became ineffective in colonial Northern Malawi since no proper mechanisms were put in place. The indirect rule was, therefore, interpreted differently by various African groups. For Tonga, indirect rule was meaningless as traditionally they did not cherish a communal life under chiefs as per the wishes of the colonial administrators while the Ngonde saw no problem with it. Yet for the Ngoni, indirect rule was an opportunity for them to acquire self-government status,

while the Tumbuka felt it would help them revive their lost political identity. The paper has also noted that the Tumbuka people could not be united under Chikulamayembe. Most Tumbuka traditional leaders perceived Chikulamayembe as a colleague and not their superior. The paper, therefore, concludes that the British indirect rule policy produced a mixed bag of identities in colonial northern Malawi. The paper advances a need for an extensive understanding of how the British indirect rule policy contributed to multiple identities in colonial Northern Malawi which might have a bearing on modern times. This paper, therefore, adds significantly to the growing historical understanding of the complexities involved in identities by using the experiences of colonial Northern Malawi.

References

Archival sources

Malawi National Archives (hereafter MNA): PDA/2/2/1, (1891-1963), Provincial and District Administration.

MNA: Periodicals, (1904), Livingstonia Mission: Letters to the Sub-Committee, First Quarter.

MNA: S1/1204/19, (1919-20), District Administration Annual Reports, West Nyasa.

MNA: S1/1631/29, (1929), Native Administration of the North Nyasa District, district notes.

MNA: S1/539/31, (1931), Tanganyika Report: On Native Administration in Tanganyika.

MNA: S1/61D/32, (1931), District Administration Annual Reports, Chintcheche.

MNA: S1/61G/32, (1931), District Administration Annual Reports, Karonga.

MNA: S1/61H/32, (1931), District Administration Annual Reports, Mzimba.

MNA: S1/54I/33, (1932), District Administration Annual Reports, West Nyasa.

MNA: S1/54J/33, (1932), District Administration Annual Reports, Karonga.

MNA: S1/1/33, (1933), Proposed Activation of District Boundaries in the Northern Province.

MNA: S1/112F/34, (1933), District Administration Annual Reports, Mzimba.

MNA: S1/112G/34, (1933), District Administration Annual Reports, North Nyasa.

MNA: S1/89F/35, (1934), District Administration Annual Reports, Mzimba.

MNA: S1/89G/35, (1934), District Administration Annual Reports, North Nyasa.

MNA: S1/89J/35, (1934), District Administration Annual Reports, West Nyasa.

MNA: S1/1/33, (1934), Proposed Activation of District Boundaries in the Northern Province.

MNA: S1/89F/35, (1934), District Administration Annual Reports, Mzimba.

MNA: S1/80J/36, (1935), District Administration Annual Reports, West Nyasa.

MNA: S1/67F/37, (1936), District Administration Annual Reports, Mzimba.

MNA: NNM1/24/10, (1942), Mzimba District Book, Volume 1.

MNA: NNMI/24/11, (1948), Mzimba District Book.

Secondary sources

Bayart, J. (2009) *The state in Africa: The Politics of the Belly*, Cambridge: Polity.

Beach, D. (1980) *The Shona and Zimbabwe, 900-1850: An outline of Shona History*, London: Heinemann.

Boateng, C. (2003) *The Political Legacy of Kwame Nkrumah of Ghana*, New York: The Edwin Mellen Press.

Cammack, D. *et al.*, (2009), "Town Chiefs' in Malawi", *Working Paper*, No. 3, pp. 2 - 3.

Costa., A. (2000), "Chieftaincy and Civilisation: African Structures of Government and Colonial Administration in South Africa", *African Studies*, Vol. 59 No.1, pp. 13-27.

Curtin P. *et al.* (1978) *African History*, London: Longman.

Falola, T. (2002) *Key Events in African History: A reference guide*, Westport: Greenwood Press.

Fisher, M. (1984), "Indirect Rule in the British Empire: the foundations of the residency system in India (1764-1858)", *Modern Asian Studies*, Vol. 18 No. 3, pp. 393 - 428.

Forster, P. (2003) *T. Cullen Young: Missionary and anthropologist*, Blantyre: Christian Literature Association in Malawi.

Fraser D. (1970) *Winning a primitive people*, Westport: Negro Universities Press.

- Gallejo F. and Woodberry, R. (2010), "Christian Missionaries and Education in Former African Colonies: how completion mattered", *Journal of African Economies*, Vol. 19 No. 3, pp. 294 – 329.
- Green, E. (2011), "Indirect Rule and Colonial Intervention: Chiefs and Agrarian Change in Nyasaland, ca. 1933 to the Early 1950s", *The International Journal of African Historical Studies*, Vol. 44 No. 2, pp. 249 - 274.
- Hailey, W. (1950) *Native Administration in the British African Territories, Part II. Central Africa: Zanzibar, Nyasaland, and Northern Rhodesia*, London: His Majesty's Stationery Office.
- Haskard, C. (2005), "Mzuzu: Recollections of Early days", *The Society of Malawi Journal*, Vol. 58 No 1, pp. 6 -13.
- Haskins J. and Biondi, J. (1995) *From Afar to Zulu: a Dictionary of African Cultures*, New York: Warkner and Company.
- Iliffe, J. (1979), "The Creation of Tribes", Iliffe J. (Ed.), *A Modern History of Tanganyika*, Cambridge: Cambridge University Press.
- Iliffe, J. (1968), "Tanzania Under German and British Rule", in Ogot, B. and Kieran, J. (Eds.), *Zamani: a survey of East African History*, Nairobi: East African Publishing House Ltd, pp. 290 - 311.
- Isaacman, A. and Isaacman, B. (2004) *The Making of Men and Chikunda Ethnic Identities in the Unstable World of South-Central Africa, 1750-1920*, Portsmouth: Heinemann.
- Kalinga, O. (1985), "Colonial Rule, Missionaries and Ethnicity in North Nyasa District, 1891- 1938", *African Studies Review*, Vol. 28 No. 1, pp. 57 - 68.
- Kaspin, D. (1995), "The Politics of Ethnicity in Malawi's Democratic Transition", *The Journal of Modern African Studies*, Vol. 33 No. 4, pp. 595 - 620.
- Kayira, G. and Banda, P. (2022), "Ethnicity, Regionalism, and Nation-Building Challenges in Post-1994 Malawi: whither a Federal State System?", in Ross, K. et al. (Eds.) *Beyond Impunity: New Directions for Governance in Malawi*, Cape Town: University of Cape Town Press with Mzuni Press, pp. 282 - 305.
- Kayira, G. et al. (2019), "Ethnic Associations and Politics in Contemporary Malawi", *Journal of Eastern African Studies*, Vol. 13 No. 4, pp. 718 - 738.
- Kiwanuka, M. (1968), "Uganda Under the British", in Ogot, B. and Kieran, J. (Eds.), *Zamani: a survey of East African History*, Nairobi: East African Publishing House Ltd, pp. 312 - 333.
- Laband, J. (2009) *Historical Dictionary of the Zulu Wars*, Toronto: The Scarecrow Press.

Lugard, F. (1922) *The Dual Mandate in British Tropical Africa*, Edinburgh and London: William Blackwood and Sons.

Lusaka, M. (2020), "Dividing the nation or promoting unity? Ethnic based associations and production of heritage in Malawi", in Ross K. and Mulwafu W. (Eds.), *Politics, Christianity and society in Malawi: Essays in honour of John McCracken*, Mzuzu: MZUNI Press, pp. 372 - 395.

Lwanda, J. (1993), *Kamuzu Banda of Malawi: a study in promise, power and paralysis*, Dudu Nsomba Publications, Glasgow.

McCracken, J. (2012) *A History of Malawi 1859-1966*, Woodbridge: James Currey.

McCracken, J. (2000) *Politics and Christianity in Malawi: Impact of Livingstonia Mission in the Northern Province, 1875-1940*, Blantyre: Christian Literature Association in Malawi.

Meredith, M. (2011) *The Fate of Africa: A History of the Continent Since Independence*, New York: Public Affairs.

Mkandawire, B. (2010), "Ethnicity, Language, and Cultural Violence: Dr. Hastings Kamuzu Banda's Malawi, 1964-1994", *The Society of Malawi Journal*, Vol. 63 No.1, pp. 23 - 42

Molosiwa, P. (2013), "The tragedy of the Ababirwas": cattle herding power and the socio-environmental history of the ethnic identity of the Babirwa in Botswana, 1920 to the Present", PhD Thesis, University of Minnesota.

Moyo, T. (2002), "Language Politics and National Identity in Malawi", *South African Journal of African Languages*, Vol. 4, pp. 262 - 272.

Mudenge, S. (1974), "An Identification of the Rozvi and its implication for the history of the Karanga", *Rhodesian History*, Vol. 5, pp. 19 - 30.

Nyati-Ramahobo, L. (2008), "Minority tribes in Botswana: The politics of recognition", *Minority Rights Group International*, p. 3.

Oliver, R. (1991) *The African Experience*, New York: Harper Collins Publishers.

Oliver, R. (1965) *The Missionary Factor in East Africa*, London: Longman.

Osei-Hwedie, B. (1998), "The Role of Ethnicity in Multi-Party Politics in Malawi and Zambia", *Journal of Contemporary African Studies*, Vol.16 No. 2, pp. 228 - 247.

Pachai, B. (1975), "African Initiatives in Local Administration: the case of the M'mbelwa African Administrative Council", in MacDonald, R. (Ed.), *From Nyasaland to Malawi*, Nairobi: East African Publishing House, pp. 189 - 212.

Pachai, B. (1973) *Malawi: The History of the Nation*, London: Longman.

Parker J. and Rathbone, R. (2007) *African History: a very short introduction*, Oxford: Oxford University Press.

Phiri, D. (1982) *From Nguni to Ngoni: A History of the Ngoni in Malawi, Zambia, and Tanzania*, Limbe: Montfort Press.

Posner, D. (2004), "The Political Salience of Cultural Difference: Why Chewas and Tumbukas are Allies in Zambia and Adversaries in Malawi", *The American Political Science Review*, Vol. 98 No. 4, pp. 529 - 545.

Power, J. (2010) *Political culture and nationalism in Malawi: Building Kwacha*, Rochester: University of Rochester Press.

Power, J. (1992), "Individualism is the Antithesis of Indirect Rule: Cooperative Development and Indirect Rule in Colonial Malawi", *Journal of Southern African Studies*, Vol. 18 No. 2, pp. 317-347.

Ramsay, J. et-al. (1996) *Building a Nation: A History of Botswana from 1800 to 1910*, Gaborone: Longman.

Ranger, T. (1989), "Missionaries, Migrants and the Manyika: the invention of Ethnicity in Zimbabwe", in Vail L. (Ed.), *The Creation of Tribalism in Southern Africa*, California: James Currey Ltd, pp. 118-145.

Ranger, T. (1983), "The Invention of Tradition in Africa", in Hobsbawn E. and Ranger T. (Eds.), *The Invention of Tradition*, Cambridge: Cambridge University Press, pp. 211-262.

Read, M. (1956) *The Ngoni of Nyasaland*, Oxford: Oxford University Press.

Rogers, J. (2004), "Early British Rule and Social Classification in Lanka", *Modern Asian Studies*, Vol. 38 No. 3, pp. 625-647.

Rotberg, R. (1965) *Christian Missionaries and the Creation of Northern Rhodesia, 1880 - 1924*, New Jersey: Princeton University.

Shillington, K. (2012) *History of Africa*, London: Macmillan.

Short, P. (1974) *Banda*, London and Boston: Routledge and Kegan Paul.

Sivasundaram, S. (2010), "Ethnicity, Indigeneity, and Migration in the Advent of British Rule to Sri Lanka", *The American Historical Review*, Vol. 115 No. 2, pp. 428 - 452.

Strayer, R. (1978) *The Making of Mission Communities in East Africa*, London: Heinemann.

Thompson, J. (1981), "The origins, migration and settlement of the Northern Ngoni", *The Society of Malawi Journal*, Vol. 34 No. 1, pp. 6 - 35.

Thomson, A. (2016) *An Introduction to African Politics*, New York: Routledge.

Thorold, A. (2000), "Regionalism, Tribalism and Multiparty Democracy: The case of Malawi", *South African Journal of International Affairs*, Vol. 7 No 2, pp. 135 - 139.

Vail, L. and White, L. (1989), "Tribalism in the Political History of Malawi", in Vail, L. (Ed.), *The Creation of Tribalism in Southern Africa*, London: James Currey, pp. 151-184.

Vail, L. (1978), "Ethnicity, Language and National Unity: the case of Malawi", African Studies Institute, University of Witwatersrand, pp. 1-19.

Vanthemsche, G. (2012) *Belgium and the Congo, 1885 -1980*, Cambridge: Cambridge University Press.

Salvaging Heritage in Soil Archives: Striking a balance between Development concerns and Heritage Preservation

Aaron Khombe

MA Student (African History and Heritage Studies), Mzuzu University, Malawi.

Email: akhombe@gmail.com

Abstract

This paper calls for the creation of a critical mass to demand the screening of the soils before permanent land transforming activities are executed. This research uses a historical approach to uncover the past through use of development projects have been used to assess their sensitivity to the soil archives. Oral interviews purposively executed were also done with developers, government officials and consultants. Besides, primary and secondary sources of information have been utilised to assess the historical record. Drawing on two case studies of development projects in Lilongwe, this paper argues that if heritage professionals do not step in to call for screening of development areas for their layers of the rich past, Malawi stands to lose out in learning about its distant past. Malawi is developing at a very fast rate. The soil archives are being disturbed and covered under concrete eternally burying and disturbing the archaeological record. This paper, therefore, makes a contribution to our understanding of how archaeological methods can be employed to rescue Malawi's heritage in the midst of development projects.

Keywords: Soil archives, archaeology, heritage, history, Lilongwe, development

1.1 Introduction

The African Past is the longest as the Cradle of Humankind (Shillington, 1995). Humans have been on the scene since the Paleolithic Era. As such, historical materials (archival documents) are inadequate to help in the reconstruction of the human record beyond 5000 years. To reconstruct the human record beyond oral and written records, historians have to turn to the archaeological record – the soil archives or the archaeological archives. This record comes to light through scientific recovery from the ground through excavations and archaeological surveys, as well as accidental discoveries, often during, illegal looting and industrial activity. It is the last activity that is very worrisome as it destroys the context of the materials and renders their study futile. Malawi is seeing a lot of developments that are permanently altering the landscape, with Lilongwe City in the lead. Lilongwe became a boma in 1902, a town in 1947 and a city in 1975. To create the capital, villages were moved out of the four designated zones of the city namely Old Town, City Center, Kanengo and Lumbadzi. At independence, the urbanisation level in Malawi was at 5% and about three-quarters of the whole urban population was living in the three cities of Lilongwe, Zomba and Blantyre (Potts, 1985). From 1966 to 1977 there was a rapid 8% growth of population in all the cities

(ibid). Urbanisation rate has further accelerated since 2005 with the transfer of all government offices into Lilongwe.

However, Lilongwe has several heritage layers created over time by successive occupations since the Stone Age. This means that the soils have a lot of cultural resources that it has archived. These cultural resources buried in the ground can contribute enormously to opening up new frontiers of Malawian history. They can tell the secrets of the past from prehistoric periods. However, where developments take place without proper regard to these resources, the world would be denied prosecuting shreds of evidence of the existence of a rich and diverse Malawian cultural past. It is for this reason that this paper proposes for the creation of a critical mass of historians, archaeologists, heritage professionals and cultural practitioners that has to demand for the screening of the soil archives before development works start. It is only where such a mass exists that Malawi's history and heritage can better be identified, conserved and promoted for posterity.



Figure 1: Arrows found in burials at Mtemankhokwe

1.2 Problem Statement

Potential challenges of cultural heritage resources in various landscapes due to permanently land-altering development projects are not adequately considered in heritage management planning processes. Most development projects are blind to heritage resources buried in the ground. Developing countries are striving to turn their nations into middle-income status as they endeavour to improve the standards of living for their people. To this end, they have sought to attract new investments and also embarked on accelerated development programmes meant to provide basic infrastructure for their citizens (Kiriama et. al, 0000). Developments of various types are encouraged towards this end. These developments inevitably lead to modifications to the natural and cultural environments. In order to mitigate for such changes, most African countries have legislated environmental laws to provide guidelines for all developments that may change the social, cultural and natural environments (ibid). These environmental legislations require the

implementation of an Environmental Impact Assessment for all development projects. However, few of these projects have included cultural heritage as a component of the environment that needs to be studied (ibid).

The absence of a grouping that can demand the screening of the soils before development projects are done contributes to the destruction and loss of history and heritage. According to the Merriam Webster online dictionary, the term critical mass refers to or means a size, number, or amount large enough to produce a particular result. Where a critical mass exists it becomes easy to push for a particular result. When the Six-Lane Road was launched in Lilongwe, environmental experts rose up in unison to push for environment impact assessment for the project. As a result, the project stopped, even though it was launched by the President of the Republic of Malawi until such studies as ordered were fulfilled. Heritage was not part of this study unfortunately because no such mass exists for the heritage of Malawi hence construction vehicles continue to disturb, destroy and bury heritage under concrete and/or tarmac.

1.3 Objectives/research questions

The general objective of this research project was to examine the extent to which infrastructure development of Lilongwe has taken into account the identification and protection of the country's history and heritage.

1.3.1 Specific Objectives

- i. To assess the potential of the Malawi soil archives for cultural resources worth identifying
- ii. To explore how infrastructure developments threaten Malawi's history and heritage
- iii. To examine how the lack of a history and heritage critical mass leads to the destruction and loss of heritage

These objectives were explored with the following research questions:

1. Do the Malawi soil archives have rich cultural resources worth identifying?
2. How do land altering projects affect the soil archives?
3. Does the lack of a critical mass affect the identification and preservation of heritage and history?

2.0 Literature Review

African heritage issues came to the fore in academic discourse during the independence era. Heritage was identified and promoted to achieve national unity (Peterson, et. al, 2015). During this time, African countries made

legislation to identify, conserve and promote their heritage resources. In Malawi, for instance, the Monuments Act was enacted in 1965 which was to be executed by the Department of Antiquities. The Nubia incident (from the early 1950s to 1960s) awakened the issue of the conservation of heritage sites especially in light of developments. The Egyptian Government wanted to build a new Aswan High Dam in the Valley of Kings to enhance economic development. This part of Egypt, however, had famous monuments such as the temples of Abu Simbel and the temple complex of Philae hence there was public outrage against the project.

Consequently, the project created awareness about the effects of large-scale development projects on heritage assets. It also led countries of the world to realise that loss of heritage in one country leads to a loss of universal human history and this ultimately led to the adoption of the 1972 UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage (Prott, 1993; Smith, 2006; Kiriyama, et. al 2010; Avrami, et. al, 2000). With this instrument the World Heritage List was established to document all sites and monuments with Outstanding Universal Values (OUVs). Listed sites were to be regarded as sites for all humanity because their values transcended national boundaries. The whole world has an interest in what happens to and in that site. The Convention, therefore, has means of technical periodic monitoring and reporting to ensure that the sites maintain their integrity and authenticity.

Over 130 sites have so far been inscribed on the List with Malawi having two sites Lake Malawi National Park World Heritage Site (1984) and Chongoni Rock Art Area World Heritage Site (2006). All listed sites are protected by the World Heritage Centre from all sorts of threats - human-induced or natural and a fund is made available for conservation purposes. With the World Heritage Sites protected, this leaves the entire landscape at the mercy of national legislation and institutions to protect. As observed by Arazi (2011) cultural heritage management in Africa often leaves out archaeological sites except for those inscribed on the World Heritage List. She, therefore, notes that a real threat to the continent's archaeological resources is Africa's current infrastructure boom. The cultural heritage dimension of development was put back on the international agenda in the early 1980s by the United Nations and UNESCO. This led to the creation of the World Commission for Culture and Development. In its 1995 report, the Commission stated that culture is the basis for all human development and that sustainable development and the flourishing of culture are interdependent. This led to the efforts to link culture to development. In 1992, the World Bank organised a conference under the theme "Culture and Development" at which archaeologists and heritage professionals met to link the two and chart the way forward.

According to Eboreime (2009) development and heritage conservation are not necessarily antagonistic they can rather be mutually reinforcing. He argues that many archaeological sites in Africa were discovered in the course of excavations for development projects such as railway and road building,

mining and water supply. Various literature shows that this is not a problem isolated to Africa in space and time. Prott, (1993) states that during the construction of Anglesey Airport in the United Kingdom during the World War II a Celtic sacrificial site was exposed. Some rescue was done but whatever remained of the Celtic art was buried under tons of concrete. In Italy, a similar incident happened during the construction of Fiumicino airport. Several historic shipwrecks and wharf areas were discovered in the old Roman port of Ostia. Chirikure (2014) explains that on April 1, 2008, excavations for diamond mining in Namibia exposed a 500-year-old Portuguese shipwreck that lay forgotten on the Atlantic seabed near the southern Namibian town of Oranjemund.

The African landscape, in general, is very rich as successive generations have lived on it from time immemorial. Studies done by several researchers in Malawi have uncovered many sites in various parts of the country (Cole-King, 1973; Robinson, 1982; 1970; 1979; 1977; 1973). Cultural resources that have helped to reconstruct the Malawian past have been harvested and analysed revealing the Middle and Late Stone Age and Iron Age cultures. Recent works in Mzimba District under the Malawi Ancient Lifeways and People's Project (MALAPP) have shown that Malawi has a lot to offer from her remote past through its landscape. Ostrich egg shells have been excavated in some sites in Mzimba which helps us peep into the paleo-environment of ancient Malawi which supported such birds now extinct. The Malawian landscape, therefore, needs protecting and putting in place mechanisms that would help find out what is buried underneath it - this motive spurred this research.

However, cultural heritage protection is faced with the question of what to conserve as it is argued that it is impossible to preserve everything (Costin, 1993). This kind of thinking has led to the destruction of heritage resources. However, such decisions have been made based on value or interest of the heritage resource in the present regardless of how that outlook may be viewed in the future. Values and interests change over time reflecting the current political, social and economic climate (ibid). These changes have also been seen in professional archaeologists who in the past were much interested in big and complex sites for their work. But today, all sites whether large or small are recognised as bearing significant information about the past. Costin (1993) argues that it is from the small sites that we gain information about the daily life of the peasants, fisherfolk, herders and craftspeople who sustained great cultures. In light of this, all bare lands are possible sites for historical study hence care must be taken to minimise permanent alteration, a proposal that this research advances.

Lilongwe, which is my study area for this research, started growing in 1902 when it was set up as a boma (Crosby, 1980). This declaration of a boma meant that administrative offices were erected and necessary facilities for a boma were put in place around Bwaila. There were five Principal Headmen that were recognised at this early stage viz Chimdidi who was on the side of Lumbadzi; Matanda on the Bua side bordering Nambuma River; Masumba on the road to Fort Manning (now Mchinji) bordering Namitete River; Masula who

had the biggest area of what is today Old Town up to Diamphwe River to the south; and Mazengela who bordered Chimdidi to the north, Masula to the west and his area extended to the confluence of Diamphwe and Linthipe River (Lilongwe District Book, 1907). By 1939 Lilongwe had grown big with nine Native Authorities and three Sub Native Authorities (SNA) namely Khongoni with SNA Kabudula; Chitukula; Chimutu; Mazengera; Kalumbu with SNA Tsabango; Kalumba with SNA Njewa; Chadza with SNA Malili; Masula; and Kalolo (ibid).

Later its importance grew as it was on the crossroads of a number of roads (Crosby, 1980). Agricultural produce especially tobacco further gave the Lilongwe significance. In 1923 trials for tobacco cultivation with seeds supplied by Mr. Baron of Mbadzi Estate was started which proved successful hence the Imperial Tobacco Company established a station in Lilongwe in 1930. The construction of a Roman architecture brick bridge to connect Lilongwe to the south of Nyasaland in 1924 over Diamphwe River attests to this (Antiquities, File No. A.II.4.13). The 1947 declaration over Lilongwe to the status of a town is testimony to its growth. However, infrastructural developments started to grow very fast in Lilongwe with its declaration as a capital city (Malawi: Lilongwe Urban Profile, 2011). At independence, the urbanisation level in Malawi was at 5% and about three-quarters of the whole urban population was living in the three cities of Lilongwe, Zomba and Blantyre (Potts, 1985). From 1966 to 1977 there was a rapid 8% growth of population in all the cities (ibid). Urbanisation rate has further accelerated since 2005 with the transfer of all government offices into Lilongwe.

Many villages were relocated to pave way for development of the capital city. These villages left their cultural resources such as graves one of which was exposed during six-lane road construction from Parliament Roundabout to Lizulu Market. Other heritage layers of Lilongwe are recorded by Cole-King (1973) during his 1970 survey. He found out that Lilongwe was occupied since the Stone Age with evidence along Lingadzi steam, along the Lilongwe – Dowa M1 Road, Lilongwe – Likuni Road, Chimutu and Lilongwe old aerodrome (Kukumba Mbiri, 1973). All these finds from the prehistoric era through the historic settlements of Malawi to the colonial epoch inspire this research for the study of Lilongwe's cultural landscape before land-altering development projects take place. A number of heritage layers have been created by these historical developments that require study and preservation for posterity.

With all this rich history, developments in Lilongwe continue to be done without regard to its care. This is happening even though major development funders like European Union and African Development Bank all have safeguard policies to protect cultural heritage found in areas where their money is used.

3.0 Methodology

This research made use of different historical modes of inquiry such as desk research, interviews, fieldwork, archival and library research. This was done in the context of two case study projects within Lilongwe which were the

construction of an interchange and the six-lane road. In summary, the researcher used both primary and secondary research. Dawson, (2009) defines primary research as research that involves the study of a subject through first hand observation and investigations. This source is useful where it is difficult to find previously published material about a subject under study as is the case with this study. Sources of background information for primary research includes researcher experience, organisation records, interviews with relevant people and researcher observation. The researcher has some considerable experience in heritage conservation having worked with the Department of Museums and Monuments (formerly the Department of Antiquities) for over ten years. The experience gained was very helpful in providing background information for this research. Organisation records for several institutions were accessed to help in the background information. The researcher consulted records at the National Records and Archival Services (NRAS) in Zomba; oral records and files in the library and registry for the Department of Museums and Monuments (DMM) in Lilongwe; and records of Environmental and Social Impact Assessments (ESIA) reports of some client agencies. At the NRAS and DMM, the researcher found records about Lilongwe and its history. The NRAS native district book volumes for Lilongwe were of great use for the early history of Lilongwe. The DMM records also furnished the researcher with records of archaeological and historical sites. Further, at DMM the researcher got the policy and legislative frameworks that are used for the protection of heritage resources in Malawi.

On the other hand, Dawson defines secondary research as a study that involves the collection of information from studies that other researchers have made available on the subject. Therefore, this study made use of books, journal articles, newspapers, conventions and Environmental and Social Impact Assessment (ESIA) documents. The researcher used internet sources for relevant books, ESIA reports and journal articles through such archives like Anna's Archive. The NRAS collection of newspapers informed this research as well. Through the newspapers, the researcher found articles on the developments that were taking place in Lilongwe and how they were done. Clients of development projects within Lilongwe shall be consulted to make available project reports from which an assessment of their sensitivity to heritage shall be made.

Finally, oral interviews were done with at least eight participants. Two participants were from project clients for projects in the four Lilongwe development areas. Formal letters were prepared to invite them for the interview. Client employees who deal with social safeguards or communication were the ideal interview candidates. Two other participants were people with information about Lilongwe and its early history. These were gotten through the Friends of Lilongwe grouping which is led by Chief Chigoneka. Through these informants this research got information about sensitive heritage areas such as graves of their forbears. Another two participants were heritage practitioners. These were former employees of the Department of Antiquities who retired at senior management levels. This research got insight into the operations of the Department of Antiquities in its

heritage preservation programmes and the challenges they faced in this regard. The last two informants were officers; one from DMM, and one each from MEPA, Lilongwe City Assembly and Lilongwe District Council. From these officers this research got insights into their policy documents; their roles in development activities; and their safeguards for heritage resources.

4.0 Results

Before the construction of the interchange, studies were done. However, there was a graveyard opposite Chimutu Primary School at the former Area 18 Roundabout where the interchange was constructed. The last person to be buried in the grave was in 1968 when the village was moved out to where it is now on the Salima – Lilongwe Road. It was a big graveyard with over one hundred buried in it. The grave mounds were very visible in some places.

In the case of the construction of the six – lane road from Parliament Roundabout to Old Town, there were no visible graves along the road. The President of the Republic of Malawi inaugurated the construction of this road on 31st August, 2021. Some *mibawa* trees lined the road which were marked for felling down. However, environmental expert stalled the project for want of environmental and social impact assessment studies. It was only after it was done that the project resumed.

5.0 Discussion

Malawi history based on oral and some written sources makes reference to the remote past as far as the interaction of the Batwa with the Iron Age migrants. Palpable evidence of the existence of the earlier peoples and their affluence is revealed through studies in soil archives. The layers in the soil archives have buried treasures for any caring heritage professional to peep into the prehistoric past. Advances in prehistoric methods and their interdisciplinary nature put to light the paleo environments from the Lower Pleistocene when the first homo species appear on the scene and how these people interacted with them. This is a realm that is out of reach for study through other methods of studying history. However, Malawi just like other countries in the world is developing fast thereby covering the soil archives under tons of concrete. In most cases, the heritage treasures are disturbed, destroyed and immortally hidden from history by blind excavations for development foundations and extraction of various resources.

There have been many accidental discoveries of heritage as development works were in progress. Some sites come to light by accident, through construction work, plowing, or just plain chance. This is usually so because most sites are far less conspicuous. Some examples of accidental finds include:

1. Ingombe Ilede: discovered during a dam project.
2. The graveyard along the Six-Lane Road: road construction.

3. Olduvai hominin site: nature itself revealed it.

In most cases the accidental finds are discovered after a portion is disturbed and destroyed. This is why projects must proceed after cultural heritage screening of the soil archives.

Lilongwe has a number of heritage layers. During the 1970 archaeological survey conducted by Cole-King revealed these rich layers. Around the site for Capital Hill he found Middle Stone Age (MSA) and Late Stone Age (LSA) flakes, cores and pebble tools. He also got Mawudzu ceramics which is associated with the Chewa. This shows two historical eras the Stone Age and the Iron Age. The MSA and LSA materials were observed at several sites within Lilongwe, for example, along Lingadzi steam, along the Lilongwe – Dowa M1 Road, Lilongwe – Likuni Road, Chimutu and Lilongwe old aerodrome (Kukumba Mbiri, 1973).

Measures have to be put in place to protect the different heritage layers in Lilongwe from irreplaceable damage. As Lilongwe is developing at this fast rate, there is great potential that heritage layers within it will be disturbed through excavations and buried under concrete. The protection of cultural property involves safeguarding it from wilful and unintentional destruction (Costin, 1993).

In the case of the interchange road, the graveyard was relocated to pave the way for it. This graveyard was reputed for strange happenings that some motorists experienced. The Department of Antiquities then relocated the graveyard. In some graves, the dead were adorned in leg and neck iron bangles and they had other items that hinted at the belief in an afterlife. The grave goods and the burial rites distinguished royalty from common persons, affluent and poor. It would seem that what is regarded as heritage worth saving are the graves. Where graves are visible, people tend to be careful not to tamper with them. Cultural heritage impact assessment was not done for the whole project serve just for the relocation of the graveyard.

In the instance of the six-lane road along Kenyatta to Sharrar Road, the ESIA that was done excluded cultural heritage. When the project stalled, and the environmental issue was sorted works on the road began in earnest until towards Lizulu Market, just after Sana food court, human bones and pieces of cloth and blankets were revealed along the road. There was no evidence of grave mounds along this road, however, after research it was revealed that this was a graveyard for the village of Chilambula. It was also noted that much of the graveyard extended to the areas that are now built. Some graves were removed but there many more that will go under the tarmac.

Drawing on these two case studies of development projects in Lilongwe this paper argues that if heritage professionals do not step in to call for the screening of development areas for their layers of the rich past, Malawi stands to lose out in learning about its distant past. Malawi is developing at a very fast rate. The soil archives are being disturbed and covered under concrete eternally burying and disturbing the archaeological record.

However, there is a contention between heritage and development. Where development is seen to solve problems, attention to heritage in the same space is seen to be a useless science (Marliac, 1997). The stereotypic image created is that of a useless science with a tint of adventure versus a useful science meant to address a need. The value of heritage is immeasurable (priceless) hence most countries have enacted legislation aimed at preventing the eventual and eternal loss of the heritage in the soil archives. Every project has to ensure its sensitivity to the soil archives so as not to disturb materials from their original context. Even though this is the case many projects do not involve a cultural heritage expert in the implementation of projects.



Figure 2: President Chakwera at the groundbreaking of the Kenyatta Road

6.0 Conclusion and Recommendations

Since people appeared on the evolution trail, they have always been artistic exploiting their environment for their survival. As such, they have left numerous footprints for our use to enter into their world if we dare to care. The recovery of Malawi's past as it were before the Iron Age era is evidence enough to prove that our history has a longer stretch into the remote past.

This paper recommends that a critical mass of historians, archaeologists and heritage professionals be established that should demand the protection of the soil archives in face of development activities. As is the case with other professionals that demand for studies in their areas of interest, this mass has to intervene for the sake of our history and heritage. Both national and international legislations are in place to protect heritage, however, contractors and their clients are not ready to implement cultural heritage impact assessments. It is, therefore, the formation of a critical mass that can help put up a fight for the heritage of Malawi. Historians, archaeologists, heritage professionals and practitioners must come together to rescue the historical record in the soil archives.

This paper recommends

1. Creation of a critical mass of historians, archaeologists, heritage professionals and practitioners to demand the protection of the soils archives in the face of development activities.
2. Contractor training in cultural material identification and management.
3. Community awareness about the importance of the soil archives.
4. CHIA must be included in the undergraduate studies on heritage, history and archaeology.

References

Antiquities File No. A.II.4.13 Old Diamphwe Bridge.

Arazi, N. (2011), "Safeguarding Archaeological Cultural Resources in Africa—Policies, Methods and Issues of (non) Compliance", *African Archaeological Review Volume*, Vol. 28, pp. 27-38.

Avrami, E., Mason, R. and de la Torre, M (2000) *Research Report: Values and Conservation*, Los Angeles: The J. Paul Getty Trust.

Chirikure, S. (2013), "Heritage Conservation in Africa: The good, the bad, and the challenges", *Southern African Journal of Science*, Vol. 109 No. 1-2, pp.1-3.

Clark, J.D. (1968) *Malawi Antiquities Programme*, Paris: UNESCO.

Clark, G.K. (1967) *The Critical Historian*, New York: Basic Books, Inc.

Cole-King, P. (1973) *Kukumba Mbiri mu Malawi: A Summary of Archaeological Research to March 1973*, Lilongwe: Malawi Department of Antiquities.

Costin, C.L. (1993), "Legal and Policy Issues in the Protection of Cultural Heritage in South Asia and the Pacific", in Mac Lean, M.G.H. (Eds.) (1993) *Cultural Heritage in Asia and the Pacific: Conservation and Policy: Proceedings of a Symposium held in Honolulu, Hawaii, September 8-13, 1991*, California: The J. Paul Getty Trust.

Crosby, C.A (1980) *Historical Dictionary of Malawi*, London: The Scarecrow Press, Inc.

Dawson, C (2009) *Introduction to Research Methods: A Practical Guide for Anyone Undertaking a Research Project*, United Kingdom: How to Books Ltd.

ICOMOS (1998), "Declaration of ICOMOS Marking the 50th Anniversary of the Universal Declaration of Human Rights", Available at: https://www.academia.edu/4766393/1998_Declaration_of_ICOMOS_50th_anniversary_of_the_Universal_Declaration_of_Human_Rights_ (Accessed 11/12/2024).

Avgerinou-Kolonias, S., Ocampo, M.C. and Pérez, GB. (Eds.) (2025), “ICOMOS International Scientific Symposium 2013 San Jose, Costa Rica”, Available at: https://openarchive.icomos.org/id/eprint/1533/4/ADCOM_2013_CostaRica_SymposiumProceedings.pdf (Accessed 11/12/2024).

ICOMOS, (2010), “*Guidance on Heritage Impact Assessments for Cultural World Heritage Properties*”, Available at: <http://openarchive.icomos.org> (Accessed 25/06/2022).

Kiriama, H., Odiava, I. and Sinamai, A. (Eds.) (2010) *Cultural Heritage Impact Assessment in Africa: An overview*, Mombasa: Centre for Heritage Development in Africa.

Lilongwe District Book Volume 1 (1907) *Lilongwe Division Central Angoniland District*, Zomba: National Records and Archival Services.

Malijani, O.C. (2020) Mining in the Context of African World Heritage Cultural Landscapes: An Assessment of Management Planning Effectiveness, PhD Thesis, Brandenburg University of Technology Cottbus-Senftenberg.

Marliac, A (1997), “Archaeology and Development: A Difficult Dialogue”, *International Journal of Historical Archaeology*, Vol. 1 No. 4, pp. 323 - 337.

Mapesa, M.W. (2017) “Heritage: Conservation vs Development - Challenging Our Attitude”, Available at: https://www.google.com/url?q=https://www.iucn.org/backup/iucn/cmsdata.iucn.org/downloads/mosesheritage_conservation_vs_development_2.pdf&sa=U&ved=2ahUKEwi0t4W88pX4AhUMQEEAHTzzAWEQFnoECAIQAg&usg=AOvVaw1ylBbNfNbu7SvLdVnX9tX8 (Accessed 11/12/2024).

Malawi Government (1990) *Monuments and Relics Act*, Zomba: Government Press.

Malawi Government (2015) National Cultural Policy, Lilongwe: Government Press.

Ndoro, W. (2016), “World Heritage and Development in Sub-Saharan Africa”, *World Anthropologies*, Vol. 119 No. 1, pp. 129 -131.

Olwig, K.R (2007), “The practice of landscape ‘Conventions’ and the just landscape: The case of the European landscape convention”, in *Landscape and Urban Planning*, Vol. 84 No. 2.

Peterson, D., Gavua, K. and Rassool, C. (2015) (Eds.), *The Politics of Heritage in Africa: Economies, Histories, and infrastructure*, New York: Cambridge University Press.

Prott, L.V. (1993), “The Impact of Policy on Cultural Heritage Protection”, in Mac Lean, M.G.H. (Eds.), *Cultural Heritage in Asia and the Pacific: Conservation and Policy: Proceedings of a Symposium held in Honolulu, Hawaii, September 8-13, 1991*, California: The J. Paul Getty Trust.

Robinson, K.R. (1982) *Iron Age of Northern Malawi: An Archaeological Reconnaissance*, Zomba: Department of Antiquities Publication No. 20.

Robinson, K.R. (1979) *The Nkhotakota Lake Shore and Marginal Areas, Malawi: An Archaeological Reconnaissance*, Zomba: Department of Antiquities Publication No. 19.

Robinson, K.R. (1977) *Iron Age Occupation: North and East of the Mulanje Plateau, Malawi*, Zomba: Department of Antiquities Publication No. 17.

Robinson, K.R. (1973) *The Iron Age of the upper and lower Shire*, Zomba: Malawi Department of Antiquities Publication No. 13.

Robinson, K.R. (1970) *The Iron Age of the southern area of Malawi*, Zomba: Department of Antiquities Publication No. 08.

Smith, L. (2006) *Uses of Heritage*, London: Routledge.

Shillington, K (1995) *History of Africa*, London: Macmillan.

The National Charcoal Strategy and Gender Dimensions among Zomba and Mzuzu City Market Charcoal Users. A Theological Reflection

Rachel NyaGondwe Fiedler, Cogitator Mapala and Chrispin Gogoda, Mzuzu University, P/Bag 201, Luwingu, Mzuzu, Malawi.

fiedler.r@mzuni.ac.mw; mapala.c@mzuni.ac.mw; gogoda.c@mzuni.ac.mw

Abstract

Purpose: The purpose is to show how gender perspectives from a theological reflection can broaden the National Charcoal Strategy (NCS) among Zomba and Mzuzu City Market charcoal users.

Methodology/approach: Qualitative data was collected using ethnographic methods especially participant observation and intensive conversations with market charcoal users. Data were analyzed using an interdisciplinary gender inequality grounded theory from a theological reflection, where the concepts of the participants guided the development of the themes of the paper. The paper is part and parcel of the Nagel Institute research on Engaging African Realities (EAR) that was cleared by the Mzuzu University Research Ethics Committee (MZUNIREC).

Findings: The paper records the following findings; 1. Women and men are influenced by the same pulling factors to engage in the Charcoal Value Chain. 2. Men receive more severe punishment for producing, transporting and trading in charcoal than women. Users of charcoal and firewood are not punished, as such more women than men are not punished because the majority of women use charcoal and firewood for cooking in accordance with their traditionally ascribed roles. 3. Religions rarely teach members on the role of charcoal and firewood in conserving forests, regardless of the fact that religion has teachings and practices that can enhance implementation of the NCS.

Discussion: The National Charcoal Strategy is instrumental in decreasing deforestation. However, the Strategy promotes gender inequality as it excludes women from being punished even though more women than men use charcoal for cooking and heating. There is need to reflect on this reality from a religious perspective. Christian theology argues for the God's creation motif that both men and women are created in the Image of God and that God expects both men and women to care for the environment and punishes both for not caring for the environment. It is also against ethical and moral theology where there is preferential justice for wrongdoing.

Recommendations: The NCS strategy should be nuanced with gender-differentiated content from a theological reflection for the sensitization of sustainable charcoal usage for city charcoal users. The NCS should expand its approaches beyond popularizing use of innovations such as briquettes to include licensing of all charcoal users as a way forward in conserving forests in Malawi. The paper supports perspectives that contradictions in the Biomass Energy policies undermine the drive to conserve forests (Gamula 2013) and that gender equality should promote women's agency and inclusion in decision making (Chilapula 2023).

Conclusion:

The Strategy should include gendered theological resources as part of the sensitization curriculum and include a clause on licensing all involved in the charcoal supply chain from production, transportation, marketing points as well as for all users and broaden the Strategy to all users and not only household users.

Originality/Value of contribution: It is a contribution on gendered theological perspectives on broadening the National Charcoal Strategy and advocacy on bringing Charcoal users both at household level and in public to account to promote justice for both men and women involved in the charcoal supply chain.

Key words: National Charcoal Strategy, Charcoal Production, Gender-theology, Biomass Energy, Deforestation.

1.1 Introduction

Malawi is a landlocked country with 15 million inhabitants as of 2012 and 22 million as of 2025 (worldometers, 2025). Around 90 percent rely on agriculture (worldometers, 2025). There are several sources of energy in Malawi. Among them are electricity, solar and biomass. Fluctuations in water levels, economic challenges and lack of infrastructure have restricted people from accessing electricity and solar energy. The current Malawi forest cover is 34.4 percent and the loss in tree cover is estimated at 16 percent since 2000. The loss in forest cover is getting worse as in 2023 alone the loss was at 1.5 percent (globalforestwatch, 2025). Malawi energy sector relies primarily on biomass energy because it is readily available and easily accessible to the majority of people in Malawi. However, this presents a challenge in conserving forests and triggers climate change. Climate change has reduced development as its negative effects such as floods has brought suffering to people. This has led to losses of resources towards Disaster management programmes. Renewable energy sources are a preferred source for a resilient and sustainable environment globally. SDG11 is about taking urgent action to combat climate change. However, the reliance on non-renewable energy sources is high especially in underdeveloped countries where access to affordable, reliable, sustainable and modern Energy for All in accordance to SDG7, is still a challenge. By 2013, nearly 95% of rural households and 55% of urban households in Malawi relied on charcoal and firewood (Box, 2013). There have been efforts to promote sustainable use of biomass energy through Policies and innovations that reduce use of charcoal and firewood for energy. The Government put in place the National Forest Policy (1997); the Forest Act 1997; Biomass Strategy 2009 (Gamula 2013) and the National Charcoal Strategy.

Innovations that reduce use of charcoal include briquettes and modern stoves. This chapter focusses on how the 2017 National Charcoal Strategy

can be made more effective in combating unsustainable use of charcoal in Malawi.

This chapter is a contribution from a theological perspective within the context of public theology which promotes engagement of religion with issues affecting society (Felix Nyika et al., 2023; Tinyiko Maluleke, 2021). Public theology is critical in promoting the realization of Malawi Growth and Development Goals through one of its aspirations on the role of religion in Mindset Change. Population estimates for religions in Malawi are contentious however, based on the 2018 population Census, there are about 80 percent Christians, 15 percent Muslims and 4 percent African Traditional Religionists. This chapter reflects on the subject from perspectives of the three religions. The chapter makes a contribution to Circle theologies of engendering 2030 Sustainable Development Goals on Goal 5 “Gender Equality, women and Girls empowerment” (Maveresa et al 2024). It also adds voices to theological perspectives on the nexus between religion and climate change.

1.2 Problem Statement

Malawi is losing many trees which are important to preserving a sustainable environment regardless of the 2017 National Charcoal Strategy aimed at conserving forests. The role of religious actors and teachings is integral in conserving forests through reinforcing mindset change principles that can save forests. There is differentiation of traditional roles of men and women in the charcoal supply chain, and preferential treatment between men and women in the supply chain and this has an influence on the application of the NCS. Men are more involved in the production and transportation of charcoal for selling, while women are more involved in buying and using charcoal for cooking. The NCS has punitive measures for transporters and producers, but women are not punished for buying charcoal for cooking. This raises a theological problem as it is opposed to the Christian theological concept that men and women equally have to care for the Environment. However, there is limited literature on gender dynamics from a theological perspective in relation to the application of the Strategy, and this has potential to undermine the efficiency of the Strategy in curbing illegal charcoal production that has contributed significantly to deforestation in Malawi.

1.3 Objectives/Research Questions/Hypothesis

The main objective of the research was to investigate gender responsiveness of the National Charcoal Strategy from a theological perspective in dealing with charcoal and firewood abuses among Market City Users in Zomba and Mzuzu Urban contexts through the following research questions:

1. What are the pulling factors to charcoal and firewood abuse?

2. How are charcoal and firewood abuses dealt with in relation the NCS?
3. How can the NCS be strengthened with gender perspectives?

2.0 Literature Review

I did not come across any study on the issue of charcoal and firewood from a gendered theological perspective. However, there are gendered theological perspectives on conserving the environment in general that serve as pointers to the discussion in this chapter. The more recent works relevant to this topic are on engendering Sustainable Development Goals as stipulated in Goal 5 “Gender equality, women and girl’s empowerment.” The subject of sustainable use of charcoal is important to the realization of sustainable development in Malawi.

Some theologians have shown that in some African traditional religions women have played a role in preserving the environment by playing a significant role in making the Chisumphu Rain Cult flourish (Phiri, 1996). Gadama (2010) has also written on the role women play in caring for the environment through prayers at a shrine in Misuku Hills. Through such examples African Traditional Religions (ATR) women played a role in protecting forests.

This is because there are stringent rules on cutting trees as the deity is considered to inhabit the whole nature of such places, such that cutting down trees and other vegetation without following rules is perceived to be a desecration of the place. Visitation by people to such places was guided by beliefs that caused fear for the places. This concept prevents people from carelessly cutting the trees, and women as priestesses to the shrine help conserve trees and maintain the equilibrium between creatures and the environment in the world that God (Namalenga) created (Schoffeleers, 1999; Amanze, 2002). And some women have cemented this theology by calling for a mother earth theology, where women must be at the center of caring for the environment (Moyo, 2024). This necessitates the re-interpretation of culture and religion (Fiedler, 2016). This would enhance the NCS curriculum on sensitization against abuse of forests through unsustainable use of charcoal.

The Department of Theology and Religious Studies of the University of Malawi addressed the issue of deforestation (and charcoal) early for Zomba Plateau by publishing a small book in the Kachere Series in English and Chichewa (Moyo and Ott, 1996), which later published two monographs with an eco-theology perspective (Chikafu, 2012) with traditional land concepts as the starting point (Kaoma, 2013) located in the context of the Tonga of Zambia (of course, similar to Malawi).

Kapya Kaoma points out that the abuse of God's creation causes suffering especially among the poor (Kaoma, 2015a and 2015b). In Catholic African Theology, the Church is the Family of God, and Maximian Khisi extends this concept to include the non-human creation (Khisi, 2018).

Recently Michael Phiri of EBCOM published an introduction to Christian Eco-Theology, relating it to Malawi's Vision 2063, and proposing an "approach that is theocentric, eco-justice conscious and gender sensitive, and it eschews both anthropocentrism and biocentrism" (Phiri, 2023).

The majority of works on charcoal are written by non-theologians; however, their views are supported by religion. One body of such literature is by Elizabeth Harriet *et al.* (2016).

The (over-)use of charcoal must be seen in the context of deforestation. In 2005, twelve NGOs wrote a Memorandum of Protest to Government, Parliament and People (Bone, 2023), accusing government (especially the Forestry Department) of making good laws but only to completely disregard them, and demanding that punishment of the worst offenders must change from transfer to a new location (to continue doing the same thing) to stiff prison sentences. They also stated that they could find no signs that the re-forestation pact agreed with Germany was implemented in any way ("In Memoriam" 2005). They demanded that a charcoal strategy be developed ("In Memoriam" 2005), but did not mention the consumers as stakeholders.)

This chapter is within the context of theological and sociological gender inequality theories. The dominant public gender inequality theological theories are those written by the Circle of Concerned African Women Theologians [The Circle] (Fiedler 2016). In Malawi, Circle theologians who have written on such theories in relation to the environment are Fulata Moyo (1996) and Isabel Phiri (Phiri, 2015).

From the sociological gender inequality theory, Johnson et al. (2020) argue that energy interventions that marginalise approaches to dealing with energy problems can perpetuate the existing inequalities. Users are often left out in some of the legal frameworks; yet consumers are an important sector in shifting towards more sustainable energy sources (Scot, 2016).

Lastly, the chapter problematises that there is a disconnect between legal frameworks and the legal framework, in this case, the NCS, is able to achieve. This is also within theological literature such as that by Klaus Fiedler (2023).

3.0 Methods

This study was based on an ethnographic research design, where we began with observation to learn more on the charcoal supply chain and find out about where men and women were located in the supply chain. As we observed, we conducted one on one interviews and group interviews to find out more on what we did not understand about the data we got from observation. As we carried out the interviews we selected individuals for Key Information Interviews (KII). We then had Focus Group Discussions to get more information on issues that were still unclear to us but also to get more information that we did not get from earlier interviews.

Observation: We had market walks and sometimes sat at one location of the cities and watched those using charcoal and firewood. We did this to familiarize ourselves with people who were engaged in the charcoal value chain. After observation, we selected 20 Key Informants, 10 from each of the two Cities: Zomba and Mzuzu and the chapter does not make reference to the respondents individually for ethical reasons and the limitation of space for this chapter.

Sampling: We selected KIIs using purposive sampling. The selection was based on their keenness to interact with us, the type of information they had in relation to the objectives of the study. We also included 2 KIIs based on the position of influence in the market.

Analysis: This study was based on grounded theory where concepts from the participants to the study formed the themes for discussion. We used an iterative method of analyzing data: compiling data, coding data into theme blocks using gender inequality lens and subjecting the data to available literature.

4.0 Findings/Results

The findings presented in accordance to the Objectives:

4.1 Pulling Factors to Charcoal and Firewood Abuses

Women and men are influenced by the same pulling factors in different ways as they engaged in the Charcoal Value Chain.

4.1.1 Economic reasons for transporting and trading in charcoal

Women engage in transporting and trading charcoal to earn money for their households through their marriage partners. This challenges the dominant views that men only are involved at this location of the supply chain. This was

the case for both Cities. “A woman in Mzuzu for example, transports charcoal produced by her husband from Mpherembe area and trades it in the Mzuzu City. She ferries the charcoal by a vehicle together with fellow charcoal transporters.” A woman in Zomba also has been transporting charcoal for a period of 30 years from Machinga Hills. She sells it along the main road. They both engage in the business to earn money for their families. We however, found that men are the majority among those who transport to and trade charcoal in the city markets.

4.2 Sociological Factors and Use of Charcoal

Both men and women use charcoal and firewood based on sociological factors. Among them are socialization and fear of being isolated by friends and family. In Mzuzu someone stopped using electricity because of derogatory remarks from the neighbour who equated use of electricity to being proud. In Zomba, a woman has used charcoal and firewood for her restaurant business as that is the business their single mother was engaged in for years. She and her brother have also learned the business and continued with it.

4.2.1 Lack of Access to Alternative Sources of Energy as a Conduit to Charcoal Use

We found that some men and women use charcoal in the Cities to cook in restaurants and open spaces. This is because the structures in which these restaurants are housed do not have provisions for individual access to electricity. Again, many restaurants are used by more than one person. Communal access to electricity comes with challenges as billing is dependent on the number of individuals and where a businessperson has more than one person engaged in the business, access to electricity is expensive. Some businesses require mobility and, in such businesses, one may not depend on being connected to the source of electricity. We found that the majority of individuals in these restaurants are women.

Electrical appliances are often unaffordable to majority of women and hence more women rely on charcoal and firewood than men. We also found out that even in the homes where houses have access to electricity and families have electrical appliances, husbands often bar wives and family to use them. A man in Mzuzu has electricity in his home but has demanded that his wife and family use charcoal and firewood instead of the cooker he bought for the family. Charcoal and firewood are perceived by such men to be cheaper than available alternative sources such as electricity.

4.2.2 Weak Institutions Safeguarding NCS.

We found out that there is no supervision by City officials on charcoal users and traders. In the Cities, there are areas where charcoal is sold by transporters and retailers. This means that there is no attempt to check on whether the charcoal is produced in compliance to the NCS. A man in Zomba has been using, buying and transporting charcoal from 2018 to 2024 and never met any City official to question his charcoal businesses. Another man said that he stopped producing and transporting charcoal briefly not because of the City officials but because of COVID-19, when social distancing made people stop buying firewood from him for fear that they could contract COVID-19.

4.2.3 More Men than Women Market Supervisors

In both cities, we found that men were supervisors of the restaurant businesses. The supervisor in Zomba said that this role is occupied by men because it requires aggressiveness, a trait that is rare among women.

5.0 Discussion

Change in Perceptions Regarding Charcoal Production, Transportation and Use.

The National Charcoal Strategy includes provision of sensitisation activities to deal with the Charcoal problem. The National Planning Commission highlight the need for religious leaders' engagement in promoting mindset change, one of the aspirations in the realisation of the MIP-1/Malawi Growth and Development Strategy 2030. Though religion has some negative aspects, it has positive aspects that are useful in promoting healthy attitudes/perceptions among people. Among scholars who provide perspectives on how to deal with the dual realities of religion in proving positive mindset change are women theologians who belong to the Circle of Concerned African Women Theologians (The Circle). The Circle was launched in 1989 in Accra Ghana with the special mandate to produce gender academic literature that will promote gender equality from the position of women.

Masenya (1995) argues that religion is a 'double edged sword' that can oppress and liberate; therefore, it should be interpreted accordingly not to promote injustices. And in reference to gender issues, she argues that religion should not be interpreted to promote gender Based Violence against women and men. From the same lens, religious teachings should be interpreted as empowering both men and women in preserving forests, and abiding to regulations enshrined in the National Charcoal Strategy. Here we discuss how some of the findings can be illuminated from a gender theological lens.

Firstly, one of the issues that arise with the implementation of the NCS is that there seems to be an argumentation on whom, between men and women, are responsible for deforestation through charcoal production. This is consistent with the ‘blame game approach’ between Eve and Adam in the Garden of Eden, when Adam blamed the woman to have given him the forbidden fruit to eat, and Eve in turn blamed the snake (Genesis 3:12-13). God did not play that game, and both the man and the woman had to bear equally the consequences of their transgression, difficult labour in the field and in childbirth and male dominance over the woman (Genesis 3:14-19). That Eve was “morally weak” or a “seducer,” is a sin ascribed to her (wrongly) by supporters of male dominance (Chifungo, 2023).

Male dominance and destruction of the environment (which *munthu* was assigned to care for) is equally the result of rebellion against God, who had created (and still creates) *munthu* in his own image (Genesis 1:27) and gave them dominion over (care for) the created world (Genesis 1:28) [Kholowa and Fiedler, 2000].

God applied the same equality when he apportioned them the work of caring for the garden: “And God put the man [human being, *munthu*, not *mwamuna*] in the Garden “to work it and take care of it” (Genesis 2:15).

The Bible texts about protecting the environment were misunderstood and misinterpreted for a long time, taking dominion not as the duty to care but as the right to destroy.

Islamic theology expresses similar concepts by understanding man and women (*munthu*) as God’s *khalifa* (representative) (Quran 6:175 and Hadith Sahih Muslim 2742) who is the vice regent to look after the world (Khalifa 2017).

5.1 Both Men and Women Are Called to Protect Nature and Care for it

In the Christian tradition, the mandate to care for Creation (the environment) was given to both Adam and Eve. In the Kapirinithiwa Myth, the man comes with an axe, an implement used for logging and the mortar, coming with the woman, is also a product of the forest. The NCS clearly shows that it is not against using forest products and logging, but there are rules within which such use must be done. Even in the Christian theology of caring for the Environment, there is no objection to proper use. Yes, a shepherd must live from his flock, but if he eats all the sheep at once, he (or she) has nothing to live on. However, this has been undermined by a culture which promotes abuse of the environment through unsustainable production of charcoal. In this case, both Christian theology and African Traditional culture are a

double-edged sword, on one hand protecting the environment and on the other hand promoting its destruction (Masenya, 1995). There is need to include religious concepts that promote morals in the NCS that will build resilience against behaviours, attitudes and practices that undermine adherence to the NCS. The lack of monitoring of charcoal abuses by stakeholders such as City officials is probably due to the lack of such concepts in the curriculum.

Charcoal production destroys the environment. This means that both men and women are the cause for the loss of forests through charcoal production. Since both men and women are pulled by the same factors to engage in the charcoal value chain, they should receive the same punishment. However, the Charcoal Strategy leaves users of charcoal and firewood unpunished. From a theological perspective, this implies that men are created in a lesser image of God than women. This distorts God's creation motif where God created men and women in the same image – His Image (Gen 1:26-27). From an ethical position, punishing producers, transporters and traders only and leaving users out of the equation is unethical as it allows one group to be exempted from punishment as they enjoy the proceeds of crime. There is need to promote teachings on gender equality in the fight against charcoal abuse. Such teachings should include advocacy for women and girls' agency in conserving the forests. On a practical front, women and girls should be taught leadership skills in a public space. The argument that women are not involved as supervisors in the markets where charcoal is traded because they lack the trait of "being aggressive is supported by both tradition and religion where women are conditioned to be silent and shun public leadership roles. One way would be to stand up against colluding with their husbands who are involved in destroying forests through unsustainable charcoal usage.

5.2 Traditional Roles of Women Promote Unsustainable Use of Charcoal

Dominance of men in decision making at household level contributes to reliance on charcoal and firewood use as it is often men who are financial managers of homes. Traditionally, the role of fetching income for the household lies on man (Siwila, 2022). Decision making in the home is also fueled by negative traditional and Christian teachings as regards headship of a man in the household (Phiri, 2004), and that the household belongs to the husband (Oduyoye, 1999). Thus, some men make decisions on choices of energy sources to be used in the home based on these teachings. This is a form of Gender Based Violence as it robs time from women to be used in other productive engagements (Fiedler and Mphande, 2024).

5.3 Recommendations

There should be gender-differentiated content for the Curriculum used for sensitization of sustainable charcoal usage for city charcoal users. The Curriculum should also include gender equality issues from theological perspectives relating to use of charcoal at household level. The NCS should include licensing of all charcoal users as a way forward in conserving forests in Malawi. The Strategy should include licensing at production, marketing points as well as for all users and broaden the Strategy to all users and not only household users. Religious institutions should include teachings on conserving forests and the environment as a whole. Religious institutions often have women groups and women belonging to such groups can be taught on making charcoal from used paper. This could go a long way towards reducing charcoal use from trees.

5.4 Originality/Value of Contribution

It is a contribution on broadening the National Charcoal Strategy to include gender-responsive perspectives from a theological gender perspective.

6.0 Conclusion

Malawians have a strong religious and cultural heritage which has a bearing on their engagement in transforming the world around them. The NCS should build on this heritage to promote adherence among Malawians. From a gender theological perspective, women and girls should not take a passive role in making the NCS a reality based on negative religious and cultural teachings.

The NCS should deconstruct negative femininities such as remaining silent when husbands are engaged in illegal charcoal production. Women should desist from being accomplices to such crimes because of femininities that discourage them from voicing out gender-based violence relating to being denied opportunity to use clean energy even when that energy is accessible in their households.

Likewise, negative masculinities that promote illegal charcoal uses must be deconstructed. This is a moral decision because it saves lives and men should utilize their headship roles to protect lives.

The energy sector should not exclude religious resources in promoting gender inequality between men and women. Such a position would negatively impact the realization of Agenda 2063 and Vision 2030 and other SGDs which emphasize that gender equality is instrumental to accelerating the development agenda of any nation including Malawi. The NCS should be aligned with other legal frameworks that do not give room to selective justice. This is within the theological conversations that are opposed to any form of injustices. The NCS should be reviewed in such a way that it should address

the rights of men and women in in the charcoal supply chain. These teachings should take into account the various religions in Malawi. The producers, transporters, traders and users must face the same restrictive laws and practices; if not, the restrictive laws on producers, transporters and traders must be relaxed.

References

Amanze, J. (2002), *African Traditional Religion in Malawi. The Case of the Bimbi Cult*, Blantyre: Claim-Kachere.

Bone, D. (ed) (2023), *Protests, Petitions and Persuasion. A Compilation of Documents from Malawi's History*, Mzuzu: Luviri Press.

Box, O. (2013), "Towards Sustainable Energy Utilisation: An Analysis of Various Cooking Fuel Options in Malawi", *Journal of Mechanical Engineering*, Vol. 5 No. 3, pp. 68-75.

Chifungo, P.F. (2012), *Let My People Go! A Biblical and Cultural Study of Women in the Church in Central Malawi*, Mzuzu: Luviri Press.

Chikafu, P. (2012), *Usahwira: A Look at the Old Testament Covenant Traditions from an African Perspective*, Zomba: Kachere.

Chilapula, M. (2023), "Towards Inclusion: Experiences of Women Clergy in the Church of Central Africa Presbyterian (CCAP) Blantyre Synod," PhD Thesis, Mzuzu University, Mzuzu.

Fiedler, K. (2023), *For the Sake of Christian Marriage, Abolish Church Weddings*, Mzuzu: Luviri Press.

Fiedler, R.N. (2016), *The History of the Circle of Concerned African Women Theologians, 1989-2007*, Mzuzu: MZUNI Press.

Fiedler, R.N. (2024), *Gender Based Violence in Malawi. Critiquing Beliefs and Practices that Impede Gender Equality*, Mzuzu: Mzuni Press.

Gadama, R. (2010), "Women's Leadership at Rain Shrines among the Sukwa in Northern Malawi," MA Module, Mzuzu University, Mzuzu.

Gamula, G. et al (2013), "An Overview of the Energy Sector in Malawi," *Energy and Power Engineering*, 5, 8-17.

Global Forest Watch (2023), www.globalforestwatch.org/dashboard/country/MWI (accessed 24 February, 2025).

Harriet, E. et al. (2016), "Livelihood Diversification: The Role of Charcoal Production in Southern Malawi", <https://doi.org/10.1016/j.esd.2016.10.001>.

Johnson, O.W., Han, J.Y.C., Knight, A.L., Mortensen, S., Aung, M.T., Boyland, M. and Resurrección, B.P. (2020), "Intersectionality and energy transitions: A review of gender, social equity and low-carbon energy", *Energy Research & Social Science*, Vol. 70, p. 101774.

Kaoma, K. (2013), *God's Family, God's Earth. Christian Ethics of Ubuntu*, Zomba: Kachere.

Kaoma, K. (2015a), *The Creator's Symphony. African Christianity, the Plight of the Earth and the Poor*, Doorpspruit: Cluster.

Kaoma, K. (2015b), *Creation Care in Christian Mission*, Philadelphia: Fortress; (2016), Eugene: Wipf & Stock.

Khisi, M. (2018), *The Church as the Family of God and the Care for Creation*, Mzuzu: Mzuni Press.

Khalifa in Islam (2017), "An Environmental Stewardship Perspective," *Islam and the Environment*, October 2017.

Kholowa. J and K. Fiedler (2000), *In the Beginning God Created them Equal*, CLAIM-Kachere.

Likupe, R., (2010) "God's Creation: Towards an African Theology of Creation," *Religion in Malawi*, 10, 12-20.

Maluleke, T. (2021), "Why I Am Not a Public Theologian", Available at: repository.up.ac.za/bitstream/handle/2263/87984/Maluleke_2021.pdf. (Accessed 16/12/2024).

Masenya, M.J., "African Womanist Hermeneutics: A Suppressed Voice from South Africa Speaks," *Journal of Feminist Studies in Religion*, vol 11(1), 149-155.

Maveresa, T. et al (eds) (2024), *Religion, Gender, and Sustainable Development in East and Southern Africa*, London: PalgraveMacmillan.

Moyo, F. and Ott, M. (1996), *Christianity and the Environment: Care for what you have been Given*, Zomba: Kachere.

Moyo, F. and Ott, M. (1996), *Chikristu ndi Chilengedwe*, Zomba: Kachere.

Nyika, F. *et al.* (Eds) (2023), *A Theology of Public and Political Engagement*, Zomba: TSM Press.

Oduyoye, M.O. (1999), *Daughters of Anowa. African Women and Patriarchy*, Maryknoll: Orbis.

Phiri, I.A. (1996), "African Traditional Religion and Eco-feminism: The Role of Women at Chisumphi Shrine in Preserving Ecology", in Ruether, R. (Ed.), *Women Healing Earth*, Orbis, Maryknoll, 161-171.

Phiri, I.A. (2015), "Climate Change and Theology in Malawi: A Reflection on Prophetic and Charismatic Approaches."

Phiri, M., (2023), "Negotiating the Terrain of Ecological Theology in Malawi: Conceptual and Practical Considerations," in Felix Nyika et al, (eds), (2023), *A Theology of Public and Political Engagement*, Zomba: TSM Press, 179-201.

Schoffeleers, M. (ed), *Guardians of the Land*, Zomba: Kachere, 1999.

Scot, J. et al. (2016), "The Roles of Users in Shaping Transitions to New Energy Systems", *Nat Energy* 1, 16054, 2016.54
<https://doi.org/10.1038/nenergy.2016.54>.

Twelve NGOs, (2005) "In Memoriam Malawi's Forests, Trees and Environment. Rest in Peace" in David Bone (ed), *Protests, Petitions and Persuasion. A Compilation of Documents from Malawi's History*, Mzuzu: Luviri Press, 2023, 145-168.

Environmental Sustainability and Christian Stewardship: An Integrated Approach

Richard Gracious Gadama (PhD)

Department of Theology and Religious Studies, Faculty of Humanities and Social Sciences, Mzuzu University, Malawi.

Email: gadamagracious@gmail.com

Abstract

This article examines how Christian stewardship principles can influence environmental conservation and resource management. By exploring the theological foundations of stewardship in Christianity and their implications for contemporary environmental issues, this research aims to deepen the understanding of how religious beliefs shape attitudes and behaviors towards environmental sustainability. The study posits that environmental stewardship provides a promising moral framework for achieving sustainability and emphasizes the need for stakeholders to adopt sustainable attitudes and actions. Utilising a multidisciplinary approach that integrates theological analysis with environmental science and ethics, the article compares Christian teachings on stewardship with contemporary environmental discourse, identifying areas of convergence and tension. It aims to provide insights into how Christian theology can enrich discussions on environmental stewardship in both religious and secular contexts. The article concludes that religious environmental stewardship, particularly in the context of the Sabbath, can offer a moral framework for environmental sustainability. It recommends that churches incorporate stewardship and Sabbath principles into their doctrines on environmental sustainability. This approach integrates Christian beliefs and practices into the environmental academic spectrum, emphasizing how church liturgies, sacraments, and conduct can contribute to environmental sustainability through the application of stewardship and Sabbath concepts.

Key Words: Stewardship, Environmental sustainability, Environmental problem, Religion.

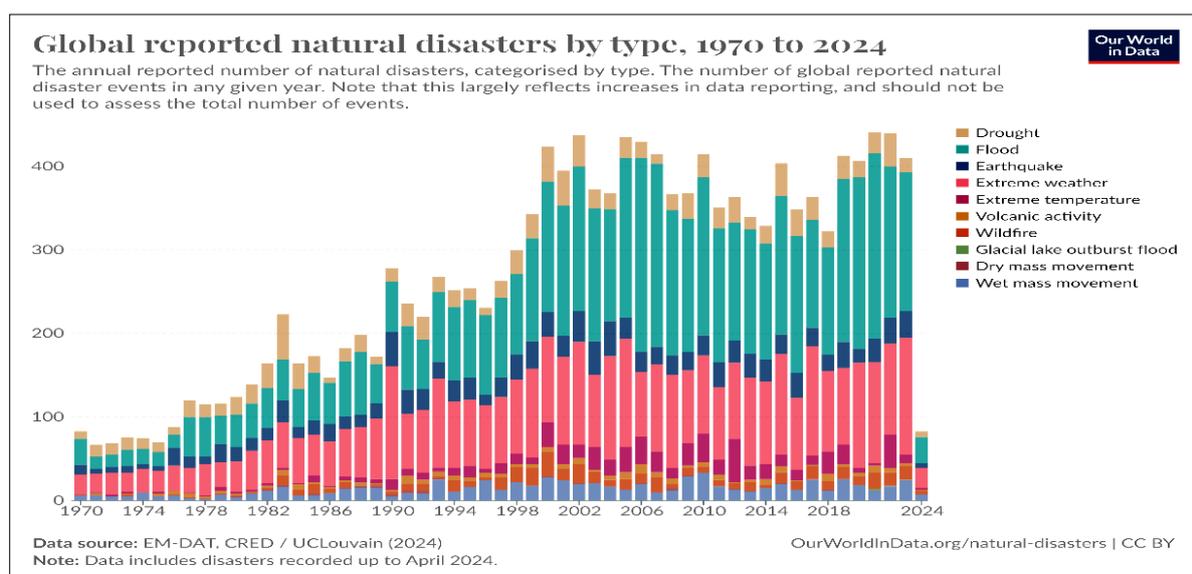
1.1 Introduction

Environmental sustainability involves managing natural resources responsibly for future generations, recognising that humanity's stewardship, as entrusted by God, must consider the well-being of all living creatures (Stigall, 2013). Global environmental issues such as climate change, deforestation, pollution, and biodiversity loss are escalating, impacting health and intensifying natural disasters (Dijoo & Khurshid, 2022). Despite international efforts like the Paris Agreement, success has been mixed, underscoring the need for more effective environmental protection measures (Young, 2016). Promoting better human-environment interactions is crucial across all settings. Many individuals, local communities, environmental groups, and governments worldwide are taking action to steward the

environment. Environmental stewardship encompasses diverse actions such as creating protected areas, replanting trees, limiting harvests, reducing harmful activities or pollution, creating community gardens, restoring degraded areas, or purchasing more sustainable products. These actions range from strict environmental conservation to active restoration and sustainable resource management, occurring on local to global scales. Environmental stewardship and Christian biblical stewardship are deeply interconnected, as both advocate for responsible management and care of the Earth's resources. Christian biblical stewardship is rooted in the belief that humans are caretakers of God's creation, as outlined in scriptures like Genesis 2:15, which calls on humans to "till and keep" the Earth (Blomberg, 2013). This theological perspective emphasises that the environment is a divine gift that must be preserved and protected for future generations. It promotes sustainable practices and ethical resource management to maintain the planet's health and biodiversity.

Christian communities are encouraged to view environmental care as a spiritual and moral duty, reinforcing the importance of integrating faith-based stewardship principles into broader environmental sustainability efforts

(Smith & Scales, 2013: 79-97). This alignment not only enriches the discourse on environmental issues within religious contexts but also mobilises faith communities to take meaningful action towards a sustainable future. Local actions, often central to promoting sustainability, involve people using their expertise and knowledge to respond to external drivers of change. Thus, the aim of this paper is to explore how Christian principles and beliefs can guide actions towards preserving the environment for future generations. By incorporating these principles into environmental efforts, the study seeks to



foster more holistic and ethical approaches to sustainability.

Figure 1: Global reported disasters, 1970 to 2024, source, [worldindata.org/natural disasters](https://worldindata.org/natural-disasters)

1.2 Significance

The article explores the integration of Christian principles and beliefs in guiding actions towards environmental sustainability, emphasising the theological perspective of biblical stewardship as a moral and spiritual duty to care for the Earth. It addresses escalating global environmental issues like climate change, deforestation, pollution, and biodiversity loss, and highlights the importance of effective protection measures. By linking faith-based stewardship with broader sustainability efforts, the article aims to mobilise faith communities to take meaningful action and promote holistic, ethical approaches to preserving the environment for future generations.

1.3 Problem Statement

The escalating environmental crises, including climate change, deforestation, pollution, and biodiversity loss, necessitate a comprehensive approach to sustainability that integrates ethical and spiritual dimensions. Environmental disasters are increasing in frequency and severity due to human activities, resulting in dire consequences for ecosystems and human health. Despite international efforts like the Paris Agreement, the effectiveness of current environmental protection measures remains limited. This research aims to explore how Christian principles of stewardship, which view the environment as a divine gift entrusted to humanity for responsible care, can inform and enhance environmental sustainability practices. By examining the intersection of Christian theological perspectives and practical environmental stewardship, this study seeks to develop more effective and morally grounded strategies for addressing global environmental challenges and ensuring the well-being of future generations.

1.4 Aim and Objectives

The aim of this paper is to explore how Christian principles and beliefs can guide actions towards preserving the environment for future generations. To achieve this, the paper grapples with the following specific objectives:

1. To explore how Christian principles and beliefs can guide actions towards environmental sustainability
2. To address and highlight the urgency of mitigating global environmental issues.
3. To mobilise faith communities to take meaningful action.

2.0 Literature Review

The biblical principles of stewardship, rooted in the creation mandate and the image of God, among others, provide a robust framework for addressing contemporary environmental issues. These principles call Christians to active engagement in ecological restoration and sustainability, showcasing the

enduring relevance of biblical teachings in modern environmental stewardship.

2.1 Christian Principles and Beliefs towards Environmental Sustainability

The creation mandate, found in Genesis 1:28, commands humanity to "be fruitful and multiply, fill the earth and subdue it," implying responsible dominion over creation, not reckless exploitation. Genesis 9, while not explicitly using the language of dominion and subduing found in Genesis 1:26 and 28, still evokes the idea of human superiority over animals and the enforcement of justice (Genesis 9:2-6). David VanDrunen suggests that this covenant underscores the idea of dominion, reinforcing the responsibility humans have towards creation (Van Drunen, 2014, 105). Additionally, Twardziłowski (2021: 9-32) argues that Genesis 2:5-25 serves as an exposition of Genesis 1:26-28, underscoring the central importance of these verses in the structure of Genesis. This exposition highlights the balance between dominion and stewardship, emphasizing that humanity's role is not to exploit but to manage the earth's resources responsibly. Mangililo asserts that understanding this mandate encourages Christians to engage actively in addressing ecological issues, demonstrating the relevance of biblical teachings in modern environmental stewardship (Mangililo, n.d.).

Humans, created in God's image (Genesis 1:26-27), are uniquely positioned as stewards, reflecting God's creativity, love, and care for His creation. Burdett discusses the scientific challenges to the idea of human uniqueness, noting that despite genetic similarities with other primates, humans' capacity for language and symbolic representation sets them apart as image-bearers of God (Burdett, 2015: 3-10). This uniqueness implies a special responsibility towards creation, as humans are called to mirror God's care for the world. Bergmann explores how theological reflections on space and place, once marginalized, are now central to understanding our relationship with the environment (Bergmann, 2007: 353-379). The "spatial turn" in theology emphasizes that our understanding of God's creation should include a deep awareness of our embeddedness in the natural world, enhancing our responsibility as stewards.

2.2 Urgency of Mitigating Global Environmental Issues

Environmental sustainability involves the responsible management of natural resources to ensure their availability for future generations. Christians recognize that God created the earth and entrusted it to human care (Stigall, 2013: 69-80). Environmental disasters, degradation, and problems continue to escalate globally, driven by factors such as climate change, deforestation, pollution, and biodiversity loss (Dijoo & Khurshid, 2022, 39-56). Climate change results in more frequent extreme weather events, rising sea levels, and global warming, while deforestation, particularly in rainforests like the Amazon, leads to significant biodiversity loss. Pollution affects air, water, and soil quality, with severe health implications. Efforts to mitigate these issues, including international agreements like the Paris Agreement and various

conservation initiatives, have had mixed success, highlighting the need for more effective and widespread environmental protection measures (Young, 2016: 124-132). The urgency to promote improved human-environment interactions through stewardship is paramount, applicable to terrestrial, marine, aquatic, and aerial environments in both rural and urban settings. After the flood, God establishes a covenant with Noah and all living creatures (Genesis 9:8-17), signifying a commitment to care for the earth. This covenant, which involves all living creatures, highlights the ongoing responsibility humans have to care for creation. Hiers (1996: 127-188) further explains that postdiluvian biblical texts suggest a more limited human dominion, emphasizing that ultimate dominion belongs to God, and humans are caretakers within God's creation. This perspective aligns with contemporary environmental ethics, which advocate for sustainable and respectful interaction with the natural world.

2.3 Faith Communities and Meaningful Action

The Sabbath rest (Exodus 20:8-11) extends beyond human rest to include the land and animals, emphasizing the need for balance and renewal. Hartman explores how Sabbath-keeping can be mobilized as both a spiritual and environmental practice, promoting a lifestyle of simplicity and ecological mindfulness (Hartman, 2011: 47-64). Observing the Sabbath as a time to cease intervening in nature aligns with Moltmann's view that true Sabbath observance inherently includes environmental care (Moltmann, 1998: 5). This practice encourages a holistic approach to environmental stewardship, integrating spiritual rest with ecological sustainability. Furthermore, Dayaneni's concept of restorative labor, inspired by Sabbath principles, challenges the exploitative practices of the industrial growth economy and advocates for sustainable interactions with the environment (Berlin, 2005: 71-83).

Psalm 104 celebrates God's creation, highlighting His wisdom and provision for all living beings, which inspires awe and reverence for the natural world. Berlin notes that Psalm 104, though not typically classified as a wisdom psalm, reflects wisdom thought by emphasising the well-crafted nature of creation and the appropriate place for all creatures within it (Ibid). This psalm encourages a theocentric view of ecology, recognizing God's intricate design and care for creation (Seurei (n.d.: 19-23) further illustrates how Psalm 104 underscores principles of intrinsic worth, purpose, and interconnectedness, suggesting that all elements of creation have value and are interconnected within God's plan. This perspective calls for an ecological theology that recognises and respects the divine wisdom embedded in the natural world.

In all, by aligning with these biblical foundations, contemporary environmental efforts can be both spiritually meaningful and practically effective, highlighting the Bible's timeless guidance in fostering a responsible and sustainable relationship with the natural world.

3.0 Methodology and Theoretical Approach

This article employed a desk research methodology to explore how Christian principles and beliefs can guide actions towards environmental sustainability. The approach involves an extensive literature review, analysing existing studies, theoretical frameworks, and case reports to understand the intersections between faith and environmental stewardship. Data is synthesised using qualitative content analysis, allowing for the identification of recurring themes and patterns within the literature. Key theories, such as social identity theory, cognitive dissonance theory, and environmental communication theory, are applied to examine how religious identity fosters stewardship, how dissonance between beliefs and behaviors motivates sustainable practices, and how faith-based messaging can effectively promote ecological responsibility.

This methodological framework is significant for achieving the objectives as it enables a thorough examination of the available knowledge, providing a robust theoretical basis for understanding the integration of faith and environmental action. By systematically analysing secondary data, the study identifies best practices and successful strategies that can be adopted by faith communities. This approach ensures that the findings are grounded in existing evidence, offering a comprehensive understanding of how Christian teachings can be effectively mobilised to foster a sustainable future. The study is attuned to providing a comprehensive framework for mobilising faith communities to address the environmental crisis in a way that aligns with their spiritual values and collective identity.

4.0 Results and Discussion

4.1 Integrating Faith in Environmental Crisis

In the face of contemporary environmental challenges, integrating faith-based principles provides a meaningful avenue for fostering sustainable practices. Several social scientific theories offer insights into how faith communities can effectively engage in environmental stewardship.

4.2 Reimagined Identity

Individuals derive a sense of identity and self-esteem from the groups to which they belong (Tajfel & Turner, 1979: 33-47). This idea has the potential to foster environmental stewardship within faith communities by emphasising a collective identity rooted in biblical principles of stewardship (Schultz, 2002: 67-82). Religious leaders can reinforce the identity of believers as stewards of God's creation, encouraging pro-environmental behaviors as a reflection of shared values. This approach not only strengthens community bonds but also promotes sustainable practices aligned with their religious identity (Hogg & Abrams, 2003). For instance, indigenous tribes in the Amazon rainforest lead conservation efforts by emphasising the sacredness of the forest in their cultural identity, mobilising collective action to protect biodiversity and

advocate for sustainable practices. This borders on individuals conforming to the expectations of their social groups like churches to gain acceptance and avoid disapproval (Cialdini & Goldstein, 2004: 591-621). Within faith communities, religious norms and teachings significantly influence members' environmental attitudes and behaviors. By establishing clear environmental norms based on biblical teachings, religious leaders can create a culture where eco-friendly behaviors are expected and valued. Preaching on the biblical mandate for stewardship, integrating environmental education into religious activities, and highlighting positive examples within the community can reinforce these norms. As members observe and emulate these behaviors, the collective impact can lead to significant environmental improvements.

4.3 Cognitive Dissonance and Behaviour

Cognitive Dissonance relates to the idea that individuals experience psychological discomfort when their beliefs and behaviors are inconsistent, motivating them to change either their beliefs or behaviors (Festinger, 1957). Faith communities can utilise this concept by highlighting the dissonance between religious beliefs about stewardship and environmentally harmful behaviors. Religious teachings emphasising care for creation can create cognitive dissonance in those who engage in destructive behaviors, motivating them to adopt sustainable practices (Aronson, 1999). Faith-based groups like the Bhumi Project in India and Gulewamkulu among the Chewa in Malawi and Zambia emphasise the sanctity of nature, encouraging cleaner technologies and reduced emissions. This aligns with the Theory of Planned Behavior, which suggests that individuals' intentions to engage in a behavior are influenced by their attitudes, subjective norms, and perceived behavioral control (Ajzen, 1991: 179-211). Christian communities can enhance pro-environmental intentions by shaping positive attitudes through teachings on the moral importance of caring for creation, establishing strong subjective norms, and providing resources for sustainable practices (Sniehotta et al., 2014). The Roman Catholic Church in Malawi, for example, promotes creation care as a moral imperative, encouraging sustainable practices among its members (www.ncronline.org).

4.4 Environmental Communication

Environmental Communication is very important in as far as shaping public perception and behavior regarding environmental issues is concerned. Faith communities, with their established communication channels and trusted leaders, are well-positioned to effectively disseminate environmental messages. Religious leaders can use their platforms to communicate the urgency of environmental issues and the biblical mandate for stewardship (Cox, 2012). Effective communication strategies might include sermons, educational workshops, and media campaigns that resonate with the community's values. By framing environmental care as a religious duty and providing clear, actionable steps, faith leaders can inspire collective action and foster a culture of sustainability (Pezzullo & Cox, 2017). For example, in the Middle East, Islamic leaders emphasise water conservation as a religious obligation through sermons and community programs, teachings cultivated

from the concept of Khalifah (stewardship) as illustrated in *Figure 2*. Islamic Khalifah means humans are appointed as caretakers of the Earth by Allah, responsible for its protection and wise management. This role necessitates sustainable actions, as highlighted in the Qur'an: "He made you stewards over the earth" (Qur'an 35:39) and "Do not cause corruption on the earth" (Qur'an 2:11). These teachings stress the importance of maintaining ecological balance and responsibly using natural resources. Environmental communication can be accelerated if faith groups incorporate ecological modernisation, which suggests that environmental protection can be achieved through technological innovation and institutional change, aligning economic development with ecological sustainability (Mol, 2002: 92-115). Faith communities can advocate for ecological modernisation by supporting policies and initiatives that promote sustainable technologies and practices.

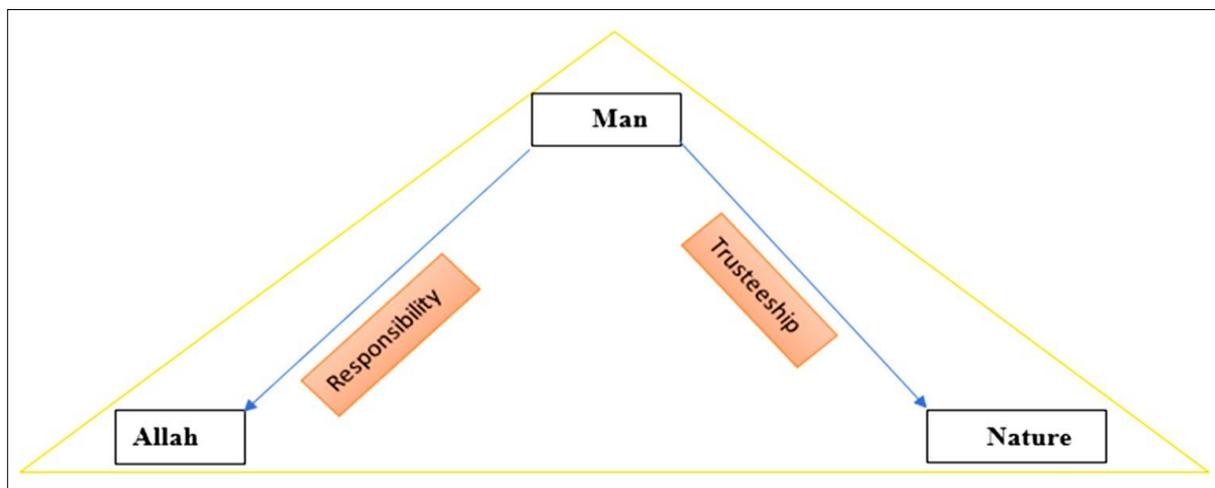


Figure 2: Relationship between Allah, nature and human beings, Source: authors' drawing. (Source: Najibullah Loodin and Aaron T. Wolf. 2022. "Will Islamic Water Management Principles Be Included If the Helmand River Treaty Is Revisited?" *Water* 14, no. 1: 67.

By partnering with environmental organisations, investing in green technologies, and implementing sustainable practices within their own operations, religious communities can model ecological modernisation. This approach not only demonstrates the practical application of faith principles but also contributes to broader societal efforts towards sustainability (Ibid). For example, in Sub-Saharan Africa, churches and mosques are promoting renewable energy solutions like solar panels and wind turbines, aligning these technologies with stewardship values. Integrating faith with environmental action can be effectively supported by social scientific theories. By leveraging these concepts, Christian communities can foster a deep and active commitment to environmental stewardship. These approaches provide a robust framework for mobilising religious believers to address the environmental crisis in a way that is consistent with their spiritual values and collective identity.

4.5 Pragmatism in Christian Stewardship

Environmental sustainability and Christian stewardship are intertwined concepts that emphasize the responsible care and management of natural resources. Individuals, groups, and networks of stewards each play critical roles in this integrated approach. Individual actions, such as maintaining soil health, managing vegetation, and adopting sustainable marine practices, reflect daily decisions grounded in the Christian principle of stewardship (Seurei: 19-23). These actions underscore the responsibility of individuals to care for God's creation, aligning personal choices with broader ecological goals.

Collective stewardship by groups and communities further amplifies this responsibility. Urban community gardens, cooperative conservation efforts, and stricter-than-mandated environmental measures showcase the power of collective action. These community-driven initiatives foster a sense of shared responsibility and community, essential tenets of Christian stewardship (Twardziłowski, 2021: 9-32). By working together, these groups exemplify the biblical call to community, demonstrating how collective efforts can effectively manage common resources and protect communal areas.

Stewardship often involves complex networks and multi-stakeholder partnerships, bringing together public agencies, NGOs, civil society organisations, and local communities. This collaborative approach enables a more holistic and integrated strategy for environmental sustainability, reflecting the Christian ethos of collaboration and mutual support. Understanding the motivations and capacities of different actors, recognizing the rights of traditional and indigenous groups, and adhering to the principle of subsidiarity—decisions made at the lowest possible level—are crucial for effective stewardship. As incentive structures, social norms, and resource access evolve, so too must our commitment to stewardship, ensuring that our actions continuously reflect the interconnectedness and sacredness of all creation.

4.6 Fostering Stewardship, an Integrated Approach

The concept of environmental stewardship (ES) is deeply rooted in the traditional principle of stewardship, which has evolved over centuries from its origins in Old English. The term steward, derived from "stigweard," meaning a servant responsible for a hall or estate, reflects a role of caring for resources on behalf of another. Historically, this concept has been applied to various forms of resource management, including land and material assets, underpinned by the belief that humankind was created by God to dwell and improve the earth as His representatives. This religious significance is evident in passages like Genesis 2:15, which states, "The Lord God took the man and put him in the Garden of Eden to work it and take care of it." Christian communities, especially in the Protestant West, have embraced stewardship as integral to church practices such as tithing and fundraising for community ministries, emphasising it as both a religious duty and a practical approach to resource management.

In modern times, the term stewardship has been adopted by secular environmental movements, reshaping humanity's relationship with the natural world from ownership to guardianship. This transformation emphasises four key virtues: guardianship with constraints on personal interest, association with landholdings, a sustained relationship with resources, and the exercise of moral virtues like loyalty, temperance, diligence, justice, and integrity. These virtues align closely with Christian teachings found in verses like Luke 16:10, "Whoever can be trusted with very little can also be trusted with much," and 1 Corinthians 4:2, "Now it is required that those who have been given a trust must prove faithful." For Christians, stewardship is not just about managing resources but about fulfilling a divine mandate to care for creation, reflecting a commitment to future generations and a sense of accountability to God and society. Additionally, the biblical concept of the Sabbath, which mandates rest for people, land, and animals, underscores the holistic relationship between humanity and creation. By observing these principles, Christian communities can integrate environmental stewardship into their faith practices, promoting sustainable living and justice for the vulnerable. This integrated approach not only fulfills a spiritual duty but also contributes to a sustainable future, demonstrating the profound connection between faith and environmental responsibility.

5.0 Conclusion

The intersection of environmental sustainability and Christian stewardship reveals a profound integration of faith, ethics, and ecological concern. Christian stewardship, rooted in the sacredness of creation and humanity's role as caretakers, motivates believers to address environmental degradation as a moral imperative, transcending anthropocentric views for a holistic ethic of care. This theological perspective promotes environmental responsibility imbued with moral urgency and spiritual significance. Beyond individual ethics, Christian stewardship encompasses social, economic, and political dimensions, advocating for environmental justice and equitable resource distribution. Practical applications manifest in grassroots initiatives and global advocacy, demonstrating faith's transformative power in mobilising collective action for sustainability. While challenges such as anthropocentrism and religious exclusivism exist, a comprehensive and integrated approach can significantly contribute to a sustainable and just world, emphasising the need for nuanced and inclusive strategies.

6.0 Recommendations

The study recommends a sober look at:

- **Biblical Principles:** Highlight scriptures that emphasise stewardship of the Earth, such as Genesis 1:26-28, which speaks of humans having dominion over the Earth while also being tasked with caring for it.

- **Education and Awareness:** Encourage education within Christian communities about the importance of environmental sustainability and how it aligns with stewardship principles.
- **Practical Action:** Advocate for practical actions such as reducing waste, conserving energy, supporting renewable energy initiatives, and practicing sustainable agriculture.
- **Community Engagement:** Foster community engagement through activities like environmental clean-ups, tree planting events, and supporting local conservation efforts.
- **Advocacy and Policy:** Advocate for policies that promote environmental protection and sustainability at local, national, and global levels, emphasizing the responsibility of Christians to influence positive change.

7.0 Future Direction

Moving forward, there is a need for continued research, education, and advocacy to deepen the integration of environmental sustainability and Christian stewardship. This includes developing innovative strategies, expanding interdisciplinary partnerships, and empowering communities to become agents of positive environmental change informed by both scientific insights and moral imperatives. In essence, this paper underscores the transformative potential of harmonising ecological concerns with spiritual values. It calls for holistic approaches that recognise the interconnectedness of human well-being with environmental health, fostering a sustainable future that honors both God-given responsibilities and the imperatives of scientific stewardship.

References

- Ajzen, I., (1991), "The theory of planned behavior", *Organisational Behaviour and Human Decision Processes*, Vol. 50 No. 2, pp. 179-211.
- Bergmann, S. (2007), "Theology in its spatial turn: Space, place and built environments challenging and changing the images of God", *Religion Compass*, Vol. 1 No. 3, pp. 353-379.
- Berlin, A., (2005), "The wisdom of creation in Psalm 104", in *Seeking out the Wisdom of the Ancients: Essays offered to honor Michael V. Fox on the occasion of his sixty-fifth Birthday*, 71-83
- Blomberg, C. L. (2013) *Christians in an age of wealth: A biblical theology of stewardship*, Grand Rapids, Michigan, US: Zondervan Academic.
- Burdett, M. S. (2015), "The image of God and human uniqueness: Challenges from the biological and information sciences", *The Expository Times*, Vol. 127 No. 1, pp. 3 -10.

Cialdini, R.B. and N.J. Goldstein, (2004), "Social influence: Compliance and conformity", *Annual Review of Psychology*, Vol. 55, pp. 591-621.

Cox, R. (2012) *Environmental Communication and the Public Sphere*, London: Sage Publications.

Dijoo, Z.K. and Khurshid, R. (2022), "Environmental Degradation as a Multifaceted Consequence of Human Development", in Bhat, R.A. (Eds.) *Environmental Biotechnology*, New Jersey, USA: Apple Academic Press, pp. 39-56.

Festinger, L. (1957) *A Theory of Cognitive Dissonance*, Redwood City, CA: Stanford University Press.

Hartman, L., (2011), "Christian Sabbath-keeping as a spiritual and environmental practice", *Worldviews: Global Religions, Culture, and Ecology*, Vol. 15 No. 1, pp. 47-64.

Hiers, R.H., (1996), "Reverence for life and environmental ethics in biblical law and covenant", *Journal of Law and Religion*, Vol. 13 No. 1, pp. 127-188.

Hogg, M.A. and Abrams, D. (2003), "Intergroup relations: Essential readings", UK: Psychology Press.

Mangililo, I.D. (2022), "An Assessment of the Dominion Mandate of Humans: Ecological Implications of Genesis 1: 26-28", *Eco. Env. & Cons.*, Vol. 28, pp. (S14-S18).

Mol, A.P.J. (2002), "Ecological modernization and the global economy", *Global Environmental Politics*, Vol. 2 No. 2, pp. 92-115.

Moltmann, J. (1998) *God for a Secular Society: The Public Relevance of Theology*, Minneapolis, MN: Fortress Press.

Schultz, P.W. (2002), "Knowledge, information, and household recycling: Examining the knowledge-deficit model of behavior change", in Dietz, T. and Stern, P.C. (Eds.), *New Tools for Environmental Protection: Education, Information, and Voluntary Measures*, Washington, DC: National Academies Press, pp. 67-82.

Seurei, K. E. (n.d.), "Ecological Theology of the Bible: Re-imagining Ecological Restoration in the Rationale of Psalm 104 and Romans 8: 19-23."

Smith, J. C. and Scales, T.L. (2013), "Stewardship: A biblical model for the formation of Christian scholars", *Journal of Education and Christian Belief*, Vol. 17 No. 1, pp. 79-97.

Stigall, J. (2023), "Entrusted with Creation: God's Therapeutic Trust in Humanity for Creation Care", in Fuller, M., Harris, M., Leidenhag, J. and Runehov, A. (Eds.) *Issues in Science and Theology: Global Sustainability:*

Science and Religion in Dialogue, Cham: Springer Nature Switzerland, pp. 69-80.

Tajfel, H. and Turner, J. C. (1979), "An integrative theory of intergroup conflict", Austin, W.G. and Worchel, S. (Eds.), *The Social Psychology of Intergroup Relations*, Monterey, CA: Brooks/Cole, pp. 33-47.

Twardziłowski, T. (2021), "The command to rule over the creation (Gen 1: 26–28) in the ecological hermeneutics of the Bible", *Collectanea Theologica*, Vol. 90 No. 5, pp. 9-32.

Vander Hart, M. D. (1990), "Creation and Covenant: Part One", *Mid-America Journal of Theology*, Vol. 6, pp. 10-13.

VanDrunen, D. (2014) *Divine Covenants and Moral Order: A Biblical Theology of Natural Law*, Grand Rapids: Eerdmans.

Young, O.R. (2016), "The Paris Agreement: destined to succeed or doomed to fail?" *Politics and Governance*, Vol. 4 No. 3, pp. 124-132.

Organisational legitimacy dimensions: perspectives from African managers

Stan G. Kaunda

School of Business and Economic Sciences, Malawi University of
Business and Applied Sciences, Blantyre, Malawi.

Email: sgkaunda@poly.ac.mw

Abstract

Purpose: The study aimed to determine the dimensions, and drivers that influence African manager's perception of organisational legitimacy.

Design/Methodology/Approach: the study generated four meta-organisational categories arising from the categorising constructs of locus of ownership (specific or diffuse) and origin of organisation (national or foreign) as premised on the underlying Two-Publics theory. Six respondents partook in the study from each of the four generated meta-categories. Data was generated from the resulting 24 participants through indepth interviews. Data was analysed by thematic analyses.

Findings: from analysis of interview transcripts eleven dimensions of organisational legitimacy perception were derived. These eleven dimensions were distilled, crystallised into three finite encompassing dimensions of organisational legitimacy: presence, enforcement of policies, rules, regulations in the HRM arena; presence, activation of organisational vision, core values; domestication of top management. Thus, the study finds that African manager's perception of organisational legitimacy is embodied in these three overarching dimensions.

Recommendations: individual managers should, in their decision making and behaviour, aim to consistently live up to an organisation's touted values, vision. At the organisational level, organisations should take into consideration the effect on organisational legitimacy of deployment of expatriates. At the societal/industry level, it is critical that regulators: ensure HRM policies, rules, regulations are developed and activated by organisations (and not simply deployed as a symbolic element); the 'unnecessary' deployment of expatriates is minimised.

Originality: the study is original as it determines the perception of organisational legitimacy amongst internal stakeholders/constituents of an organisation. Additionally, the study is original as it is contextualised in a dyadic public setting manifested by managers whose existential reality is reified by concurrently living in the opposing, contrasting settings of the formal, explicit legal rational organisation and the informal, implicit wider primordial public.

Keywords: Legitimacy, organisational categorisation, top management team, Two-Publics Theory, perception, Southern Africa.

1.1 Introduction and problem statement

The organisational landscape in Africa is generally noted to display a relatively high incidence of malfeasance such as nepotism, cronyism, corruption, mismanagement (Amankwah-Amoah *et al.*, 2016; Dowden, 2019). Such malfeasance consequently has the potential to negatively influence organisational performance potentially leading to suboptimal performance and likely organisational malaise (Zezeza, 2022). Relatedly, a stream of literature advances that employees, including managers, in Africa largely work in organisational settings that are culturally, and socially alien (Barnard *et al.*, 2017; Kamoche *et al.*, 2015; Kan *et al.*, 2015). Subsequently, it is advanced that it is, on the whole, this feeling of alienation that arises to potentially negatively influence managerial behavior.

An extensive literature (e.g., Bitektine and Haack, 2017; Deephouse *et al.*, 2017; Suddaby *et al.*, 2017) on legitimacy suggests that stakeholder perception of an organisation's legitimacy fundamentally influences the sense of propriety, appropriateness of a focal organisation. Subsequently, one's sense of propriety, appropriateness of an organisation significantly influences their behaviour in relation to a focal organisation.

An organisation's stakeholders can broadly be divided into external (e.g., customers, suppliers, shareholders) and internal (e.g., managers, line employees) ones. Logically, manager's perception of an organisation's legitimacy should critically influence their behaviour and decision making. Thus, where a manager perceives a focal organisation to be legitimate the more likely their decision making, behaviour will align with the interests of the organisation, and vice versa. However, our understanding of internal legitimacy, that is, legitimacy perception of an organisation's internal stakeholders, actors is underdeveloped, limited.

Thus, it is critical to deepen our understanding of internal legitimacy by, among others, uncovering the dynamics, dimensions, factors underlying, driving organisational legitimacy perception amongst African managers. Plausibly, enhanced understanding of the dynamics, dimensions, drivers underlying African managers perception of organisational legitimacy should contribute to effecting, actualising more perceptibly legitimate and contextually appropriate organisations in the African setting. Consequently, this should conceivably contribute to diminishing organisational malfeasance.

1.2 Research objective and question

The research is centered on studying the organisational legitimacy perceptions of African managers. Results of the study should suggest dimensions, factors, and drivers underlying organisational legitimacy perception among African managers. Subsequently, the study will answer the following research question:

- *Among African managers, what dimensions, factors underlie, drive organisational legitimacy perception?*

2.0 Literature review

2.1 Legitimacy and the two-publics

Legitimacy is a pivotal construct in a number of disciplines of the social sciences in particular political science, philosophy, social psychology, institutionalism (Barnard, *et al.*, 2017; Deephouse *et al.*, 2017; Suddaby *et al.*, 2017). In institutionalism, which broadly reflects the relevant discipline of the paper, legitimacy acts as a social evaluation of organisations, their products, services, processes, leaders, among others (Deephouse *et al.*, 2017; Suddaby *et al.* 2017). It infers alignment, congruence between a legitimacy subject (*e.g.*, an organisation, organisational field, organisational product/service) with a legitimacy source (*e.g.*, the media, consumers, regulators). In definitional terms, there is a noted convergence in extant literature towards the definition offered by Deephouse *et al.* (2017). Deephouse *et al.* (2017, p. 3) proffered legitimacy as “a generalised perception or assumption that the actions of an entity are acceptable, proper, or appropriate within some socially constructed systems of norms, values, beliefs, and definitions”.

For purposes of the paper, Deephouse *et al.* (2017) definition is relevant for two important reasons. Firstly, it emphasises that legitimacy relates to ‘some socially constructed systems’ implying that what is perceived as legitimate may differ from society to society. The paper forwards that the basis of legitimacy judgments in Africa is fundamentally different from Western society wherein most of the legitimacy literature originates. Secondly, the definition lays emphasis on norms, values, beliefs. In the African context these norms, values, beliefs crucially differ from those in other contexts, in particular Western society.

Arising from the above, in order to further management knowledge, enhance managerial performance and organisational effectiveness it is, thus, important to investigate dynamics, and dimensions underlying, driving African managers’ perception of organisational legitimacy. All in all, enhanced understanding of the dynamics, dimensions, drivers underlying organisational legitimacy perception should, firstly, illumine how organisations can ensure, enhance their legitimacy, and, secondly, inform as to what organisational forms, structure(s) are deemed appropriate, proper to the African setting.

2.2 The Two-Publics

Extant literature relates that African managers straddle between two societies (Dia, 1996; Ekeh, 1975; Kan *et al.*, 2015). The contrasting lived societies of African managers are depicted as dualities: modern, primordial; economically based, socially based; formal, informal; explicit, implicit; urban, rural (Ekeh, 1975; Kamoche *et al.*, 2012; Kan *et al.*, 2015; Zoogah *et al.*, 2015).

In this dyadic setting, for African managers one society comprises membership in implicit kinship-based networks in the broad society or superordinate system. The other society is composed of the explicit world of work in the narrower legal rational organisation (Amankwah-Amoah, 2018; George *et al.*, 2016; Kamoche *et al.*, 2012). Relatedly, Ahiauzu (1989, p.15) aptly summarily elucidates the dyadic condition: “the African worker is constrained to live daily two different patterns of life, with different sets of values, social norms, communicative symbols and patterns of human relational processes, and general systems of... mental programming”.

In this vein, borrowing from the field of political science, the paper is theoretically, and conceptually grounded in the pioneering work of the Nigerian academic, Peter Ekeh (Ekeh, 1975). In essence, Ekeh’s work elaborates why the post-colonial state and its affiliated institutions in most of Africa are largely ineffective. Deploying an institutional lens, Ekeh suggests that modern Africa has two types of institutions. One type consists of formal, legal-rational, explicit organisations. Such organisations essentially being an inheritance from the colonial era (Dia, 1996), and Ekeh terms these the civic public (Dia, 1996, in a somewhat similar conceptualisation, terms them ‘transplanted institutions’).

A second set of institutional types consists of informal, implicit, principally kinship-based networks whose existence essentially predates colonialism. Ekeh terms these the primordial public (whilst Dia, 1996, terms them ‘indigenous institutions’). The two (*i.e.*, the civic and primordial publics) institutional types differ fundamentally in their logic, rationale, objectives, outcomes, underlying values (Dia, 1996; Ekeh, 1975). However, African managers are necessarily located in both the contrasting institutions. Critically, presence in both institutional types influence African manager’s perception of legitimacy of formal, legal rational organisations (Dia, 1996; Ekeh 1975).

In sum, our limited understanding of legitimacy from the micro, internal perspectives open up space for its finer examination. This is particularly the case in relation to African managers who operate in a profoundly hybrid environment. In contrast to managers in Western society, African managers straddle between two contrasting -and potentially conflicting- societies: one composed of the legal rational organisation, the other comprising informal, subterranean networks in the broader superordinate system. In Africa, these dyadic societies are inherently mutually exclusive. Subsequently, with a footing in both the contrasting societies, African manager’s perception of legitimacy of focal organisations is necessarily complex, ambiguous, contestable.

3.0 Research method

Utilising in-depth, semi-structured interviews the study generated data in the Southern African countries of Malawi, Zambia, Zimbabwe. It limited itself to formal or legal-rational organisations. In definitional terms, a legal-rational organisation implied being registered with an appropriate authority (the

Registrar General’s office, as is the case in Malawi; the Patents and Companies Registration Agency, as is the case in Zambia; or the Department of Deeds, Companies and Intellectual Property, as the case is in Zimbabwe). As legal rational organisations are of different forms, types the study ensured to cover legal rational organisations of diverse forms. These include profit-seeking and nonprofit seeking (*e.g.*, nongovernmental organisations or NGOs) ones; public organisations (*e.g.*, publicly listed companies, government departments/agencies) and narrowly owned ones (*e.g.*, family businesses, cooperatives); local/domestic and foreign/international (*e.g.*, multinationals) ones.

Deploying the categorising constructs of Origin of Organisation (Local or Foreign) and Locus of Ownership (Specific or Diffuse) as premised on the Two-Publics theory, the study develops four meta-organisational categories (National-Diffuse, National-Specific, Foreign-Diffuse, Foreign-Specific). The covered organisations types are subsequently positioned within an appropriate organisational category as depicted in Figure 1. Six organisations are hence selected from each meta-organisational category to partake in the study.

Chief Executive Officers (CEO) and managers directly reporting to the CEO (what are aggregately commonly termed as an organisation’s top management team- or TMT) represent the ultimate source of data (*i.e.*, the unit of analysis) for the study. TMT members in eligible organisations automatically qualified to partake in the study- nonetheless, a supporting additional condition to qualify for participation in the study was that such managers meet the study’s definition of ‘African’ manager. Similar to Wanasika *et. al* (2011) the construct is operationalised by the citizenship of a manager, *viz.* members of the TMT of qualifying organisations who are, in addition, citizens of Malawi, Zambia, or Zimbabwe were considered to be ‘African’ managers. Hence, one qualifying manager from an eligible organisation partook in the study.

		Origin of Organisation	
		National	Foreign
Locus of Ownership	Specific	A Family Business Founder-managed Business Owner-managed Business Privately-held Company Government Department (Local) NGO (National) NGO (Local) Cooperative	B Family Business Founder-managed Business Owner-managed Business Privately-held Company NGO (International)
	Diffuse	C Publicly-listed Company Privately-held Company NGO (National) NGO (Local) Government Depart. (National) Government Department (Local) State-owned Enterprise Cooperative	D Publicly-listed Company Privately-held Company NGO (International) Government Depart. (International) State-owned Enterprise

Note : NGO = Non-Governmental Organisation

Figure 1: Quadrant of Organisational Categories for the Study

3.1 Data Analysis

At the outset, it is important to point out that though data for the study was generated from three different Southern African countries it is, however, analysed and presented collectively, aggregately at the regional level (*viz.* Southern Africa). Thus, the data to be analysed represents findings from a region (*viz.* Southern Africa) and not necessarily a particular individual country. According to Kiggundu (2013), analysing and presenting data at the regional level enhances, critically, the transferability and generalisability of a study's findings. This aspect pertains, particularly, to keenly diverse, eclectic, heterogeneous contexts such as Africa's. (Incidentally, an additional, collateral benefit of analysing, and presenting study findings at the regional level- as opposed to country level- is that it contributes to enhancing participant anonymity).

For the study, data analysis principally comprises the derivation of themes from the conducted interviews (Bolden and Kirk, 2009). In line with the reasoning of Eisenhardt (1989), the themes are generated from: firstly, within each separate individual interview; secondly, themes are generated from the interviews held at organisational category level or amongst similar organisational types; lastly, themes are derived from the aggregated findings emanating from all the interviews (24 in total) conducted for the entire study across all the different organisational categories.

4.0 Findings

4.1 Dimensions, dynamics determining, underlying organisational legitimacy perception

The study now offers its findings. The findings will be presented and discussed at a thematic level. The themes are distilled from analysis of the interview transcripts. For brevity and space purposes, the section limits itself to offering, firstly, the overall, cross-cutting themes and, secondly, the study's resulting distilled, crystallised themes, dimensions. Additionally, to augment and support the findings sample direct quotations are provided from the interview sessions.

4.1.1 Overarching Themes

The eleven overarching themes emerging from the study are now proffered. In essence, what are proffered are the study's findings as regards the dimensions, factors, dynamics underlying, determining African manager's perception of organisational legitimacy. Thus, African managers perceive an organisation as legitimate in as far as, or to the extent, it displays the emerging themes. Conversely, please note, for an organisation to be perceived as legitimate some of the themes- and sub-themes as later outlined- necessitate that an organisation not display the specified theme and/or subtheme.

4.1.1.1 Vision, values, integrity

From analysis of participant responses, a recurring theme as regards dimensions, factors underlying organisational legitimacy perception is the presence of vision, values, and an organisation's wherewithal to sustainably live up to its touted vision, values (a feature some respondents denoted as "integrity").

Whilst it emerges that presence of organisational vision and values is, among respondents, a key dimension underlying perception of organisational legitimacy these two dimensions are further qualified by an organisation's wherewithal to live up to them. As noted, this 'living the talk' is denoted as integrity by several respondents. A respondent states: *in essence... a well-run organisation should have a set of core values that it, additionally, and critically, has the wherewithal to sustainably uphold and live up to.*

4.1.1.2 Equality in the HRM sphere

From participant responses another dimension critically determining organisational legitimacy perception is equality in the Human Resource Management (HRM) realm. A respondent outlines that he: *strongly believes in and practices the principle of equality in employment. This equality is ideally premised on the competence, skill of an individual for a specified post.*

Detailed analysis of responses pertaining to the theme of equality in the HRM sphere reveals that it can be subdivided into three sub-themes which though they appear similar are, however, unique, peculiar in their own way. One sub-theme relates to an explicit desire among respondents for an organisation to have merit based HRM systems, procedures. Secondly, and fairly related to the first sub-theme but somewhat more specified, respondents outline that they perceive an organisation as legitimate where there is no purposeful recruitment of the underqualified or unqualified. A final sub-theme relates to personalised decision making or, to paraphrase the expression of a respondent, decisions not being made based on "one's affinity" with the decision maker or relevant authority. Thus, the theme of equality in HRM can largely be effected, operationalised through the three subthemes.

4.1.1.3 Standardised HRM policies, rules, regulations

Another dimension of organisational legitimacy perception emerging from participant responses relates to the standardisation or formalisation of organisational HRM policies, rules, regulations. This dimension is somewhat related to the previous dimension. A respondent states: *HRM related issues need to be comprehensively outlined... put in black and white.*

Thus, respondents on the whole advance that presence of standardised policies, rules, regulations in the HRM arena is a key dimension, determinant of organisational legitimacy perception. Nonetheless, delving into the responses, discussion this dimension is deemed to be further qualified by the policies, rules, regulations being as relevant, appropriate to the local context as possible. Hence, borrowing from the field of political science, one can add the concept of "subsidiarity" as a finite qualifier of the standards dimension.

To explain, respondents are of a view that a legitimate organisation not only develops, formalises policies, rules, regulations in the HRM arena but- so as to ensure the rules, regulations are relevant and appropriate- the rules, regulations are developed as close to the level of implementation as possible.

Accordingly, a respondent (a co-founder and current CEO of a community based environmental NGO) relates: *in terms of HRM issues ... the organisation has to abide by laid down guidelines- in terms of organisational structure, recruitment, training et cetera, set by the principal donor... for a young, nascent organisation this offers the benefit of a ready framework for organisational development and growth... however... over reliance on the imposed framework has put a straitjacket on the organisation... (as) copied rules, regulations not fitting the unique needs, circumstance of the copying organisation.* Hereafter, the respondent acknowledges the advantages of self-generated policies, rules, regulations.

4.1.1.4 Competitive compensation

An area which was cited by a number of respondents as influencing organisational legitimacy perception relates to compensation. In this regard, two contributing aspects are the competitiveness of compensation and, secondly, its relative equality. Being rather positive on an employer organisation, a respondent notes: *the organisation's compensation regime was incentive based with one receiving compensation based on effort and contribution and not simply based on their rank.* The respondent goes on: *an organisation's compensation and benefits regime should be premised on an individual's effort and contribution and not be simply based on rank, seniority, or years worked in an organisation.*

As regards relative equality in compensation a respondent (a claims analyst at a multinational insurance firm with operations across the region) narrates: *there were big gaps in compensation internally between senior management and the rest, and across the seven countries (the organisation operates in) the compensation levels at the company in the focal country were by far the lowest, thus, there also were big gaps in compensation externally.*

All in all, respondents perceive an organisation as legitimate where the compensation is relatively competitive and where differences in compensation are not tantamount to unreasonable big gaps. These 'big gaps' could be manifested internally, that is, between senior management and others. They could also be manifested externally, that is, compensation differences for the same level, grade across different countries where an organisation operates.

4.1.1.5 Symbolism

Unlike the preceding dimensions, this dimension has a negative inference, that is, for an organisation to increasingly be perceived as legitimate it should not display the dimension. The dimension apes the previous dimension on standardised HRM policies, rules, regulations.

A number of respondents noted that organisations at times develop rules, regulations or/and start initiatives without the meaningful intent to bring the initiative, rules, regulation to full reality, execution. In other words, rules, regulations, initiatives can be developed, initiated to simply send either a symbolic message, signal something, and/or assuage stakeholder demands/pressure. All in all, respondents look negatively on the legitimacy of an organisation that readily deploys symbolism as a managerial tool.

A respondent posits: *though the organisation had appropriately documented rules, regulations, conditions of service these were readily and openly flouted.* The respondent goes on to describe the organisations culture, work environ as laissez-faire.

As the findings of the study indicate, respondents readily note symbolic behaviour. Additionally, and critically, respondents are not supportive of symbolism and have a negative perception of the legitimacy of an organisation that readily utilises symbolism as a managerial tool.

4.1.1.6 Transparency

The need for transparency- in, among others, access to information, decision making, explicating the condition and direction of an organisation- is also a pointed dimension of organisational legitimacy perception arising from the study. Thus, a respondent stipulates: *through integrity and transparency the leader can attain the buy in and belief- in the organisation's vision- of employees, followers... the leader and the organisation itself must be internally transparent so as to enable employees fully and continually understand and appreciate the vision, goals, situation of the organisation.*

A detailed analysis of responses falling under the transparency dimension suggests two component sub-themes. Firstly, is what we can term personalised decision making. This observation from a respondent self-explains this sub-theme: *decision making at the organisation was highly personalised with, for example, promotion decisions being largely based on your affinity with the organisation's owner.* Secondly, is the desire for predictability, conventionality in the behaviour of leaders. As a respondent (a public relations manager in a family construction firm) puts it: *the founder manager was unconventional, being someone who was liable to fire you at any time... unconventional, eccentric, spur of the moment decision making can at times mentally, psychologically disorient employees.*

In essence, the study finds that respondents place an emphasis on transparency, at least towards employees, in an organisation's decision making and explication of its status and direction. In this regard, they feel that personalised decision making and unpredictable, eccentric leadership behaviour compromises the perceived legitimacy of an organisation.

4.1.1.7 Strong, independent leadership

The presence of a strong, independent organisational leadership -particularly at the Board and CEO levels- was also cited as a key dimension influencing,

the underlying perception of organisational legitimacy. As a respondent reflects: *the key to improving the HRM scenario at the organisation is to ensure it has strong, independent, objective leadership... it's not an issue of further generation of rules and regulations- the organisation already has adequately developed ones.* The respondent goes on: *without consistently strong, objective leadership in an organisation, political correctness and pragmatism will trump over rules and regulations.*

Analysing respondent comments pertaining to this theme one is able to trace three sub-elements. Upon reflection, contemplation, these sub-themes could, in a way, be denoted or described as respondent's views as regards the general key roles, functions of an effective leader.

One sub-theme relates to talent spotting, development, blossoming. A respondent notes: *for an organisation to remain competitive it is vital that talent is spotted, appreciated, rewarded, given space to blossom.* Meanwhile, another respondent (a public relations manager in a founder managed company) states that he admired the organisation's founder: *because of his propensity to spot and appreciate talent.*

A second sub-theme relates to ensuring the sustainability, long-term survival of an organisation, or what we can broadly term the "stewardship" of an organisation. Narrating on a former employer organisation that was "thoroughly mismanaged" by the progeny of the founder, a respondent opines: *it is important for the owners and management of an organisation to take their responsibility of ensuring the survival and sustainability of an organisation seriously... as the lives, well-being of people- employees and their families, dependents- depends on this.*

A final sub-theme relates to the need for leaders to develop and have, to utilise the exact words of a respondent, *the wisdom for navigating politically sensitive environments, and situations.* This sub-theme is likely particularly pertinent to respondents from the centered-on countries as the prospect, existential reality of political intrusion, interference into the activities of a typical organisation is potentially high (Amankwah-Amoah *et al.*, 2016; Barnard *et al.*, 2017).

All in all, respondents perceive organisations as having higher legitimacy where the leadership is strong, independent, objective. This is particularly the case where the leadership objectively identifies, blossoms talent. Additionally, positive, effective leadership displays the skills, wisdom to deal with, navigate political intricacies, and is able to ensure the long-term survival, sustainability (*i.e.*, stewardship) of an organisation.

4.1.1.8 Expatriate-Local manager nexus

From analysis of participant responses, a recurring emerging theme underlying, driving organisational legitimacy perception is the need for organisations to have an appropriate balance of local or host country employees in their top management team (TMT). What's more, this increasingly includes having a local manager occupy the post of CEO itself. A

respondent simply forwards: *the organisation's continued deployment of a CEO from the organisation's home country is unfair... (when) managers from the local, host country has the capability to run the organisation.*

Detailed analysis of participant responses pertaining to the dimension unearthed two overriding aspects driving, underlying it. Firstly, and evidently, there is as a respondent states: *need for appropriate balance of locals in senior managerial positions in an organisation.*

Next, is the issue of “signaling” that deployment of expatriates sends. A respondent contends: *the deployment of expatriate managers when competent, experienced local managers are available sends wrong signals in terms of the value placed on local, host country employees.*

More specifically, a respondent raises the concept of “glass ceiling” that arises from the: *perception, or even feeling, that one cannot rise beyond a certain level in the organisational hierarchy due to demographic characteristics, for example, not being from the home country of the employer organisation.*

4.1.1.9 Cultural Authenticism

Another dimension of organisational legitimacy perception arising from the interview data pertains to an organisation having leadership that has cultural awareness, understanding, appreciation of the local context. Thus, a respondent (a commodity buyer in a foreign headquartered multinational firm) argues: *the organisation should deploy more locals in senior management positions... locals have a better, deeper understanding of where a typical local employee comes from- his, her thinking, upbringing.*

Even though there is a general, and logical, viewpoint that, compared to expatriates, local employees have a better, deeper understanding of the local cultural milieu there was an added complexity to this dimension. A number of respondents stated that due to their likely long stay in an organisation local managers can lose sense of their cultural setting. This is because they might be, to utilise the phraseology of a respondent: *co-opted and brainwashed by the organisational system.*

An organisational leadership's understanding, appreciation of, and alignment with local cultural values, ideals, and principles is thus an element determining respondent's perception of an organisation's legitimacy. Logically, some respondents believe that, with their foreignness, expatriates' understanding, appreciation of the local cultural undercurrent might naturally be restricted as compared to local managers. Nonetheless, respondents are acutely aware that due to a likely long stay in an organisation and potential consequent co-option and brainwashing even local managers might not be “culturally authentic”.

4.1.1.10 Share of Authority

There is a sense from the interviews that respondents also relate an organisation's legitimacy in terms of employee's ability to, in the words of a

respondent: *be listened to and be able to actively influence the operations and direction of their employer organisation.*

Borrowing a phrase from Lamb (1987), the theme of being “listened to” and being able to influence an organisation can summingly be denoted as “share of authority”. Analysing responses pertaining to this dimension two elements stand out. Firstly, an organisation must create an environment, and system that is amenable to change. In the words of a respondent, an organisation must not have an: *impenetrable system... (that gives) a sense that one cannot change, or reshape the current organisational system.*

According to respondents, a second aspect enabling a share of authority is a tolerant culture towards challenging your boss. As a respondent puts it: *the culture of not challenging your boss should be challenged... not only because the boss does not necessarily know everything but also, in particular, because the younger, more educated employees of today and, likely, more so those of tomorrow, expect to be listened to and to be able to actively influence the operations and direction of their employer organisation.*

4.1.1.11 Internal-External Hygiene

The final dimension comprises a diverse collection of factors and elements identified by respondents. Since these factors were not widely mentioned by a cross-section of participants, they do not qualify as separate dimensions. Nonetheless, the issues raised appear pertinent. Additionally, the five issues can be grouped into two groups: internal hygiene factors and external hygiene factors. The term “hygiene” is borrowed to indicate that the factors contribute to a healthy internal organisational climate and/or external stakeholder relationship. Due to their pertinence and aggregation in terms of organisational hygiene, the rudiments are amassed into this one dimension.

The first factor relates to the employment of people from an organisations immediate surrounding community. This is the sole emerging factor pertaining to external hygiene. A respondent (a founder CEO of a community-based environmental NGO) advocates that it is: *important for an organisation to provide opportunities to the local community so as to ensure an organisation’s acceptance.* The respondent continues: *the organisation’s ability to recruit youth from the community it operates in... is key to the success and sustainability of an organisation.*

A second factor relates to a suitable work environ that, to continue paraphrasing a respondent, appropriately balances a relaxed attitude with a serious, target-oriented ethic. Speaking of an employer organisation, another respondent is: *particularly attracted to the organisations unique balance between a relaxed, almost tranquil work environ with a serious sales-focused ethic.* The respondent sums the work environ, culture as: *stress-free but when you mess no mercy.*

Thirdly, concerning family-owned businesses, there is a wish for an organisation to have an optimal number of family member employees. As a respondent (a former public relations manager in a family construction firm)

continues: *having a superfluity of family member employees can give a picture- to nonfamily member employees- of their being too many eyes on you... working in a family-owned organisation with numerous family member employees around you gave a feeling of being spied upon.*

A somewhat similar factor to the above concerns having an optimal “gender balance” in an organisation. A respondent (a male medical practitioner in a foreign headquartered global health NGO) notes: *the organisation is heavily skewed gender wise having a preponderance of male employees... an organisation should have an optimal employee representation of both sexes. At the least, the employee contingent should not be too skewed towards one gender.*

A final factor revolves around the loyalty of an organisation to its employees, current and even past ones. A respondent (a former business development manager in a family firm) points out: *the owning family was very loyal to employees and believes in keeping relationships.* He further advises: *an organisation has to display loyalty to its employees.*

The above four factors (suitable work environ, optimal number of family member employees, appropriate gender balance, organisational loyalty to employees) can be termed internal hygiene factors. They contribute to creating a psycho-socially healthy internal work environ. Meanwhile, the factor of community employment contributes to creating a positive relationship between an organisation and its surrounding community.

In essence, respondents advance that they perceive an organisation displaying positive internal and external hygiene as increasingly legitimate. Subsequently, among the factors advanced as indicators of hygiene are the above outlined five.

4.2 Distilled, Crystallised Dimensions of Organisational Legitimacy Perception

Further analysis- including by delving into the logic, rationale behind the uncovered dimensions-, cross relating of the dimensions leads to distilling, crystallising of the eleven initial emerging dimensions into three comprehensive, overarching dimensions as captured in Table 1.

Table 1: Distilled, Crystallised Dimensions of Organisational Legitimacy Perception

Dimension
Presence, Activation of HRM Policies, Rules, Regulations
Presence, Activation of Organisational Vision, Core Values
Domestication of Top Management

Thus, it is forwarded that at a high level the dimensions underlying participants' perception of organisational legitimacy is embodied in the outlined three dimensions captured in Table 1. What's more, an added advantage of distilling the dimensions into a manageable few is that it enhances the parsimony of a study's findings. As Hofstede (2006, p. 895) argues, "our minds have limited capacity for processing information, and therefore dimensional models that are too complex will not be experienced as useful".

4.3 Summing Organisational Legitimacy Dimensions

In brief, of the distilled, crystallised overarching themes the two dimensions on presence, activation of HRM policies, rules, regulations, and vision, values, integrity are generally in tandem with literature (Collins and Porras, 1996; Greiner, 1998). However, the finding on domestication of top management as being a key dimension, driver of organisational legitimacy perception can be contended to be a new, unique finding. It is forwarded that this fresh, unique finding regarding domestication of top management is reflective of the Two-Publics nature (with its emphasis on limited trust of the 'foreign', *e.g.*, foreign organisations and managers) of the study context and the subsequent preeminence of the primordial public.

Furthermore, the importance of rules, regulations likely is also grounded on the significance of the primordial public. As Davidson (1992), Dia (1996) outline, the primordial public is full of restrictions, obligations, and rituals. Subsequently, it might be the case that African managers are transferring-possibly inadvertently, serendipitously- their conditioned state for rules, and regulations to the formal world of work in the civic public. Three related additional interesting findings are, firstly, that from a values perspective (the actual practice could be quite different) respondents have a desire for equality, standardisation in the HRM sphere. This differs profoundly from the literature (*e.g.*, Wanasika *et al.*, 2011) and the study's own theoretical framework which seem to suggest that the HRM sphere in Africa, from both a values and practice perspective, is riddled with bias, favouritism on tribal, ethnic, spatial/regional bases.

A second fascinating finding concerns respondents' apprehension with external inequality-which relates to HRM bias, favouritism based on employee nationality. This complements the regularly cited internal inequality that is based on tribe, religion, regionalism. Lastly, it is interesting that respondents appear to equally have an issue with near foreigners, that is, expatriates from regional, neighbouring countries, as they do with far foreigners, that is, expatriates from more distant lands. Logically, one would have insinuated that the reservation against near foreigners would be less as compared with far foreigners.

5.0 Conclusion and implications

The study determines eleven dimensions that underlie respondent's perception of organisational legitimacy. Through distilling, crystalising the

dimensions the study emerges with three overriding indicators, factors that drive African manager's perception of organisational legitimacy: presence, activation of HRM policies, rules, regulations; presence, activation of organisational vision, core values; domestication of an organisations top management.

Practically, the three distilled, crystallised dimensions construe the determinants of organisational legitimacy perception in the African setting. Subsequently, organisations are increasingly perceived as legitimate to the extent they operationalise the three dimensions. Hence, the uncovered dimensions (e.g., presence and standardisation of HRM rules, and regulations) are not only beneficial in their own right, but they also critically contribute to shaping the legitimacy perception of an organisation.

Findings of the study offer numerous practical recommendations at varied levels of analysis. To be brief, key recommendations include that individual managers should, in their decision making and behaviour, aim to consistently live up to an organisation's touted values, vision. At the organisational level, organisations should take into consideration the effect on organisational legitimacy of deployment of expatriates. At the societal/industry level, it is critical that regulators: ensure HRM policies, rules, regulations are developed and activated by organisations (and not simply deployed as a symbolic element); the 'unnecessary' deployment of expatriates is minimised.

References

- Ahiauзу, A.I. (1989), 'The 'Theory A' System of Work Organisation for the Modern African Workplace', *International Studies of Management and Organisation*, Vol. 19 No. 1, pp. 6 -27.
- Amankwah-Amoah, J., Ifere, S.E., and Nyuur, R.B. (2016), "Human Capital and Strategic Persistence: An Examination of Underperforming Workers in Two Emerging Economies", *Journal of Business Research*, Vol. 69 No. 10, pp. 4348-4357.
- Amankwah-Amoah, J. (2018), "Cultivating Greater Self-Confidence in African Management Research", *Thunderbird International Business Review*, Vol. 60 No. 4, pp. 511-522.
- Barnard, H., Cuervo-Cazurra, A. and Manning, S. (2017), "Africa Business Research as a Laboratory for Theory-Building: Extreme Conditions, new Phenomena and Alternative Paradigms of Social Relations", *Management and Organisation Review*, Vol. 13 No. 3, pp. 467-495.
- Bitektine, A. and Haack, P. (2015), "The 'Macro' and the 'Micro' of Legitimacy: Towards a Multi-Level Theory of the Legitimacy Process", *Academy of Management Review*, Vol. 40 No. 1, pp. 49-75.
- Bolden, R. and Kirk, P. (2009), "African Leadership: Surfacing new Understandings Through Leadership Development", *International Journal of Cross-Cultural Management*, Vol. 9 No. 1, pp. 69-86.

- Chabal, P. and Daloz, J. (1999) *Africa Works: Disorder as Political Instrument*, Oxford: James Currey.
- Collins, J.C. and Porras, J.I. (1996), "Building your Company's Vision", *Harvard Business Review*, Vol. 74 No. 5, pp. 65-77.
- Davidson, B. (1992) *The Black Man's Burden: Africa and the Curse of the Nation-State*, New York: Three Rivers Press.
- Deephouse, D.L. and Suchman, M.C. (2008), "Legitimacy in Organisational Institutionalism", in Greenwood, R., Hardy, C., Sahlin, K., and Suddaby, R. (Eds.), *Sage Handbook of Organisational Institutionalism*, London: Sage, pp. 49-78.
- Deephouse, D.L., Bundy, J., Tost, L.P., and Suchman, M.C. (2017), "Organisational Legitimacy: Six Key Questions", in Greenwood, R., Oliver, C., Lawrence, T., and Meyer, R. (Eds.), *Sage Handbook of Organisational Institutionalism*, 2nd ed, Thousand Oaks: Sage.
- Dia, M. (1996) *Africa's Management in the 1990's and Beyond: Reconciling Indigenous and Transplanted Institutions*, Washington, D.C.: World Bank.
- Dowden, R. (2019) *Africa: Altered States, Ordinary Miracles*, 2nd ed., London: Granta Books.
- Eisenhardt, K.M. (1989), "Building Theories from Case Study Research", *Academy of Management Review*, Vol. 14 No. 4, pp. 532-550.
- Ekeh, P. (1975), "Colonialism and the Two Publics in Africa: A Theoretical Statement", *Comparative Studies in Society and History*, Vol. 17 No. 1, pp. 91-112.
- George, G., Corbishley, C., Khayesi, J.N.O., Haas, M.R. and Tihanyi, I. (2016), "Bringing Africa in: Promising Directions for Management Research", *Academy of Management Journal*, Vol. 59 No. 2, pp. 377-393.
- Greiner, L.E. (1998), 'Evolution and Revolution as Organisations Grow', *Harvard Business Review*, Vol. 76 No. 3, pp.55-64.
- Haack, P 2012, "Legitimacy in Institutional Theory: Three Essays on Social Judgements in a Globalised World", Doctoral Dissertation, University of Zurich, Zurich.
- Hofstede, G 1980, 'Motivation, Leadership and Organisation: Do American Theories Apply Abroad?', *Organisational Dynamics*, Vol. 9 No. 1, pp. 42-63.
- Kamoche, K, Siebers, LQ, Mamman, A and Newenham-Kahindi, A. (2015), "The Dynamics of Managing People in the Diverse Cultural and Institutional Context of Africa", *Personnel Review*, Vol. 44 No. 3, pp. 330-345.

Kan, A.K.S., Apitsa, S.M. and Adegbite, E. (2015), "African Management': Concept, Content and Usability", *Society and Business Review*, Vol. 10 No. 3, pp. 258-279.

Kiggundu, M.N. (2013), "Personal Reflections on African Management: Looking in, looking out and Looking Ahead", *African Journal of Economic and Management Studies*, Vol. 4 No. 2, pp. 177-200.

Lamb, D (1987), *The Africans*, 2nd ed, New York: Vintage Books.

Nkomo, SM, Zoogah, D. and Acquaaah, M. (2015), "Why Africa Journal of Management and Why Now?", *Africa Journal of Management*, Vol. 1 No. 1, pp. 4-27.

Suddaby, R, Bitektine, A. and Haack, P. (2017), "Legitimacy", *Academy of Management Annals*, Vol. 11 No. 1, pp.451-478.

Wanasika, I, Howell, J.P., Littrell, R. and Dorfman, P. (2011), 'Managerial Leadership and Culture in Sub-Saharan Africa', *Journal of World Business*, Vol. 46 No. 2, pp. 234-241.

Zezeza, P.T. (2022), "The Possibilities and Perils of Leading an African University: Personal Reflections", *Council for the Development of Social Science Research in Africa (CODESRIA) Bulletin Online*, No. 2, pp. 1-6.

Zoogah, D.B., Peng, M.W. and Woldu, H. (2015a), "Institutions, Resources, and Organisational Effectiveness in Africa", *The Academy of Management Perspectives*, Vol. 29 No. 1, pp. 7-31.

Perception of library services among level three nursing students at Ekwendeni College of Health Sciences

Wezzie Mkweu, wezziemkweu@gmail.com

Fiskani Ngwira, fiskangwira@gmail.com

Abstract

Purpose: The purpose of this study was conducted to investigate the perception of library services among level three nursing students at Ekwendeni college of Health Sciences (ECOHS). The study covered three objectives namely: finding out the library services provided and used at the ECOHS, to ascertain if users are satisfied with the library services at ECOHS and to determine the challenges faced by the students in using library services at ECOHS.

Methodology: The study adopted case study and survey research design in which both qualitative and quantitative data were collected to answer research questions. The study population comprised fifty-nine (59) nursing student and one library staff at ECOHS. Data were collected as follows: firstly, a questionnaire was sent to fifty-nine level three nursing students and data was also collected through an interview with library staff. Questionnaire results were quantitatively analysed and presented in terms of frequency tables and graphs.

Findings: The findings revealed that ECOHS has different library services namely: provides memberships to the library, loan entitlements, circulation services, reference services, current awareness services, readers' services, Internet services and e-resources services, and reprographic services. The findings revealed that nursing students used library services. The study also revealed that a majority of nursing students used circulation services the most amongst the library services. The study also revealed that students were satisfied with the library services. The findings showed that the key challenges faced by nursing students when accessing library services; slow internet, electricity black-out, lack of computers, lack of promotion of library services, lack of awareness of library services, and limited library space. In line with the findings and conclusions drawn from the study, the following recommendations were made: There is a need for the College to increase the library space. This will help make the library environment conducive to utilisation. There is also a need for the college to upgrade the bandwidth of the library eliminate the slow pace of Internet connectivity and also increase the strength of their wireless connections. Library management should organise library training with new students joining the College in order to equip students with requisite knowledge and skill on how to use library services. ECOHS management should procure power back up as a heavy duty and solar energy system to ensure the smooth running of the library.

Keywords: User perception, academic library, library services, Ekwendeni College of Health Sciences.

1.0 Introduction

An academic library is defined as an embodiment and a storehouse of information resources (Okolo, 2020). An academic library serves two purposes: support university curricular and to support research and students (Arthur *et al.*, 2013). Academic libraries play a significant role towards the achievement of the goals of tertiary institutions and hardly would academic institutions be able to provide for the academic, intellectual and other interest and information needs of students without the services of good libraries (Banting *et al.*, 2008). There is a need for university libraries to understand their user needs and satisfy them (Thusithakumari, 2020). The identification of the gaps in the library services and the assessment results can improve service delivery (Naidu, 2009). This research hopes to better understand the concept of the research in their real-life environments. The researcher acquired to conduct the research at Ekwendeni College of Health Sciences because of the minimal knowledge created on the User perception of library services.

1.1 Problem Statement and purpose of the study

The literature reviewed discusses that user perception can guide between the users' expectations and service delivery by the librarians. According to a study conducted by Rilwani (2017) in Nigeria discuss that satisfaction with the library services, information resources and facilities available, will always encourage users to make use of the library where the quality of services rendered will help them satisfy their need. According to Naidu (2009) discuss that the gaps between users' expectations and perceptions of service quality are indicated the level of user satisfaction at the library and the identification of the gaps in the library services and the assessment results can improve service delivery. The researcher upon visiting the library discovered the library is well stocked with information resources, and therefore wanted to find the perception of those library services by third year nursing students at ECOHS. Therefore, this study intends would like to fill the research gap by investigating the user's perception on library services by the third-year nursing students at Ekwendeni college of health sciences.

1.2 Research Objectives

The specific objectives of this study were to:

1. To find out the library services provided and used at the ECOHS.
2. To ascertain if users are satisfied with the library services at ECOHS
3. To determine the challenges faced by the students in using library services at ECOHS

2.0 Literature Review

2.1 Library services provided and used

The study conducted by Raza, Upadhyaya and Noor (2011) on the utilisation of library resources and services in select management institutes, India. The study shows that most students were aware of the library services such as circulation services. Adewole et al. (2015) conducted a study on the effectiveness of Library Services and Resources in an African University, Nigeria. The findings of this study therefore show that if library services and resources are adequate and readily available, it would result to increase in use.

2.2 User satisfaction with library services by nursing students

Saika and Gohain (2013) conducted a study on user satisfaction with Library Resources and Services at Tezpur University (India). The finding shows that the majority 71 (44.65%) of the respondents were satisfied with the textbooks, 63 (39.62%) of the respondents were highly satisfied with the online database resources and 63 (39.62%) of the respondents were also satisfied with the regular supply of newspapers/magazine. It was, however, discovered that users were dissatisfied with the mobile alert services. Motiang, Wallis and Korodia (2014) conducted a study on an evaluation of user satisfaction with library services at the University of Limpopo, South African. The study shows that the level of user satisfaction of library opening hours, library registration, duration of loan services and available resources such as books and journals, was generally high.

2.3 Challenges in using library services

Sahabi and Otobo (2021) examined the academic library and challenges of service delivery in Nigerian Universities in the Digital Era. It was discovered that Nigerian universities had a few challenges when using library services such as incompetence, lack of knowledge of technology, low internet connection, insufficient energy supply, and low funding. In Uganda, a study of operational challenges of providing library services to distance education learners in a higher education system by Burunga and Osamai (2019). The study indicated that students had various challenges when accessing library services and resources such as poor attitudes towards the library mostly by students, and some of the library users are computer illiterate. i.e. they cannot retrieve information from the internet, limited access to computers by distant learners, poor attitude towards electronic resources (e-journals and eBooks), poor internet connectivity and inaccessibility.

3.0 Methodology

The target population of the study was fifty-nine (59) third year nursing students at ECOHS and one (1) library staff of at ECOHS Library. Out of 59 questionnaires which were distributed fifty (50) were completed and returned. A self-administered questionnaire was used to collect data. The library staff

was interviewed to collect data. This study used a mixed-method design. Quantitative data was analysed using Statistical Package for Social Science (SPSS) version 20 to generate percentages and frequency, while qualitative data was analysed using thematic analysis. Results were presented in pie charts, tables and graphs.

4.0 Results and Discussion

4.1 Background information

4.1.1 Personal Information

This section describes to determine personal information of the respondents such as gender.

4.1.2 Gender of Respondents

The respondents were asked to indicate their gender. Out of 50 respondents, 27 (54%) were female and 23 (46%) were male. The results show that there were more female students than male students.

4.2 Library services provided and used at Ekwendeni College of Health Sciences

The first objective of the study intended to solicit responses from respondents pertaining to library services provided and used in the library. The results in Figure 1 below.

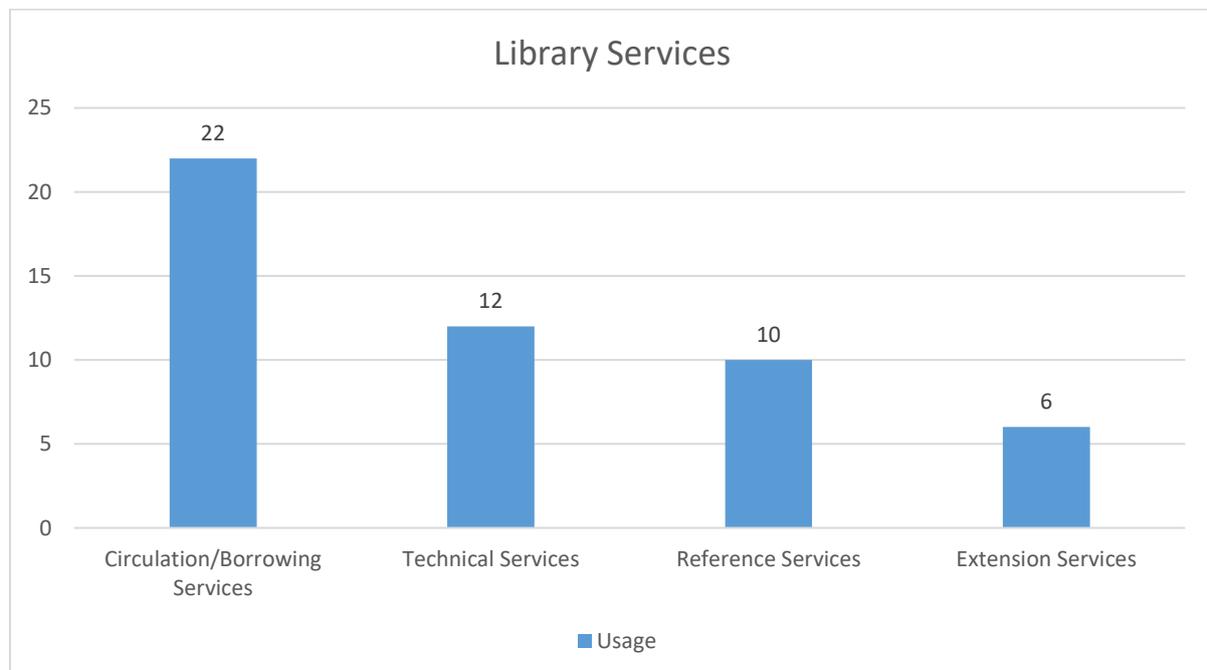


Figure 3: Type of Library Services offered (N=50)

As shown in Figure 1, a total of 22 (44%) level three nursing students are provided with circulation services. The study also revealed that 12 (24%) Nursing level three students are provided with technical services. Furthermore, the study shows that 10 (20%) are provided with reference library services. Additionally, the study also revealed that 6 (12%) are provided extension library services are offered at Ekwendeni College of Health Science. The findings suggest that nursing level three are provided with circulation services and extension library services are not provided. The findings are consistent with those of Abdulhamid and Hayatu (2021) who found that the majority of respondents (72%) use circulation services in Muhammadu Library Bauchi, Nigeria.

4.3 Level of familiarity of these library services

This part was intended to find out the levels to which the students are familiar with library services. The results are shown in the Figure 2 below.

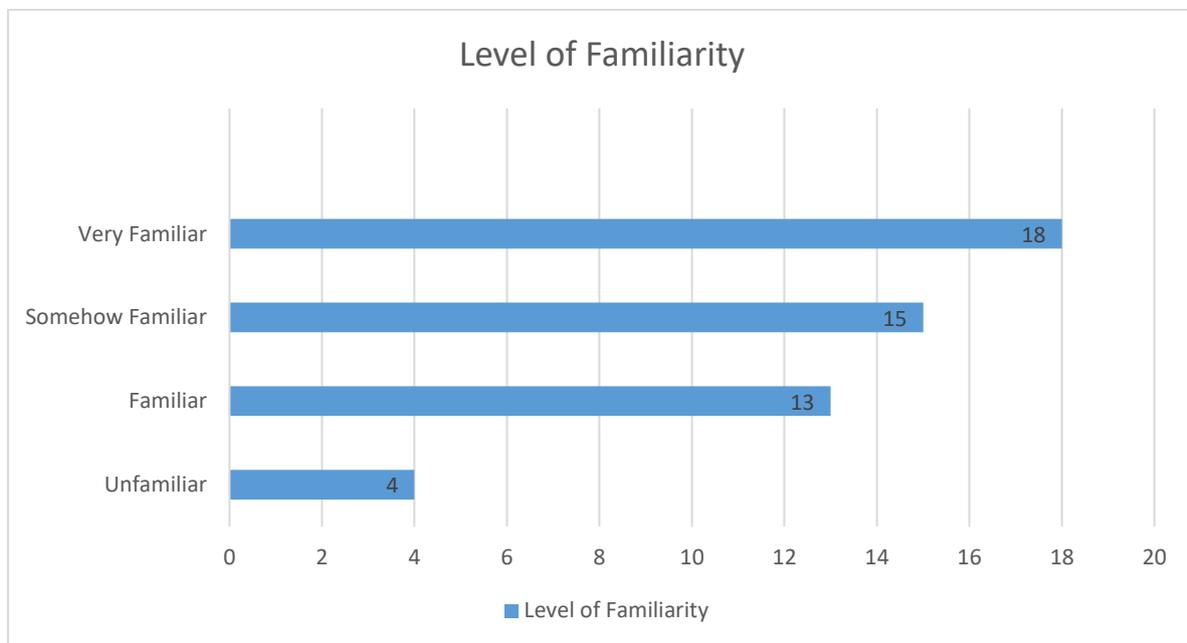


Figure 4: Level of familiarity with Library Services (N=50)

As shown in Figure 2 above, a total of 18 (36%) level three nursing students are very familiar with library services. The study also revealed that 15 (30%) are somehow familiar, 13 (26%) Nursing level three students are familiar with library services. Furthermore, the study shows that 4 (8%) level three nursing students are unfamiliar with library services. The findings suggest that nursing level three are very familiar with library services. This is in line with Raza, Upadhyay and Noor (2011) which indicated that users were aware of the library services such as circulation services by Indian students.

4.4 Satisfaction with library services by students

Section C of the questionnaire intended to solicit data from nursing students on the level of satisfaction with library services by students.

4.4.1 Access interval of the library services

In this segment, the researcher wanted to find out the intervals of access of the library services by level four nursing students. Findings on this item are presented in Figure 3.

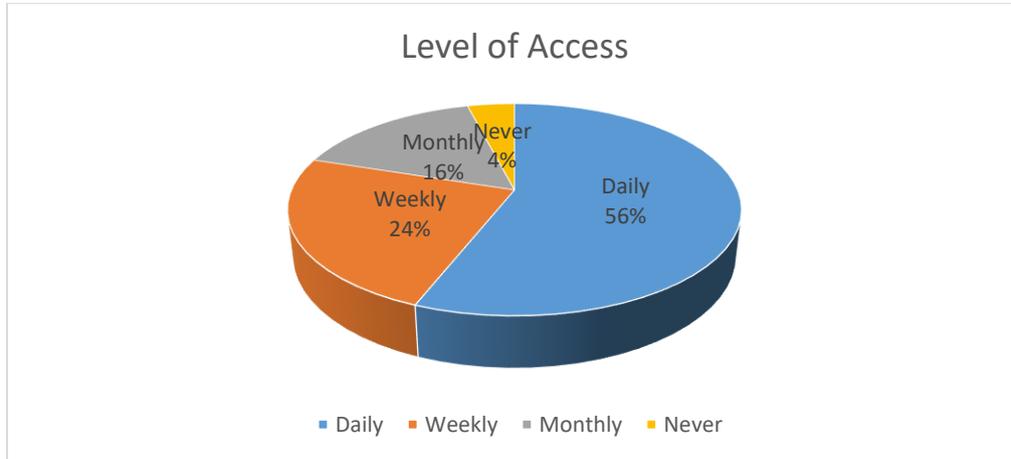


Figure 5: Library access intervals (N=50)

As illustrated in Figure 3 above, it has been established that 28 (56%) respondents said they accessed library services daily, 12 (24%) of the respondents accessed library services weekly. 8 (16%) respondents said they accessed library services monthly. On the other hand, 2 (4%) respondents showed that they never accessed library services. This finding suggests that a lot of the student's access library services daily basis.

4.4.2 Level of satisfaction with library services

In this segment the researcher wanted to find out the level of satisfaction of the library services by level four nursing students. Findings on this item are presented in Figure 4.



Figure 4: Level of satisfaction of library services. (N=50)

As illustrated in Figure 4 above, it has been established that 24 (48%) of the respondents are satisfied with the library services, On the other hand, 16 (32%) respondents said are strongly satisfied with the library services. Furthermore, 6 (12%) respondents said they were dissatisfied with the library services. Additionally, 4 (8%) respondents showed that they were strongly dissatisfied with library services. This finding suggests that many students are satisfied with the library services. This may suggest that the students are satisfied with the library services being provided. These findings are similar to those in a study by Motiang, Wallis and Korodia (2014) which found that user's satisfaction with library services at the University of Limpopo, South Africa.

4.5 Challenges encountered in using library services by nursing students at Ekwendeni College of health science

4.5.1 Challenges faced by students when using library services

This section shows the findings on the challenges faced by level four nursing students when accessing library services. The findings are presented in Table 1 below.

Table 1: Challenges encountered in using library services ECOHS library (N=50)

Statement	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Lack of Promotion of library services for use by the librarians	14	28%	10	20%	5	(10%)	15	(30%)	6	(12%)
Lack of awareness about library services	3	6%	18	36%	8	(16%)	15	(30%)	6	(12%)
Inability to interact with library staff in order to get assistance	7	14%	5	10%	10	(20%)	19	(38%)	9	(18%)
I have a negative feeling towards the library	3	6%	7	14%	1	(2%)	24	(48%)	15	(30%)

According to Table 4.2 above, the findings reveal that 24 (48%) disagreed to having a negative feeling towards the library and 19 (38%) also disagreed to being unable to interact with library staff in order to get assistance. However, 18 (36%) respondents agreed to lack of awareness of library services as a challenge and 14 (28%) strongly agreed and 10 (20%) agreed to lack of promotion of library services as a challenge in using ECOHS library.

5.0 Conclusion and Recommendations

5.1 Conclusion

The study was conducted to find out the perception of library services among level three nursing students at Ekwendeni College of Health Sciences. This was achieved by analysing the response of users on the use of library services, the satisfaction of library services and the challenges encountered when using library services. Based on the findings of this study, the researcher concluded that a lot of respondents use library services and they are very familiar with their existence and that they are satisfied with the library services. The study also revealed that respondents also face some challenges when using library services. Slow internet, limited library space and electricity black-out was found as the major barriers in getting access to electronic information resources. The reason for these problems might be due to a slow server and electricity breakdown problem

5.2 Recommendations

Based on the findings and conclusions drawn from the study the following recommendations were made by the researchers: There is need for the College to increase the library space. This will help make the library environment conducive for utilisation. There is also a need for the college to upgrade the bandwidth of the library eliminate the slow pace of Internet connectivity and also increase the strength of their wireless connections. Library management should organise library training with new students join the College in order to equip students with requisite knowledge and skill on how to use library services. Ekwendeni College of Health Science management should procure power back up as a heavy duty and solar energy system to ensure the smooth running of the library.

References

Abdulhamid, A. A. and Hayatu, M. M. (2021), "Challenges of Effective of Circulation Services in Academic Library: A Case Study of Muhammadu Library, Federal Polytechnic Bauchi", *International Journal of Library and Information Science*, Vol. 7 No. 5, 37-47.

Burunga, B. A. and Osamai, M. O. (2019), "Operational Challenges of Providing Library Services to Distance Educationa Learners in Higher Education System in Uganda", *Library Philosophy and Practice (e-journal)*.

Ijekhuamhen, O., Aghojare, B. and Ferdinand, O. (2015), "Assess users' satisfaction on academic library performance: a study", *International Journal of Academic Research and Reflection*, Vol. 3 No. 5, 66-77.

Ikenwa, I. and Adegbilero-Iwari, I. (2014), "Utilisation and User Satisfaction of Public Library Services in South-West, Nigeria in the 21st Century: a survey", *International Journal of Library Science*, Vol. 3 No. 1, 1-6.

Ikolo, V. E. (2015), "User satisfaction with library services: a case study of Delta State University library", *International Journal of Information and Communication Technology Education*, Vol. 11 No. 2, pp. 80-89.

Iwhiwhu, B. E. and Okorodudu, P. O. (2012), "Public Library Information Resources, Facilities, and Services: User Satisfaction with the Edo State Central Library, Benin-City, Nigeria", *Library Philosophy and Practice (e-journal)*. Retrieved from <http://digitalcommons.unl.edu/libphilprac>

Iwhiwhu, B. and Okorodudu, P. (2012), "Public Library Information Resources, Facilities, and Services: User Satisfaction with the Edo State Central Library, Benin City, Nigeria", *Library Philosophy and Practice*.

Krishnappa, S. and Kemparaju, T. D. (2019), "Awareness and Use of Library Resources and Services among the Social Science: A Case Study", *Library Philosophy and Practice*, 1-24. Retrieved from <http://digitalcommons.unl.edu/libphilpra>

Kumar, R. (2011) *Research Methodology: a step by step guide for beginners*, 3rd ed., London: Sage Publications Inc.

Mohammed, B. B. (2019). Provision of Public Library Services to Meet the Information Needs of Rural Dwellers in the North-Western Zone of Nigeria, Doctoral dissertation, College of Humanities, University of KwaZulu-Natal, Pietermaritzburg, South Africa.

Munir, U., Annum, G., Reyes, D. and Hassan, S. (2017), "Research instruments for data collection", Diakses daripada. Available at: https://www.academia.edu/34823600/RESEARCH_INSTRUMENTS_FOR_DATA_COLLECTION (Accessed 7/01/2025).

Nagaiah, M. and Ayyanar, K. (2016), "Software for Data Analysis in SPSS: On overview", *Research Methodology in Library and Information Science" (NCRMLIS 2016)* (pp. 1-9). Allagappa University. Retrieved from https://www.researchgate.net/publication/348740813_Software_for_Data_Analysis_in_SPSS_On_over_view

Naidu, Y. (2009) User Perception of Service Quality and the Level of User Satisfaction at the Mangosunthu University of Technology Library Umlazi, Durban, South Africa.

- Okolo, S. E. (2022), "Users Perception of the role of Academic Library in Private Universities in Delta State", *Library Philosophy and Practice*, 1-20.
- Omehia, A. E., Obi, B. B. and Itohowo, H. (2008), "Student Characteristics and Use of Library Services in the University of Uyo", *Library Philosophy and Practice (e-journal)*, 170-175. Retrieved from <http://digitalcommons.unl.edu/libphilprac/173>
- Oyelekan, G. and Iyortsuun, J.A. (2011), "An Evaluative Study of Reader Services in University of Agriculture Library Makurdi", *An Internation Journal of Information and Communication Technology*, Vol. 8 No. 2, pp. 129-137.
- Pandey, P. and Pandey, M. M. (2015) *Research Methodology : Tools and Techniques*, Bridge Center.
- Pickard, A. (2013), *Research Methods in Information*, London: UK Facet Publications.
- Ponto, J. (2015), "Understanding and Evaluating Survey Research", *Journal of Adv. Pract. Onco.*, Vol. 6, pp. 168 -171.
- Rani, M. and Roopa, S. (2012), "Questionnaire Designing for a Survey", *The Journal of Indian Orthodontic Society*, Vol. 46 No. 4, pp. 273-277.
- Raza, M. M., Upadhyay, A. K. and Noor, F. (2011), "Utilisation of Library Resources and Services in the Select Management Institutes: A Study", *International Journal of Library Sciwncw* , Vol. 3 No. 11, pp. 76-86.
- Rodrigues, M. and Mandrekar, B. (2020), "Impact of Academic Library Service on Students Sucess and Perfomance", *Library Philosophy and Practice (e-journal)*, 1-21.
- Saika, M. (2013), "Use and User's Satisfaction on Library Resources and Services in Tezpur University (India)", *Library Philosophy and Practice*. Available at: <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=2354&context=libphilprac> (Accessed 7/01/2025).
- Simon, M. and Goes, J. (2013), "*Scope, Limitations and Delimitations*". Retrieved from <http://www.dissertationrecipes.com> (Accessed 7/01/2025).
- Singh, A. (2014), "Sampling Techniques & Determination of Sample Size in Applied Statistics Research: an Overview", *International Journal of Economics, Commerce and Management*, Vol. II No. 11, pp. 1 -22.
- Suleiman, S. A. (2012), "User Education Programs in Academic Libraries; the Experience of the International Islamic University Malsya Students", *Library Philosophy and Practice (e-journal)*. Available at: <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1851&context=libphilprac> (Accessed 7/01/2025).

Taherdoost, H. (2017), "Sampling Methods in Research Methodology; How to Choose a Sampling technique for research", *International Journal of Academic Research in*, Vol. 5 No. 2, pp. 19-20.

Thusithakumari, W. M. (2020), "User perception about the quality of library services: with special reference to main library", *International Journal of Research and Analytical Reviews (IJRAR)*, Vol. 7 No. 4, pp. 161-173.

Tripathi, M. and Manomara. (2017), "Circulation Serrvices", in *Block 2 :Library Services* (pp. 89-110). Retrieved from <http://hdl.handle.net/123456789/34968>

Wallimani, N. (2011) *Research Methods: The Basics*, London: Taylor & Francis.

Zainal, Z. (2007), "Case study as a research method", Available at: https://www.researchgate.net/publication/41822817_Case_study_as_a_research_method (Accessed 7/01/2025).

Support for smallholder farmers with climate change information in Rumphi District: Role of Bolero Agriculture Resource Centre

¹Eunice Chimberenga and ²Austine Phiri

¹Former Student, Department of Information Sciences, Mzuzu University, Malawi. **Email:** eunicechimberenga4@gmail.com

²Senior Lecturer, Department of Information Sciences, Mzuzu University, Malawi. **Email:** austine_phiri@yahoo.com

Abstract

Purpose: The purpose of the study was to explore the role of Bolero Agriculture Resource Centre (ARC) in the provision of climate change information to smallholder farmers in Rumphi District

Methodology/approach: The study was underpinned by the constructivism paradigm. The study adopted a qualitative approach with a case study design. The population of the study was 30 comprising of Bolero Agriculture Resource Centre (ARC) Staff and Rural Smallholder Farmers within Bolero Extension Planning Area (EPA). A purposive sampling technique was adopted to select the EPA and smallholders for the study. The sample size of 30 was determined using a census approach. Data collection instruments were semi-structured interviews and focus group discussions. The instruments were subjected to peer checking to ascertain the correct use of language and level of items. Ethical clearance was sought from the Mzuzu University Research Ethics Committee (MZUNIREC). Data was analysed using NVivo 12 to generate themes and sub-themes.

Findings: The major finding of the study was that Bolero ARC offers different types of climate information sources to smallholder farmers such as pamphlets, leaflets, posters, booklets and television programmes. The study also revealed that smallholder farmers were aware of the climate change information sources at Bolero ARC despite the challenges of insufficient climate change information sources, language barriers and limited access to the ARC which impacted on use of information sources.

Conclusion and recommendations: Bolero ARC plays an important role in supporting smallholder farmers in Rumphi District with climate change information. Therefore, the government, donors and well-wishers should support the centre with additional climate change information sources in all formats and in the local language to enhance access and use of information for agricultural activities.

Originality/value of contribution: The study contributes to the rare body of knowledge on the provision of climate change information to smallholder farmers in Rumphi district in Malawi. Cognisant of the fact that the Malawian economy is agrarian, this study offers valuable lessons and insights to smallholder farmers, the Department of Agriculture and Extension Services, donors, and the general public on the importance of climate change information in agricultural productivity in the era of climate change.

Keywords: Climate Change Information, Agriculture Resource Centre, Smallholder Farmers, Rumphi District, Malawi

1.1 Introduction

The economies of many developing countries rely heavily on agriculture for livelihoods and economic growth approximately, 70 percent of agricultural output in developing countries is derived from small-scale farmers who mostly practice rain-fed agriculture (Mashonjowa *et al.*, 2011, p.441). Smallholder farmers are defined as those farmers owning small-based plots of land on which they grow subsistence crops and one or two cash crops relying almost exclusively on family labour (Agriculture, Forestry and Fisheries, 2012). Smallholders are characterized by family-focused motives such as favouring the stability of the farm household system, using mainly family labour for production and using part of the produce for family consumption (Wolfenson, 2013). Agricultural sector has been negatively affected by climate change. It is therefore important for smallholder farmers to have access to climate change information for accurate decision-making in agricultural production (Mwalukasa, 2018). Climate change information helps farmers in mitigating the negative impacts of climate change. Climate change adaptation is a higher priority than mitigation for smallholder farmers (Murray *et al.*, 2016). Climate change adaptation cannot be achieved if there is a lack of climate change information disseminated to the farmers. Information is accessed and used when it has been shared or disseminated. Information dissemination is a means by which facts are distributed to the public at large (Issa, 2010). Dissemination of information allows smallholder farmers to access reliable, timely and up-to-date information on climate change which is necessary for raising awareness about the impacts of climate change, planning for adaptation and mitigation strategies, and better management of climate change related risks (Siyao and Sife, 2018). There are various sources of climate change information for smallholder farmers such as fellow farmers, agricultural extension and resource centres, print material (newspapers and books), and ICT sources such as radio, television and internet. Majority of climate change information sources are found in the agriculture resource centres (F. Kachali, personal communication, January 11, 2020). Smallholder farmers are able to access climate change information available in the agriculture resource centres.

1.2 Context of the study: Bolero Agricultural Resource Centre

The Malawi Government through the Ministry of Agriculture and Food Security discovered that inadequate and inequitable access to agricultural information is one of the major constraints affecting agricultural productivity for all categories of farmers particularly smallholder farmers (Ministry of Agriculture and Food Security, 2008). To improve access to agricultural information, the government established Agriculture Resource Centres in the country. The Ministry of Agriculture and Food Security (2008) defines an agricultural resource centre as a place where agricultural information is gathered, processed, equitably accessed and disseminated for the purpose of

decision making in relation to choose and application of technology, target market, timing of sales and storage to enhance agricultural growth and development. Agriculture Resource Centres promote linkage between agricultural research and various stakeholders and complement information dissemination to various stakeholders including smallholder farmers (Ministry of Agriculture and Food Security, 2008). Some of Agriculture Resource Centres in Malawi are Lunyangwa Agriculture Resource Centre, Bvumbwe agriculture resource centre, Chitedze Agriculture Resource Centre, Chikwawa Agriculture Resource Centre and Bolero Agriculture Resource Centre. Bolero Agriculture Resource Centre is located in Bolero Extension Planning Area (EPA) in Rumphi District, Malawi. Bolero EPA covers an area of 1260 square kilometres consisting of three (3) Area Development Committee (ADCs) and 32 Village Development Committee (VDCs) under Traditional Authority Chikulamayembe (F. Kachali, personal communication, January 11, 2020). To the north, Bolero EPA is bordered by Nyika National Park, South Rukulu River to the south, Mwazisi EPA to the west, Mhujju and Bwengu EPA to the east. There are 10360 Households in the EPA with an average household size of 5, giving a population of 51800. (F. Kachali, personal communication, January 11, 2020). Bolero EPA has six sections which include Bolero A, Bolero B, Lundu, Mjuma, Bumba and Luviri. The sections have smallholder farmers groups. Madeya group is one of the eight groups found in Bolero A section. It is in this section where Bolero Resource Centre is found. Bolero Agriculture Resource Centre is located 16 kilometres west of Rumphi *Boma*. The Agriculture Resource Centre was opened on 3rd May 2019. The resources offered at the agriculture resource centre include printed materials such as books, fliers, posters and *zachikumba* magazine. Services offered include reading books, borrowing books, internet and climate information sharing. These resources and services are accessed by different patrons. They include agriculture extension officers, large scale farmers, smallholder farmers and students.

1.3 Problem statement

Smallholder farmers often lack information on climate change and this makes them to be affected as they fail to absorb climate shocks (Contò *et al.*, 2016; Gwenzi *et al.* 2015). Gwenzi *et al.* (2015) suggests that exposure to climate shocks among smallholder farmers can potentially be reduced through the use of reliable climate and weather forecast information from different sources such as agriculture resource centres that can actively influence important farm decisions. Agriculture Resource Centres are expected to do trainings of farmers, provide information on new technologies and innovations, provide climate and weather forecast information, enabling communities to know what to produce, how to produce, when to produce, so as to improve their household income, food and nutrition security situation and providing information for producers for advance planning to support agribusiness activities, (Degrande *et al.*, 2015; Mohammed, n,d; Ministry of Agriculture and Food Security, 2008). Degrande *et al.* (2015) argue that despite this, most of rural information resource centres face challenges in the provision of this information and services. Some include insufficient or lack of resources, low

capacity of staff and funding problems. Bolero Agriculture Resource Centre is one of the resource centres that have been put in place by the Malawi government to disseminate information which includes climate change information. Since its establishment in 2019, only a few rural smallholder farmers have been accessing the resources (F. Kachali, personal communication, January 11, 2020). Very little was known about how climate change information is disseminated and accessed at Bolero Agriculture Resource Centre. Therefore, the purpose of the study was to explore the role of Bolero Agriculture Resource Centre in provision of climate change information to smallholder farmers in Rumphi District.

In order to address the purpose of the study, the following research questions were formulated:

1. What are the types of climate change information sources offered at Bolero Agriculture Resource Centre?
2. What is the level of awareness of smallholder farmers on information sources available at Bolero Agriculture Resource Centre?
3. What are the challenges faced in the dissemination of climate change information to smallholder farmers at Bolero Agriculture Resource Centre?

2.0 Literature review

2.1 Information sources

Literature has revealed that farmers access information from various sources such as radio, television libraries, extension workers, and contact with fellow farmers from print material such as leaflets, magazine and newsletters. Most of these information sources are found in agriculture resource centres which are established to improve extension services (Mohammed, 2017).

2.2.1 Radio

Mntambo (2007) points out that radio is the most important way of reaching farmers in developing countries. Adamides and Stylianou (2018) stated that the radio is still the most appropriate communication technology available for most people, particularly rural communities. When used effectively in resource centres, radios can provide general information about climate change quickly and accurately to a large number of farmers, making them aware of the climate change and agricultural information which aims at improving agricultural production (Ozowa and Mwalukasa, 2012). The enhanced use of radio and television for climate change information dissemination could, for instance, complement extension service delivery in the area (Popoola, Yusuf & Monde, 2020). The emergence of low-cost ICTs such as radio, provided by the resource centres may bridge the digital divide (Lwoga and Ngulube, 2008). Nyambo and Ligate (2013) reported in their study

that in Tanzania particularly in Sudi and Pangatena villages, the radio was ranked highly by the respondents (smallholder farmers).

2.2.2 Television

Television has been shown to have the strongest effects in general and to be the main source of people's information about climate change (Schafer, 2015). Studies have revealed that television as one of the mass media plays a more significant role in climate change information dissemination and it is a major source of climate information for smallholder farmers (Popoola et al., 2020). The provision of climate change information by local television weather forecasters is one major way in which the masses may come to the realisation that their local climate is changing (Bloodhart *et al.*, 2015; Popoola *et al.*, 2020). Nevertheless, Elly and Silayo (2013) argue that television is not a reliable source of agriculture and climate information as compared to other information sources.

2.2.3 Print media

Smallholder farmers use printed materials such as newsletters, leaflets, brochures, newspapers and books to access climate change information (Mwalukasa, 2013). The context-specific publications such as leaflets and newsletters could be potential sources of information if the producers of the information choose to use them as means of disseminating context-specific information (e.g., climate change information) to the farmers (Elly and Silayo, 2013). When compared to other popular media such as radio and television, print media have additional advantages of providing flexibility in reading as they can allow a reader to go back to it, refer to it, read, review and study the material at his/her own pace and convenient time (Siyao and Sife, 2018). However, these sources of information are expensive and their effectiveness depends upon the level of literacy and communicative nature of the people (Mwalukasa, 2013). Studies have shown that many smallholder farmers are semiliterate thus it is a great obstacle for them to use printed climate change information sources (Nyambo and Ligata, 2013; Wyche *et al.*, 2016). However, Mugwisi *et al.* (2012), argued that farmers preferred print sources. In areas with a high rate of literacy, this medium is very effective if certain pre-conditions including a good level of education among farmers are met (Wambura and Mwalukasa, 2013).

2.2.4 Internet

The Internet is a modern-day technology that provides a platform for information access and interaction (Toma *et al.*, 2020). Information on climate change can be accessed on the internet through sources like e-books, journals, audio-visuallys, images and texts/records (Adio *et al.*, 2016). Mwalukasa (2012) states that rural dwellers do not have access to modern information technology such as the internet. The author continues that the fact that the internet is one of the least channels to disseminate information to farmers in rural areas points to the need for having an enabling

environment for such modern information communication technologies that farmers may have access to updated information. Poor farmers are mainly affected by the digital divide which is a gap between groups or individuals in their ability to use ICTs effectively due to differing literacy, technical skills and useful digital content (Ghatak and Mwalukasa, 2013). Despite this, Agwu and Chah (2007) point out that the internet is a formidable source of information; and if well used in the rural resource centres, access to information on recent developments in the field of agricultural extension can be readily obtained.

2.2.5 Agriculture extension workers/officers

In developing countries, dissemination of agricultural information depends much on the agricultural extension workers (Mwalukasa, 2012). Rural farmers have continued to rely on the traditional ways to access information. Studies have shown that to a large extent rural farmers get their agricultural information (climate change information inclusive) through extension officers (Elly and Silayo, 2013). Thus, agencies responsible for generating information and knowledge have to identify the right mechanisms to disseminate the same if the majority of the rural farmers are to be informed about climate change. However, there are inadequate agricultural officers and cannot always be available to give information on climate change when required to do so (Sheba & Mwalukasa, 2013).

2.3 Awareness on climate change information sources

Awareness of climate change information sources is important so as to keep the smallholder farmers alert of the available media through which they can access climate change information. A study by Popoola *et al.* (2020) reported that awareness of climate change information enables smallholder farmers to utilise weather forecast information through print and electronic media to plan their production activities and make critical production decisions. In line with this, Bello *et al.* (2013) stated that the ability of farmers to effectively cope with and adapt to climate change is largely dependent on their level of knowledge on accessibility to climate change information. Smallholder farmers often lack information on climate change because they do not utilise climate change information sources as a result this makes them fail to absorb climate shocks (Contò *et al.*, 2016; Gwenzi *et al.*, 2015). This underutilisation of information is attributed to a lack of awareness of the existence of different information sources (Mokotjo and Kalusopa, 2010; Majid *et al.*, 2001; Maponyas *et al.*, 2013). Nkeme and Ndaeyo (2013) in their study in Nigeria showed that farmers related their inability to utilise adaptation strategies to their lack of awareness and dearth in climate change information dissemination. Likewise, in Malawi, there is a lack of awareness of many smallholder farmers on the available climate change information sources (Mkisi 2014).

Agricultural extension plays a crucial role in dealing with climate change problems by raising awareness of smallholder farmers on various availability of climate change information sources which in the end will help them make informed decisions on climate change adaptation technologies and strategies,

(Mandleni and Anim, 2011; Nhemachena and Hassan 2007). The study by Ukwu and Iorkaa (2011) revealed that few farmers, 53(39.8%) out of a sample size of 186 (100%) were aware of the use or existence of information sources such as video and telephone and none were aware of the use of the Internet in extension service delivery. In contrast, a study done by Phiri *et al.* (2017) in Malawi revealed that the majority of respondents (smallholder farmers) 180 (94.8%) were aware of information sources while 12 (5.2%) were not.

2.4 Challenges faced in the dissemination of climate change information

Literature is replete with various challenges hindering the dissemination of climate change information. A study done by Mwalukasa (2012) revealed that lack of infrastructure, lack of information services, time of accessing information, access to outdated information, cost of accessing information, lack of power and language barrier are some of the challenges faced in the dissemination of climate change information sources to smallholder farmers. This is in line with findings by Abubakar *et al.* (2009) that language is one of the barriers to information dissemination. Mwalukasa (2012) also states limitations of different media affect the dissemination of climate change information. For example, broadcasting media such as television and radio are expensive and they require timing to access the information, farmers have to be listening or watching at the same time the programme is broadcast as such this becomes a challenge. Furthermore, the print media depends on the level of literacy of the farmers.

3.0 Methods

The study was underpinned by the constructivism paradigm. The study adopted a qualitative approach with a case study design. The population of the study was 30 comprising of Borero Agriculture Resource Centre (ARC) staff and Rural Smallholder Farmers within Bolero Extension Planning Area (EPA). A purposive sampling technique was adopted to select the EPA and smallholders for the study. The sample size of 30 was determined using a census approach. Data collection instruments were semi-structured interviews and focus group discussions. The instruments were subjected to peer checking to ascertain the correct use of language and level of items. The interview guide was pretested on two (2) Bolero Agriculture Resource Centre staff and the focus group discussion guide on four (4) Bolero smallholder farmers to check if the wording and questions are correct. The study adhered to ethical principles of confidentiality, privacy, beneficence, non-maleficence, and autonomy. After approval of the proposed study, the researcher obtained a consent letter from the Head of Department of Information Sciences at Mzuzu University and sought permission from the Bolero Resource Centre to collect data from the participants. Data was analysed using NVivo 12 to generate themes and sub-themes.

4.0 Results

4.1 Data collected from Bolero Agriculture Resource Centre staff

4.1.1 Types of climate change information sources

The objective of the study was to find out types of climate change information sources offered by Bolero Agricultural Resource Centre. Consequently, a question was posed to Bolero Agricultural Resource Centre staff to mention the types of climate change information sources offered. The participant stated that there are several types of climate change information sources that are available at the ARC such as books, leaflets, posters, booklets and television. The following was the response from the participant.

“We have books, leaflets, posters, booklets and the television.”

4.1.2 Challenges faced in the dissemination of climate change information

The study intended to find out from the participant some of the challenges faced in the dissemination of climate change information to smallholder farmers at Bolero ARC. The results from the interview revealed several challenges experienced. Some of the challenges were insufficient climate change information sources, limited knowledge of calculations needed for weather forecasts, and limited time to access the ARC. The following was a response from the participant related to the challenges identified above.

“We only have few information sources and, there are some information sources on weather forecasts which need calculation and many farmers do not know the calculations”

Apart from the challenges, the study also found possible solutions to the challenges faced in the dissemination of climate change information to smallholder farmers. The solutions were the acquisition of climate change information sources to address the challenge of insufficient climate change information, utilising the lead farmer to equip fellow farmers with knowledge on weather forecast calculations and increased opening hours of the resource centre so that smallholder farmers can have access to the centre. The following were some of the responses from the participants related to the solutions of the challenges identified above.

“Soon DAES will provide information sources both printed and electronic, and we will also have an internet connection”

“Using the lead farmer approach and extension workers to teach smallholder farmers weather forecast calculations”

4.2 Data collected from smallholders

4.2.1 Types of climate change information sources

Concerning the question on the types of climate change information sources offered at Bolero ARC, the smallholder farmers stated that there are a number of types of climate change information sources that are offered at the ARC. These climate change sources offered at Bolero ARC include: Television, books, extension staff and weather forecast bulleting. The following was the response from one of the participants.

“There are books, extension workers, television, and weather forecasts bulletin.” (Participant 1)

4.2.2 Awareness on climate change information sources

This section sought to find out the level of awareness of the smallholder farmers on any climate change information sources provided by Bolero ARC. The results of the study showed that almost all respondents were aware of the climate change information sources available at Bolero ARC. This level of awareness is attributed to the existence of extension officers and lead farmers as revealed by the study. The extension officers and lead farmers to educate smallholder farmers on climate change information sources found in the ARC and on how to use them to be well-informed in their farming. Besides that, they use on farm demonstrations on how to mitigate climate change based on the information sources found in the ARC. These exercises have helped smallholder farmers to be aware of the various sources of information. The following was the response from one of the participants.

“We are aware of the information resources that are offered at Bolero ARC.” (Participant 7)

4.2.3 Challenges faced when accessing climate change information sources

This section intended to find out from the smallholder farmers challenges that they face when accessing of climate change information at Bolero ARC. The focus group discussion revealed some challenges faced. These include: language barrier and limited time of accessing the Agricultural Resource Centre. The following were some of the responses from the participants related to the challenges identified above.

“We are only given an opportunity to use the resource centre once a week which is not enough for all smallholder farmers in Bolero.” (Participant 14)

“Most of the information sources like books are in English which many of us are not conversant with.” (Participant 9)

The section also sought to find out from the smallholder farmers some possible solutions to the challenges encountered. The solutions include: the translation of climate change information sources in English to Chichewa and Tumbuka, and introducing a circulation section where smallholder farmers may borrow the information sources. The following were some of the responses from the participants related to the solutions of the challenges identified above.

“They should let us borrow information sources from the ARC in groups like Madeya that we can use them at home.” (Participant 5)

“The information sources in English should be translated to vernacular, Chewa and Tumbuka languages.” (Participant 7)

5.0 Discussion

5.1 Types of climate change information sources offered

The study intended to find out the types of climate change information sources that are offered at Bolero ARC. The study revealed that there are several climate change information sources available at Bolero ARC. The major ones are pamphlets, leaflets, posters, booklets and television. The findings are similar to the studies done by Degrande *et al.* (2015), Mwalukasa (2011) and Mohammed (2017) which revealed that small libraries at the agriculture resource centre have print materials such as leaflets, magazines, booklets and posters and mass media such as television as the climate change information sources.

5.1.1 Awareness of smallholder farmers on climate change information sources

The results of the study showed that almost all respondents were aware of the availability of climate change information sources at Bolero ARC. The respondents stated that they were aware of the availability of the television, booklets, and posters (weather forecast bulletin). This level of awareness is credited to the existence of extension officers and lead farmers as revealed by the study. These results are in line with the study done by Phiri *et al.* (2017) revealed that 94.8% of the respondents (smallholder farmers) were aware of the information sources at their disposal and the awareness is partly attributed to the existence of extension officers. Similarly, Iwuchukwu and Udoye's (2014) study in Nigeria revealed that 97.5% of rural smallholder farmers were aware of information sources and the presence of extension officers contributed to smallholder farmers' level of awareness. In contrast, similar studies by Maponyas *et al.* (2013), Nkeme and Ndaeyo, (2013) and Mkisi (2014) showed that there is lack of awareness among many smallholder farmers on the availability climate change information sources (Mkisi 2014).

5.1.2 Challenges in the dissemination of climate change information

This section intended to establish challenges faced by Bolero ARC in the dissemination of climate change information to smallholder farmers. Some major challenges were found that affect the provision of climate change information at Bolero ARC such as inadequate information sources, language barrier and limited time of accessing the ARC. In accordance with the findings of this study, Abubakar et. al. (2009) found that one of the hindrances to information accessibility is language barriers. Most climate change information sources provided are in English which most farmers are not conversant with like the local language and this results in underutilisation (Mwalukasa, 2011). Mwalukasa (2011) mentioned other challenges which include; lack of infrastructure, lack of information services, time of accessing information, access to outdated information, cost of accessing information and lack of power.

6.0 Conclusion

The study was conducted to find out the role of Bolero ARC in the provision of climate change information to smallholder farmers in Rumphu. The research report covered five chapters which included an introduction and background, literature review, methodology, data analysis and presentation of results, discussion conclusion and recommendations. The study was meant to address the following objectives; the types of climate change information sources offered at Bolero ARC, find out level of awareness of smallholder farmers on information sources available at Bolero ARC and to investigate the challenges faced in the dissemination of climate change information to smallholder farmers at Bolero ARC. It has been shown from the study that Bolero ARC has the following information sources on climate change; pamphlets, leaflets, posters, booklets and television. It was also noted that almost all respondents were aware of the climate change information sources offered at Bolero ARC but most of them were aware of the television and books. Even though respondents were aware about the availability of different climate change information sources at Bolero ARC, there is underutilisation of these information sources. The study also found out that the major challenges that Bolero ARC faces in the dissemination of climate change information to smallholder farmers include insufficient climate change information sources, limited time of accessing the ARC and language barrier.

6.1 Recommendations

The study provides the following recommendations:

- The Bolero ARC with the help from the DAES should translate both electronic and printed climate change information sources to vernacular to make sure that all smallholder farmers benefit from the information sources.

- The DAES should purchase more information sources on climate change for Bolero ARC that they can be sufficient for all smallholder farmers in Bolero.
- The Bolero ARC should introduce awareness campaigns on the significance of ARC in the provision of climate change information.
- The ARC should introduce borrowing services that various smallholder farmers' groups may borrow the information sources especially print resources

6.2 Originality/value of contribution

The study contributes to the rare body of knowledge on the provision of climate change information to smallholder farmers in Rumphi district in Malawi. Cognisant of the fact that the Malawian economy is agrarian, this study offers valuable lessons and insights to smallholder farmers, the Department of Agriculture and Extension Services, donors, and the general public on the importance of climate change information in agricultural productivity in the era of climate change.

References

Abubakar, B.Z., Ango, A.K. and Buhari, U. (2009), "The roles of mass media in disseminating agricultural information to farmers in BirninKebbi local government area of Kebbi state: A case study of State Fadama II Development Project", *Journal of Agricultural Extension*, Vol. 13 No. 2, pp. 42-54.

Agriculture, Forestry and Fisheries (2012), *A framework for the development of smallholder farmers through cooperative development*, SA: Agriculture, Forestry and Fisheries.

Bello, M., Salau, E.S., Galadima, O.E. and Ali, I. (2013), "Knowledge, perception and adaptation strategies to climate change among farmers of Central State Nigeria", *Sustainable Agriculture*, Vol. 2, pp. 107-117.

Bloodhart, B., Maibach, E., Myers, T. and Zhao, X. (2015), "Local climate experts: The influence of local TV weather information on climate change perceptions", *PloS one*, Vol. 10 No. 11, e0141526.

Degrande, A., Tchoundjeu, Z., Kwidja, A. and FongangFouepe, G. (2015), *Rural Resource Centres: A Community Approach to Extension. Note 10. GFRAS Good Practice Notes for Extension and Advisory Services*, Lindau, Switzerland: GFRAS

Elly, T. and Silayo, E.E. (2013), "Agricultural information needs and sources of the rural farmers in Tanzania: A case of Iringa rural district", *Library Review*, Vol. 62 No 8/9, pp. 547-566.

Gwenzi, J., Mashonjowa, E., Mafongoya, P.L., Rwasoka, D.T. and Stigter, K. (2015), "The use of indigenous knowledge systems for short- and long-range

rainfall prediction and farmers perception of science-based seasonal forecasts in Zimbabwe”, *International Journal of Climate Change Strategies and Management*, Vol. 8 No. 3, pp. 440-462.

Issa, A.O (2010) *Information Dissemination to the Rural Persons in Nigeria: A Librarian’s Perspective*, Offa-Kwara State, Nigeria: Department of Library & Information Science, Federal Polytechnic.

Iwuchukwu, J.C. and Udoye C.E. (2014), “Climate change information needs of pineapple farmers in Enugu State, Nigeria”, *Journal of Agriculture Extension*, Vol. 18 No. 1, pp. 73–83.

Lwoga, E. T. and Ngulube, P. (2008), “Managing indigenous and exogenous knowledge through information and communication technologies for agricultural development and achievement of the UN Millennium Development Goals in Tanzania”, in Njobvu, B. and Koopman, S. (Eds.), *Libraries and information services towards the attainment of the UN millennium development goals*, Berlin: Walter de Gruyter, p. 73e88).

Mandleni, B. and Anim. F.D.K. (2011), “Climate change awareness and decision on adaptation measures by livestock farmers in South Africa”, *Journal of Agriculture Science*, Vol. 3 No. 3, pp. 258–268.

Maponya, P. and Mpandeli, S. (2012), “Climate change adaptation strategies used by Limpopo Province farmers in South Africa”, *Journal of Agricultural Science*, Vol. 4 No. 12, p.39.

Mntambo, B.D. (2007) *Socio-economic, institutional and behavioural determinants of accessibility and utilisation of agricultural information by women farmers in Korogwe district*, Master of Arts Dissertation, Sokoine University of Agriculture, Tanzania.

Murray, U., Gebremedhin, Z., Brychkova, G. and Spillane, C. (2016), “Smallholder Farmers and Climate Smart Agriculture: Technology and Labour-productivity Constraints amongst Women Smallholders in Malawi”, *Gender Technology and Development*, Vol. 20 No. 2, pp. 117-148.

Mwalukasa, N. (2013), “Agricultural information sources used for climate change adaptation in Tanzania”, *Library Review*, Vol. 62 No. 4/5, pp. 266-292.

Ministry of Agriculture and Food Security (2008) *The Agricultural Resource Centres: Implementation Guide*, Lilongwe: Institution Development Across Agri-Food Sector (IDAF) Programme.

Mkisi, R.B. (2014), “The role of agricultural extension in smallholder farmer adaptation to climate change in Blantyre district, Malawi”, *Open access theses*, p. 353. https://docs.lib.purdue.edu/open_access_theses/353

Mokotjo, W. and Kalusopa, T. (2010), "Evaluation of the agricultural information service (AIS) in Lesotho", *International Journal of Information Management*, Vol. 30 No. 4, pp. 350-356.

Nkeme, K.K. and Ndaeyo, N.U. (2013), "Climate change and coping strategies among peasant farmers in Akwa Ibom state, Nigeria", *International Journal of Basic and Applied Sciences*, Vol. 2 No. 1, pp. 24-28.

Pandey, P. and Pandey, M. M. (2015) *Research methodology: tools and techniques*, Romania: Bridge Centre.

Phiri, A., Chipeta, G.T. and Chawinga, W.D. (2017), "Information needs and barriers of rural smallholder farmers in developing countries: A case study of rural smallholder farmers in Malawi", *Information Development*, Vol. 35 No. 3, pp. 421-434.

Popoola, O.O., Yusuf, S.F.G. and Monde, N. (2020), "Information Sources and Constraints to Climate Change Adaptation amongst Smallholder Farmers in Amathole District Municipality, Eastern Cape Province, South Africa", *Sustainability*, Vol. 12 No. 5846. <https://doi:10.3390/su12145846>

Siyao, P.O. and Sife, A.S. (2018), "Coverage of climate change information in Tanzanian Newspapers", *Global Knowledge, Memory and Communication*, Vol. 67 No. 6/7, pp. 425-437.

Ukwu, O. J. and Iorkaa, T.I. (2011), "An assessment of farmers' use of new information and communication technologies as sources of agricultural information in Ushongo local government area, Benue State, Nigeria", *Journal of Sustainable Development in Africa*, Vol. 13 No. 2, pp. 41-52.

Wolfenson, K.D.M. (2013), "Small holders and family farmers". <http://www.fao.org/docrep/018/ar588e/ar588e.pdf>.

Improving access to information through library marketing in a private University in Malawi

¹Racheal Cham'mudzi and ²Austine Phiri

¹Former Student, Department of Information Sciences, Mzuzu University, Malawi. **Email:** rchammudzi1122@gmail.com

²Senior Lecturer, Department of Information Sciences, Mzuzu University, Malawi. **Email:** austine.phiri@yahoo.com

Abstract

Purpose: To explore the marketing of library services at Deayang University in Lilongwe to raise awareness and improve access to library services and products.

Methodology/approach: The study was underpinned by the AIDA model. The study adopted a mixed methods approach with a social survey design. The population of the study was 504 (500 library users and 4 library staff members). Convenience and Purposive sampling methods were adopted. The sample size of 217 was determined using a sample size table by Krejcie and Morgan Sample Size Table (Krejcie and Morgan, 1970). Due to the impact of the COVID-19 pandemic and the impending closure of the University, the study adopted a sample of 54 representing 50 library users and four (4) library staff. Questionnaires and interview guides were used to collect data. Ethical clearance was sought through the Mzuzu University Research Ethics Committee (MZUNIREC). Data was analysed using Statistical Package for Social Science (SPSS) version 20.0 for quantitative data and thematic analysis for qualitative data.

Findings: The major finding of the study was that all library users at Deayang University were aware of the library services and products offered and that the institution is one of the few libraries in Malawi that market its products and services and this process is done through posters, flyers, social media platforms, positive word of mouth and other tools of marketing.

Conclusion and recommendations: The library at Deayang University can properly market its services and products. This capacity can be enhanced with adequate funding and well-trained library staff that can improve the image of the library among its clients through formal and informal interactions. The library should improve the effectiveness of the existing marketing tools such as posters, the university website and friends

Originality/value of contribution: The study is significant in the sense that the findings can be utilised in decision-making by library management to improve the visibility and usability of library services and products. The study also contributes significantly to the global discussion on the marketing of library services in the era of the COVID-19 pandemic.

Keywords: Library, Library Services, Library Products, Library Marketing, Deayang University Library

1.1 Introduction

Marketing of products and services is the most important aspect for an organisation to let people know of the products and services that it offers. Kotler (1997:4) defines marketing as “an analysis, planning, implementation, and control of carefully formulated programs designed to bring about voluntary exchanges of values with target markets for the purpose of achieving organisational goals. Weingand (1998:118) has described marketing as a process of exchange in which “elements” of value are exchanged between a producer and a consumer and which begins with a community analysis to determine the needs of the consumers and ends with the library's communication to the community relating the products created to respond to those needs. Marketing relies heavily on designing the organisation's offerings in terms of the target markets, needs and desires, and on using effective pricing, communication, distribution to inform, motivate, and service the markets. Marketing and promotion are vital for libraries to enhance their reputation and usage (Bhardwaj and Jain, 2016). Marketing is an approach to achieve users' satisfaction. Information is a marketable commodity and libraries and information centres can be revenue-earning units rather than revenue consuming ones (Mahesh, 2012). Therefore, library as one of the institutions that provide information services to the people; also uses marketing strategies in making people aware of the services that it offers. Libraries engage in marketing for various reasons such as competition for customers in that libraries are facing an increasing competition from a diverse of competitors such as bookstores, consultants, the Internet, private information providers such as bureaus and so on (Olorunfemi and Ipadeola, 2018: n.p). In essence, libraries are no longer the sole providers of information with the coming of the above-mentioned information providers and an increase in service providers has also led to information explosion which is defined as the rapid increase in the amount of published information or data and the effects of this abundance. Therefore, libraries need to engage in marketing to justify its existence in dealing with the issue of information explosion as the amount of data grows, the problem of managing the information becomes more difficult which can lead to information overload (Hilbert, 2015).

1.2 Context of the Study: Daeyang University

Deayang University is a Christian university founded by the Miracle for Africa Foundation, registered and accredited by the Nation Council for Higher Education (NCHE). The University believes in biblical principles and values and these are reflected in its teaching and training processes. The Deayang University campus is located in Kanengo in Lilongwe, off the M1 road that passes between Kamuzu International Airport and Malawi Institute of Management (MIM) within the complex which also houses Deayang Luke Hospital. The University started with the establishment of Deayang College of Nursing in 2010 and Deayang College of Information and Communication Technology (ICT) in 2014. Deayang University library was opened in the honor of Malawi's former vice president Dr Joyce Banda in 2010. Deayang University

library is committed to offering high quality customer services through current awareness services and responding to reference queries.

1.3 Problem statement

A study was conducted in Malawi which based on children's' libraries and concluded that librarians have shown a positive attitude towards the adoption of marketing library services which can lead to improved academic performance if well planned and promoted so that the users are aware of these services and make full use of them (Ngaunje, 2003). However, libraries have not adopted marketing as a working culture as libraries in developing countries are struggling to conduct outreach programs to promote their resources and services (Bhardwaj and Jain, 2016). This researcher has observed that many academic libraries in Malawi including Deayang University are facing problems when it comes to marketing of the services that the library offers and not many studies have been done on marketing of library services in Malawi. Therefore, the study endeavors to explore marketing of library services at Deayang University in Lilongwe with the goal of awareness and use of library services. In order to address the aim of the study, the following research questions were formulated:

1. What is the level of awareness of users on library services available at Deayang University?
2. What are the library services marketed by the library at Deayang University?
3. What are the marketing tools in use at Deayang University?
4. What are the challenges that the library faces in marketing library services and products at Deayang University?

2.0 Literature review

Studies have reported contrasting levels of awareness of library services. For instance, a study by Hinson and Amidu (2006) revealed that the majority of users were aware of the library services being offered while a study by Roberts (1995) indicated that the majority of users were not aware of the library services partly due to poor communication and inadequate interaction between users and the library, coupled with the library's failure to apply marketing strategies to promote its services. This Interaction can be influenced both by factors directly related to the library, such as how efficiently and effectively it is run, the relevance of the information it provides and the communication channels it employs (Roberts, 1995). Hinson and Amidu (2006) reveal that the majority of the final year students in the University of Ghana Business School are aware of the internet, having been introduced to it by family and friends, or under self-tuition. With respect to obstacles to internet use, the majorities of the students have difficulty in accessing the internet and thus consider lack of access to be an obstacle to its use.

A study by Kudirat (2015) at Usmanu Danfodiyo University in Nigeria revealed that the university library offers the following services such as a circulation section, reference section, ICT division such as the internet café services, and audio-visual section; the library also markets other library resources such as print materials, non-print resources and reference resources such as dictionaries, encyclopaedias, handbooks, directories, atlas and others. Similarly, an exploratory study by Chipeta (2007) titled *Marketing of Library and Information Services: A Comparison of the Mzuzu University and University of Zululand Libraries* found out that some of the services marketed by the university libraries include databases; Malawian section which is composed of periodicals such as newspapers, magazines, thesis and dissertations; reprographic services such as lending of books; audio visuals; inter-library loan; reference services and photocopying.

There is overwhelming evidence of the use of marketing tools for the promotion of library services and products in university libraries (Kaur, 2009; Hua *et al.*, 2015; Nemeckova, 2012; Mugyabuso *et al.*, 2002). Some of the marketing tools as revealed by the studies were the university website, interviews, flyers, posters, personal selling (Kaur 2009), mobile library and microblog (Hua *et al.*, 2015), publicity, library orientation, user education (Nemeckova, 2012), promotions (Kinnell and MacDougall, 1994: 106), advertising (Chipeta 2007), television, radio, newspapers, magazines, direct mail, public transport; out-door billboards, catalogues or the Internet (Dibb, *et al.*, 2002, p.464), public relations and publicity (Kinnell and MacDougall, 1994, p.106). Public relations can be immeasurably enhanced by the attitude of staff in dealing with the users of the library's services with the assumption that a user who is well treated by the staff is likely to go back and recommend the service to others (Kinnell and MacDougall, 1994). The authors (Kinnell and MacDougall, 1994) further noted that an important part of public relations is publicity which involves the community, parents, alumni, potential donors, and other influencers and catalysts (Reynolds, 2003, n.p). Reynolds (2003, n.p) further argues that public relations personnel can send press releases, stories, and pictures to the media (newspapers, radio, TV, newsletters and letters) in order to stimulate publicity. The use of marketing tools has proven to improve access and use of library services as reported in a study by Kaur (2009) in Malaysia. The study (Kaur, 2009) revealed that academic libraries lacking in their promotional activities and that the library websites are not fully utilised as a marketing tool and enabler to reach out to the community for promotion of services and collections.

Library marketing in a university setting is faced by several challenges as indicated in the literature. A study by Chandratre (2005) revealed that university libraries face challenges such as a relatively low level of knowledge and lack of agreement on user requirements, wants, and needs; the virtual impossibility of estimating the value contributed by information products and services to the efficiency and conduct of research and development and the advancement of scholarly pursuits; the general economic unsophistication of those, mostly schooled in the humanities and the non-market-oriented library school environment, which purchase information products and services; lack of

business expertise among librarians and information scientists; casual approach in supplying information to the potential users and lack of perception of how much information services and products can contribute to boosting research and development activity. Similarly, a related study by Mahesh (2002) also revealed that university library faces challenges to marketing such as Carnegie's Syndrome where users still view libraries as a place to obtain free services, lack of income generating activities, lack of user needs assessment, lack of trained personnel to conduct library marketing, lack of management support towards marketing, poor quality of service quality, delay in rendering the service, poor response to customers (Rao, 1999).

3.0 Theoretical framework: AIDA Model

Several theories and models have been developed in the study of library marketing. The most popular models are 4Ps (Gohari *et al.*, 2009; Kaur and Rani, 2008; Madhusudhan, 2008), Defleur's Shannon and Weaver model (cQuail and Windahh, 1981), Information Needs and Seeking Behaviour model (Wilson, 1981), and Information Behaviour model (Wilson, 1996) and AIDA model (Honhon, 2013). This study will adopt the AIDA model due to its relevance to the research objectives which seeks to understand awareness of users on library marketing which is attention under the model, services and products to be marketed addressed under the interest and desire component of the model, and marketing tools and challenges to be guided by the action of the AIDA model. AIDA is an acronym that stands for Attention, Interest, Desire, and Action. Attention The first step in marketing or advertising is to consider how to attract the attention of consumers. Therefore, attention address pertinent questions such as following; how do we make buyers aware of our products or services? What is our outreach strategy? What is our brand awareness campaign? Which tools or platforms do we use? What should the message be? The second step is interest which is concerned with keeping the user interested in the products and services having being captured of their attention. This step addresses the questions; how will we gain their interest? What is our content strategy? Social proof available to back up our reputation? How do we make this information available and where, i.e. on website, via videos, customer ratings? The third step is desire and the goal in this level is to make a user change his or her attitude from "I want it" to "I like it" the pertinent questions addressed at this level are what makes our products or services desirable? how do we interact personally to make an emotional connection? The last step of the model is action which drive the receiver of the marketing campaign to initiate action and purchase the product or service. Questions that the marketer addresses at this level are what is the call to actions and where do we place them? Is it easy for consumers to connect and where would they expect to find it?

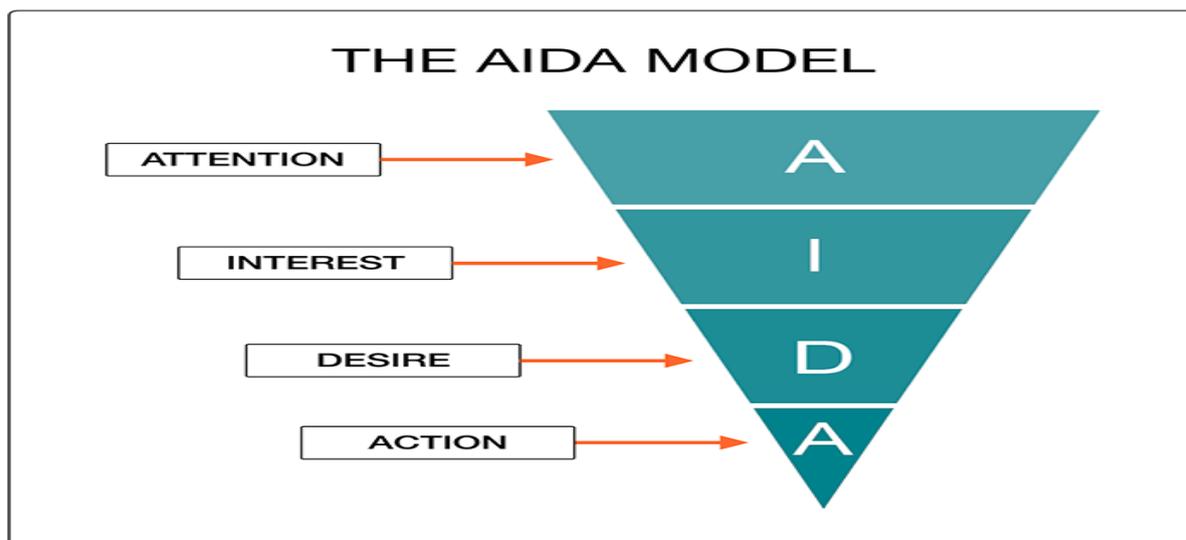


Figure 1: AIDA Model (Honhon, 2013)

4.0 Methods

Fifty questionnaires were distributed to library users of Deayang University and 43 questionnaires were returned representing a response rate of 86%. Four interview guides were prepared and conducted with four library staff representing a 100% response rate. The study adopted a mixed methods research approach with a social survey design. The study was conducted at Daeyang University Library. The population of the study was 504 (500 library users and 4 library staff members). Convenience and Purposive sampling methods were used to select participants for the study. The sample size was determined using a sample size table by Krejcie and Morgan Sample Size Table which stipulates that when the population is 500 the sample size is supposed to be 217 with the degree of accuracy of 0.05 (Krejcie and Morgan, 1970). Due to the impact of the COVID-19 pandemic and the impending closure of the University, the study adopted a sample of 54 representing 50 library users and 4 library staff. Questionnaires with open and closed questions and structured interview guide were used to collect data from library users and staff respectively. Data collection exercise was done in the period between May to June 2020. Pretesting was conducted at Mzuzu University library in March 2020 with 3 library users and 1 member of staff. Consent was sought from respondents through a written consent form and use of codes on data collection instruments in order to enquire privacy and confidentiality of participants. Data was analysed in two-fold; Statistical Package for Social Science (SPSS) version 20.0 for quantitative data and thematic analysis for qualitative data.

5.0 Results

5.1 Demographic Data

According to the data in Table 1 below, out of 43 respondents, 27 were male representing 63% and 16 were female representing 37%; the age ranges of the

respondents were as follows; 15-20 (16, 38%), 21-25(18,43%), 26-30 (5,12%) and above 30 years old (3,7%); educational levels for the respondents were: Level 1(16, 37%), Level 2 (15, 35%), Level 3(8, 19%), Level 4(4,9%) and program of study for the respondents were that nursing (26, 59%) and ICT(18, 41%). The results entail that majority of respondents were male; majority of respondents belonged to age category of 21-25; the education level of majority of respondents was level one and as regards to the programme of study, majority of respondents were in nursing programme. Participants' gender composition was that three were male and one female library staff while the library positions were one University Librarian and three Library Assistants.

Table 1: Demographic Data of Respondents (N=43)

Variables		Frequency (f)	Percentage (%)
Gender	Male	27	63
	Female	16	37
Age	15-20	16	38
	21-25	18	43
	26-30	5	12
	Over 30	3	7
Education	Level 1	16	37
	Level 2	15	35
	Level 3	8	19
	Level 4	4	9
Program of study	Nursing	26	59
	ICT	18	41

5.2 Awareness of the library services offered

The objective aimed at finding out if the library users were aware of the library services provided by the Deayang University Library and how they became aware of the services offered. The respondents were asked if they were aware of the library services being offered and 43 respondents representing 100% said they were aware of the library services offered at Deayang University library and when they were asked of how they became aware of these library services, all the respondents, 43 (100%) said through library orientation that happens upon their arrival as first-year students. Similar results were revealed from those of interview guide that participants were aware of library

services and products at Daeyang University library through library orientations, social media, university website, Open Public Access Catalogue (OPAC), display notice boards and word of mouth. The response from one of the participants was;

“The library uses library orientations and social media platforms in letting people aware of the services offered” (Participant 3)

The findings entails that the majority of respondents were aware of library services mostly through library orientations and social media.

5.3 Library services

The objective aimed at finding out the library services offered at Daeyang University library, the frequently used services and how often the users use these services.

5.3.1 Types of library services

A question was posed to respondents on library services offered at Daeyang University. According to data in Figure 1, 42 (21.4%) responded that the library provide photocopying, 39 (19.9%) indicated internet services, 33 (16.8%) indicated circulation, 29 (14.8%) respondents indicated reference services, 27 (13.8%) indicated library instructions, 15 (7.7%) chose online database and 11 (5.6%) indicated inter-library loan, as one of the services offered by the library at Daeyang University. The participants mentioned that the major library services and products offered by the library are reprographic services, books, electronic resources such as CDs, reading space, lending services, internet services, newsletters, periodicals, reference services and inter library loan services. The following was the response from one of the participants;

“the library offers reprographic service (printing, photocopying and binding), reading space, internet services, lending, periodicals, references services, newsletters and inter library loan and he continued to say that this are the services marketed not only those that are offered” (Participant 4)

The findings entails that the major types of library services at Daeyang University library were reprographics, internet services and circulation.

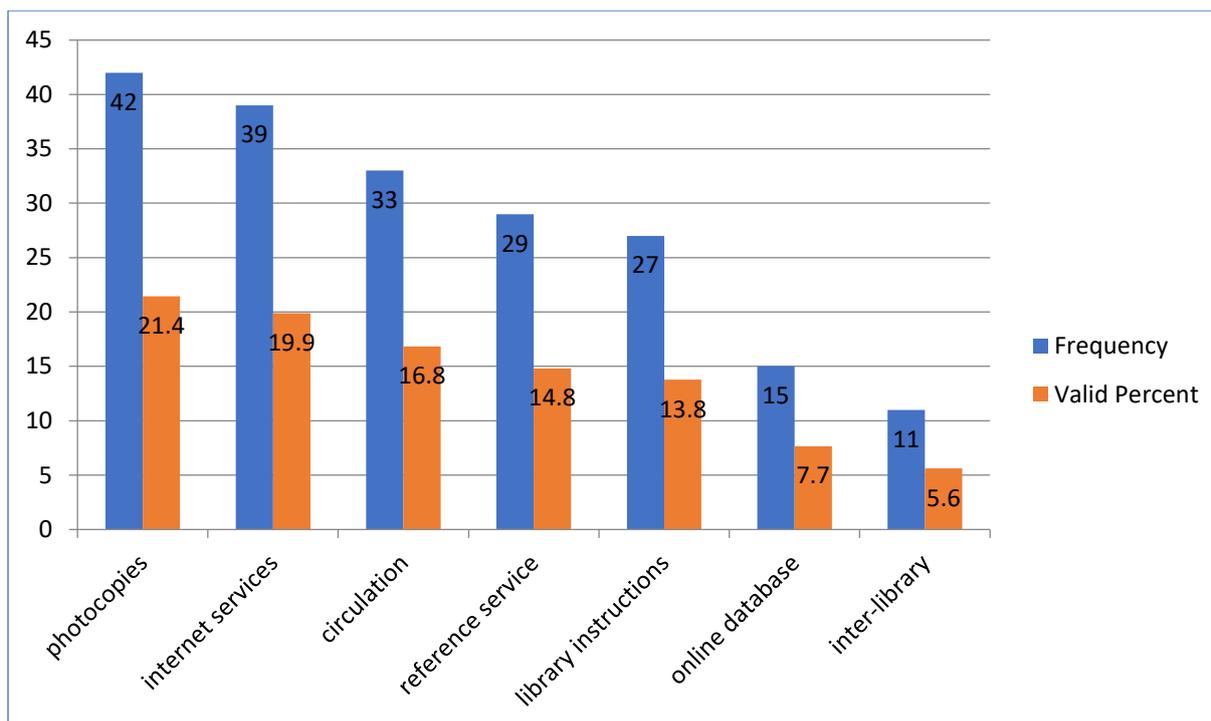


Figure 1: Types of Library Services

5.3.2 Frequency of library services

Respondents were asked about frequently used library services at Deayang University. From the data in Figure 2 below, 38 (28%) respondents indicated photocopying, 33 (24%) respondents often use the internet services, 23 (17%) respondents often use reference services, 22 (16%) respondents often use circulation services, 12 (9%) respondents often use library instruction, 4 (3%) respondents often use the online database, 3 (2%) respondents often use the inter-library loan, 1 (1%) respondent indicated that he/she do not use any of the library services. Results from the interview guide revealed that the most frequently used library products and services at Deayang University were books, reprographic services, lending services, reading space and internet services. The following was the response from one of the participants;

“Reprographic services, seconded by reading and internet services are the services often used by library users” (Participant 3)

This means that the majority of respondents frequently use reprographic and internet services.

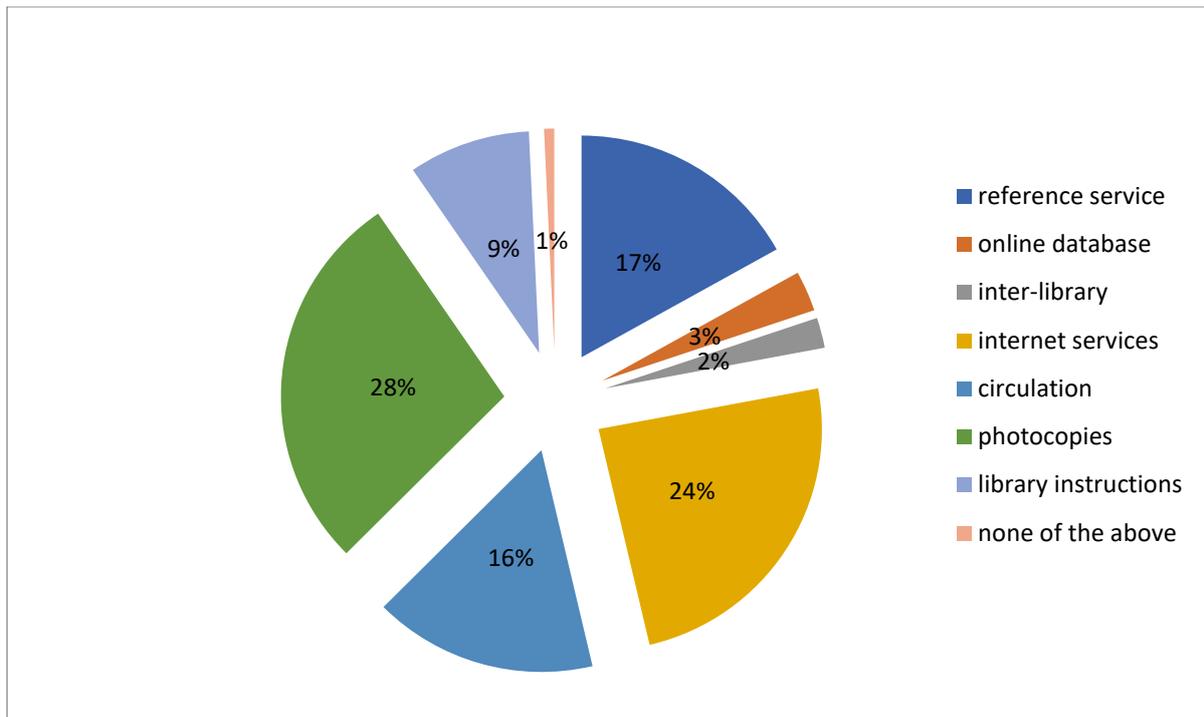


Figure 2: Frequency of using library services

5.3.3 Frequency of using library services

Respondents were asked about how often they use library services at Deayang University. Twenty-nine (69%) respondents use the library services daily, 7 (17%) respondents use library services weekly, 4 (9%) respondents use library services monthly and 2 (5%) respondents use library services fortnightly. The results are displayed in Table 2 below. This means that the majority of respondents use library services on a daily basis.

Table 2: Frequency of using library services

Frequency	Frequency (f)	Percentage (%)
Daily	29	69
Weekly	7	17
Monthly	4	9
Fortnight	2	5

4.4 Library marketing tools

5.4.1 Types of library marketing tools

Respondents were asked to find out the types of library marketing tools at Deayang University Library. The findings revealed that 21 (24%) respondents indicated posters, 18 (21%) respondents mentioned library orientation, 17

(20%) respondents mentioned hand-outs, 11 (13%) respondents indicated emails, 10 (12%) respondents indicated library website as a marketing tool, 7 (8%) respondents indicated social media as a marketing tool and 2 (2%) respondents indicated workshops. The results are presented in Figure 3 below. Similarly, results from the interview guide also revealed that the library uses marketing tools such as social media platforms (Facebook, WhatsApp, LinkedIn, Twitter), brochures, flyers, blogs, broadcasts, notices and positive word of mouth. The following was the response from one of the participants;

“As of now we are using brochures, we also market on Facebook, we also use twitter account, linked in and WhatsApp said”
(Participant 2)

The results entails that the major marketing tools used by the library were posters, library orientation, hand-outs and social media. The respondents were also asked to give the reasons behind the use of these marketing tools and the following were their responses; easy to access the marketing messages, affordable and availability, provision of detailed information of what the library is offering, and provision of updates.

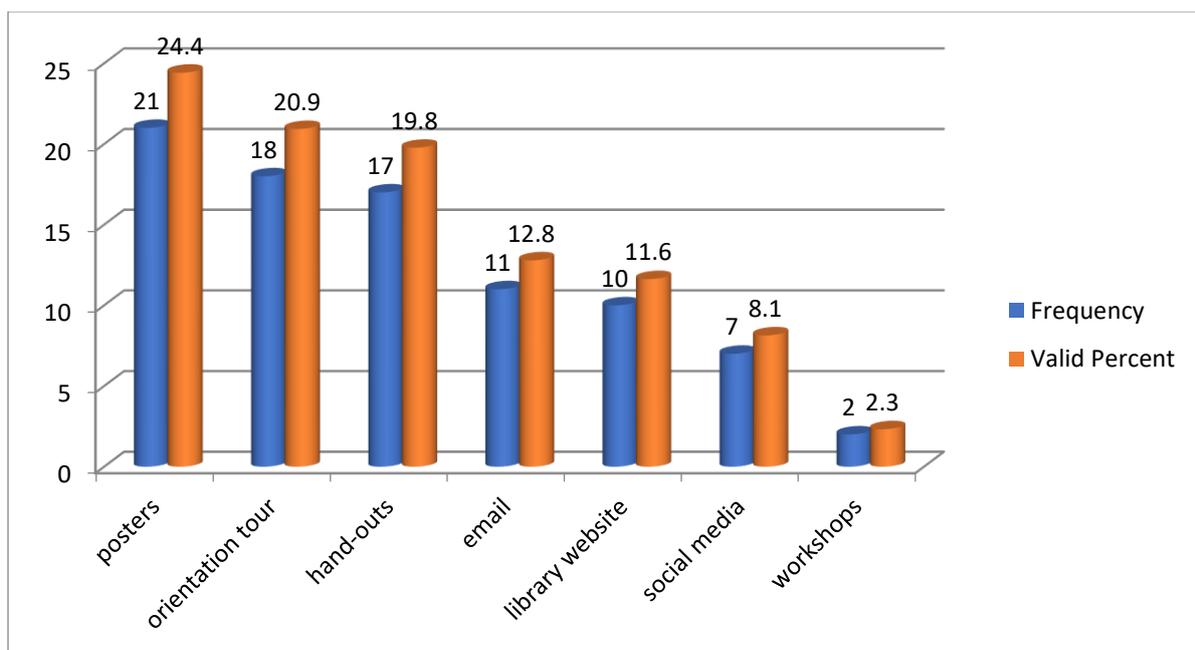


Figure 3: Library Marketing Tools

5.4.2 Level of satisfaction with library marketing tools

A yes or no question was posed to respondents to find out if they are satisfied with library marketing tools being utilised at Deayang University Library. According to the data in Figure 4 below, 23 (53.5%) respondents were not satisfied while 20 (46.5%) were satisfied. The same question was also posed to participants using interview guide. The results revealed that two (25%) participants said that they were satisfied while others were not sure. The following was the response from one of the participants;

“Yes, the participants are satisfied by the way the library market its products and services” (Participant 1)

This means that majority of respondents were not satisfied with library marketing tools.

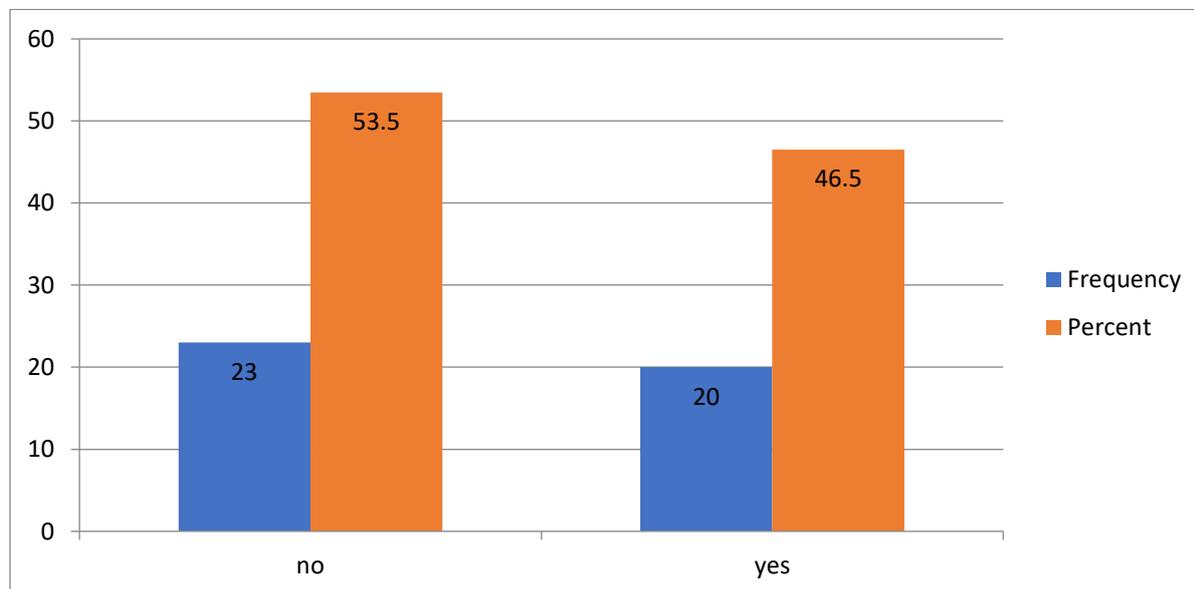


Figure 4. Level of satisfaction of library marketing tools

5.5 Challenges in accessing library services and products

A question was posed to respondents in order to unveil the challenges they experience in accessing library services and products. According to the results displayed in Figure 5 below, 20 (30.3%) respondents indicated inadequate services available, 13 (19.7%) respondents mentioned inadequate information resources, eight (12.1%) respondents indicated poor information resources delivery, seven (10.6%) respondents indicated unavailability of services, six (9.1%) respondents indicated poor service delivery and six (9.1%) respondents unavailable information resources. Similarly, the results from the interview guide also indicated that the challenges faced were lack of funds or low library budget, insufficient staff, negative perception of people towards the library, information overload due to the coming of the internet, poor internet connection and lack of familiarity by users on accessing information from the internet. The following was the responses from one of the participants

“Mostly funds so it’s hard to do marketing especially when it involves travelling far to do marketing to the community, people’s negative perception towards the existence of the library and information overload with the coming of the internet” (Participant 4)

The results entails that the major challenges in accessing library services and products were inadequate services and inadequate information resources due to lack of funds or low library and budget, insufficient staff.

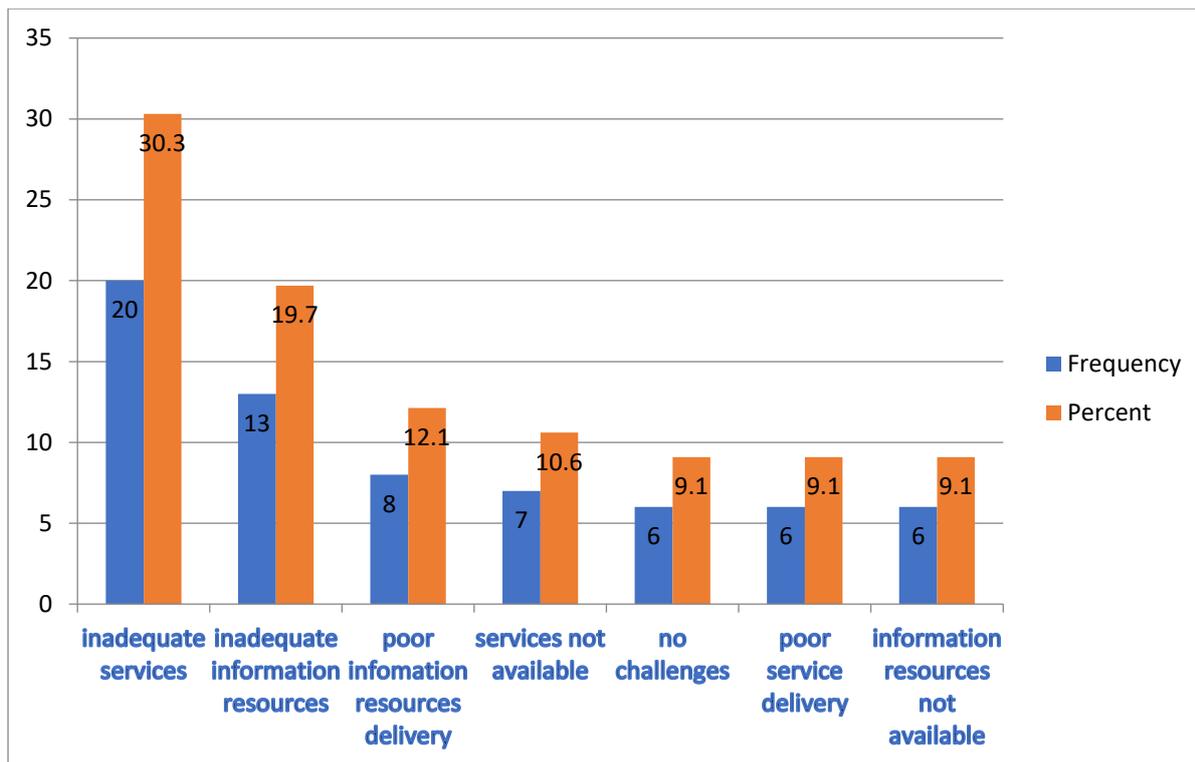


Figure 5. Challenges of marketing of library services and products

According to data in Figure 6 below, 24 (37.5%) respondents suggested that the library should update its materials, 14 (21.9%) respondents suggested the use of interlibrary loan, 13 (20.3%) respondents suggested that the library should subscribe to online databases, 13 (20.3%) respondents suggested that the library should provide different formats of information resources. Results through interview guide also revealed some of the solutions to the challenges such as library user education, improved library funding, recruitment of library staff, and library partnerships. The following was the response from one of the participants;

“Probably in terms of perception there is need to civic educate people that in the library they will find evaluated resources and peer reviewed resources; in terms of funds there is need to introduce sustainable means of funding the library maybe by introducing library user fee” (Participant 4)

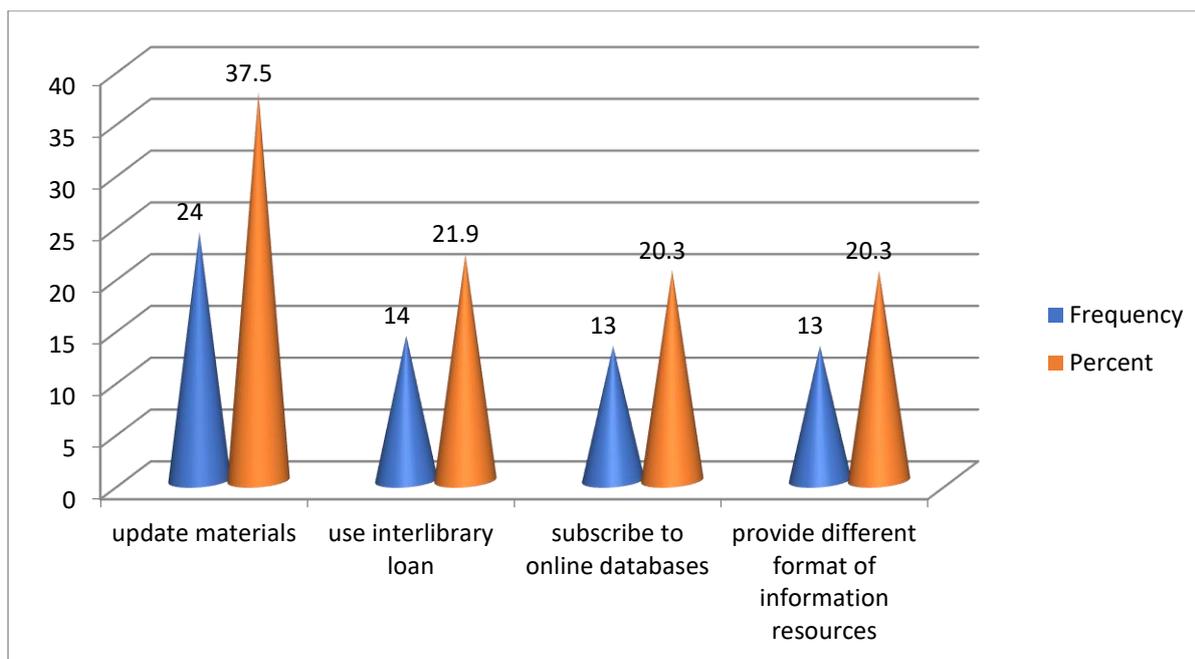


Figure 6. Possible solutions to the challenges

6.0 Discussion

6.1 Level of awareness of library services

The study found that all library users (43, 100%) were aware of the library services offered at Deayang University Library and mostly through library orientations. Similar findings collected through the interview guide also revealed that the library offers library orientations and social media to raise awareness of its services. This may imply that library marketing tools through library orientations and social media being utilised at the University library are effective. However, it is not clear in this study whether this level of awareness translated to the improved use of the library. Besides, the University library should intensify the use of other marketing tools such as the University website, Open Public Access Catalogue (OPAC), display notice boards and word of mouth through awareness campaigns and other means with the impression that an increase in level of awareness will eventually improve access and use of library services and products by users as expounded by AIDA model (Honhon, 2013). Similar findings were reported in the study by Chipeta (2007) at Mzuzu University and University of Zululand in Malawi and South Africa respectively which indicated that the most popular methods through which students from the Mzuzu University became aware of the services was through librarians' user education (79%), followed by talks and lectures (53%), while at the University of Zululand, the most popular method was wandering around the library (43%), followed by talks and lectures (40%). Based on the findings from the study by Chipeta, Deayang University library should widen its marketing tools with the inclusion of talks and lectures.

6.2 Library Services

The study found that the major library services offered at Deayang University Library were photocopying represented by 21%, internet services (20%), circulation services (17%), and reference services (15%). Similar findings from library staff added to say that the library also provides reprography, reference, lending, reading space, internet and periodicals as some of the library services and products. To improve access and use of library services, the library should be proactive in providing a variety of modern services. The findings imply that the services revealed by the study are directly relevant to teaching, learning, research and outreach activities of Daeyang University being one of the higher education institutions in Malawi. Similar findings were reported in the study by Namugera (2014) on user awareness, perception and usage of Makerere University (Uganda) library services in the main and selected libraries. In addition, similar findings of the study by Chipeta (2007) on the marketing of library and information services indicated that the most often used services at Mzuzu University Library were reference services represented by 91%, then online databases which were represented by 84%, circulation services represented by 79% and inter library loan represented by 37%.

6.3 Marketing tools

The study found that the marketing tools used at Deayang University library were posters (24%), library orientation (21%), handouts (20%), email (13%), library website (12%), social media (8%) and lastly workshops (2%). Library staff added that some of the library marketing tools used at Deayang University include the use of brochures, flyers, blogs, broadcast, OPAC displays and positive word of mouth. From these results it can deduced that the major marketing tools in use at Daeyand University library are posters, library orientation, handouts, brochures, flyers, blogs, broadcast, OPAC, displays and word of mouth. The library should, therefore, revamp the use of lowly used marketing tools such social media and workshops which are equally effective in marketing library services and products. Similar findings were revealed in the study by Chipeta (2007) on marketing of library and information that some of the marketing tools used at Mzuzu University and University of Zululand libraries were leaflets, sign posting, displays, talks and lectures, exhibitions, web articles and posters. Therefore, Deayang library can also adopt some of the marketing tools such as talks and lecturers, and exhibitions with ability for instant feedback.

6.4 Challenges to marketing of library services and products

The study found out that the challenges that the Deayang University library face in marketing its products and services are lack of funds for marketing, insufficient staff, negative perception of people towards the library, information overload, poor internet connectivity that would be used for online marketing such as through social media platforms, and lack of user awareness towards finding information on the internet. Furthermore, library users were of the view that the major challenges the library faces in marketing library services and products were inadequate library services and

information resources. The findings of the present study are similar to those of Mahesh (2002) in the study that he did on barriers to marketing of information products and services in libraries. The study found that the major barriers to library marketing were Carnegie's syndrome, lack of needs assessment, lack of trained manpower, pricing, low library budget, lack of management support, poor quality services and lack of sharing touch. The library users suggested some of the solutions to the challenges highlighted above such as updating the library collection, the use of inter-library loan and subscription to online databases. Library staff suggested some solutions to the problems faced when marketing library services and products. Some of the solutions were that the users should be educated on the importance of the library and the products and services it offers, and Deayang University should provide adequate funds for the library which might help in the process of marketing library services. Other solutions were that the library should establish sustainable funds such as pricing library user fee, diversify collection, and establishing partnership with other libraries.

7.0 Conclusion

In conclusion the study aimed at finding out marketing of library services at Deayang University and due to the process of data collection and analysis it has been noted that all library users at Deayang University were aware of the library services and products offered and that Deayang University is one of the few libraries in Malawi that market its products and services and this process is done through posters, flyers, social media platforms, positive word of mouth and other tools of marketing. Slightly the majority of library users were not satisfied with the marketing of library services and products at Deayang University library in the midst of challenges such as lack of funds, insufficient library staff, and negative perception of users towards the library. Based on the findings of this study the researcher recommends the following points to the Deayang University library;

- The library should improve the effectiveness of the existing marketing tools such as posters, university website and through friends as revealed by the study that majority of library users are aware of the services through library orientations.
- The library should employ more library staff whom will be involved in the process of marketing of the library services especially through outreach programmes as revealed by the study.
- The library should vigorously market its services through the use of various library marketing tools in order to justify its existence as revealed by the study that users do not value it.
- Deayang University management should support the library through funding and other means in marketing of library services and products as indicated by the study.

7.1 Originality/value of contribution

The study is significant in the sense that the findings can be utilised in decision-making by library management to improve the visibility and usability of library services and products. The study also contributes significantly to the global discussion on the marketing of library services in the era of the COVID-19 pandemic.

References

Bhardwaj, R. K. and Jain, P. K. (2016), "Marketing of library resources and services: A structured literature review", *DESIDOC Journal of Library & Information Technology*, Vol. 36 No. 3, pp. 119-125.

Chipeta G. (2007) *An Exploratory study of the Marketing of Library and Information Services: A Comparison of the Mzuzu University and University of Zululand Libraries*. Proceedings of the Faculty of Arts 2nd Annual Conference, University of Zululand, South Africa.

Hilbert, M. (2015) *Global Information Explosion*, California: California University Press.

Hinson, R. and Amidu, M. (2006), "Internet adoption amongst final year students in Ghana's oldest business school", *Library Review*, Vol. 55 No. 5, pp. 314-323.

Hua, X., Si, L., Zhung, X. and Xing, W. (2015), "Investigations about new methods of library marketing in Chinese Universities", *Library Management*, Vol. 36 No. 6/7, pp. 408-420

Kaur, K. (2009), "Marketing academic library on the web", *Library Management*, Vol. 30 No. 6/7, pp. 454-468.

Kotler, P. (1997), *Marketing Management: Analysis, Planning, Implementation, and Control*, Upper Saddle River: Prentice-Hall.

Krejcie, R.V. and Morgan, D.W. (1970), "Determining sample size for research activities", *Educational and Psychological Measurement*, Vol. 30, pp. 607- 610.

Adegoke, K.A. (2015), "Marketing of library and information services in university libraries: A case study of Usmanu Danfodiyo University library, Sokoto-Nigeria", *Intel Prop Rights*, Vol. 3 No. 2, p.143.

Mahesh, G. (2012), "Barriers to marketing of information products and services in libraries", *Bulleting of information Technology*, pp.35-38.

Ngaunje, M. (2003), "The National library Service of Malawi", in Castelyn, M (Ed), *Librarians in Malawi: A text book for students*, Zomba: Malawi Library Association.

Nemeckova, I. T. (2012), "Marketing tools to support university library's mission", *Qualitative and Quantitative methods in Libraries*, p.205.

Olorunfemi, M. and Ipadeola, D. A. (2018), "Marketing Library and Information Services in Selected University Libraries in South West Nigeria", *Library Philosophy & Practice*. 1975. <https://core.ac.uk/download/pdf/188140814.pdf>

Roberts, J. M. (1995), "Faculty knowledge about library services at the University of the West Indies", *New Library World*, Vol. 96 No. 2, pp.14-22.

Weingand, D.E. (1998), *Future-Driven Library Marketing*, Chicago, IL.: American Library Association.

The Malawi Access to Information Act: An Effective Tool to Control Government Corruption?

Ezilon Kasoka¹

Abstract

International organisations like the World Bank, the United Nations, and non-state actors like Transparency International (TI) have encouraged countries to adopt Access to Information (ATI) laws. Such laws are believed to increase transparency and thus combat corruption. This study examines the recently introduced Malawi ATI Act to determine its effect on controlling public sector corruption in the country.

Primary data was obtained from Information Officers; information requesters (citizens, journalists); and the representatives of the Malawi Human Rights Commission (oversight body) and Ministry of Information (policyholder). Secondary data was obtained from government documents, media articles and investigative reports, journal articles, and indices and reports. Data was analysed through qualitative content techniques (including thematic) to determine the level of awareness, utilisation and empowerment of citizens by the ATI Act and the effectiveness of the government agencies in implementing the Act.

Empirical data revealed low levels of awareness, utilisation of the ATI Act, transparency and accountability among public officials. They fail to disclose data in their custody proactively and to provide the information requested by citizens. The Commission and the Ministry have not effectively implemented the ATI Act, including failure to develop and publish guidelines and submit reports to Parliament. The ATI Act in Malawi has a positive impact on the control of government corruption. However, the substantial impact is yet to be realized as the law has not been adequately implemented and enforced. In addition, the ATI Act must be accompanied by other accountability measures such as the sanctioning of public officials whose involvement in corrupt practices has been exposed.

The study recommends a robust awareness campaign targeting citizens and public officials, the development of necessary tools such as guidelines and manuals, proper training of public officials concerning the Act, the digitalization of information held by public institutions, and proactive disclosure of information.

The ATI Act has not yet fully made public bodies more transparent and accountable. In addition, it has not increased trust or fully rooted itself within the citizens.

The study is the first to focus on the ATI Act with its impact on enhancing transparency, accountability, citizen empowerment, and control of public sector

¹ Anti-Corruption Bureau, P.O. Box 2437, Lilongwe, Malawi. +265999660014,

kasokaebm@gmail.com

corruption in Malawi. It adds to the knowledge of the role of the ATI Act in preventing corruption.

Keywords: Corruption; transparency; accountability; access to information; citizen empowerment.

1.1 Introduction

The level of corruption is a key element in economic underperformance, political turmoil, and a major obstacle to poverty alleviation and development. Corruption – defined as “the abuse of entrusted power for private gain (Transparency International, n.d.) – has detrimental effects and hurts the poor disproportionately by diverting funds intended for development. It can undermine democracy and the rule of law, apart from promoting inequality and discouraging foreign aid and investment (Moitra, 2019).

Legislation on free access to information is one of the tools for exposing government corruption. The disclosure of information that would have not otherwise been publicly accessible increases public sensitivity to corrupt behaviours by public officials. It also enhances transparency, which is one of the main approaches to preventing corruption and safeguarding the integrity of public service (Imrovič & Nemec, 2018).

The term "access to information" refers to the right of citizens of society to seek, receive and impart information, documents, materials, data or records held by public bodies (Abdulai, 2022). It is an integral part of the fundamental right of freedom of expression, as recognized by Article 19 of the Universal Declaration of Human Rights, which states that the fundamental right of freedom of expression encompasses the freedom to "seek, receive and impart information and ideas through any media and regardless of frontiers" (United Nations, 1948).

The concept of access to information is designated by several terminologies, depending on the school of thought under emphasis, as well as intents and purposes. Some of the common terms include "freedom of information" (FOI), "right to information" (RTI) and "right to know law." All these concepts are understood to have a common goal of promoting and protecting the public right to know government information (Abdulai, 2022). This paper adopts the term "access to information" (ATI) which is in line with the naming of the legal framework for access to information in Malawi.

1.2 Corruption in Malawi

Corruption is, by its nature, a clandestine activity. It makes accurate information hard to obtain, hence it is difficult to measure its nature and extent in any country (Langseth, 2006). Corruption perception surveys, scholarly and government publications have been used to gain insight on the levels of corruption in Malawi.

Malawi suffers from massive corruption and is ranked poorly in corruption perception indices and surveys. Quite often, it is home to various forms of corruption scandals, especially in the public sector (Strasser, 2016). The 2022 Corruption Perception Index (CPI) by Transparency International (TI) ranks Malawi 110 out of 180 countries with a score of 34 percent (where 0 denotes most corrupt and 100 least corrupt) (Transparency International, 2022).

A corruption and governance survey by the Institute of Public Opinion and Research (IPOR) indicates that 97 percent of Malawians consider corruption a serious problem (Dulani, et al., 2019). The IPOR survey results corroborate CPI's claims that Malawi has significant levels of corruption. Nawaz (2012) and Kukutschka (2014) argue that corruption in Malawi is more prevalent in the public sector and takes various forms, such as facilitation payments, nepotism or patronage networks in appointment to public service positions or award of government contracts that impede service delivery. This suggests that more work remains to be done in the battle against corruption in Malawi.

1.3 Linking access to information and corruption control

Mambulasa (2016) argues that access to information legislation enhances inclusiveness and participation by the people in their governance, accountability, transparency and openness. It, therefore, plays a critical role in the creation and recreation of just societies for all. Abdulai (2022) further asserts that the free flow of information creates transparent and open societies. Transparency imports accountability, which in turn produces effective and efficient service delivery. Developing countries now increasingly view the implementation of an access to information law as a key tool for promoting good governance and facilitating public participation. In Malawi, for example, the National Anti-Corruption Strategy (NACS) provided for the need to pass access to information legislation if it was going to deal with corruption in the country (Mambulasa, 2016). Thus, Malawi enacted the Access to Information (ATI) Act in 2017 intending to expose and prevent corruption and enhance citizens' ability to participate in public affairs (The Access to Information Act, 2017).

Access to information legislation reflects the fundamental premise that all information held by governments is, in principle, public and may only be withheld from disclosure if there are legitimate reasons, typically for privacy and security (Abdulai, 2022). Access to information ensures that citizens are aware of the decisions made by public entities and the reasons for the decisions. In turn, citizens are empowered to enforce their rights to access information to verify that public entities make decisions in the interests of society as a whole and not motivated by individualistic motivations. Abdulai (2022) argues that the accountability of public officials can only be enforced through the effective implementation of access to information laws. However, effectiveness highly depends on the ability of the citizens to access reliable information.

The linkage between access to information laws and corruption is well-summarized by Worthy & McClean (2015) who explain that access to

information laws exposes corruption by providing the citizens with the information needed to make public officials accountable, adding that such laws prevent corruption because they encourage transparency among public officials. Being transparent makes these public officials avoid indulging in corrupt acts for fear of exposure and sanctions.

1.4 Problem Statement

The paper is grounded in the Principal-Agent Theory ("the agency theory"). The theory considers citizens (principals) as the owners of an asset who delegate direct control of the asset to public officials (agents) (Lambsdorff, 2007). The agent is expected to perform the assigned tasks by agreed-upon rules, but indulges in corrupt activities, taking advantage of too much information obtained due to the day-to-day management of the asset. The principal is mostly unaware of the daily transactions, which makes it difficult to monitor the agent, thereby creating information asymmetry (Teichmann, 2018; Simonović, 2018).

The agency theory considers information asymmetry as a problem (Simonović, 2018). This is particularly true in situations where the principal is unable to monitor the agent adequately. This is caused by the unwillingness of the agent to inform the principal about all the important matters, or when the agent betrays the interests of the principal (Simonović, 2018). In some instances, the agent deliberately hides information from the principal through such means as distortion of information and facts (Lambsdorff, 2007). Typically, this increases opportunities for corruption as the agent cannot be fully monitored and controlled by the principal. The agent focuses on attaining benefits at the expense of pursuing the interest of the principal (Klitgaard, 1988).

Based on the agency theory, the paper assumes that access to information legislation – the Malawi ATI Act – addresses the problem of information asymmetry and should, therefore, be associated with lower levels of government corruption. This is based on the understanding that if there is an increase in access to government information, there will be a decrease in information asymmetry between government officials (agents) and the citizens (principals). This results in more favourable conditions for citizens to hold the government (both elected and public officials) accountable and make well-informed choices and decisions (Žuffova, 2020).

Corruption flourishes when agents have monopoly power over clients when agents have great discretion, and when the accountability of agents to the principal is weak. Klitgaard (1988, p. 75) presents an equation where corruption equals monopoly plus discretion minus accountability ($C = M + D - A$). Using the formula, the public official is entrusted with powers that can be abused for private gain. Therefore, dealing with corruption depends on the reduction of monopoly and discretion, but at the same time, increasing transparency and accountability. The model on which the access to information laws are formulated responds directly to this principle. The reliable information accessed by citizens under the access to information laws

should adequately empower them to monitor the agents (public officials). This will enhance transparency and accountability and, eventually, reduce the levels of government corruption (Worthy & McClean, 2015).

1.5 Research Question

The paper examines the impact of the access to information law in Malawi on the promotion of transparency and making government information accessible. Therefore, the study focuses on the following question:

What is the impact of the ATI Act on enhancing transparency, accountability, citizen empowerment, and control of public sector corruption in Malawi?

1.6 Research Hypotheses

The research addresses the following hypotheses:

H₀. The ATI Act has not had a significant impact on enhancing transparency and accountability in the public sector and the level of public sector corruption in Malawi.

H₁. The ATI Act has enhanced transparency and accountability in the public sector and helped decrease the level of public sector corruption in Malawi.

H₂. The ATI Act has reduced transparency and accountability in the public sector and helped increase the level of public sector corruption in Malawi.

2.0 Literature review

Balule & Dambe (2019) argues that access to information held by state bodies promotes transparency and openness because it allows citizens to have access to information on how they are being governed so that they can demand accountability from public officials. However, there still exists a gap in the relationship between access to information laws and corruption levels (Žuffova, 2020). Some studies have found that access to information is positively correlated to the control of corruption, but only when effectively implemented and accompanied by other measures (Martini, 2014). In agreement, Adu (2018) argues that making information available alone will not reduce corruption levels as it is dependent on several factors which may take a long period to have an impact.

The effectiveness of access to information laws in the control of corruption is linked to such factors as “guaranteed freedom of press and association, effective checks and balances mechanisms, including the prosecution and dismissal of public officials found to be involved in corruption, and coherent policy responses to problems detected in service delivery” (Martini, 2014, p. 1). In addition, access to information laws should be accompanied by strong

political leadership and a robust civil society, strong publicity and accountability, and the protection of individual privacy. The publicity condition means that citizens (principals) receive information about the misbehaviour of their representatives (agents) and should have both technical and literacy competencies (Lindstedt & Naurin, 2010).

Some empirical studies have been done aimed at investigating the links between access to information laws and governance indicators, including corruption, produced mixed results. Moitra (2019) argues that when people know the information, it is a vital weapon to help get rid of corruption in the system. This in turn will ensure greater transparency and accountability in governance, key principles in reducing corruption as it mainly thrives on secrecy (Moitra, 2019). In agreement, Rani (2021) holds that for governments to deliver the right actions, the citizens should have access to reliable and trustworthy information and make the government transparent and public officials accountable. The key challenge with this type of linear relationship arises in situations where information is deliberately withheld. This is a common trend by governments across the globe as they are not always forthcoming with such information (Rani, 2021).

Legislation on increased access to information enables the media to get access to more reliable sources of news, which creates a sense of social awareness among the citizens. Public and private bodies will thus be made more alert and conscious of being transparent and accountable, reducing levels of corruption in the process (Rani, 2021). An empirical study conducted in India found that such legislation reduces corruption by an average of 18.5 percent points (Rani, 2021). Further, the study concluded that access to information legislation makes a “significant contribution in controlling corruption, enhancing the quality of public goods and services, empowering citizens, and by breaking the informational monopoly of public officials” (Rani, 2021).

A study by Lindstedt & Naurin (2010) contends that increasing access to information makes undertaking fraudulent behaviour more complicated and dangerous, but only when the relevant laws are well-implemented and enforced. Corrupt officials must make an additional effort to cover up, which might discourage some of them from corrupt practices (Lindstedt & Naurin, 2010). Further, Žuffova (2020, p. 4) argues that “when investigative journalists use this information, it can also act as a corrective measure pointing out to already committed infringements and calling for justice.”

Mungiu-Pippidi (2013) found that the existence of access to information law is positively associated with lower corruption levels and a significant positive trend in controlling corruption. Other studies have also shown a positive correlation between control of corruption and years of implementation of access to information laws. The older access to information law is in a country, the more the country tends to have lower corruption levels (Martini, 2014). Martini (2014) concludes that countries with access to information laws have lower corruption levels.

The majority of these studies investigate correlation and not causation. This means that lower levels of corruption may not necessarily only result from the adoption and implementation of access to information laws, but could also be related to other factors. Within this framework, some studies have also shown a negative correlation between the enactment of access to information laws and control of corruption. This could be attributed to the fact that more transparency can lead to an increased perception of corruption, as more corruption cases are uncovered, and the media publishes more on the topic (Martini, 2014).

Žuffova (2020) argues that laws alone are less effective in addressing corruption. Increased access to information, Vadlamannati & Cooray (2017) argue, enhances corruption by increasing individuals' knowledge of whom to bribe, permits establishing connections with those individuals, and reduces the quality of government officials by impinging upon their privacy and generating reputational costs. Further, Vadlamannati & Cooray (2017) argue that access to information laws should be accompanied by the establishment of appropriate institutions and well-trained public officials. In addition, access to information should be associated with a free press and internet freedom, and active civil society (Žuffova, 2020; Tavares, 2007; Vadlamannati & Cooray, 2017).

There are success stories reported about access to information laws and the control of corruption. In India, citizens, civil society, and the media use access to information law to expose corruption and the misuse of public resources. As a result, public officials, including Ministers, have been expelled from the government due to information disclosed through access to information requests (Martini, 2014). Singh (2021) argues that the former government that initiated the law makes negative statements and government agencies deliberately delay responding to requests. Further, the government has tried to change certain provisions in the law but failed due to strong protests from citizens (Singh, 2021).

In Bangladesh, access to information law is effectively used by various stakeholders, including journalists, citizens, non-governmental organisations (NGOs) and activists to detect and address corruption. For instance, a study by Hossain (2020) revealed that both journalists and citizens were able to detect corruption successfully in tendering, recruitment processes and tax evasion. The study further found that the access to information law helps prevent corruption in Bangladesh when public officials adhere to set procedures for fear of being discovered and exposed in the media (Hossain, 2020).

In Brazil, the access to information law requires public bodies to proactively publish a series of budgetary information online. Media outlets analyse the published information to identify inconsistencies, expose corruption and enhance transparency and accountability in government programs (Capuano, 2021). Such initiatives have exposed the wrongdoings of politicians and led to the resignation of ministers (Martini, 2014). Consequently, Brazil is considered one of the countries performing well in the implementation of its

access to information law. The Global RTI Rating puts Brazil in position 29 out of the 128 countries that were assessed, with a score of 108 points out of 150 points (The RTI Rating, 2022).

To a greater extent, the literature review indicates a relationship between access to information by citizens, governance and control of government corruption. Several scholars have argued that access to information laws empowers citizens (principals) to demand information from public officers (agents) on how they are discharging their duties. This enhances transparency and accountability and eventually contributes to the control of government corruption (Hazell & Worthy, 2010; Darch & Underwood, 2010; Islam, 2006). The effectiveness of the access to information laws to control government corruption is associated with other accountability measures (Žuffova, 2020). Costa (2012) suggests a free press as an enabler for access to information laws to have an impact on reducing government corruption.

Since the enactment of the ATI Act in Malawi in 2017, there has been no empirical study done to evaluate the effectiveness of the Act in controlling government corruption. Therefore, the study is motivated by the need to assess the effectiveness of the ATI Act in Malawi using empirical data.

3.0 Methodology

3.1 Sources of data

The paper utilised both primary and secondary data to determine the effectiveness of the ATI Act in controlling government corruption. Data from both categories of sources were reviewed and analysed to determine the relationship.

Primary data was obtained using a series of semi-structured key informant interviews with three different categories of people conversant with the processes related to the ATI Act. The first category is the information providers, who are public officials designated as Information Officers in the public bodies. These are responsible for responding to the applicant for information and proactively disclosing information to the citizens. The second category of respondents included those who are entitled to make applications for access to information (information seekers) using the ATI Act from public bodies covered by the law. These include citizens, journalists (including media bodies) and civil society organisations (CSOs). The last category of respondents in the study was the representatives of the Commission (the oversight body) and the Ministry of Information (the policyholder). These are responsible for the overall coordination of the implementation of the ATI Act. Among others, they are responsible for the development of guidelines and regulations, receiving annual reports, reviewing appeals made under the ATI Act and monitoring the implementation of the Act.

Secondary data was retrieved for analysis from government documents, media articles and investigative reports relating to access to information, journal articles, and various indices and reports. The ATI Act and the Access to

Information Regulations were reviewed and corroborated with other information. This was mainly aimed at examining whether they contain provisions that could act as obstacles to the implementation of the law. They were also examined to check conformity with the international ATI regime represented by the Model Law (Model Law on Access to Information for Africa, 2013).

3.2 Sampling

The paper purposively sampled a total of 22 information seekers and 15 information providers for the semi-structured key informant interviews. However, the actual respondents were 17 and 11 respectively. It also sampled at least two representatives from both the Commission and the Ministry of Information for the interviews, but only one from each was interviewed.

3.3 Data analysis

The paper utilised qualitative content techniques to analyse data. The data collected from closed questions was grouped and labelled then entered into Microsoft Excel to show patterns and trends. The thematic analysis was used on data collected through open-ended questions, as this enabled the capturing of views expressed by the respondents and triangulation.

4.0 results and Discussion

4.1 Level of awareness about the ATI Act

Citizens, especially those in rural areas, are not aware of the existence of the ATI Act. This is attributed to inadequate publicity of the ATI Act among the citizens by various stakeholders. A few citizens (mainly literate and based in urban areas) are aware that the ATI Act exist - but are not familiar with its provisions.

Public officials are aware of the ATI Act because they are involved in the formulation of the laws, the majority are literate and the publicity of the law by the media compelled them to understand the provisions, and through the establishment of the Information Offices (IOs) within their institutions. Others are believed to be aware of the provisions of the ATI Act because it helps them to understand the loopholes in the law and use them to their advantage, such as deliberately and proactively withholding information and not providing the information requested.

CSOs and the media are believed to be very aware of the provisions of the ATI Act. This is because they formed part of the team that strongly advocated for the passing and enactment of the ATI Act. Consequently, both were ably represented at various stages in the formulation and implementation of the ATI Act. Further, the media underwent targeted training organized by the Media Institute for Southern Africa (MISA), while CSOs implement transparency and accountability projects and it is considered one of the key legal instruments for enhancing transparency and accountability. However,

as with the citizens, CSOs and the media are considered only to be aware of the existence of the ATI Act and not necessarily of its provisions hence have not utilised the law effectively.

4.2 Empowerment of citizens

With regard to the utilisation of the ATI Act, the paper found that very few citizens submitted requests for information using the ATI Act to various public bodies. The information requested was mainly in areas of expenditure reports for various projects, asset declarations for listed public officials and procurement award and contract management. The majority indicated that they have never requested information using the ATI Act because they still access the information through other means (whistleblowing and undercover investigation). They cited complex procedures and delays as a reason for not using the ATI Act to request information.

On a number of requests, the paper contends that the volume of requests received by information holders from citizens is very low. Over a period of two years, each information holder interviewed received an average of only two requests under the ATI Act. It is important to point out that five institutions reported an average of eight requests for information per week during the same period. However, a close analysis shows that the Information Officer (IO) doubles as a Public Relations Officer (PRO). As such, the reported figures may include media inquiries and not necessarily requests for information using the ATI Act.

Information seekers are at some point denied information requested under the ATI Act. In such circumstances, the majority do not take any further action against both individuals (Information Officers) and institutions (information holders). Interestingly, all the respondents who were denied information were not satisfied with the justifications provided by the information holders where requests were submitted. Further, all the respondents who were denied information indicated that they were aware of both the internal and external appeal mechanisms provided by the ATI Act, but only one person appealed the decision to the Commission. Based on the reasons provided for not appealing (the Commission is compromised; time-consuming, etc), the paper concludes that the majority of citizens are not empowered enough to utilise the ATI Act for the attainment of their right to access information held by public bodies.

4.3 Utilisation of obtained information

The primary use of the requested information by investigative journalists is to enrich their investigative report (story) with factual data from the holders of the information as this carries more weight than reporting based on secondary sources. In this regard, the information obtained is mainly used to expose corruption by public institutions and individuals in the media. However, it is argued that this has been the trend even before the ATI Act came into force – such that the Act has simply simplified the process as public institutions were not compelled by any law to divulge information. Consequently, law

enforcement agencies pick up the issues and undertake their independent investigations that may lead to the prosecution of the alleged corrupt public officials. In addition, having corruption investigative reports in the media forces public institutions to change their approaches. They become more conscious when exercising their official duties and discharge them in accordance with the set rules and procedures. This results in improved delivery of public services and enhanced transparency among public officials.

4.4 Transparency and accountability

Transparency focuses on efforts to increase the visibility of government activities by lifting the veil of secrecy. Accountability looks at how public officials should be held to answer for the performance expected by citizens. The citizens need information they can use to hold the government accountable or to seek an explanation as to why certain decisions have been made. Transparency on its own – simply making information available – will do little to prevent corruption but should be accompanied by accountability.

Public institutions in Malawi proactively disclose information in their possession to the citizens – though not regularly – and are mainly on the operations of the institutions in line with their mandates. In most instances, they do so not necessarily because of the ATI Act, but rather because the business nature of the institution encourages transparency – to enhance public trust. This is encouraging because the spirit of the ATI Act manifests where public institutions put citizens as the primary focus of their activities. The disclosure is mainly through press briefings, press releases, websites, e-newsletters, newspaper columns, radio, television, and social media platforms. An analysis of these means of disclosing information points to the fact that the majority target literate urban citizens. This means that the majority of rural citizens are not the primary target of the information that is proactively disclosed by public institutions.

One other element that indicates the willingness to provide information is the charges imposed by information holders. Section 24 of the ATI Act requires that the information requester shall only pay a fee limited to standard charges for document duplication, translation, or transcription, if applicable. This is adhered to by public institutions in Malawi as they do not charge to process information requested under the ATI Act, and rarely even charge for duplication of the documents requested. This indicates the willingness of public bodies to make information available to citizens at no charge to ensure transparency in the operations of public institutions.

Refusal to disclose information to citizens is against the principles of transparency and accountability as espoused by the ATI Act. Consequently, Section 25 of the ATI Act mandates information holders to notify the applicant of the refusal. Among others, the information holder should provide adequate justification for the refusal, in relation to the provisions of the Act. The paper found that public institutions mostly refuse to disclose information requested under the Act, citing such reasons as having no rights to access the information, the information requested was under review and would be

provided when ready or not even giving a justification at all. Refusal to provide the requested information to citizens is in itself an indication of a lack of transparency and accountability. However, the ATI Act has provisions to allow information holders to refuse to provide the requested information. This mainly applies where the information requested falls within the category of exempted information and the intended use of the information is contrary to the promotion of the right to access information. Based on the reasons provided by information holders, the paper contends that they were justified in refusing to grant the information requested. Citizens should ensure that they make requests for information to hold duty-bearers accountable and not with malicious intent.

The ATI Act lays down 15 working days as a timeline for complying with a request for information. On the contrary, delays in providing information could be interpreted as a culture of secrecy among public institutions and a lack of transparency. The majority of the information requesters indicated that their requests were processed within the 15 working days provided by the law – while information providers indicated an average of two days only. From the analysis of the data collected, the paper observes that, to a greater extent, public bodies comply with the provision of the ATI Act on the timeline for processing information requests. This entails that the ATI Act does enhance transparency and accountability.

4.5 Effectiveness of the Commission (oversight body) and the Ministry of Information (policyholder)

One of the critical roles of the oversight body and policyholder is to build capacity and raise awareness among the citizens on the ATI Act. The empirical findings indicate that not much has been done in terms of building the capacity of Information Officers and raising awareness among the citizens. The key factor identified by the paper is inadequate resources since the government provides the Commission with limited funds to coordinate the implementation of the ATI Act.

The study has revealed that the Commission and the Ministry are yet to develop the guidelines and enforce the digitalization of records. In line with Section 9 of the Act, the guidelines are essential as they lay out the objectives of the Act, provide contact details of the Commission, obligations of all information holders, methods of applying for disclosure of information and the rights of the citizens under the Act. On the other hand, the digitalization of records/information is very important as it could enhance proactive disclosure and ensure quick access and release of information. Based on the data obtained, the paper concludes that both the Commission and the Ministry have not been effective in developing enabling tools for the effective implementation of the ATI Act.

Based on the analysis of the empirical data obtained, to some extent, the Commission can discharge the oversight functions as provided for by the ATI Act. However, the study has observed that the Commission can only undertake some of its functions when moved by relevant government entities

and citizens. On submission of the reports to the Parliament, the Commission is yet to comply with the provision.

Empirical data on the level of compliance by the Ministry shows that it has not done enough to comply with the provisions of the ATI Act and its implementation. The Ministry has not yet published the names of Information Officers, public bodies do not compile and submit annual reports to the Ministry – consequently, the Ministry has no information to report to Parliament as it is supposed to consolidate reports from institutions. Furthermore, the Ministry is in the process of developing guidelines for institutions to use when preparing annual reports. Overall, the empirical data suggest that the Ministry has not done enough to monitor the implementation of the ATI Act.

4.6 The ATI Act and corruption control

Access to information encourages public authorities to be responsive, predictable, efficient and effective in the formulation and execution of public policy. It may also discourage corruption while encouraging the rational allocation of public resources. Therefore, access to information laws works to resolve the pervasive problem of the principal-agent theory, whereby principals only have imperfect information about what their agents are doing, controlling government corruption in the process.

To illustrate the nuances of how the ATI Act can work as an anti-corruption tool, the study obtained and analysed data to understand whether the ATI Act can be used to fight public sector corruption. The paper observed that the ATI Act has exposed some government corruption. An analysis of specific cases cited by respondents shows diversity – from high-profile to low-level cases – however, they are remarkable. A most common case of government corruption, cited by the majority, is the alleged abuse of MK6.2 billion of Coronavirus (COVID-19) response funds. Consequently, a report titled “Investigative report on the usage and accountability of the K6.2 billion COVID-19 disbursement” (National Audit Office, 2021) was made public in April 2021 following the directive by His Excellency, Dr. Lazarus McCarthy Chakwera, President of the Republic of Malawi. Based on the findings of the audit, the President fired one Minister from his Cabinet and ordered the interdiction and arrest of public officials suspected to have been involved in the abuse of the resources. Further, the President acknowledged the role of citizens and the press in demanding accountability and making the ATI Act effective in exposing government corruption.

On the contrary, others believe that the ATI Act has not exposed any government corruption. While acknowledging that there has been increased exposure of government corruption since the ATI Act was enacted and operationalised, they attribute the exposure to other elements such as whistleblowing (inside sources, leakage), undercover investigations, and increased access to the internet and social media.

An analysis of the empirical data on the effectiveness of the ATI Act in the control of government corruption reveals that, to a greater extent, public officials are compelled to discharge their duties out of fear of both exposure and consequences rather than mere adherence to the tenets of transparency and accountability. The ATI Act has the potential to enhance professionalism among public officials through adherence to set procedures and the reversal of a culture of secrecy, which is associated with public institutions in Malawi and contributes to the control of government corruption.

5.0 Conclusion and Recommendations

The results from the study show that Hypotheses H_1 and H_2 are rejected and Hypothesis H_0 is validated.

The data support the null hypothesis that the ATI Act has not had a significant impact on enhancing transparency and accountability among public officials. The ATI Act has not yet fully made public bodies more transparent and accountable. In addition, it has not increased trust or fully rooted itself within the citizens. Public officials appear comfortable with their 'business as usual approach' and a 'culture of secrecy' as citizens remain passive and fail to fully exercise their right to access information held by public bodies. Consequently, the ATI Act in Malawi has not enhanced transparency and accountability to decrease the level of public sector corruption.

The paper has established that the ATI Act is capable of exposing government corruption in line with the principal-agent theory. However, there is no strong evidence that the ATI Act currently helps control government corruption. Public officials discharge their duties without regard to the provisions of the ATI Act. This confirms the information asymmetry challenge of the principal-agent theory, where the agent willingly hides information from the principal.

The paper points to low levels of awareness and utilisation of the ATI Act by citizens, supporting the theory that the principal lacks information. At the same time, CSOs and the media are quite aware of the provisions of the ATI Act and use it more often than ordinary citizens.

The findings also suggest poor utilisation of the obtained information by citizens, as stipulated by the agency theory that principals do not monitor agents adequately. Citizens do not usually have clear plans on how the obtained information can be utilised to enhance transparency and accountability. Only journalists can use the information in their articles, and where corruption is exposed, governance institutions may take up the issues.

Regarding accountability, the paper finds that the ATI Act in Malawi provides citizens with the right to demand accountability from public officials. However, little has been done to give the citizens the power to hold public officials to account for their behaviour. Citizens are provided with the information requested under the ATI Act but fail to use the information and take action against public officials.

Guided by the principal-agent theory which requires the agent (public official) to be fully monitored by the principal (citizens) to control corruption in the government, the paper makes the following key recommendations:

- a. The Ministry of Information should ensure that all public institutions have appointed/designated Information Officers. Their names and contact details should be published.
- b. The Commission, in collaboration with the Ministry of Information, should ensure that all Information Officers are properly trained to facilitate the paradigm shift from secrecy to openness. Among others, the training should focus on the provisions of the ATI Act and the processing of requests.
- c. All public institutions should prioritise the development of information manuals to provide clear categories of information that can be accessed by citizens. The information manuals will enable increased knowledge among citizens on categories of information accessible at every institution as well as guide Information Officers in the performance of their duties.
- d. The Commission and the Ministry should ensure that public bodies proactively disclose information using a variety of channels, such as the internet, radio, and public libraries to ensure that all categories of citizens have access to public information. The information should be disclosed timely and in a user-friendly format, and it should be in areas of public interest, such as budgets, spending data above a certain agreed-upon threshold, and details of salaries.
- e. The government should ensure the independence of the Commission and the Ministry of Information by providing adequate budgetary allocation for operation as well as ensuring the availability of a well-trained non-partisan human resource. This will enable the two institutions to discharge their roles and responsibilities of developing guidelines and regulations, capacity building of information officers and holders, raising awareness of citizens as well as ensuring adherence to the provisions of the law by public bodies effectively.
- f. The media, under MISA, should set up a task force to support the implementation of the law. Among other things, the task force will be responsible for lobbying for a conducive environment, monitoring the implementation, setting up rewards and sanction mechanisms, and building the capacity of citizens.

6.0 Declaration

I declare that I have no known competing financial and professional interests, or personal relationships that could have appeared to influence the work or materials discussed in this manuscript.

The primary data for the study was collected in August 2022, as such, certain circumstances with regard to the implementation of the ATI Act in Malawi might have changed.

References

Abdulai, E. S. (2022) Freedom of information law and good governance: the curse of corruption in Sierra Leone, Cham: Palgrave Macmillan.

Adu, K. K. (2018), "The paradox of the right to information law in Africa", *Government Information Quarterly*, Vol. 35 No. 4, pp. 669-674.

Balule, T. B. and Dambe, B. J. (2019), "The right of access to state-held information in Botswana: lessons from emerging international human rights jurisprudence", *Commonwealth Law Bulletin*, Vol. 44 No. 3, pp.429-451.

Capuano, E. (2021) Access to information law in Brazil: what the implementation data reveal, Cambridge: American Political Science Association.

Costa, S. (2012), "Do freedom of information laws decrease corruption?" *The Journal of Law, Economics, and Organisation*, Vol. 29 No. 6, pp. 1317-1343.

Darch, C. and Underwood, P. G. (2010) Freedom of information and the developing world: the citizen, the state and models of openness, Oxford: Chandos Publishing.

Dulani, B., Jamu, E. and Tengtenga, J. (2019) Corruption perceptions survey 2019, Zomba: Institute of Public Opinion and Research (IPOR).

Hazell, R. and Worthy, B. (2010), "Assessing the performance of freedom of information", *Government Information Quarterly*, Vol. 27, pp. 352-359.

Hossain, S. A. S. M. (2020) Right to Information Act and its effectiveness as a tool to fight corruption in Bangladesh, Luxemburg: IACA.

Imrovič, M. and Nemeč, P. (2018), "Access to information as one of the means of fight against corruption in public administration in Slovak Republic", *Slovak Journal of Public Policy and Public Administration*, Vol. 5 No. 1, pp. 33-42.

Islam, R. (2006), "Does more transparency go along with better governance?" *Economics & Politics*, Vol. 18 No. 2, pp. 121-167.

Klitgaard, R. (1988) Controlling corruption, Berkeley: University of California Press.

Kukutschka, R. (2014) Overview of corruption in Malawi, Berlin: Transparency International.

Lambsdorff, J. G. (2007) The institutional economics of corruption and reform: theory, evidence, and policy, Cambridge: Cambridge University Press.

Langseth, P. (2006), "Measuring corruption", in Sampford, C., Shacklock, A., Connors, C. and Galtung, F. (Eds.), *Measuring corruption*, Hampshire: Ashgate Publishing Limited, pp. 7-44.

Lindstedt, C. and Naurin, D. (2010), "Transparency is not enough: making transparency effective in reducing corruption", *International Political Science Review*, Vol. 31 No. 3, pp. 301-322.

Mambulasa, M. (2016), "Access to information in Malawi: the journey to date and a quick survey of the ATI Bill of 2016", in *Goal 16 of the Sustainable Development Goals: Perspectives from Judges and Lawyers in Southern Africa on promoting rule of law and equal access to justice*, Johannesburg: Southern Africa Litigation Centre, pp. 156-166.

Martini, M. (2014) *Right to information laws: impact and implementation*, Berlin: Transparency International.

African Human Rights Commission (2013) *Model law on access to information for Africa*. Available at: http://www.achpr.org/files/news/2013/04/d84/model_law.pdf (Accessed 21 January 2017).

Moitra, S. (2019), "Combating corruption in India through right to information: an analysis", *Journal of Law and Justice*, Vol. 9 No. 1, pp. 127-140.

National Audit Office (2021) *Investigative report on the usage and accountability of the K6.2 billion COVID-19 disbursement*, Lilongwe: National Audit Office.

Nawaz, F. (2012) *Overview of corruption and anti-corruption in Malawi*, Berlin: Transparency International.

Rani, K. J. (2021), "Right to Information Act in India: an effective tool to combat corruption", in Tummala, K.K. (Ed.), *Corruption in the public sector: an international perspective (public policy and governance, volume 34)*, Bingley: Emerald Publishing Limited, pp. 43-55.

Simonović, B. (2018), "Challenges in controlling, combating, and preventing corruption in developing countries", in Kratcoski, P.C. and Edelbacher, M. (Eds.), *Fraud and corruption: major types, prevention, and control*, Cham: Springer International Publishing, pp. 181-212.

Singh, P. (2021), "Fifteen years of Right to Information Act in India: a long way to go", *The Age of Human Rights Journal*, Vol. 17, pp. 346-362.

Strasser, P. G. (2016), "An Anti-Corruption Bureau's inexorable endeavor: a study of Malawi's cashgate scandal", *Washington and Lee Law Review Online*, Vol. 37 No. 1, pp. 303-337.

Tavares, S. C. (2007) Do freedom of information laws decrease corruption, Munich: Rochester Institute of Technology.

Teichmann, F. M. J. (2018), "Anti-bribery compliance incentives", *Journal of Financial Crime*, Vol. 25 No. 4, pp. 1105-1110.

Malawi Government (2017) *The Access to Information Act*, Lilongwe: Government Print.

The RTI Rating (2022) *Global Right to Information Rating*. Available at: <https://www.rti-rating.org> [Accessed 20 June 2022].

Transparency International (2022) *Corruption perceptions index 2021*, Berlin: Transparency International.

Transparency International, n.d. *Transparency International*. Available at: <https://www.transparency.org/en/what-is-corruption> [Accessed 1 September 2022].

United Nations (1948) *Universal Declaration of Human Rights*, New York: United Nations.

Vadlamannati, K. C. and Cooray, A. (2017), "Transparency pays? Evaluating the effects of the freedom of information laws on perceived government corruption", *The Journal of Development Studies*, Vol. 53 No. 1, pp. 116-137.

Worthy, B. and McClean, T. (2015), "Freedom of information and corruption", in Heywood, P.M. (Ed.), *Routledge handbook of political corruption*. London: Routledge, pp. 347-358.

Žuffova, M. (2020), "Do FOI laws and open government data deliver as anti-corruption policies? Evidence from a cross-country study", *Government Information Quarterly*, Vol. 37 No. 3, pp. 1-27.

HEALTH SCIENCES

Health Sciences is another area that attracted a number of intriguing papers. Presentations to be made under this thematic area fall under the following:

- Innovative approaches and interventions to strengthen health delivery
- Healthcare access, delivery and outcomes
- Health technology and digital transformation
- Maternal, new-born, child and adolescent health
- Communicable and non-communicable diseases
- Biomedical and Health Informatics

Covid-19 Vaccination Hesitancy among Malawians: A Scoping Review

Ellen Nkambule*¹, Chingaticlifwe Mbakaya ^{2,3}

1 Department of Nursing and Midwifery, Mzuzu University, Mzuzu, Malawi

2 Department of Public Health, University of Livingstonia, Mzuzu, Malawi

3 Department of Biological Sciences, Mzuzu University, Mzuzu, Malawi

Abstract

Purpose: This review's objective was to currently analyse COVID-19 vaccination hesitancy amongst Malawians.

Methodology/Approach: This scoping review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) extension for Scoping Reviews. An electronic database search was performed using CINAHL, OVID Medline, PubMed and Google Scholar for studies published between January 1, 2020, and July 10, 2023 on the topic of reluctance towards the COVID-19 vaccine in Malawi. A review of the journal titles and abstracts was performed to establish a match within the selection criteria. Based on the parameters of interest, this paper included publications that explicitly mentioned COVID-19 vaccine hesitancy in Malawi.

Findings: A total of seven articles were identified as meeting the inclusion criteria. Some of the eligible Malawian population's poor response to COVID-19 vaccination was due to hesitancy. Misinformation is primarily to blame for COVID-19 vaccine reluctance. COVID-19 Vaccines are viewed as dangerous or intended to cause harm such as the myth that the COVID-19 vaccine would cause infertility, severe disability and even death. The review revealed that some people choose not to receive vaccines due to religious convictions and beliefs. Some individuals also think that getting the COVID-19 vaccine could result in receiving a triple-six (666) mark from the devil. There were also reports that the COVID-19 vaccination is being considered experimental and ineffective.

Discussion: The best chance of eradicating the COVID-19 pandemic lies in a successful vaccination campaign against the virus. There is still hesitancy among some of the Malawians over the use of COVID-19 vaccines that are readily available.

Recommendations: The Malawi government should focus on fear and misinformation regarding COVID-19 vaccination campaigns, using interventions, motivational interviews and individual sensitization. Traditional, religious and youth-led organisations should provide practical information on COVID-19 vaccine safety and efficacy.

Conclusion: Vaccine hesitancy is a growing problem that affects vaccine uptake. Vaccine hesitancy could derail global efforts to end the COVID-19 pandemic.

Therefore, it is vital that the Malawi government and other stakeholders should understand why people are uncertain about receiving the COVID-19 vaccine.

Originality/value of contribution: This paper is one of the few studies on COVID-19 vaccination reluctance in Malawi. The findings may be applicable to other settings in developing countries.

Keywords: COVID-19, COVID-19 Vaccine Hesitancy, Scoping Review, Malawi.

1.1 Introduction

Vaccination against the novel coronavirus (COVID-19) is the best solution for eradicating the virus (Afolabi & Ilesanmi, 2021; Elgendy & Abdelrahim, 2021). However, COVID-19 vaccination hesitancy has been documented in many parts of the world including sub-Saharan Africa (SSA) (Afolabi & Ilesanmi, 2021). According to the World Health Organisation (WHO), vaccine hesitancy is described as reluctance or delay in receiving vaccines regardless of the availability of immunization services (World Health Organisation, 2019). The WHO (2019) identified vaccine hesitancy as one of the top ten worldwide public health hazards in 2019. It is driven by a variety of reasons such as safety concerns, rumors and conspiracy theories and fear of catastrophic events (World Health Organisation, 2019). Currently, 26.8% of the SSA population is fully vaccinated against COVID-19, compared to more than 50% in the Global North (Mathieu et al., 2021).

The COVID-19 pandemic has had a remarkable global impact. Besides loss of life, the pandemic response had a negative impact on world health, education, trade, agriculture, and socioeconomic growth (United Nations Development Programme, 2020). There is evidence that if the COVID-19 vaccine had been available at the start of the pandemic in 2019, we would not have endured lengthy lockdowns, a downturn in the economy and a decline in mental health (Giubilini, 2020). In addition, fewer individuals would have died (Giubilini, 2020). The COVID-19 vaccine is currently viewed as a means to fight COVID-19. However, there are challenges as regards to the vaccine such as vaccine inequity, adverse side effects and hesitancy among others. The Malawi government launched an action plan to increase the number of areas where people can get COVID-19 vaccines conveniently such as workplaces and shopping centers. However, there is still reluctance in Malawi to use easily available vaccines (Ochola, 2023). In March 2021, the government received a donation of 360 000 doses of AstraZeneca COVID vaccination as a first dose for eligible people (Government of Malawi, 2019). The government prioritized this first shipment for people who were assessed to be at high risk of developing the COVID-19 pandemic such as healthcare workers, the elderly over 60 years, individuals with underlying comorbidities like diabetes and asthma. The vaccine uptake was so low that 19,610 doses expired and were discarded in May 2021 (Masina, 2021). While the rest of the world was attempting to combat COVID-19 through vaccination, most Malawians particularly those living in rural regions refused to get vaccinated. According to reports, COVID-19 vaccination was introduced in Malawi without sensitizing communities or conducting workshops (The World Bank, 2021).

Only 1 072 229 persons in Malawi received at least one dose of the AstraZeneca vaccine by December 26, 2021, out of a nationwide target population of 18 546 324; and only 672 819 had been fully vaccinated (Government of Malawi., 2021). As of February 2023, just two million people (10.3%) of the target population of 13.8 million had been fully vaccinated (UNICEF, 2022). Vaccine hesitancy remains a significant component of vaccine rollout that the Malawi government should address.

1.2 Problem statement

The best chance of eradicating the COVID-19 pandemic lies in a successful vaccination campaign against the virus. Vaccine hesitancy has been observed in a few surveys, although the prevalence of this problem in LMIC has yet to be thoroughly researched (Bhopal & Nielsen, 2021; Lazarus et al., 2021, Lin, Tu, & Beitsch, 2020; Sallam, 2021). To inform steps to promote public acceptability and uptake of COVID-19 vaccinations, it is critical to understand the factors that impact COVID-19 vaccine hesitancy. This scoping review, therefore aims at analysing COVID-19 vaccination hesitancy among Malawians.

1.3 Objectives/ Research questions

This study aimed to answer the following research question: "what is influencing COVID-19 vaccine hesitancy in Malawi?"

2.0 Methods

This scoping review was conducted on 10th July, 2023 following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) extension for Scoping Reviews (Page et al., 2021). An electronic database search was performed using CINAHL, OVID Medline, PubMed and Google Scholar on the topic of reluctance towards the COVID-19 vaccine in Malawi. A review of the journal titles and abstracts was performed to establish a match within the selection criteria. Based on the parameters of interest, this paper included publications that explicitly mentioned COVID-19 vaccine hesitancy in Malawi. The publications that fit the inclusion criteria were obtained for a full-text review. PRISMA (Page et al., 2021) propose a two-stage screening procedure, known as sequential or staged. In stage one, the articles were screened based on the title and abstract, and only those that passed this stage had their full content extracted. According to PRISMA, a second screening occurred based on the full text, with "Reports Assessed for Eligibility." This struck a good compromise between quality and quantity, as the amount of first papers discovered during a systematic review can be alarming. Zotero software assisted in reference deduplication isolation and Microsoft Excel software was employed for the screening process. The review excluded publications that reported any form of vaccine hesitancy not related to COVID-19. To synthesize the review results, we qualitatively summarised the information and employed a data analysis approach to extract significant details from the papers included in this study.

2.1 Eligibility criteria

Eligible studies were (1) peer-reviewed, published and indexed in CINAHL, PubMed, OVID Medline and Google Scholar; (2) primarily discussing or evaluating COVID-19 vaccine acceptance/hesitancy; (3) focused on Malawi; (4) published in English; and (5) published between January 1, 2020, and July 10, 2023. Letters to the editor, non-empirical research, reviews, or protocols, conference proceedings, reports, opinion pieces, and comments were all excluded.

2.2 Search strategy

The searches on all four databases were done on 10th July 2023. Detailed search strategies and search results are presented in the additional file 1. Bibliographies of articles that were included for review were also scanned to capture any literature that was missed from the formal search. The phrase 'Malawi' was used to find studies conducted in this nation. We did not incorporate a date filter because we expected papers on COVID-19 to be released during the epidemic.

2.3 Data extraction

E.N and B.C.M created a data extraction form and independently conducted data extraction on the selected articles following the inclusion and exclusion criteria. The following information was extracted from the articles that were included for data extraction: last name of the first author, title, study design and study aim.

Table 1: Eligible papers for analysis of vaccine hesitancy n = 7

Article	Title	Study design	Study Aim
Chimatiro et al. (2023)	Barriers affecting COVID-19 vaccination in Phalombe District, Malawi: A qualitative study.	Cross-sectional qualitative study employing six focus group discussions (FGDs) and 19 in-depth interviews (IDIs) to collect data.	The paper looks into reasons for vaccine refusal and hesitancy, how contextual cultural beliefs influenced people's decision to receive the COVID-19 vaccine, and which sources of information were trusted in the community
Safary & Mtaita (2022)	A qualitative exploration of perceptions of the COVID-19 vaccine in Malawi during	Online survey to collect free-text responses to assess factors leading to hesitation or refusal of COVID-	The paper looks into factors leading to hesitation and/or refusal of COVID-19 vaccination in Malawi.

	the vaccine rollout phase.	19 vaccination in Malawi.	
Ao et al.(2022)	Acceptance of COVID-19 Vaccines among Adults in Lilongwe, Malawi: A Cross-Sectional Study Based on the Health Belief Model.	A cross-sectional design was used for this field-based survey.	The purpose of this study was to investigate current vaccination rates for COVID-19 among Malawians, assess the level of COVID-19 vaccine hesitancy among Malawians, and explore the factors influencing vaccination and willingness to be vaccinated against COVID-19.
Aron et al. (2022)	Attitudes toward COVID-19 Vaccines among Patients with Complex Non-Communicable Diseases and Their Caregivers in Rural Malawi.	This cross-sectional study was nested in a prospective open cohort study among Patients with complex NCDs in Neno.	The paper advocates for Strong trust in health care workers and community engagement that could help increase vaccine acceptance.
Ojong & Agbe (2023)	“This is most likely not the correct vaccine”: Analysing COVID-19’s viral spread and vaccine anxieties in Ghana, Cameroon, and Malawi	This paper uses a qualitative research approach that included 144 semi-structured interviews.	The focus of this paper is on vaccine anxiety, which is a significantly understudied area in the public health discourse. Specifically, the authors examined how social and political dynamics shaped people’s perspectives in particular environments in Ghana, Cameroon, and Malawi about COVID-19 vaccines

			and the spread of COVID-19
Holden et al. (2023)	Religion, beliefs, trust, and COVID vaccination behavior among rural people in Malawi.	Quantitative research approach.	This study investigated the religious and other beliefs related to the corona/COVID-19 pandemic and how they are related to COVID-19 risk perceptions, trust in COVID vaccines, and how these are affected by the religious beliefs, religious affiliations, trust in authorities, generalized trust, and how these affect vaccine demand/vaccine hesitancy
Mchawa et al. (2023)	Assessing SARS-CoV-2 vaccine hesitancy among the people living with and without HIV from May to September 2022 in Blantyre, Malawi.	Cross-sectional study.	To find out the status of SARS-CoV-2 vaccine hesitancy among PLHIV and explore the influencing factors from May to September 2022 in Blantyre, Malawi, and then put forward feasible measures to improve the situation based on the findings.

3.0 Results

From our initial search in the aforementioned databases, a total of 249 records were qualified for title and abstract screening. After removing duplicates (n = 120), 129 studies were eligible for the title and abstract screening. One hundred and nine (109) papers were deemed irrelevant and were eliminated; a good number of these researches focused on other African nations rather than Malawi; discussed vaccine reluctance in general rather than COVID-19 vaccine hesitancy in particular, leaving 20 studies for full text screening. Five reports were not obtained during a full text screening, leaving

out 15 papers. Then, eight (8) studies were eliminated because they were protocols; did not focus on COVID-19 vaccine reluctance, or did not have the entire text available. The final analysis included the remaining seven papers (table 1). The selection process is shown in the PRISMA flow diagram (Fig. 1).

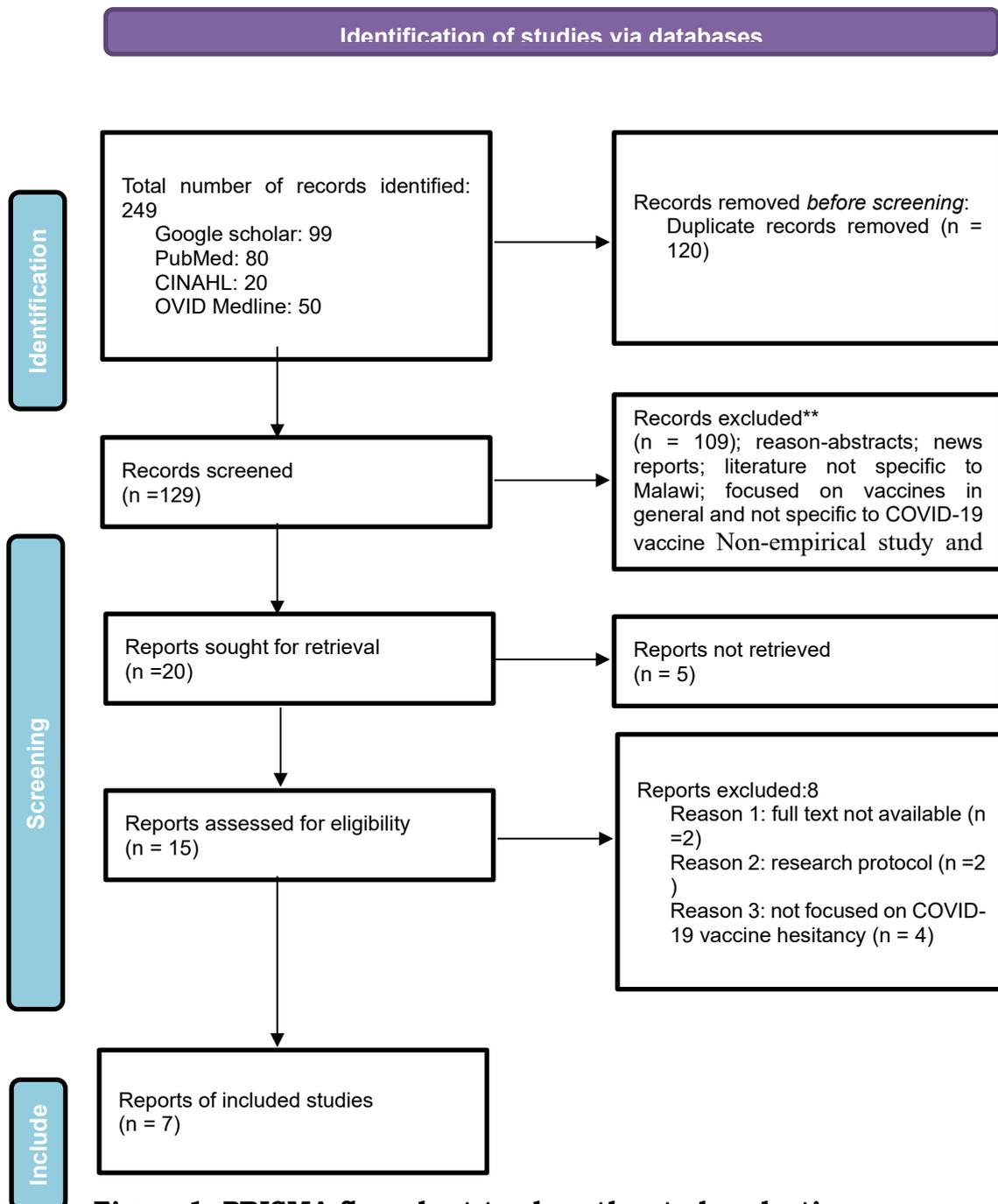


Figure 1: PRISMA flow chart to show the study selection process

3.1 Factors related with/reasons for COVID-19 vaccine hesitancy

The results of the reviewed papers corroborate vaccine hesitancy in Malawi. The first paper, by Chimatiro et al. (2023), reports that COVID-19 vaccine hesitancy and refusal in Malawi are associated with myths. The myths are circulated in the community through social media sites such as WhatsApp

and Facebook. Participants believed information that was being circulated on social media; such as that vaccines caused blood clots and infertility. In addition, religious leaders discouraged people from receiving the vaccine. Chimatiro et al. (2023) uncovered that COVID-19 was perceived as a disease of wealthy people; others believed that it signaled the end of the world and the pandemic could not be cured. This negatively contributed to vaccine uptake.

The paper by Safary and Mtaita (2022) look into factors leading to hesitation and/or refusal to COVID-19 vaccination in Malawi. Fear of getting vaccinated due to potential reactions and side effects led to hesitancy of COVID-19 vaccination. The most perceived serious side effects reported are infertility and the potential formation of blood clots. According to Safary and Mtaita (2022), the COVID-19 vaccine is perceived as dangerous and ineffective, thus one could still get the infection even after being fully vaccinated. Additionally, study participants questioned the long-term efficiency and efficacy of the vaccine. There are discussions of either having the COVID-19 vaccination on a yearly basis or adding additional booster doses. Such opinions deter respondents from getting vaccinated. Some respondents felt that the vaccination rollout was part of a clinical trial and hence did not want to participate in it. The authors advocate for measures to increase COVID-19 vaccine uptake and acceptance, targeting fear and misinformation.

Ao et al. (2022) investigated vaccination rates for COVID-19 among Malawians. They also assessed the level of COVID-19 vaccine hesitancy among Malawians and explored the factors influencing vaccination and willingness to get vaccinated against COVID-19. The authors exposed that there is so much ignorance or incorrect knowledge about vaccines. This led to distrust and rejection of COVID-19 vaccines amongst Malawians. Ao et al. (2022) recommend that individuals should be aware of existing health risks and take protective measures. The benefits of vaccination also need to be highlighted. Individuals should know that vaccines protect them from untimely deaths. Additionally, as recommended by Ao et al. (2022), we can spread information on real-life COVID-19 cases and successful vaccination stories to promote vaccination behavior. We should also track and address rumors and misinformation about vaccines to rebuild public confidence in vaccination. At the same time, Malawi has its own unique cultural and religious background, so it is essential to work with trusted community leaders. Religious leaders can also act as vaccine advocates, using existing trust relationships to promote vaccination.

Furthermore, Aron et al. (2022) describe attitudes toward the uptake of the COVID-19 vaccine and perceptions in patients with non-communicable diseases (NCDs) and their caregivers in rural Malawi. Vaccine uptake and intention to vaccinate among this group of vulnerable non-communicable disease patients and their caregivers in rural Malawi were three times higher than the general public's current vaccination rate but substantially below the vaccination target of 70%. However, vaccines were perceived as unsafe or designed to harm and commonly associated with death, severe disability, infertility and evil. Ojong and Agbe (2023) exposed to COVID-19 vaccine

anxieties. Vaccine anxiety was not limited to any particular class or social status. According to Ojong and Agbe (2023), the fact that a person was vaccinated did not indicate that they had no anxiety, thus context matters.

Holden et al. (2023) exposed that some Malawians did not receive vaccines due to religious convictions and beliefs. They believed that getting the vaccine could result in receiving a triple-six (666) mark from the devil; a negative omen among devout Christians strongly associated with trust in the vaccine. Trust in vaccines had a strong impact on demand for vaccines and vaccine hesitancy. Furthermore, certain religious groups are associated with more of these pandemic-related beliefs, lower trust in vaccines and lower vaccine demand or stronger vaccine hesitancy (Holden et al., 2023). Some of the Malawians belonging to the Seventh Day Adventists, the Pentecostals and the Community of Christ Church have had significantly lower trust in the vaccine than those belonging to the Roman Catholic Church (base category) (Holden et al., 2023). On the other hand, the authors found that trust in politicians, health personnel and trust in general contributed to strengthening confidence in vaccines.

Furthermore, research has demonstrated that vaccination intention and behavior can be influenced. Age, education, religion and occupation have a substantial impact on vaccination hesitancy rates against COVID-19 (2023). According to Mchawa et al. (2023) participants in older age groups (40–49 years) and above 50 years are less likely to have vaccine hesitancy compared to younger adults aged 18–29 years. Probably, older adults may perceive to be at a greater risk of severe illness and complications from COVID-19 and would be more motivated to get vaccinated (Govere-Hwenje et al., 2022). Mchawa et al. (2023) observed that people with a higher educational level might act better in understanding the knowledge of the vaccination importance of COVID-19 vaccine, so they performed a lower vaccine hesitancy. The vaccine hesitancy rate of Christians was dramatically higher than the Muslims (Mchawa et al., 2023). Furthermore, individuals with lower monthly incomes have a higher acceptance of the COVID-19 vaccine (Aron et al., 2022). This is widely believed due to government’s policy of free vaccines (Aron et al., 2022).

4.0 Discussion

This paper aimed to investigate vaccine hesitancy amongst Malawians in the context of COVID-19 vaccination. The reviewed papers demonstrate that vaccine hesitancy in Malawi occurs as a result of myths and misinformation. The vaccines are viewed as dangerous or intended to cause harm; such as the myth that the COVID-19 vaccine would cause infertility, severe disability and death. There were also reports that COVID-19 vaccination is being considered experimental and ineffective; the anticipated and observed vaccine side effects led to hesitancy. The review revealed that some people didn’t receive the vaccine due to religious convictions and beliefs. They believed that receiving the vaccine could result in receiving a triple-six (666) mark from the devil. All these factors undermine the confidence that is crucial for sustaining collective

immunity in vaccine programs. COVID-19 vaccine hesitancy has also been reported in some of the healthcare personnel (Phwitiko, 2021). Despite the fact that COVID-19 vaccines have been proven to be safe (WHO, 2023), some healthcare workers remain hesitant. It is not surprising that the vaccines that targeted persons at risk of acquiring the COVID-19 pandemic in Malawi such as healthcare workers, the elderly and people with underlying comorbidities like diabetes, asthma got expired and discarded in May 2021 (Masina, 2021).

Although vaccination is framed as a collective duty in which citizens of welfare states contribute to population health as a measure of good citizenship (Government of Malawi., 2021) the right to autonomy should also be considered. Though public health programs are argued to limit freedom, a patient-centered approach is important for trust and decision-making. Therefore, efforts to address vaccine hesitancy should not rely on coercive public policies; instead, they should focus on citizen engagement to inform a patient-centered approach and cultivate an ethically consistent strategy (Government of Malawi., 2021) hence the need to strengthen the relationship between individual, collective and institutional responsibility to prevent vaccine hesitancy and promote herd immunity. Additionally, it is indicated that the success of the COVID-19 vaccination program depends on the proportion of the population willing to be vaccinated (Moola et al., 2021). Recent estimates suggest that up to 70% of the population may require vaccination to bring an end to the current pandemic (Bartsch et al., 2020). Thus, highlighting the need for a speedy rollout of vaccines to bring normalcy back as soon as possible.

In the pursuit of dealing with vaccine hesitancy, it has been earlier suggested that governments should communicate vaccine risks and benefits in a responsible manner and take responsibility for individuals negatively affected by the adverse effects of the vaccines (Mathieu et al., 2021). Furthermore, vaccine skeptics should not be treated as ill-informed or less educated; their concerns should be addressed respectfully. In the event that individuals suffer from the side effects of vaccines, the public should get support from the government (Mathieu et al., 2021) to responsibly remedy concerns and restore trust. Finally, the citizens of Malawi need to be actively involved in the structure and modes of delivery of the COVID-19 vaccine. Additionally, the stakeholders responsible for vaccine rollout should acknowledge community efforts in vaccine acceptance and determine areas that require improvement to maintain vaccine acceptance (UNICEF, 2022).

Additionally, Chimatiro et al. (2023) suggest that health specialists engage with religious leaders so that they can provide accurate messages to their followers. The vaccine uptake could be improved by effective community engagement by role models who advocate the vaccine and by integrating COVID-19 vaccination into community outreach services. False information related to COVID-19 vaccine may circulate through rural communities. Community engagement efforts should be directed at sensitizing the community on the need for vaccination against COVID-19 so that people should develop positive perceptions. Similarly, in Zambia, Pugliese-Garcia

and Heyerdahl (2018) reported that people were hesitant to take the oral cholera vaccine because of religious beliefs. We cannot ascertain how the COVID-19 vaccine is associated with religious beliefs; however, we assume that inadequate and incorrect information could contribute to this line of thinking. Constant community sensitization would increase knowledge and awareness among individuals with little or no education and improve the uptake of health interventions (Chimatiro et al., 2023; Safary & Mtaita, 2022). The article further argues that we live in a modern world where new technologies and social media platforms have resulted in a flood of publicly accessible information (Lin et al., 2020). As recommended by Safary and Mtaita (2022), interventions such as individual sensitisation and motivational interviewing should be considered for guiding individuals towards considering COVID-19 vaccination. Religion plays a strong role in many African nations and many countries across the globe. Most of the religious congregations in Malawi and elsewhere belong to international networks that could potentially help protect against the pandemic though there may be persistent beliefs that are hard to change (Holden et al., 2023). It may be important to address some of the religious groups and their leaders to promote vaccine demand, thereby reducing vaccine hesitancy.

5.0 Conclusions and take-home messages

Vaccine hesitancy is a growing problem that affects vaccine uptake. Vaccine hesitancy could derail global efforts to end the COVID-19 pandemic. Therefore, it is vital that the Malawi government and other stakeholders should understand why people are uncertain about receiving the COVID-19 vaccine. Firstly, tackling vaccine hesitancy necessitates improved information communication between healthcare professionals and Malawians, including full disclosure of immunization information at the point of delivery. Secondly, misconceptions about the COVID-19 vaccination hinder the vaccine's predicted success. As a result, response techniques to address misunderstandings must be implemented. All potential barriers to vaccine acceptance must be proactively addressed in a culturally and linguistically sensitive manner that includes the involvement of religious leaders.

Reference

Afolabi, A. A. and Ilesanmi, O. S. (2021), "Dealing with vaccine hesitancy in Africa: The prospective COVID-19 vaccine context", *The Pan African Medical Journal*, Vol. 38 No. 3. <https://doi.org/10.11604/pamj.2021.38.3.27401>

Ao, Q., Egolet, R. O., Yin, H. and Cui, F. (2022), "Acceptance of COVID-19 Vaccines among Adults in Lilongwe, Malawi: A Cross-Sectional Study Based on the Health Belief Model", *Vaccines*, Vol. 10 No. 5, 760. <https://doi.org/10.3390/vaccines10050760>

Aron, M. B., Connolly, E., Vrkljan, K., Zaniku, H. R., Nyirongo, R., Mailosi, B., ... Barnhart, D. A. (2022), "Attitudes toward COVID-19 Vaccines among Patients with Complex Non-Communicable Disease and Their Caregivers in

Rural Malawi", *Vaccines*, Vol. 10 No. 5, 792.
<https://doi.org/10.3390/vaccines10050792>

Bartsch, S. M., O'Shea, K. J., Ferguson, M. C., Bottazzi, M. E., Wedlock, P. T., Strych, U., ... Lee, B. Y. (2020), "Vaccine Efficacy Needed for a COVID-19 Coronavirus Vaccine to Prevent or Stop an Epidemic as the Sole Intervention", *American Journal of Preventive Medicine*, Vol. 59 No. 4, 493–503.

Bhopal, S. and Nielsen, M. (2021), "Vaccine hesitancy in low- and middle-income countries: Potential implications for the COVID-19 response", *Archives of Disease in Childhood*, Vol. 106 No. 2, 113 – 114.

Chimatiro, C. S., Hajison, P., Jella, C. D., Tshotetsi, L. and Mpachika-Mfipa, F. (2023), "Barriers affecting COVID-19 vaccination in Phalombe District, Malawi: A qualitative study", *South African Medical Journal = Suid-Afrikaanse Tydskrif Vir Geneeskunde*, Vol. 113 No. 4, e16554.
<https://doi.org/10.7196/SAMJ.2023.v113i4.16654>

Elgendy, M. O. and Abdelrahim, M. E. A. (2021), "Public awareness about coronavirus vaccine, vaccine acceptance, and hesitancy", *Journal of Medical Virology*, Vol. 93 No. 12, 6535 – 6543.

Giubilini, A. (2020), "Vaccination Ethics", *Br. Med. Bull*, Vol. 137, pp. 4 – 12.

Govere-Hwenje, S., Jarolimova, J., Yan, J., Khumalo, A., Zondi, G., Ngcobo, M., ... Bassett, I. V. (2022), "Willingness to accept COVID-19 vaccination among people living with HIV in a high HIV prevalence community", *BMC Public Health*, Vol. 22 No. 1, 1239. <https://doi.org/10.1186/s12889-022-13623-w>

Government of Malawi (2021), "*Coronavirus – Malawi: COVID 19 daily info uptake*", Available at: www.zawya.com/en/press-release/coronavirus-malawi-covid-19-daily-info-update-26-december-2021-gncelim5

Government of Malawi (n.d.). "*Malawi receives first shipment of COVID 19 vaccines from COVAX*", Available at: <https://www.unicef.org/malawi/press-releases/malawi-receives-first-shipment-covid-19-vaccines-covax>

Holden, S. T., Tione, S., Tilahun, M. and Katengeza, S. (2023), "Religion, beliefs, trust, and COVID vaccination behavior among rural people in Malawi", in 34 [Working paper]. Norwegian University of Life Sciences. Available at: <https://nmbu.brage.unit.no/nmbu-xmlui/handle/11250/3046947>

Lazarus, J. V., Ratzan, S. C., Palayew, A., Gostin, L. O., Larson, H. J., Rabin, K., ... El-Mohandes, A. (2021), "A global survey of potential acceptance of a COVID-19 vaccine", *Nature Medicine*, Vol. 27 No. 2, pp. 225–228.

Lazarus, J. V., Wyka, K., Rauh, L., Rabin, K., Ratzan, S., Gostin, L. O., ... El-Mohandes, A. (2020), "Hesitant or Not? The Association of Age, Gender, and Education with Potential Acceptance of a COVID-19 Vaccine: A Country-level Analysis", *Journal of Health Communication*, Vol. 25 No. 10, 799 – 807.

Lin, C., Tu, P. and Beitsch, L. M. (2020), "Confidence and Receptivity for COVID-19 Vaccines: A Rapid Systematic Review", *Vaccines*, Vol. 9 No. 1, 16. <https://doi.org/10.3390/vaccines9010016>

Masina, L. (2021), "Malawi burns expired COVID-19 vaccine amid concerns of low uptake", Available at: www.voanews.com/a/africa_malawi-burns-expired-covid-19-vaccine-amid-concerns-lowuptake/6205989.html

Mathieu, E., Ritchie, H., Ortiz-Ospina, E., Roser, M., Hasell, J., Appel, C., ... Rodés-Guirao, L. (2021), "A global database of COVID-19 vaccinations", *Nature Human Behaviour*, Vol. 5 No. 7, pp. 947 – 953.

Mchawa, C., Zhang, S.-S., Zhang, W.-X., Zhou, Y., Wei, T.-T., Du, J., ... Lu, Q.B. (2023), "Assessing SARS-CoV-2 vaccine hesitancy among the people living with and without HIV from May to September 2022 in Blantyre, Malawi", *Human Vaccines & Immunotherapeutics*, Vol. 19 No. 2, 2222052. <https://doi.org/10.1080/21645515.2023.2222052>

Moola, S., Gudi, N., Nambiar, D., Dumka, N., Ahmed, T., Sonawane, I. R. and Kotwal, A. (2021), "A rapid review of evidence on the determinants of and strategies for COVID-19 vaccine acceptance in low- and middle-income countries", *Journal of Global Health*, Vol. 11, 05027. <https://doi.org/10.7189/jogh.11.05027>

Ochola, E. A. (2023), "Vaccine Hesitancy in Sub-Saharan Africa in the Context of COVID-19 Vaccination Exercise: A Systematic Review", *Diseases*, Vol. 11 No. 1, p. 32. <https://doi.org/10.3390/diseases11010032>

Ojong, N. and Agbe, E. (2023), "This is most likely not the correct vaccine: Analysing COVID-19's viral spread and vaccine anxieties in Ghana, Cameroon, and Malawi", *Social Science & Medicine*, Vol. 329, 116001. <https://doi.org/10.1016/j.socscimed.2023.116001>

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... Moher, D. (2021), "The PRISMA 2020 statement: An updated guideline for reporting systematic reviews", *BMJ*, Vol. 372, n71. <https://doi.org/10.1136/bmj.n71>

Phwitiko, R. (2021), "Hope and some hesitancy on the frontline as COVID-19 vaccination takes shape in Malawi | UNICEF Malawi", Available at: <https://www.unicef.org/malawi/stories/hope-and-some-hesitancy-frontline-covid-19-vaccination-takes-shape-malawi> (Accessed 8/10/23).

Pugliese-Garcia, M., Heyerdahl, L. W., Mwamba, C., Nkwemu, S., Chilengi, R., Demolis, R., ... Sharma, A. (2018), "Factors influencing vaccine acceptance and hesitancy in three informal settlements in Lusaka, Zambia", *Vaccine*, Vol. 36 No. 37, 5617 – 5624.

Safary, E. and Mtaita, C. (2022), "A qualitative exploration of perceptions of the COVID-19 vaccine in Malawi during the vaccine rollout phase", *One Health*

& *Implementation Research*, Vol. 2 No. 2, null.
<https://doi.org/10.20517/ohir.2022.08>

Sallam, M. (2021), "COVID-19 Vaccine Hesitancy Worldwide: A Concise Systematic Review of Vaccine Acceptance Rates", *Vaccines*, Vol. 9 No. 2, 160.
<https://doi.org/10.3390/vaccines9020160>

The World Bank (2021), "Rolling out COVID-19 Vaccines in Malawi Amid Hesitancy and Supply Challenges", Available at:
<https://www.worldbank.org/en/news/feature/2021/10/19/rolling-out-covid-19-vaccines-in-malawi-amid-hesitancy-and-supply-challenges>

UNICEF (2022), "Multilateral Leaders Task Force on COVID-19: Malawi", Available at: <https://data.covid19taskforce.com/data/countries/Malawi> (Accessed 08/11/2022).

United Nations Development Programme (2020), "COVID 19 pandemic in Malawi: Final report. Lilongwe, Malawi: UNDP", Available at:
[//www.undp.org/sites/g/files/zskgke326/files/migration/africa/UNDP-rba-COVID-assessment-Malawi.pdf](https://www.undp.org/sites/g/files/zskgke326/files/migration/africa/UNDP-rba-COVID-assessment-Malawi.pdf)

WHO (2023), "New study helps inform actions to increase COVID-19 vaccine uptake among Albania's health workers", Available at:
<https://www.who.int/europe/news/item/06-03-2023-new-study-helps-inform-actions-to-increase-covid-19-vaccine-uptake-among-albania-s-health-workers> (accessed 8/01/24).

World Health Organisation (2019), "Ten health issues WHO will tackle this year", Available at: <https://www.who.int/newsroom/spotlight/ten-threats-to-global-health-in-2019>

Clinical Teaching Practices of Nurse Educators in Maternal Mental Health at St Lukes and Ekwendeni Colleges of Health Sciences in Malawi: A Mixed Method Study

Chrissie Rashidi Hussein¹, Masumbuko Baluwa², Thokozani Bvumbwe³

1. Department of Community and Mental Health Nursing, St Johns Institute for Health, Mzuzu, Malawi;

2. Department of Nursing and Midwifery, Mzuzu University, Mzuzu, Malawi;

3. Department of Nursing and Midwifery, Mzuzu University, Mzuzu, Malawi,

Correspondence: Chrissie Rashidi Hussein, Department of Community and Mental Health Nursing, St Johns Institute for Health, P. O. Box 18, Mzuzu, Malawi. Email: chrissie.hussein@stjohnsinstituteforhealth.com

Abstract

Purpose: To assess clinical teaching practices of nurse educators in maternal mental health at St Lukes and Ekwendeni Colleges of Health Sciences in Malawi.

Methodology/approach: An explanatory sequential mixed method study was conducted at St. Lukes and Ekwendeni Colleges of Health Sciences, using convenient and purposive sampling techniques. Data was collected through a survey, in-depth interviews, focus group discussions, and document reviews. Data was analysed using Descriptive statistics, Fisher's exact test, thematic and content analysis.

Findings: Nurse educators implemented a few maternal mental health competencies in the nursing and midwifery technician education program, such as documentation ($M = 4.55 \pm 0.595$), collaboration of care ($M = 4.27 \pm 0.78$), and referral ($M = 4.08 \pm 0.910$). Furthermore, nurse educators used a few teaching practices, like sharing clinical objectives ($M = 4.17 \pm 0.964$), encouraging students to develop individual objectives ($M = 4.51 \pm 0.680$), and orienting students to clinical objectives ($M = 4.39 \pm 0.728$). The Fishers Exact test revealed an association between the gender of students and the utilisation of clinical teaching strategies (two-tailed p -value = 0.011).

Discussion: The study encourages nurse educators to teach all maternal mental health competencies and use student-centeredness strategies as emphasized in the Competency Outcomes and Performance Assessment model. This will enable students to gain maternal mental health competencies and serve clients seeking mental health services.

Recommendations: The study recommends nurse educators review the nursing and midwifery technician curriculum by incorporating all the maternal mental health competencies, continuous professional development of nurse educators on student-centeredness strategies, and mobilization of resources to support students' learning.

Conclusion: The study established that nurse educators were teaching some of the maternal mental health competencies. However, all the maternal mental health competencies should be taught using student-centered teaching strategies to produce a competent nurse midwife technician.

Originality/value of contribution: The study has implications for policy, education and practice. Its recommendations, if acted upon, would lead to the formulation of relevant policies that were found to be lacking. Findings could also lead to effective teaching practices in maternal mental health.

Keywords: Maternal mental health; perinatal mental health; nurse midwife technician; clinical teaching; clinical education; and nurse educator.

1.0 Introduction

Clinical teaching is instruction and learning that occurs near patients (Atakro and Gross, 2016). Nurse educators' supervision in clinical settings is critical for students' confidence and application of theoretical knowledge, while real-world experience and a qualified mentor bridge the gap between theory and practice. In Malawi, the majority of nurse educators are employed by the Christian Health Association of Malawi (CHAM), where their role is to teach in the classroom and supervise students in the clinical area (Mbirimtengerenji, 2018). It is estimated that over 87% of nurses in Malawi are NMTs, who are the main frontline healthcare providers (Ministry of Health, 2017). NMTs are trained to provide general patient care, midwifery, and mental health services. Even though NMTs are present in various healthcare settings and fulfill a range of responsibilities, they do not possess the necessary skills to effectively address mental health issues in maternal women. Consequently, patients may either go unnoticed or receive inadequate treatment Chorwe-Sungani and Chipps, 2018; Ng'oma et al., 2019). Limited research exists on how students are supported in clinical settings to improve their MMH competencies, resulting in a lack of literature on clinical teaching practices used by nurse educators in the NMT program. This study was conducted to address the gap.

1.1 Problem statement

The clinical teaching practices of nurse educators play a crucial role in imparting knowledge and skills to students, ultimately shaping their competence. The ability of students to deliver quality care to patients is heavily influenced by the education and skills they receive during their training. In Malawi, there is a noted lack of competence among students in providing mental health services (Mwale and Mselle, 2017; Kulisewa et al., 2022). Efforts have been made to address this issue, such as the review of the NMT curriculum for nursing colleges in 2020, with a focus on strengthening clinical courses and promoting participatory teaching methods (Christian Health Association of Malawi, 2020). Additionally, nurse educators were trained to enhance their clinical teaching competencies, particularly in supporting students in the clinical setting (Mhango, 2021). Despite these initiatives, NMTs still face challenges in providing MMH services, as a result,

clients are missed and not treated holistically as the focus of care is on physical health over mental health care. It was unclear regarding the clinical teaching practices of nurse educators in helping NMT students attain MMH competencies, hence, the need by which this study was conducted to address the gap.

1.2 Research questions

1. What MMH clinical competencies are implemented by nurse educators during student practice?
2. What clinical teaching strategies are nurse educators utilizing in MMH competencies

2.0 Literature review

A broad search was conducted using databases such as PubMed/MEDLINE, Hinari, EBSCO Host, and Google Scholar were used with Boolean operators AND, OR, and NOT to broaden and narrow the search. Keywords used in searching were: clinical teaching, clinical practices, perinatal mental health, maternal mental health education, midwifery education, clinical skills, and clinical education. There are six major skills for mental health nurses: risk assessment, recovery principles, person and family-centered care, effective communication, physical health knowledge, and humor (Moyo, Jones and Gray, 2022). These skills help nurses create a safe environment, support patients in decision-making, build trust, collaborate with healthcare professionals, and maintain a positive attitude in stressful situations. In addition, nurse educators must possess a comprehensive understanding of the teaching environment and its strategies to efficiently utilise resources and ensure a practical learning experience during clinical practice. However, studies have reported a lack of competence among midwifery educators, leading to challenges in managing mental health conditions (Satoh, Fujimura and Sato, 2020).

In the UK, Health Education England authorized the nursing and midwifery education program to include the PMH module to help midwives achieve the appropriate level of competence(Health Education England and The Tavistock and Portman NHS Foundational Trust, 2018). However, studies observed little content, poor alignment of PMH competencies, inconsistencies in clinical teaching practices, and lack of seriousness among students as barriers to achievement of competence among midwives (Legere et al., 2017a; Morton and Rylance, 2019). For midwives to achieve MMH competence, three teaching approaches are used which include face-to-face, online, and blended learning(Legere et al., 2017a; Everitt et al., 2022a). In face-to-face teaching, nurse educators use strategies such as presentations, case studies, role plays, audio recordings, and lived experiences of clients with mental health problems. These strategies promote the development of MMH competencies such as; screening, managing common mental health problems and actively engaging clients in the teaching and learning process (Legere et al., 2017b; Everitt et al., 2022). Furthermore, pre-clinical meetings, clinical teacher

availability, and sharing learning objectives are essential for teaching students in a mental health clinical setting (Wenzel et al., 2022). These meetings help align students' needs with clinical goals, clarify expectations, roles, and responsibilities, and promote collaborative partnerships. Nurse educators should accompany students during clinical placements to reduce fear and stress, providing a supportive learning environment.

3.0 Methodology

This study utilised a mixed-methods research design (MMRD) to analyse clinical teaching practices in (MMH) at two Malawian institutions, Ekwendeni College of Health Sciences (ECHS) and Saint Luke's College of Health Sciences (SLCHS). The two institutions were selected because they are found in and close to districts with an increased prevalence rate of maternal depression, and no study of this nature was reported to have been done in the districts (Stewart *et al.*, 2015; Silungwe, 2021). The entire sample was estimated at 217, however, during data collection only 157 participants who met the inclusion criteria were available and this resulted in recruiting the entire population. Convenience sampling was used to recruit participants, with the sample size determined by selecting people who accurately represented the population (Sharma, 2018). For qualitative data, key informants who were teaching and learning MMH competencies were purposively recruited so that they could provide enough information for the study (Creswell and Creswell, 2018). The key informants included nurse educators, preceptors, and third-year students who met the inclusion criteria. Data collection was done using a semi-structured interview guide, a checklist, and a questionnaire. The tool's internal consistency was high, with a score between 0.8 and 0.9, indicating that it was valid and reliable. Trustworthiness of the interview guides was achieved using Lincoln and Guba's five criteria: credibility, dependability, confirmability, transferability, and authenticity (Lincoln and Guba, 1985). Credibility was achieved through focus group discussions and in-depth interviews, which were interactive and conducted in English. The study also underwent member checking and peer debriefing to confirm the truthfulness of the findings. Dependability was achieved through an audit trail, which included research designs, implementation, interview notes, and transcriptions. Confirmability was achieved through continuous bracketing and an audit trail on data collection tools, analysis decisions, and audio recordings. Transferability was achieved through a detailed description of the study, including fieldwork, setting, study process, limitations, and report. Authenticity was achieved through prolonged engagement with participants, member checking, an audio tape recorder, field notes, and textual quotations in the study report.

Data was analysed using descriptive statistics, thematic analysis, and content analysis. The mean score for MMH competencies was 3.75, and for clinical teaching strategies was 3.31. Cross-tabulations and Fisher's exact tests were performed on each of the three dependent variables against six demographic characteristics of nurse educators. Thematic analysis was conducted concurrently with data collection, identifying areas for further

investigation and refining the interview guide. Content analysis was used to analyse data from checklists, organizing information into categories based on research questions. Data from NMT syllabi, curriculum, course outlines, and student logbooks were grouped based on MMH topics taught, knowledge, skills, attitudes, and teaching methods.

4.0 Results

The results are presented in two forms namely quantitative and qualitative findings.

4.1 MMH competencies utilised in the NMT clinical teaching

Table 1: Participants' Responses on MMH Competencies

MMH Competencies	M	SD	Decision
Documentation	4.55	0.595	Agree
Collaboration	4.27	0.728	Agree
Referral	4.08	0.910	Agree
Psychological support	3.94	0.941	Agree
Critical thinking skills	3.80	0.814	Agree
Ethical decision-making skills	3.86	0.823	Agree
Counselling skills	3.79	0.910	Agree
Communication Skills	3.84	1.046	Agree
Screening skills	2.78	1.367	Disagree
MMH conditions	2.62	0.967	Disagree
Weighted mean	3.75		

Results from Table 1 indicate that the majority of participants agreed with teaching student's documentation ($M = 4.55 \pm 0.595$), collaboration ($M = 4.27 \pm 0.728$), and referral ($M = 4.08 \pm 0.910$). However, they disagreed with teaching common MMH conditions ($M = 2.78 \pm 1.367$) and screening skills ($M = 2.62 \pm 0.967$), skills.

4.2 Clinical Teaching Strategies Utilised in MMH Care

Table 2: Participant's Responses on Clinical Teaching Strategies

Clinical teaching methods	Mean	SD	Decision
Developing objectives	4.51	0.680	Agree
Objectives orientation	4.39	0.728	Agree
Sharing objectives	4.17	0.964	Agree
Coaching	3.76	0.958	Agree
Learning from patient experiences	3.75	1.091	Agree
Case studies	3.67	1.276	Agree
Feedback	3.41	1.211	Agree
Discussion	2.88	1.279	Disagree
Return demonstration	2.88	1.314	Disagree
Demonstration of:			
- Communication skills	3.72	1.278	Agree
-Counselling skills	3.18	1.278	Disagree
-Anxiety screening skills	2.52	1.176	Disagree
- Depression screening skills	2.21	0.964	Disagree
Laboratory skill practice	2.42	0.824	Disagree
Portfolio	2.16	0.919	Disagree
Weighted average	3.31		

Findings from Table 2 show that participants agreed on using 8 out of 13 clinical teaching strategies, with sharing clinical objectives ($M = 4.17 \pm 0.964$), developing individual objectives ($M = 4.51 \pm 0.680$), and orientation to clinical objectives scoring highly. However, they disagreed with demonstrations of MMH skills, such as screening for maternal depression, anxiety, counseling, and Laboratory skills practice.

4.3 The association between social demographic variables and dependent variables

Fisher's exact test was done and revealed no statistically significant relationship between the demographic variables of nurse educators and MMH competencies, clinical teaching strategies, and challenges faced by nurse educators in clinical teaching. This indicates that the variables are independent and that the study data does not provide enough evidence to reject the null hypothesis. Thus, teaching MMH competencies, use of clinical teaching strategies, and challenges faced by nurse educators are not influenced by the social demographic variables of nurse educators. However, there is an association between the gender of students and utilisation of clinical teaching strategies in MMH (two-tailed p -value = 0.011) because the p -value was less than 0.05. Hence, the study data provide enough evidence to reject the null hypothesis and conclude that the two variables are dependent. This means that the utilisation of clinical teaching methods in MMH competencies is influenced by the gender of students.

4.4 Themes and Subthemes

Findings from qualitative data responded to all research questions and complimented the quantitative data. Themes and subthemes of the study are presented in Table 3.

Table 3: Themes and Subthemes

Themes	Subthemes
a) Assessment and management of women with MMH conditions	i. MMH topics ii. MMH skills
b) Classroom-based teaching	i. Lecture method ii. Student-centeredness strategies
c) Clinical teaching and support	i. Student support ii. Clinical-based teaching

4.4.1 Assessment and Management of Women with MMH Conditions

The study revealed that students were taught the assessment and management of women with MMH problems. Two subthemes were identified from this theme, such as the topics and skills taught in MMH care.

4.4.1.1 MMH Topics

Participants indicated that students were taught symptoms of puerperal psychosis for them to have knowledge and be able to identify maternal women with such problems.

“Students are taught in terms of knowledge on puerperal psychosis as well as what areas to know that this client has symptoms of puerperal psychosis after delivery” (Participant# 08-NE-M).

Other participants indicated that they teach students anxiety and depression, which is covered as postpartum depression and psychosis, and the application of legal issues, as stated by this participant:

“According to the curriculum for NMTs, there is anxiety and there is depression, which comes in as postpartum depression and postpartum psychosis. We also teach them legal issues that students are supposed to follow when managing or assessing people with mental health problems” (Participant #06-NE-M).

4.4.1.2 MMH Skills

This study also revealed that NMTs are taught counselling skills to help women identify the underlying causes of MMH conditions as stated by this participant:

“We teach our students how to counsel patients or clients that have anxiety or problems with depression. You know that every condition that the client will come up with has specific causes, so we teach our students to target those specific causes, so we counsel them” (Participant # 06-NE-M).

4.4.2 Classroom-Based Teaching

The findings show that participants utilised different teaching strategies to help students develop MMH competencies. Two themes were identified such as lecture and student-centered teaching strategies.

4.4.2.1 Lecture Method

The majority of the participants indicated that the lecture method was commonly used because it was effective in teaching a new topic like puerperal psychosis as explained by this participant:

“For puerperal psychosis, I teach using the lecture method because it is a new topic to the students, and as such, students mostly depend on the teacher to provide enough information so that they can understand the topic” (Participant # 04-NE-F).

4.4.2.2 Student-Centered Teaching Strategies

The majority of participants stated that student-centered teaching strategies such as group discussion and assignments were commonly utilised when teaching students MMH competencies to help students gain an in-depth understanding of MMH problems as explained by this participant:

“We use discussion, lecturing, and a small part of student-centered methods like group assignments. Using a variety of methods helps students to understand and critique more on the condition, its cause, and how they can manage the client” (Participant # 08- NE-M).

4.4.3 Clinical-Based Teaching

The findings indicate that participants use various clinical teaching strategies to support students in the clinical setting, such as demonstrations, case studies, and clinical conferences. Participants explained how demonstrations were done in the clinical area to help students develop MMH competencies as reported by this participant:

“We do demonstrations in the sense that I will take a woman who is having mental health problems, and then I assist the woman while students are just watching.” (Participant #01-NE-M).

5.0 DISCUSSION

The study found that the majority of participants agreed that student NMTs were taught mental health (MMH) competencies, with puerperal psychosis being the most common condition. In addition, the majority disagreed with teaching students the management of other common MMH conditions and their screening skills. This lack of knowledge may suggest that midwives in Malawi are not adequately prepared for MMH practice. Consistent with the findings, Carroll et al. (2018) asserted that midwives have a knowledge deficit on the management of other MMH conditions such as maternal anxiety, depression, and suicide. However, the lack of knowledge on the management of common MMH problems and screening skills is contrary to the recommendations made by ICM, where the core competencies for midwives include screening, emotional support, and referral of such cases for further management (ICM, 2018). Furthermore, the current MMH practice in Malawi is contrary to the World Health Organisation recommendations, which encourage non-specialized healthcare providers to be familiar with the management of common mental health conditions, screening, psychological support, and the use of psychotropic medication (WHO, 2022). The findings suggest that the NMT curriculum should be reviewed to include MMH competencies such as common PMH conditions and their screening skills, helping students be adequately prepared for practice.

The qualitative findings indicate that participants utilised the lecture method when teaching MMH competencies in the classroom, but this method has been associated with poor understanding of the course and reduced concentration span (Mbirimtengerenji and Adejumo, 2015; Lateef and Mhlongo, 2019). Learner-centered teaching methods such as role-play, group discussion, and group presentations were also used to help students develop communication, interpersonal, problem-solving, critical thinking, and empathetic skills. However, debriefing and supportive supervision were not done by nurse educators, making it difficult for students to grasp the content.

These findings are inconsistent with the study findings done by Rahman et al. (2019), where group discussion improved student's competencies in MMH care. However, Rahman et al. (2019) suggested that for an effective group discussion, nurse educators should use video recordings, feedback, and supportive supervision to ensure that students understand the content and gain the required competencies. The absence of video recordings might have prevented students from developing MMH competencies and skills for practice. As NMTs are primary healthcare providers, they need to be well prepared for practice to provide holistic care to maternal women.

6.0 CONCLUSION AND TAKE-HOME MESSAGES

The study was carried out to assess clinical teaching practices in MMH in selected nursing colleges under the Christian Health Association of Malawi. This study has established that NMTs learn a few competencies in MMH care, such as puerperal psychosis, collaboration, referral, and documentation of care, among others. The study has further established that nurse educators utilise a few teaching strategies when supporting students in MMH care, which include orientation and sharing clinical objectives, encouraging students to develop individual objectives, demonstration, case studies, role play, and lecture methods. The study recommends incorporating MMH competencies into the nursing curriculum, implementing a MMH policy, and allocating mental health psychiatric nurses to maternal and child health departments to support student learning and provide care to all maternal mothers so that Malawi can reduce maternal and neonatal mortality and morbidity rates which are currently high.

References

Atakro, C.A. and Gross, J. (2016), "Preceptorship versus Clinical Teaching Partnership: Literature Review and Recommendations for Implementation in Ghana", *Advances in Nursing*, 1919246. <https://doi.org/10.1155/2016/1919246>.

Chorwe-Sungani, G. and Chipps, J. (2018), "A cross-sectional study of depression among women attending antenatal clinics in Blantyre district, Malawi", *South African Journal of Psychiatry*, Vol. 24, pp. 1–6.

Christian Health Association of Malawi (2020) *Nursing and midwifery Technician Curriculum*, Lilongwe: Christian Health Association of Malawi.

Creswell, W.J. and Creswell, J.D. (2018) *Research Design: Qualitative, Quantitative and Mixed Methods Approaches*, London: Sage publications.

Everitt, L. et al. (2022a), "Educational programs and teaching strategies for health professionals responding to women with complex perinatal mental health and psychosocial concerns: A scoping review", *Nurse Education in Practice*, Vol. 60, p. 103319. Available at: <https://doi.org/10.1016/J.NEPR.2022.103319>.

Happell, B. *et al.* (2020), “It is much more real when it comes from them: The role of experts by experience in the integration of mental health nursing theory and practice”, *Perspectives in Psychiatric care*, <https://doi.org/10.1111/ppc.12496>.

Health Education England and The Tavistock and Portman NHS Foundational Trust (2018) *The Competency Framework for Professionals working with Women who have Mental Health Problems in the Perinatal Period*, London: NHS, pp. 1–44. Available at: [Users/Right Click/Downloads/Documents/The Competency Framework July 2018 - Perinatal.pdf](#).

Kulisewa, K. *et al.* (2022), ‘The feasibility and acceptability of a task-shifted intervention for perinatal depression among women living with HIV in Malawi: a qualitative analysis’, *BMC Psychiatry*, Vol. 22 No. 1, pp. 1–13. Available at: <https://doi.org/10.1186/s12888-022-04476-z>.

Lateef, A.M. and Mhlongo, E.M. (2019), “Factors Influencing Nursing Education and Teaching Methods in Nursing Institutions: A Case Study of South West Nigeria”, *Global Journal of Health Science*, Vol. 11 No. 13, p. 13. Available at: <https://doi.org/10.5539/gjhs.v11n13p13>.

Legere, L.E. *et al.* (2017a), “Approaches to health-care provider education and professional development in perinatal depression: A systematic review”, *BMC Pregnancy and Childbirth*, Vol. 17 No. 1. Available at: <https://doi.org/10.1186/s12884-017-1431-4>.

Lincoln, S., Yvonna. and Guba, G., E. (1985) *Naturalistic Inquiry*, London: SAGE Publications.

Mbirimtengerenji, N.D. and Adejumo, O. (2015), “Utilisation of the Teaching Strategies among Nurse Tutors in Malawi Nursing Colleges”, *Open Journal of Nursing*, Vol. 5 No. 3, pp. 276–294. Available at: <https://doi.org/10.4236/ojn.2015.53031>.

Mhango, L. (2021) *Assessing the Preceptorship Model in Clinical Teaching of Undergraduate Nursing and Midwifery Students in Malawi*, Doctoral dissertation, Kamuzu University of Health Sciences, Blantyre, Malawi.

Ministry of Health (HSSP 2017-2019) (2017) *Health Sector Strategic Plan II (2017-2022): Towards universal health coverage*, Lilongwe: Ministry of Health.

Morton, C. and Rylance, R. (2019), “Perinatal mental health: preparing the future nursing workforce”, *Mental Health Practice*, Vol. 22 No. 3, pp. 17–19. Available at: <https://doi.org/10.7748/mhp.2019.e1339>.

Moyo, N., Jones, M. and Gray, R. (2022), “What are the core competencies of a mental health nurse? A concept mapping study involving five stakeholder groups”, *International Journal of Mental Health Nursing*, Vol. 31 No. 4, pp. 933–951. Available at: <https://doi.org/10.1111/inm.13003>.

Mwale, O.G. and Mselle, L.T. (2017), “Exploring barriers to utilisation of mental health services in Malawi: A qualitative exploratory study”, *Mental Health and Prevention*, Vol. 5, pp. 52 – 62. Available at: <https://doi.org/10.1016/j.mhp.2017.01.004>.

Ng’oma, M. *et al.* (2019), “Passing through difficult times”: Perceptions of perinatal depression and treatment needs in Malawi - A qualitative study to inform the development of a culturally sensitive intervention”, *PLoS ONE*, pp. 1–20. Available at: <https://doi.org/10.1371/journal.pone.0217102>.

Phuma-Ngaiyaye, E.E., Adejumo, O. and Dartey, A.F. (2017), “Challenges in neonatal nursing clinical teaching to nurse-midwife technicians in Malawi”, *Journal of Nursing Education*, Vol. 56 No. 4, pp. 215 – 221. Available at: <https://doi.org/10.3928/01484834-20170323-05>.

Satoh, M., Fujimura, A. and Sato, N. (2020), “Competency of Academic Nurse Educators”, *Sage Open Nursing*, Vol. 6, pp. 1–11. Available at: <https://doi.org/10.1177/2377960820969389>.

Sharma, K, S. (2018) *Nursing Research & Statistics*, 3rd Edition, India: Elsevier Inc.

Wenzel, C. *et al.* (2022), “Clinical instruction in mental health nursing: students’ perceptions of best practices”, *International Journal of Nursing Education Scholarship*, Vol. 19 No. 1, pp. 1–12. Available at: <https://doi.org/10.1515/ijnes-2021-0147>.

WHO (2022), “*Guide for integration of perinatal mental health in maternal and child health services*, World Health Organisation (WHO)”. Available at: <https://www.who.int/publications/i/item/9789240057142>.

A review of Malawi's community-based management of acute malnutrition (CMAM): A model for reducing child mortality



Mike Khunga

Masters of Public Health (International)

&

Francis Poitiers

PHD International Public Health/ International Health

Nuffield Centre for International

University of Leeds

Health and Development

Leeds Institute of Health Sciences

Abstract

Purpose: The goal of this study was to review the implementation and effectiveness of the CMAM programme in Malawi

Methodology/approach: This was a retrospective study that involved desk review/secondary data collection on CMAM governance, financing, community engagement and information. Published English materials were collected from Medline, PubMed, and Global Health supported by Google Scholar. Grey literature was obtained from the Ministry of Health-Malawi, UNICEF, WFP and NGOs implementing CMAM.

Findings: Malawi has a strong governance mechanism to coordinate CMAM alongside local production of RUTF which effectively lowers costs. However, implementation is challenged by inconsistency and insufficient funding, inadequate trained and motivated healthcare workers and limited data collection and monitoring. Overdependence on external support hampers scalability and sustainability while inadequate trained health staff leads to poor data collection and monitoring.

Discussion: In terms of governance there is a solid CMAM coordination structure at the national level however, weak inter-departmental convergence between DNHA and MoH at the subnational level leads to poor oversight and control of CMAM activities. Financing for CMAM in Malawi has consistently remained below 5% over the years with donors shouldering 95%. CMAM relies heavily on untrained and poorly incentivised volunteers. Local production of RUTF is challenged by high aflatoxins and costs of ingredients. Nevertheless, these can be minimised by incentivising local producers by removing the tax on CMAM. CMAM can also be integrated into other health care services such as HIV to maximise resources for example in Ethiopia and using mobile apps to timely collect and report data as used in Rwanda and Nigeria.

Recommendations: The recommendation are to integrate CMAM into other health and nutrition interventions, use technology to collect and report CMAM data, increasing domestic finance and incentivising local producers of RUTF.

Conclusion: This paper highlights areas of improvement in CMAM programming in Malawi.

Originality/value of contribution: This is an original research paper that provides valuable Malawi specific information for CMAM programmers and advocates.

Keywords: Malnutrition, nutrition, child, infant, mothers, Ready to Use Therapeutic Food (RUTF), Malawi Bureau of Standard (MBS).

1.1 Introduction

Acute malnutrition, or wasting, is a major public health problem in low- and middle-income countries like Malawi. In 2021, over 45.4 million children worldwide suffered from acute malnutrition, 17 million were severely affected, resulting in 1 million preventable deaths (WHO, 2021). Wasting is often caused by inadequate nutrition and repeated illness, and severely wasted children are 11 times more likely to die than well-nourished children (UNICEF, 2023). In Malawi, it is a leading cause of under-five mortality,

affecting 41 out of every 1,000 live births, with the southern region particularly affected (DHS, 2016). To combat this, Community-Based Management of Acute Malnutrition (CMAM) was introduced in 2007 for early identification and treatment within communities, reducing reliance on overcrowded health facilities (Akuu and Amagnya, 2023). CMAM has four components: community mobilisation, inpatient care, outpatient therapeutic programmes and supplementary feeding. Community Health Workers and Volunteers (CHW&V) use Middle Upper Arm Circumference (MUAC) bands to screen and refer malnourished children. Those with a MUAC of less than 110 mm are classified as severely acutely malnourished (SAM) and are referred for inpatient care if they have medical complications, while those without complications are treated in the community with ready-to-use therapeutic food (RUTF). Children with a MUAC between 110-125 mm are classified as moderately acutely malnourished (MAM) and are enrolled in supplementary feeding programmes, where mothers receive food rations and training on how to prepare nutritious meals. Community mobilisation and early screening are crucial for effective case finding and referral (WHO, 2021; UNICEF, 2023; Ireen *et al.*, 2018; Aguayo *et al.*, 2018).

1.2 Problem Statement

The 2012 Cost of Hunger Study found that 10% of Malawi's GDP is lost due to malnutrition, highlighting the social and economic benefits of addressing the issue (WFP, 2015; DHS 2016). The Malawi Demographic Health Survey 2016 (DHS) indicated high prevalence of malnutrition in Malawi; stunting is at 37% while underweight and wasting is at 12% and 2.7% respectively. Regional wasting disparities exist with the Southern part reporting 6.6% wasting classified as *poor* (DHS, 2016). If not prevented acute malnutrition can contribute to drastic consequences for children's development and survival in the short and long term (WHO, 2020). Despite decades of CMAM implementation, high wasting prevalence in Malawi indicates CMAM challenges and failure to meet global CMAM objectives and global nutrition targets indicated in the Sustainable Development Goal 2; Zero Hunger (GNR, 2020). This study aims to analyse CMAM in Malawi and recommend strategies to improve its impact, effectiveness and sustainability. Evaluations of CMAM in countries such as Ethiopia, Nigeria, and Pakistan have led to improvements in programme delivery, such as local RUTF production and mobile OTPs for pastoralist communities (Aguayo *et al.*, 2018; Nyirenda and Belachew, 2010; Girma, 2008). Evaluating CMAM in Malawi is critical to strengthening its implementation.

1.3 The aim of the study

To evaluate the implementation of CMAM programme to treat acute malnutrition and make recommendations for its strengthening.

1.4 Objectives

- To assess how crosscutting areas governance, human resource, financing, information, and community mobilization influence the implementation of CMAM using an adapted conceptual framework based on Integrated Community Case Management (ICCM) framework.
- To assess the effectiveness, impact and sustainability in the implementation of the CMAM program in Malawi in reducing under-five mortality.
- To provide evidence-based recommendations to improve the implementation of the CMAM program in Malawi.

2.0 Literature Review

The WHO and UNICEF recommended CMAM in 2001 as a standard of care to reduce the high caseloads of children in hospitals (UNICEF, 2020). The United Nations in 2007 endorsed CMAM as a strategy to attain Millennium Development Goal 4 on reducing child mortality (Wilford *et al.*, 2012; Aguayo *et al.*, 2018;). CMAM proved as an effective approach in many countries while the cost-effectiveness of the programme was demonstrated in Zambia, Malawi, and Bangladesh, where the cost per Disability Adjusted Life Years (DALY) averted for the CMAM program was US\$ 42 US\$41 and US\$ 26 respectively (Wilford *et al.*, 2012; Maleta and Amadi, 2014; Njuguna *et al.*, 2020). Thus, CMAM is a feasible option in low-income countries where resources are constricted, and the burden of malnutrition is high. As of 2018 CMAM was implemented in 70 countries while countries like Kenya integrated CMAM into the Integrated Community Case Management (ICCM) (aah-uk, 2019). Malawi started implementing CMAM in 2002 as a pilot project in Dowa district by Valid International and Concern Worldwide (Wilford, 2011). It was later adopted in 2007 as a national programme, thus Malawi is one of the first countries to implement CMAM (Gray *et al.*, 2014; Wilford, 2011). The Department of Nutrition HIV and AIDS (DNHA), a standalone entity under the Ministry of Health (MoH) coordinates CMAM. This is different from many countries such as Ghana, Zambia and Bangladesh where coordination is via their governmental Ministries of Health (MoH). All countries implement through health workers (Kathumba, 2012; Maleta and Amadi, 2014). CMAM in Malawi is guided by several policies and strategies which strengthened multisectoral implementation, though commitment for resources 'falls through the cracks' as no department allocate enough budget to CMAM to ensure the programmes sustainability (Wilford *et al.*, 2012; Shoham *et al.*, 2013; Kathumba, 2012).

3.0 Methodology

This was a retrospective study which involved desk review/secondary data collection on CMAM governance, financing, community engagement and information. Peer-reviewed studies were assessed using a computerised

search of credible databases using keywords related to CMAM and malnutrition in Malawi, as well as the effectiveness, policy, governance and financing of CMAM. The search used wildcard and logical operators and focused on materials from 2002 to 2023, as CMAM in Malawi began in 2002. Databases such as Medline, PubMed and Global Health were used, as well as grey literature from the Malawi Ministry of Health, DNHA, NGOs and UN agencies. A secondary search analysed the effectiveness and efficiency of CMAM in low- and middle-income countries to identify best practices for improving CMAM implementation in Malawi. The evaluation employed criteria of impact, effectiveness, and sustainability. Programme impact was defined as the positive and negative primary and secondary long-term effects of an intervention produced intended or unintended. Effectiveness was the extent to which programme objectives were achieved while sustainability is a continuation of benefit from an intervention after major assistance has been completed (WHO Evaluation handbook, 2013). It looked at CMAM areas of governance. The study adapted the Integrated Community Case Management framework for analysis.

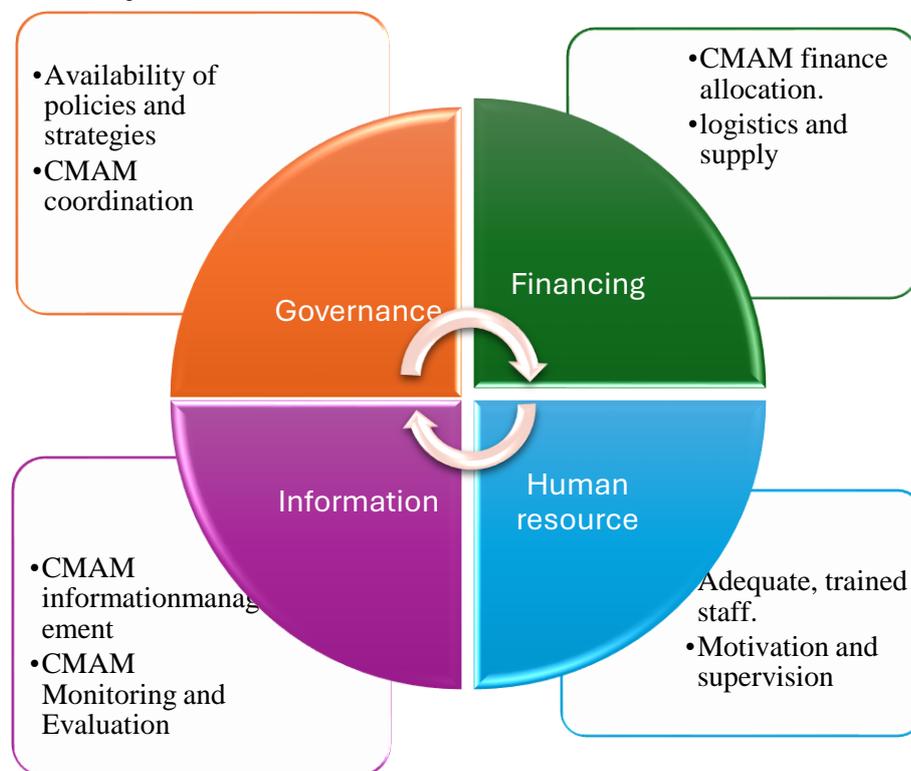


Figure 1: Conceptual Framework

4.0 Results and Discussions

4.1 Governance

In terms of governance, CMAM in Malawi is guided by policies and strategies such as the Health Sector Strategic Plan III (HSP 2023-2030), National Multisectoral Nutrition Policy and Strategic Plan (MNSP2018-2022), National CMAM Operational Plan (2017-2021), and the National CMAM guidelines (2016). The policies support the design, planning, and implementation of the

programme (Kathumba, 2012). However, these policies expired which indicates that current implementation is without proper targets and aspirations. Solid and coordinated structure is observed at the national level while at the subnational level, weak coordination systems exist. For example, there is no coordination committee for CMAM nor a dedicated person to provide oversight control of CMAM (Maleta and Amadi, 2014). This is because CMAM activities are implemented by MoH frontline workers at the subnational level while at the national level, it is DNHA, a separate unit that provide leadership (Maleta and Amadi, 2014). This creates weak authority at the subnational level as DNHA cannot exert power on MoH frontline workers with a different reporting line (DNHA, 2020). Furthermore, CMAM is poorly integrated into other health and nutrition-related interventions like HIV, Livelihoods, and ICCM (MoH, 2021). This creates competition for resources as Malawi has several health priorities and limited budgets (UNICEF-Malawi, 2023). It also signifies that CMAM relies on external support and as such threatens the sustainability of CMAM activities. CMAM governance and coordination challenges can be addressed by strengthened coordination at subnational level and integrating CMAM into other health interventions. Countries like Sudan decentralized CMAM for easy implementation by having CMAM coordinators at sub national level to supervise implementation and monitoring at the subnational level. The decentralized approach makes it easy for Sudan to plan and budget for CMAM and also promote ownership. In Malawi, subnational coordination is technically feasible since there is a TNP-TWG which provides oversight power to implementation of CMAM at the national level (DNHA, 2021). The TNP-TWG can facilitate the development of CMAM action plans and stakeholder mapping at the subnational level. However, since CMAM guidelines are outdated, DNHA should first spearhead updating the CMAM guidelines. Additionally, Malawi recently employed the Principal Nutrition HIV/AIDS Officer (PNHAO) at sub national level, they can help in coordination of CMAM activities (DNHA, 2021). Training and capacity building in CMAM is required in this case, though this has financial implications. CMAM integration into other health interventions such as HIV/AIDS is administratively feasible since HIV and nutrition are under the same department. However, HIV activities require a specially trained health workforce. As such, DNHA needs to strengthen coordination with HIV stakeholders and facilitate the development of integrated guidelines, policies, and strategies. In Zambia A retrospective analysis by Amadi et., (2016) showed that integrating HIV into CMAM reduced SAM mortality rate even in high-prevalence HIV-infected populations (Amadi *et al.*, 2016).

4.2 Human resource

In terms of Human resource Malawi utilises trained clinicians, nurses and nutritionists to treat malnutrition in health facilities while at the community level frontline health workers such as Health Surveillance Assistance (HSAs) and Community Volunteers conduct community outreach for early identification of cases, referral and follow ups (MoH, 2021). Aside from this strength, opportunities to up-skill training for health staff also exist through CMAM 'Master Trainers'- an academic training team that conducts Training of Trainers (ToT) to health facility staff which trains new staff or conducts

refresher training (Kauchali *et al.*, 2022). This improves quality services and promotes transfer of knowledge which are a key attribute of programme effectiveness and sustainability. Nevertheless, CMAM training is not routine and depends upon the availability of resources, usually by partners (Kathumba, 2012). In consequence majority of frontline health workers conduct duties without proper training which results in wrong identifications of cases and false referrals (Deconinck *et al.*, 2007). These challenges can be addressed by Task shifting which is a strategy for shifting some of the responsibilities of professional staff such as nurses to community health workers while training them adequately to screen and refer complicated cases (Gray, 2014). This would provide the professional staff with additional time so that they can perform other duties such as treatment, triage, and diagnosis (Gray, 2014). In addition, non-financial incentives can be adopted, and these include creative ways of motivation such as; staff budes, recommendation letters, T-shirt trainings, exchange visits, supportive supervision and certificates (Gray, 2014).

4.3 CMAM financing, logistics and supplies

CMAM financing largely depends on external support in Malawi. This is indicated in Figure 2 and figure 2 below. For example, in Figure 2.1, in the 2019/20 budget, overall, donors contributed 95% of resources to all nutrition interventions while government covered the remaining 5% (UNICEF- Malawi, 2021). Furthermore, in Figure 2.2 more than 50% of funding gaps existed since 2018 for procurement of RUTF in Malawi. In 2020 for example, only US\$ 3 million was available against the US\$ 19 million required for procurement of RUTF (UNICEF-Malawi, 2021). This makes CMAM rely on external support which is a significant drawback for scalability and sustainability. Government should provide a favorable environment for local RUTF producers by removing tax on essential CMAM ingredients and empowering Malawi Bureau of Standard to conduct testing of RUTF quality. Furthermore, Malawi should exploit opportunities of developing RUTF using local materials.



Figure 2: Domestic Vs External financing to nutrition

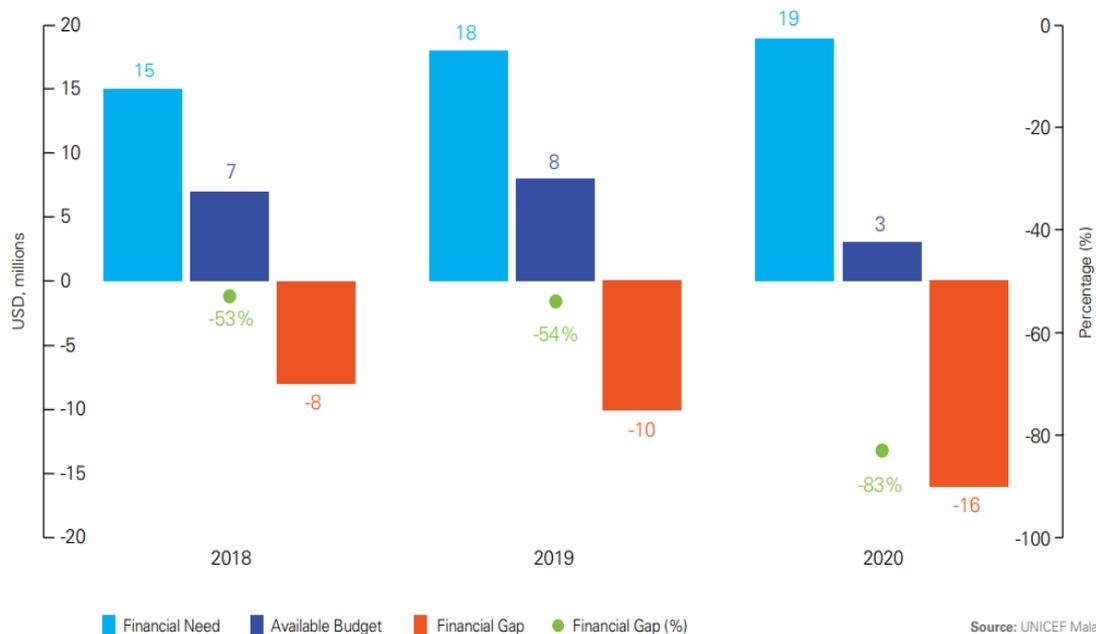


Figure 2: Financing gap analysis of RUTF supplies funding

Fig 2.1 and figure 2.2 indicates huge financing gap for nutrition and CMAM in Malawi

4.4 CMAM information

CMAM is integrated into the Health Information Management System (HIMS) which puts less pressure on health staff and frontline workers to collect CMAM data alongside other health interventions (Maleta and Amadi, 2014). Nevertheless, it is difficult to add new CMAM indicators to the HIMS (Kathumba, 2012). This becomes more pronounced when indicators change at the global level. Daniel *et al.*, (2022) highlighted difficulties in assessing programme effectiveness by gender since CMAM data at the subnational level is not disaggregated by gender (Daniel *et al.*, 2022). This also means that gender-based tailored approaches for the improvement of the programme cannot be designed. Daniel *et al.* (2022) also highlighted that district data is not properly disaggregated to examine, cure rate, default, recovery, and death rate which are key elements of programme effectiveness at the district level (Daniel *et al.*, 2022). Using technology to collect, monitor, and analyse CMAM data can be the best approach and this can be learned from several countries. For example, SMS and mHealth Apps are widely adopted in Nigeria, Ethiopia, and Rwanda to complement paper-based systems (Gray, 2014). In Northern Nigeria, CMAM data is weekly texted via SMS from facilities to UNICEF at the federal level. This is easier, and quicker and bypasses intermediaries used in the paper-based systems (Tuffrey., 2021). In Malawi, the use of SMS was previously conducted in nutrition surveillance, the systems proved effective

over traditional paper-based systems, however, it required training community health workers and engaging network companies for increased coverage (Hall *et al.*, 2014). As such a similar approach can be adopted for CMAM

4.5 Community mobilization

In terms of community mobilization, Malawi utilises community outreach to reach out to communities with CMAM intervention (MoH, 2021). The approach entails mobilizing health workers to provide services to the population away from their workplace (Gray, 2014). Outreach is conducted monthly in identified sites and it has several advantages: It increases CMAM geographical coverage by reducing distance to services, enhances community nutrition awareness, and strengthens local leaders' participation subsequently fostering CMAM community acceptability (Kathumba, 2012). Nevertheless, several weaknesses exist. It blindly overlooks physical, logistical, social, and cultural barriers to accessing services (Puett and Guerrero, 2015). For example, an old building, a school, or a tree can be used as a site for community outreach as such services easily get detracted during the rainy season (Munthali *et al.*, 2019). There are also physical barriers such as poor access to services in hard-to-reach areas because of broken roads and flooding of rivers during the wet season (Munthali *et al.*, 2019). As a result, some districts such as Kasungu, Mzimba South, and Karonga had poor SAM coverage below 75% while the national coverage was 90% (MoH, 2021). The disproportionate access to CMAM services raises equity concerns

5.0 Conclusion and Recommendations

Future directions and recommendations for the CMAM program in Malawi can be enriched through the adoption of innovative approaches and technologies. Implementing digital health tools, such as mobile health (mHealth) applications, can significantly enhance community mobilization and real-time data collection. These tools will support Community Health Workers and Volunteers (CHW&V) in identifying and referring malnourished children more efficiently, thereby improving data accuracy and program monitoring. Additionally, the utilisation of Geographic Information Systems (GIS) for mapping malnutrition hotspots can optimize resource allocation and intervention strategies. GIS technology will aid in identifying high-risk areas, tracking program performance, and enhancing decision-making processes.

Encouraging local production of Ready-to-Use Therapeutic Food (RUTF) can further reduce costs and enhance sustainability. This approach, successfully implemented in countries like Ethiopia and Nigeria, involves engaging local communities and private sector partners in the production process, which can boost local economies and ensure a steady supply of RUTF. Establishing quality control measures and certification processes is essential to ensure the safety and nutritional quality of locally produced RUTF, maintaining the high standards required for effective treatment of severe acute malnutrition.

Strengthening policy frameworks is another crucial step. Reviewing and updating the National CMAM Guidelines and related policies to reflect current scientific evidence and best practices will ensure these guidelines are comprehensive, context-specific, and aligned with global standards. Advocating for the integration of CMAM into national health and nutrition policies is essential to make it a priority within the broader health sector. This includes securing political commitment, allocating adequate resources, and fostering inter-sectoral collaboration.

Adopting multi-sectoral approaches will also be beneficial. Integrating CMAM with agriculture, water, sanitation, and hygiene (WASH), and social protection programs can address the underlying causes of malnutrition more effectively. Encouraging partnerships with international organisations, NGOs, and the private sector can leverage resources and expertise, while enhancing community-based platforms for nutrition education, social support, and health services can facilitate coordinated efforts across sectors and increase community engagement in nutrition interventions.

Conducting operational research to identify barriers and facilitators of CMAM implementation is vital. Understanding these factors can help refine strategies, improve program delivery, and enhance outcomes. Focus areas may include cost-effectiveness studies, impact assessments, and feasibility evaluations of innovative practices. Investigating innovative treatment protocols and feeding practices can further enhance the effectiveness of CMAM. This includes exploring new formulations of RUTF, testing new therapeutic approaches, and evaluating the impact of novel interventions on recovery rates.

Developing robust monitoring and evaluation frameworks is essential to assess the impact of CMAM interventions. This includes regular assessments, impact evaluations, and real-time monitoring systems. Ensuring that monitoring and evaluation systems are data-driven, participatory, and responsive to emerging needs will enhance their effectiveness. Utilizing evaluation findings to inform policy decisions and program adjustments is also crucial. Sharing lessons learned and best practices with stakeholders will foster continuous improvement and innovation in CMAM implementation.

Finally, capacity building and training are fundamental to the success of CMAM. Developing and implementing ongoing training programs for health workers, CHW&V, and other stakeholders involved in CMAM should focus on the latest evidence-based practices, innovative approaches, and emerging technologies in nutrition. Continuous professional development will ensure that the workforce remains knowledgeable, skilled, and capable of delivering high-quality care and services.

In summary, by adopting innovative approaches and technologies, strengthening policy frameworks, fostering multi-sectoral collaboration, conducting operational research, developing robust monitoring and evaluation frameworks, and investing in capacity building and training, the CMAM program in Malawi can continue to evolve and improve. These

strategies will help address the challenges and limitations currently faced, ensuring that the program remains effective, sustainable, and capable of meeting the needs of malnourished children across the country.

References

aah-uk (2019), "Linking CMAM and iCCM in Kenya", *Knowledge Against Hunger*, Vol. 3. Available at: <https://knowledgeagainsthunger.org/research/treatment/linking-cmam-and-iccm/> (Accessed: 29 May 2023).

Aguayo, V.M. *et al.* (2018), "Community management of acute malnutrition (CMAM) programme in Pakistan effectively treats children with uncomplicated severe wasting", *Maternal & Child Nutrition*, Vol. 14 No. S4, p. e12623. Available at: <https://doi.org/10.1111/mcn.12623>.

Akuu, J.A. and Amagnya, M.A. (2023), "Community-based management of acute malnutrition: Implementation quality, and staff and user satisfaction with services", *Journal of Taibah University Medical Sciences*, Vol. 18 No. 5, pp. 988 – 996. Available at: <https://doi.org/10.1016/j.jtumed.2023.02.002>.

Amadi, B. *et al.* (2016), "Integration of HIV Care into Community Management of Acute Childhood Malnutrition Permits Good Outcomes: Retrospective Analysis of Three Years of a Programme in Lusaka", *PLOS ONE*, Vol. 11 No. 3, p. e0149218. Available at: <https://doi.org/10.1371/journal.pone.0149218>.

Daniel, A.I. *et al.* (2022), "Severe acute malnutrition admissions, clinical characteristics, and treatment outcomes in Malawi from 2011 to 2019", *medRxiv*, p. 2022.06.17.22276562. Available at: <https://doi.org/10.1101/2022.06.17.22276562>.

Deconinck, H. *et al.* (1825), "Review of Community-based Management of Acute Malnutrition (CMAM) in the Post-emergency Context: Synthesis of Lessons on Integration of CMAM into National Health Systems (Ethiopia, Malawi, and Niger)", April - June 2007'.

Girma, M.E. and T. (2008), "Effectiveness of Integrated Outpatient Care of Severe Acute Malnutrition in Ethiopia", *Field Exchange*, Vol. 34, p. 7.

Gray, N. *et al.* (2014), "Community Engagement: the 'C' at the heart of CMAM", in *CMAM Forum Technical Brief*, Citeseer.

Hall, C.S. *et al.* (2014), "Assessing the impact of mHealth interventions in low- and middle-income countries – what has been shown to work?", *Global Health Action*, Vol. 7 No. 1, p. 25606. Available at: <https://doi.org/10.3402/gha.v7.25606>.

Ireen, S. *et al.* (2018), "Challenges and opportunities of integration of community based Management of Acute Malnutrition into the government health system in Bangladesh: a qualitative study", *BMC Health Services*

Research, Vol. 18 No. 1, p. 256. Available at: <https://doi.org/10.1186/s12913-018-3087-9>.

Kathumba, M.S. (2012), "Creating an enabling policy environment for effective CMAM implementation in Malawi", *Field Exchange 43: Government experiences of CMAM scale up*, p. 73.

Kauchali, S. *et al.* (2022), "Scaling Up Improved Inpatient Treatment of Severe Malnutrition: Key Factors and Experiences From South Africa, Bolivia, Malawi, and Ghana", *Global Health: Science and Practice*, Vol. 10 No. 2. Available at: <https://doi.org/10.9745/GHSP-D-21-00411>.

Levels and trends in child malnutrition: UNICEF/WHO/The World Bank Group joint child malnutrition estimates: key findings of the 2021 edition (no date). Available at: <https://www.who.int/publications/i/item/9789240025257> (Accessed: 31 July 2024).

Maleta, K. and Amadi, B. (2014), "Community-Based Management of Acute Malnutrition (CMAM) in Sub-Saharan Africa: Case Studies from Ghana, Malawi, and Zambia", *Food and Nutrition Bulletin*, Vol. 35, pp. S34 – S38. Available at: <https://doi.org/10.1177/15648265140352S105>.

Munthali, A.C. *et al.* (2019), "This one will delay us: barriers to accessing health care services among persons with disabilities in Malawi", *Disability and Rehabilitation*, Vol. 41 No. 6, pp. 683–690. Available at: <https://doi.org/10.1080/09638288.2017.1404148>.

Njuguna, R.G., Berkley, J.A. and Jemutai, J. (2020), "Cost and cost-effectiveness analysis of treatment for child undernutrition in low- and middle-income countries: A systematic review", *Wellcome Open Research*, Vol. 5, p. 62. Available at: <https://doi.org/10.12688/wellcomeopenres.15781.2>.

Nyirenda, G. and Belachew, T. (2010a), "Concern Worldwide Final Evaluation of National CMAM Programme Ethiopia", *Ethiopia: Valid International & Jimma University* [Preprint].

Nyirenda, G. and Belachew, T. (2010b), "Concern Worldwide Final Evaluation of National CMAM Programme Ethiopia", *Ethiopia: Valid International & Jimma University* [Preprint].

Puett, C. and Guerrero, S. (2015), "Barriers to access for severe acute malnutrition treatment services in Pakistan and Ethiopia: a comparative qualitative analysis", *Public Health Nutrition*, Vol. 18 No. 10, pp. 1873 – 1882. Available at: <https://doi.org/10.1017/S1368980014002444>.

Shoham, J., Dolan, C. and Gostelow, L. (2013), "The management of acute malnutrition at scale: A review of donor and financing arrangements (2013)". Available at: <https://www.enonline.net/www.enonline.net/enncmamfinancingreport2013> (Accessed: 17 June 2023).

‘Snapshot’ (n.d.). Available at: <https://www.unicef.org/lac/en/press-releases/urgent-action-needed-acute-malnutrition-threatens-lives-millions-vulnerable-children> (Accessed: 15 August 2023).

Tuffrey, V. *et al.* (2021), "Assessment of monitoring systems in the management of severe acute malnutrition in northern Nigeria", *BMC Nutrition*, Vol. 7 No. 1, p. 2. Available at: <https://doi.org/10.1186/s40795-020-00405-z>.

‘UNICEF-Malawi-2021-2022-Nutrition-Budget-Brief.pdf’ (n.d.). Available at: <https://www.unicef.org/esa/media/10511/file/UNICEF-Malawi-2021-2022-Nutrition-Budget-Brief.pdf> (Accessed: 2 June 2023).

‘UNICEF-Malawi-2021-2022-Nutrition-Budget-Brief.pdf’ (n.d.). Available at: <https://www.unicef.org/esa/media/10511/file/UNICEF-Malawi-2021-2022-Nutrition-Budget-Brief.pdf> (Accessed: 15 August 2023).

Urgent action needed as acute malnutrition threatens the lives of millions of vulnerable children (n.d.). Available at: <https://www.unicef.org/lac/en/press-releases/urgent-action-needed-acute-malnutrition-threatens-lives-millions-vulnerable-children> (Accessed: 15 August 2023).

WHO 2013 (n.d.) *WHO Evaluation handbook*, Geneva: WHO.

WHO, WFP, SCN and UNICEF Joint Statement on Community-Based Management of Severe Acute Malnutrition | UNICEF (n.d.). Available at: <https://www.unicef.org/documents/who-wfp-sc-and-unicef-joint-statement-community-based-management-severe-acute> (Accessed: 11 May 2023).

Wilford, R., Golden, K. and Walker, D.G. (2012), "Cost-effectiveness of community-based management of acute malnutrition in Malawi", *Health Policy and Planning*, Vol. 27 No. 2, pp. 127–137. Available at: <https://doi.org/10.1093/heapol/czr017>.

Gray, N. *et al.* (2014), “Community Engagement: the ‘C’ at the heart of CMAM”, in *CMAM Forum Technical Brief*, Citeseer.

‘Technical Working Groups – General’ (2020) *DNHA*, 30 December. Available at: <https://dnhamalawi.org/technical-working-groups-general/> (Accessed: 15 August 2023).

‘UNICEF-Malawi-2021-2022-Nutrition-Budget-Brief.pdf’ (n.d.). Available at: <https://www.unicef.org/esa/media/10511/file/UNICEF-Malawi-2021-2022-Nutrition-Budget-Brief.pdf> (Accessed: 15 August 2023).

WFP and Union, A. (2015), “The Cost of Hunger in Malawi”. Available at: <https://policycommons.net/artifacts/3145000/the-cost-of-hunger-in-malawi/3939064/> (Accessed: 7 May 2023).

OPEN, DISTANCE AND ELEARNING

The sub-thematic area of *Open, Distance and eLearning* captured the followings areas:

- eLearning
- Student support
- Self-learning materials
- Copyright
- Open Educational Resources

Student support in distance education and the study circle innovation in Malawi: A case study

Annie Tamara Chizengo-Thawani, PhD

Malawi University of Business and Applied Sciences

Email: achizengo@mubas.ac.mw

Lester Brian Shawa, PhD

University of KwaZulu Natal

Email: shawa@ukzn.ac.za

Abstract

Despite its essential role, student support in distance education often remains overlooked. This paper stems from a larger project that explored the learning implications of distance secondary school teacher training in Malawi, drawing on conversational learning theory and phenomenology. The study focused on Mzuzu University and Domasi College of Education, the then primary public providers. Data collection involved semi-structured, in-depth interviews with administrators, instructors, and distance students, alongside document analysis. The study revealed both positive and negative students' and instructors' experiences while also revealing an innovative and effective student support strategy: the study circle. The innovative approach appeared to have complemented mediated study materials and significantly enhanced satisfaction and retention at one institution, while the other experienced high dropout rate. Notable student experiences included (1) under-learning, (2) delayed feedback on assessments and examinations, and (3) unprofessionalism and pedagogical skills gaps in some cases, with educators feeling overwhelmed. These findings highlight the necessity for clearer student support services and underscore the diversity among higher education institutions in Malawi's distance education landscape. Recommendations are offered for novice and struggling distance education institutions to leverage lessons learned for improved learning support provision through innovative support services including the study circle strategy.

Keywords: Distance education, student support, study circle, Malawi.

1.1 Introduction

Distance education is a global strategy for promoting knowledge, skills, and self-reliance through accessible and equitable lifelong learning opportunities, fostering a skilled workforce and entrepreneurship. However, it requires comprehensive student support services, which are often neglected, leading to negative experiences for both students and instructors (Musingafi, et al.,

2015; Rosdian, 2019), rather than satisfaction (Gupte, 2015). Negative key issues include underlearning and delayed feedback, with instructors often feeling overwhelmed, unskilled, or unprofessional. These challenges contribute to high dropout rates instead of retention and completion (Chawinga & Zozie, 2016). This paper examines student support at Mzuzu University and Domasi College of Education in Malawi tapping from a larger study on distance teacher training. It highlights the study circle strategy at one institution as complementary to mediated student support leading to student satisfaction and retention, compared to the other with high dropout rates. The paper discusses study circle concept, problem statement, objective and research question, literature review and theoretical framework, methodology, findings, recommendations, and conclusion.

1.2 Conceptualising study circle

Conceptualisation of the term study circle is important in understanding the learning experiences of distance education and the role of study circles in education. What is a study circle? Or what constitutes a study circle? A study circle is a small group of students or equals who formally or informally meet for academic purposes to learn by sharing knowledge and experiences based on similar objectives or targets (Campaign for Female Education, 2015). This implication diverges the Malaysian model where “undergraduate students from various bachelor degree programmes” (Shirin, et al. 2014, p. 1) are involved in the study circle programme. As mentioned earlier, formal study circles follow timetables for peer engagement in specific or mixed programmes. It is argued in literature that study circles supplement mediated instructions hence foster independent learning while also allowing students to discuss issues pertaining to learning, support, clarity of subject matter, effectiveness of teaching methods, community/school projects and professional topics as identified. Shirin, et al. (2014) argues that study circles can be used in “instilling the best moral and ethical value-laden ... philosophy into the graduates” (p. 20). The authors point out to the infiltration and imparting of islamisation of knowledge as well as religious values in the Islamic university as done through study circles in Malaysia. It can further be argued that a study circle is a source of real interaction for distance students as they interact not only with peers, but also field supervisors. The conversed purposes of study circles imply that they promote students’ thinking, active learning, creation of knowledge, problem solving, writing of assignments and homework, clarity of concepts and promotion of cultural and religious values in some instances (Chizengo-Thawani, 2019).

Supervisors play a crucial role in monitoring student performance and providing guidance when students encounter difficulties. Interactive engagements facilitate peer monitoring of academic progress through the scrutiny of professional portfolios, which include documented sample performances, and other materials showing student progress. Individual students compile these portfolios to document achievements and competencies according to set guidelines. During face-to-face (f2f) sessions, peers review these portfolios before submission to lecturers or instructors for evaluation and grading. This practice ensures that students bring their

portfolios to all f2f meetings for review by peers, instructors, and supervisors as applicable. Each student maintains a professional portfolio for all modules or subjects, which contributes formative and summative assessments. The portfolio serves as substantial evidence of student attainment and is part of the final assessment results. Additionally, a reflective journal functions as a monitoring tool for students, study circles, and institutional performance. It records specific times and dates of occurrences, reflecting on student experiences which can reveal strengths or weaknesses in the learning and support system thereby, highlighting positive or negative aspects of the programme (Chizengo-Thawani, 2019).

1.3 Problem statement

Distance education mostly lacks comprehensive student support, resulting in students' negative experiences hence high dropout rates. This paper explores student support experiences linked to how the study circle strategy complements mediated study materials to improve satisfaction and retention in Malawi's distance teacher training programmes.

1.4 Objectives and research questions

The paper's objective is to explore learning experiences of the distance students trained at Domasi College of Education and Mzuzu University.

1.5 Research questions

The main study focused on three main questions; however, this paper focuses on only one: How does the institutional organisation of the distance secondary school teacher training affect students' learning experiences? The next section presents literature and the theoretical framework.

2.0 Literature review

Contemporary research identifies student support as essential for distance education, crucial for achieving learning outcomes outside conventional classrooms. Terms like student support, learning support, and academic support are used interchangeably to describe the various forms of assistance in remote learning environments (Ramdass & Masithulela, 2016). Effective support includes academic guidance, tutoring, technical help, and mental health resources. Distance education functions within an interconnected system where support is vital from admission to graduation. This includes material and learning sub-systems, with experts designing content and facilitating learning. Effective support integrates with instructional materials, enhancing navigation and retention through interactive content and assignments, accompanied by occasional f2f interactions and systematic feedback. Continuous student support is critical for success in distance education, impacting quality, retention, and completion rates. Dialogue between students and instructors bridges psychological gaps. However, financial constraints and reliance on traditional funding often hinders the creation of interactive materials, and lack of prompt human responses can

worsen support inadequacies (Moore & Kearsley, 2012; Musingafi, et al., 2015; Chizengo-Thawani, 2019).

Literature however, discloses a mixture of negative and positive students and instructors' experiences. For example, a study on holistic approach to distance education in Virginia Polytechnic revealed dissimilarities in student support due to staff expertise gap hence negative experiences (Rosdian, 2019). Similarly, Musingafi, et al., (2015), study on Zimbabwe University students presented negative experiences aligned to ineffective, lost examination scripts delayed and lack of study materials, feedback on assignments and examinations, counselling and guidance. However, Gupte's (2015) study on Maharashtra, Indian teachers' lived experiences of distance training revealed their satisfaction with interactive instructional materials complemented by rigorous practical sessions and application-oriented assignments. In the Indian study instructors demonstrated "positive experiences of offering counselling and tutorials to student teachers though it meant, sacrificing their vacation" (Chizengo-Thawani, 2019, p. 50). These findings entail the gap in student support provision derailing students' progress and positive experiences linked to educators' devotion. Conversational learning and phenomenology framework is discussed next.

2.1 Conversational learning and phenomenology as theoretical lenses

The paper employed lenses of conversational learning and phenomenology theories as theoretical framework to examine "real" and "mediated" conversations, and "lived" and "shared" experiences.

2.1.1 Conversational learning theory

Conversational learning theory, developed by Börje Holmberg in 2003, highlights the role of interaction in distance education. Holmberg distinguishes "real" conversations in f2f interactions offering immediate feedback and discussions from "mediated" conversations facilitated by technology. By successfully integrating both, educators provide an engaging learning environment yielding positive learning experiences (Holmberg, 2003; Chizengo-Thawani, 2019).

2.1.2 Phenomenology

Phenomenology, as articulated by van Manen, (2006) focuses on understanding human experiences from individuals' perspectives therefore, aids educators recognise and address the "lived" and "shared" students' experiences. Although lived experiences are subjective to first-person experiences like thoughts, feelings, and perceptions their understanding is crucial to the development of tailor-support services that addresses unique students' needs. Shared experiences though arise from interacting with the educational settings, foster a sense of community and collaboration thereby creating inclusive and supportive environments while enhancing learning and growth. These lenses revealed the importance of real and mediated conversations in instructional materials, diverse technologies, professional

portfolios, and reflective journals in study circles, leading to identification of the innovative study circle strategy as complementing student support provision (Tharakan, 2019).

3.0 Methodology

The study employed an interpretive qualitative case study approach, drawing upon conversation theory and phenomenology to explore the enactment of distance teacher training and student support strategies.

3.1 Data collection methods

Data collection involved semi-structured interviews with 2 administrators, 2 instructors, and 10 distance students, supplemented by document analysis. Multiple methods enriched and verified findings, enabling triangulation (Yilmaz, 2013). Validation tools ensured accuracy and trustworthiness (Miles & Huberman, 1994; Moustakas, 1994). Document analysis included 9 instructional materials, 2 strategic plans, a teacher handbook, and study circle guidelines.

3.2 Interviews

The study employed semi-structured in-depth interviews with administrators, instructors, and distance students, alongside rigorous document analysis thereby offering a deep understanding of the student support offered. The researchers dug out existing challenges and innovative approaches to learning support provision within the Malawian context.

3.3 Document Analysis

Document analysis involved interpreting documents to reveal their significance and gain empirical insights into the study. By examining instructional and organisational documents, the researcher triangulated data, understood participants' experiences and practices and policies impacting learning and support in study's context.

3.4 Ethical Considerations

Qualitative research involves immersing oneself in participants' experiences (Anney, 2014) requiring devotion to ethical standards for participants' safety and privacy (Yilmaz, 2013). Researchers thus, sought ethical clearance from the University of KwaZulu-Natal's Humanities and Social Sciences Ethics Committee and institutions understudy while ensuring informed participants' consent and assigning codes for confidentiality (Chizengo-Thawani, 2019).

4.5 Data Analysis

Data analysis followed Miles and Huberman (1994) and Moustakas (1994) hence interviews underwent transcription, editing, and coding to identify emerging themes while coding data extracted from documents to capture significant emerging patterns.

5.0 Findings and Discussions

The findings revealed disparities in distance education provision between institutions thereby upholding students' retention on one side and high dropout on the other. Students' experiences indicate (1) underlearning, (2) delayed feedback on assignments and examinations, (3) instructors' unprofessionalism and pedagogical skills gaps while also presenting overwhelmed instructors.

5.1 Underlearning

Students mentioned underlearning occurring due to some instructors delivering instructions at awkward times or inadequately thereby negatively impacting their learning. For example, they highlighted that some instructors could not engage them during orientation or contact sessions but organised make-up classes late in the night as the term came to an end. The students further, linked their poor performance to inadequate instructors' facilitation time during orientation as stated,

"...sometimes we are oriented for only few days. The reasons include: late submission of timetables to heads of departments to identify responsible lecturers to facilitate courses...". Although students appreciated synchronisation of distance with tradition education in terms of content, they concurred with the previous speaker on the concerns as one said:

...It is rewarding to know that open and distance students are exposed to the same material as the regular face-to-face students. However, due to face-to-face time constraints, some courses are not done at the time they are supposed to. They are pushed forward to another semester. As such, the open and distance programme is elongated. It takes five to six years to obtain a degree unlike the four years in the regular face-to-face programme.

One student reported that some instructors could not properly facilitate their work, leading to difficulties with exam questions. This issue, along with others, highlights gaps in planning and coordination, resulting in "underlearning" and stunted academic progress. Instructors giving untimely instructions, often at inconvenient hours, shows a lack of preparedness and seriousness. This mishandling of distance students, marked by poor content delivery, aligns with Chawinga and Zozie's (2016) notion of a "bad perception of Open and Distance Learning (ODL)" due to inadequate support and teaching practices. Overloading students with makeup classes without ensuring understanding contributes to fears of producing "half-baked students (Chawinga & Zozie, 2016, p. 13)." Traditional philosophies and unprofessionalism prevent instructors from adapting to distance education, indicating a need for training and a shift in mindset. Theoretical frameworks suggest that "underlearning" reflects inadequate mediated and real conversations, as seen in an instructor's comment on the lack of support systems, similar to findings by Musingafi, et al., (2015).

5.2 Delayed feedback on assessment

Delayed feedback on assessment including assignment and examination results and resubmission of misplaced assignments was presented. Students lamented as one complained:

...Submitting assignments can be a challenge...expensive, to send typed work via express mail... Assignments sent to the wrong lecturer by mistake within the distance learning centre need re-submission, which is expensive to print, frustrating and time consuming. The assignment saga is faced when the students have gone to write end of semester examination...

Another student teacher concurred with the aforesaid, affirming:

...Failure to provide feedback by some lecturers also affected my learning. When one is given feedback, she is able to know where to put in extra effort in order to improve. Other lecturers seem not to have even marked the scripts, despite the whole effort we put into writing the assignment. This is discouraging and negatively affected learning...

Students voiced complaints about the lack of professionalism from some instructors similar to Rosdian (2019) study stating, "...instructors need to be well-trained to effectively teach distance learners and provide timely feedback to motivate students in this demanding programme." Issues with assignment handling were linked to grading and inadequate support. One student highlighted a concern about not receiving previous semester's exam results, saying, "A semester starts without knowing last semester's results...its disappointing." Delayed feedback and other assessment issues hinder learning as students face frustration from resubmitting lost assignments, often discovered during examinations time. Some students reported that despite submitting assignments, instructors sometimes did not mark them. Additionally, new semesters began without examination results feedback. The failure to provide timely feedback suggests a lack of supportive learning, depriving students of gauging their progress similar to Musingafi, et al., (2015) study. Timely feedback is crucial in conversational learning, with written feedback acting as mediated conversation. This interaction creates supportive educational environments, enabling students to engage with instructors and gain insights for academic growth.

5.3 Overwhelmed instructors

The lack of downtime for instructors seemed to negatively impact students' learning and experiences in dual-mode institutions as observed by one administrator:

... Because they are overwhelmed, ...handling double load with the face-to-face, feedback in most cases delay. They will give feedback sometimes when the students are already back on campus preparing for end of semester exams, too late... we cannot recruit as a centre so the university, as faculty of education where the programme is housed is

going to recruit more academic staff to beef up to the existing members of staff who are struggling and overwhelmed with work load...

One instructor agreed with these sentiments and expressed their frustration by saying:

It becomes a problem; I am expected to handle courses for face-to face and open and distance education...few instructors... It is very difficult because practically, you do not have a holiday. Throughout the year we are teaching! Because when we are supposed to observe a holiday, that's when open and distance students come in... no time to rest, if you are not teaching then, you are marking... Look at this! (Pointing at a large pile of assignments) to be marked by one person... humanities for example; we have huge numbers. We are encouraging Mathematics but students are running away from Mathematics because of the problems they face...So, it's not easy! We are going to break down soon or later...ODL should have its own members of staff if not all of them, but a few and we should just be supporting rather than running two schools at the same time.

An instructor from an institution that retained students held a contrary opinion. They elaborated by stating:

... It's something to do with planning... if the planning is well done, you find that you are able to assist all the two groups of students, they do not meet each other... Maybe in terms of marking...but this cannot be registered as a problem because in terms of assignments it's like you are giving assignments to generic and you are actually receiving assignments from your distance students...for marking, maybe if you have got very large classes for both generic and distance learners, you can panic in terms of marking. But I for one, I do not feel any problem with such kind of arrangement...

The first administrator attributed delayed feedback on students' assignments to pressure on instructors as they handle both, traditional and distance modes. This was further linked to staff shortages in the institution especially that existing staff was employed for f2f and not distance education. Although the delay negatively affected distance students' performance and completion rates, the administrator mentioned that, additional staff could not be recruited due to centralised management. It was further learnt that; instructors were overwhelmed with workloads from the two groups of students hence burnout. Phenomenologically, instructors' lived experiences reflected the stressors they faced, highlighting system inefficiencies and the emotional toll on them. Mediated and real conversational learning is also disrupted by the lack of timely study materials and feedback courtesy of centralised management of the two modes hindering effective learning and student support. It can be argued that, the lack of support in this institution cannot ably retain Mathematics students as indicated by one instructor hence large humanities classes and extensive grading tasks. Overcrowded classes further block students-instructor and peer interaction hence limited shared lived

experiences and real conversation. Paradoxically, the instructor from the other institution regarded proper planning as the best solution to handling both distance and traditional mode without experiencing burnout. Both situations are possible where, synchronisation of the 2 modes in time and space may yield burnout while the opposite is a relief though in this case, the two modes were enacted asynchronously. However, proper planning remains key for a better and efficient option if quality teaching, learning and support is to be achieved.

5.4 Study circle innovation

Participants from the institution that presented minimal teaching, learning and student support challenges mentioned the study circle innovation as complementing mediated student support and a push to student learning. Student teachers elaborated on the structure of study circles and the crucial roles they play in enhancing their studies away from campus. One student teacher explicated:

Study circles are according to programme of study...very important because that is where errors are corrected...students meet and share. It is expensive to have a discussion via telephone... supervisors available...but should be within the reach of the students to reduce travel distances...

An instructor briefly shared how the local centres hosting study circles operate saying:

...we structured our distance education in such a way that no student should be an island. Supervisors ... given districts, we started with 18, remaining with 15 but they share the Malawi 28 districts ...we created cluster centres where the students meet fortnightly, to discuss issues pertaining to their education... field supervisors visit them... rotationally...students are really assisted...

One administrator proudly mentioned the presence of groups for students' interaction as a mechanism for learning and learning support. The administrator clarified:

...we have a support mechanism ... students... are supported by supervisors in study circle centres. You know studying on your own has several challenges and ... a field supervisor has a cluster within which she or he operates...also monitors learning and performance of student... using specific forms.

The study circle emerged as an effective innovation that supplemented mediated instructional materials as students studied at a distance. The administrator's description of a robust student support mechanism featuring the study circle aligns with existing guidelines and the student handbook, reflecting the institution's commitment to learning support, unlike the other institution's practice. This strategy emerged a good practice that promoted

high students' retention and completion rate. Based on the shared experiences, this strategy fostered real conversation and supported self-study, integrating well with the Malawian context by leveraging local structures and innovative strategies, peer interaction and enhanced collaboration. The study circles proved vital evidenced by students' recommendation of satellite centres in the other institution as an adaption to study circle centres. In this other institution students mentioned the need for their institution to set up satellite centres that would operate in the way study circle centres did. The students linked these centres to reduced transport costs as they submitted assignments and interact with peers and instructors. Further, students highlighted on the need for collaboration amongst education stakeholders in offering education through the distance mode while also hinting on the need for adequate mediated study materials to accelerate learning. This implies that, real conversation and sharing of lived experiences are a requirement in distance education as they support mediated conversation technologically presented in study materials. However, in the struggling institution, high dropout was revealed as the institution strictly and ineffectively adhered to traditional practices, partially applying distance education principles hence hindering student retention and completion rate. As one administrator averred:

In terms of enrolment ... in 2011...they started with 34 students...we have 15 remaining pursuing bachelors...16 graduated with diplomas only 15 are still continuing with the bachelors... 2012 we had 150 with 85 remaining, 2014 we had 500 recruits, 369 remaining out of the 500 and then 2015, just last year, we had almost 800 recruited...575 remaining...

The administrator could not explain the cause of such dropout confessing he had no idea of the cause of the high dropout unless research was done to pin the cause. He lamented that the institution really failed to retain students but lacked knowledge of what went wrong then. In trying to justify why the institution kept on enrolling more students regardless of the high dropout rate the instructor explained that, they responded to the donor's targets stating: "we have to recruit a minimum of 600...we are talking of 800 because we know that even if we recruit 800 some will dropout then we will still go near to what is required by the donor." The administrator could not notice the huge dropout rate registered in the institution but celebrated growth of the same.

Table 1: High dropout

Year	Enrolment	Retention	Dropout	Dropout rate
2011	34	15	19	55.9
2012	150	85	65	76.5
2014	500	369	131	26
2015	800	575	225	28

Adapted from Chizengo-Thawani (2019, p. 206)

High dropout rates attributed to underlearning, delayed feedback on assessment attached overwhelmed instructors and to some extent, unprofessionalism and pedagogical skills gaps resulting in deficient student support.

6.0 Conclusion and Recommendations

Effective student support is essential for successful distance education, particularly in areas with limited access to traditional institutions. This paper highlights the importance of innovative strategies like study circles in enhancing learning outcomes. By prioritising collaborative learning, professional development, and reflective practice, study circles can stimulate positive change, and improve distance education delivery in Malawi and beyond. In light of the study's findings, struggling and novice ODE institutions can strategically and comprehensively plan distance education, collaborate with other stakeholders in student support provision, and advance instructors' pedagogical and andragogical skills for effective facilitation and student support.

References

Anney, V. N. (2014), "Ensuring the quality of the findings of qualitative research: Looking at trustworthiness criteria", *Journal of Emerging Trends in Educational Research and Policy Studies*, Vol. 5 No. 2, pp. 271-281.

Campaign for Female Education (2015) *Study circle guidelines for secondary schools: A Practical Approach to students' participation in learning*, Lilongwe: Ministry of education.

Chawinga, W. and Zozie, P. (2016), "Increasing access to higher education through open and distance learning: Empirical findings from Mzuzu University, Malawi", *International Review of Research in Open and Distributed Learning*, Vol. 17 No. 4, pp. 1-20.

Chizengo-Thawani, A. T. (2019) *Exploring Learning Implications of the Distance Secondary School Teacher in Malawi: A Case of Domasi College of Education and Mzuzu University*, Doctoral Thesis, University of KwaZulu Natal, Durban, South Africa.

Gupte, K. (2015) *Teacher training through ODL in Maharashtra: The IGNOU experiences challenges and achievement (Formal education : Revamping teacher education)*, Dissertation, Indira Gandhi National Open University, New Delhi, India.

Holmberg, B. (2003) *Distance Education in Essence..* Oldenburg: Oldenburg: Universität.

Miles, B. and Huberman, M. (1994) *Qualitative data analysis: An Expanded sourcebook of qualitative data analysis*, USA: Sage.

Moore, M. and Kearsley, G. (2012) *Distance education: A systems view of online learning*, United States of America: Wardsworth.

Moustakas, C. (1994) *Phenomenological Research Method*, Thousand Oaks, CA: Sage..

Musingafi, M., Mapuranga, B., Chiwanza, K. and Zebron, S. (2015), "Challenges for Open and Learning (ODL) Student: Experiences from Students of the Zimbabwe university", *Journal of Education and Practice*, Vol. 6 No. 18, pp. 59 - 66.

Ramdass, K. and Masithulela, F. J. (2016), "Comparative Analysis of Pedagogical Strategies across Disciplines in Open Distance Learning at Unisa", *The International Review of Research in Open and Distributed Learning*, Vol. 17 No. 2.

Rosdian, D. (2019), "Distance Education/Instructional Design", Available at: <https://es.scribd.com> [Accessed 22/02/2019].

Shirin, R., Islam, S., Mohammad, M. and Islam, S. (2014), "Study Circle Programme: A Study on its Effectiveness among Undergraduate Students", *Journal of Education and Practice*, Vol. 5 No. 1, pp. 19-25.

Tharakan, M. (2019), "Study Circles as a Mechanism for Community Engagement and Empowerment", *Global Journal of Community Psychology Practice*, pp. 1-10..

van Manen, M. (2006), "On the epistemology of reflective practice", *Teachers and Teaching*, Vol. 1 No. 1, pp. 33-50..

Yilmaz, K. (2013), "Comparison of Quantitative and qualitative research traditions: Epistemological, theoretical, and methodological differences", *European Journal of Education*, Vol. 48 No. 2, pp. 311-325.

EDUCATION

The thematic area of Education will host papers under the following thematic areas:

- Education and Development
- Education, Society and Culture
- Critical Thinking and Reasoning Education
- Science, Technology, Engineering and Mathematics (STEM) Education
- Language Education
- Inclusive and/or Special Needs Education

Assessing the reliability of computer adaptive testing in college entrance communication skills examinations in Malawi

Thokozani Chisale

Abstract

Admission into tertiary institutions in Malawi is very competitive considering the limited capacity of higher education institutions. Admission procedures vary by institution; some offer entrance examinations, while others do not. Nevertheless, college entrance examinations provide a standardised and objective measure of students' academic level from diverse educational backgrounds and boost a high predictive validity of student's success in college. In Malawi, the institutions that administer entrance examinations use paper and pencil (PBT) mode of delivery, which have limited reliability, among other challenges. On the other hand, computer-adaptive testing (CAT) provides a changed approach and has practical advantages that could be leveraged to overcome the difficulties of PBT. However, previous studies have reached different conclusions when comparing the scores from CBT to PBT. Hence, this research assessed the reliability of (CAT) as an alternative to paper-based testing (PBT). The study took a quantitative approach with a quasi-experimental design. Data was collected from a sample of the 2022 DCE and NCE scripts of the paper-based test and the Live CAT administration. The item parameters were examined to determine the paper's quality, and then, using an independent sample t-test, theta estimates and standard error of measurement were compared. Finally, Pearson moment correlation was used to assess the linear relationship of CAT to PBT estimated scores. The results indicate that Paper-based entrance exams are of moderate quality. CAT estimates are more precise than PBT, with a correlation statistic of 0.717, and the scores from CAT and PBT have a positive relationship. Research suggests that test delivery methods in entrance examinations affect the college selection process, and CAT can be relied upon as an alternative to PBT in entrance examinations. Malawi Agenda 2063's priority area 2, industrialisation, calls for a redesigned education system to promote research, science, technology, and innovation. Computer adaptive assessments are viewed as a missing crucial component in tertiary education selection criteria.

Keywords: Computer adaptive testing; Test delivery method; Item response theory; college admission criteria.

1.1 Introduction

Technology in teaching and learning has taken centre stage in recent years. Assessment as a part of teaching and learning has not been excused. Different development agendas, as well as policies, have streamlined technology and innovations in education (Ministry of Education [MoE], 2016; National Planning Commission [NPC], 2020; Ministry of Education, Science and Technology. [MoEST], 2020). For example, Malawi Agenda 2063 priority area 2, industrialisation, calls for a redesigned education system to respond to current and future skills in promoting research, science, technology, and innovation. This entails that educational institutions will be driven to adopt

technological approaches to teaching and learning. Technology in assessment is a complex issue. It offers potential benefits, such as using organic data and machine learning algorithms, at the same time it also raises concerns about the validity, reliability, measurement bias, and the digital divide of the assessments (Hsu and Liou, 2021). More research, therefore, is needed to establish the reliability and precision of these assessments before institutions can contemplate the possibility of adopting technology in assessment.

In Malawi, most assessments are in the form of tests. Tests are systematic procedures that observe and describe people and their abilities using numerical scales or categorical systems. To be effective, tests must be reliable, valid, and unbiased. Tests can be delivered in oral, paper-based, or computer-based modes. The effects of test mode on student performance have been a topic of debate with divergent findings (Zucker, 2003; Oz and Ozturan, 2018). Tests are also supposed to have an underlying measurement theory. Measurement theory in educational psychology consists of statistical and methodological tools to support inferences about examinees. The theory is commonly called test theory. Test theory is based on a positivist worldview in which latent traits are interpreted realistically. The common test theories are classical test theory, generalizability theory, and item response theory.

Some tertiary institutions in Malawi administer entrance examinations for various programs, assessing numerical, reasoning, and communication skills. Candidates are given identical questions on paper and pencil, answering them in a specific timeframe. After submitting the scripts, examiners collect and mark the responses. Each question earns one mark, and the total test score per paper is added. The total scores for all three papers are then combined to determine the candidate's final score. The candidate's eligibility for college admission is based on the total test score.

The college entrance examinations using paper-based mode have administrative and reliability challenges. *On administrative challenges*, the college entrance examinations are administered on a single day at regional centres. This entails that all candidates must make it without fail on the said day, or else they miss their chance for that year. Cheating issues manifest, and scoring is another issue, as it takes much time to score and report the scores to examinees (Personal communication, DCE, 2023). *On reliability challenges*, human error in marking affects the scores, and items administered have unknown parameters, which affects the measurement of the examinee's ability. The scoring of the entrance examination test also assumes that items are of the same difficulty and discrimination level.

All the institutions that administer college entrance examinations in Malawi use the classical test theory (CTT), which is helpful for test development but lacks information on an examinee's aptitude level. The two statistics forming its cornerstone, item difficulty and item discrimination, are sample-dependent, making it unsuitable for tests targeting an examinee's aptitude level (Hambleton *et al.*, 1991). On the other hand, item response theory has become an essential complement to CTT in developing, interpreting, and evaluating tests and test items. The interest in IRT grew out of concerns about

the limitations inherent in CTT and the availability of computing systems. IRT has a solid mathematical basis and depends on complex algorithms more efficiently solved via computer. It describes the relationship between an examinee's test performance and the traits assumed to underlie such performance on achievement tests as a mathematical function called the item characteristics curve (Hambleton and Swaminathan, 1985). IRT primarily focuses on item-level information, unlike the CTT's primary focus on test-level information. Test items are of different difficulty levels and discriminate against examinees differently. The issue of guessing also affects the examinee's response. Raw test responses need to be weighed to estimate ability using measurement theory techniques to sift through item difficulty, discrimination, and guessing. Considering the advantages of IRT and its compatibility with computer adaptive testing, it is worth assessing its reliability to provide precise estimates of ability, standard error of measurement, and psychometric properties compared with the paper-and-pencil mode. Resultantly, when institutions contemplate the transition, they should be aware of the characteristics of alternative test delivery mode from empirical research.

1.2 Problem Statement

Admission into tertiary institutions in Malawi is very competitive, considering the limited capacity of higher education institutions. Hence, paper-based entrance examinations are administered by several academic institutions to admit deserving students. However, entrance examinations face several challenges, among them administrative and security, hindering the reliability of scores obtained from entrance examinations (Yongbo, 2020). This has compelled some institutions to abolish entrance examinations in favour of the Malawi School Certificate of Education (MSCE) or its equivalent as a yardstick for admitting students (University of Malawi [UNIMA], 2015). The challenges with entrance examinations are influenced by test delivery mode, among other factors. Scholars have reached different conclusions on the reliability of scores from paper-based and computer-based tests. Bennett *et al.* (2008), Piaw (2012), and Kalender and Berberoglu (2017) found that computer-based tests and paper-based tests provide the same estimates of ability, Wang *et al.* (2008) revealed no comparability between scores obtained from the two testing modes whilst Clariana and Wallace (2002) suggest that equivalent measures don't need to be produced from CBT and PBT. Computer adaptive testing (a component of CBT) provides a changed approach to assessment. With the advancement of technology and its sophistication in the analysis of test items, it could be leveraged as an alternative test delivery mode. However, CAT has primarily been used in developed nations, and its application in developing countries, including Malawi, is minimally known. Yet, it seems research is insufficient on assessing the reliability of computer adaptive testing in college entrance examinations in Malawi.

1.3 Research Questions

The following research questions will guide the research.

1. What is the quality of the communication skills entrance examination paper?
2. How comparable is the frequency of correct responses to items in CAT and PBT?
3. How comparable are the candidate's ability measurements in CAT to PBT?
4. What is the relationship between candidates' scores in CAT and PBT?

2.0 Literature review

2.1 Understanding College Entrance Examination

College entrance examinations are standardised tests that assess an individual's readiness for tertiary education, focusing on their potential for future success rather than school knowledge. The examination also levels the testing field as candidates who wrote senior secondary examinations from different examination boards are tested on the same constructs. There are numerous types of entrance examinations and various test publishers. While content and structure may vary between publishers, the skills under assessment remain the same. The most common tests are numerical, reasoning, and communication skills.

The National Council for Higher Education has been harmonising admissions to public tertiary institutions in Malawi, leading to the abolishment of college entrance examinations in the process (Singini, 2014). However, some institutions, such as Domasi College of Education (DCE), Nalikule College of Education (NCE), Malawi College of Health Sciences (MCHS), and teacher training colleges (TTC), still administer these exams. These institutions are expected to abolish entrance examinations soon. However, college entrance examinations are crucial in education, as they test knowledge and personality. In China, they have been instrumental in selecting talents and promoting quality education (Jiang and Xuyang, 2020). Consequently, instead of abolishing entrance exams, the National Council for Higher Education and tertiary institutions should reform them as a selection procedure.

2.2 Qualities of an Effective Test

Tests are chosen for their reliability, validity, and unbiased nature, ensuring consistent results and accurate measurement and not depriving students based on gender, ethnicity, language, or disability (Zucker, 2003). This paper focuses on test reliability issues. Among the several definitions of test

reliability, the fundamental idea has been the precision and consistency of test scores, with various methods used to estimate it (Cronbach, 1947; Mead, 2005). Test reliability is a joint characteristic of a test and examinee group, influenced by factors in the test, students taking the test, and scoring factors. To enhance reliability, better tests with fewer random measurement errors are needed. Some scholars have proposed longer tests as more reliable in educational and psychological measurement (Piaw, 2012; Mead, 2005), while others proposed that longer tests might not be feasible in most cases; as such, with fewer test items, adaptive tests can be more reliable (Weiss, 1982; Hambleton *et al.*, 1991; Wang *et al.*, 2010).

2.3 Test Delivery Modes

Tests can be delivered in different modes, including oral, paper-based, and computer-based modes. Tests should be developed and delivered to allow the participation of the broadest possible range of students and results in reliable and valid inferences about performance for all students who participate in the assessment (Thompson *et al.*, 2002, p. 5). The digital age has led to the transition to computer-based tests (CBTs) from paper-based tests (PBTs). However, the American Educational Research Association [AERA] (2014) states that empirical evidence supporting the validity of interpretations and the reliability of test scores of a CBT adapted from a PBT should be warranted whenever the transition is proposed.

2.4 Use of Technology for Assessment Purposes

Integrating technology in assessment has revolutionised the field, offering new opportunities and tools for administrators. Cognitive and measurement science advancements have significantly impacted test design, item generation, and scoring (Sandars and Dearnley, 2008). Technology can enhance entrance examinations in Malawi by improving assessment design, delivery methods, data collection, analysis, and reporting. However, it's essential to acknowledge that some practices may make assessments more accessible, while others may be divisive or exclusionary. (Grant and Villalobos, 2008).

2.5 Computer Adaptive Testing

Computer-adaptive testing is a distinct approach to assessing latent traits through a computer, where the test item is precisely matched to the ability of each examinee (Davey and Pitoniak, 2006). Development and administration of CAT take five stages: item bank calibration, starting rule, item selection rule, scoring rule, and stopping rule. The test items are selected depending on the answer to the previous item: If the previous item is answered correctly, the next item will be more difficult. If the item is answered incorrectly, then the next item will be less difficult. Figure 1 illustrates the steps in CAT.

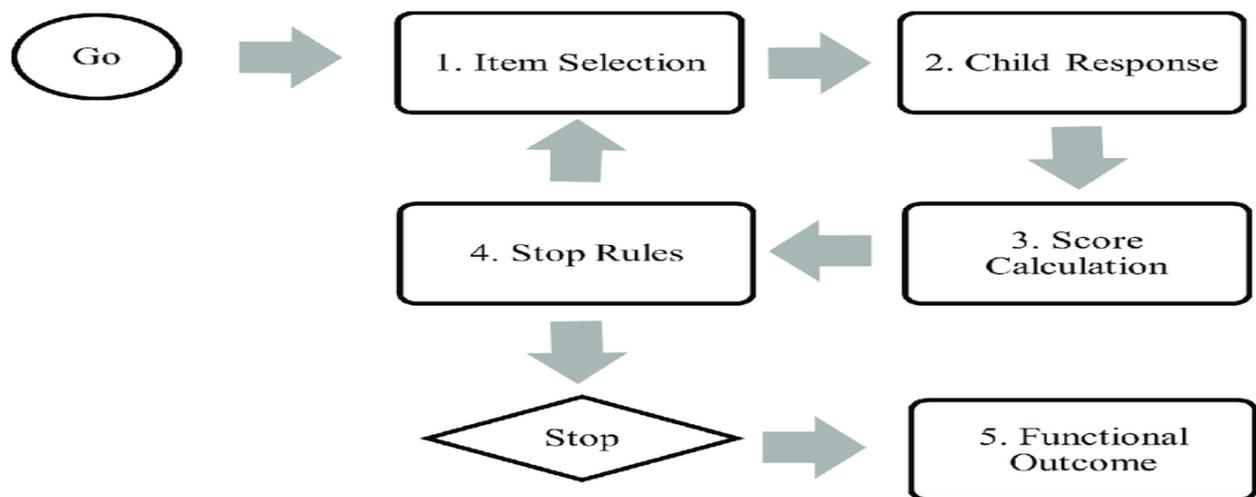


Figure 1: Steps of a CAT in assessment (Source: Chen et al., 2018, p. 3)

2.6 Studies on the Comparability of CAT and PBT

Score comparability between the two administration techniques becomes the main problem when the existing PBT method is replaced by CAT administration or when the methods are used interchangeably (Wang and Kolen, 2000). As a result, research is required to provide evidence on the reliability and comparability of the scores. Wang and Shin (2010) state that administration mode is an influential factor needing investigation across CAT and PBT, also pointing out that score comparability from different administrations is a reliability issue. Studies have divergent findings on the comparability of CAT and PBT scores. Vispoel (2000) and Wang *et al.* (2008) concluded that scores obtained from the two testing modes are not comparable. Similarly, Schaeffer *et al.* (1998) found that GRE scores in PBT and CAT are not comparable. On the contrary, Kalender and Berberoglu (2017), in their study on CAT in the admission of students in Turkey, found the correlation of ability estimates between PBT and CAT to be .764 ($p < .05$). Likewise, Kaya (2021) reported no significant difference observed between PBT and CATs terminated with SE threshold and fixed-item stopping rules and Babcock and Weiss (2012) found that CATs produced comparable ability estimates with their PBT counterparts regardless of the test termination method.

2.7 Studies on the Reliability of CAT

Reliability studies are considered classical methods of data analysis. However, their computations are still present and very useful. In literature, reliability in computer adaptive tests has been measured using the standard error of measurement (SEM), item information function (IIF), and Pearson moment correlation. Kalender and Berberoglu (2017) used Pearson moment correlation to check the reliability of CAT. The study found that CAT significantly reduces the number of items used, with correlations between full test length and mathematics subtest scores above .65 at $SE = .30$. Likewise, Kaya (2021) analysed the reliability of CAT and PBT using Pearson Moment correlation. The study used a standard error of .50 to .10 and a test length of

10 to 50 items as termination criteria, finding an average correlation of above .70 at .01 alpha level.

2.8 Summary of the Literature

The literature research has revealed three key findings about assessing the reliability of computer adaptive testing as an alternative to paper-based assessment in Malawi. Firstly, the item parameters and information functions of the tests should be checked to deduce the quality of the items. After that, a decision on the comparability of scores should be made as there is an apparent variance of findings on the comparability of test delivery modes in estimating ability. In addition, there is a need for evidence on the relationship of scores from CAT and PBT administration as defined by Wang and Kolen (2001). Furthermore, technology-enhanced assessment must minimise the challenges of the paper-based delivery mode whilst not being divisive.

3.0 Methodology

3.1 Research Paradigm Approach and Design

This research employed a positivist paradigm and quantitative approach. This approach was selected to generalise the findings' applicability to a larger population (Johnson *et al.*, 2007). A Quasi-experimental design was used in this study for its capability to demonstrate the correlation of variables. The researcher compared the items' ability estimates, standard error, and psychometric properties obtained from two test delivery methods.

3.2 Study Population and Sampling

The study population consisted of 4360 scripts for the DCE communication skills paper, of which a sample size of 1005 was used for item bank calibration. For the Live CAT administration, the population of the study was 2204 first-year students enrolled at Catholic University (CU), Domasi College of Education (DCE), Malawi College of Health Science (MCHS), and Nalikule College of Education (NCE) of which a sample size of 546 students was used. A sample of above 500 is a requirement of IRT techniques, as recommended by Ree and Jensen (1983), for statistically meaningful results. The researcher stratified the sample by college. A student sample was 150 from CU, 150 from DCE, 150 from MCHS, and 96 from NCE.

3.3 Data Analysis

Firstly, IRT Assumptions of Local independence and unidimensionality were checked. KMO and Bartlett's test was used for local independence, whilst principal factor analysis was used to test for unidimensionality. A model-data fit assessment was done to choose among the three IRT models to be used for the study. 3 Parameter Logistic model (3PL) fitted the data and was used in this study. Maximum Likelihood Estimation (MLE) was used to estimate the candidate's ability. To check the quality of the test, item parameters and test information function were analysed. Likewise, Using an Independent sample

t-test, the decision on the comparability of the two different test delivery modes was made at a 95% confidence level. The Pearson moment correlation was used to assess the correlation of CAT as an alternative to PBT.

3.4 Limitations of the Study

Three significant limitations were noted. Firstly, this study was conducted in an area where CAT has never been used. Secondly, the study assumed that candidates had an above-average computer proficiency level since they were college students. Lastly, for Live CAT administration, the 30 items bank could not be sufficient to provide ability estimates of candidates in the extremes.

3.5 Ethical Considerations

The study adhered to UNIMAREC guidelines for ethical considerations, with voluntary participation and informed consent from all participants. Privacy and confidentiality were prioritised, and the researcher evaluated potential harms and risks to participants. Participants could withdraw at any time, and the researcher attempted to minimise damage and maximise safety (Kitchin, 2007).

3.6 Validity and Reliability of the Study

The evidence of validity and reliability are prerequisites to assure the integrity and quality of the research process and have a significant bearing on the results (Kimberlin and Winterstein, 2008). To ensure this, the research took several measures. Firstly, the hypothesis and research questions were clear and SMART. Secondly, the software used was recent and reliable, and a pilot study was conducted to ensure the required data was provided. Furthermore, the research ensured that the data collection instrument was error-free and that items were proofread after conversion. Likewise, a data audit was conducted to ensure the data was free of errors and omissions.

4.0 Results

4.1 Testing IRT Assumptions (Local Independence and Unidimensionality)

This study used KMO and Bartlett's Test to check the sampling adequacy and independent functioning (local independence) of items in the data. With a KMO of 0.701, the data was suitable for factor analysis (Kaiser and Rice, 1974). Bartlett's test, which had a significance value of 0.000, less than 0.05, indicated that the variables in the correlation matrix are not interrelated and could be used in factor analysis (Bartlett, 1954). This explains that the items in the data set function independently; hence, local independence is obtained. This study used eigenvalue plots of the inter-item correlation matrix with a Varimax rotation to check the items' unidimensionality. Figure 2 shows the scree plot that was obtained.

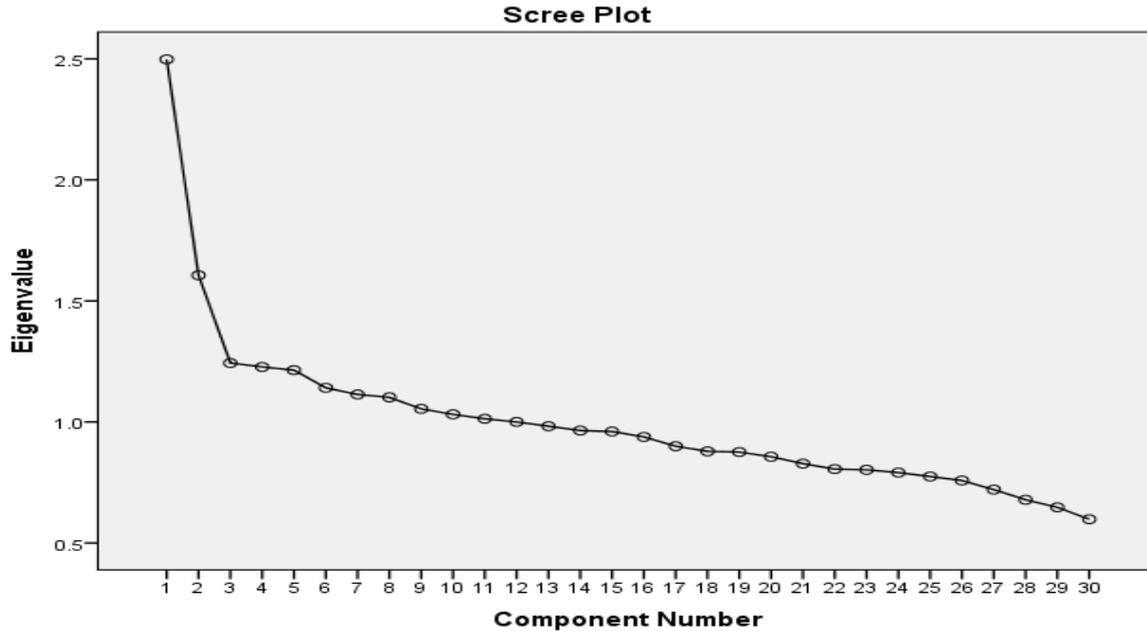


Figure 2: A scree plot showing the extracted Eigenvalues

4.2 Quality of the Test Items

The 3PL model fitted the data and was used for analysis. The 3PL model has three parameters: discrimination (a), difficulty (b), and guessing (c). The parameters explain the relationship between the examinees' latent traits and the items. They also explain the items' quality based on the test's purpose. The discrimination parameter ranged from 0.1251 for Q1 to 2.2178 for Q4. The difficulty levels ranged from -0.9096 for Q13 to 3.0534 for Q23. The test information function showed that the test explained for 6 to 8 items and peaked at theta (θ) = 1.75 with a standard error of 0.755. This explained that the test would best estimate the ability of examinees whose abilities were 1.0 to 2.5. Overall, the test was of moderate quality.

4.3 Comparability Analysis of PBT and CAT

PBT and CAT were compared in terms of test time, frequency of items administered, and mean values of theta. The PBT administration provided examinees 30 minutes to complete the 30 test items; in contrast, in the CAT administration, examinees answered 20 items in 14 minutes. In terms of item exposure rate in PBT, all examinees were exposed to all the items, representing a 100% exposure rate of the items, whereas in CAT, the exposure rate ranged from 28% for question 1 to 94% for question 10, with a mean of 64%. For the mean values of theta, using independent sample t-test, the results show that there was a significant difference ($t(1049) = -4.488, p = .000$) in the theta value with mean theta values of PBT ($M = -0.327, SD = 1.72$) lower than mean values of CAT ($M = 0.047, SD = 1.18$). The magnitude of the differences in the mean (mean difference = -0.3701 at 95% CI: -1.5085 to -0.4813) was significant.

4.4 Correlation Analysis of PBT and CAT

The study checked the relationship between theta values using Pearson moment correlation, based on Baker's (2001) classification of correlation values. Table 1 summarises the correlation statistic and the significance of the relationship.

Table 1: Results of Pearson Moment Correlation

		Frequency of examinees (CAT)	Frequency of examinees (PBT)
Frequency of examinees (CAT)	Pearson Correlation	1	0.717
	Sig. (2-tailed)		.000
	N	22	22
Frequency of examinees (PBT)	Pearson Correlation	0.717	1
	Sig. (2-tailed)	.000	
	N	22	22

4.5 Summary of Results

In this study, local independence and unidimensionality hold, and the 3PL model fits the data. The test information peaks at theta 1.75 with 6 to 8 items providing enough information for the test. Further to that, the test which was used was of moderate quality. Further to that, the two test delivery methods are not significantly comparable. However, the theta values obtained are linearly correlated.

5.0 Discussion

Item response theory requires that the assumptions are obtained and a model fits the data. Since the local independence and unidimensionality assumptions were obtained, we can be confident that the test items measured a single construct independently. The 3-PL Model fitted the data using empirical proportions as the probability against theta plots runs through the trace lines. However, it was worth noting that the fit was not perfect.

The test was for selection purposes in the first year of college. Hence, only items with appropriate discrimination values, difficulty level and acceptable guessing parameters could be classified as quality items for the test. In this study, only 20 (66.6%) items in the 2022 DCE communication skills paper could

discriminate appropriately between candidates with low ability and those with the required ability to succeed in college education. This could mean that the test developer could be compelled to select only 20 items whose discrimination parameter was above 0.65. 63% of the test items (medium + hard) were of appropriate difficulty level. The item difficulty parameter enables the test developer to predict how examinees perform on different items. Adedoyin and Makabi (2013) found that higher difficulty levels of the items and higher omitted response rates affect the estimation of guessing parameters as well as the selection of students for Graduate Studies. It thus corresponds with the findings of this study that items with high-difficulty parameters should not be part of the test for selecting students for college. On the other hand, the guessing parameter of 0.22267 is within the acceptable level. A critical analysis of the items shows that only four items could be included in the test if the inclusion criteria were that an item should satisfy both item discrimination and item difficulty appropriate levels. The test quality was also checked based on the test information function. The results show that the information obtained in the test could be achieved with only 6 to 8 items instead of 30. Based on the classification of the item parameters and the test information function, we can conclude that the test was of moderate quality.

Comparability between the two modes of testing provided exciting findings. It was shown that CAT reduced test time to an average of 14 minutes from 30, enhanced the security by reducing the exposure rate of items by 36% and minimised test anxiety as the rate of providing correct responses was higher in CAT than PBT. Likewise, the significant difference found using an independent sample t-test explains that PBT and CAT are not comparable in the mean values of theta. It also shows that the values obtained for CAT are higher than those obtained in PBT. This indicates that CAT precisely estimates the examinee's ability within the test's maximum information range compared to PBT. The results in this study are similar to what Cikrikci *et al.* (2018) found (theta range, -3.00 to +2.96 with a mean of 0.38 and an SEM of 0.35 to 0.56) in their study on the development of a computerised adaptive version of the Turkish driving license exam.

A Pearson moment correlation statistic of 0.717 explains a solid positive relationship in the ability estimations of candidates in PBT and CAT. This confirms that if we change the test delivery mode from a Paper-based test to a computer-based test or use the two test delivery modes interchangeably, we will undoubtedly get reliable estimates in 71.7% of the cases. The P-value of .000 for a 2-tailed analysis proves the relationship is significant. The results are consistent with the findings of Kalender and Berberoglu (2017) where they found the correlations of CAT's ability estimations with the mathematics subtest scores of the full PBT versions to be 0.83, 0.68, and 0.77 for public, Anatolian, and private high schools. They discussed such results as supporting the use of CAT in the admission system. Similarly, it is in tandem with the findings of Oz and Ozturan (2018) in their study on whether the test administration mode influences the reliability and validity of achievement tests. It was deduced that at a correlation of 0.84, there was a statistically significant relationship between the test administration modes.

6.0 Conclusion and take-home messages

This research aimed to assess the reliability of the estimation of examinees' ability using computer adaptive testing as an alternative to paper-based tests in communication skills entrance examinations in Malawi. It has been argued throughout this study that the reliability of a test mode must have evidence of the quality of items, comparability of the scores and correlation of scores. This study has addressed methodological concerns to assist in deciding whether to transition from paper-based testing to computer-adaptive testing or to use the two approaches concurrently.

The moderate quality of the test used reveals that a crucial stage in the assessment process is the pre-testing of items to determine their parameters. For the test's purpose to be effectively fulfilled, it must have items with acceptable difficulty levels and discrimination. Likewise, the test assembly should include items that offer sufficient information, with the test information covering a broad spectrum of the latent trait continuum. Against this disclosure, the selection of test items is currently made solely by the face judgment of subject matter experts. Hence, this study questions the quality of tests that follow this methodology.

The study found significant variance in mean examinee ability estimations between paper-based tests and computer-adaptive test delivery methods, with the latter having higher mean ability levels. This clarifies that computer adaptive testing assesses examinees' abilities more precisely than paper-based assessments. Similarly, it has been demonstrated that CAT decreases test time, improves test security by restricting item exposure to examinees, and enriches the test-taking experience by allowing examinees to provide more accurate responses because the test adapts to their potential. This study agrees with Wang *et al.* (2008) that PBT and CAT provide measurements of ability that are minimally equivalent.

The results show a strong positive relationship between the PBT and CAT theta estimates. Tertiary institutions can thus make informed decisions about using computer adaptive testing that will not jeopardise the selection of college students. The college can use CAT's benefits without sacrificing the purpose of admitting outstanding students.

Further research studies can complement this study in the following related areas: Understanding students' perception with the transition from paper-based tests to computer adaptive tests. A study on consequences of using a misfit model in Computer adaptive tests. In this study, the model data fit did not perfectly fit. A study on minimum items for calibrating an item bank.

References

Adedoyin, O. and Mokobi, T. (2013), "Using IRT psychometric analysis in examining the quality of junior certificate mathematics multiple choice examination test items", *International Journal of Asian Social Science*, Vol. 3

No. 4, pp.992–1011. Retrieved from <https://archive.aessweb.com/index.php/5007/article/view/2471>

American Education Research Association (2014) *The standards for educational and psychological testing*, Washington DC: American Educational Research Association.

Babcock, B. and Weiss, D. J. (2012), “Termination criteria in computerized adaptive tests: do variable-length CAT provide efficient and effective measurement”, *Journal of Computerized Adaptive Testing*, Vol 1, pp.1-18. <http://dx.doi.org/10.7333/1212-0101001>

Baker, F. B. (2001), *The basics of item response theory*, ERIC Clearinghouse on Assessment and Evaluation, United States of America.

Bartlett, M. S. (1954), “A note on the multiplying factors for various chi square approximation”, *Journal of Royal Statistical Society*, Vol. 16, pp.291-298.

Bennett, S., Maton, K. and Kervin, L. (2008), “The ‘digital natives’ debate: a critical review of the evidence”, *British Journal of Educational Technology*, Vol. 39 No. 5, pp.775–786.

Chen, C. T., Chen, Y. L., Lin, Y. C., Hsieh, C. L., Tzeng, J. Y. and Chen, K. L. (2018), “Item saving assessment of self-care performance in children with developmental disabilities: a prospective caregiver-report computerised adaptive test”, *PLoS ONE*, Vol. 13 No.3, <https://doi.org/10.1371/journal.pone.0193936>

Cikrikci, O. (2018), “The predictive roles of cognitive flexibility and error-oriented motivation skills on life satisfaction”, *International Journal of Eurasia Social Sciences*, Vol. 9 No. 31, pp. 717–727.

Clariana, R. and Wallace, P. (2002), “Paper-based versus computer-based assessment: Key factors associated with the test mode effect”, *British Journal of Educational Technology*, Vol. 33 No. 5, pp.593 – 602.

Crocker, L. and Algina, J. (1986) *Introduction to classical and modern test theory*, New York: Harcourt.

Cronbach, L. J. (1947), “Test "reliability": its meaning and determination”, *Psychometrika*, Vol. 12, pp.1–16. <https://doi.org/10.1007/BF02289289>

Davey, T. and Pitoniak, M. J. (2006), “Designing computerized adaptive tests”, in Downing, S.M. and Haladyna, T. M. (Eds.), *Handbook of test development*, Lawrence Erlbaum Associates, New Jersey.

Grant, L. and Villalobos, G. (2008) *Designing educational technologies for social justice*, Bristol: Futurelab.

Hambleton, R.K. and Swaminathan, H. (1985) *Item response theory: principles and applications*, New York: Springer.

Hambleton, R.K., Swaminathan, H. and Rogers, H.J. (1991) *Fundamentals of item response theory*, Newsbury Park, CA: Sage.

Hsu, S. F. and Liou, S. (2021), “Artificial intelligence impact on digital content marketing research”, *The 9th International Conference on Orange Technology, ICOT 2021*. <https://doi.org/10.1109/ICOT54518.2021.9680666>

Jiang, Q. and Xuyang, G. (2020), “Research on the reform of the Chinese college entrance examination system”, *Advances in Social Science, Education and Humanities Research*, Vol. 402. <https://doi.org/10.2991/assehr.k.200205.024>

Johnson, R., Onwuegbuzie, A. and Turner, L. (2007), “Toward a definition of mixed methods research”, *Journal of Mixed Methods Research*, Vol. 1, pp.112 – 133.

Kaiser, H. F. and Rice, J. (1974), “Little jiffy, mark IV”, *Educational and Psychological Measurement*, Vol. 34 No. 1, pp.111–117.

Kalender, I. and Berberoglu, G. (2017), “Can computerised adaptive testing work in students’ admission to higher education programs in Turkey?”, *Educational Sciences: Theory & Practice*, Vol. 17 No. 2, pp.573 – 596.

Kaya, E. (2021), A comparability and classification analysis of computerized adaptive and conventional paper-based versions of an English language proficiency reading subtest, Thesis, Bilkent Universitesi, Ankara, Turkey.

Kimberlin, C. L. and Winterstein, A. G. (2008), “Validity and reliability of measurement instruments used in research”, *American Journal of Health-System Pharmacy*, Vol. 65, pp.2276-2284.

Kitchin, H. A. (2007), *Research ethics and the internet: negotiating Canada’s tri-council policy statement*, Halifax and Winnipeg, Canada.

Mead, A. D. (2005), “Psychometric reliability: definition, estimation, and application”, *Wiley StatsRef: Statistics Reference Online*, pp.1–6. <https://doi.org/10.1002/0470013192.bsa672>

Ministry of Education (2020) *National Education Sector Investment Plan 2020 – 2030*, Lilongwe: Ministry of Education.

Ministry of Education, Science and Technology (2016) *National Education Policy*, Lilongwe: Ministry of Education.

National Planning Commission (2020) *Malawi 2063*, Lilongwe: National Planning Commission.

Oz, H. and Ozturan, T. (2018), "Computer-based and paper-based testing: Does the test administration mode influence the reliability and validity of achievement tests?", *Journal of Language and Linguistic Studies*, Vol. 14 No. 1, pp.67-85.

Piaw, C. Y. (2012), "Effects of computer-based testing on test performance and testing motivation", *Computers in Human Behavior*, Vol. 28 No. 5, pp.1580 - 1586.

Ree, M. J. and Jensen, H. E. (1983), "7 Effects of Sample Size on Linear Equating of Item Characteristic Curve Parameters", in Chikoko. T. A (Ed.), unpublished thesis, University of Malawi, Zomba, Malawi.

Sandars, J. and Dearnley, C. (2008), "Twelve tips for the use of mobile technologies for work-based assessment", *Medical teacher*, Vol. 31, pp.18-21. <http://dx.doi.org/10.1080/01421590802227966>

Schaeffer, G., Bridgeman, B., Golub-Smith, M., Lewis, C., Potenza, M. and Steffen, M. (1998), "Comparability of paper-and-pencil and computer adaptive test scores on the GRE, general test", *ETS Research Report Series*. <http://dx.doi.org/10.1002/j.2333-8504.1998.tb01787.x>

Singini. G (2014, December 30), "Council wants 'varsity entrance exams scrapped", *Nation Online*. <https://mwnation.com/council-wants-varsity-entrance-exams-scrapped/>

Thompson, N. (2021, February 2), "IRT test information function", *Assessment systems*. <https://assess.com/irt-test-information-function/>

University of Malawi (2015) *University entrance examinations*, Zomba: University of Malawi.

Vispoel, W. P. (2000), "Reviewing and changing answers on computerized fixed-item vocabulary tests", *Educational and Psychological Measurement*, Vol. 60, No. 3, pp.371-384. <https://doi.org/10.1177/00131640021970600>

Wang, H. and Shin, C. D. (2010), "Comparability of computerized adaptive and paper-pencil tests", *Test, Measurement and Research Service Bulletin*, Vol. 13, pp.1-7.

Wang, S., Jiao, H., Young, M. J., Brooks, T. and Olson, J. (2008), "Comparability of computer-based and paper-and-pencil testing in K-12 reading assessments: A meta-analysis of testing mode effects", *Educational and Psychological Measurement*, Vol. 68 No. 1, pp.5-24.

Wang, T. and Kolen, M. J. (2001), "Evaluating comparability in computerized adaptive testing: Issues, criteria, and an example", *Journal of Educational Measurement*, Vol. 38 No. 1, pp.19 - 49.

Weiss, D. J. (1982), "Improving measurement quality and efficiency with adaptive theory", *Applied Psychological Measurement*, Vol. 6 No. 4, pp. 473 – 492.

Yongbo, L. (2020), "Improvement of College Entrance Examination Enrolment System Based on Fairness, Efficiency and Autonomy", *Advances in Social Science, Education and Humanities Research*, Vol 500, pp.397 – 403.

Zucker, S. (2003) *Fundamentals of Standardized Testing: Assessment report*, London: Pearson.

Towards business intelligence implementation in secondary education in Malawi from management perspective

Tamara Mumba*, Sarah Khudze, Mtisunge Malemia, Umali Leonard and Patrick Chikumba

Malawi University of Business and Applied Sciences, School of Science and Technology,

Department of Computer Science and Information Systems

*Contact person: tmumba@mubas.ac.mw

Abstract

Purpose: Business Intelligence (BI) is beneficial to education institutions in developing countries as literature indicates its increase in use. However, BI is mostly used in higher education institutions like universities, yet it can equally be used by secondary schools, which generate huge volumes of data required for decision-making. Secondary schools lack effective data integration, sharing, analysis and visualisation that can be addressed by BI. Therefore, this study sought to investigate how BI can be utilised for effective data management in secondary education in Malawi keeping in mind its challenges and cost.

Methodology/approach: This was a case study using Shire Highlands Education Division (SHED) in which qualitative interpretive methods were adopted. Data was collected through interviews, observation, online questionnaire and artefact examination. The data analysis was done in four key steps – immersion in the data, coding, creating categories and identification of themes.

Findings: SHED performs four key data management processes namely data collection, storage, analysis and dissemination, which require computers, internet and smartphones. SHED has adequate modern desktop and laptop computers with internet and Excel for data analysis that provide opportunities for introducing BI. SHED also uses smartphones for collecting data from secondary schools through KoboCollect. However, SHED has inadequate data management and digital skills, ICT support and majority of paper-based processes.

Discussion: Since data is from multiple sources and formats, SHED needs an effective data analysis, visualisation and sharing mechanism such as BI. However, BI is to be institutionalised for easy use, management and sustainability. Local expertise needs to be built for ICT management and support.

Recommendations: For successful and sustainable BI implementation, these are key recommendations: (a) BI to be implemented at SHED since it is where most data analysis is done; (b) using already existing technologies for BI components; and (c) enhancement of local ICT expertise and support.

Conclusion: Secondary education divisions in Malawi such as SHED generate large volumes of data that require appropriate data management practices with the

support of cost-effective ICT systems like BI that need to be institutionalised for sustainability.

Keywords: Business intelligence; data management; institutionalisation, local ICT expertise; secondary education.

1.0 Introduction

1.1 Background

Education institutions such as secondary schools undertake several processes and activities that include staff recruitment, promotions, student enrolment, student assessment, student transfers, student attendance, and performance monitoring, among others. From these processes and activities, volumes of data are generated pertaining to staff, students, infrastructure, and other resources facilitating the need for data management. Owan and Bassey (2019) define data management as the process of collecting, sorting, coding, storing, analysing, presenting, interpreting, and securing data for decision-making. Although data management is critical in education management, it is one of the most undermined areas in developing countries, yet it is necessary for effective planning and quality improvement in education (Ndiku, Oyoo and Owano, 2014).

Information and Communication Technology (ICT) plays a significant role in data management by enhancing the process of collecting, processing, and interpreting information which is critical for education management (Azeroual and Theel, 2018). Business Intelligence (BI) is one of the ICT solutions that is recommended for managing large volumes of data as it has the capacity to turn data into information and knowledge that can be used to enhance business services or operations (Alasiri and Salameh, 2020; León-Barranco et al., 2015). Wixom and Watson (2010, p. 14) define Business Intelligence (BI) as an extensive group of “technologies, applications, and processes for gathering, storing, accessing, and analysing data to help users make better decisions”. Previous research on BI adoption, utilisation, and success from 2000 and 2019 indicates a growing interest among scholars and practitioners in different sectors but the education sector presents low levels of BI adoption and utilisation at 2% (Ain et al., 2019). However, BI has the potential to give educational institutions a strategic advantage just as it does for business institutions. Abai et al. (2019) state that most public institutions are not using BI for data analysis. However, BI coupled with data mining tools can be useful for discovering some hidden patterns in education institutions thereby facilitating easy extraction of specific relevant knowledge from large and multiple integrated sources easily (León-Barranco et al., 2015).

1.2 Problem Statement

Literature indicates an increase in the use of BI in education (Herter and Yang, 2022; Jansen and Brown, 2021; Apraxine and Stylianou, 2017). From observation, BI is mostly used in higher education institutions like universities, yet it can equally be used by educational institutions like secondary schools to quickly analyse data and information turning it into knowledge that helps in decision making (Ain et al., 2019; Javier, 2017). Like higher learning institutions, public secondary schools generate huge volumes of data required for decision-making. Therefore, this study sought to investigate how BI can be utilised for effective data management in secondary education in Malawi. This paper specifically focuses on BI implementation strategies.

1.3 Objectives

The study aimed to investigate how BI can be utilised for effective data management in secondary education bearing in mind its challenges and cost. The following were the specific objectives;

1. Examine data management practices in secondary education
2. Assess the ICT infrastructure used for data management in secondary education
3. Recommend strategies for BI Implementation for effective data management in secondary education

2.0 Literature review

2.1 Business intelligence for data management in education

BI provides significant benefits to several organisations including educational institutions. Using BI, educational institutions can access accurate data which can be easily analysed to generate intelligible and inclusive information which can support future planning and improvement of education quality (Aziz et al., 2014). However, Abai et al. (2019) argue that the effectiveness of any BI solution largely depends on how well it has been implemented. Therefore, understanding the BI components is very critical for their successful deployment. As illustrated in Figure 1, BI is a two-part process which involves getting data in and getting data out (Watson and Wixom, 2007).

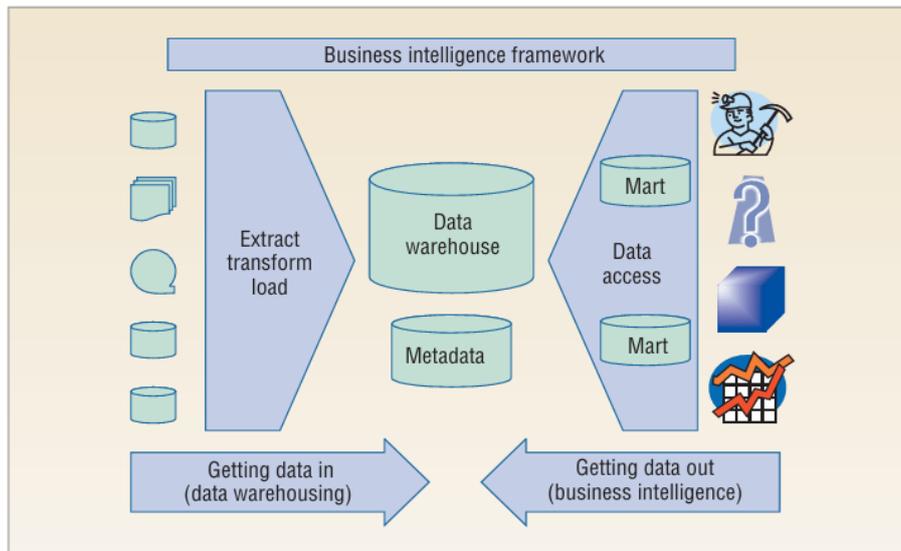


Figure 1: Business Intelligence as a Two-Part Process (Source: Watson and Wixom, 2007, p. 97)

Getting data in also termed Extract, Transform and Load (ETL) involves the integration of data from multiple sources and converting it into the required format before it can be loaded in the data warehouse. This stage requires almost 80% time and effort hence it is considered the most challenging and expensive (Watson and Wixom, 2007). Getting data out adds value to the enterprise by providing users and applications with access to the data in the data warehouse to facilitate querying, reporting and data analytics.

2.2 Critical Factors for Successful BI Implementation

Although BI provides so many potential benefits to organisations, its implementation also presents challenges (Margsoudi and Nezafati, 2023; Adamala and Cidrin, 2011). The implementation of BI systems is very costly and requires adequate resources, appropriate infrastructure, and time therefore identifying and addressing the critical factors for successful BI implementation is very important especially in resource-constrained settings (Kharade and Pathan, 2022; Ugur and Turan, 2018). Information Technology (IT) infrastructure, system architecture and data quality are some of the key technological factors to be considered during BI implementation.

IT Infrastructure is very critical and organisations with strong IT infrastructure support and compatible computer systems are likely to succeed with BI implementation (Olszak, 2016; Olszak and Ziemba, 2012). Organisations can choose to either deploy IT infrastructure on-premises or on the cloud subject to cost, security and regulatory requirements (Rehman, Ahmad, and Mahmood, 2018). Although on-premises hosting provides high levels of privacy and security, it can be very costly since BI infrastructure is often relatively expensive (Aziz et al., 2014), and most organisations lack BI expertise facilitating the need for outsourcing (Murthy, Balaji and Sontakke, no date).

Data storage is one critical issue in BI implementation which requires carefully designed data marts or data warehouses which are quite expensive to implement and maintain (Kasim et al., 2018). There are several data warehouse architectures but the two most popular are hub and spoke architecture and the data mart bus architecture (Breslin, 2004). The hub and spoke architecture comprise a central data warehouse (hub) which is developed based on organisational requirements upon which several dependent data marts (spokes) derive their specific business unit requirements (Merceedi et al., 2022). The data mart bus architecture starts with the development of independent data marts based on the requirements of specific business units and these are later linked based on conformed dimensions (Blažic, Pošic and Jakšic, 2017). The choice of which data warehouse architecture is appropriate is based on resource availability, organisational domain, compatibility with existing systems and technologies, urgency of need and the strategic view of the data warehouse by management (Boonsiritomachai, 2014; Ariyachandra and Wilson, 2008: 2010).

Data quality remains a recurrent issue that potentially hinders the successful implementation of BI (Nasab, Selamat and Masrom, 2015; Kimball et al., 2008; Ponniah, 2011). Although BI can be useful to organisations, its usefulness heavily relies on the availability of high-quality data (Thamir and Poulis, 2015; Ponniah 2011). Organisations can only make better decisions, mitigate risks, and effectively respond to dynamic market conditions if they have access to the right information at the right time (Maghsoudi and Nezafati, 2023). Although organisations might have several sources of data both internal and external, the organisation goals, business and user requirements, compatibility with existing internal data structures determine what data needs to be generated and used (Altynpara and Bestaiva, 2023; Ponniah 2011).

2.3 Theoretical Framework

The study adopted Activity Theory as a theoretical framework that uses the concept of tool mediation and the notion of activity as the basic unit for studying human activity (Mwanza, 2001). By analysing the subjects, tools, division of labour, roles and responsibilities, community, rules and regulations for data collection, storage, analysis and information dissemination at SHED, the authors were better positioned to determine the data management opportunities and challenges at SHED to inform the strategies for successful implementation of BI.

3.0 Research methods

3.1 Research Strategy

The study adopted a qualitative interpretive approach using Shire Highlands Education division as a case study. The case study approach was adopted as the authors wanted to gain a deeper understanding of data management practices within their natural setting.

3.2 Research Setting and Sampling

Shire Highlands Education Division (SHED) was selected out of the 6 education division offices in Malawi because it was easy to access. The division has 126 Secondary schools which are located in the 4 education districts namely; Thyolo, Phalombe, Mulanje and Chiradzulu. All the education districts and secondary schools participated in the study. Purposive sampling was used to select participants from the division offices, district education offices and secondary schools specifically those involved in data management.

3.3 Data Collection

Data was collected using semi-structured interviews, observations, artefact examinations and an online questionnaire. Semi-structured interviews were conducted with the Heads of sections at the Division office and the District Education Manager. Observations were made during assessment and installation of new computers and printers at SHED, during Excel training and meeting with Heads of sections. An online questionnaire was also distributed using KoboCollect to Data Officers in Secondary schools. The use of multiple data sources and different data collection methods ensured the triangulation of findings (Saunders et al., 2019; Rose, Spinks & Canhoto, 2015).

3.4 Data Analysis

Thematic analysis was employed to analyse the qualitative data and the following four steps were done as suggested by Green et al. (2007).

1. *Immersion in the data* – The authors familiarised themselves with the data by reading and re-reading for several times. The data was in three forms: transcripts of interviews, field notes from the observation, and artefacts.
2. *Data coding* – The authors examined and organised the data into significant groups and applied descriptive labels to data segments.
3. *Creating categories* – The authors gradually brought similar codes under a set to create coherent categories.
4. *Themes identification* – The authors identified themes from the generated categories.

4.0 Results

BI involves a number of activities that are similar to those of data management such as data collection, storage, analysis, and reporting. Hence, results are presented in relation to data management activities through the theoretical lenses of Activity theory.

4.1 Data Collection Activity System

Shire Highlands Education Division (SHED) collects large volumes of data from different sources including 126 secondary schools in which the majority are Community Day Secondary Schools (CDSS). SHED requires different types of data concerning learners, teachers, and facilities. Specifically, the data includes student enrollments, dropouts, repeaters, school performance, cohort tracking, university selection, sports activities, staffing, infrastructure development, school locations and MANEB examinations, among others. As summarised in Table 1, the data collection involves subjects, tools, division of labour, community, and rules and regulations.

Table 1: Data Collection Activity System

Component	Description
Subjects	<p>Data officers: Each secondary school appoints one teacher as the data officer who is responsible for data collection at the school level and reports to SHED through his/her head teacher. Out of the 104 secondary schools, 103 schools (99%) indicated that they have Data Officers responsible for data collection at their respective schools.</p> <p>Heads of Sections: There are 5 Heads of sections (Human Resource, Internal Audit, Special Needs Education, Quality Assurance and Planning) at SHED and each Head collects data for their section.</p> <p>Other sources: Ministry of Education, MANEB, donors and other development also collect data that is required by SHED.</p>
Tools	<p>Digital Tools: Desktops, laptops and Smart Phones together with software applications such as Excel and Kobocollect are used to collect school data, staff data and financial data.</p> <p>Physical Forms: Inspection forms and various printed forms used to collect school data and staff data.</p> <p>Other Tools: Global Positioning System (GPS) is used to collect spatial data.</p>
Division of Labour	<p>Data request: Planning Section or Heads of sections request data from schools through the head teachers. Data requests to the schools by stakeholders such as MANEB are made through SHED.</p> <p>Data collection instrument development and distribution: Officers in the Planning section develop data collection forms and tables.</p> <p>Data capturing: Done by Data Officers in secondary schools.</p> <p>Data reporting: Data Officers and Headteachers from their respective schools' report to the Planning Officer at SHED. The Planning Officer then reports to the Education Division Manager (EDM) who then reports to the Ministry and other relevant stakeholders.</p>

Community	Secondary schools, District education offices, Education division office, Ministry of Education, Donor community and other stakeholders.
Rules and Regulations	<p>Policies: National Education Policy, Malawi National Education Sector Implementation Plan (NESIP)</p> <p>Standards: Data collected at different intervals subject to requirements following National Education Standards. Some data collected every year, every term, every quarter, every month and some as required. Head teachers approve data from schools before reporting to SHED and only SHED can report on behalf of the Ministry to other stakeholders.</p> <p>Strategies: Data Officers appointed in each school by respective management. KoboCollect was introduced to facilitate easy data collection at any time.</p>

The findings demonstrate that despite their ability to collect data for their sections directly from the schools, heads of sections frequently depend on the Planning section to provide them with the necessary data. One of the participants explained, *“oftentimes, I get data from our Planning Officer.”* KoboCollect was also introduced to address the issue that SHED also needs dynamic data from secondary schools which may not always be readily available. One participant elaborated,

“Sometimes we receive additional dynamic data from the secondary schools and the data we require for day-to-day operations at SHED is not always readily available, therefore we introduced Kobo Collect as a tool to address these issues.”

Apart from KoboCollect, different software applications are also used to collect data in different formats and in some cases some data is collected manually making data integration very difficult.

4.2 Data Storage Activity System

The collected data at SHED is stored awaiting to be processed or after processing. Both digital and manual tools are used for data storage. As summarised in Table 2, the data storage involves subjects, tools, division of labour, community, and rules and regulations.

Table 2: Data Storage Activity System

Component	Description
Subjects	<p>Data officers: Store data collected from their respective schools.</p> <p>Heads of Sections: Store data for their respective sections. The Planning section stores data received from schools and all the sections.</p>

Tools	<p>Digital Tools: Computers, Laptops, Smart Phones, Hard drives, Flash disk drives</p> <p>Physical Tools: Physical forms such as student registration forms and staff data files are kept in filing cabinets.</p> <p>Other Tools: Government information systems such as EMIS and IFMIS have integrated databases that are used to store educational and financial data respectively.</p>
Division of Labour	<p>Data Structuring: Data Officers in the schools and Officers in the Planning section define the data formats.</p> <p>Physical Filing: Data Officers and Head teachers organise the data in files in the schools. At SHED, the Human resource section, specifically those in the Registry are responsible for filing.</p> <p>Data Archiving: Physical archiving done by Data Officers and Head teachers at the school and at the division, Planning section in coordination with those in the Registry.</p> <p>Data Backup: Data Officers and the Planning Section are responsible.</p>
Community	Secondary schools, Sections at SHED, Ministry of Education and other stakeholders.
Rules and Regulations	<p>Policies: National Education Policy, Malawi National Education Sector Implementation Plan (NESIP)</p> <p>Standards: Data only archived after 7 years. The Department of Archives under National Archives provides guidance on archiving of physical files.</p> <p>Strategies: 1TB Hard drive purchased for data backup at the division. Schools and SHED identify places for physical data archiving.</p>

In terms of data storage, SHED does not have adequate facilities for archiving digital data as one of the participants commented: *“So far we don’t have the necessary facilities for data archiving.”* This also extends to physical archiving where sometimes the division is forced to request for space from the secondary schools as expressed by one of the participants:

“Sometimes when we want to archive data, especially physical records, we ask for schools with space, and we keep the files there. However, we have had challenges where termites have destroyed our files”

4.3 Data Analysis Activity System

The data collected from schools is analysed at SHED mostly using Excel. Table 3 provides a summary of the subjects, tools, division of labour, community, and rules and regulations.

Table 3: Data Analysis Activity System

Component	Description
Subjects	Heads of Sections: Analyse data for their respective sections but the Planning section specifically the Planning Officer and Statistician analyse most of the data
Tools	Digital Tools: Excel is mostly used to aggregate, summarise, sort, merge and filter data. Excel is also used to visualise data in the form of tables and graphs. ArcGIS is used for spatial data analysis.
Division of Labour	Data Cleaning: Planning Officer and Statistician check data for omissions, duplicates and irrelevant data. Data Processing: The two Officers use Excel formulas and functions to transform the data into information. Data Interpretation: The two officers create tables and graphs to demonstrate trends and patterns.
Community	Sections at SHED
Rules and Regulations	Policies: No specific policies available. Standards: No specific standards available hence analysis is done subject to available data and capability of the two officers involved. Strategies: Data is usually cleaned as soon as it is received. Sometimes past data used to check for omissions in received data and omitted data sometimes generated from available raw data using formulas.

Since SHED mostly uses KoboCollect to collect data from the schools, the data is usually exported to Excel for better analysis since KoboCollect is limited. Despite the use of Excel for data analysis, most of the analysis done is very basic as it is self-taught as elaborated by a participant;

“We mostly use Excel for data analysis, but we can’t say we use it perfectly well. We are very far from it, but we are trying to teach ourselves on how to do it”

Similar sentiments were also shared by another participant with respect to analysis of spatial data:

“There is still a need for GIS software and training as most of us do not possess the expertise required to fully utilise the software.”

4.4 Information Dissemination Activity System

The information generated from the analysis needs to be shared with relevant stakeholders for decision making. Both Digital and Physical tools are used to share information and Table 4 provides a summary of the subjects, tools, division of labour, community, and rules and regulations.

Table 4: Information Dissemination Activity System

Component	Description
Subjects	<p>Heads of Sections: Each Head of section is responsible for reporting to other sections, including the Planning section. The Planning Officer reports to the Education Division Manager (EDM) on behalf of the different sections but sometimes the Heads can directly report to the EDM. The EDM then disseminates information with other stakeholders on behalf of the division.</p>
Tools	<p>Digital Media: Several internet-based applications including Emails, Whatsapp, Google Meet and Zoom are used to share information in different formats. Google Meet and Zoom are usually used for online meetings where Microsoft PowerPoint can also be used to enhance the presentations. Flash disks are also used to share information sometimes.</p> <p>Printed Reports: Physical reports submitted to stakeholders upon request.</p> <p>Others: Some reports are shared verbally during physical meetings.</p>
Division of Labour	<p>Information Generation: Heads of sections generate information for their respective sections with assistance from the Planning section.</p> <p>Information Distribution: Heads of section share information about their sections with the Planning section. The Planning section then shares this information with the EDM for sharing with stakeholders.</p> <p>Information use: Different stakeholders use it based on their needs and requirements.</p>
Community	<p>Secondary schools, District Education Offices, Education Division Office, Ministry of Education and Donor community.</p>
Rules and Regulations	<p>Policies: No clear policies however, SHED is mandated to share data on behalf of the Ministry from the schools.</p> <p>Standards: Reports generated in four categories; Annual, Quarterly, Monthly and Ad Hoc.</p> <p>Strategies: Use of Whatsapp groups to facilitate easy and faster sharing of information.</p>

Most of the information is distributed using internet-based applications such as Email and Whatsapp which require internet connectivity which is a challenge especially in the secondary schools with only 13% of the schools having internet connectivity. In addition to the same, most of the laptops used in the schools are personal which raises issues related to data accessibility, availability and security.

5.0 Discussion

From the study, data management at SHED includes four key activities; data collection, storage, analysis and information dissemination. Although SHED possesses modern ICT infrastructure in the form of desktops, laptops, smart phones and internet connectivity to facilitate data management activities, different applications are being used leading to data integration and sharing challenges. However, the implementation of BI has got potential to improve data management as it can provide quicker and easier access to fragmented information in different formats from multiple sources thereby improving decision making (Abai et al., 2019; Wang and Harbert, 2015; Wieder Ossimitz, 2015 and Watson and Wixom (2007).

For BI implementation to be successful it requires appropriate IT Infrastructure, relevant system architecture and quality data (Merhi, 2021; Kumar and Krishnamoorthy, 2020; Müller *et al.* 2020). From the findings of the study, most of the data is collected from the schools which are the most resource constrained hence most of the analysis is mostly done at SHED. SHED has adequate IT infrastructure but most of its computer systems are disintegrated therefore there is a need to develop a data warehouse to facilitate data integration and easy sharing of data. There are several data warehouses architectures in existence, but the hub and spoke architecture is more suitable for SHED because most of the sections require common structured data with some few unique data. The hub and spoke architecture would facilitate easy retrieval of large amounts of data, scalability (Maier, 2013) and maintenance (Ariyachandra & Wilson, 2008).

Apart from IT infrastructure, the development of the data warehouse also requires necessary expertise which can be quite expensive (Aziz *et al.*, 2014; Murthy, Balaji and Sontakke, no date). Currently SHED does not have the necessary expertise required to develop and maintain a BI solution. Therefore, the use of a secure cloud solution and outsourcing in combination with readily available quality data and resources such as Excel would be ideal as it would minimise the cost and complexity of implementation (Bange, Eckerson 2017; Fedouaki, Okar, El Alami, 2013). However, the use of Excel for BI will require advanced power tools which would require further training in data analysis using advanced Excel tools and ICT support.

6.0 Conclusion

In conclusion, secondary education still faces challenges in terms of data management, specifically data integration, analysis and visualisation which

can be addressed by BI. However successful BI implementation requires adequate IT infrastructure, proper architecture, data quality and expertise which is very costly. However, outsourcing and the use of cloud solutions in combination with already existing software solutions such as Excel with additional power tools can facilitate the successful implementation of BI at SHED. To ensure its sustainability, development of local expertise through the provision of training in data analysis and ICT support is required at SHED.

References

- Abai, N.H.Z. *et al.* (2019), “Integrating Business Intelligence and Analytics in Managing Public Sector Performance: An Empirical Study”, *International Journal on Advanced Science Engineering Information Technology*, Vol. 9 No. 1, pp. 172 – 180.
- Adamala, S. and Cidrin, L. (2011), “Key success factors in business intelligence”, *Journal of Intelligence Studies in Business* 1, pp. 107-127.
- Ain, N.U. *et al.* (2019), “Two decades of research on business intelligence system adoption, utilisation and success – A systematic literature review”, *Decision Support Systems*, Vol. 125, pp. 1–13.
- Alasiri, M.M. and Salameh, A.A. (2020), “The impact of business intelligence (BI) and decision support systems (DSS): Exploratory study”, *International Journal of Management*, Vol. 11 No. 5, pp. 1001–1016.
- Altynpara, E. and Bestaiva, D. (2023), “Implementing Business Intelligence in 2024: The Utter Roadmap”, *Cleveroad 10th March 2023*. Available at: [The Full Guide on Business Intelligence Implementation in 2024 \(cleveroad.com\)](https://www.cleveroad.com/guide-on-business-intelligence-implementation-in-2024) (Accessed: 20 April, 2024).
- Apraxine, D. and Stylianou, E. (2017), “Business intelligence in a higher educational institution: The case of University of Nicosia”, *2017 IEEE Global Engineering Education Conference (EDUCON)*, pp. 1735 –1746.
- Ariyachandra, T. and Watson, H. J. (2008), “Which data warehouse architecture is the best?”, *Communications of the ACM*, Vol. 51 No. 10, pp.146 - 147.
- Ariyachandra, T. and Watson, H. (2010), “Key organisational factors in data warehouse architecture selection”, *Decision Support Systems*, Vol. 49 No. 2, pp. 200-212.
- Azeroual, O. and Theel, H. (2018), “The Effects of Using Business Intelligence Systems on an Excellence Management and Decision-Making Process by Start-Up Companies: A Case Study”, *International Journal of Management Science and Business Administration*, Vol. 4 No. 3, pp. 30 – 40.
- Aziz, A.A. *et al.* (2014), “A framework for Educational Data Warehouse (edw) Architecture using Business Intelligence (BI) technologies”, *Journal of Theoretical and Applied Information Technology*, Vol. 69 No. 1, pp. 50 - 58.

Bange C. and Eckerson W. (2017) *BI and Data Management in the Cloud: Issues and Trends*, BARC Research Study.

Blažic, G., Pošic, P., and Jakšic, D. (2017), "Data warehouse architecture classification", *Information and Communication Technology, Electronics and Microelectronics (MIPRO), 2017 40th International Convention* (pp. 1491-1495). IEEE.

Boonsiritomachai, W. (2014) *Enablers affecting the adoption of Business Intelligence: a study of Thai small and medium-sized enterprises*, Doctoral dissertation, Victoria University, New Zealand.

Breslin, M., (2004), "Data Warehousing Battle of the Giants: Comparing the Basics of the Kimball and Inmon Models", *Business Intelligence Journal*, Vol. 9 No. 1, pp. 6 – 20,

Fedouaki, F., Okar, C. and El Alami, S. (2013), "A maturity model for Business Intelligence System project in Small and Medium-sized Enterprises: an empirical investigation", *International Journal of Computer Science Issues (IJCSI)*, Vol. 10 No. 6, p.61.

Green, J., et al. (2007), "Generating Best Evidence from Qualitative Research: The Role of Data Analysis", *Australian and New Zealand Journal of Public Health*, Vol. 31 No. 6, pp. 545-550.

Herter, G.L. and Yang D.K. (2022), "Business Intelligence for the Education Sector: A Review of Literature and Practice", *Journal of Educational Technology & Society*, Vol. 25 No. 1, pp.30-45.

Jansen, C.S. and Brown, R.A. (2021), "The impact of Business Intelligence on the Decision-Making Process in Higher Education Institutions", *Educational Technology Research and Development*, Vol. 69 No. 4, pp. 1457-1476.

Javier, K. (2017), "Higher Education Meets Business Intelligence", Available at: <https://digitalcommons.wou.edu/>.

Kassim, A. (2018), "Business Intelligence in Developing Economies: A Case Study Approach", *International Journal of Business and Management*, Vol. 13 No. 7, pp. 112-130.

Kharade, J. and Pathan, I., (2022), "Role of Business Intelligence in Developing Countries", *International Journal of Scientific Research in Engineering and Management (IJSREM)*, Vol. 6 No. 6, pp. 1-6.

Kimball, R., et al. (2008) *The Data Warehouse Lifecycle Toolkit*, 2nd ed., Indianapolis: Wiley.

León-Barranco, A. et al. (2015), "Business Intelligence in Educational Institutions", *Research in Computing Science*, Vol. 96, pp. 45 – 53.

- Maghsoudi, M. and Nezafati, N., (2023), "Navigating the acceptance of implementing business intelligence in organisations: A system dynamics approach", *Telematics and Informatics Reports*, Vol. 11, p.100070.
- Merceedi, K.J. *et al.* (2022), "Analyses the Performance of Data Warehouse Architecture Types", *Journal of Soft Computing and Data Mining*, Vol. 3 No. 1, pp. 45-57.
- Merhi, M.I. (2021), "Evaluating the critical success factors of data intelligence implementation in the public sector using analytical hierarchy process", *Technological Forecasting and Social Change*, Vol. 173, p.121180.
- Müller, J. *et al.* (2020), "Success factors for implementing Business Analytics in small and medium enterprises in the food industry", *IEEE International Conference on Technology Management, Operations and Decisions (ICTMOD)*.
- Murthy, N., Balaji, A.K. and Sontakke, S., (n.d.) Outsourcing a Business Intelligence (BI) Program.
- Nasab, S.S., Selamat, H. and Masrom, M., (2015), "A delphi study of the important factors for BI system implementation in the public sector organisations", *Jurnal Teknologi*, Vol. 77 No. 19, pp.113 -120.
- Ndiku, J.M., Oyoo, O.N. and Owano, A. (2014), "Student Data Management and School Decision Making in Kenya", *International Journal of Education and Research*, Vol. 2 No. 6, pp. 577-590.
- Olszak, C. M. (2016), "Toward better understanding and use of Business Intelligence in organisations", *Information Systems Management*, Vol. 33, pp. 105 - 123.
- Olszak, C. M. and Ziemba, E. (2012), "Critical success factors for implementing business intelligence systems in small and medium enterprises on the example of upper Silesia, Poland", *Interdisciplinary Journal of Information, Knowledge, and Management*, Vol. 7, pp. 129-150.
- Owan, V.J. and Basse, B.A. (2019), "Data Management Practices in Educational Research", in Pearl Publishers International Ltd. Available at: <https://doi.org/10.13140/RG.2.2.16819.04647>.
- Ponniah, P., (2011) *Data warehousing fundamentals for IT professionals*, London: John Wiley & Sons.
- Rehman, K.U.U., Ahmad, U. and Mahmood, S., (2018), "A Comparative Analysis of Traditional and Cloud Data Warehouse", *VAWKUM Trans. Comput. Sci*, Vol. 6, pp.34-40.
- Rose, S., Spinks, N. and Canhoto, A.I. (2015) *Management Research: Applying the Principles*, London: Routledge.

Saunders, M.N.K., Lewis, P. and Thornhill, A. (2019) *Research Methods for Business Students*, London: Pearson Education Limited.

Thamir, A. and Poulis, E. (2015), “Business Intelligence Capabilities and Implementation Strategies”, *International Journal of Global Business*, Vol. 8 No. 1, pp. 34

Wieder, B. and Ossimitz, M.L. (2015), “The Impact of Business Intelligence on the Quality of Decision Making - A Mediation Model”, *Procedia Computer Science*, pp. 1163–1171. doi: <https://doi.org/10.1016/j.procs.2015.08.599>.

Wixom, B. and Watson, H. (2010), “The BI-based organisation”, *International Journal of Business Intelligence Research (IJBIR)*, Vol. 1 No. 1, pp.13-28.

ICT usage in secondary education management in Malawi: The case of Shire Highlands Education Division

Patrick Chikumba*, Tamara Mumba, Sarah Khudze, Mtisunge Malemia and Umali Leonard

Malawi University of Business and Applied Sciences, School of Science and Technology,

Department of Computer Science and Information Systems

**Contact person: tmumba@mubas.ac.mw*

Abstract

Purpose: Understanding and mastering ICT skills and concepts is part of the core of education alongside reading, writing and numeracy. In Malawi, NESIP 2020-2030 promotes the use of ICT-enabled pedagogy and some indicators include ICT as a tool in providing education services. Although the use of ICT in education is promoted at all levels, hinderance to usage of modern technologies still exist. Much have been discussed on ICT in Education in relation to teachers, learners and technologies. In addition, the education managers need modern technologies for their day-to-day work particularly in data management and communication. Hence, this paper aims at analysing how ICTs are used in the secondary education management in Malawi.

Methodology/approach: This is a case study using Shire Highlands Education Division (SHED) in which qualitative interpretive methods were adopted. Data was collected through interviews, observation, online questionnaires and artefact examination. Thematic analysis was adopted as the data analysis technique.

Findings: The secondary education management is in two levels – the education division office and secondary schools. SHED is very keen to make sure that ICT usage by its staff grows. SHED has modern desktop computers in each office with the access to local area network and Internet. They have Windows 10/11 with Microsoft Office 2013/2019. Printers are available in 9 out of 13 offices. While at the school level, there are few ICT facilities. For instance, some secondary schools have computer laboratories (20%), internet connectivity (13%), desktop computers (37%), printers (68%) laptops (62%) and smartphones (100%). Even other schools (18%) offer Computer Studies in Forms 1 to 4. However, there is lack of expertise in terms of installation, management and maintenance of these ICT facilities.

Discussion: Although there are a number of ICT initiatives at both education division and school levels, SHED needs a lot of support and guidance for successful and sustainable ICT implementation, management and use.

Recommendations: For successful and sustainable ICT implementation, these are key recommendations: (1) digital skills and computer maintenance training; (2) ICT

rehabilitation; (3) enhancement of local ICT expertise and support; and (4) establishment of strong partnership with other institutions for support.

Conclusion: The expectation is that an active participation and initiatives of education divisions and schools are required to enhance ICT implementation. However, due to financial and expertise constraints among other factors, they cannot afford on their own to implement ICT initiatives. Hence, partnerships with other institutions are required.

Keywords: ICT for Education; ICT Infrastructure; local ICT expertise; secondary education management

1.0 Introduction

Information and Communication Technologies (ICTs) influence all aspects of life including education in which they provide opportunities in adapting learning and teaching to individual needs of students and teachers. Introducing ICT as a tool to support the education sector has initiated substantial discussions since the late 1990s (Chikumba, 2011). In Malawi, some policies promote the use of ICTs in different sectors and disciplines including education. For example, as emphasised in Malawi 2063, ICT is one key component of the national economic infrastructure as a key enabler to the inclusive wealth creation agenda. Hence, the Malawian population is required to be ICT literate which is achieved through education and training. NESIP 2020-2030 promotes the use of ICT-enabled pedagogy and institutionalisation of ICT in teachers' and curriculum development. Malawi National Education Policy of 2013 proposes complementary schemes to increase access to education and one scheme is Open Distance Learning (ODL) which requires the use of ICT.

Although the use of ICT in education at all levels is promoted, in Malawian secondary schools, challenges exist that hinder the utilisation of modern technologies, including lack of ICT expertise and facilities, and inadequate maintenance of available ICT facilities. In addition, many public universities are moving towards open-distance and electronic learning (ODeL) to widen access to education. However, at the secondary school level, much has not been done to prepare the school leavers for the ODeL as the higher education delivery method. Due to challenges such as financial and expertise constraints, public secondary schools cannot afford on their own to implement ICT initiatives. The expectation is that active participation and initiatives of schools are required to enhance ICT implementation at secondary schools. ICT in Education requires the whole school workforce having at least basic ICT skills and knowledge to provide necessary support to students in using ICT in academic activities.

From this background, this paper aims to answer the following research question: How ICTs are utilised in the secondary education management in Malawi? The research used the case of Shire Highlands Education Division (SHED) among six education divisions. Other five education divisions are South East Education Division (SEED), Central West Education Division

(CWED), Central East Education Division (CEED) and Northern Education Division (NED). Each education division has education districts in which secondary schools reside.

The rest of paper includes the related literature in the second section, which is followed by the research methodology in the third section. The fourth section contains results. The fifth section contains discussions. Conclusions are in the sixth section.

2.0 Related literature

The use of ICT in education is an essential element of the educational environment (Hernandez, 2017) and this ICT includes computers, the Internet, and electronic delivery systems such as radios, televisions, and projectors (Fu, 2013). In this paper, the focus is on computers, the Internet and smart devices such as smartphones. The argument is that since ICT is an excellent information-processing tool and schools are information and knowledge holding institutions, ICT is fundamental information management tool at all levels of an educational system and learners need to become competent in their use (Mikre, 2011). ICT in education can be seen from two different and distinct aspects: teaching ICT itself and using ICT as an augmented tool to the existing teaching methods (Meenakshi, 2013).

2.1 Reasons of Implementing ICT in Education

ICT is implemented in an education system for various reasons and some are:

1. to implement the principle of lifelong learning/education as sustainable development goals (SDGs) promote lifelong learning (United Nations, 2015);
2. to promote equal opportunities to obtain education and information to achieve Education for All (United Nations, 2015; Ministry of Education, 2013);
3. to promote technology literacy of all citizens, especially students, that is, all learners are to acquire ICT knowledge and skills needed to promote sustainable development (United Nations, 2015; Government of Malawi, 2013);
4. to increase a variety of educational services and medium/methods, that is, providing opportunities for increasing access to education (United Nations, 2015; Ministry of Education, 2013);
5. to develop a system of collecting and disseminating educational information (Ministry of Education, 2013);
6. to develop distance education with national contents, for example, the introduction of open distance and e-learning (ODEL) in secondary schools (Ministry of Education, 2013); and

7. to promote the culture of learning at school; i.e. promoting student-centred learning (United Nations, 2015; Ministry of Education, 2013).

In order to achieve these, secondary schools need to utilise the benefits and also find strategies of minimising the limitations of ICT use in education.

2.2 Benefits of ICT in Education

One key benefit of using ICT in education is to facilitate the acquisition and absorption of knowledge by learners. ICT has opened access to knowledge in many ways (Mikre, 2011), for example, through the Internet, since multiple resources are abundant on the Internet. ICTs assist learners in accessing digital information efficiently and effectively leading to learner-centered and self-directed learning (Fu, 2013). That is, ICT in education has created a new learning environment where students take responsibility for their own learning (Hernandez, 2017). The understanding is that ICT has made learning to depart from traditional approaches since learning is a going lifelong activity where learners change their expectations by seeking knowledge (Fu, 2013). From the data management perspective, ICT has revolutionized the way information is obtained, managed and interpreted in educational systems (Hernandez, 2017). To utilise ICT in education, learners and teachers should be imparted with necessary ICT knowledge and skills. The gradual progress in using computers can be in three phases: learning about computers, learning computers, and learning with computers.

Another key benefit is using ICT in education is to facilitate the equalisation strategy since policies in education promotes equitable access to education (United Nations, 2015; Ministry of Education, 2013). Particularly, ICT offers developing countries unprecedented opportunities to enhance educational systems for equitable access to quality education. However, the reality of the digital divide provides a huge difference in the use of ICTs, which makes the introduction and integration of ICT in education to be the most challenging undertaking (Mikre, 2011).

2.3 Challenges of ICT in Education

Challenges of ICT in education can be categorized as teacher-related, student-related and technology-related (Fu, 2013; Hernandez, 2017). Teachers are to be the main motivators and initiators of ICT implementation in schools. Their ability to structure the learning environment is critical for the successful integration of ICT into education. One key teacher-related challenge is the lack of ICT knowledge and skills due to a lack of adequate in-house training and technical support. It is important to provide effective, timely and continuous training to improve teachers' ICT skills and knowledge and offer necessary technical support when needed. Basically, teachers' role needs to be structured in order to effectively support ICT implementation in education.

As a result of being born into a high-tech society, students are treated as new educational agents who need the necessary support from other stakeholders. Some main challenges associated with ICT use in education are student

mobility, lack of technical skills, and insufficient number of academic advisors, among others. There is a need to provide educational mechanisms that encourage students to acquire specific technical skills to facilitate learning in ICT environments.

In developing countries, the use of computers and the Internet in education is still in its infancy due to limited infrastructure and high costs of access. Some challenges faced by schools are as (a) a lack of appropriate hardware, software, materials, and maintenance of ICT facilities; (b) high costs of acquisition and maintenance of the Internet and ICT facilities; and (c) interruptions of internet connections and poor supply of electric power.

Planning for ICT integration into education needs a special understanding of hardware and software specifics related to the curriculum. In addition, staff development and teacher training are also indispensable to supporting the curriculum with technology integration.

2.4 ICT Systems in Secondary School as a Social System

In this paper, ICT systems in secondary schools are conceptualised as social systems. That is, ICT systems cannot be implemented in secondary schools without people and organisations. A better understanding of how secondary school stakeholders work and social practices and organisation culture in which they are engaged helps to get a better understanding of the ICT systems development, implementation, use, and research.

3.0 Research Methods

Qualitative interpretive and case study methods were adopted using the case of the Shire Highlands Education Division (SHED) which was conveniently selected. Data was collected using interviews, artefact examination, observations and questionnaire. Using multiple data sources and methods ensured triangulation of findings (Saunders et al., 2019; Rose, Spinks & Canhoto, 2015). Semi-structured interviews were conducted at the education division (SHED) office and four district education offices (see Table 1). The data collected was related to data management, ICT infrastructure and secondary schools. Interviews are the important data source which enable researchers to examine the interpretations of participants in some details (Walsham, 1995).

Table 1: Interviews conducted in SHED

Site	Date	Participants	Interviews
SHED	21 st July 2022	Education Division Manager, Planning Officer, Desk Officer, and 5 Heads of Sections	2
	29 th June 2023		
Chiradzulu	24 th August 2022	2 District Education Managers (DEM), Director of Education	5
Mulanje	2 nd September 2022		
Thyolo	8 th September 2022		

Phalombe	15 th September 2022	Youth and Sports (DEYS), District EMIS Officer (DEMISO), and Chief Education Officer	
----------	---------------------------------	--	--

Artefact examination was conducted in two ways: (a) assessment of ICT facilities at SHED and (b) Computer Studies curricula and examination papers. The data was collected at SHED through physical inspections of ICT facilities, which were conducted on 29th June 2023 from 10:00 am to 12:30 pm. Each office was visited and desktop computers, printers, local area network and Internet connectivity were assessed. Computer Studies curricula for Forms 1 to 4 and MSCE examination papers. The examination papers included Paper I and Paper II of the year 2022 and Paper II of the year 2023. Paper I is the theory paper while Paper II is the practical paper. Norum (2008, p. 25) refers to artefacts as “things that societies and cultures make for their own use” including written texts (e.g., documents, diaries, memos, letters), archival records, and those in the form of film, television, and music.

Observations were done during the installations of new computers at the SHED office on 7th July 2023 and Excel training with SHED staff and four teachers from Mulanje Secondary School on 23rd, 24th, 30th November and 1st December 2023 (see Figure 1).



Figure 1(a): MUBAS Technician installing new computers at SHED office

Figure 1(b): Excel training with SHED staff and teachers at Mulanje Secondary School

To assess ICT initiatives and usage in public secondary schools, an online questionnaire was distributed to 124 secondary schools which involved (a) ICT facilities; (b) data management practices; (c) digital platforms for teaching, learning, data or class management; and (d) challenges related to ICT usage and initiatives. The questionnaire was created and distributed using KoboCollect. Out of 124, 104 secondary schools answered the questionnaire; representing 84%.

The authors used thematic analysis to analyse the qualitative data by following four steps as suggested by Green et al. (2007): *immersion in the data* (authors familiarised themselves with the data); *data coding* (authors

examined and organised the data into significant groups and applied descriptive labels to data segments); *creating categories* (authors gradually brought similar codes under a set to create coherent categories); and themes identification (authors identified themes from the categories guided by three concepts of the social system – human, organisation and technology).

4.0 Results

Results are categorised into ICT facilities and technologies in data management at both education division and school levels and associated challenges and initiatives. SHED office interacts with various stakeholders including district education offices and secondary schools. By January 2024, SHED had 126 secondary schools which are in four education districts of Chiradzulu, Mulanje, Thyolo and Phalombe being headed by District Education Managers (DEMs). Majority of secondary schools are community day secondary schools (CDSS). Secondary schools are the key source of data which is mainly processed at the education division level.

4.1 ICT Facilities

SHED is very keen to make sure that ICT usage by its staff grows. Each office at the education division office has been provided with desktop computers which are on the local area network (LAN) and Internet. Their processors range from i3 to i7 and operating systems are mainly Windows 10 and Windows 11 with Microsoft Office 2013 and 2019. Printers are also available in 9 out of 13 offices. SHED uses the Government-wide area network (GWAN) as the main internet service provider. However, if there is a challenge with GWAN, SHED uses WiFi and MiFi routers. During the Excel training, every participant from SHED office brought modern laptops with MS Windows 10 and MS Office 2019. Table 2 summarises the availability of computers and internet connections at SHED and education districts.

Table 2: Availability of computers and internet connections at SHED and education districts

Site	Availability of computers	Availability of Internet
SHED	<ul style="list-style-type: none"> • Desktops and laptops in each office 	<ul style="list-style-type: none"> • GWAN for IFMIS but connected to few computers • Wi-Fi/MiFi routers for Internet connection
Chiradzulu	<ul style="list-style-type: none"> • Few desktops and laptops in offices and donated by partners 	<ul style="list-style-type: none"> • No functional network and Internet connection • GWAN installed but not functional due to the

		malfunction of some connection devices <ul style="list-style-type: none"> • Personal mobile phones as Internet hotspots
Mulanje	<ul style="list-style-type: none"> • Desktops and laptops in each office 	<ul style="list-style-type: none"> • No functional network and Internet connection • Wi-Fi and mobile hotspots to access the Internet
Phalombe	<ul style="list-style-type: none"> • Few desktops and laptops in offices 	<ul style="list-style-type: none"> • No functional network and Internet connection • Personal mobile phones as Internet hotspots
Thyolo	<ul style="list-style-type: none"> • Desktops and laptops in many offices 	<ul style="list-style-type: none"> • GWAN installed but for few offices • Personal mobile phones as Internet hotspots

In the context of secondary schools, for technologies to penetrate into secondary schools, ICT facilities need to be available at the schools. The expectation is that each secondary school should have at least a computer laboratory and Internet to support every student in his or her studies. However, secondary schools in SHED face several challenges to achieve this expectation. Out of 104 secondary schools in SHED, only 21 schools (20%) have computer laboratories. Interestingly, 13 out of 21 schools are CDSS. However, the average number of computers is 15 per school with a maximum of 40 computers. On average, only 66% of computers are functional due to, for example, a lack of expertise in terms of management of ICT facilities although 17 out of 21 schools (81%) have dedicated staff members to look after their computer laboratories. The computer laboratories need software and hardware upgrades and, in most cases, there are inadequate staff with necessary computer maintenance skills as one participant commented: “... *at our secondary school, we have the computer laboratory with donated computers ... however, they are not adequate to support all students who take Computer Studies ... even us we do not have adequate skills and knowledge of computer maintenance ...*”

Apart from computer laboratories, secondary schools need access to the Internet. However, it has been observed that it is one key challenge in secondary schools. As illustrated in Table 3, in SHED, the results show that 13% of secondary schools (14 out 104) have access to the Internet from which the majority get support from external organisations through certain projects.

However, this approach is not sustainable because after the end of projects secondary schools need to find other ways of maintaining the Internet access. There is lack of expertise in terms of installation, management and maintenance of these ICT facilities. Out of 104 only 28 schools (27%) indicated that they have members of staff having some expertise in computer installation and maintenance while the rest depend on the outsourcing which is becoming very expensive for schools.

Table 3: Other ICT Facilities in Public Secondary Schools in SHED

Response	PCs in Offices	Laptops	Smartphones	Printers	Internet	Local ICT Management
Yes	37%	62%	100%	68%	13%	27%
No	63%	38%	0%	32%	87%	73%

Apart from computer laboratories and the Internet, it has been observed that secondary schools in SHED have desktop computers (37%) and printers (68%) in some offices, and access to laptops (62%) and smartphones (100%) (see Table 2). Desktop computers are not available to all offices but mainly in head teachers' office, bursary office, examination room, staff room, school library, Accounts, General office, secretary's office and reception. Generally, printers in secondary schools are used for printing teaching materials, examination papers and reports, among others. During the data collection, SHED advised the authors to adopt KoboCollect for the questionnaire because almost all secondary schools have access to smartphones as one participant said: "... we have been using the KoboCollect for some time when we want to collect data from our secondary schools ... they have smartphones... so we encourage you to follow the suite ... it is fast and convenient way of collect data ...". On average, there are 17 smartphones per school with the minimum of 1 and maximum of 39 smartphones. However, these are individual smartphones.

ICT initiatives require the personnel with adequate knowledge, experiences and skills to use and manage implemented ICT solutions; and in some cases, even design, develop, test and implement ICT systems. As observed at SHED and four district education offices, there is a need to have ICT expertise to both use and management of ICT solutions and systems. However, there is inadequate ICT expertise among the staff members. Some staff build ICT expertise through self-initiatives. The education offices generally get the ICT support from Management Information Systems Officers (MISOs) from their respective District Councils when a need arises.

4.2 Computer Studies in Secondary Schools

Computer Studies is offered from Forms 1 to 4, the content covers computer fundamentals, application software, communication networks, personal computer management and maintenance, and programming techniques and logical methods. In SHED, out of 104 secondary schools, only 19 schools offer

Computer Studies in Forms 1 to 4; representing 18%. In terms of students, on average, a school has 85 students studying Computer Studies. In terms of teachers, 17 out of 19 schools have qualified teachers for Computer Studies; representing 89%. With reference to the Computer Studies curricula, to deliver this subject, every secondary school needs various resources such as computers, Microsoft Office, operating systems, input devices, videos, Internet, output devices, storage devices, antivirus software, communication devices, motherboards, and technician's toolkits. However, secondary schools do not have much of these technologies and facilities.

Computer Studies in secondary schools is one approach of making sure that Malawian population is computer literate towards the country's socio-economic development. The content of Computer Studies covers the basics of ICT that are needed for someone to use computers at the workplace and day-to-day personal activities. However, the Computer Studies curriculum is missing some important basics according to the advances of technologies today. For instance, there is a need for social media, digital communications and e-services to be emphasised in the computer education. The authors also consider emerging technologies to be part of the Computer Studies curriculum so that students can learn some important new technologies in their societies.

4.3 Technologies for Data Management

Data management consists of a wide range of practices and methodologies adopted for the purpose of leveraging data. Most data at SHED are generated from secondary schools. SHED requires different types of data concerning secondary school learners, teachers and facilities. The data include student enrollments, dropouts, school performance, university selection, sporting activities, staffing and infrastructure development, among others. Usually, data is collected from secondary schools at regular times (annually, every term, and monthly) and as required through printed questionnaires, physical visits and technology tools such as KoboCollect, phone calls, WhatsApp and emails. To enhance data management, SHED appointed one teacher at every secondary school as a Data Officer responsible for school data management.

The data and information are stored in three different ways namely physical files, digital files and archives. Usually, SHED uses physical files to store and distribute data and information since most processes are not computerised yet. However, due to the promotion of digitalisation in the public sector, there are some information systems that are also used to store and process data such as Education Management Information System (EMIS) and Integrated Financial Management Information System (IFMIS). SHED also uses KoboCollect and Microsoft Office applications to process and store data and information. Likewise, in education districts, the data and information are stored as physical and digital files. The storage devices include hard drives, Google drive, CDs and flash disks. Most data and information are stored in personal desktop and laptop computers. For data processing, a number of systems are used such as standalone systems (SPSS, CSPro, Microsoft Office and ArcGIS), mobile app (RTDM, ODK), and web systems (EMIS and IFMIS).

5.0 Discussion

Literature of ICT in Education has mainly discussed challenges in the context of teaching and learning in relation to expertise and technology (Fu, 2013; Hernandez, 2017; Mndzebele, 2013), which has also been observed in this study in the context of education management. ICT in education requires access to relatively expensive hardware, software and communication technologies (Crawford, 1999; Salim, 2007). Even in Swaziland, the government is failing to fully implement ICT in schools because of a lack of teachers' ICT knowledge and skills, lack of equipment and its maintenance, availability of Internet only in urban areas, and insufficient funds (Mndzebele, 2013). Apart from teacher-, student- and technology-related challenges (Fu, 2013; Hernandez, 2017), challenges related to education management needs to be considered. Hence, from the education management perspective, two key challenges have been identified – poor ICT infrastructure and lack of ICT expertise that require some interventions.

The paper has suggested two key interventions to enhance ICT expertise and infrastructure as assessment of ICT infrastructure and digital skills training at both division and district education offices. The ICT infrastructure assessment includes computer hardware and accessories, Internet connectivity and software applications. There is a need to assess these computers including accessories like printers to determine if they can accommodate modern software applications.

Nowadays, the Internet is critical in office and personal communications and information sharing. It has been observed that education officers cannot work without the Internet. Although SHED has Wi-Fi routers for some of its staff, only laptops and smartphones are connected to the Internet; that is, desktop computers in some offices need to be connected to the Internet. Using Wi-Fi routers and smartphone hotspots is more expensive to sustain than being connected to Government Wide Area Network (GWAN). Hence, it is necessary to assess how these computers can be connected to GWAN so other staff can also enjoy the privileges of the Internet.

It has also been observed that some education offices have introduced technologies to enhance data management, for example, KoboCollect at SHED. However, these are individual initiatives that need adequate support including technical assessments on how education officers can utilise self-introduced technologies like KoboCollect.

To utilise ICT in SHED, education officers need to have adequate expertise to use and manage technologies which is currently not the case. Hence, ICT training is critical to realize the benefits of ICT in SHED. This paper outlines three key areas of ICT training – digital skills, data analysis with Excel and computer maintenance.

- Digital skills are taken as the ability to find, evaluate, use, share, and create content using digital devices, such as computers and

smartphones. At education offices, staff need adequate digital skills in order to utilise ICT tools such social media, MS Office, email and the Internet.

- The ability to analyse data is a powerful skill that helps an officer to make better decisions. Microsoft Excel is one of the top tools for data analysis in SHED. Staff responsible for data analysis need to be well-trained. Most of them have had self-training in Excel.
- Education offices rely on MISOs and some cases DEMISOs (District Education Management Information System Officers) to provide basic ICT support. However, these officers do not have adequate knowledge and skills in computer maintenance which results in outsourcing ICT services from private firms for any required support beyond the capacity of MISO and DEMISO. This approach is expensive to the education offices.

6.0 Conclusion

The authors appreciate the challenges SHED is facing related to ICT utilisation. Despite the challenges and limitations, the authors also appreciate the efforts so far taken by SHED in embracing the use of technology in their capacity, such as the introduction of KoboCollect for collecting and analysing data from secondary schools. To support the effort by SHED, the authors propose to carry out interventions such as training and assessment of ICT infrastructure at the education offices through collaboration with, for example, local universities.

References

- Chikumba, P. A. (2011), "Student Performance in Computer Studies in Secondary Schools in Malawi", in Popescu-Zeletin, R. et al. (Eds.), *AFRICOMM 2010*, LNICST 64, pp. 113–121.
- Crawford, R. (1999), "Teaching and learning IT in secondary schools: towards a new pedagogy?" *Education and Information Technologies*, Vol. 4, pp. 49 – 63.
- Fu, J. S. (2013), "ICT in Education: A Critical Literature Review and Its Implications", *International Journal of Education and Development using Information and Communication Technology*, Vol. 9 No. 1, pp. 112-125.
- Government of Malawi (2013) *National ICT Policy*, Lilongwe: Government of Malawi.
- Green, J., Willis, K., Hughes, E., Small, R., Welch, N., Gibbs, L., and Daly, J. (2007), "Generating best evidence from qualitative research: the role of data analysis", *Australian and New Zealand Journal of Public Health*, Vol. 31 No. 6, pp. 545-550.
- Hernandez, R. M. (2017), "Impact of ICT on Education: Challenges and Perspectives", *Propósitos y Representaciones*, Vol. 5 No. 1, pp. 325-347.
- Meenakshi, P. G. (2013), "Importance of ICT in Education", *Journal of Research & Method in Education*, Vol. 1 No. 2, pp. 468 - 493.

Mikre, F. (2011), "The Roles of Information Communication Technologies in Education Review Article with Emphasis to the Computer and Internet", *Ethiopian Journal Education & Science*, Vol. 6 No. 2, pp. 109 - 126.

Ministry of Education (2013) *National Education Policy (NEP)*, Lilongwe: Government of Malawi.

Mndzebele, N. (2013), "Challenges Faced by Schools when Introducing ICT in Developing Countries", *International Journal of Humanities and Social Science Invention*, Vol. 2 No. 9, pp. 1-4

Rose, S., Spinks, N., and Canhoto, A. I. (2015) *Management Research: Applying the Principles*, London: Routledge.

Salim, R. (2007) Computer education at secondary school level: The Amader Gram Information Technology for Development (ICT4D) project.

Saunders, N. K. M., Lewis, P. and Thornhill, A. (2019) *Research Methods for Business Students*, London: Pearson.

United Nations (2015), "Transforming our world: the 2030 Agenda for Sustainable Development", Available at: <https://sustainabledevelopment.un.org/post2015/transformingourworld/publication> (Accessed on 9/01/2025).

Walsham, G. (1995), "Interpretive Case Studies in IS Research: Nature and Method", *European Journal of Information Systems*, Vol. 4, pp. 74-81.

Cultural fears towards the use of e-learning/blended learning (technology) amongst lecturers and students in medical institutions of higher learning post COVID-19

Uchizi Khoswe

Department of Basic Sciences

Malamulo College of Health Sciences

Malawi

Email: uchizikhoswe@gmail.com

Abstract

This paper aims to examine the perceived cultural fears that are there among lecturers and students in higher learning institutions towards e-learning/blended learning. The post-COVID-19 era has rapidly changed institutions of higher learning in Malawi. Most institutions of higher learning have resorted into the use of both online and classroom learning (blended). Blended learning approach is believed to be one of the learning models that are considered more effective for learning in this new normal era. This study was qualitative research with a phenomenological approach. Data was collected from 86 students through focus group discussions and 14 lecturers through in-depth interviews from Malamulo College of Health Sciences. Thematic analysis was used to analyse the data in the study. The results of data analysis indicated three major themes; under learning in the use of e-learning/blended learning, techno-phobia in the use of online learning platforms and conspiracy theories on the existence of COVID-19. The study concludes that while online learning can be a viable option in creating flexibility for the learners to take classes anywhere and at any time, but it fails to ensure that students are being equipped with knowledge and skills that are relevant, beneficial and enable them to exhibit best practice in their own future work endeavours.

Keywords: e-learning; cultural fears; medicine; post-COVID-19.

1.1 Introduction

At the onset of COVID-19 in the year 2020, most countries went on lockdown as a precautionary measure for avoiding the spread of the disease. This was no different for most schools and other service providers. To avoid a relapse in the provision of education, schools in Malawi went electronic and online to provide students instructional materials. However, in some schools, selected instructional materials were being offered through online teaching and learning due to the nature of the programs offered. Most of the materials provided online were theoretical in nature and few lessons were hands-on lessons. On the other hand, some schools went fully fledged online. For some schools, especially for universities that went online for teaching and learning,

electronic gadgets were a must for its students to access the instructional content.

Now that the pandemic is over, most bans have been lifted and things have gone back to normal. Schools too have now gone back to the traditional face-to-face way of teaching and learning. Due to the innovations and discoveries that were made during the lockdown in teaching and learning, some schools haven't completely abandoned e-learning. They have rather come up with a new method of teaching and learning known as blended learning. The blended learning model is a learning model that integrates technology into the learning process (Thahir *et al.*, 2023). Thus, it is a combination of online learning and face-to-face interaction. Under this learning model, teaching and learning allow the use of online learning resources; especially web-based ones, without leaving the traditional face-to-face activities. There have been reasons that have been cited as to why schools are taking onboard the blended learning approach. The first reason is that this is a new normal after COVID-19 and there have been innovations in education which has brought a revolution in instruction. Secondly, blended learning provides flexibility and increased interactive and communicative learning environment and provides meaningful learning outcomes (Garrison and Kanuka, 2004).

Despite all these innovations in teaching and learning, education doesn't take place in a vacuum; it is bounded by culture. Emile Durkheim considers culture as social facts that consist of ways of thinking, behaving and feeling that are imposed on the individual by the society in which he lives. These social facts work as a framework that shapes the individual's behaviour and controls it (Emile Durkheim, 1895). According to Edward Taylor, culture is that complex whole that includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society (Taylor, 1924(origin 1871)). So, based on this definition, culture depends heavily on society. Thus, it is subjective in nature. Therefore, according to Hatah, *et al.* (2023), different norms, beliefs and values are put in place to set behavioral patterns that are eventually related to thoughts, manners and actions, which members of society have shared and passed on to succeeding generations. These learned shared behaviours are the framework for understanding and explaining all human behaviour (Winkelman, 2009). As a part of a social institution, culture has a social significance in serving society by bringing group cohesion thereby maintaining society as a whole.

1.2 Problem statement

The advancements in technological innovations have been so fast at the onset of COVID-19. A lot of digitisation has happened like never before. Most institutions have taken onboard these innovations for the smooth running of day-to-day activities. This has not left behind the education sector. However, it should be noted that the society is apprehensive on some of the innovations that have taken place citing various reasons. Some reasons are a course for genuine concern while others are speculations. This paper seeks to establish the fears that most resonate with e-learning/blended learning in medical institutions of higher learning post-COVID-19.

1.3 Research objectives

This paper was guided by the following objectives

1. To define the influence of cultural beliefs on educational practices in Malawi.
2. To investigate the social-cultural factors contributing to attitudes towards COVID-19 and e-learning in Malawi.
3. To examine myths and fears surrounding COVID-19 and e-learning in the Malawian society.

1.4 Research questions

The study answered the following research questions:

1. What are the cultural beliefs on the definition of education in a society?
2. Do local cultural beliefs influence how communities perceive e-learning in education?
3. Are myths social determinants with respect to medicine and education?

2.0 Literature review

2.1 Defining education

Education is the process of acquiring knowledge, skills, values and attitudes through various forms of learning (Verma, *et al.* 2023). In most cases, teachers or adults are believed to be the ones to transmit knowledge to learners through teaching. The learners' role is to receive or acquire the knowledge being transmitted through the process known as learning. Learning is considered as a process through which a learner acquires both theoretical and practical knowledge that can help him/her in his/her life. It is also defined as a process that leads to change, which occurs as a result of experience and increases the potential of improved performance and future learning (Ambrose, *et al.* 2010).

Verma, *et al.* (2023) further states that education is both formal and informal. Formal education takes place in schools and training institutions using the curricula and syllabi. While on the other hand, informal education is done in homes or initiation camps whereby knowledge is mostly transferred from the older generation to the younger generation orally.

2.2 Defining COVID-19

In late 2019, the world had seen the emergence of flu like disease called Corona Virus Diseases-19 but popularly known as COVID-19. The disease

was known to be caused by a virus called corona. This virus originally existed and began to develop in Wuhan city, China. This virus outbreak spread very quickly to various countries so that the World Health Organisation (WHO) declared it a world pandemic. Most countries went on lock down as a preventive measure against the disease.

Malawi's COVID-19 response began before there were any confirmed cases in the country Tengtenga, *et al.* (2021). The first three cases were confirmed on 2 April 2020 in Lilongwe (Mzumara, *et al.* 2021). A special cabinet committee on coronavirus was established and it was mandated to receive updates about COVID-19 and relay these to the public. On 20 March 2020, Malawi made a declaration of a state of national disaster which was valid for three months (Tengtenga, *et al.* 2021). On 14 April 2020, the minister announced a planned nationwide lockdown to run from 18 April 2020 to 9 May 2020.

2.3 Cultural beliefs on educational practices

As stated earlier in this paper, education does not take place in a vacuum; it is bounded by culture. Therefore, all the cultural norms, beliefs and practices that are shared among the members of a society, are considered as a framework that guides and shapes teachers and students' behaviour in the school (Abdessallam, *et al.*, 2020). That is to say, culture has an impact on how people think, perceive, act and communicate all of which influence how teachers teach and how students learn (Chafi, 2017). These cultural norms and practices that are transmitted to schools' shape different teaching and learning methodologies, the choice of teaching and learning materials and teaching practices. That is to say, the cultural principles that a society holds about schools and education in general decides what role the teacher and the student should play and how should teaching and learning take place. This means that cultural and social conditions generate the methods and techniques of teaching in a powerful manner (Kumar, 2013).

2.4 Defining e-learning in Malawi

E-learning refers to the integration and utilisation of information technology tools such as computers, software and internet in the process of teaching and learning in education (Kayange, 2019). Having access to gadgets such as a laptop or a smart phone helps both teachers and learners in achieving smooth teaching and learning process. E-learning in Malawi was being offered in various universities usually to cater for distant learners. Over the years, it has grown due to the need to expand access to higher education, and the inadequacies of faculty teaching staff with pressure on the capacity of higher education institutions being so high (Chawinga & Zozie, 2016).

Recently, the COVID-19 pandemic has forced educational institutions such as universities to shift rapidly to distance and online learning (Almaiah *et al.*, 2020). This means that educational institutions are using a lot of ICT innovations in order to have smooth teaching and learning. Learning platforms have also been developed and put to so much use. However, Isaacs (2007) provides a summary of ICT development in Malawi in terms of enabling

or constraining features in the education system and he states that Malawi has a very poor and underdeveloped ICT infrastructure and very low levels of ICT access in education institutions. This finding concurs with Gama, *et al.* (2022) who did a literature review on e-learning in Malawi and stated that despite the few publications and sustainable e-learning research in Malawi, the review has found that technological, individual, financial and managerial challenges, impede the development of best practice standards for e-learning implementation.

On the other hand, Maatuk, *et al.* (2022) did a study targeting the society that included students and teaching staff in the Information Technology faculty at the University of Benghazi. In this study, the findings state that students believe that e-learning contributes to their learning. This reduces the instructor workload, however, and raises it for students. The teaching staff agrees that e-learning is beneficial in enhancing the skills of students, although it needs financial resources and the cost of implementing them is high.

2.5 Cultural Attitudes Surrounding e-learning post-COVID-19

Online media can provide multiple benefits for both staff and students in supporting students' learning experiences, particularly for isolated students (Salmon, 2011, 2014). Despite student acknowledgement of the benefits of supporting their learning through technology, a difficulty arises through the limits around the technical capability of the software particularly in terms of its functionality. As revealed through student feedback and experience from numerous online classes over several years, this can often be a source of frustration for students and facilitators/staff as it can make normally simple tasks such as viewing a video increasingly complex.

However, a study at University of Porto was conducted about various technical and social dimensions present in the conception and deployment of learning management systems, both in the context of supporting face-to-face education and as technical infrastructure to blended and distance learning programmes. A survey by questionnaire was applied to 504 members of the academic community at the university, and it was found that among the participants there is still great scepticism towards e-learning and technologically mediated education, especially among younger students. Participants also considered that learning management systems presenting a plethora of features are not as desirable as systems focused on providing a pleasant and consistent user experience. Morais, Morais & Paiva (2014)

3.0 Methodology

3.1 Research Approach

The study was a case study approach. It had the combination of open-ended data qualitative data and closed-ended data.

3.2 Theoretical framework

3.2.1 Phenomenological theory by Edmund Husserl

Creswell (2007) defined phenomenology as a study that “describes the meaning for several individuals of their lived experiences of a concept or a phenomenon” (p. 62). Phenomenological approach therefore recognises that lecturers and students have different interpretations towards their experiences in teaching and learning using blended approach (technology) based on their different life backgrounds which may include culture, norms and religion.

3.3 Design and Methodology

This study was qualitative research with a phenomenological approach.

3.4 Participants

Data was collected from 100 participants; 86 students (23 females and 23 males) and 14 lecturers (7 females and 7 males) from Malamulo College of Health Sciences, through focus group discussions and in-depth interviews. The students were sampled from all the programs offered at the institution (clinical medicine, biomedical laboratory science, public health and nursing and midwifery) whose teaching and learning were being offered both in class and online. A random selection of lecturers was done. These were lecturers who provided online lessons.

3.5 Instrumentation and administration

The main instrument for data collection was a focus group interview guide for students. For lecturers, interview guides were used with both open-ended and closed.

3.6 Data Handling and Analysis

The responses provided by the participants were collected through the physical administration of interviews and focus group discussions. The open-ended questions were analysed using themes. Thematic analysis is a data reduction and analysis strategy by which qualitative data are segmented, categorized, summarized, and reconstructed in a way that captures the important concepts within the data set (Given, 2008).

3.7 Ethical Considerations

Ethics in research addresses the issue of application of a system of moral principles to prevent harming or wronging others, to promote the good, to be respectful and to be fair (Sieber, 1993). In this study, consent was obtained from the institution and all participants taking part in the study. Participants of the study were given anonymity in the study.

4.0 Results

Below is a presentation of the findings of the study. The results have been presented by answering the research questions.

4.1 Cultural beliefs on the definition of education in a society

Participants from the study expressed that as compared to face-to-face learning, students and lecturers have not accepted to start learning using e-learning on a regular basis. This was evidenced in the number of lecturers who actually provide online lessons. Few lecturers use the online platform for lessons. Lecturers further stated that most courses are not taught online because e-learning needs a lot of resources to use than face to face teaching.

Furthermore, the results of the study showed that e-learning came at a time when not enough knowledge about e-learning and COVID-19 was clear. Schools adopted the online model of teaching and learning as a way of keeping students for the schools' finances to stay afloat. As a result, proper training on online learning platform was done haphazardly leading students to have little access to the facilities.

Students stated that in most societies, the health of an individual or household must be handled with utmost care. Some other views suggested that in medicine, proper instruction and training make up part of preparing medical personnel to take up different roles in the hospital. This includes how the health care providers are trained in the basic wellness and taking care of the home.

4.2 Local cultural beliefs influence on how communities perceive e-learning in education

Students expressed that hands-on experience in the clinical fields helps to bring about better understanding. As such, e-learning may compromise the development of essential clinical skills in students. Further to that, there is a lack of physical interaction between students and lecturers as lessons are done virtually. This was also echoed by the lecturers who stated that it proves difficult to teach practical lessons online. As a result, students will be half-baked health professionals since they may miss the hands-on experience.

Lecturers expressed that access to technology and learning resources for e-learning is a necessity in lesson delivery. Accessing these gadgets is difficult, especially for students coming in from less privileged families, necessary devices and internet access for remote learning; familiarity to the internet has had a huge impact on their mode of delivery. They further state that this has influenced the understanding of the importance of e-learning as a viable education tool.

4.3 Myths as social determinants with respect to medicine and education

People fear that those studying medicine through e-learning can be exposed to some information against the morals of the community. People fear that the information attained through e-learning will not be enough for one to be qualified medical personnel. As a result, there are fears that medical persons might not perform to the best of their abilities and issues of the safety of the patients might arise.

The participants from the study expressed that blended learning is a new concept in teaching and learning. Traditionally, teaching and learning has been face-to-face. Therefore, the provision and delivery of relevant instructions through e-learning platforms is a challenge. As such, both lecturers and students feel that there is more to learning as done online; as a result, students feel they are under-learning and this might affect their performance in the hospital setting.

Lecturers expressed that access to technology and learning resources for e-learning, necessary devices and internet access for online learning, and familiarity to the internet have had a huge impact on their mode of delivery. They further state that this has influenced the understanding of the importance of e-learning as a viable education tool. It was also learnt that the college takes part in making sure that lecturers are familiar with the online platform for teaching and learning. Lectures undergo regular in-service training so as to ensure the quality deliverance of instructional materials to learners.

5.0 Discussion

Below is the presentation of research discussions using themes. The themes in the study emerged from the participants' responses to the research questions. The emerging themes and issues from the analysed data formed the subtitles and the basis for interpretation and discussion.

5.1 Under learning

E-learning/ blended learning relies on providing teaching and learning instructional materials through the use of online learning domains. Both lecturers and students acknowledged that the use of online platforms is a new concept in teaching and learning. Some lecturers and students are well conversant with the online learning platforms while others are not so familiar with how to use the online learning platforms. As a result of this, teaching and learning instructions vary from one lecturer to another and from student to student. This has resulted in under-learning in some courses in which lecturers under-utilise the online learning system and students fail to get access to such materials.

The findings above conquer with Aung and Khaing (2015) who state that developing countries face many challenges in applying e-learning (Aung and

Khaing, 2015). E-learning is marred by poor internet connection, insufficient knowledge about the use of information and communication technology, and weak content development. Further to this, Aljawarneh, 2020 states that the provision of content such as video and advanced applications is still a new thing for many educators, even at the higher education level in developing countries. All these factors combined; lecturers end up uploading instructional materials that are not befitting the learners' level of knowledge. On the learners' part because of the absence of personal interactions between students and lecturers and also among fellow students most learners do not feel the urge to complete online tasks hence under learning takes place.

5.2 Techno-phobia

Both lecturers and students had fears in the use of technology in teaching. Technology is often associated with advancing secular beliefs on human life. Being a medical institution, the technology used in lesson delivery initiates critical thinking which in the end gives students a feeling that everything is possible. Critical thinking in education is seen as a sign of learning and application of knowledge to real-life events. However, the fear in advanced critical thinking was that human beings might end up playing the role of God.

The findings above concur with Siddiquei and Kathpal (2021). They state that the conventional view suggests that instructors and probably the textbook are the primary sources of students' information. From a phenomenological theorist's point of view, through lived experience, a textbook is the sole source of knowledge. Society has grown to familiarise itself with the textbook and has accepted that teaching and learning instructions come from a textbook. As a result, anything other than a textbook brings in confusion among educators and society as a whole. Therefore, the coming of advancements in technology to support teaching and learning is diluting the core and traditional way of instruction in education. As such, both students and lecturers find it a little difficult to wholesomely adopt the e-learning/blended model of teaching and learning. Lecturers and students would rather have a specific angle of how to use online learning systems which on the other hand results in underutilising the facility.

5.3 Conspiracy theory

Lecturers and students expressed some mythical explanations as to how COVID-19 is contracted and how it spreads. As a result of this, both lecturers and students question the numerous innovations that have also come with the pandemic stating that some may go beyond the line of moral ethical practice in medicine.

COVID-19 was and is treated as a public health concern. The World Health Organisation (WHO) in January 2020 announced COVID-19 as a public health crisis of worldwide importance (WHO, 2019). This development was coupled with a number of drastic measures to combat the disease. Institutions went on complete shutdown; travel bans were instituted and different countries started to manufacture vaccines just to mention a few.

From the different developments that took place due to the outbreak of COVID-19, most individuals failed to understand the existence of the diseases. Some of the demographic features such as behaviors and cultural background impact student education in the e-learning domain. Therefore, for lecturers to design educational activities to make learning more effective, they should understand these features.

6.0 Conclusion

The study concludes that teaching with technology is not a one-size-fits-all. The nature of courses being provided and the learners' abilities determine the approach to be taken when offering e-learning/blended model in teaching and learning as it depends on the types of technology in use at the time and also the curriculum content being taught.

In addition, the outbreak of COVID-19 has seen a shift from the traditional face-to-face way of teaching to that of virtual classroom. Technology has advanced this form of teaching and learning. Therefore, while online learning can be a viable option in creating flexibility for the learners to take classes anywhere and at any time, but it fails to ensure that students are being equipped with knowledge and skills that are relevant, beneficial and enable them to exhibit best practice in their own future work endeavours.

References

Abdessallam, K., El Ghouati, A. and Nakkam, J. (2020), "The Impact of Culture on Teaching: A Study of the Impact of Teachers' Cultural Beliefs and Practices on Students' Motivation", *International Journal of Innovation and Scientific Research*, Vol. 49 No. 2, pp. 2351-8014.

Aljawarneh, S. A. (2020), "Reviewing and exploring innovative ubiquitous learning tools in higher education", *Journal of Computing in Higher Education*, Vol. 32, pp. 57 – 73.

Almaiah, M. A., Al-Khasawneh, A., & Althunibat, A. (2020), "Exploring the critical challenges and factors influencing the E-learning system usage during COVID-19 pandemic", *Education and Information Technologies*, 1-20. <https://doi.org/10.1007/s10639-020-10219-y>

Ambrose, S. et al. (2010), "Seven Research-Based Principles for Smart Teaching: Challenges of implementing e-learning in developing countries: A review", *International Conference on Genetic and Evolutionary Computing*, Cham: Springer, pp. 405–411.

Chafi, M.E., Elkhouzai, E. and Ouchoud, J. (2016), "Teacher excessive pedagogical authority in Moroccan primary classroom", *American Journal of Educational Research*, Vol. 4 No. 1, pp.134-146.

Chawinga, W. D. and Zozie, P. (2016), "Increasing access to higher education through open and distance learning: Empirical findings from Mzuzu

university, Malawi”, *The International Review of Research in Open and Distance Learning*, Vol. 17 No. 4, 1–20.

Creswell, J. W. (2007) *Qualitative inquiry and research design.*, (2nd ed.), Thousand Oaks, CA: SAGE.

Durkheim, E. (1895) *The Rules of Sociological Method*, New York: The Free press.

Gama, L. C., Chipeta, G. T. and Chawinga, W. D. (2022), “Electronic learning benefits and challenges in Malawi’s higher education: A literature review”, *Education and Information Technologies*, Vol. 27, pp. 11201 - 11218.

Garrison, D. R. and Kanuka, H. (2004), “Blended learning: uncovering its transformative potential in higher education”, *The Internet and Higher Education*, Vol. 7, No 2, pp. 95 – 105.

Given, L. (ed). (2008) *The SAGE encyclopedia of qualitative research methods*, Volume 1 & 2, Los Angeles: SAGE.

Hatah, E., Lim, K. P., Ali, A.M., Mohamed Shah, N. and Islahudin, F. (2015), “The influence of cultural and religious orientations on social support and its potential impact on medication adherence”, *Patient Prefer Adherence*, Vol. 9, 589. doi: 10.2147/PPA.S82441

Isaacs, S. (2007), “ICT for Education in Malawi”, Survey of ICT and Education of ICT and Education in Africa: Malawi Country Report.

Kayange, A. K. (2019), “E-learning encounters in Malawi higher education institutions”, *International Journal for e-Learning Security (IJeLS)*, Vol. 8 No. 1, pp. 592–603.

Kumar (2013), “Culture and Education”, Récupéré sur <https://sol.du.ac.in/mod/book/view.php?id=1449&chapterid=1335>.

Maatuk, A.M., Elberkawi, E.K., Aljawarneh, S., Rashaideh, H. and Alharbi, H. (2022), “The COVID-19 pandemic and E-learning: challenges and opportunities from the perspective of students and instructors”, *Journal of computing in higher education*, Vol. 34 No. 1, pp. 21 - 38.

Morais, E. Morais, C. and Paiva, J. (2014), “Myths and Realities of E-Learning: exploratory survey of higher education students”, *E-Learning and Digital Media*, Vol. 11 No. 3, pp. 300 - 313.

Mzumara, G.W., Chawani, M., Sakala, M., Mwandira, L., Phiri, E., Milanzi, E., Phiri, M.D., Kazanga, I., O’Byrne, T., Zulu, E.M. and Mitambo, C. (2021), “The health policy response to COVID-19 in Malawi”, *BMJ global health*, Vol. 6 No. 5, p.e006035.

Salmon, G. (2011) *E-moderating: The key to teaching and learning online* (3rd ed.). London: Routledge.

Siddiquei, M.I. and Kathpal, S. (2021), "Challenges of online teaching during Covid-19: An exploratory factor analysis", *Human behavior and emerging technologies*, Vol. 3 No. 5, pp. 811 - 822.

Sieber, J. (1993), "The ethics and politics of sensitive research", in Renzetti, C. and Lee, R. M. (Eds.), *Researching sensitive topics*, London: SAGE, p. 4.

Taylor, E. (1924) (origin 1871) *Primitive Culture*, New York: Brentano's.

Tengatenga, J., Tengatenga Duley, S.M. and Tengatenga, C.J. (2021), "Zimitsani moto: Understanding the Malawi COVID-19 response", *Laws*, Vol. 10 No. 2, p. 20. The Crisis of Religious Freedom in the Age of COVID-19 Pandemic, p.149.

Thahir, M., Widiawati, W. and Baitillah, N. (2023), "The post pandemic education: A blended learning approach for teaching and learning in higher education in new normal era", *International Journal of Ethno-Sciences and Education Research*, Vol. 3 No. 3, pp.99-108.

Verma, A., Verma, K. and Yadav, V.R. (2023), "Education: Meaning, definition & types", *Agriculture Extension Education*, pp.1-6.

Winkelman, M. (2009) *Culture and Health: Applying Medical Anthropology*, San Francisco: Josses-Bass.

WHO: Coronavirus disease (COVID-2019) situation reports. Available from: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports> (Accessed 14/8/2020).

ENVIRONMENTAL SCIENCES

Environmental Sciences had several sub-thematic areas that included:

- Agrisciences
- Urban and Regional Planning
- Estate Management
- Fisheries and Aquaculture
- Forestry
- Environmental Management
- Geosciences
- Water, Sanitation and Hygiene
- Waste Management and Recycling
- Climate Change, Adaptation and Mitigation

Contribution of agricultural donor-funded projects to rural women's empowerment

Allan Kaliwo

PhD Student

Department Of Agrisciences

Mzuzu University

Malawi.

Email: akaliwo@gmail.com

Abstract

Purpose: The purpose of the study was to analyse the contribution of agricultural donor-funded projects to rural women's empowerment in Malawi: the case of the Agriculture Sector Wide Support Project (ASWAp-SP) in Zomba district. There was a literature gap on the contributions made by agricultural donor-funded projects to rural women empowerment in Malawi. Previous studies mainly focused on sustainability of donor-funded projects not on their contribution to rural women's empowerment. Specifically, the study aimed at determining the extent to which the ASWAp-SP empowered women in decision making, asset creation and ownership.

Methodology/approach: Data were collected by interviewing 65 randomly selected targeted beneficiaries and 65 randomly selected non targeted beneficiaries using a structured household survey questionnaire and semi structured focus group and key informant interviews. Data were analysed by running descriptive statistics: i.e., frequencies, percentages and Chi-Square tests to see patterns, relationships and associations of variables.

Findings: The findings showed that ASWAp-SP made significant improvements to the social, physical, financial, natural and human capitals of rural women $p < .05$ by providing trainings, messages, radio programmes, inputs like maize, legume, agroforestry seed and fertilisers. The results showed that there was a positive correlation between women having agriculture as their main source of income and the category of beneficiary (targeted and non-targeted). Women who were in the targeted households took agriculture as their main source of income more than women from non-targeted beneficiary households ($p < .05$). ASWAp-SP increased women's ability to decide to participate in farmer groups while increasing their status of production.

Recommendations: The study recommends agricultural projects targeting rural farmers to always involve women as they form an integral farming community in rural areas.

Conclusion: The study concluded that ASWAp-SP changed the status of production of women from the targeted households more than the non-targeted ones since results showed that there were statistically significant differences $p < 0.05$ ($p = 0.015$)

in the status of production between the targeted beneficiaries and the non-targeted ones.

Originality/value of contribution: The study was the first of its kind as no other such study was documented and has added knowledge to the literature.

Key words: contribution; donor-funded; rural women; empowerment.

1.1 Introduction

Donor-funded agricultural projects are essential for addressing the diverse challenges faced by rural communities worldwide, including limited access to resources, market inefficiencies, and environmental degradation. These projects empower smallholder farmers, improve their resilience to shocks, and contribute to inclusive growth in rural economies (IFAD, 2019).

Women contribute more than 50 percent of the total agricultural workforce in developing countries. They produce more than half of all the food that is consumed worldwide (McClain, 2009). There is hardly any area in agriculture where women are not involved. However, a study by Behera in 2013 showed that women's occupation in agriculture in low-income countries in Asia is between 60-80 per cent. In almost, Asian countries, the number of women employed in agriculture as a percentage of the economically active population is higher. Long standing obstacles faced by rural women in terms of limited access to productive resources (Land, Credit, Inputs, Transport, Extension Services, Storage and Technical Assistance) prevent them from adopting new technologies or encoring them economies of scale and though women are the world's principal food producers and providers, their contribution to agricultural activities is not valued and they remain as invisible partners in agricultural development programmes. Women farmers receive only 5 percent of all agricultural extension services and education worldwide.

A survey done by World Bank in 2009 in Mozambique, Kenya, Morocco, Sierra Leone, Mauritius, Botswana and Zambia showed that women participate more than any other Gender category in food production activities (World Bank, 2009; FAO, 2011). However, in the study titled "Agriculture in Africa: Telling Myths from Facts", it was found that the female share of labor in crop production in Ethiopia, Malawi, Niger, Nigeria, Tanzania, and Uganda was at 40% (Christiaensen, 2018).

Gender disparities exist in Malawi's agriculture sector in terms of access to and control over agricultural production resources like land, credit, extension services, farm implements, and inputs. Illiteracy levels are higher in women (41 percent) than in men (31 percent) (MIHPS, 2015). Poverty is more prevalent in women (59 percent) as compared to males (51 percent). Women have 14 percent less consumption per capita than men, mainly due to gender-based differences in access to and control over production resources (MGDS III, 2017). Women have limited access to agricultural information and technologies at 14 percent against 18 percent for men (MoAFS, 2012).

1.2 The ASWAp Support Project

The Ministry of Agriculture (MoA) developed the Agriculture Sector Wide Approach Support Project (ASWAp-SP) with its development partners. This was designed to harmonize government and donor investments relating to the agriculture components of the Malawi Growth and Development Strategy (MGDS). It was aimed at increasing agricultural productivity, contributing to 6% agriculture growth annually, improving food security, diversifying food production to improve nutrition at household level and increasing agricultural incomes of the rural people. The programme had three broad focus areas, namely; (i) Agribusiness and Market Development (ii) Sustainable Land and Water Management and (iii) Food Security and Risk management.

1.3 Problem Statement

Despite the implementation of various Agricultural donor- funded projects and programmes targeting smallholder farmers in Malawi, agriculture in Malawi is still characterized by low and stagnant yields (MGDS, 2016, Malawi Vision 2063). There are also low levels of irrigation development and low uptake of improved farm inputs. Consequently, Malawi continues to suffer from chronic food shortages, low income, unsustainable livelihood, lack of food purchasing power and general poverty (NSO-IHS5, 2020). Harvested farm produce does not last for the whole season neither is there surplus for sale. Women are still not economically empowered as observed from their continued dependence on men and external support (MoAFS, 2012).

1.4 Objective/ research questions/hypothesis

The main study objective was to determine the extent to which the ASWAp-SP empowered women in decision making, asset creation and ownership.

1.5 Research question

To what extent did the ASWAp-SP empower women in decision making, asset creation and ownership?

1.6 Hypothesis

The study hypothesised that ASWAp-SP enhanced the productivity and livelihoods of rural women against a null hypothesis that the project did not bring any impact on the productivity and livelihoods of rural women

2.0 Literature review

2.1 Donor-Funded Agricultural Projects in Malawi

Over the past decade, Malawi has been a recipient of numerous donor-funded agricultural projects aimed at improving rural livelihoods. Projects such as the Agricultural Sector Wide Approach (ASWAp) supported by the World Bank and the Agricultural Transformation Initiative (ATI) funded by various international donors have targeted key areas such as increasing agricultural

productivity, promoting sustainable practices, and enhancing market access for smallholder farmers (World Bank, 2020; IFAD, 2019).

Studies assessing the contribution of donor-funded agricultural projects to rural livelihoods in Malawi have employed various methodological approaches, including quantitative surveys, qualitative interviews, and mixed-method designs. Primary data sources include household surveys conducted by research organisations such as the International Food Policy Research Institute (IFPRI) and the National Statistical Office (NSO), as well as project evaluations and impact assessments commissioned by donor agencies (Chirwa and Matita, 2018; Guta *et al.*, 2020).

Empirical evidence suggests that donor-funded agricultural projects have made significant contributions to rural livelihoods in Malawi. For example, a study by Chirwa and Dorward (2013) found that beneficiaries of agricultural extension services supported by donor projects experienced higher crop yields and improved food security compared to non-beneficiaries. Similarly, an evaluation of the Farm Input Subsidy Program (FISP) funded by the Government of Malawi and development partners reported positive impacts on household incomes and nutritional outcomes (Ministry of Agriculture, 2020).

Several factors influence the effectiveness of donor-funded agricultural projects in Malawi, including project design, implementation capacity, and local context.

Despite their contributions, donor-funded agricultural projects in Malawi face various challenges and limitations. These include issues related to sustainability, scalability, and dependency on external funding (Holden and Lunduka, 2019). Furthermore, concerns have been raised about the potential displacement of local agricultural systems and the unintended consequences of input subsidies on market dynamics and farmer decision-making (Dorward *et al.*, 2018).

A Comparative Assessment of women's involvement in farming and family life in rural parts of Nigeria by Ogunsumi *et al.* (2017) revealed that women farmers undertake most of the farm operations themselves and have low productivity. The hypothesis put forward was that low productivity amongst women farmers could be due to problems they encounter in the production process. Major constraints towards increased production were identified as shortage of land; inadequate irrigation water; lack of management abilities; limited control over factors of production; limited education; unavailability of credit and inefficient market outlets. The following measures were suggested in order to improve agricultural production: increase in the number of land holdings with freehold ownership of land; provision of efficient market outlets; infrastructure, credit and irrigation water; and provision of better qualified extension workers to improve farmers' knowledge of farming. The research found that there was no tangible financial income realized by women farmers especially those in the rural areas.

3.0 Methods

3.1 Study Area

The study was conducted in Malosa Extension Planning Area in Zomba district where the project interventions of ASWAp-SP had been taking place since 2012. The study area is characterized by suitable climate for agriculture.

The economy of Zomba district is dominated by agriculture, where individual maize production accounts for the main activity, while tobacco is cultivated as the main cash crop. Other crops produced include rice, cassava, sweet potato, groundnuts, sugar cane, beans and pigeon peas.

3.2 Research design and sampling methods

The study used a mixed research design. Specifically, cross-sectional and explanatory survey designs. According to Neuman (2014), a mixed research design offers richer insights into the phenomenon under study and captures information that may be missed if only one type of design was used.

Multi-stage sampling technique was used: The study district of Zomba was purposively sampled because it is where the ASWAp-SP has been taking place in Machinga ADD, the ADD having been randomly selected out of 8. Malosa EPA was randomly selected out of 9 because all the 9 EPAs in Zomba district participated in the project so there was no specific criterion to choose the EPA. Sampled villages and respondents were determined by using proportional allocation method according to size of the Primary Sampling Units (PSUs) which were the sections). The target population for this study was 20,921 (the farming families in Malosa EPA). According to Israel, (1992) and Bryman, (2004), 30% of the available sampling units in a target population are adequate for one to carry out research hence using the Yamane 1967 formula below, the sample sizes were calculated and a figure of 392.5 was found, 30% of which was 118.

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

Where: n = sample size, N = population size; e = error margin which is 0.05.

Substituting the values in the equation, the sample size (n) obtained is:

$$n = \frac{20921}{1 + (20921)0.05^2}$$

$$n = 392.5$$

$$30\% \qquad \qquad \qquad = 118$$

Adding 10% non-response rate = 130 (65 beneficiaries and 65 non-beneficiaries)

Respondents were sampled from sampled villages of the following sections were interviewed in Malosa EPA: 1. Chopi, 2. Kanache, 3. Lifani, 4. Malemia, 5. Matandani, 6. Matuta, 7. Mbelo, 8. Mpungulira, 9. Mtwiche, 10. Naisi, 11. Ndaje, 12. Songani.

3.3 Data Collection and analysis

Kobo tool collection was used to administer a semi-structured household survey questionnaire which was the main data collection tool. GPS handsets were used to collect the location of the households and measure the size of households' fields.

Frequencies and cross-tabulations were done to see patterns in the data. A chi-square test was done to determine the association between the dependent and the independent variables.

3.4 Results

The results showed that ASWAp-SP increased women's ability to decide to participate in farmer groups while increasing their status of production (Figure 1). According to Hox *et al.*, (2017), correlation technique was used to analyse the degree of association between two variables. Pearson correlation coefficient was used to determine the strength and direction of the relationship between the dependent and the independent variable. The data analysis using Pearson product moment correlation was based on the assumption that data was normally distributed and the variables were continuous. There was a strong positive correlation of 11.116 between women's increased status of production and ability to participate in farmer groups ($p < .05$) (Table 1)

Table 1: Status of production * Women's ability to decide to participate in farmer groups correlation

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.116 ^a	3	.011
Likelihood Ratio	9.223	3	.026
Linear-by-Linear Association	7.865	1	.005
N of Valid Cases	127		

a. 5 cells (62.5%) have an expected count of less than 5. The minimum expected count is 1.23.

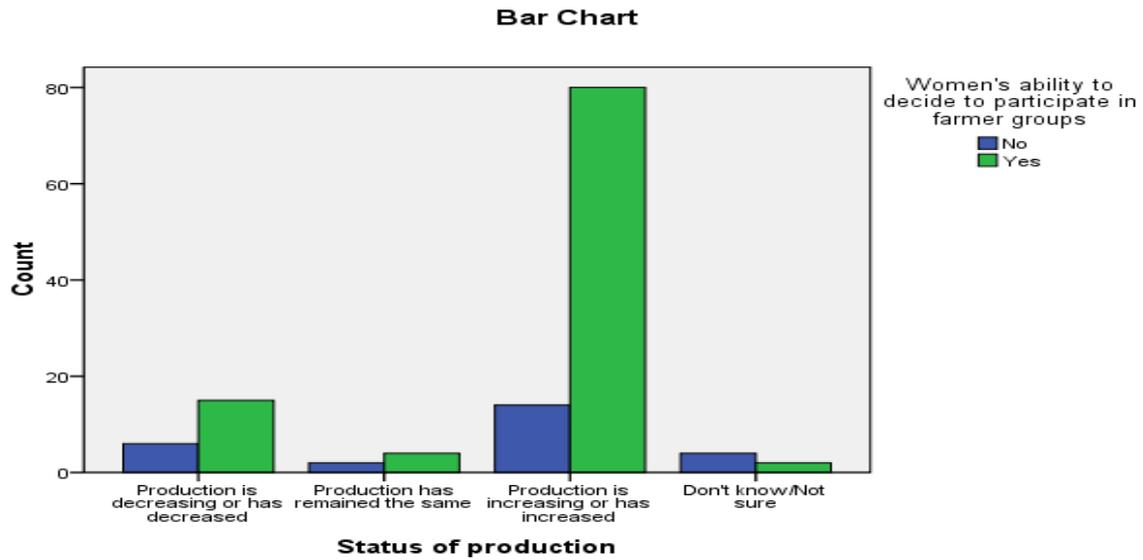


Figure 6: Status of production and women's ability to decide to participate in farmer groups

The results also showed that the level of involvement in the agriculture business was higher in women from the targeted households than those from the non-targeted households (Figure 2) though the association was not statistically significant at $p=.05$.

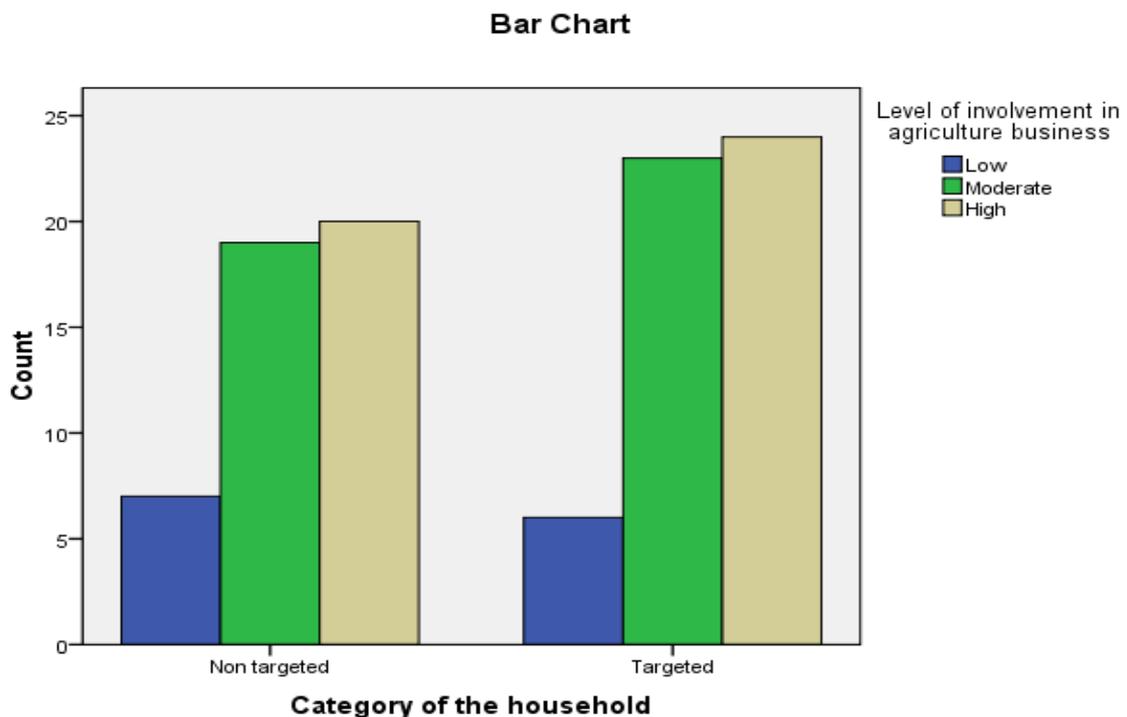


Figure 7: Level of women involvement in agriculture business between the targeted households and non-targeted households

The results also showed that women from the households who reported to have benefited from ASWAp-SP had more involvement in decision-making on

how to use income and had increases in their status of production than their counterparts who reported to have not benefited or benefited very little from ASWAp-SP ($p < .05$) (Table 2 and figure 3).

Table 2: ASWAp-SP benefit * Women's involvement in decision making on how to use income correlation

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	15.646 ^a	2	.000
Likelihood Ratio	13.854	2	.001
Linear-by-Linear Association	10.894	1	.001
N of Valid Cases	129		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 2.81.

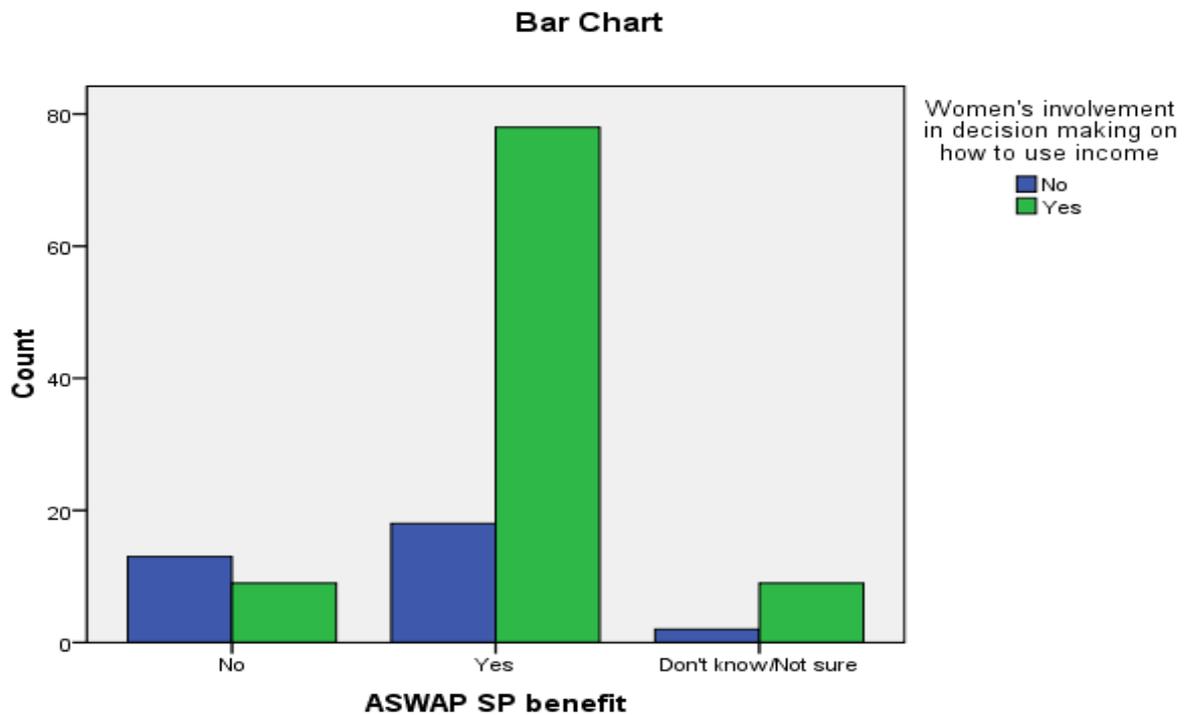


Figure 3: ASWAp-SP benefit and women involvement in decision making on how to use income

4.0 Discussion

Farmer groups are a particularly effective platform to improve crop yields and other constraints confronting female farmers (Ingutia and Sumelius, 2020). The results showed that ASWAp-SP increased women's ability to decide to participate in farmer groups while increasing their status of production and women were more elected leaders in farmer groups than any other groups while their status of production increased as well. The results are in line with findings by Ingutia and Sumelius, (2020) who found that women's participation in agriculture is positively influenced by membership in a farmer group and land. Crop yield is positively affected by membership years in a farmer group and negatively by lack of credit.

5.0 Conclusion and take-home messages

ASWAp-SP enhanced the productivity and livelihoods of rural women. Women who were in the targeted households took agriculture as their main source of income more than women from non-targeted beneficiary households and their level of involvement in agriculture business and ability to use income were more.

5.1 Take-home messages

Women and children are generally regarded as vulnerable category of people. ASWAp-SP did not have specific interventions targeting women or young farmers. They were just in the general categories of direct and indirect beneficiaries. Agricultural donor-funded projects should try to incorporate activities or interventions specific for vulnerable categories like women.

References

- Behera, B. S and Behera, A.C. (2013), "Gender Issues: The Role of Women in Agriculture Sector in India", *International Journal of Marketing, Financial Services and Management Research*, Vol. 2 No. 9, pp 134-45.
- Bryman, A. (2004) *Social Research Methods*, Oxford: Oxford University Press.
- Chirwa, E. W. and Matita, M. (2018), "The impact of Malawi's farm input subsidy programme: Who benefits and how?" *Journal of Development Studies*, Vol. 54 No. 4, pp 696-715.
- Christiaensen, L. and Demery, L. (2018) *Agriculture in Africa: Telling Myths from Facts*, Washington, DC: Directions in Development-Agriculture and Rural Development.
- Dorward, A., Chirwa E. and Kelly, V. (2018), "Malawi's Agricultural Input Subsidy Programme: Where do we go from here?", *Food Policy*, Vol. 75, pp 1-12.

Government of Malawi (2017) *Malawi Growth and Development Strategy III: Building a Productive, Competitive and Resilient Nation*, Lilongwe: Government of Malawi.

Government of Malawi (2020) *Malawi Vision 2063: An Inclusively Wealthy and Self-reliant Nation*, Lilongwe: National Planning Commission.

Guta, D. D., Holden, S. T. and Lunduka, R. W. (2020), "Impact of extension services on technology adoption and crop productivity: Evidence from a field experiment in Malawi", *World Development*, Vol. 128, 104849.

Hox, *et al.* (2017) *Multilevel Analysis: Techniques and Applications*, London: Routledge.

IFAD (2019) *Rural Development Report 2019: Creating opportunities for rural youth*, Rome: International Fund for Agricultural Development.

Ingutia, R. and Sumelius, J. (2020), "Do farmer groups improve the situation of women in Agriculture in rural Kenya?" *International Food and Agribusiness Management Review*, Vol. 25 No. 1. DOI: 10.22434/IFAMR 2020.0142.

Government of Malawi (2012) *Agriculture Sector, Gender, HIV and AIDS strategy*, Lilongwe: Ministry of Agriculture and Food Security.

Government of Malawi (2020). *The 2020 Agricultural Production Estimates Report*, Lilongwe: Ministry of Agriculture and Food Security.

National Statistics Office (2021) *The fifth Integrated Household Survey (IHS5 2020 Report)*, Zomba: National Statistical Office.

Ogunsumi, L.O and Adeyeye V.A. (2017) *Comparative Assessment of Women Involvement in Farming and Family Life in Rural Parts of Nigeria*, Ibadan: Institute of Agricultural Research and Training.

World Bank (2020), "World Development Indicators", Available at: www.data.worldbank.org.

World Bank (2012), "World Development Indicators", Available at: www.data.worldbank.org.

Yamane, Y. (1967), "Mathematical Formulae for Sample Size Determination", Available at: https://www.researchgate.net/publication/342447837_Sample_Size_Determination_in_Survey_Research (Accessed 10/01/2025).

Performance analysis of Zomba water users' association in rural water supply schemes: A focus on financial, operational, and customer perspectives

Temwa Chilanga

Department of Water and Sanitation

Mzuzu University

Malawi

Email: temwachilanga@gmail.com

Abstract

Purpose: Water utilities in developing countries are locked in a vicious cycle, with weak operational and financial capacity leading to performance failures and inefficiencies. Water Users Associations (WUAs) have been adopted in Malawi to govern rural water supply systems. This study aimed to analyse the performance of WUAs in Zomba. Specific objectives were to: assess the performance of WUAs in financial, customer and operational performance indicators; identify performance gaps and assess factors affecting the WUAs.

Methodology/approach: The study adopted a mixed-method research design. Seven WUAs were targeted in Zomba of which one was dissolved. Questionnaires, key informant interviews, and focus group discussions were used to collect data on performance measures of the utilities, customer perceptions, and factors influencing performance. SPSS and Microsoft Excel software and thematic analysis were used in data analysis.

Findings & Discussion: Results displayed poor financial performance as one WUA hit a working ratio of 1.1 while the rest operated on negative accounts. The majority further faced challenges in revenue collection. Compromised water quality due to lack of chlorination was displayed in two-thirds of the WUAs and customers complained of turbid water during the rainy season in all WUAs due to lack of filters. On tariffs, 73% of customers found the pricing reasonable whilst on the overall customer satisfaction, 95% of customers were satisfied. It was found that all WUAs, except one, were unable to quantify their water losses and none had hit the target of the staff-efficiency measure. Major gaps found were on non-treatment of water, poor financial and operational performance. It was also found that WUAs were mostly affected by lack of supportive policies, poor governance, low revenue-base and aging infrastructure.

Conclusion: The study concluded that the WUAs were mostly affected by a lack of supportive policies, poor governance, a low revenue base, and aging infrastructure.

Recommendations: Therefore, it is recommended that the WUAs deserve post-construction support from the government and other key players to enhance the sustainability of rural water supply schemes in Malawi.

Originality/value of contribution: Generating useful information regarding the performance status of the existing Zomba Water Users Associations and the causes of the WUAs' failure to sustain their water supply systems and enhance performance improvements.

Keywords: Customers, Financial, Operational, Performance, Water Users Associations (WUAs).

1.1 Introduction

The Government of Malawi (GoM) has emphasized the Community-Based Management (CBM) approach for sustainable operations and maintenance of piped water supply schemes through Water User Associations (WUAs) (WUA Guidelines, 2010; Adams and Zulu, 2015). Designed around principles of collective management, empowerment, participation, efficiency, and full cost recovery, WUAs aim to address challenges in sustainable service delivery (Rap and Wester, 2013). However, various challenges still affect their performance, necessitating ongoing monitoring and evaluation to ensure continuous service delivery and achievement of their objectives. This study assesses the performance of WUAs in the Zomba district to provide insights for improving their sustainability and effectiveness.

1.2 Problem statement

Water utilities in developing countries often face a vicious cycle of performance failures due to weak operational and financial capacities (Sattarov & Volkova 2020). In Malawi, Water Users Associations (WUAs) are struggling to deliver sustainable piped water services, as highlighted by the Sector Performance Report (2012) and the Malawi Appraisal Report (2014). Despite efforts to improve, significant sustainability challenges remain, including insufficient training, inadequate financial resources, and governance issues (Ministry of Water and Sanitation 2023). This study aims to analyse the current performance of WUAs, extract valuable insights, and develop strategies to drive sustained improvements in water delivery services.

1.3 STUDY OBJECTIVES

1.3.1 Main Objective

To assess the financial, operational, and customer performance of Zomba Water Users Associations in rural water supply schemes.

1.3.2 Specific Objectives

To assess the financial performance of the Water Users Associations.

To analyse the customer service and user perceptions towards the performance of Water Users Associations.

To evaluate the operational performance of the Water Users Associations.

To examine factors influencing the performance of WUAs

1.3.3 Research Questions

- i. What is the financial performance of the Water Users Associations in the study area?
- ii. What are the customer performance and user perceptions towards performance in the Water Users Associations?
- iii. What is the operational performance of the Water Users Associations?
- iv. What are the issues influencing the performances of the Water Users Associations?

2.0 LITERATURE REVIEW

2.1 Overview

With the shift from Millennium Development Goals to Sustainable Development Goals, particularly SDG 6, there is a global commitment to ensuring universal access to safe, affordable water and sanitation by 2030. This includes an integrated approach emphasizing sustainability, inclusivity, and equity (WHO and UNICEF, 2017). As a result, water-policy reforms have increasingly adopted community-centered approaches under decentralization and Community Based Natural Resources Management (CBNRM) (Ferguson et al., 2005). In Malawi, the Ministry of Irrigation and Water Development (MoIWD) advocates for community participation through the Community Based Management (CBM) approach, empowering communities to manage their water systems (WUA guidelines, 2010).

2.2 Theoretical Framework

The performance management (PM) framework guides the evaluation of WUA effectiveness. PM involves systematic management of strategy execution, emphasizing continuous improvement through iterative action, evaluation, and adjustment (Sattarov and Volkova, 2020). Successful WUA service delivery relies on well-functioning relationships and clear institutional responsibilities among stakeholders (UNICEF, 2018).

2.3 Performance Assessment

Effective performance assessment in the water sector addresses efficiency (doing things right) and effectiveness (doing the right things). Utilities often face performance gaps due to market failures, necessitating robust performance measures (De Witte and Marques, 2012). In this context, performance assessment is a crucial tool for guiding managerial decisions, optimising resource allocation, and enhancing service quality.

2.4 Performance indicators used in the study

The broad category of performance indicators used in this study has been based on the three elements Van Den Berg and Danilenko (2017) defined: financial performance, customer performance, and operational performance. Some indicators under the mentioned performance categories have been adapted from the Tynan and Kingdom (2002) framework with seven performance categories: operational efficiency, cost recovery, commercial performance, coverage and access, asset maintenance, service quality, and price and affordability.

The selected variables under financial performance include the working ratio and the period it takes for the WUAs to collect water revenues. Reliability of the water utility, affordability of water tariffs, and quality of the provided service constitute the selected variables under the customer performance indicator. For operational performance, the selected variables include non-revenue water quantification and staff efficiency in the WUAs.

2.5 Performance Gaps

Several challenges hinder WUA performance, including political interference, lack of capacity building, vandalism, low operation and maintenance fees, lack of technical expertise, aging infrastructure, and inadequate water treatment capacity (Ministry of Water and Sanitation, 2023). Addressing these gaps is crucial for enhancing WUA functionality and sustainability.

2.6 Factors Affecting Performance

Peter and Nkambule (2012) investigated factors affecting the sustainability of rural water schemes in Swaziland. They found that non-involvement in decision-making, unwillingness to contribute funds, absence of users' committees, and lack of cooperation between local leaders and users committees were the main factors causing unsustainability. They suggested addressing technical, social, financial, and institutional factors, emphasizing that technical and social factors are more critical for sustainability than financial and institutional factors. However, in Malawi, financial factors are crucial for rural water supply schemes' sustainability.

The Ministry of Water and Sanitation (2023) identified several issues affecting WUAs' operation and maintenance in Malawi:

Lack of trained personnel: Rural water supply systems often lack knowledgeable experts and technicians, leading to inadequate monitoring, maintenance, and timely repairs.

Limited financial resources: Rural communities have limited financial resources for effective maintenance and repairs which hinders the purchase of spare parts, hiring of staff, and regular system assessments.

Weak institutional framework: The fragmented framework for managing rural water supply leads to unclear responsibilities, lack of accountability, and difficulties in coordinating efforts and implementing effective monitoring systems.

Inadequate infrastructure: Outdated equipment, unreliable power supply, and poorly constructed infrastructure cause frequent breakdowns and reduce efficiency.

Limited community involvement and ownership: Communities' lack of ownership over water supply systems results in neglect and improper care of the infrastructure.

Lack of monitoring and evaluation: The absence of regular monitoring and evaluation mechanisms leads to unnoticed problems, resulting in significant breakdowns and water supply disruptions.

Climate change and environmental impacts: Extreme weather events like droughts and floods damage infrastructure and reduce water resources, adding stress to the systems.

These issues collectively affect the performance of rural water supply schemes in Malawi.

2.7 Gaps in Literature

The literature on rural water supply in Malawi reveals gaps such as limited consideration of user perspectives, inadequate monitoring and evaluation frameworks, and lack of comparative studies among WUAs. This study aims to fill these gaps by assessing performance and exploring factors influencing WUA performance, while incorporating customer perceptions.

3.0 Materials and Methods

3.1 Study area

The research was carried out in Zomba District, an area covering 2,580 km² located along Latitude -15.351902 Longitude 35.010796 and Latitude -15.452756 Longitude 35.665983 South-East of Malawi. The district has a population of 746,724 (NSO 2019) and it shares boundaries with Machinga District to the North, Balaka District Northwest, Mulanje and Phalombe Districts to the South, Chiradzulu and Blantyre Districts to the Southwest

and the Republic of Mozambique to the East. Figure 1 displays the Map of Zomba and the locations of the WUAs.

The gravity fed schemes which are operating in the district under WUA management include Malosa, Zomba East, Zomba West, Makhwawa North, and Makhwawa South. Mayaka WUA operates using pumps, which abstract water from boreholes. Jali WUA was dissolved in 2016 and now the community is supplied by SRWB and some areas by Zomba East WUA.

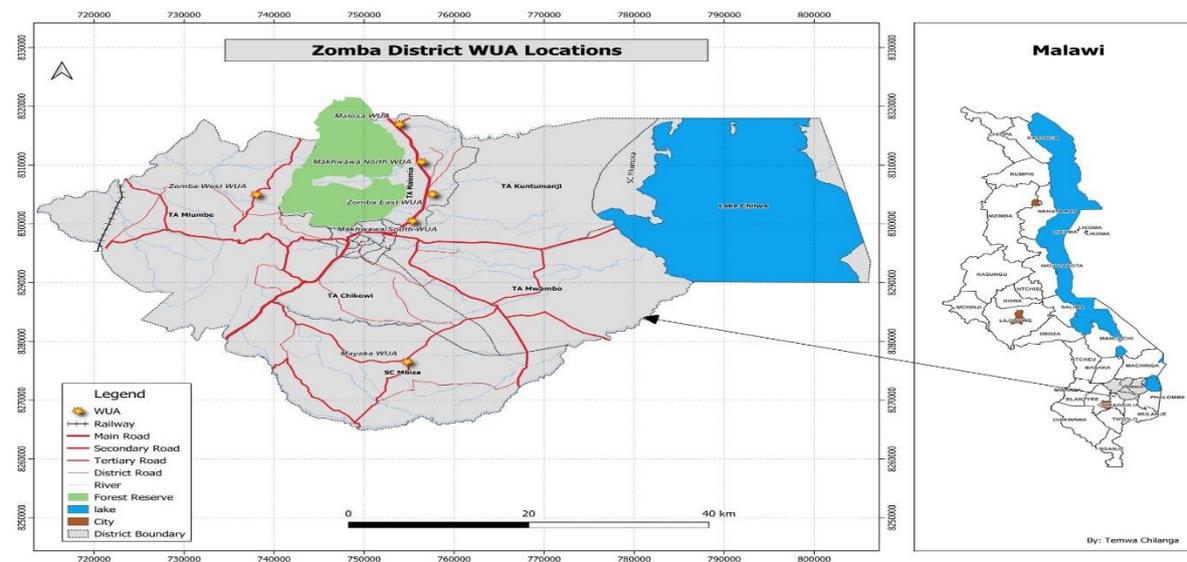


Figure 1: Map showing the study area

3.2 Research Design and Sampling Methods

The research study adopted a mixed research approach, whereby both quantitative and qualitative research methods were used to collect data. Non-probability sampling methods were used to select research subjects in the WUAs. A purposive sampling technique was used to determine participants in the customer survey, key informant interviews (KII), and focus group discussions (FGD). The WUA secretariat was selected to participate in the KIIs since it is the technical group undertaking responsibility in water service delivery. Variables regarding the operational, financial and customer performance were, therefore, collected during the interviews. The FGDs comprised of the WUA board members and secretariat and data on the factors affecting WUA performances was obtained. WUA customers were also interviewed to obtain complementary data on customer performance. The targeted customers included those having a shared connection, private connection, and communal taps. The sample size depended on the saturation of responses and a total of 30 connections were assessed in the WUAs.

3.3 Determination of selected performance indicators

Based on Van den Berg and Danilenko (2017) the analysis looked at three elements with their underlying indicators to define a well-performing utility; financial performance, customer performance (an index that covers the quality of access to water services), and operational performance. Some

4.0 Results and Discussion

4.1 Financial performance of WUAs

4.1.1 Working ratio

Only Zomba East achieved the target ratio, the rest of the WUAs operate with deficiencies & indicated to have challenges in collection of revenue. Tynan (2002) & Van den Berg and Danilenko (2017) indicates good financial performance with ratio > 1. Table 2 displays the results. The WUAs indicated that they cannot sustain major maintenance works, such as rehabilitations and extensions as they would require external support. Mohanty and Rout (2023) emphasise that maintaining a financially sustainable pipe water supply is one of the serious challenges in the sustainable provision of water supply in rural areas.

Table 2: WUAs Financial performance

Name of WUA	Working Ratio	Gap/Deviation
Zomba East	1.1	+0.1
Malosa	-	-
Makhwawa North	-	-
Makhwawa South	-	-
Mayaka	0.8	-0.2
Zomba West	-	-

- = data not available

4.1.2 Revenue collection

All WUAs, except one, indicated that they have challenges in the collection of revenue. It takes a longer period for the WUAs to collect a significant amount of water tariffs from customers to utilise in daily operations, except for the Zomba East WUA, which indicated otherwise. In instances where only part of the required revenue is collected, incapacitation of the schemes' operations is inevitable due to insufficient funds. Tynan and Kingdom (2002), argue that although poor collection efficiency is usually blamed on customers, the utility may also be at fault for delayed and faulty billing (for metered utilities), inadequate responses to consumer queries on billings, poor customer service, and a lukewarm effort to collect overdue accounts. Mohanty & Rout (2023) emphasises that poor revenue collection and willingness to pay for the service affects sustainable provision of water services.

4.2 Customer service and user perceptions

4.2.1 Reliability

One-third of the WUAs manage to provide water to most sections within their total targeted area. Most customers (68%) reported receiving water for about 12-24 hours, while 18% had water for about 5-12 hours, and 14% received water for only 0-5 hours. While taking into account the customers perception on the reliability of the WUAs, 82% of customers interviewed believed the WUAs are reliable, 13% felt they were somewhat reliable, and 5% indicated they were not reliable. However, the WUAs face significant limitations due to aging infrastructure, design capacity issues, and insufficient financial capacity to carry out major maintenance work or expand the schemes. According to Adams & Zulu (2015) and Adams & Smiley (2018), government interventions are essential to meet the ambitious targets of the Sustainable Development Goals (SDGs).

4.2.2 Affordability

Half (3) of the WUAs indicated to have received complaints on tariffs from their customers. Following the customer survey, 73% of the customers indicated that there was no need of reducing the water tariffs. On the cost of new connections, 64% indicated it to be not expensive while 36% indicated it to be somewhat expensive. As shown in Table 3, the water tariffs charged by the WUAs generally lack consideration for the volume of water consumed, with the exception of Mayaka WUA, which strictly uses meters for billing. To improve customers' understanding and willingness to pay, it is essential to sensitize communities about the costs incurred in successfully conveying water from the source. This could also make it easier for the WUAs to raise tariffs where necessary. Supporting this, a study by Abualtayef et al. (2019) on household affordability and willingness to pay for water services in Palestine found that improvements in service quality can also increase consumers' willingness to pay.

Table 3: Water tariffs for Zomba WUAs

Name of WUA	Private tap	Communal tap	Additional cost on shared pvt connection
Zomba West	1000	1000	-
Malosa	600	600	-
Zomba East	2500	350 /household	600/ additional house
Makhwawa North	1500	2000	-

Makhwawa South	2000	2000	-
Mayaka	700/m ³		

- = data not available, tariffs in Malawian kwacha currency.

4.2.3 Quality of service

4.2.3.1 Water Quality

One-third of the WUAs consistently apply chlorine to the water supplied. During the customer survey, 82% of respondents perceived the water supplied by WUAs to be of good quality. However, there were complaints about turbid water during the rainy season, forcing customers to seek alternative, cleaner sources for home consumption. Some WUAs have been supplying poor-quality water, primarily due to the lack of treatment facilities and inconsistent chlorination before distribution. This not only undermines the WUAs' responsibility within the community but also diminishes users' willingness to pay (WTP), as the substandard service affects efficient revenue collection. Consequently, inadequate maintenance due to reduced revenue leads to the eventual non-functionality of these schemes. A report by Rijdsdijk and Mkwambisi (2016) also highlights that poor water quality is amongst the causes of poor sustainability of rural water systems.

4.2.3.2 Customer responsiveness

The majority (86%) of customers reported that the WUAs provided timely responses to complaints and other issues. However, there were instances of unintentional delays, particularly when requests required resources that were not immediately available. The speed of response by staff in water utilities is crucial, as it directly influences customers' willingness to pay for services (Abualtayef et al., 2019).

4.2.3.3 Customer satisfaction (perceptions)

Most customers expressed concerns about turbid water during the rainy season, a problem attributed to the absence of filters in the supply system as indicated in figure 2. Notably, complaints regarding reliability were particularly pronounced in Zomba West and Makhwawa South and regarding affordability in Zomba East and Makhwawa South. Despite these issues, overall satisfaction with WUA service delivery was high, with 95% of customers expressing contentment. However, a study by Abualtayef et al. (2019) recommended improving service quality to address dissatisfaction, as it directly impacts consumer contributions.

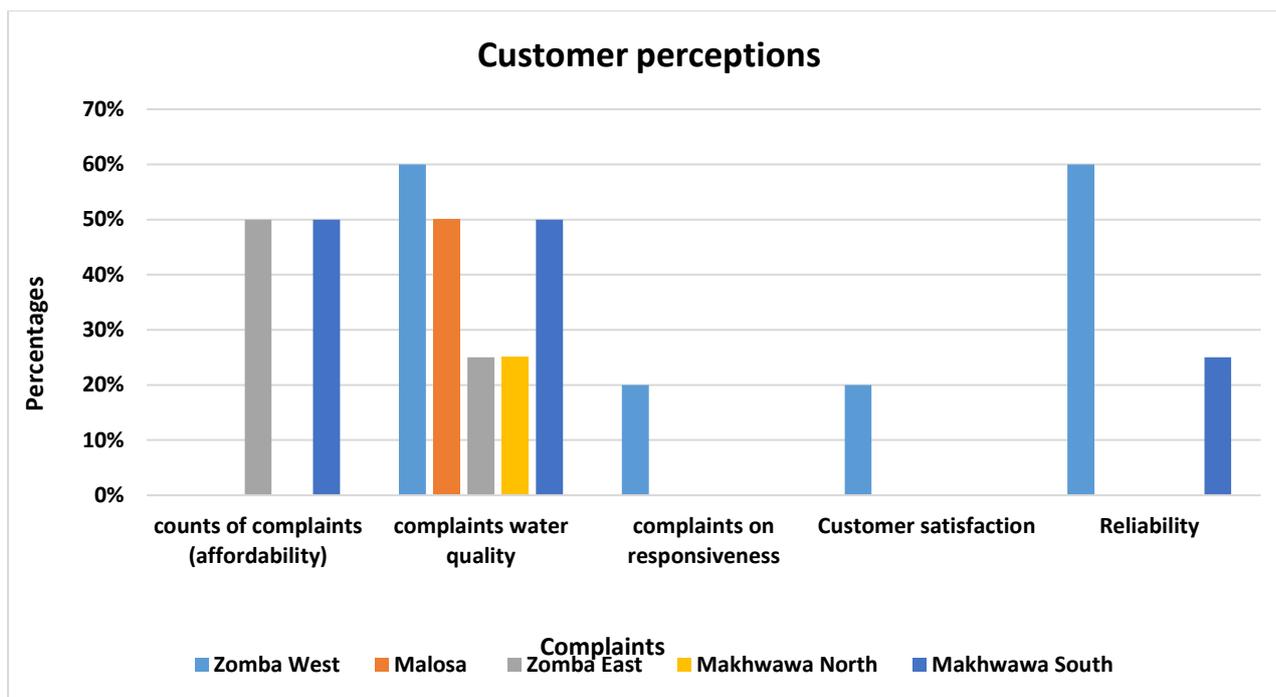


Figure 2: Customer perceptions on quality of service

4.3 Operational performance

4.3.1 Non-revenue water management

Among the WUAs, only one can monitor the water quantity produced and billed, while the others are unable to do so due to the absence of back meters. Additionally, all but one WUA faces challenges with illegal water connections, which contribute to significant operational losses. These issues underscore the importance of focusing on efficiency in operation and maintenance, particularly in parameters such as metering, non-revenue water, and the balance between water production and consumption. Mayaka WUA is notable for its stringent billing system, making it the only WUA effectively managing these parameters.

The aging infrastructure in the water supply schemes as portrayed in Figure 3 not only exacerbates water losses but also contributes to delays in repairs. This issue is echoed in a study from Ghana by Kumasi (2019), which found that the "fix upon failure" approach often led to extended repair times due to the time required to gather financial resources from post-paid water users. These challenges highlight the urgent need for improved asset maintenance systems to ensure the sustainability of water services.



Figure 3: Maintenance using old materials.

4.3.2 Staff efficiency

Staff efficiency across all WUAs is below target, as Table 4 displays. This is mostly attributed to single connections serving many people, as noted by Tynan & Kingdom (2002) and McKenzie & Ray (2009). Nevertheless, most of the WUAs are characterized by a lack of enough resources and assets to help in maintenance works and ease transportation around their coverage area. Consequently, these limitations hinder the ability of staff to effectively manage and maintain water supply systems.

Table 4: Staff efficiency deviations

WUA	Variable	Observed value	Benchmark	Gap/ deviation
Zomba West	Staff/1000 connections	80	5	+ 75
Malosa	Staff/1000 connections	8	5	+3
Zomba East	Staff/1000 connections	8	5	+3
Makhwawa North	Staff/1000 connections	19	5	+14
Makhwawa South	Staff/1000 connections	16	5	+11
Mayaka	Staff/1000 connections	29	5	+24

4.4 Factors affecting WUA performance

From the pre-indicated themes, almost all factors were found to impact the performance of WUAs, except for social and technological factors. Financial factors emerged as the most significant, notably contributing to the dissolution of the Jali WUA. Additionally, other issues affecting WUA performance include aging infrastructure, insufficient resources, and ineffective systems within the WUAs. Table 5 displays the results. These factors among others were also highlighted in a report by the Ministry of Water and Sanitation (2023), which identified them as barriers to effective management of rural water supply schemes.

Table 5: Factors affecting WUA performance

Factors	Mode of occurrence
Financial	7
Scheme design capacity and old infrastructure	7
Management approaches	7
Resources	6
Policies	5
Governance	4
WUA systems	4
Technological	0
Social	0

5.0 Conclusions

The study found that the majority of the WUAs exhibited poor financial performance which doesn't allow for smooth operation and maintenance. For better servicing of their customers, it is noted that the WUAs need rehabilitation works and extensions to improve water supply coverage as well as treatment of water for better quality. Despite the complaints, customers are overall satisfied with the service delivery. The WUAs unveil poor operation performance with cases of non-revenue water, old infrastructure, and inefficiency of labour. The performance of WUAs is influenced by factors such as policies, governance, finances, management approaches, WUA systems (institution recording systems), lack of resources, scheme design capacity, and old infrastructure, while technological and social factors were not found to have a negative impact.

The study concludes that targeted efforts and interventions should be implemented and closely monitored to address performance gaps in WUAs, mitigate factors hindering their effectiveness, and enhance the sustainability of the rural water supply schemes.

5.1 Recommendations

- Redesigning of water tariffs to recover costs, and sensitization of people on costs incurred in service delivery to increase their willingness to pay.
- Implementation of interventions on consistent chlorination in the water supply schemes and installation of filtration systems for improved water quality.
- Continuous oversight and post-construction support from the government and development partners to WUAs in hefty projects especially extensions and rehabilitation of scheme infrastructure to improve water coverage.
 - ✓ This highlights the implementation of a joint management model under the WUA framework as it can later transition to autonomous management.
- Train WUA leaders in scheme management and record keeping, ensuring a complete leadership structure. Proper documentation will facilitate future assessments and performance tracking.

References

- Abualtayef, M., Oukal, Y., Ghabayen, S., Eila, M. and AbuEltayef, H. (2019), "Households' Affordability and Willingness to Pay for Water Services in Khan Younis City, Palestine", *Journal of Engineering Research & Technology*, Vol. 6 No. no. 3., p21.
- Adams, E.A. and Zulu, L.C. (2015), "Participants or customers in water governance? Community-public partnerships for peri-urban water supply", *Geoforum*, Vol. 65, pp.112-124.
- Adams, E.A. and Smiley, S.L. (2018), "Urban-rural water access inequalities in Malawi: implications for monitoring the Sustainable Development Goals", *Natural Resources Forum*, Vol. 42 No. 4, pp. 217-226.
- De Witte, K. and Marques, R.C. (2012), "Gaming in a benchmarking environment: A non-parametric analysis of benchmarking in the water sector", *Water Policy*, Vol. 14 No. 1, pp. 45-66.
- Ferguson, A., Whiteford, L. and Whiteford, S. (2005), "Water reform, gender and HIV/AIDS: Perspectives from Malawi", *Water Health*, pp. 45-66.

Kumasi, T.C., Agbemor, B.D. and Burr, P. (2019), “Rural water asset management practices in Ghana: the gaps and needs”, *Water and Environment Journal*, Vol. 33 No. 2, pp. 252-264.

Government of Malawi (2010) *Guidelines for establishment of Water Users Associations in Malawi*, Lilongwe: Ministry of Natural Resources.

Government of Malawi (2012) *Sector Performance Report*.

Government of Malawi (2014) *Malawi Appraisal Report*.

Government of Malawi (2019) *National Statistical Office Report, Zomba: National Statistical Office*.

McKenzie, D. and Ray, I. (2009), “Urban water supply in India: status, reform options and possible lessons”, *Water Policy*, Vol. 11 No. 4, pp. 442-460.

Government of Malawi (2023) *Strengthening of Water User Associations and Development of Operation and Maintenance Strategy for Rural Water Supply Systems in Malawi*, Lilongwe: Ministry of Water and Sanitation.

Mohanty, T. and Rout, H.S. (2023), “Financial sustainability of rural water supply: An analysis of cost recovery, revenue collection, and efficiency”, *Water and Environment Journal*, Vol. 37 No. 1, pp. 44-57.

Peter, G. and Nkambule, S.E. (2012), “Factors Affecting Sustainability of Rural Water Schemes in Swaziland”, *Physics and Chemistry of the Earth, Parts A/B/C*, Vol. 50, pp.196-204.

Rap, E. and Wester, F. (2013), “The practices and policies of making policies: Irrigation management transfer in Mexico”, *Water Alternatives*, Vol. 6 No. 3, pp. 506-531.

Rijsdijk, A. and Mkwambisi, D. (2016) *Evaluation of the water and sanitation (wash) programme in Malawi (2007–2013) final report*, Lilongwe: UNICEF.

Sattarov, M. and Volkova, T. (2020), “A Performance Management Framework Water Utilities in Developing Countries”, *Journal of Business Management*, Vol. 6 No. 1, 91-109.

Tynan, N. (2002) *A water scorecard: Setting performance targets for water service providers*, Washington, DC: World Bank.

UNICEF (2018) *Programming for sustainability in water services- a framework*, Paris: UNICEF.

Van Den Berg, C. and Danilenko, A. (2017) *Performance of water utilities in Africa*, Washington DC: World Bank.

WHO and UNICEF (2017) *Progress on drinking water, sanitation and hygiene: 2017 update and SDG baselines*, Geneva: WHO.

Estimation of small hydropower potential using HBV hydrological model. A review article

Jeremiah Nkowan^{a*}, Brighton. A. Chunga^a, Cosmo Ngongondo^b,

Patsani Kumambala^c, Wales Singini^a

^a*Department of Water and Sanitation, Mzuzu University, Private Bag 201, Luwingu, Mzuzu University*

^b*School of Natural and Applied Sciences, University of Malawi, PO Box 280, Zomba*

^c*Department of Agricultural Engineering, Lilongwe University of Agriculture and Natural Resources, PO Box 219, Lilongwe.*

* Corresponding author: nkwanijeremiah@yahoo.com

Abstract

This paper reviews the application of a conceptual hydrological model in improving the estimation of stream flow for small hydropower and other water resources projects in data-scarce regions. Small hydropower is among the renewable sources that are used widely. Small hydropower is characterized by the utilisation of varying daily streamflow and power production. The study reviews the application of a conceptual model in different catchments globally and regionally through a thorough systematic literature review of research projects, papers, and case studies. The conceptual model used is the HBV (Hydrologiska Byrans Vattenbalansavdelning), developed at the Swedish Meteorological and Hydrological Institute (SMHI) in 1970 and has been used widely global north. The model simulates, fills in missing data, and forecasts stream flow in gauged and scaling of hydrological data in ungauged catchments for water resources planning purposes. The systematic review also indicates the model's performance, particularly focusing on altering, adjusting, and changing model parameters due to limited techniques in hydrological data collection and management. Studies have indicated that the model's performance was satisfactory with a Nash-Sutcliffe efficiency coefficient (NSE) for model performance with an accepted value of > 0.74 . The system review has indicated the model has been widely used in the global north and attempts to use the model to ably simulate stream flows in data-scarce regions. The systemic review has also shown that Flow Duration Curves (FDC) have been used to scale hydrological data from gauged to ungauged catchments and estimate hydropower in river basins. The limitation of the model is the limited application of the model in the global south. The review indicates that the HBV model can predict stream flows and can be applied to the planning of hydropower and other water resources projects.

Keywords: Hydrological Modelling; HBV; Hydropower; Streamflow.

1.1 Introduction

Hydropower is the main source of electricity globally, provides (Kwakye and Bárdossy, 2020). Globally hydropower contributes 16.6% to 23% of the total energy production (Sahin *et al.*, 2017). Hydropower is sustainable and has relatively few emissions (Khurana and Kumar, 2011). The exploitation of hydropower in the Sub-Saharan region remains a challenge (Killingtveit, 2019). Hydropower is classified as large, small, mini and Pico (Mdee *et al.*, 2018). Hydropower plants are broadly classified based on the size of the production, head, operation, and type of flow (Majumder *et al.*, 2013). The classification is important as it reflects the level of investment, expertise required, permits required, and generally the complexity of the power plant. (Singh and Singal, 2017).

Table 3: Hydropower development classification

Size	By capacity (MW)	By head (m)	By operation
Pico	0.005	0.2 < H > 4	Run of river
Micro	0.1	1 < H < 10	Reservoir
Mini	1	2 < H < 40	Pumped storage
Small	1-100	10 < H < 350	In-stream using technology existing facilities
Medium	100 -500	50 < H < 1300	
Large	>500	50 < H < 250	

Source: (Mdee *et al.*, 2018)

Small hydropower is widely used to provide electricity at a relatively lower cost (Ndhlovu and Woyessa, 2022). Small hydropower plants are classified as “run-of-river” which depend on daily stream flows to produce power (Ayik *et al.*, 2023). Small hydropower offers alternative and low-cost means of providing power (Mdee *et al.*, 2018). A study by Kaunda, Kimambo and Nielsen (2012) indicated that Malawi has a potential of 7.6 MW of small hydropower mostly in the northern region. A total of 5.8 MW is installed in the country and most of the plants are not functional for different reasons (Ehimen *et al.*, 2023).

The assessment of Small Hydro Plants (SHP) potential requires a high degree of estimation of stream flows and available gross head based on hydrological historical data and topographic data in a river basin (Kumambala, 2010). Historical hydrological data has limitations in terms of completeness, missing data and poor data collection techniques (Ndhlovu and Woyessa, 2022). The

reliability of hydrological data is a concern in the decisive process concerning the design and operation of water resources projects (Bernier, 1987).

1.2 Application of the HBV model

Computer hydrological simulation models are a promising technique to improve the accuracy of the estimation of hydropower potential combined with remote sensing techniques (Ndhlovu and Woyessa, 2022). The computer-based models provide a platform for quick and easier assessment of potential hydropower sites so that developers understand the availability and adequacy of water resources and reliable decision-making (Kusre *et al.*, 2010). The use and promotion of hydrological models in water resources provide accurate and cost-effective techniques in planning and operations (Weigend *et al.*, 2023). The HBV model is a lumped hydrological model which has been used widely (Kwakye and Bárdossy, 2020). The required data for developing the HBV model is generally easily accessible and easy (Rusli, Yudianto and Liu, 2015).

The HBV model was initially developed and founded by the Swedish Meteorological and Hydrological Institute (SMHI) and was first applied in the early 1970s (Bergström, 2006). The HBV model has been used widely in the global north and is a standard model in the Nordic area and more than 50 countries (Seibert and Bergström, 2021). The model has performed well despite its simplicity and few parameters. The model has become popular since its inception by hydrologists in the world (Seibert and Bergström, 2021). The model has evolved over the years and is used for various purposes. The model has among others evolved such as the HBV TEC version (Mendez and Calvo-Valverde, 2016), the NTNU Education version (Hamududu and Killingtveit, 2016) version of the HBV IWS version (Kwakye and Bárdossy, 2020) and HBV light among others. The model requires calibration and validation to confirm its performance and suitability of the model (Seibert and Bergström, 2021). HBV requires relatively few parameters compared to other models (Kwakye and Bárdossy, 2020). It is one of the models that provides robustness in simulating stream flows based on observed stream flows in a given catchment which generally requires fewer data and has few parameters (Seibert and Bergström, 2021). Most Low-income countries have scarce data due to limited funding in techniques for acquiring data for meteorology and stream flows (Kwakye and Bárdossy, 2020).

The choice of a hydrological model depends on so many factors. Some pertinent factors include the availability of the model to predict scenarios and the purpose and time availability to construct the model (Marshall, Nott and Sharma, 2005). The HBV model is widely used in the global south because it is a relatively simple model requiring few data and few parameters (Bergström, 2006).

1.3 HBV Model Structure

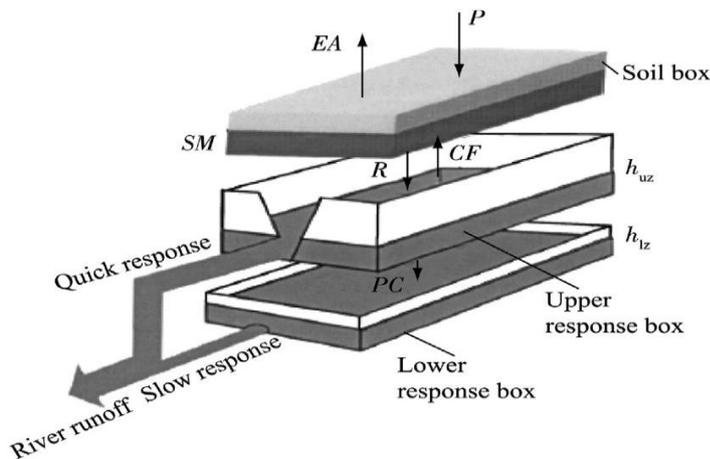


Figure 8: The HB Structure adapted (Mendez and Calvo-Valverde, 2016)

The HBV model consists of three zones as shown in Fig 1. The inputs are precipitation (P) and Evaporation (EA). Water flows from the Soil Moisture zone (SM) through infiltration to the Quick Upper response zone and percolates into the Slow Lower response zone. The combined runoff from quick and slow response is the stream flow.

The primary parameters of the HBV model are catchment area, field capacity (FC), evapotranspiration limitation (LP), capillary action (CFLUX), percolation of water (PERC), coefficient of subsurface (K_f), and the coefficient of groundwater (K_4), the power of recharge coefficient (β), power of coefficient for subsurface (α) (Rusli, Yudianto and Liu, 2015).

The model inputs are climate (precipitation and temperature) and spatial (Digital Elevation Model) data. There are four routines in the model: the precipitation routine, the soil moisture routine considers loss due to evaporation, infiltration and saturation of the soil, and the response function which consists of quick runoff and slow runoff (Mendez and Calvo-Valverde, 2016).

The soil moisture zone represents the soil surface and conditions. Parameters such as FC and LP represent the transformation of precipitation to water flow. The soil zone has a free parameter, which is the initial soil moisture (SM_0) used in the simulation (Rusli, Yudianto and Liu, 2015). The main variables in the simulation are in the equations.

$$EA = \frac{SM}{LP} EP \quad (1)$$

$$R = P \frac{SM_0^\beta}{FC} \quad (2)$$

$$CF = CFLUX \frac{FC - SM}{FC} \quad (3)$$

$$SM = SM_o + P + EA + CF \quad (4)$$

Where EA is the actual evaporation (mm), SM is the soil moisture storage (mm), EPA is the potential evaporation (mm), and P is the precipitation (mm).

The upper response zone has a similar transformation of water flow in which recharge (R) is the input from the soil moisture zone and the capillarity flux (CF). The initial water depth (h_{uz0}) percolates as percolation (PC) that moves to the lower response zone and the baseflow (Q_{uz}) which has the following equations (Rusli, Yudianto and Liu, 2015).

$$PC = PERC \frac{SM^\beta}{FC} \quad (5)$$

$$Q_{uz} = K_f h_{uz}^{a+1} \quad (6)$$

$$h_{uz} = h_{uz0} + R - CF - PC - Q_{uz} \quad (7)$$

Where h_{uz} is the water depth in the upper zone (mm).

A similar scenario in the lower zone occurs. The percolation is the major input with h_{uz0} as the initial water level in the zone. Groundwater flow is the output. The total of Q_{uz0} and Q_{lz} is the considered total stream flow of the river basin. The equations are as follows: -

$$Q_u = K_4 h_z \quad (8)$$

$$h_{lz} = h_{lz0} + PC - Q_{lz} \quad (9)$$

$$Q_t = Q_{uz} + Q_{tz} \quad (10)$$

Where h_{lz} is the water depth in the lower zone (mm).

The time step for simulation using the HBV-TEC and other versions is on a daily basis (Mendez and Calvo-Valverde, 2016).

1.3 Model performance

Calibration of a hydrological model is performed to understand the relationship and correlation between the model parameters and the catchment response (Harlin, 1991; Zhang and Lindström, 1997; Rusli, Yudianto and Liu, 2015; Singh and Singal, 2017). This involves adjusting parameters manually to achieve the goodness of fit between the observed stream flow and the simulated flows (Hamududu and Killingveit, 2016). The objective tests for calibration of a hydrological model are the Nash-Sutcliffe efficiency coefficient (*NSE*) widely used for goodness of fit, relative error (*RE*) and the root mean square error (*RSME*) and coefficient of determination (*R²*) (Rusli, Yudianto and Liu, 2015; Zeybek, 2018). *NSE*, *R²*, *RE* and *RSME* are dimensionless (Rusli, Yudianto and Liu, 2015). The *NSE* assesses the goodness of fit of a simulation of observed and simulated values through the variances of the variables. If the variance is large, then the model is deemed to be performing well (Bergström, 2006; Rusli, Yudianto and Liu, 2015; Zeybek, 2018).

The acceptable value of *NSE* and *R²* must be close to 1.0, while the values of *RE* and *RSME* should be as close as possible to zero (Rusli, Yudianto and Liu, 2015). The other test for the performance of a hydrological model is the coefficient of determination (*R²*) which is used to determine the goodness of fit (Tibangayuka, Mulungu and Izdori, 2022).

Several studies have indicated that hydrological models were calibrated and validated with sub-catchments and a best-of-fit greater than *NSE* > 0.74 was achieved (Kwakwe & Bardossy 2020, Hamududu & Killingveit, 2016). The equations below have been used to check the goodness of fit of a hydrological model: -

$$NSE = 1 - \left(\frac{\sum_{t=1}^T (Q_{oi}(t) - Q_{si}(t))^2}{\sum_{t=1}^T (Q_{oi}(t) - Q)^2} \right) \quad (11)$$

$$RE = \frac{\sum_{i=1}^n (Q_{si} - Q_{oi})^2}{\sum_{i=1}^n Q_{oi}} \quad (12)$$

$$RMSE = \sqrt{\frac{1}{n} \sum_{i=1}^n (Q_{si} - Q_{oi})^2} \quad (13)$$

$$R^2 = 1 - \frac{SS_{res}}{SS_{tot}} \quad (14)$$

Where $Q_{oi}(t)$ and $Q_{si}(t)$ represent the observed and simulated streamflow at the time (t) respectively and Q is the mean streamflow.

1.4 Flow duration curves

Stream flow estimation in ungauged catchments remains a subject of research (Ndhlovu and Woyessa, 2022). A study by Ngongondo *et al.* (2013), recommended use of the Flow Duration Curve (FDC) in the analysis of the stream flow regime. The flow duration curve is a graphical presentation of the percentage of time of exceedance of a particular stream flow (Vogel and Fennessey, 1994).

Conventional techniques with reasonable high accuracy have been developed to predict streamflow data from gauged to ungauged catchments (Ndhlovu and Woyessa, 2022). Some of the common methods to transfer stream flows include the Drainage Area Ratio (DAR), the Standard Mean Method (SMM), the Mean and Standard Deviation Method (MSM), and the Regional Flow Duration Method (Castellarin *et al.*, 2004; Ndhlovu and Woyessa, 2022). In a study, of the Kabompo River basin by Ndhlovu and Woyessa (2022), the Regional Flow Duration Method was used and the results were acceptable.

1.5 Derivation of flow duration curves

Flow duration curve is a handy technique to streamflow of a particular river at a given time of exceedance (Burgan and Aksoy, 2022). FDCs are useful for determining flooding and lean stream flows. In a gauged catchment, the FDC is derived by sorting the observed streamflow data from the largest to the smallest and plotting each against the corresponding exceedance percentages (Requena, Chebana and Ouarda, 2018). Regional FDCs are generated at ungauged catchments based on the gauged FDCs (Burgan and Aksoy, 2022). Regional curves are useful in hydrological practices such as the urban stormwater system design, environmental flow allocation, hydropower potential and water availability (Mutua and Klik, 2007; Mohamoud, 2008)

FDCs are built as explained in the following (Ridolfi, Kumar and Bárdossy, 2020):

- rank the streamflow values in descending order.
- plot the sorted values against their corresponding frequency of exceedance.

The duration d_i of the i th sorted observation is its exceedance probability P_i . If P_i is estimated using a Weibull plotting position (Weibull, 1939), the duration d_i for any q_i (with $i=1; \dots; N$) is

$$P_i = \frac{i}{N+1} \quad (15)$$

Typical FDC curve (Mutua and Klick, 2007)

2.0 Results and Discussion

Previous studies have shown that the value of hydrological models provides a robust and accurate measure of stream flows for the planning of hydropower and water resources projects in data-scarce areas. The scaling of such simulations needs to be carefully studied. The application of an integrated methodological approach on the use of regional FDCs, linear regression, and GIS tools to estimate flows and potential head of hydropower for the ungauged sites is a novelty in the Kabompo River Basin (Ndhlovu and Woyessa, 2022). It has shown promising results in developing countries (Hamududu and Killingtveit, 2016)

A study by Tibangayuka, Mulungu and Izdori (2022) in Tanzania assessed the HBV model in the data-scarce tropical catchment, and the model was calibrated and validated in multiple catchments with limited hydrological and climatic data with varied topography. The goodness of fit was found at $NSE = 0.73$ and $R^2 = 0.74$ respectively (Tibangayuka, Mulungu and Izdori, 2022) The minimum values for NSE and R^2 values are 0.65 and 0.7 respectively (Bergström, 2006; Seibert and Bergström, 2021; Tibangayuka, Mulungu and Izdori, 2022). The results indicate that the HBV model can adequately be used to predict stream flows in data-scarce tropical catchments.

Another study A study by Moshe and Tegegne (2022) in Ethiopia applied the hydrological model to assess potential small hydropower. The $NSE = 0.76$ was determined which was found to be satisfactory. A similar study by Nonki *et al.* (2021) performed a runoff-rainfall model using HBV – Light in the Upper Benue River Basin in Cameroon, the performance varied from good to the marginal band of uncertainty. The model was useful for estimating streamflow for hydropower estimation.

In another study by Hamududu and Killingtveit (2016), assessed hydropower under climatic changes in the Zambezi River basin. The HBV model was integrated with other computer software such as nMAG to assess the hydropower in a changing climate. The HBV model was used to predict streamflow changes in the catchment. The average $R^2 = 0.78$, the fit was to be reasonable and good for use (Hamududu and Killingtveit, 2016).

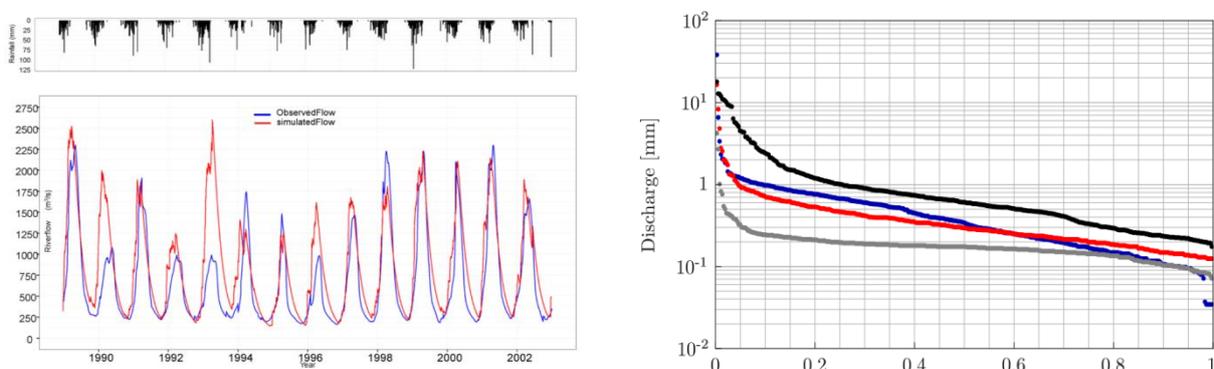


Figure 9: Victoria Falls (Hamududu and Killingtveit, 2016)

In the Kafue river basin, the average $R^2 = 0.75$ was found by Hamududu and Killingtveit (2016). This was lower than the Zambezi, in both cases, the model performed well to predict streamflow to estimate hydropower potential.

A study by (Mavaringana *et al.*, 2023) the modelling of flood events in climate-changing scenarios in the Pungwe River (two catchments) used the HBV model and the calibration was adequate. The $NSE > 0.86$ and $R^2 = 0.89$

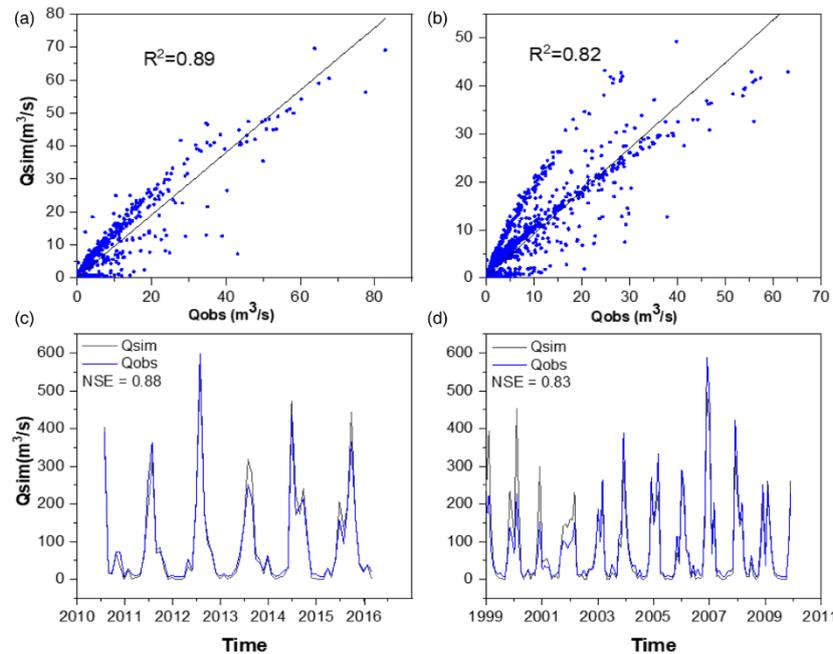


Figure 10: Calibration of the HBV model (Mariangana *et al.*, 2023)

2.1 Estimation of Hydropower Potential

The estimation of hydropower potential is computed from a derived flow duration curve of the gauged stream flow regime (Kwakye and Bárdossy, 2020; Hamududu and Killingtveit, 2016); Ayik *et al.*, 2023). Often the 95% time of exceedance is the minimum stream flow design criteria for ‘run of river’ power plants. The $Q_{95\%}$ is the primary power for a particular catchment flow regime. The computation of hydropower is as follows.

$$P = \eta \rho Qgh \quad (15)$$

Where P = power (Watts), η = efficiency of the turbine, ρ = density of water (1000kg/m³), Q = streamflow (m³/s), h = gross head (m). The gross head is determined by the DEM for the catchment (Abebe, 2014).

A study by Ndhlovu and Woyessa (2022) assessed hydropower sites for the Kapombo River basin in ungauged catchments at 95% time of exceedance. The study successfully evaluated small hydropower potential in the river basin.

Table 4: Hydropower computation for Kapombo

Hydropower Potential (Ungauged)	Site	Area (km ²)	Potential Height(m)	Estimated	
				Design Flow (m ³ /s)	Estimated Potential Gen Capacity (KW)
Mujila Falls site	Lower	501.04	40	16.32	5123
Mujila Falls site	Upper	1275.98	30	17.09	4024
Kasanjiku falls site		1625.11	40	17.44	5475
Chauka fall site	Matambu	555.03	40	16.37	5139
Satelenge Falls		3598.22	15	19.41	2285
Kangongo Falls		0.3	4	15.81	496

Source : (Ndhlovu and Woyessa, 2022)

3.0 Acknowledgement

This paper is part of ongoing PhD work research at Mzuzu University and supported by the NORHED Norwegian Program for Capacity Development Higher Education and Research for Development. The author (s) would like to thank NORHED and the collaborating universities, the University of Malawi (UNIMA), and the University of Dar es Salaam Mwalimu (UDSM) and the reviewers for their valuable input in the preparation and production of the paper.

References

- Abebe, N. (2014), "Feasibility Study of Small Hydropower Schemes in Giba and Worie Subbasins of Tekeze River, Ethiopia", *Journal of Energy Technologies and Policy*, Vol. 4 No. 8, pp. 8 – 17.
- Ayik, A. *et al.* (2023), "Preliminary assessment of small hydropower potential using the Soil and Water Assessment Tool model: A case study of Central Equatoria State, South Sudan", *Energy Reports*, Vol. 9, pp. 2229 – 2246.
- Bergström, S. (2006), "Experience from applications of the HBV hydrological model from the perspective of prediction in ungauged basins", *IAHS-AISH Publication*, Vol. 307, pp. 97–107.
- Bernier, J.M. (1987), "Elements of Bayesian analysis of uncertainty in hydrological reliability and risk models", in *Engineering reliability and risk in water resources*, Dordrecht: Springer Netherlands, pp. 405 – 422.

Burgan, H.I. and Aksoy, H. (2022), "Daily flow duration curve model for ungauged intermittent subbasins of gauged rivers", *Journal of Hydrology*, Vol. 604, p. 127249.

Castellarin, A. *et al.* (2004), "Regional flow-duration curves: reliability for ungauged basins", *Advances in water resources*, Vol. 27 No. 10, pp. 953 – 965.

Ehimen, E.A. *et al.* (2023), "Improving Energy Access in Low-Income Sub-Saharan African Countries: A Case Study of Malawi", *Energies*, Vol. 16 No. 7, pp. 1 – 26. Available at: <https://doi.org/10.3390/en16073106>.

Hamududu, B.H. and Killingtveit, Å. (2016), "Hydropower production in future climate scenarios; the case for the Zambezi River", *Energies*, Vol. 9 No. 7, pp. 1–18. Available at: <https://doi.org/10.3390/en9070502>.

Harlin, J. (1991), "Development of a process oriented calibration scheme for the HBV hydrological model", *Hydrology Research*, Vol. 22 No. 1, pp. 15 – 36.

Kaunda, C.S., Kimambo, C.Z. and Nielsen, T.K. (2012), "Hydropower in the Context of Sustainable Energy Supply: A Review of Technologies and Challenges", *ISRN Renewable Energy*, pp. 1–15. Available at: <https://doi.org/10.5402/2012/730631>.

Khurana, S. and Kumar, A. (2011), "Small hydro power - A review', *International Journal of Thermal Technologies*, Vol. 1 No. 1, pp. 107 – 110.

Killingtveit, Å. (2019), "Hydropower", in *Managing global warming*, Amsterdam: Elsevier, pp. 265 – 315.

Kumambala, P.G. (2010) Sustainability of water resources development for Malawi with particular emphasis on North and Central Malawi, Doctoral dissertation, University of Glasgow, Glasgow, Scotland.

Kusre, B.C. *et al.* (2010), "Assessment of hydropower potential using GIS and hydrological modeling technique in Kopili River basin in Assam (India)", *Applied Energy*, Vol. 87 No. 1, pp. 298 – 309.

Kwakye, S.O. and Bárdossy, A. (2020), "Hydrological modelling in data-scarce catchments: Black Volta basin in West Africa", *SN Applied Sciences*, Vol. 2 No. 4, pp. 1–19. Available at: <https://doi.org/10.1007/s42452-020-2454-4>.

Majumder, M. *et al.* (2013), "Hydropower Plants", *Decision Making Algorithms for Hydro-Power Plant Location*, pp. 15–19.

Marshall, L., Nott, D. and Sharma, A. (2005), "Hydrological model selection: A Bayesian alternative', *Water resources research*, Vol. 41 No. 10, pp. 1-7.

Mavaringana, M. de J.P. *et al.* (2023), "Modelling future flood events under climate change scenarios in the Pungwe River Basin", *Water Practice and Technology*, Vol. 18 No. 5, pp. 1300–1316.

- Mdee, O.J. *et al.* (2018), "Assessment of hydropower resources in Tanzania: A review article", *Renewable Energy and Environmental Sustainability*, Vol. 3, p. 4. Available at: <https://doi.org/10.1051/rees/2018004>.
- Mendez, M. and Calvo-Valverde, L. (2016), "Development of the HBV-TEC hydrological model", *Procedia Engineering*, Vol. 154, pp. 1116 – 1123.
- Mohamoud, Y.M. (2008), "Prediction of daily flow duration curves and streamflow for ungauged catchments using regional flow duration curves", *Hydrological Sciences Journal*, Vol. 53 No. 4, pp. 706 – 724. Available at: <https://doi.org/10.1623/hysj.53.4.706>.
- Moshe, A. and Tegegne, G. (2022), "Assessment of run-of-river hydropower potential in the data-scarce region, Omo-Gibe Basin, Ethiopia", *International Journal of Energy and Water Resources*, Vol. 6 No. 4, pp. 531–542.
- Mutua, B.M. and Klik, A. (2007), "Predicting daily streamflow in ungauged rural catchments: The case of Masinga catchment, Kenya", *Hydrological Sciences Journal*, Vol. 52 No. 2, pp. 292 – 304.
- Ndhlovu, G.Z. and Woyessa, Y.E. (2022), "Streamflow Analysis in Data-Scarce Kabompo River Basin, Southern Africa, for the Potential of Small Hydropower Projects under Changing Climate", *Hydrology*, Vol. 9 No. 8, p.149. Available at: <https://doi.org/10.3390/hydrology9080149>.
- Ngongondo, C. *et al.* (2013), "Flood frequency under changing climate in the upper Kafue River basin, southern Africa: a large scale hydrological model application", *Stochastic Environmental Research and Risk Assessment*, Vol. 27, pp. 1883 – 1898.
- Nonki, R.M. *et al.* (2021), "Performance assessment and uncertainty prediction of a daily time-step HBV-Light rainfall-runoff model for the Upper Benue River Basin, Northern Cameroon", *Journal of Hydrology: Regional Studies*, Vol. 36, p. 100849.
- Requena, A.I., Chebana, F. and Ouarda, T.B.M.J. (2018), "A functional framework for flow-duration-curve and daily streamflow estimation at ungauged sites", *Advances in water resources*, Vol. 113, pp. 328–340.
- Ridolfi, E., Kumar, H. and Bárdossy, A. (2020), "A methodology to estimate flow duration curves at partially ungauged basins", *Hydrology and Earth System Sciences*, Vol. 24 No. 4, pp. 2043–2060.
- Rusli, S.R., Yudianto, D. and Liu, J. (2015), "Effects of temporal variability on HBV model calibration", *Water Science and Engineering*, Vol. 8 No. 4, pp. 291 – 300.
- Sahin, O. *et al.* (2017), "Renewable hydropower generation as a co-benefit of balanced urban water portfolio management and flood risk mitigation", *Renewable and Sustainable Energy Reviews*, Vol. 68, pp. 1076–1087.

Seibert, J. and Bergström, S. (2021), "A retrospective on hydrological modelling based on half a century with the HBV model", *Hydrology and Earth System Sciences Discussions*, pp. 1–28.

Singh, V.K. and Singal, S.K. (2017), "Operation of hydro power plants-a review", *Renewable and Sustainable Energy Reviews*, Vol. 69, pp. 610 – 619.

Tibangayuka, N., Mulungu, Deogratias M M and Izdori, F. (2022), "Evaluating the performance of HBV, HEC-HMS and ANN models in simulating streamflow for a data scarce high-humid tropical catchment in Tanzania", *Hydrological Sciences Journal*, Vol. 67 No. 14, pp. 2191 – 2204.

Tibangayuka, N., Mulungu, Deogratias M.M. and Izdori, F. (2022), "Performance evaluation, sensitivity, and uncertainty analysis of HBV model in Wami Ruvu basin, Tanzania", *Journal of Hydrology: Regional Studies*, Vo. 44, p. 101266. Available at: <https://doi.org/10.1016/j.ejrh.2022.101266>.

Vogel, R.M. and Fennessey, N.M. (1994), "Flow-duration curves. I: New interpretation and confidence intervals", *Journal of Water Resources Planning and Management*, Vol. 120 No. 4, pp. 485–504.

Weibull, W. (1939) *A statistical theory of strength of materials*, Stockholm: IVB-Handl.

Weigend, F.C. *et al.* (2023), "A hydraulic model outperforms work-balance models for predicting recovery kinetics from intermittent exercise", *Annals of Operations Research*, Vol. 325 No. 1, pp. 589 – 613.

Zeybek, M. (2018), "Nash-sutcliffe efficiency approach for quality improvement", *J. Appl. Math. Comput*, Vol. 2, pp. 496 – 503.

Zhang, X. and Lindström, G. (1997), "Development of an automatic calibration scheme for the HBV hydrological model", *Hydrological Processes*, Vol. 11 No. 12), pp. 1671–1682.

Geospatial land cover change analysis using Ca-Markov Chain Model in Chikwawa District, Malawi.

Japhet khendlo¹, Rajeshwar Goodary² and Roodheer Beeharry³

Université des Mascareignes, Mauritius

Corresponding Author: Japhet khendlo: jtkhendlo@student.udm.ac.mu

Abstract

Changes in Forest cover is highly impacting the climate of the Chikwawa District in Malawi within global climate change, by altering energy and water balances. Assessing and quantifying these changes is crucial for sustainable resource management and the protection of ecosystems in the country. This study utilised ISODATA, Support Vector Machine, Random Forest, and Maximum Likelihood classifiers using Kappa Coefficient and accuracy metrics for Landsat images (1979-2023). CA-Markov projected future land cover for 2035, 2045, and 2065, while Spearman rank correlation assessed the statistical significance of changes. The Random Forest classification yielded the highest accuracies, with Kappa coefficients of 85%, 86%, 86%, and 90%, and overall accuracy of 88%, 90%, 90%, and 93% for 1979, 1995, 2009, and 2023. Forest, vegetation, and water decreased by 21%, 3%, and 0.3%, while built areas and bare land increased by 22% and 16% over 44 years. The predicted results of Land Cover changes indicate a sharp decrease in Forest cover (-28.6%, -33.8% and -51.0%), Vegetation (-12.9%, -19.8% and -24.7%) and Water (-28.2%, -12.3% and -14.0%) with an increase in the Built-up area (+23.2%, +22.2% and +22.8%) and Bare land (+13.0%, +15.3% and +37.1%) for the time period 2035-2023, 2045-2035 and 2065-2045 respectively. Validation of predictive outcomes and the assessment of model accuracy were conducted using CA-Markov and Kappa index. The CA-Markov model demonstrated a level of agreement ranging from good to perfect for the three testing years: 2009 (CA-Markov = 83.4, $K_{no} = 0.79$, $k_{location} = 0.81$ and $K_{standard}=0.81$), 2011 (CA-Markov = 82.7, $K_{no} = 0.81$, $k_{location} = 0.79$ and $K_{standard}=0.82$) and 2023 (CA-Markov = 81.6, $K_{no} = 0.80$, $k_{location} = 0.84$ and $K_{standard}=0.83$). Over the past 44 years, the study area has identified a significant decrease in forest land, a trend that is expected to continue without proper intervention. This ongoing deforestation will exacerbate the absorption of runoff and increase flood severity in the district. The results of this study highlight the necessity for authorities to reinforce mitigation measures in response to the significant decline in Forest resources in the Chikwawa District of Malawi.

Key words: GIS; Land Use Land Cover; Remote sensing; CA-Markova Chain model; Random Forest

1.1 Introduction

Climate change, biodiversity loss, and environmental degradation are unprecedented, interconnected socio-economic and environmental issues facing the world today (Grima, 2020). Recent studies describe the ongoing global biodiversity loss as "biological annihilation," with adverse changes in land use and management being the primary drivers of terrestrial biodiversity

decline (OECD, 2018). Over the past 300 years, land use activities, mainly agricultural expansion and timber extraction, have resulted in a net loss of 11 million square kilometers of Forest worldwide (FAO, 2023; Ramankutty and Foley, 1999; Foley *et al.*, 2005). According to the FAO's 2022 report, an estimated 289 million Hectares of Forests will be deforested by 2050. Forests act as natural sponges, absorbing rainfall from tropical storms, stabilizing soil conditions, and occasionally discharging water (Butler, 2019). Deforestation, the intentional clearing of Forests, significantly contributes to global warming and climate change as the carbon stored in trees is released into the atmosphere as carbon dioxide (Fisher, 2004; Jagger *et al.*, 2016).

1.2 Problem Statement

Between 2001 and 2023, Malawi lost 224,000 Hectares of tree cover, resulting in approximately 94.0 metric tons of CO₂ emissions (Munthali *et al.*, 2019). When Forest cover is depleted, rainwater runoff increases, leading to elevated river levels and the risk of flooding in downstream communities, urban areas, and farmlands. Malawi's economy relies heavily on Agriculture, Forestry, and Fisheries, making it extremely vulnerable to climate change due to growing susceptibility to flooding and droughts in the country. Despite numerous Land Use Land Cover (LULC) studies in specific regions of Malawi (Munthali and Murayama, 2011; Munthali *et al.*, 2020; Nyirenda, 2022; Pangapanga-Phiri *et al.*, 2022), the LULC changes in the Chikwawa District of Malawi has not been explored.

1.3 Objectives of this Study

In view of the above-mentioned problem there is a crucial need for addressing the ongoing deforestation trend in Malawi, more specifically in the Chikwawa District. Thus, there is an urgent need for more in-depth investigation in view of a systematic measure of the extent of the problem. The latter knowledge would enable an organised approach to awareness raising and development of evidence-based countermeasures. Thereby, this study has three objectives; (i) assessing land use and land cover changes from 1979 to 2023 using supervised (user controlled) and unsupervised (computer-controlled) classifications, (ii) create an updated land cover Map for the District and (iii) predict future land cover land use using CA-Markova Chain Model.

1.4 Literature Review

About 85% of Malawi's population lives in rural areas, with 80% relying entirely on natural resources for their livelihoods, leading to overuse and degradation of these resources (Minde *et al.*, 2001; Jumbe and Angelsen, 2007). Major contributors to deforestation in Malawi include uncontrolled firewood collection, infrastructure development, agricultural expansion, illegal charcoal production, shifting cultivation, urban growth, high population density, and Tobacco drying (Fisher, 2004; Daulos *et al.*, 2010; Munthali *et al.*, 2019). Only 6% of urban Malawians and 2% of the overall population have access to expensive, rationed power, increasing the demand for wood energy (Gondwe *et al.*, 2019).

Existing studies (Du *et al.*, 2014; Pullanikkatil *et al.*, 2016; Wang and Lu, 2017; Teluguntla *et al.*, 2018) indicate a significant increase in land use land cover (LULC) changes, often with detrimental consequences. The main drivers of these changes are the expansion of commercial agriculture, urbanization, and extractive activities (Pacheco, 2017). Researchers have utilised various Geographical information and Remote sensing based classification methods, such as unsupervised methods like Iterative Self-Organizing Data Analysis (Lemenkova, 2021; Zhang *et al.*, 2008; Vimala, 2020; Lemenkova, 2021) and supervised methods like Maximum Likelihood Classifier, Support Vector Machine, Random Forest Classifier and other methods which have achieved varying degrees of accuracy in LULC classification (Ulbricht *et al.*, 1993; Alkaradaghi *et al.*, 2019; Norovsuren *et al.*, 2019; Shi and Yang, 2015; Taati *et al.*, 2015; Gislason *et al.*, 2006; Rodriguez-Galiano *et al.*, 2012). LULC modeling also has been done by several researchers employing several methods, including Cellular Automata (Akdeniz *et al.*, 2023), Agent-based models (Chambers *et al.*, 2023), Neural networks (Burrewar *et al.*, 2024), and Bayesian networks (Nascimento *et al.*, 2020). Each method exhibits distinct performance and behavior depending on their approaches and complexities (Tessema *et al.*, 2020; Lukas *et al.*, 2023).

2.1 Area of study

Chikwawa District, situated in the Southern Region of Malawi, has a population of at least 565,000 (GoM, 2019). Bordering Mozambique, it holds the distinction of having the lowest elevation in the country, at roughly 37 meters above mean sea level. Both Chikwawa and the adjacent Nsanje District are part of the Lower Shire Valley, an area known for its high levels of poverty and food insecurity (GoM, 2020). It faces an increasing threat of environmental degradation due to various developmental pressures like rapid population growth, urbanisation, industrialisation, and deforestation for agriculture and fuel. The limited arable land is often overused, making the soil highly vulnerable to erosion and degradation during floods and droughts. Future climate changes, including more extreme weather events and alterations in Water supply quantity and quality, are anticipated to significantly impact wetlands throughout District (Mixed Migration Centre, 2023)

2.2 Data sources and Image processing

Remotely sensed Landsat ORS/TM/ETM+ spectral data are often used for LULC classification on regional scales due to its comparatively inexpensive costs, extensive history, and greater frequency archival (Manandhar *et al.*, 2009). Landsat images were acquired during the dry season (between September and November) for the years 1979, 1995, 2009, and 2023 in order to fully comprehend the long-term changes in land cover throughout time. Landsat 3 (MSS), Landsat 5 (TM), Landsat 7 (ETM+) and Landsat 8 (OLI & TIRS) were downloaded from [EarthExplorer \(usgs.gov\)](https://earthexplorer.usgs.gov). All downloaded images had a cloud cover of less than 9% to prevent cloud obstruction of land surface features. The images were projected to Malawian local coordinate

system of Arc 1950 Zone 36 South using Esri ArcGIS Pro Software. Subsequently, they were resampled to a common nominal spatial grid of 10-meter resolution using the nearest neighbor technique to correct distortions induced by sensor misalignment or changes in satellite altitude. The root-mean-square errors for both image resampling and re-projection were found to be less than 0.5 pixels. Additionally, a composite multispectral band image was generated utilizing a spatial analysis tool within the ArcGIS Pro Software.

To ensure precise geometric alignment of the images, a basic edge detection method was employed for image registration and masked to within the boundary of the study area. During the classification process, each method utilised 1,000 training samples and 560 test datasets. A training sample is a region classified according to a specific scheme (ESRI, 2022). Some studies (Van *et al.*, 2005; Liu, 2022) suggest that the size of the training sample for each class should be 10 to 30 times larger than the total number of bands in the image. The land cover class categories were based on the (FAO, 2016) classification, which includes Water, Vegetation, Built-up, Bare land, and Forest.

2.3 Assessing LULC classification methods

The study assessed the accuracy of both supervised and unsupervised classification using kappa coefficient, producer accuracy, user accuracy and overall accuracy (Rwanga and Ndambuki, 2017).. The accuracy of image classification is affected by several factors, such as the type of sensor, the data used for training and accuracy assessment, the number of classes, and the classification method (Heydari and Mountrakis, 2018). The Four classification methods comprised of Iterative self-organising Data unsupervised classification (Lemenkova, 2021) and three supervised classifications namely Maximum likelihood classifier (Alkaradaghi *et al.*, 2019; Norovsuren *et al.*, 2019), support Vector machine learning classifier (Yang *et al.*, 2000; Hahn *et al.*, 2007) and Random Forest classifier (Gislason *et al.*, 2006 and Rodriguez-Galiano *et al.*, 2012).

2.4 Accuracy assessment

The kappa coefficient is calculated as;

$$K = \frac{N \sum_{i=1}^r x_{ii} - \sum_{i=1}^r (x_{i+} x_{+i})}{N^2 - \sum_{i=1}^r (x_{i+} x_{+i})} \quad (\text{Equation.....1})$$

where N = total number of observations, r = number of rows and columns in the error matrix (pixels)

X_{ii} =observation in row I and column 1,

X_{i+} = marginal total of row i, and X_{+i} = marginal total of column i

A Kappa Coefficient of 1 denotes perfect agreement, whereas a value close to zero suggests that the agreement is only somewhat better than would be expected by chance (Radoux and Bogaert, 2017).

The overall accuracy is given as;

$$OA = \frac{\sum_{i=1}^n S_i \sum_{j=1}^k \alpha_{ij} \beta_{ij}}{\sum_{i=1}^n S_i} \quad (\text{Equation.....2})$$

where k is the number of classes and n is the total number of segments, α_{ij} is 1 if the reference label for segment i is j and 0 otherwise, β_{ij} is 1 if the map label of segment i is j true classification of segment i is indicated by $\sum_{j=1}^k \alpha_{ij} \beta_{ij} = 1$, where the reference and map classes for segment i are equal. For area-based metrics, S_i is the area of segment i , for count-based metrics, S_i is 1 (Brinkhoff *et al.*, 2020).

The producer's accuracy provides the likelihood that a class j object will be accurately classified, and it is represented as;

$$PA_j = \frac{\sum_{i=1}^n S_i \alpha_{ij} \beta_{ij}}{\sum_{i=1}^n \alpha_{ij} S_i} \quad (\text{Equation.....3})$$

The user's accuracy determines the possibility that an object actually belongs to class j , which is expressed as;

$$US_j = \frac{\sum_{i=1}^n S_i \alpha_{ij} \beta_{ij}}{\sum_{i=1}^n \beta_{ij} S_i} \quad (\text{Equation.....4})$$

2.5 Predicting future land dynamics.

2.5.1 CA-Markova Chain Model

Cellular automata (CA)-based models are spatially explicit models (SEM) that operate on the basic principle that the future state of a land cover type is influenced by past local interactions between various land covers (Rwanga and Ndambuki, 2017). The CA-Markov Model combines the cellular automaton's spatial dependencies with the Markov model's temporal dependencies and this is achieved by integrating the transition rules of the CA with the transition probabilities of the Markov Model (Supriatna *et al.*, 2022; Asif *et al.*, 2023). It calculates the extent of change, the results from transition matrices, and cellular automata (CA); spatially distributing these changes based on the transition matrices. The Markov process uses transition probabilities to manage the temporal dynamics between occupancy categories. Local rules control the spatial dynamics through a cellular automata (CA) mechanism, which considers either the neighborhood configuration or the transition probabilities (Oquadif *et al.*, 2023).

2.5.2 Land use change Modeler (LCM)

Land Change Modeler (LCM) module in the TerrSet software is built to examine changes in land use and land cover and forecast possible future changes (Mishra *et al.*, 2014). This model uses artificial neural networks (ANN), Markov Chain matrices, and transition suitability maps, created by training multilayer perceptron (MLP) or logistic regression models (Akdeniz *et al.*, 2023). The model generates an initial estimate of changes between two

distinct periods based on the acquired classified images (Jalayer *et al.*, 2022; Ait *et al.*, 2023).

2.5.3 Spatial variables

Spatial variable or driving forces are factors that influence future's land use changes based on their current state (Gharaibeh *et al.*, 2020). Topographic and distance variables have been employed globally in simulating land cover change studies (Baker, 1989; Zhang *et al.*, 2008; Bahari *et al.*, 2014; Taati *et al.*, 2015). Based on previous studies and the specific characteristics of the region the following spatial variables were identified for this study; elevation, slope, aspect, proximity to roads, proximity to Water bodies and Population densities (Nguyen *et al.*, 2020; Khawaldah *et al.*, 2020; Jalayer *et al.*, 2022; Shih *et al.*, 2022; Ait *et al.*, 2023).

2.5.4 Model Validation

Validation of the model involved calculating the Kappa coefficient, the most commonly used metric for measuring a model's predictive accuracy (Lukas *et al.*, 2023). The Kappa index was computed by comparing the model's simulated images with the reference data (classified maps) for the same year (Ahmad *et al.*, 2023; Ait *et al.*, 2023). The predicted LULC for 2009, 2011 and 2023 was compared with the classified images of the same years using the validation model in IDRISI Selva Software (Alshari and Gawali, 2022; Avtar *et al.*, 2022; Lukas *et al.*, 2023).

3.0 Results

3.1 Historical Land cover land use changes

The image classification results for the years 1979, 1995, 2009, and 2023, using all four classification methods as illustrated in Figure 2 below.

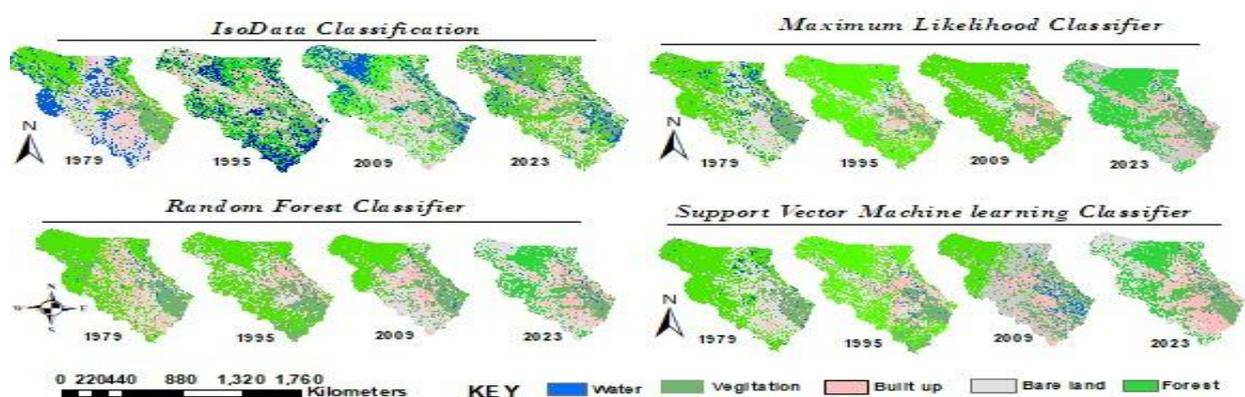


Figure 11: Classified Images using IsoData, MLC, SVM and RF for 1979, 1995, 2009 and 2023

3.2 Accuracy assessment of Classification methods

The results indicate that Random Forest classification had the highest both Kappa coefficient and overall accuracies value for all the years with 82% in 1979, 86% in 1995, 86% in 2009 and 90% in 2023, and the overall accuracies were 88% in 1979, 90% in 1995, 90% in 2009 and 93% in 2023. The results also show that Producer and User accuracies for Random Forest classification were within a range of 84% to 96% for classified images of all the years. Random Forest classified images were used for quantifying the changes in land use land cover changes and also prediction of future land use.

Table 5: Kappa Coefficient and overall accuracy

	Kappa-Coefficient				Overall Accuracy			
	1979	1995	2009	2023	1979	1995	2009	2023
RF	0.88	0.90	0.90	0.93	0.88	0.90	0.90	0.93
SVM	0.87	0.90	0.87	0.92	0.87	0.90	0.87	0.92
MLC	0.76	0.86	0.87	0.89	0.76	0.86	0.87	0.89
IsoData	0.45	0.37	0.45	0.55	0.45	0.37	0.67	0.58

Table 6a: Producer and User accuracy

Classification Method	Land Class	1979		1995		2009		2023	
		UA (%)	PA (%)						
Random Forest Supervised classification	Water	85	82	94	89	86	96	89	97
	Vegetation	81	82	97	85	97	93	97	94
	Built up	87	95	87	94	80	89	88	97
	Bare land	81	86	93	81	91	89	95	92
Support Vector Machine Supervised	Forest	82	98	93	98	97	93	93	94
	Water	65	64	87	60	65	86	81	87
	Vegetation	54	77	80	67	80	78	86	88
	Built up	68	61	51	74	53	86	87	93

classification	Bare land	69	70	86	79	95	85	78	82
	Forest	57	80	81	82	98	83	95	87

Table2b: Producer and User accuracy

		1979		1995		2009		2023	
Classification Method	Land Class	UA (%)	PA (%)						
Maximum likelihood Supervised classification	Water	65	14	86	63	92	49	79	82
	Vegetation	65	58	90	66	87	83	78	94
	Built up	54	89	39	72	55	76	58	70
	Bare land	68	78	84	79	87	98	78	83
	Forest	56	87	76	95	98	95	90	81
Iterative Self-organising DATA classification	Water	27	26	26	10	49	78	57	96
	Bare land	60	48	30	46	80	55	86	54
	Forest	38	57	30	71	74	62	75	89
	Built up	38	64	57	39	67	85	69	82
	Vegetation	52	27	29	20	53	56	76	68

3.3 Quantities for Historical Land Cover Land use changes

From 1979 to 1995, Forest cover area decreased by 14.28%, Water bodies decreased by 0.23%, whereas Vegetation, Built-up areas and Bare land increased by 4.85%, 9.07%, and 0.86%, respectively. Between 1995 and 2009, Forest cover decreased by 13.73%, Water bodies decreased by 0.35%, while Vegetation, Built-up areas, and Bare land increased by 3.15%, 2.75%, and 7.90% respectively. Lastly, during the period between 2009 and 2023, Forest cover decreased by 4.54%, and Vegetation increased by 11.24%, while Bare land, Water bodies, and built-up areas increased by 5.19%, 0.36%, and 10.44% respectively. The results are shown in Figure 2 below.

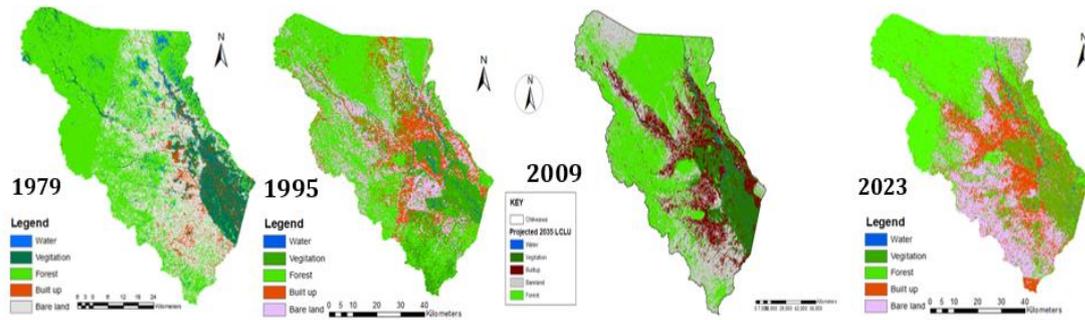


Figure 12: Land Cover and Land use classification Trends using Random Forest Classification method

3.4 Land Cover prediction

3.4.1 Assessing Spatial variables association using Cramer's V

Cramer's V was used to assess whether a particular driver variable is appropriate for predicting changes in land use and land cover (LULC). Cramer's V ranges from 0 to 1. According to (Jin *et al.*, 2013; Karakus *et al.*, 2015), values close to or exceeding 0.4 are deemed suitable for prediction, while values below 0.4 indicate a weak predictive capability for a driver variable. However, Cramer's V does not ensure robust model performance, as it cannot account for the mathematical specifications of the modeling approach or the complexity of the relationships involved (Ghosh *et al.*, 2017; Akdeniz *et al.*, 2023). Cramer's V is used to assess whether a specific driver variable should be included in predicting LULC changes. Cramer's V for the variable is introduced in Table 3 below. The Cramer's V for all variables ranges between 0.75 to 1 and hence all the variables were used in creating sub-models and hence incorporated in the prediction of future land cover classes.

Table 7: Spatial variable association assessment using Cramer's V

Variable	Cramer's V	χ^2	Degrees of freedom	P-Value
Distance from road	0.736	10.833	8	0.2113
Distance from Water bodies	1	20	4	0.000499
Elevation	1	20	4	0.000499
Slope	1	20	4	0.000499
Population density	1	20	4	0.000499

3.4.2 Markov and CA-Markov Transitional Probability Matrices

A Markov chain process generates a transition probability matrix that describes the likelihood of land cover change. This matrix displays the probability of land cover changing on a scale from 0 to 1, where 0 indicates that the change is impossible and 1 indicates that the change is certain to occur (Marko *et al.*, 2016; Akbar and Supriatna, 2019). The results are shown in Figure 5 below; where C1 is Water, C2 is Vegetation, C3 is Built up area, C4 is Bare land and C5 is Forest. Both Markov and CA-Markov transitional matrices are part of the transitional processes for the Land use land cover prediction in Land Cover Modelling. The results of predicted total land cover areas in percentages have been presented in Figure 7 below;

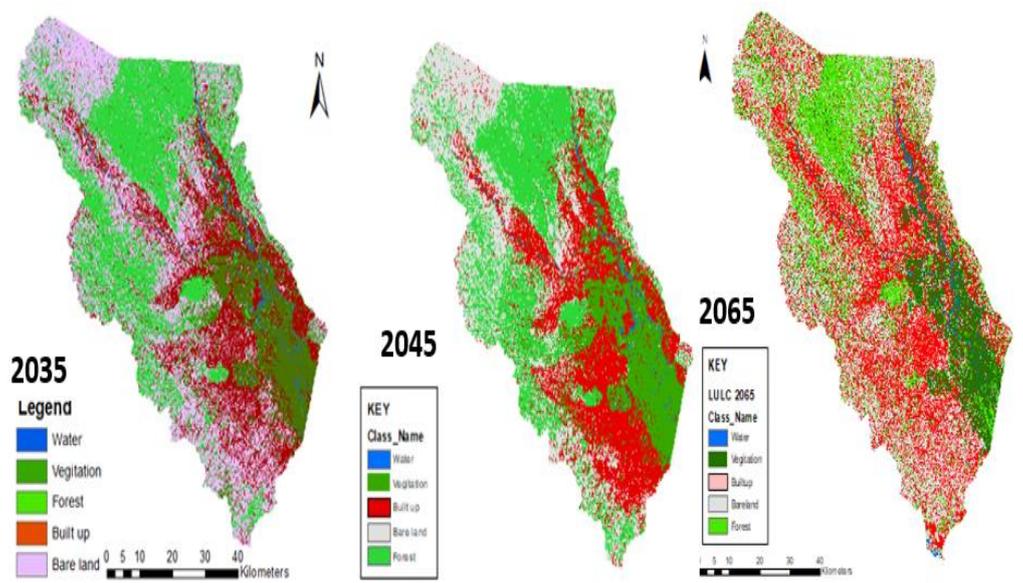


Figure 13: Future Land cover land use Trends for the years 2035, 2045 & 2065

The predicted land cover classes show that the area covered by Water bodies will decrease by 28.2%, 12.0%, and 14% by the years 2035, 2045, and 2065, respectively, and Vegetation will decrease by 12.9%, 19.8%, and 24.7% for the same years. The predictions also indicate that built-up areas will increase by 23.2%, 22.2%, and 22.8% for the years 2035, 2045, and 2065, respectively, and Bare land will increase by 13.0%, 15.3%, and 37.1% for the same years. Additionally, the forecast for land covered by Forests indicates that Forests will decrease by 28.6%, 33.8%, and 51.0% by the years 2035, 2045, and 2065, respectively.

3.4.3 Validation of CA-Markova Model

The validation of predictive outcomes and the assessment of model accuracy were conducted using the kappa index and the confusion matrix. The CA-Markov model demonstrated a level of agreement ranging from good to perfect for the two testing years. The results have been summarized in Table 7 below.

Table 8: Accuracy assessment for model validation

Maps used for simulation	Maps used for validation		Degree of compatibility	Kappa Index		
Observed LULC			<i>Validation of simulation</i>			
(RF Classified)	Simulated LULC	(RF Classified)	CA-Markova %	K_{no}	$K_{location}$	$K_{standard}$
1979-1995	2009	2009	83.4	0.79	0.81	0.81
1995-2009	2011	2011	82.7	0.81	0.79	0.82
1979-2009	2023	2023	81.6	0.80	0.84	0.83

Where RF is Random Forest classified images, k_{no} is over accuracy (measures overall agreement between the simulated and observed maps), $k_{location}$ is the Location kappa (measures the agreement considering the location of the changes) and $k_{standard}$ is the Standardized Kappa (standardized Kappa index that accounts for the chance agreement)

3.5 Land use land cover change Trend analysis

The results indicate a perfect negative correlation for Forest cover ($\rho = -1.0000$, P-Value = 0.0004), demonstrating a sharp decline over time. This means that as time progresses, the Forest area significantly decreases. Conversely, Bare land and built-up areas show perfect positive correlations, indicating a strong and direct increase in these land types over time. Bare land exhibits a perfect positive correlation ($\rho = 1.0000$, P-Value = 0.0004), and similarly, the built-up area also shows a perfect positive correlation ($\rho = 1.0000$, P-Value = 0.0004). Vegetation has a very weak negative correlation ($\rho = -0.1071$, P-Value = 0.8397), meaning its area has remained relatively stable with no significant change. Water bodies display a strong negative correlation ($\rho = -0.7500$, P-Value = 0.0663), indicating a notable decrease over time.

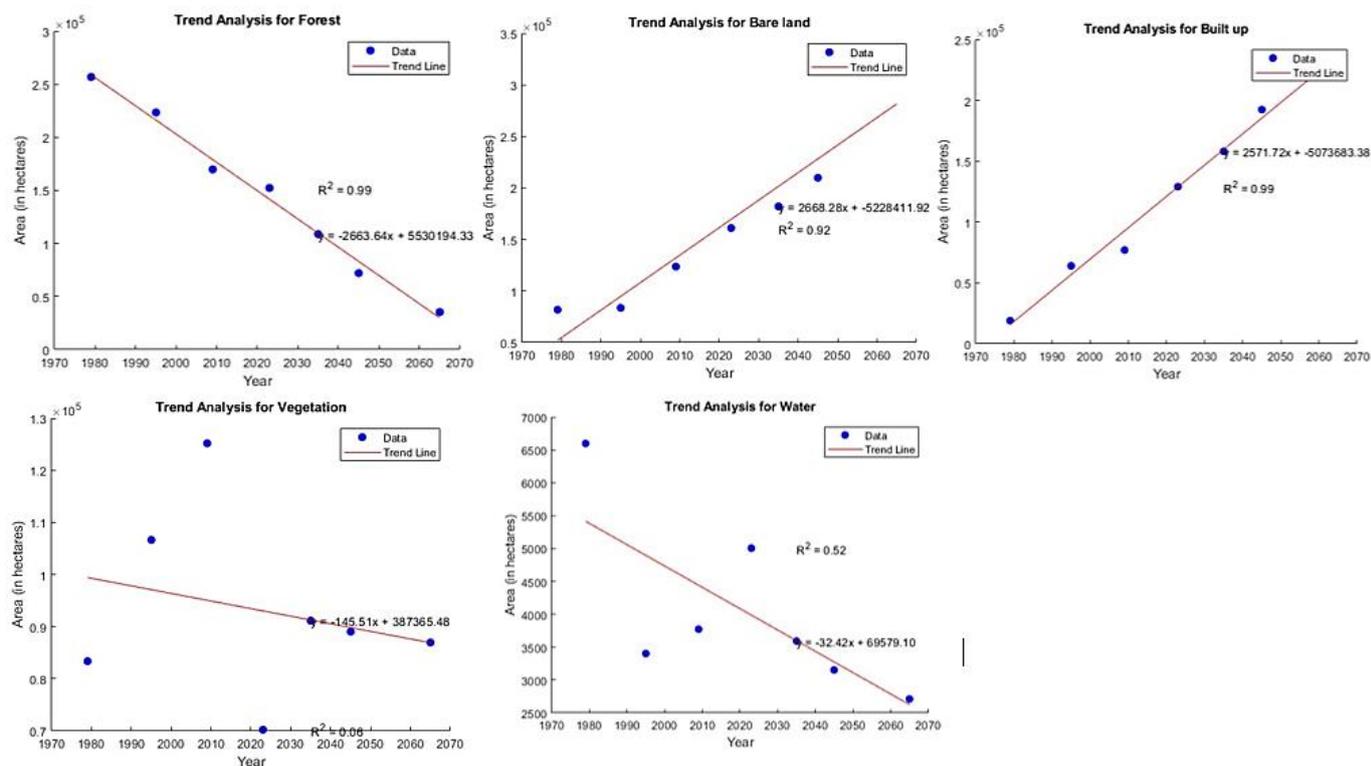


Figure 14: Trend analysis for Forest, Bare land, Built up area, Vegetation and Water

4.0 Discussion & Recommendations

This research sought to analyse land cover and land use changes, and to make predictions using remotely sensed data. The sharp decline in Forest, Vegetation, and Water cover areas reveals the detrimental effects of both anthropogenic and natural activities. Forest and vegetative cover play a crucial role in moderating the hydrological cycle, retaining runoff and thus preventing exacerbating impacts of climate change-induced events such as floods (Sharma *et al.*, 2011; Nguyen *et al.*, 2020). Chikwawa, being one of the districts acutely affected by floods (GoM, 2023), requires reinforced natural buffers of Vegetation and Forests to absorb excess Water and mitigate flood impacts. The disappearance of large areas of vegetative cover and Forests, which has paved the way for Bare land and Built up areas, has also impacted Water-covered areas (Bourguignon *et al.*, 2007; Bradshaw *et al.*, 2007). As a district through which one of the two major rivers flows and is acutely affected by any major flood events in the Country, it is essential to ensure that Forest and vegetative covers are protected, since these play a crucial role in regulating Water availability and flood impact severity.

5.0 Conclusion

The results of this study based on the CA-Markov model indicate that Forest and Vegetation Land Cover in the Chikwawa District of Malawi will continue to decrease further and pave the way for Built-up areas and Bare land. If the

current land use practices persist, the deterioration of Forest cover will acutely affect different economic sectors, such as population, agriculture, water, energy, tourism, fisheries, health, and biodiversity of the district. It is imperative for the Government and District officials to reinforce conservation efforts to protect vegetation, Forests, and Wetlands from further depletion. Further studies are needed to understand the drivers and socioeconomic factors influencing this rapid depletion of Forest and vegetative land cover in the Chikwawa District.

5.1 Originality

Adopting and assessing the accuracy of four classification methods provides a unique approach to using satellite images for land cover classification, ensuring the comparability, accuracy, and validation of the results.

5.2 Limitations

The spatial resolution of the satellite images may affect the classified land classes and hence the quantities generated.

Authors declaration

The author declares that there is no conflict of interest in the research as any data source has been duly cited

Funding

The research did not receive any funding

Acknowledgement

The author appreciates research supervisors Dr. Roodheer Beeharry and Dr. Rajeshwar Goodary from the University of des Mascareignes the support received during the writing process and whole research.

LLM Statement

In some cases, certain Large Language Model (LLM) tools have been utilised for paraphrasing and correcting grammatical errors.

References

Aalders, I. (2008), "Modeling land-use decision behavior with Bayesian belief networks", *Ecology and Society*, Vol. 13 No. 1. Available at: <https://doi.org/10.5751/ES-02362-130116>.

Ahmad, H., Abdallah, M., Jose, F., Elzain, H.E., Bhuyan, M.S., Shoemaker, D.J. and Selvam, S. (2023), "Evaluation and mapping of predicted future land use changes using hybrid models in a coastal area", *Ecological Informatics*, Vol. 78, p. 102324. Available at: <https://doi.org/10.1016/j.ecoinf.2023.102324>.

Ait El Haj, F., Ouadif, L. and Akhssas, A. (2023), "Simulating and predicting future land-use/land cover trends using CA- Markov and LCM models", *Case Studies in Chemical and Environmental Engineering*, Vol. 7, p. 100342. Available at: <https://doi.org/10.1016/j.cscee.2023.100342>.

Akbar, F. and Supriatna (2019), "Land cover modelling of Pelabuhanratu City in 2032 using cellular automata-markov chain method", *IOP Conference Series: Earth and Environmental Science*, Vol. 311 No. 1. Available at: <https://doi.org/10.1088/1755-1315/311/1/012071>.

Akdeniz, H.B., Sag, N.S. and Inam, S. (2023), "Analysis of land use/land cover changes and prediction of future changes with land change modeler: Case of Belek, Turkey", *Environmental Monitoring and Assessment*, Vol. 195 No. 1, pp. 1–28. Available at: <https://doi.org/10.1007/s10661-022-10746-w>.

Alencar, A., Shimbo, J.Z., Lenti, F., Marques, C.B., Zimbres, B., Rosa, M., Arruda, V., Castro, I., Ribeiro, J.P.F.M., Varela, V., Alencar, I., Piontekowski, V., Ribeiro, V., Bustamante, M.M.C., Sano, E.E. and Barroso, M. (2020), "Mapping three decades of changes in the brazilian savanna native vegetation using landsat data processed in the google earth engine platform", *Remote Sensing*, Vol. 12 No. 6. Available at: <https://doi.org/10.3390/rs12060924>.

Alexander, P., Rounsevell, M.D.A., Dislich, C., Dodson, J.R., Engström, K. and Moran, D. (2015), "Drivers for global agricultural land use change: The nexus of diet, population, yield and bioenergy", *Global Environmental Change*, Vol. 35, pp. 138 – 147. Available at: <https://doi.org/10.1016/j.gloenvcha.2015.08.011>.

Alkaradaghi, K., Ali, S.S., Al-Ansari, N. and Laue, J. (2019), "Land use classification and change detection using multi-temporal Landsat imagery in Sulaimaniyah Governorate, Iraq", in *Advances in Remote Sensing and Geo Informatics Applications: Proceedings of the 1st Springer Conference of the Arabian Journal of Geosciences (CAJG-1), Tunisia 2018*, Amsterdam: Springer International Publishing, pp. 117-120.

Alshari, E.A. and Gawali, B.W. (2022), "Modeling Land Use Change in Sana'a City of Yemen with MOLUSCE", *Journal of Sensors*, Available at: <https://doi.org/10.1155/2022/7419031>.

Amini, S., Saber, M., Rabiei-Dastjerdi, H. and Homayouni, S. (2022), "Urban Land Use and Land Cover Change Analysis Using Random Forest Classification of Landsat Time Series", *Remote Sensing*, Vol. 14 No. 11, pp. 1–23. Available at: <https://doi.org/10.3390/rs14112654>.

Avtar, R., Rinamalo, A.V., Umarhadi, D.A., Gupta, A., Khedher, K.M., Yunus, A.P., Singh, B.P., Kumar, P., Sahu, N. and Sakti, A.D. (2022), "Land Use Change and Prediction for Valuating Carbon Sequestration in Viti Levu Island, Fiji", *Land*, Vol. 11 No. 8. Available at: <https://doi.org/10.3390/land11081274>.

Bahari, N.I.S., Ahmad, A. and Aboobaider, B.M. (2014), "Application of support vector machine for classification of multispectral data", *IOP Conference Series: Earth and Environmental Science*, Vol. 20 No. 1. Available at: <https://doi.org/10.1088/1755-1315/20/1/012038>.

Baker, W.L. (1989), "A review of models of landscape change", *Landscape Ecology*, Vol. 2 No. 2, pp. 111–133. Available at: <https://doi.org/10.1007/BF00137155>.

Bogoliubova, A. and Tymków, P. (2014), "Accuracy Assessment of Automatic Image Processing for Land Cover Classification of St . Petersburg Protected Area", *Acta Scientiarum Polonorum, Administratio Locorum*, Vol. 13 No. 1–2, pp. 5 – 22.

Bourguignon, F., Sierra, K. and Chomitz, K.M. (2007), "Deforestation Imposes Geographically Varied Environmental Damages", *At Loggerheads: Agricultural Expansion, Poverty Reduction, and Environment in the Tropical Forests*, pp. 109–134.

Bradshaw, C.J.A., Sodhi, N.S., Peh, K.S.H. and Brook, B.W. (2007), "Global evidence that deforestation amplifies flood risk and severity in the developing world", *Global Change Biology*, Vol. 13 No. 11, pp. 2379–2395. Available at: <https://doi.org/10.1111/j.1365-2486.2007.01446.x>.

Brinkhoff, J., Vardanega, J. and Robson, A.J. (2020), "Land cover classification of nine perennial crops using sentinel-1 and -2 data", *Remote Sensing*, Vol. 12 No. 1, pp. 1–26. Available at: <https://doi.org/10.3390/rs12010096>.

Burrewar, S.S., Haque, M. and Haider, T.U. (2024), "Convolutional Neural Network Methods for Detecting Land-Use Changes", *International Journal of Intelligent Systems and Applications in Engineering*, Vol. 12 No. 14s, pp. 573–590.

Butler, R.A. (2019), "The impact of deforestation", *Mongabay*, pp. 1–13. Available at: <https://rainforests.mongabay.com/09-consequences-of-deforestation.html>.

Celio, E., Koellner, T. and Grêt-Regamey, A. (2014), "Modeling land use decisions with Bayesian networks: Spatially explicit analysis of driving forces on land use change", *Environmental Modelling and Software*, Vol. 52, pp. 222–233. Available at: <https://doi.org/10.1016/j.envsoft.2013.10.014>.

Chambers, F., Cruz, C. and Serugendo, G.D.M. (2023) Agent-based modelling of urban expansion and land cover change: a prototype for the analysis of commuting patterns in Geneva, Switzerland. In French Regional Conference on Complex Systems, Le Havre, 2023.

Chikwawa District Council (2020) *Chikwawa District Physical Development Plan*, Chikwawa: Chikwawa District Council.

Colorado, N. and Network, P. (2011) 'Land Cover Monitoring', *Program* [Preprint].

Daulos Mauambeta , David Chitedze, Reginald Mumba, S.G. (2010), "Status of Forests and Tree Management in Malawi a Position Paper Prepared for the CURE", *Coordination Union for Rehabilitation of the Environment* [Preprint], (August). Available at: <https://cepa.rmportal.net/Library/biodiversity/Status of Forests and Tree Management in Malawi.pdf>.

Degerickx, J., Roberts, D.A. and Somers, B. (2019), "Enhancing the performance of Multiple Endmember Spectral Mixture Analysis (MESMA) for urban land cover mapping using airborne lidar data and band selection", *Remote Sensing of Environment*, VOL. 221, pp. 260–273. Available at: <https://doi.org/10.1016/j.rse.2018.11.026>.

Rudrapal, D. and Subhedar, M. (2015), "Land cover classification using support vector machine", *Int. J. Eng. Res*, Vol. 4 No. 09, pp.584-588.

Djenontin, I.N.S., Zulu, L.C. and Richardson, R.B. (2022), "Smallholder farmers and forest landscape restoration in sub-Saharan Africa: Evidence from Central Malawi", *Land Use Policy*, Vol. 122, p. 106345. Available at: <https://doi.org/10.1016/j.landusepol.2022.106345>.

Du, P., Liu, S., Liu, P., Tan, K. and Cheng, L. (2014), "Sub-pixel change detection for urban land-cover analysis via multi-temporal remote sensing images", *Geo-Spatial Information Science*, Vol. 17 No. 1, pp. 26–38. Available at: <https://doi.org/10.1080/10095020.2014.889268>.

ESRI (2022), "Overview of image classification—ArcGIS Pro | Documentation", *Esri - ArcGIS Pro* [Preprint]. Available at: <https://pro.arcgis.com/en/pro-app/2.8/help/analysis/image-analyst/overview-of-image-classification.htm>.

Fisher, M. (2004), "Household welfare and forest dependence in southern Malawi", *Environment and Development Economics*, Vol. 9 No. 1, pp. 135–154. Available at: <https://doi.org/10.1017/s1355770x03001219>.

Foley, J.A., DeFries, R., Asner, G.P., Barford, C., Bonan, G., Carpenter, S.R., Chapin, F.S., Coe, M.T., Daily, G.C., Gibbs, H.K., Helkowski, J.H., Holloway, T., Howard, E.A., Kucharik, C.J., Monfreda, C., Patz, J.A., Prentice, I.C., Ramankutty, N. and Snyder, P.K. (2005), "Global consequences of land use", *Science*, Vol. 309 No. 5734, pp. 570–574. Available at: <https://doi.org/10.1126/science.1111772>.

Gharaibeh, A., Shaamala, A., Obeidat, R. and Al-Kofahi, S. (2020), "Improving land-use change modeling by integrating ANN with Cellular Automata-Markov Chain model", *Heliyon*, Vol. 6 No. 9, p. e05092. Available at: <https://doi.org/10.1016/j.heliyon.2020.e05092>.

Ghosh, P., Mukhopadhyay, A., Chanda, A., Mondal, P., Akhand, A., Mukherjee, S., Nayak, S.K., Ghosh, S., Mitra, D., Ghosh, T. and Hazra, S. (2017), "Application of Cellular automata and Markov-chain model in geospatial environmental modeling- A review", *Remote Sensing Applications: Society and Environment*, Vol. 5, pp. 64–77. Available at: <https://doi.org/10.1016/j.rsase.2017.01.005>.

Gislason, P.O., Benediktsson, J.A. and Sveinsson, J.R. (2006), "Random forests for land cover classification", *Pattern Recognition Letters*, Vol. 27 No. 4, pp. 294–300. Available at: <https://doi.org/10.1016/j.patrec.2005.08.011>.

Gondwe, M.F., Cho, M.A., Chirwa, P.W. and Geldenhuys, C.J. (2019), "Land use land cover change and the comparative impact of co-management and government-management on the forest cover in Malawi (1999-2018)", *Journal of Land Use Science*, Vol. 14 No. 4–6, pp. 281–305. Available at: <https://doi.org/10.1080/1747423X.2019.1706654>.

Government of Malawi (2023), "Malawi 2023 Tropical Cyclone Freddy Post-Disaster Needs Assessment", pp. 1–102. Available at: <https://www.preventionweb.net/media/87994/download?startDownload=true>.

Di Gregorio, A. (2016), "Land Cover Classification System: Classification Concepts", October. Available at: <https://www.fao.org/3/x0596e/x0596e00.htm%0Ahttp://www.fao.org/docrep/003/x0596e/x0596e00.htm>.

Hahn, C., Wijaya, A. and Gloaguen, R. (2007), "Application of Support Vector Machine for Complex Land Cover Classification using Aster and Landsat Data", *DGPF Proceeding*, Vol. 16, pp. 149 –154.

Häme, T., Sirro, L., Kilpi, J., Seitsonen, L., Andersson, K. and Melkas, T. (2020), "A hierarchical clustering method for land cover change detection and identification", *Remote Sensing*, Vol. 12 No. 11. Available at: <https://doi.org/10.3390/rs12111751>.

Heydari, S.S. and Mountrakis, G. (2018), "Effect of classifier selection, reference sample size, reference class distribution and scene heterogeneity in per-pixel classification accuracy using 26 Landsat sites, Remote Sensing of Environment", Available at: <https://doi.org/10.1016/j.rse.2017.09.035>.

Hodgson, F.W. (2020), "Layout and design", *Modern Newspaper Practice*, pp. 94–119. Available at: <https://doi.org/10.4324/9780080885728-12>.

Jagger, P. and Perez-Heydrich, C. (2016), "Land use and household energy dynamics in Malawi", *Environmental Research Letters*, Vol. 11 No. 12. Available at: <https://doi.org/10.1088/1748-9326/11/12/125004>.

Jalayer, S., Sharifi, A., Abbasi-Moghadam, D., Tariq, A. and Qin, S. (2022), "Modeling and Predicting Land Use Land Cover Spatiotemporal Changes: A Case Study in Chalus Watershed, Iran", *IEEE Journal of Selected Topics in*

Applied Earth Observations and Remote Sensing, Vol. 15, pp. 5496–5513. Available at: <https://doi.org/10.1109/JSTARS.2022.3189528>.

Jin, S., Yang, L., Danielson, P., Homer, C., Fry, J. and Xian, G. (2013), "A comprehensive change detection method for updating the National Land Cover Database to circa 2011", *Remote Sensing of Environment*, Vol. 132, pp. 159–175. Available at: <https://doi.org/10.1016/j.rse.2013.01.012>.

Jumbe, C.B.L. and Angelsen, A. (2007), "Forest dependence and participation in CPR management: Empirical evidence from forest co-management in Malawi", *Ecological Economics*, Vol. 62 No. 3–4, pp. 661–672. Available at: <https://doi.org/10.1016/j.ecolecon.2006.08.008>.

Karakus, C.B., Cerit, O. and Kavak, K.S. (2015), "Determination of Land Use/Cover Changes and Land Use Potentials of Sivas City and its Surroundings Using Geographical Information Systems (GIS) and Remote Sensing (RS)", *Procedia Earth and Planetary Science*, Vol. 15, pp. 454–461. Available at: <https://doi.org/10.1016/j.proeps.2015.08.040>.

Kaya, I.A. and Görgün, E.K. (2020), "Land Use and Land Cover Change in Tuticorin Coast Using Remote Sensing and Geographic Information System Land Use and Land Cover Change in Tuticorin Coast Using Remote Sensing and Geographic Information System", *Environ Monit Assess*, (January), p. 18.

Khawaldah, H.A., Farhan, I. and Alzboun, N.M. (2020), "Simulation and prediction of land use and land cover change using GIS, remote sensing and CA-Markov model", *Global Journal of Environmental Science and Management*, Vol. 6 No. 2, pp. 215 – 232. Available at: <https://doi.org/10.22034/gjesm.2020.02.07>.

Lemenkova, P. (2021), "Evaluating land cover types from Landsat TM using SAGA GIS for vegetation mapping based on ISODATA and K-means clustering", *Acta agriculturae Serbica*, Vol. 26 No. 52, pp. 159 – 165. Available at: <https://doi.org/10.5937/aaser21521591>.

Li, Q., Qiu, C., Ma, L., Schmitt, M. and Zhu, X.X. (2020), "Mapping the land cover of africa at 10 m resolution from multi-source remote sensing data with google earth engine", *Remote Sensing*, Vol. 12 No. 4, pp. 1–22. Available at: <https://doi.org/10.3390/rs12040602>.

Liu, G.R. (2022), "Unsupervised Learning Techniques", *Machine Learning with Python*, pp. 585–624. Available at: https://doi.org/10.1142/9789811254185_0017.

Lukas, P., Melesse, A.M. and Kenea, T.T. (2023), "Prediction of Future Land Use/Land Cover Changes Using a Coupled CA-ANN Model in the Upper Omo–Gibe River Basin, Ethiopia", *Remote Sensing*, Vol. 15 No. 4. Available at: <https://doi.org/10.3390/rs15041148>.

Manandhar, R., Odehi, I.O.A. and Ancevt, T. (2009), "Improving the accuracy of land use and land cover classification of landsat data using post-

classification enhancement", *Remote Sensing*, Vol. 1 No. 3, pp. 330–344. Available at: <https://doi.org/10.3390/rs1030330>.

Marko, K., Zulkarnain, F. and Kusratmoko, E. (2016), "Coupling of Markov chains and cellular automata spatial models to predict land cover changes (case study: Upper Ci Leungsi catchment area)", *IOP Conference Series: Earth and Environmental Science*, Vol. 47 No. 1. Available at: <https://doi.org/10.1088/1755-1315/47/1/012032>.

Mas, J.F. (2003), "An Artificial Neural Networks Approach to Map Land Use/Cover Using Landsat Imagery and Ancillary Data", *International Geoscience and Remote Sensing Symposium (IGARSS)*, Vol. 6, pp. 3498–3500.

Minde, I.J., Kowero, G., Ngugi, D. and Luhanga, J. (2001), "Agricultural land expansion and deforestation in Malawi", *Forests Trees and Livelihoods*, Vol. 11 No. 2, pp. 167–182.

Mishra, V., Rai, P. and Mohan, K. (2014), "Prediction of land use changes based on land change modeler (LCM) using remote sensing: A case study of Muzaffarpur (Bihar), India", *Journal of the Geographical Institute Jovan Cvijic, SASA*, Vol. 64 No. 1, pp. 111–127.

Mixed Migration Centre (2023), "Climate and mobility case study: Chikwawa, Malawi: Nchalo Chikwawa", available at: https://mixedmigration.org/wp-content/uploads/2023/01/259_Case_Study_7_Malawai.pdf (accessed 10/01/2025).

Munthali, K.G. and Murayama, Y. (2011), "Land use/cover change detection and analysis for Dzalanyama forest reserve, Lilongwe, Malawi", *Procedia - Social and Behavioral Sciences*, Vol. 21, pp. 203–211.

Munthali, M.G., Davis, N., Adeola, A.M., Botai, J.O., Kamwi, J.M., Chisale, H.L.W. and Orimoogunje, O.O.I. (2019), "Local perception of drivers of Land-Use and Land- Cover change dynamics across Dedza district, Central Malawi region", *Sustainability (Switzerland)*, Vol. 11 No. 3. Available at: <https://doi.org/10.3390/su11030832>.

Munthali, M.G., Mustak, S., Adeola, A., Botai, J., Singh, S.K. and Davis, N. (2020), "Modelling land use and land cover dynamics of Dedza district of Malawi using hybrid Cellular Automata and Markov model", *Remote Sensing Applications: Society and Environment*, Vol. 17, p. 100276. Available at: <https://doi.org/10.1016/j.rsase.2019.100276>.

Nascimento, N., West, T.A.P., Biber-Freudenberger, L., Sousa-Neto, E.R. d., Ometto, J. and Börner, J. (2020), "A Bayesian network approach to modelling land-use decisions under environmental policy incentives in the Brazilian Amazon", *Journal of Land Use Science*, Vol. 15 No. 2–3, pp. 127–141. Available at: <https://doi.org/10.1080/1747423X.2019.1709223>.

National Statistical Office (2019), "Malawi POPULATION AND HOUSING CENSUS REPORT-2018 2018 Malawi Population and Housing Main Report",

(May). Available at: [http://www.nsomalawi.mw/images/stories/data_on_line/demography/census_2018/2018 Malawi Population and Housing Census Main Report.pdf](http://www.nsomalawi.mw/images/stories/data_on_line/demography/census_2018/2018_Malawi_Population_and_Housing_Census_Main_Report.pdf) (Accessed 10/01/2025).

Nazombe, K. and Nambazo, O. (2023), "Monitoring and assessment of urban green space loss and fragmentation using remote sensing data in the four cities of Malawi from 1986 to 2021", *Scientific African*, Vol. 20. Available at: <https://doi.org/10.1016/j.sciaf.2023.e01639>.

Nguyen, Houngh Thi Thanh, Doan, T.M., Tomppo, E. and McRoberts, R.E. (2020), "Land Use / Land Cover Mapping Using Multitemporal Sentinel-2 Imagery and Four Classification", *Remote Sens*, Vol. 12, pp. 1–27. Available at: www.mdpi.com/journal/remotesensing.

Nguyen, H. T.T., Pham, T.A., Doan, M.T. and Tran, P.T.X. (2020), "Land use/land cover change prediction using multi-temporal satellite imagery and multi-layer perceptron markov model", *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences - ISPRS Archives*, Vol. 54 No. 3/W1, pp. 99–105.

Van Niel, T.G., McVicar, T.R. and Datt, B. (2005), "On the relationship between training sample size and data dimensionality: Monte Carlo analysis of broadband multi-temporal classification", *Remote Sensing of Environment*, Vol. 98 No. 4, pp. 468 – 480.

Norovsuren, B., Tseveen, B., Batomunkuev, V., Renchin, T., Natsagdorj, E., Yangiv, A. and Mart, Z. (2019), "Land cover classification using maximum likelihood method (2000 and 2019) at Khandgait valley in Mongolia", *IOP Conference Series: Earth and Environmental Science*, Vol. 381 No. 1. Available at: <https://doi.org/10.1088/1755-1315/381/1/012054>.

Nyirenda, H. (2022), "Changes in tree structure, composition and soil in different disturbance categories in Miombo and agroecosystems in Malawi, central Africa", *Heliyon*, Vol. 8 No. 9, p. e10664. Available at: <https://doi.org/10.1016/j.heliyon.2022.e10664>.

Of, T.H.E.S. (2022), "In Brief to The State of the World's Forests 2022", *In Brief to The State of the World's Forests 2022* [Preprint]. Available at: <https://doi.org/10.4060/cb9363en>.

Pacheco, P. (2017), "Deforestation Fronts Drivers and Responses in a Changing World", pp. 1–125.

Pangapanga-Phiri, I., Mungatana, E.D., Pangapanga, L. and Nkoka, F.S. (2022), "Understanding the impact of sustainable land-scape management practices on farm productivity under intensifying tropical cyclones: Evidence from Southern Malawi", *Tropical Cyclone Research and Review*, Vol. 11 No. 4, pp. 265–276.

Parker, D.C., Berger, T. and Manson, S.M. (2001) Agent-Based Models of Land-Use and Land-Cover Change - Report and review of an international workshop October 4 - 7, 2001, Irvine, California, USA.

Phillips, P.M. and João, E. (2017), "Land use planning and the ecosystem approach: An evaluation of case study planning frameworks against the Malawi Principles", *Land Use Policy*, Vol. 68, pp. 460 – 480.

Pullanikkatil, D., Palamuleni, L. and Ruhiiga, T. (2016), "Assessment of land use change in Likangala River catchment, Malawi: A remote sensing and DPSIR approach", *Applied Geography*, Vol. 71, pp. 9–23.

Pullanikkatil, D., Palamuleni, L.G. and Ruhiiga, T.M. (2016), "Land use/land cover change and implications for ecosystems services in the Likangala River Catchment, Malawi", *Physics and Chemistry of the Earth*, Vol. 93, pp. 96 – 103.

R, V. (2020), "Unsupervised ISODATA algorithm classification used in the landsat image for predicting the expansion of Salem urban, Tamil Nadu", *Indian Journal of Science and Technology*, Vol. 13 No. 16, pp. 1619–1629.

Radoux, J. and Bogaert, P. (2017), "Good practices for object-based accuracy assessment", *Remote Sensing*, Vol. 9 No. 7. Available at: <https://doi.org/10.3390/rs9070646>.

Ramankutty, N. and Foley, J.A. (1999), "Estimating historical changes in global land cover: Croplands from 1700 to 1992", *Global Biogeochemical Cycles*, Vol. 13 No. 4, pp. 997–1027.

Rana, V.K. and Venkata Suryanarayana, T.M. (2020), "Performance evaluation of MLE, RF and SVM classification algorithms for watershed scale land use/land cover mapping using sentinel 2 bands", *Remote Sensing Applications: Society and Environment*, Vol. 19, p. 100351. Available at: <https://doi.org/10.1016/j.rsase.2020.100351>.

Rodriguez-Galiano, V.F., Ghimire, B., Rogan, J., Chica-Olmo, M. and Rigol-Sanchez, J.P. (2012a), "An assessment of the effectiveness of a random forest classifier for land-cover classification", *ISPRS Journal of Photogrammetry and Remote Sensing*, Vol. 67 No. 1, pp. 93–104. Available at: <https://doi.org/10.1016/j.isprsjprs.2011.11.002>.

Rodriguez-Galiano, V.F., Ghimire, B., Rogan, J., Chica-Olmo, M. and Rigol-Sanchez, J.P. (2012b), "An assessment of the effectiveness of a random forest classifier for land-cover classification", *ISPRS Journal of Photogrammetry and Remote Sensing*, Vol. 67 No. 1, pp. 93 – 104. Available at: <https://doi.org/10.1016/j.isprsjprs.2011.11.002>.

Rwanga, S.S. and Ndambuki, J.M. (2017), "Accuracy Assessment of Land Use/Land Cover Classification Using Remote Sensing and GIS", *International Journal of Geosciences*, Vol. 08 No. 04, pp. 611–622.

Sarker, I.H. (2021), "Machine Learning: Algorithms, Real-World Applications and Research Directions", *SN Computer Science*, Vol. 2 No. 3, pp. 1–21. Available at: <https://doi.org/10.1007/s42979-021-00592-x>.

Shi, D. and Yang, X. (2015), "Support Vector Machines for Land Cover Mapping from Remote Sensor Imagery", pp. 265–279. Available at: https://doi.org/10.1007/978-94-017-9813-6_13.

Shih, H. chien, Stow, D.A., Chang, K.C., Roberts, D.A. and Goulias, K.G. (2022), "From land cover to land use: applying random forest classifier to Landsat imagery for urban land-use change mapping", *Geocarto International*, Vol. 37 No. 19, pp. 5523–5546.

Shivakumar, B.R. and Rajashekararadhya, S. V. (2018), "Investigation on land cover mapping capability of maximum likelihood classifier: A case study on North Canara, India", *Procedia Computer Science*, Vol. 143, pp. 579–586.

de Souza, J.M., Morgado, P., da Costa, E.M. and de Novaes Vianna, L.F. (2022), "Modeling of Land Use and Land Cover (LULC) Change Based on Artificial Neural Networks for the Chapecó River Ecological Corridor, Santa Catarina/Brazil", *Sustainability (Switzerland)*, Vol. 14 No. 7. Available at: <https://doi.org/10.3390/su14074038>.

Svoboda, J., Štych, P., Laštovička, J., Paluba, D. and Kobliuk, N. (2022), "Random Forest Classification of Land Use, Land-Use Change and Forestry (LULUCF) Using Sentinel-2 Data—A Case Study of Czechia", *Remote Sensing*, Vol. 14 No. 5. Available at: <https://doi.org/10.3390/rs14051189>.

Taati, A., Sarmadian, F., Mousavi, A., Pour, C.T.H. and Shahir, A.H.E. (2015), "Land use classification using support vector machine and maximum likelihood algorithms by landsat 5 TM images", *Walailak Journal of Science and Technology*, Vol. 12 No. 8, pp. 681–687.

Teluguntla, P., Thenkabail, P., Oliphant, A., Xiong, J., Gumma, M.K., Congalton, R.G., Yadav, K. and Huete, A. (2018), "A 30-m landsat-derived cropland extent product of Australia and China using random forest machine learning algorithm on Google Earth Engine cloud computing platform", *ISPRS Journal of Photogrammetry and Remote Sensing*, Vol. 144(February), pp. 325–340. Available at: <https://doi.org/10.1016/j.isprsjprs.2018.07.017>.

Tessema, N., Kebede, A. and Yadeta, D. (2020), "Modeling land use dynamics in the Kesem sub-basin, Awash River basin, Ethiopia", *Cogent Environmental Science*, Vol. 6 No. 1. Available at: <https://doi.org/10.1080/23311843.2020.1782006>.

Tokar, O., Vovk, O., Kolyasa, L., Havryliuk, S. and Korol, M. (2018), "Using the random forest classification for land cover interpretation of landsat images in the prykarpattya region of Ukraine", *International Scientific and Technical Conference on Computer Sciences and Information Technologies*,

Vol.1(November), pp. 241–244. Available at: <https://doi.org/10.1109/STC-CSIT.2018.8526646>.

Ulbricht, K.A., Teotia, H.S. and Civco, D.L. (1993), "Supervised Classification to Land Cover Mapping in Semi-Arid Environment of NE Brazil Using Landsat-TM and SPOT Data", *International Archives of Photogrammetry and Remote Sensing*, Vol. 29, pp. 821–821. Available at: http://www.isprs.org/proceedings/XXIX/congress/part7/821_XXIX-part7.pdf.

Wang, Y. and Lu, D. (2017), "Mapping *Torreya grandis* spatial distribution using high spatial resolution satellite imagery with the expert rules-based approach", *Remote Sensing*, Vol. 9 No. 6. Available at: <https://doi.org/10.3390/rs9060564>.

Wu, G., Zhong, B., Si, H., Wei, B., Wu, Q. and Song, C. (2007), "Agent-based modeling in land use and land cover change studies", *Geoinformatics 2007: Remotely Sensed Data and Information*, 6752, p. 675232. Available at: <https://doi.org/10.1117/12.761292>.

Yang, M.H. and Moghaddam, B. (2000), "Gender classification using support vector machines", *IEEE International Conference on Image Processing*, Vol. 2 No. 09, pp. 471–474.

Zhang, J., Pan, Y., Yi, C., Ma, Q. and Xu, C. (2008), "An integrated approach using ISODATA and SVR to land cover classification: an example of wheat", *Geoinformatics 2008 and Joint Conference on GIS and Built Environment: Classification of Remote Sensing Images*, Vol. 7147(2006), p. 71470C. Available at: <https://doi.org/10.1117/12.813212>.

Developing an Integrated Flood Early Warning Model in the Shire River Basin, Malawi.

Daniel Nakapu Hussein^{1*}, Maarifa Ali Mwakumanya², Mwakio Tole³

¹Department of Geographical Sciences, Faculty of Environmental Sciences,
Mzuzu University,

Private Bag 201, Luwingu, Mzuzu 2, Malawi.

^{2,3} Department of Environmental Sciences, School of Environmental and
Earth

Sciences, Pwani University, Post Office Box 195-80108, Kilifi, Kenya

*Corresponding Author's E-mail: husseindaniel@yahoo.com

Abstract

Purpose: Malawi's Shire River Basin (SRB) frequently experiences floods endangering people's lives and their property. This paper detailed a study conducted in Chikwawa district in 2021-2022 to develop a new model to improve the flood forecasting system.

Methodology: The research utilised a qualitative research design, focusing on the 2019 Tropical Cyclone Idai as a case study. Information was gathered from 114 participants through key informant interviews and focus group discussions.

Findings: Results revealed that local people possessed valuable insights that could complement scientific knowledge to forecast floods. The developed model combined indigenous and scientific knowledge to alert residents promptly about potential floods.

Discussion: The model was more sensitive to flood prediction than the current scientific flood forecasting system (SFFS) because of its ability to identify and interpret subtle environmental changes, some of which, like plant overproduction, began far in advance of any SFFS sensors registering an impending flood. The inclusion of indigenous flood forecasting system (IFFS) indicators in the model would improve the credibility of the system among local residents.

Recommendations: The Malawian Department of Climate Change and Meteorological Services (DCCMS) should consider installing additional hydrometeorological stations within the basin, spaced 5 km apart, in order to minimise inaccuracies in weather measurements. Furthermore, the department should incorporate additional mechanical tools such as radar sensors to enhance flood forecasting accuracy.

Conclusion: This model was developed in response to increased calls to acknowledge the importance of indigenous knowledge in the Shire River Basin of Chikwawa District to improve the flood forecasting system. It highlighted the potential integration of existing indigenous and scientific knowledge indicators to empower local communities in lowering their vulnerability to flood hazards.

Originality: The model featured a community-based aspect that gathered data from local communities living in the basin year-round and delivered it to FFS developers in a structured manner. This enabled the inclusion of indigenous knowledge in the warning system for the benefit of scientists, communities, and those involved in flood forecasting.

Keywords: Chikwawa District, Flood forecasting, Indigenous and Scientific knowledge, Integrated Flood Early Warning Model, Shire River Basin

1.1 Introduction

Floods continue to be the most devastating water-related disasters globally, leading to social, economic, and environmental hardships (Aziz *et al.*, 2016). Currently, two flood forecasting models include scientific and indigenous models being utilised globally to mitigate the disaster. Scientific models in watershed areas utilise advanced technological tools such as Geographic Positioning System (GPS) and rain and stream gauges to forecast potential flooding incidents. Additionally, hydrological rainfall-runoff models are employed as effective methods for flood preparedness and response (Fofana *et al.*, 2023). These watershed models are classified based on various criteria, including whether catchment processes are represented as deterministic or data-driven models, or if the catchment is spatially divided into lumped or distributed models (Jain *et al.*, 2018). The deterministic models are typically used for the organisation, design, and management of diverse water resource systems across different river basins, while the data-driven models focus on water movement within river systems.

Various terms such as folk knowledge, traditional science, traditional knowledge, indigenous traditional knowledge, indigenous technical knowledge, and traditional ecological knowledge are utilised to characterise an indigenous knowledge model (Ali *et al.*, 2019). This model is regionally specific, culturally rooted, informal, orally transmitted, closely linked to community survival, dynamic, and encourages innovation, adaptation, and experimentation (Mavhura *et al.*, 2013). The application of this model in Disaster Risk Reduction involves observing plant and animal behaviours, celestial bodies, and hydroclimatic elements (Šakić Trogrlić and Van Den Homberg, 2018; Hussein *et al.*, 2023). Examples of indigenous knowledge indicators that warn communities of imminent floods include the dense flowering of *Acacia nicolita*, heavy rain during the season, overproduction of *Adansonia digitata* tree fruits, and the construction of nests by quail birds high on trees near rivers (Abdulrashid, 2020). Abdulrashid (2020) further supported the idea of incorporating indigenous knowledge in the flood forecasting system.

Forecasting flood events using indigenous and scientific knowledge indicators separately is a complex task (Liedloff *et al.*, 2013). Therefore, this study integrated the scientific and indigenous knowledge flood forecasting models to form one system. In recent years there has been a growing awareness that scientific knowledge alone was inadequate for solving the climate crisis (Kalanda-Joshua *et al.*, 2011). On the other hand, the indigenous knowledge system was increasingly recognised as an important source of climate knowledge and adaptation strategy. However, indigenous knowledge is yet to be included in policies on disaster risk reduction. For more effective disaster risk reduction, indigenous knowledge should be integrated with modern technology, moving beyond the dichotomy to bridge the gap between them (Mercer *et al.*, 2009). This integration of indigenous and scientific flood forecasting systems demands a mutual understanding of the cultural and material basis of each (Zulfadrim, *et al.*, 2019). We contend that developing a model for both traditional owners and water managers that draws on local knowledge and builds trust and confidence in the process of discussing the impacts of various water development scenarios would be extremely valuable.

1.2 Problem statement

In 2019, Tropical Cyclone Idai, triggered flooding that affected an estimated 975,000 people, displaced 86,976, killed 60 and injured 672 and caused US\$370.5 million in economic damage (Zuzani *et al.*, 2019). These statistics suggested that the flood forecasting system (FFS) in the Shire River Basin was not as robust as it needed to be to adequately warn and prepare communities for the flooding. Therefore, the rationale behind the study was to develop an integrated flood early warning model for Chikwawa District.

1.3 Research questions

In order to increase a comprehensive understanding of the 2019 floods in the Shire River Basin, the following questions were used to generate the data:

1. What flood forecasting systems were used to predict the 2019 flood?
2. If an indigenous flood forecasting system was used, what was assessed?
3. If a scientific flood forecasting system was used, what was assessed?
4. How could the two flood forecasting systems be integrated into a single system?

2.0 Literature review

A reliable model was an essential part of flood forecasting and risk assessment. The model provided advance warnings of floods and river depths to alert people to evacuate in time (Lee *et al.*, 2020). The Integrated Flood Early Warning Model (IFEWM) was a platform providing disaster risk reduction capabilities and covering the flood management process (Kafle, 2019).

Accurate and timely forecasts were an essential prerequisite for providing reliable early warning systems. Therefore, flood forecasting and warning centres should be set up in coordination with the affected institutions and authorities (Kafle, 2019).

Globally, the adoption of a flood early warning model had helped reduce economic losses and deaths from disasters by enabling people to better protect their assets and livelihoods (UN, 2006, cited in Kafle, 2019). A direct measure of the utility of models over the period 2000-2017 was the declining global trend in flood damage and causality (EM-DAT, 2018 cited by Perera *et al.*, 2019), as 50% of the flood early warning system (FEWS) and models were developed within the same period. An example was in Nepal, where a “Community- based flood early warning system model” was established in 2002 with observation towers and a siren system to monitor and warn communities of impending flood disasters (Kafle, 2019). The results showed that 1 to 3 hours of real-time information about water levels at the upstream gauging station successfully provided communities with information to warn them of impending floods and saved many people’s lives.

In Africa, a model entitled “Integration of Indigenous and Scientific Technology in Disaster Risk Reduction Education in Kenya; A Framework for Sustainable Development”, was developed and it reduced flood disasters in communities living in Budalangi flood plains along the River Nzoia (Mukuna, 2015). FEWS models promoted the development and application of scientific knowledge, including improved information dissemination. They also provided the necessary information and strategies to a wide array of actors to enable them to be proactive and better prepared for impending disasters (Manyanhaire and Chitura, 2015).

In Malawi, a flood frequency model was developed for the Central Region as a tool to forecast future flood events and their associated magnitudes and recurrence periods (Laisi, 2016). The model helped engineers design hydraulic structures that reduced disaster damage and created flood zone maps that delineated areas unsuitable for human settlements and agricultural production. Another study conducted by Ngongondo, *et al.*, (2021 in Nhamo, *et al.*, 2021) titled "Exploring Linkages Between Indigenous Knowledge Systems and Conventional Flood Forecasting in the Aftermath of Tropical Cyclone Idai in Chikwawa, Malawi" delved deeper into the subject of assessing the effectiveness of indigenous and scientific knowledge in flood forecasting, but also fell short of developing an integrated flood warning model.

3.0 Methods

The study included individuals from the Traditional Authorities of Mlilima, Kasisi, Makhuwira, and Lundu due to their accessibility and vulnerability. It utilised a qualitative design approach. Data collection techniques involved focus group discussions (FGDs), as well as in-depth interviews with representatives from governmental and non-governmental organisations, and community elders (CEIs). Eight FGDs were conducted, each consisting of

twelve (12) participants of the same gender, along with ten (10) Malawian government and non-governmental organisation officials, and pairs of four (4) elders over the age of sixty, one male and one female. Responses were documented in Chichewa using a voice recorder, transcribed into Chichewa, and then translated into English. The collected data were categorised into various thematic areas, and tables were generated to summarise the information.

4.0 Results

4.1 Indigenous Knowledge in Model Development

The results of the study showed that numerous indigenous knowledge (IK) indicators were utilised to predict the upcoming floods. These indicators played a crucial role in creating a flood forecasting model and were classified into specific thematic areas (Table 1).

Ser. No.	IK Indicator	Explanation
1.	<i>Plants</i>	Abundance of mango fruits (<i>Mangifera indica</i>) and excess leaf growth of baobab trees (<i>Adonsia digitata</i>).
2.	<i>Animals</i>	Movement of hippos (<i>Hippopotamus</i>) from the River Shire to the villages, Ateshi frogs (<i>Guttular toad</i>) crying endlessly for many days, African Pythons (<i>Python sebae</i>) made the squeaking sounds that signalled their feeling threatened and the presence of red ants (<i>Solenopsis invicta</i>) in villages.
3.	<i>Meteorological elements</i>	Presence of strong winds, heavy rainfall for days, and recording of high temperatures.
4.	<i>Celestial bodies</i>	Development of halo rings around the moon.

4.2 Scientific Knowledge in Model Development

Results revealed that the Shire River Basin in Chikwawa District consisted of an advanced network of both automated and manned weather stations. The scientific knowledge system only measured meteorological data. The weather stations at Nchalo Sugar Irrigation Scheme (NSIS) and Chikwawa Boma Offices (CBO) used the following instruments to measure the various scientific knowledge indicators (Table 1)

Table 1: Weather elements and their instruments used to forecast floods

Indicator	Site of the Instrument	Flood hazard values
<i>1. Temperature</i>	Six's Thermometer at Chikwawa Office	Exceeded 45 °C
<i>2. Rainfall</i>	Rain gauges at NSIS and CBO	Exceeded 160 mm in 24 hours
<i>3. Wind speed</i>	Cup anemometer located at NSIS and CBO	Above 170 kilometres per hour
<i>4. River height</i>	River gauges located at the Kamuzu Bridge	Reached above 1.5 metres high

4.3 Process of integrating indigenous and scientific indicators in flood forecasting

The process of integrating indigenous and scientific knowledge indicators was carried out in steps with the participation of indigenous experts and scientists, such as a meteorologist, hydrogeologist, botanist, and zoologist. The study involved the following steps:

Step 1: Identifying, analysing and interpreting indigenous knowledge indicators that explained scientific phenomena in the Shire River Basin of Chikwawa District. It involved the following:

- a. This included observing celestial bodies like the moon, sun, and stars, which assisted communities in forecasting floods.
- b. Additionally, it involved observing environmental factors such as wind direction and strength, cloud colour, formation, and location, as well as plant and animal behaviour.

Scientifically validated IK indicators were identified and included in the study. A framework that explained how indigenous and scientific knowledge was combined in flood risk reduction was a necessary step to ensure the right people were reached with the right flood risk reduction strategies. Scientists successfully provided explanations for the IK indicators to support the idea of integration (Table 2).

Table 2: Interpretation of indigenous and scientific knowledge flood forecasting indicators

Indigenous indicators	knowledge	Scientific Description	interpretation/
<i>People removed clothes during summer</i>		Very hot, temperatures were over 45°C	
<i>Upward wind movement from south to north during the summer period</i>		Cool and moist south easterlies that brought seasonal southeasterly trade winds (<i>mwera winds</i>) over the lake. Vertical mixing of this moist air gave rise to the process of condensation, leading to intense rains.	
<i>Heavy and dark forming clouds during the rainy season</i>		They were called <i>Cumulonimbus clouds</i> . These clouds were associated with thunderstorms (thunder and lightning) and caused heavy rains with floods.	
<i>Partly cloudy, with no sunshine but very hot</i>		This was hot and humid weather, and it would not rain any soon.	
<i>Heavy rainfall lasting some days or a week</i>		This was associated with Congo air masses and Tropical cyclones, and there was high risk of flooding due to heavy rains.	
<i>Behaviour of underground animals (ants) moving to settle on high areas</i>		This was due to high water table and/or high soil moisture content under the ground.	

Step 2: Involved further identification of indigenous knowledge indicators in the Shire River Basin of Chikwawa District. However, these indicators could not be explained by science at present, but were practiced and recognised by communities and had helped them build their flood resilience. For example, consulting the rainmakers contributed to increasing a community's awareness of possible hazards, which often resulted in increased preparedness.

4.4 Development of an Integrated Flood Early Warning Model (IFEWM)

A flood disaster monitoring centre was set up to serve as the central hub in T/A Makhuwira. Representatives from the Malawi government, NGO officials,

and local residents were given specific roles within the model based on their duties. Experts in Indigenous knowledge included observations of animal and plant behaviour, weather patterns, and celestial bodies. Scientists in charge of flood forecasting were given the task of monitoring River Shire water levels, flow rates (discharge), precipitation (rainfall) and temperature intensity (Figure 1).

4.4.1 Shire River Basin Flood Forecasting System Integration Activities

Validation of IFFS among SFFS users

It was suggested by community leaders to arrange meetings between the local people and government authorities as a first step. These meetings assisted officials in understanding the importance of Indigenous knowledge in enhancing the forecasting capabilities of the flood forecasting system (FFS) in the Shire River Basin of Chikwawa District.

4.4.1.1 Community-based Data Collection

The development of the model came from the collaboration between members of the Malawi government officials and local communities. The integrated system had a community-based component, one which collected information from local people who lived in the communities year-round and brought it to flood forecasting system developers in a systematic fashion.

4.4.1.2 IFFS-User Education

Funding needed to be acquired to inform local people using the Indigenous Flood Forecasting System (IFFS) on how to organise their knowledge in ways that made it readily accessible to non-IFFS users. Scientific flood forecasting system (SFFS) developers could not be expected to replace local residents in the evaluation of IFFS indicators, nor could local residents be expected to leave their current residential areas to work somewhere else because their knowledge derived from living in the areas where flooding occurred.

4.4.1.3 Remuneration

Local residents needed to be remunerated for their contributions, just as users of modern/scientific technology were compensated for reading their instruments and reporting their results to the appropriate information agencies. This would put the two flood forecasting systems on an equal footing without placing one system above the other.

4.4.1.4 Community-Based Delivery

Community-based systems for community-wide communication were identified and/or developed to improve the flow and accessibility of information from the FFS to local communities. The communication system needed to be strengthened so that local people could understand and interpret the indicators of the flood forecasting system. Without improved system to communicate information to affected parties to help them respond more

quickly and effectively, it would be pointless to attempt to improve the flood forecasting system itself.

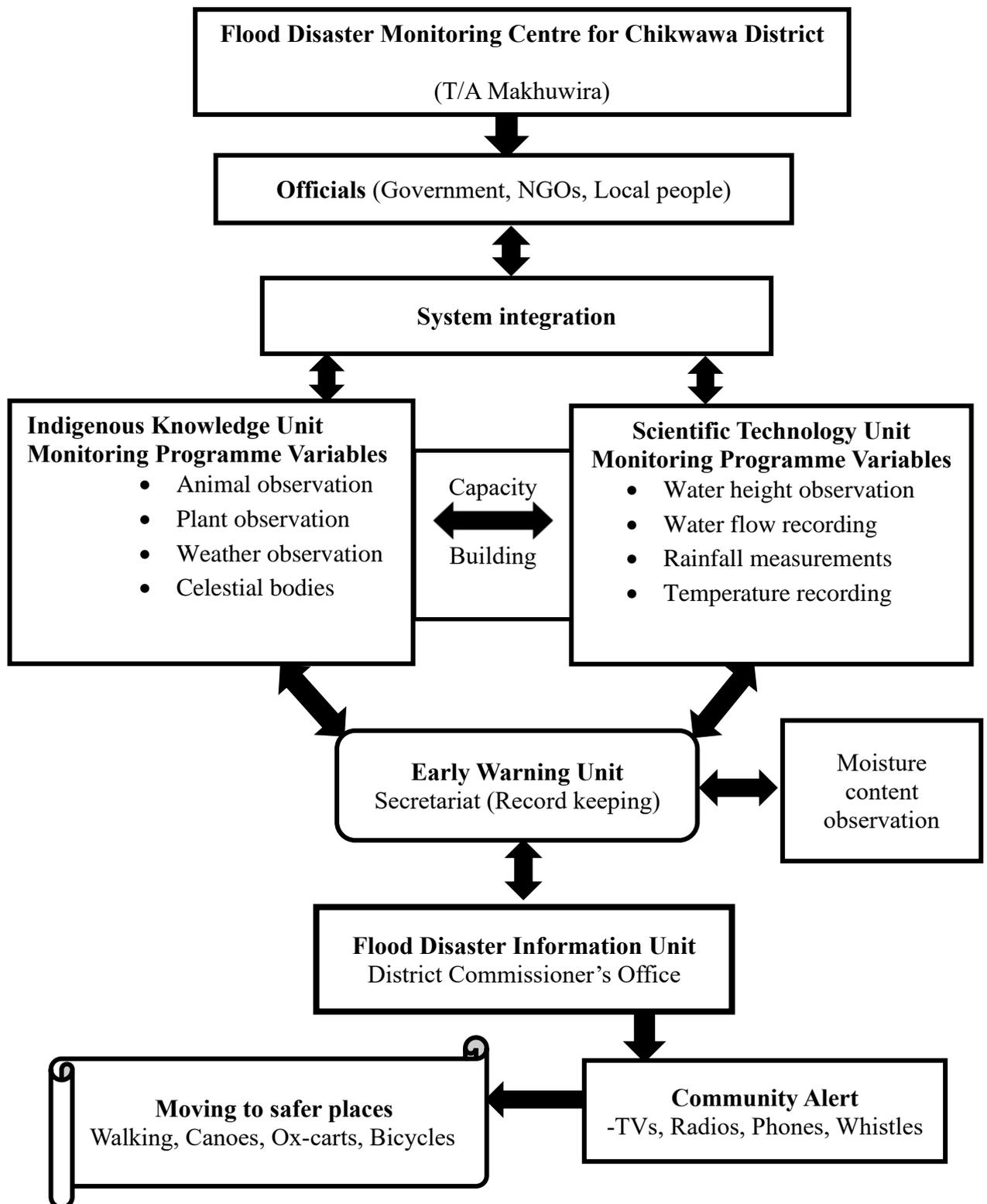


Figure 1: An Integrated Flood Early Warning Model (Source: Hussein, 2023)

5.0 Discussion

A sophisticated model was developed in the Shire River Basin of Chikwawa District to increase flood forecasting accuracy. The model served as a guide for the communities to mitigate the flood impact. The model sought to empower communities in flood-prone areas to be resilient to hydro-meteorological disasters by combining indigenous and scientific knowledge. This approach aimed to harness the strengths of both systems and ultimately reduce local people's vulnerability and poverty.

6.0 Conclusions

The model developed in the Shire River Basin of Chikwawa District demonstrated its effectiveness as a non-structural tool for flood risk management. The active participation of local communities was essential, enabling them to draw upon their own experiences and knowledge. To ensure increased community support for the model, the Malawi government, through the Department of Climate Change & Meteorological Services (DCCMS), should intensify social awareness campaigns and provide tailored response and evacuation plans to address the disaster. Furthermore, the DCCMS should expand the network of hydrological and rain gauge stations along major tributaries in T/A Makhuwira to minimise the flood impact. Lastly, the Malawi government, in collaboration with relevant authorities and institutions like the Malawi Red Cross Society should allocate the necessary resources to enhance the flood forecasting centre.

7.0 Acknowledgement

The authors thank the members of the community in Chikwawa District for their participation and collaboration in this study. Without their contribution, the study would not have been possible. Support for this research was made possible by a competitive capacity-building grant "*Training the next generation of scientists for Africa*" provided by the Carnegie Cooperation of New York through the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM).

References

- Abdul A., *et al.*, (2016), "A conceptual framework for predicting flood area in Terengganu during monsoon season using association rules", *Journal of Theoretical and Applied Information Technology*, Vol. 87 No. 3, pp. 512–519.
- Abdulrashid, L. (2020), "The use of indigenous knowledge in flood disaster forecasting for flood disaster risk reduction in Northern Katsina state", Vol. 2017 No. 1, pp. 1–9.

Ali, T., *et al.*, (2019), "Role of indigenous knowledge in managing floods projects", *Journal of Process Management. New Technologies*, Vol. 7 No. 4, pp. 13–23.

Fofana, M. *et al.* (2023), "Flood Forecasting and Warning System: A Survey of Models and Their Applications in West Africa", *American Journal of Climate Change*, Vol. 12 No. 01, pp. 1–20.

Hussein, D. N., *et al.*, (2023), "Flood Forecasting in Malawi's Shire River Basin", *American Journal of Environmental Sciences*, Vol. 19 No. 2, pp. 43–53.

Jain, S, K., *et al.* (2018), "A Brief review of flood forecasting techniques and their

applications", *International Journal of River Basin Management*, Vol. 16 No. 3, pp. 329–344.

Kafle, M. R. (2019), "Conceptual Framework of Effective Flood Forecasting and Early Warning System in Nepal: A Case Study of Koshi River Basin", *International Journal of Research in Environmental Science*, Vol. 5 No. 4, pp. 43–51.

Kalanda-Joshua, M. *et al.* (2011), "Integrating indigenous knowledge with conventional science: Enhancing localised climate and weather forecasts in Nessa, Mulanje, Malawi", *Physics and Chemistry of the Earth*, Vol. 36 No. 14–15, pp. 996–1003.

Laisi, E. (2016) Development of a Flood-Frequency Model for the River Basins of the Central Region of Malawi As a Tool for Engineering Design and Disaster Preparedness in Flood-Prone Areas. Master's Dissertation, University of South Africa.

Lee, J. H. *et al.* (2020), "Integrated flood forecasting and warning system against flash rainfall in the small-scaled urban stream", *Atmosphere*, Vol. 11 No. 9. doi: 10.3390/ATMOS11090971.

Liedloff, A. C. *et al.* (2013), "Integrating indigenous ecological and scientific hydro-geological knowledge using a Bayesian Network in the context of water resource development", *Journal of Hydrology*, Vol. 499, pp. 177–187.

Manyanhaire, I. O. and Chitura, M. (2015), "Integrating Indigenous Knowledge Systems into Climate Change Interpretation: Perspectives Relevant To Zimbabwe", *Greener Journal of Educational Research*, Vol. 5 No. 2, pp. 027–036.

Mavhura, E. *et al.* (2013), "Indigenous knowledge, coping strategies and resilience to floods in Muzarabani, Zimbabwe", *International Journal of Disaster Risk Reduction*, Vol. 5, pp. 38–48.

Mercer, J., Kelman, I. and Dekens, J. (2009), "Integrating indigenous and scientific knowledge for disaster risk reduction", *Indigenous Knowledge and Disaster Risk Reduction: From Practice to Policy*, pp. 115–131.

Mukuna, T.E. (2015), "Integration of Indigenous and Scientific Technology in Disaster Risk Reduction Education in Kenya; A Framework for Sustainable Development", *The International Journal of Humanities & Social Studies*, Vol. 3 No. 2, pp. 218–228.

Nhamo, G., Dube, K. and Topics, F. (2021), "Cyclones in Southern Africa Volume 2: Foundational and Fundamental Topics", in Ngongondo, C. (Eds.), *Exploring Linkages Between Indigenous Knowledge Systems and Conventional Flood Forecasting in the Aftermath of Tropical Cyclone Idai in Chikwawa, Malawi*, Available at: <http://www.springer.com/series/15486>.

Perera, D. *et al.* (2019), "Flood Early Warning Systems: A Review Of Benefits, Challenges And Prospects Watershed Evaluation of Beneficial Management Practices View project SOUSEI View project", Available at: <http://inweh.unu.edu/publications/>.

Šakić Trogrlić, R. and Van Den Homberg, M. (2018), "Indigenous knowledge and early warning systems in the Lower Shire Valley in Malawi", Available at: <https://zcralliance.org/resources/item/indigenous-knowledge-and-early-warning-systems-in-the-lower-shire-valley-in-malawi/> (Accessed 01/2020).

Zulfadrim, Z., *et al.* (2019), "The Integration of Indigenous Knowledge for Disaster Risk Reduction Practices through Scientific Knowledge: Cases from Mentawai Islands, Indonesia", *International Journal of Disaster Management*, Vol. 2 No. 1, pp. 1–12.

Zuzani, P. N. *et al.* (2019), "Examining trends of hydro-meteorological extremes in the Shire River Basin in Malawi", *Physics and Chemistry of the Earth*, Vol. 112, pp. 91–102.

Assessing water availability using remote sensing in South Rukuru and North Rumphu River Basin, Malawi.

Gomi Gondwe*^a, Brighton Chunga^a, Aimloss Banda^a, Susan Kumwenda^a

^a*Department of Water and Sanitation, Faculty of Environmental Sciences, Mzuzu University, Mzuzu, Malawi*

*Corresponding Author: gondwegomi@gmail.com

Abstract

Purpose: Reliable hydrological time series data is required to effectively and efficiently assess water availability. However, globally there is a dense decline in hydrological data, which makes it difficult to assess water availability. Remotely acquired data can be an alternative data source. The aim of the study was to assess water availability using remote sensing in South Rukuru and North Rumphu River Basin.

Methodology: To assess the water availability, a rainfall-runoff (soil moisture method) hydrological model was developed using the Water Evaluation and Planning (WEAP) modelling software. The WEAP inputs included the Global Land Data Assimilation System (GLDAS) climate datasets, Elevation data, and the Land Use Land Cover. The observed streamflow data was used for calibrating and validating the WEAP model.

Findings: The performance of the WEAP model simulation was assessed and the monthly measured and simulated streamflow statistics showed a positive strong relationship ($R^2 = 0.81$, NSE = 0.81, IA = 0.95, KGE = 0.89 and PBIAS of -3.8) at gauging station 7G18. Similarly, there was a very good agreement between the monthly measured and simulated streamflow at gauging station 7H3 ($R^2 = 0.94$, NSE = 0.93, IA = 0.98, KGE = 0.85 and PBIAS of -9.3).

Conclusions: The WEAP model developed is capable of estimating nearly all components of the hydrological cycle. The hydrological response showed that in months at which the precipitation was at its peak, the water availability was also at its peak. Therefore, this remote sensing rainfall runoff WEAP model can be used as a baseline for assessing water availability when there is insufficient, inconsistent or fragmented observed hydrological data.

Keywords: Water Availability; Remote Sensing; WEAP; Soil Moisture Method; GLDAS.

1.1 Introduction

To effectively and efficiently assess water availability there is a need for good quality hydrological time series data (Mwale *et al.*, 2012). Globally, there is a dense decline in the network density of operational hydro-meteorological field stations which is an obstacle to the effective development of hydrological models (Karimi & Bastiaanssen, 2014) that can be used to estimate water

availability trends over long periods (Speed *et al.*, 2013). In Malawi, more than 300 hydrological stations historically existed, but now most of these stations do not have a continuous record of data and some of the stations have been abandoned or closed (GoM, 2014).

Limited availability of hydro-meteorological data in river basins worldwide increases the value of alternative data sources such as remotely acquired data in hydrological modelling (Hulsman *et al.*, 2020). The recently released Global Land Data Assimilation System (GLDAS) 2.0 version generates a variety of hydro-meteorological variables, including rainfall, air temperature, wind, specific humidity, soil moisture and many more; provided at a spatial resolution of 0.25° (from 2000 to present) (Ji *et al.*, 2015).

1.2 Problem Statement

As there are growing and competing demands for water resources, it is essential to determine whether the available water within a river basin can meet the demand of the basin (Salehie *et al.*, 2022). However, with the decline of hydro-meteorological data availability, it is difficult to determine how much water is available. Despite this, many studies have been conducted on the potential use of remote sensing to assess water availability worldwide. Few researchers have evaluated the potential use of Global Land Data Assimilation System (GLDAS) Version 2.0 datasets in WEAP modelling software to develop a rainfall runoff model that will assess water availability. Hence, this research study was set to evaluate the potential of using GLDAS remotely acquired hydro-meteorological data to develop a rainfall runoff model in WEAP modelling software that was used to assess water availability in South Rukuru and North Rumphu Basin.

1.3 Objectives

The research study aimed at assessing water availability using remote sensing in South Rukuru and North Rumphu river basin. Specifically, a) to develop a remote sensing rainfall runoff model and b) to conduct a performance analysis of the remote sensing rainfall runoff model.

1.4 Literature Review

The current status and trends of water availability within a river basin over a specific period may be assessed from observed streamflow data or through hydrological modelling (Speed *et al.*, 2013). Although using observed streamflow data to assess the water availability is the conventional way, it can be costly, time-consuming and frequently dangerous (Costa *et al.*, 2006). Hydrological modelling was preferred in this research study. One of the hydrological models that can be used to estimate the current status and trends of water availability in an area over a specific period of time is the rainfall-runoff soil moisture method approach in Water Evaluation and Planning (WEAP) Modelling Software (Yaykiran *et al.*, 2019).

Several hydrological studies have been conducted worldwide to evaluate the use of remote sensing products for assessing water availability using simple

conceptual water balance models (Armanios & Fisher, 2014; FAO & IHE Delft, 2020; Guug *et al.*, 2020; Moreira *et al.*, 2019; Muthuwatta *et al.*, 2010; Oliveira *et al.*, 2014; Salehie *et al.*, 2022). Since most of these studies have been carried out in continents other than Africa, there is a need for specific studies to be conducted in Africa particularly in developing countries such as Malawi to evaluate the applicability of GLDAS datasets, considering that it is in these developing countries that the hydro-meteorological data is needed the most (García *et al.*, 2016), the hydrological monitoring networks are in poor state and have the most deficient infrastructure for gathering data needed to monitor and predict them (Sheffield *et al.*, 2018). The hydro-meteorological networks have deteriorated over time, at present providing only limited hydro-meteorological information for developing effective and efficient hydrological models (Karimi & Bastiaanssen, 2014). Therefore, this study aimed at assessing water availability using remotely acquired hydro-meteorological data in the South Rukuru North Rumphi River Basin.

2.0 Materials and Methods

2.1. Study Area

The study was conducted in the South Rukuru and North Rumphi River Basin which is located in the Rumphi and Mzimba districts of the Northern Region of Malawi. South Rukuru and North Rumphi River Basin is WRA 7 which is further divided into 8 WRUs (GoM, 2014). It is the largest water resource area that drains directly into Lake Malawi covering an area of 12,705 km². The major river is South Rukuru, with its main tributaries including Kasitu River, Runyina River, Rumphi River and Mzimba River. The North Rumphi River forms the other part of the river basin with a catchment area of 712 km² (Kumambala, 2010).

Two key reasons necessitated the choice of the study area, South Rukuru and North Rumphi river basin. Firstly, there is still some consistent and reliable observed streamflow data compared to other catchments. Secondly, the basin's water resources are critical to socio-economic activities such as crop and livestock production, fish farming and manufacturing industries. The basin also provides water for domestic use in rural households, peri-urban areas, and towns. The water resources within the basin also sustain the biodiversity and ecosystems of the Nyika National Park and Vwaza Marsh Wildlife Reserve.

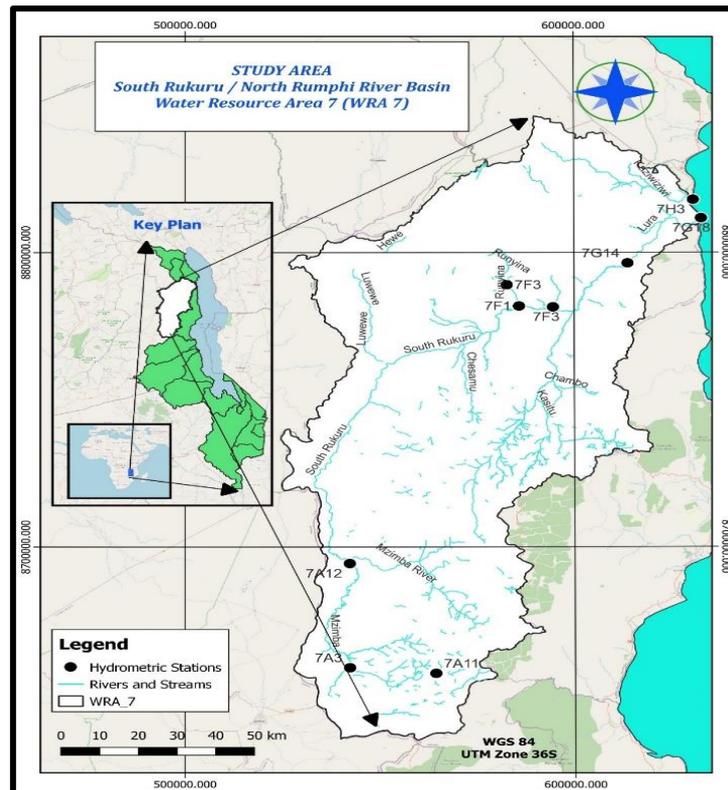


Figure 15: South Rukuru and North Rumphi river basin showing hydro-metric stations and main river network

2.2 Hydrologic Model Development

2.2.1 Data Requirements

2.2.1.1. Remote Sensing Datasets

The remote sensing datasets that are in this study are commonly and widely used, and are freely available on a global scale. Elevation data at 90 meters (3 arc seconds) spatial resolution was derived from Hydro SHEDS digital elevation data obtained from the Space Shuttle flight for NASA's Shuttle Radar Topography Mission (SRTM). For climatic data, Global Land Data Assimilation System (GLDAS) climate datasets of precipitation, relative humidity, temperature and wind speed on a monthly basis at a spatial resolution of $0.25^\circ \times 0.25^\circ$ were used for a period from 2000 to 2021 (22 years). This climatic data was accessed from the GIOVANNI website (<https://giovanni.gsfc.nasa.gov/giovanni/>). Land cover data from the European Space Agency (ESA) Climate Change Initiative (CCI) project was used. It has 22 Land Cover Classification System (LCCS) classes of land cover with a spatial resolution of 300 m (SEI, 2022a). The elevation and land cover data were automatically downloaded in the WEAP modelling software.

2.2.1.2. Surface Observations

Stream flow data was obtained from Rumphi District Water Office for four hydrometric stations within the South Rukuru and North Rumphi river basin for a period of 22 years. The first 16 years (2000 – 2015) were used for

calibration and the last 6 years (2016 – 2021) were used for validation. Observed streamflow data contained gaps or missing values. For this study, where streamflow data is missing, infilling of missing streamflow data was done using the spline interpolation methods in Microsoft Soft Excel.

2.3 WEAP Model Description

WEAP is a software tool for integrated water resources planning, developed by the Stockholm Environment Institute (SEI). The model is lumped, spatially continuous with areas configured as sub-catchments that cover the entire river basin (Ingol-Blanco & McKinney, 2009). For this study, WEAP’s Soil Moisture Method to estimate the rainfall-runoff processes at the sub-basin level was used. This method takes into account a one-dimensional, 2-layer (“bucket”) soil moisture dynamic accounting system that uses empirical functions to partition water into evapotranspiration, surface runoff, sub-surface runoff (i.e., interflow), and deep percolation for a sub-catchment unit at the root zone (SEI, 2022b). Figure 3 shows the WEAP interface and schematic of the Remote Sensing Rainfall-Runoff (Soil Moisture Method) Hydrological Model.

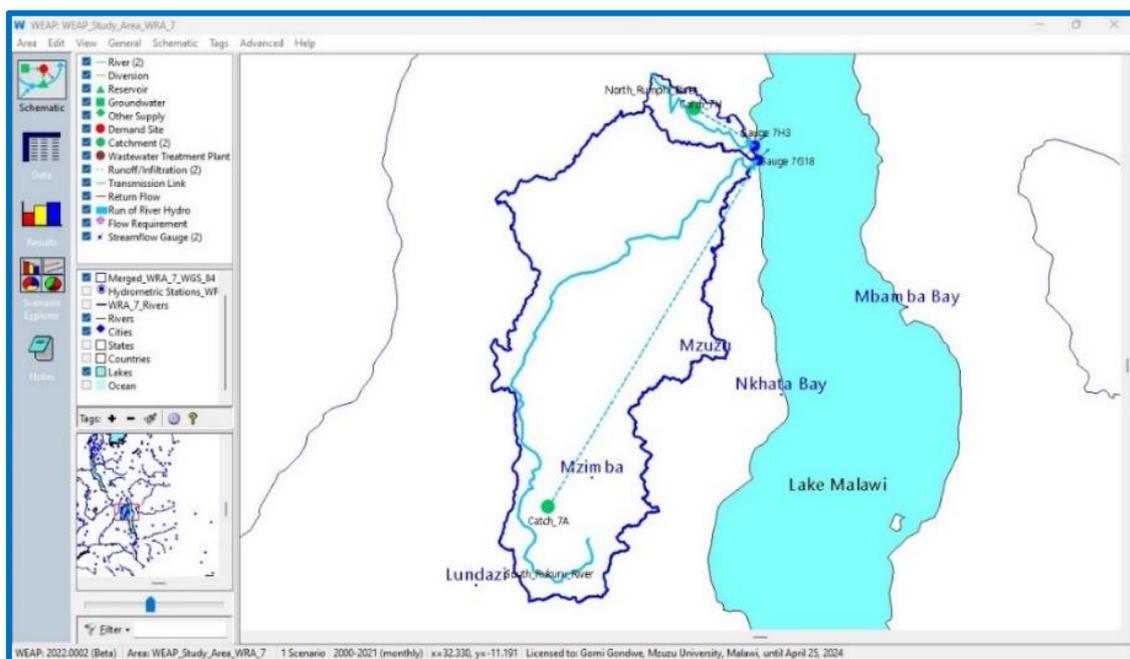


Figure 16: The WEAP interface and schematic of the Remote Sensing Rainfall-Runoff (Soil Moisture Method) Hydrological Model.

2.4 Model Calibration and Validation

The WEAP hydrological model was calibrated to estimate land use and soil-related parameters using the manual (trial-and-error) method until a good fit is observed between the measured and simulated streamflow. The calibration process was done for a period of sixteen years (2000 – 2015). The WEAP embedded soil moisture method involves estimating seven soil and land use-related parameters (Abera Abdi & Ayenew, 2021; Ingol-Blanco & McKinney, 2009).

Table 1 shows the seven soil and land use-related parameters that are used to re-calibrate the hydrologic model. A validation data set of six years (2016 – 2021) was used to assess the adequacy of the model. The adjusted calibration parameters of the hydrological model were now used in the validation data set and then the model was run. The hydrological model was regarded as a success when the resulted output at the validation stage was reasonably close to the observed measurements for the model.

Table 1: Values of initial soil and land use related parameters and values for the estimated soil and land use related parameters

Parameters	Definition	Default	Range in Values
K_c	Crop Coefficient	1	0.45 – 0.5
S_w	Root Zone Soil Water Capacity (mm)	1,000	1,150
D_w	Deep Soil Water Capacity (mm)	1,000	100 - 135
RRF	Runoff Resistance Factor	2	2.25
K_s	Conductivity of Root Zone at Full Saturation (mm/month)	20	10
K_d	Conductivity of Deep Zone at Full Saturation (mm/month)	20	20
F	Preferred Flow Direction	0.15	0.15
Z₁	Initial storage fraction at the beginning of simulation of upper soil layer	30%	40%
Z₂	Initial storage fraction at the beginning of simulation of lower soil layer	30%	40%

2.5. Model Performance Measures

The WEAP model performance was evaluated using the following objective functions; The coefficient of determination (R^2) (Krause *et al.*, 2005); Nash-Sutcliffe coefficient of efficiency (NSE) (Nash & Sutcliffe, 1970), index of agreement (IA) (Willmott, 1981), Percent Bias (PBIAS) (Gupta *et al.*, 1999), Kling and Gupta Efficiency (KGE) (Gupta *et al.*, 2009). The current version of WEAP is integrated with the R-programming Language which includes these objective functions. These objective functions have been widely used in WEAP evaluation studies and have successfully been implemented (Abera Abdi & Ayenew, 2021; Ingol-Blanco & McKinney, 2009; Tena *et al.*, 2019; Yaykiran

et al., 2019) for measured and simulated flows over the calibration and validation periods. For visual inspection, the monthly simulated and observed hydrographs were plotted.

3.0 Results

3.1. Model Calibration and Validation

The model was run for 22 years (2000 – 2021) but the first year (2000) was used for stabilisation of model runs and simulated streamflow for the 2001 – 2021 period was used for comparison purposes. The WEAP model was calibrated and validated using data from these two streamflow gauging stations (7H3 and 7G18). The calibration period extended from January 2001 to August 2015, which is 70% of the data period while the validation period is from September 2015 to December 2021 which is 30% of the data period. The division of the periods is the same for both catchments. Figure 5 provides visual inspection of monthly hydrographs of observed and simulated stream flows for hydrometric stations 7H3 and 7G18 for the entire 2000 – 2021 period.

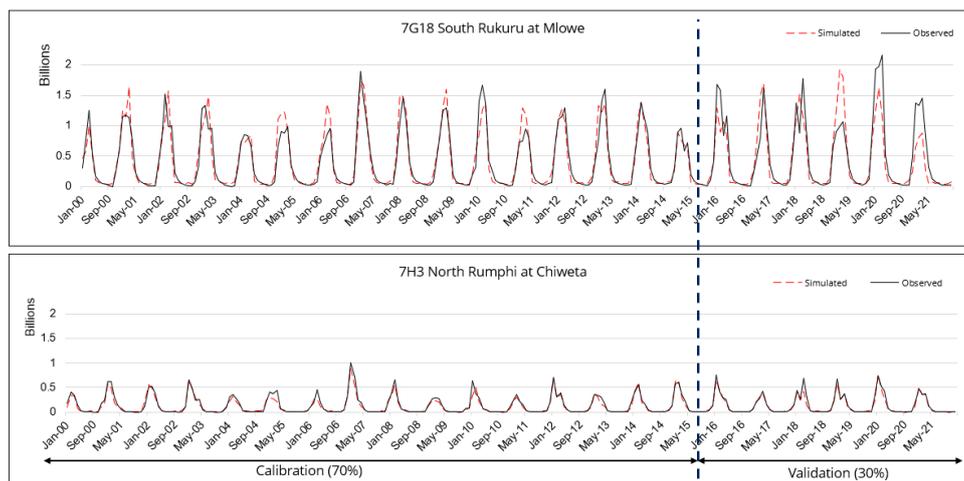


Figure 17: Monthly observed and simulated stream flows for hydrometric stations 7H3 and 7G18 for the entire 2000 – 2021 period

3.2. Model Hydrological Processes

The WEAP model developed is capable of estimating nearly all components of the hydrological cycle. The main vital components for the hydrological cycle in a specific area are precipitation, surface runoff, and evapotranspiration. The monthly behavior of these components for each catchment area, as simulated by the WEAP model using the available input data, is shown in Figure 6. In the North Rumpi sub-basin, the precipitation is around 2, 873 mm/ year, with higher values in December, January, February and March, while surface runoff and evapotranspiration reach 2, 060 and 740 mm/year, respectively. Similarly, with the South Rukuru sub-basin, the peak precipitation and surface runoff occur each year from December to March.

The precipitation, surface runoff and evapotranspiration reach around 1, 175; 381 and 756 mm/year, respectively.

3.3. Model Performance Evaluation

For comparison between the measured and simulated stream flows, goodness of fit metrics presented in Table 2, showed a stronger agreement for both stations with R^2 of 0.87, NSE of 0.86, IA of 0.97, KGE of 0.93 and PBIAS of -0.2 for station 7G18. Similarly, with station 7H3, R^2 of 0.93, NSE of 0.92, IA of 0.98, KGE of 0.84 and PBIAS of -10 during the calibration period. For the validation period, there was a reasonably very good agreement between the measured and simulated streamflow during this period for the two stations with R^2 of 0.73, NSE of 0.72, IA of 0.92, KGE of 0.79 and PBIAS of -10.9 for station 7G18. Likewise, for station 7H3, R^2 of 0.95, NSE of 0.94, IA of 0.98, KGE of 0.87 and PBIAS of -7.7 during the validation period.

Overall, station 7H3 has the strongest agreement with R^2 of 0.94, NSE of 0.93 and IA of 0.98, whereas station 7G18 with R^2 of 0.81, NSE of 0.81 and IA of 0.95. On the other hand, station 7G18 achieved a good performance with a KGE of 0.89 and PBIAS of -3.8 compared to station 7H3 which has a KGE of 0.85 and PBIAS of -9.3. There was a reasonably very good agreement between the observed and simulated streamflow, however, the goodness of fit metrics tend to be higher during the calibration period for station 7G18 while for station 7H3 the metrics are higher during the validation period.

Table 2: The Goodness of Fit Metrics (GOF) for Hydrometric Stations 7G18 and 7H3 respectively

Gauge	Type	Period	Goodness of Fit Metrics				
			NSE	IA	R^2	KGE	PBIAS
7G18	Overall	Jan 2001 to Dec 2021	0.81	0.95	0.81	0.89	-3.8
7G18	Calibration (70%)	Jan 2001 to Aug 2015	0.86	0.97	0.87	0.93	-0.2
7G18	Validation (30%)	Sept 2015 to Dec 2021	0.72	0.92	0.73	0.79	-10.9
7H3	Overall	Jan 2001 to Dec 2021	0.93	0.98	0.94	0.85	-9.3
7H3	Calibration (70%)	Jan 2001 to Aug 2015	0.92	0.98	0.93	0.84	-10
7H3	Validation (30%)	Sept 2015 to Dec 2021	0.94	0.98	0.95	0.87	-7.7

4.0 Discussion

4.1 WEAP Model Hydrological Processes

Over 60% of global precipitation is consumed by evapotranspiration and it is the largest withdrawer of water from the systems (Abera Abdi & Ayenew, 2021). For this study, the evapotranspiration shows steadiness throughout the year, with the highest values in January for North Rumphi sub-basin, while South Rukuru sub-basin the values occur in September and October. It clearly shows that even during the dry season when there is low water available in the sub-basins there is high evapotranspiration, which means there is a continuous decrease in the total water storage of the system. In summary, the North Rumphi sub-basin presents the highest precipitation and surface runoff, with evapotranspiration being lower compared to South Rukuru sub-basin in the hot dry seasons for the entire period.

4.2 WEAP Model Performance Evaluation

According to (Moriassi *et al.*, 2007), for the calibration period, the model performance was achieved to simulate streamflow with NSE, R^2 , IA, PBIAS and KGE values that have shown a strong agreement between measured and simulated streamflow in both catchments of the model. Likewise, for the validation period, there was a very good agreement between the measured and simulated flows in both catchments (See Table 2). However, the PBIAS values for all the catchments and periods there were negative, which indicates that the model was slightly underestimating the streamflow values. In general, the WEAP model was able to maintain a very good agreement in reproducing the overall streamflow characteristics. The model shows an outstanding representation of both catchments, with the best fit to the North Rumphi Catchment. Thus, these results indicate a more than reasonable ability of the WEAP hydrological model to simulate the flows using remotely acquired data.

Similarly, previous studies have confirmed the capability of the WEAP hydrologic model in reproducing catchment hydrology processes in different parts of the world (see Table 3). Among these, Abera Abdi & Ayenew (2021) reported that the WEAP hydrologic model attained the R^2 , NSE and IA values of 0.82, 0.80, and 0.95 between monthly measured and simulated streamflow in the Ketar River Basin, Ethiopia for the calibration period. During the validation period, the model showed a reasonably good agreement between the measured and simulated flows with R^2 of 0.91, NSE of 0.91 and IA of 0.98. The performance of the WEAP model simulation in The Chongwe River Catchment, Zambia showed a positive strong relationship using the R^2 of 0.97 and the NSE of 0.64 (Tena *et al.*, 2019). Ingol-Blanco & McKinney (2013) developed the WEAP model to assess the hydrologic processes in Rio Conchos Basin, Mexico. Six gauging stations were used in the basin for model performance evaluation. The goodness of fit metrics values range as follows; NSE from 0.65 to 0.87; R^2 from 0.92 to 0.97 during calibration and for validation NSE from 0.60 to 0.88 and R^2 from 0.92 to 0.97 between measured and simulated flows were found respectively. Finally, to characterize and evaluate the water supply and downstream demands of the hydrological

basins associated with the Conguillio National Park, located in the Andes Mountains in central-southern Chile, the WEAP hydrologic model was developed by (Fernández-Alberti *et al.*, 2021) and the model has demonstrated the capability from four gauging stations with values ranging from NSE (0.80 – 0.86, 0.77 – 0.84); R^2 (0.86 – 0.94, 0.88 – 0.96) and BIAS (0.04 – 0.19, 0.08 – 0.23) at calibration and validation periods between measured and simulated flows data respectively.

5.0 Conclusion and Recommendations

The rainfall-runoff model was developed in WEAP modelling software using Global Land Data Assimilation System (GLDAS) datasets of precipitation, air temperature and wind speed. The hydrological model could not only estimate water availability trends over longer periods for the South Rukuru and North Rumphi river basin but also monitor nearly all components of the hydrological cycle. In a temporal context, the WEAP model hydrological response showed that in months at which the precipitation was at the peak in all the sub-basins, the surface runoff was also at the peak.

The lion's share of available water returns to the atmosphere via evapotranspiration in both sub-basins. However, the annual stream discharge is mainly composed of interflow and baseflow which contribute a major part of flow during the dry season and the wet season the main contributor is surface runoff. The WEAP model developed has shown to be a reliable hydrological tool for water resources management and decision-making for South Rukuru and North Rumphi river system especially in applications such as water allocation planning. This could help all the interested parties in the system in taking necessary steps to balance water supplies with demands, particularly to manage the natural variability of water availability, and to avoid frequent or unexpected water shortfalls.

The WEAP model performance was evaluated using various commonly used goodness of fit metrics and joint plots of simulated and observed streamflow. Model calibration was performed to estimate the soil and land use – related parameters until a good fit was observed between the measured and simulated streamflow. Model validation was followed to check the adequacy of the remote-sensing WEAP model. The model was accepted only when the goodness of fit metrics showed a strong agreement between the measured and simulated streamflow. The WEAP model maintained a very good agreement in reproducing the overall streamflow characteristics within the sub-basins. Investigations in this thesis is based in Northern Region of Malawi and only a single basin. It is therefore necessary that future work has to be done on the usage of GLDAS datasets to assess water availability in other river basins in Northern Region, Central and Southern of Malawi. In addition, the model requires the use of up-to-date GLDAS climate data inputs, it is recommended that before using the model, the GLDAS climate data should be up to date.

References

Abera Abdi, D. and Ayenew, T. (2021), "Evaluation of the WEAP model in simulating subbasin hydrology in the Central Rift Valley basin, Ethiopia", *Ecological Processes*, Vol. 10 No. 1, p. 41.

Armanios, D.E. and Fisher, J.B. 2014. Measuring water availability with limited ground data: assessing the feasibility of an entirely remote-sensing-based hydrologic budget of the Rufiji Basin, Tanzania, using TRMM, GRACE, MODIS, SRB, and AIRS: MEASURING WATER AVAILABILITY WITH LIMITED GROUND DATA. *Hydrological Processes*, 28(3): 853–867.

Costa, J.E., Cheng, R.T., Haeni, F.P., Melcher, N., Spicer, K.R., Hayes, E., Plant, W., Hayes, K., Teague, C. and Barrick, D. (2006), "Use of radars to monitor stream discharge by noncontact methods: NONCONTACT STREAMFLOW", *Water Resources Research*, Vol. 42 No. 7, <http://doi.wiley.com/10.1029/2005WR004430>.

Moriasi, D.N., Arnold, J.G., Van Liew, M.W., Bingner, R.L., Harmel, R.D. and Veith, T.L. (2007), "Model evaluation guidelines for systematic quantification of accuracy in watershed simulations", *Transactions of the ASABE*, Vol. 50 No. 3, pp.885-900.

FAO and IHE Delft (2020), "WATER ACCOUNTING IN THE AWASH RIVER BASIN: wapor water accounting reports", Available T: <https://openknowledge.fao.org/server/api/core/bitstreams/751f9169-887d-458f-89ad-f28216ea1895/content> (Accessed 13/01/2025).

Fernández-Alberti, S., Abarca-del-Río, R., Bornhardt, C. and Ávila, A. (2021), "Development and Validation of a Model to Evaluate the Water Resources of a Natural Protected Area as a Provider of Ecosystem Services in a Mountain Basin in Southern Chile", *Frontiers in Earth Science*, Vol. 8, p. 539905.

García, L., Rodríguez, J.D., Wijnen, M. and Pakulski, I. (2016) *Earth Observation for Water Resources Management: Current Use and Future Opportunities for the Water Sector*, Washington, DC: World Bank. <http://hdl.handle.net/10986/22952> 11 May 2022.

Government of Malawi (2014) *National Water Resources Master Plan*, Lilongwe, Malawi: Ministry of Agriculture, Irrigation and Water Development.

Gupta, H.V., Kling, H., Yilmaz, K.K. and Martinez, G.F. (2009), "Decomposition of the mean squared error and NSE performance criteria: Implications for improving hydrological modelling", *Journal of Hydrology*, Vol. 377 No. 1–2, pp. 80 – 91.

Gupta, H.V., Sorooshian, S. and Yapo, P.O. (1999), "Status of Automatic Calibration for Hydrologic Models: Comparison with Multilevel Expert Calibration", *Journal of Hydrologic Engineering*, Vol. 4 No. 2, pp. 135 – 143.

Guug, S.S., Abdul-Ganiyu, S. and Kasei, R.A. (2020), "Application of SWAT hydrological model for assessing water availability at the Sherigu catchment of Ghana and Southern Burkina Faso", *HydroResearch*, Vol. 3, pp. 124 – 133.

Hulsman, P., Winsemius, H.C., Michailovsky, C.I., Savenije, H.H.G. and Hrachowitz, M. (2020), "Using altimetry observations combined with GRACE to select parameter sets of a hydrological model in a data-scarce region", *Hydrology and Earth System Sciences*, Vo. 24 No. 6, pp. 3331 – 3359.

Ingol-Blanco, E. and McKinney, D.C. (2009), "Hydrologic Modeling for Assessing Climate Change Impacts on the Water Resources of the Rio Conchos Basin", in *World Environmental and Water Resources Congress 2009: World Environmental and Water Resources Congress 2009*, Kansas City, Missouri, United States: American Society of Civil Engineers: 1–10. <http://ascelibrary.org/doi/10.1061/41036%28342%29496> 11 May 2022.

Ji, L., Senay, G.B. and Verdin, J.P. (2015), "Evaluation of the Global Land Data Assimilation System (GLDAS) Air Temperature Data Products", *Journal of Hydrometeorology*, Vol. 16 No. 6, pp. 2463 – 2480.

Karimi, P. and Bastiaanssen, W.G. (2015), "Spatial evapotranspiration, rainfall and land use data in water accounting–Part 1: Review of the accuracy of the remote sensing data", *Hydrology and Earth System Sciences*, Vol. 19 No. 1, pp. 507-532.

Krause, P., Boyle, D.P. and Bäse, F. (2005), "Comparison of different efficiency criteria for hydrological model assessment", *Advances in Geosciences*, Vol. 5, pp. 89 – 97.

Kumambala, P.G. (2010) *Sustainability of Water Resources Development for Malawi with Particular Emphasis on North and Central Malawi*, United Kingdom: University of Glasgow.

Moreira, A.A., Ruhoff, A.L., Roberti, D.R., Souza, V. de A., da Rocha, H.R. and Paiva, R.C.D. de. (2019), "Assessment of terrestrial water balance using remote sensing data in South America", *Journal of Hydrology*, Vol. 575, pp. 131–147.

Muthuwatta, L.P., Ahmad, M.-D., Bos, M.G. and Rientjes, T.H.M. (2010), "Assessment of Water Availability and Consumption in the Karkheh River Basin, Iran - Using Remote Sensing and Geo-statistics", *Water Resources Management*, Vol. 24 No. 3, pp. 459 – 484.

Mwale, F.D., Adeloye, A.J. and Rustum, R. (2012), "Infilling of missing rainfall and streamflow data in the Shire River basin, Malawi – A self-organizing map approach", *Physics and Chemistry of the Earth, Parts A/B/C*, Vol. 50–52, pp. 34 – 43.

Nash, J.E. and Sutcliffe, J.V. (1970), "River flow forecasting through conceptual models part I - A discussion of principles", *Journal of Hydrology*, Vol. 10 No. 3, pp. 282 – 290.

Oliveira, P.T.S., Nearing, M.A., Moran, M.S., Goodrich, D.C., Wendland, E. and Gupta, H.V. (2014), "Trends in water balance components across the Brazilian Cerrado", *Water Resources Research*, Vol. 50 No. 9, pp. 7100 – 7114.

Salehie, O., Ismail, T. bin, Shahid, S., Hamed, M.M., Chinnasamy, P. and Wang, X. (2022), "Assessment of Water Resources Availability in Amu Darya River Basin Using GRACE Data", *Water*, Vol. 14 No. 4, p. 533.

SEI (2022a), "Automatic Catchment Delineation", http://www.weap.ngo/WebHelp/Catchment_Delineation.htm#:~:text=Automatic%20Catchment%20Delineation%20WEAP%20can%20automatically%20delineate%20catchments,and%20land%20cover%29%2C%20download%20historical%20climate%20data%20for.

SEI (2022b), "WEAP: Soil Moisture Method: Two-bucket method", Available at: https://weap.sei.org/WebHelp/Two-bucket_Method.htm (12/05/2022).

Sheffield, J., Wood, E.F., Pan, M., Beck, H., Coccia, G., Serrat-Capdevila, A. and Verbist, K. (2018), "Satellite Remote Sensing for Water Resources Management: Potential for Supporting Sustainable Development in Data-Poor Regions", *Water Resources Research*, Vol. 54 No. 12, pp. 9724 – 9758.

Speed, R., Yuanyuan, L., Quesne, T.L., Pegram, G. and Zhiwei, Z. (2013) Basin water allocation planning: principles, procedures, and approaches for basin allocation planning. Metro Manila, Philippines: Asian Development Bank, GIWP, UNESCO, and WWF-UK. Available at: <http://www.adb.org/sites/default/files/pub/2013/basic-water-allocation-planning.pdf> (Accessed 11/05/2022).

Tena, T.M., Mwaanga, P. and Nguvulu, A. (2019), "Hydrological Modelling and Water Resources Assessment of Chongwe River Catchment using WEAP Model", *Water*, Vol. 11 No. 4, p. 839.

Willmott, C.J. (1981), "ON THE VALIDATION OF MODELS", *Physical Geography*, Vol. 2 No. 2, pp. 184 – 194.

Yaykiran, S., Cuceloglu, G. and Ekdal, A. (2019), "Estimation of Water Budget Components of the Sakarya River Basin by Using the WEAP-PGM Model", *Water*, Vol. 11 No. 2, p. 271.

About the Editors



Aubrey Chaputula (PhD) obtained his Bachelor of Arts in Education BA (Ed) degree from Mzuzu University in 2003, Master of Library and Information Studies (MLIS) degree from the University of Botswana in 2009, and Doctor of Philosophy (PhD) degree in Information Studies from the University of KwaZulu-Natal, South Africa, in 2017. He has attained the rank of Associate Professor, and is currently working as University Librarian at Mzuzu University. He has also worked as an Adjunct staff member in the Department of Information Science at Mzuzu University. Dr. Chaputula has served as a reviewer for several journals under the Emerald and Sage Publications such as Electronic Library, Library Review, Library High Tech and Information Development. He also serves as a postgraduate external examiner for the University of Cape Town. His research interests are in the fields of ICT applications in libraries, ICT4D, collection development and management, use of social media and mobile applications in libraries, and disability and inclusiveness in libraries. Dr Chaputula is an accomplished researcher who has published over 20 journal articles in reputable journals besides presenting several conference papers locally and internationally.



Precious Madula (PhD) is a prominent academic in Communication Studies, currently serving as the Deputy Dean of the Faculty of Humanities and Social Sciences at Mzuzu University. He holds a Doctor of Philosophy (PhD) degree from Huazhong University of Science and Technology, a Master's degree in International Journalism from Shanghai International Studies University, and a Bachelor of Arts (Education) degree from Mzuzu University. Proficient in English and Chinese languages, Dr. Madula specialises in strategic communication and media effects, examining the interplay between communication practices and societal outcomes. With over 10 years of experience in the communication industry, including expertise in communication for development (C4D), he demonstrates strong leadership and analytical skills. His research interests encompass health communication, social media, and crisis communication. Additionally, Dr. Madula is an author of a book and several book chapters on multilingualism and communication strategies. He also serves as an editor, enhancing the quality and rigour of academic writing across diverse fields.

