

ASSESSING THE EFFECTIVENESS OF EARLY WARNING SYSTEM IN ENHANCING ANTICIPATORY ACTION IN TRADITIONAL AUTHORITY CHIWALO

Phalombe District, Malawi

KEITH ZIWA DRM-30-21

THYOLO, MALAWI

DISSERTATION SUBMITTED TO NDATA SCHOOL OF CLIMATE AND EARTH SCIENCES OF THE MALAWI UNIVERSITY OF SCIENCE AND TECHNOLOGY IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE BACHELORS OF SCIENCE IN DISASTER RISK MANAGEMENT.

MALAWI UNIVERSITY OF SCIENCE AND TECHNOLOGY
NDATA SCHOOL OF CLIMATE AND EARTH SCIENCE
DEPARTMENT OF CLIMATE SCIENCES

29th MAY, 2026

DISSERTATION APPROVED BY:

SUPERVISOR:

Miss. Nthara Signature: _____

ASSESSOR:

Signature: _____

DISCLAIMER

This document describes work undertaken as part of a programme of study at Ndata School of Climate and Earth Sciences of the Malawi University of Science and Technology. All views and opinions expressed therein remain the sole responsibility of the author(s), and do not necessarily represent those of the school.

COPYRIGHT STATEMENT:

This copy of the dissertation has been supplied on condition that anyone who consults it is understood to recognize that its copyright rests with its author and that no quotation from the dissertation and no information derived from it may be published without acknowledgement.

ABSTRACT

This study assessed the effectiveness of early warning systems (EWS) in enhancing anticipatory action (AA) in flood-prone communities of Traditional Authority Chiwalo in Phalombe District, Malawi. Despite the presence of early warning systems, flood impacts remain significant, raising concerns about the extent to which warnings translate into timely and effective action at the household level. The study aimed to evaluate how EWS influence anticipatory actions and contribute to reducing disaster losses.

A mixed-methods approach was employed, combining quantitative and qualitative techniques. Primary data were collected from 44 households through structured questionnaires, complemented by Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs). Quantitative data were analyzed using descriptive statistics, while qualitative data were analyzed thematically to capture community experiences and perceptions.

The findings revealed that early warning systems play a significant role in triggering anticipatory actions, with 61.4% of respondents reporting reduced disaster losses after acting on warnings. However, 34.1% were uncertain, and 4.5% reported no reduction, indicating uneven effectiveness. Key barriers included delayed and unclear communication, financial constraints, inadequate infrastructure, and weak institutional coordination. These findings suggest that limitations lie not in the existence of EWS, but in the effectiveness of the warning-to-action chain.

The study concludes that while EWS enhance anticipatory action, their effectiveness depends on integrated support systems. It recommends strengthening communication, anticipatory financing, community capacity, and institutional coordination to improve disaster risk reduction outcomes.

ACKNOWLEDGEMENT

First and foremost, I give thanks to God for guiding me throughout this journey, granting me wisdom, strength, and perseverance, and for blessing me with the opportunities to pursue my academic aspirations.

My sincere gratitude goes to my supervisor, Madam T. Nthara, whose invaluable guidance, encouragement, and constructive feedback have been instrumental in shaping both the quality and trajectory of this work. Her mentorship has challenged me to think critically, refine my ideas, and pursue rigorous analysis.

I extend my heartfelt thanks to my parents for all the support from financial, spiritual, and moral, which have provided me with a solid foundation, resilience, and encouragement to persevere in the face of challenges.

Finally, I would like to express my deep appreciation to the lecturers and faculty of the Malawi University of Science and Technology (MUST) for their dedication to teaching, mentorship, and the pursuit of knowledge. Their passion for scholarship and commitment to student development have inspired and informed the research questions, methodology, and overall direction of this proposal.

Table of Contents

ABSTRACT 5
ACKNOWLEDGEMENT 6
Chapter 1: Introduction 10
1.1 Background 10
1.2 Problem statement 11
1.3 Main Objective 11
1.4 Specific Objectives 11
1.5 Research Questions 12
1.6 Significance of the study 12
Chapter 2 Literature Review 12
Chapter 3: Methodology 17
3.1 Research Design 17
3.2 Site Selection 18
3.3 Target Population 18
3.4 Sampling and Sample Size 19
3.5 Data collection 19
3.6 Data Analysis 20
3.7 Data Presentation 20
3.8 Ethical Considerations 20
CHAPTER 4: RESULTS AND DISCUSSION 22
4.1 Introduction 22
4.2 Socio-Demographic Characteristics of Respondents 22
4.2.1 Age distribution 22
4.2.2 Gender Distribution 22
4.2.3 Main Source of Livelihood 23
4.2.4 Exposure to flood hazards 23
4.2.5 Awareness and Existence of Early Warning Systems in the Community 24
4.2.6 Identified Early Warning System 25

4.2.7 Channels Used to Receive Warnings 25
4.2.8 Dissemination Methods 26
4.2.9 Barriers to Receiving Warnings 27
4.3 Anticipatory Actions Taken 27
4.3.1 Perceived Effectiveness of Early Warning Systems in Reducing Flooding Impacts 28
4.3.2 Statistical Analysis of Relationships Between EWS and Anticipatory Action 29
4.3.2 Correlation Analysis 29
4.3.3 Interpretation of Statistical Findings 30
4.4Thematic Analysis of Community Experiences and Suggestions 30
4.4.1 Experiences of Failed Anticipatory Action Interventions 31
4.4.2 Suggestions for Improving and leveling Up Anticipatory Actions 32
4.4.3DISCUSSION OF FINDINGS 33
4.4.4 Introduction 33
4.4.5 Effectiveness of Early Warning Systems in Enhancing Anticipatory Action 33
4.4.6 Influence of Communication on EWS Effectiveness 34
4.4.7 Role of Household Capacity in Influencing Anticipatory Action 35
4.4.8 Institutional and Infrastructure Constraints 35
4.4.9 Integrated Interpretation of Findings 36
4.5.0 Implications for Improving EWS Effectiveness 36
4.5.1 Policy Implications 36
CHAPTER 5: CONCLUSION AND RECOMMENDATIONS 39
5.1 Conclusion 39
5.2 Recommendations 39
5.4 Limitations of the study 40
6.0 References 41

ACRONYMS/ABBREVIATIONS

AA:	Anticipatory Action
EWS:	Early Warning System
DCCMS:	Department of Climate change and meteorological Services
WMO:	World Meteorological Organization
UN:	United Nations
PDNA:	Post Disaster Needs Assessment
UNICEF:	United Nations Children's Fund
KAP:	Knowledge, Attitudes, and Practices
SDGS:	Sustainable Development Goals
UNDRR:	United Nations Office for Disaster Risk Reduction
OCHA:	Office for the Coordination of Humanitarian Affairs
CBEWS:	Community-Based Early Warning System
IFRC:	International Federation of Red Cross and Red Cresent Societies

Chapter 1: Introduction

1.1 Background

Climate change is driving a rise in extreme weather worldwide, making robust Early Warning Systems EWS and AA critical for protecting lives and livelihoods. Reports from the WMO and the UN highlight that floods, storms and heatwaves are becoming more frequent and intense, while nearly one-third of the global population particularly in low-income countries remains without access to effective multi-hazard EWS (WMO, 2024). Within this global framework, AA has emerged as a proactive approach that uses pre-defined triggers based on scientific forecasts to initiate early interventions before hazards fully unfold (Fred Branski, 2022; IFRC, 2020).

Sub-Saharan Africa remains highly vulnerable to climate extremes, where recurrent floods, droughts, and storms have eroded livelihoods and development gains. The WMO-led Early Warnings for All initiative aims to extend EWS coverage to every person by 2027 (WMO, 2024). Despite efforts to strengthen meteorological services, last-mile challenges hinder the effectiveness of EWS across rural communities in Sub-Saharan Africa.

Malawi exemplifies the risks facing developing nations. According to the PDNA conducted by the Government of Malawi, World Bank, and UNICEF the country has experienced over 19 major flood events since the late 1990s, with increasing frequency and severity(Malawi, 2019). EM-DAT data show that between 2000 and 2024, floods affected more than 3.6 million people, resulting in substantial (Disasters, 2025). Phalombe District is one of the most disaster-prone areas in Malawi due to geographical position. Its capacity structures, and limited access to financial protection such as insurance exacerbate its exposure have increased its susceptibility to flooding (Hallegatte, 2016). To address these gaps, AA was piloted in Malawi. AA refers to pre-agreed actions that are automatically triggered before a disaster occurs, based on reliable forecasts or risk information, with the aim of reducing the humanitarian impact of hazards (Fred et al., 2022). This reflects broader findings that while AA reduces disaster impacts globally Malawi lacks fully operational, legally binding AA protocols. Against this backdrop, this study assessed the

effectiveness of Early Warning Systems in enhancing AA in flood-prone communities of Phalombe District, specifically T/A Chiwalo.

1.2 Problem statement

Flooding remains a serious threat in Phalombe District, causing repeated loss of life, property damage, and disruption of livelihoods. Although the government and partners have introduced CBFEWS, their use is still limited (Dickson D. Chinguwo, 2022). A recent KAP study in Zomba and Phalombe found that while warnings often reach communities, they are not always understood or trusted, reducing their effectiveness in prompting early action(GDPC, 2024). Studies at both national and district levels highlight "last-mile" challenges such as delayed dissemination, miscommunication, and weak institutional support, which undermine EWS and slow the shift toward AA (GDPC, 2024). The impact of Cyclone Freddy in 2023 and Cyclone Jude in 2025 further showed that even when warnings were issued, communities often failed to act in time (FEWS NET, 2024). Without clear knowledge of how EWS work in practice and the barriers to acting on them, reducing flood impacts in Phalombe through preparedness will remain a major challenge. It is against this background that this study explored how Early Warning Systems enhance AA in flood-prone communities of Phalombe District, with a focus on T/A Chiwalo.

1.3 Main Objective

- To assess the effectiveness of Early Warning Systems in enhancing anticipatory action in flood-prone communities of Phalombe District.

1.4 Specific Objectives

1. To Analyze the existing Early Warning Systems operating in T/A Chiwalo, Phalombe District.
2. To evaluate the challenges and barriers that limit the effective use of Early Warning Systems for anticipatory action.
3. To evaluate how existing Early Warning Systems influence anticipatory actions taken by households and institutions before flood events.

1.5 Research Questions

i. What Early Warning Systems currently exist in T/A Chiwalo, Phalombe District, and how are they structured and managed at community and institutional levels?
ii. What challenges and barriers limit the effectiveness of these Early Warning Systems in triggering timely and coordinated anticipatory actions?
iii. How do the existing Early Warning Systems influence the anticipatory actions taken by households and institutions before flood events?
iv. How are flood forecasts and warnings disseminated to communities in T/A Chiwalo?
v. What types of anticipatory actions do households usually take upon receiving warnings

1.6 Significance of the study

This study investigated how effective EWS are in prompting anticipatory actions in flood-prone communities of Phalombe District. It also identified what works well and what needs improvement, helping to design better, community-focused systems that encourage timely and appropriate action. The study supports Sendai Framework priority number 4. And the SDGs (1) through reducing disaster related livelihood loss, (11) by strengthening community resilience to floods and (13) through enhancing early warning and climate adaptation measures.

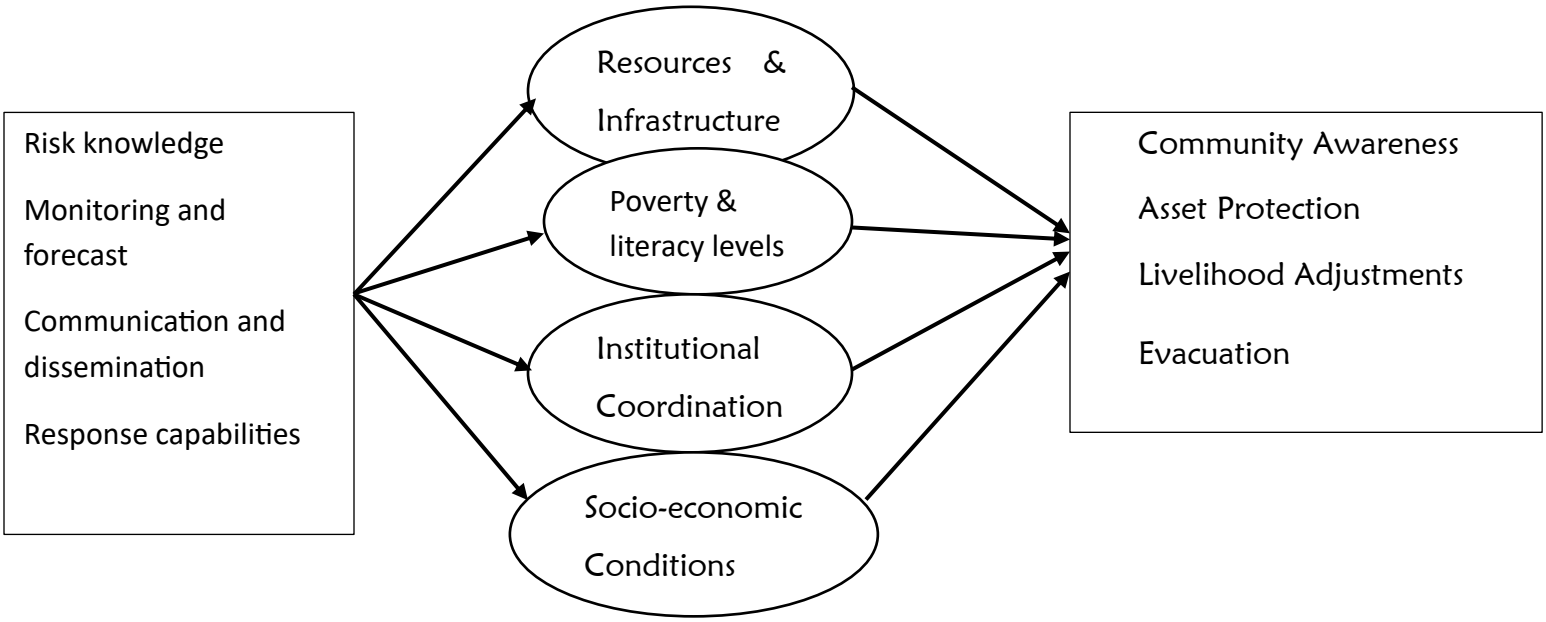
Chapter 2 Literature Review

Introduction

The purpose of this literature review was to examine existing scholarship and practice surrounding Early Warning Systems (EWS) and Anticipatory Action (AA), with the aim of situating the study within wider academic and policy discourse. It explores what has already been studied globally, regionally, and nationally; highlights theoretical and conceptual frameworks that underpin this research and identifies knowledge and practice gaps that justify the present focus on Phalombe District, Malawi.

Theoretical and Conceptual Framework

The conceptual framework was based on the reviewed literature.



The study draws on a combination of theoretical and policy frameworks to understand how Early Warning Systems can enhance Anticipatory Action in flood-prone communities, beginning with the four-component model advanced by UNDRR (UNDRR, 2015). This framework underscores that an EWS is not simply about generating scientific forecasts, but about translating them into protective action at community level. Its strength lies in its holistic approach, linking technical forecasting with social preparedness. However, Tall et al (2018) cautions that in many low-income settings the model has been applied in a largely technocratic manner overemphasizing infrastructure and forecasting tools while underestimating barriers such as low literacy, poverty, and lack of community trust (Tall et al., 2018). And also, the WMO 2023 review of global EWS progress shows that while countries have improved national-level capacity, last-mile communication and financing remain underfunded and poorly coordinated. For Phalombe, this critique is highly relevant, since vulnerable households often receive warnings but lack the resources to act on them.

Closely aligned is the concept of AA, by activating responses before a hazard fully unfolds, AA seeks to reduce losses, protect livelihoods, and avoid dependence on emergency relief. Global pilots such as in Bangladesh and in the Philippines demonstrate that AA improved

their food security and reduce displacement (WFP, 2022; IFRC, 2023). However, critical reviews argue that many of these successes are donor-driven and resource-intensive, raising doubts about their scalability in weaker institutional environments like Sub-Saharan Africa (Coughlan de Perez et al., 2019). This duality points to AA's methodological strength its rigorous, data-driven design while also exposing its vulnerability in fragile, resource-poor settings like Malawi.

The Sendai Framework for Disaster Risk Reduction (2015–2030) provides the global policy backdrop, Its Priority 1 and Priority 4 (UNDRR, 2015). Importantly, Sendai promotes people-centered, inclusive, multi-hazard EWS, directly supporting this study's concern with bridging technical and social dimensions. However, the Framework has faced substantive critiques from different author such as Piñeros & Julián (2020) argue that Sendai is dominated by a technocratic logic that foregrounds technical fixes while neglecting the socio-political roots of vulnerability (Piñeros & Julián , 2020).

Globally, EWS are widely acknowledged as a cornerstone of disaster risk reduction. Countries with mature multi-hazard systems consistently report fewer disaster-related fatalities (UNDRR & WMO, 2023). Yet, the literature emphasizes that technical forecasting alone is a necessary but insufficient condition for effective risk reduction. The UNDRR model's four pillars are broadly accepted, but evidence reveals that warnings do not automatically translate into protective action unless embedded in people-centered communication, financing, and institutional mechanisms (De Perez et al., 2015). AA has therefore emerged as a complementary approach, designed to bridge the "warning-to-action" gap. Evaluations of AA measures in Bangladesh demonstrate that timely disbursement of resources improves household food security and reduced reliance on emergency relief during floods (WFP, 2022). Similarly, in the Philippines, the pre-distribution of shelter kits ahead of typhoon and Monson rains minimized displacement and property damage (IFRC, 2023). However, several scholars problematize the transferability of these successes. Coughlan de Perez et al. (2015) argue that many AA pilots are conducted in contexts with high levels of donor and technical support, raising concerns about their replicability in weaker institutional environments. This critique manifests in two

recurrent challenges: first dependence on external financing and two limited institutionalizations of trigger protocols at the national or district level (De Perez et al., 2015). FAO (2021) further notes that most pilot evaluations, often using before/after or case-study designs, capture short-term benefits but rarely demonstrate long-term sustainability or cost-effectiveness at scale (FAO & WFP, 2023). Recent reviews of OCHA-facilitated pilots in Somalia, Ethiopia, and Bangladesh confirm these systemic challenges. Chaves-Gonzalez et al. (2022) highlight persistent difficulties in designing reliable triggers due to data limitations, as well as operational bottlenecks in fund disbursement and procurement (ChavesGonzalez et al., 2022). Tye & I. Suarez (2021) adds that scaling AA requires mindset shifts and long-term institutional commitment, emphasizing the need for coordination across Resident Coordinators, national disaster platforms, and inter-cluster systems (Tye & I. Suarez, 2021).

The global evidence bases both motivates and cautions the current research. It motivates by showing that AA, when effectively embedded in EWS, can reduce humanitarian impacts and costs. It cautions by demonstrating that pilot successes elsewhere often rely on donor resources, may not scale, and frequently neglect equity and long-term sustainability.

EWS and AA in Sub-Saharan Africa

In Sub-Saharan Africa, climate change has intensified the occurrence of floods, droughts, and storms, eroded livelihoods and reversing hard-won development gains (WMO, 2024). Despite increasing investments in meteorological infrastructure, largely donor-supported, last-mile challenges persist. Warnings frequently arrive late, are couched in inaccessible technical language, or omit clear, actionable steps for households and communities (Tall et al., 2018). In Malawi, recent innovations reveal both opportunities and limits: integrating local knowledge with formal early warning systems can enhance trust and responsiveness, showing that hybrid models may strengthen community buy-in and action. (Nigussie et al., 2025). Similarly, AA in West suggests that anticipatory cash transfers and pre-positioned relief can reduce humanitarian costs and bolster household preparedness. Yet, these pilots remain donor-dependent and small in scale, prompting questions about long-term sustainability and formal institutionalization. (FAO & WFP, 2023). Van Aalst et

al. (2008) argue that while technological forecasting capacity has improved, weak governance and coordination mechanisms often prevent warnings from translating into meaningful action. Coughlan de Perez et al. (2015), further note that without national ownership and legal frameworks, AA risks remaining a donor-driven experiment rather than a systemic solution (De Perez et al., 2015). A related critique concerns financing: even where triggers are established, slow fund disbursement and bureaucratic bottlenecks limit timely action (ChavesGonzalez et al., 2022). This highlights a gap between the technical provision of warnings and their social reception.

Flood Risk in Malawi

Malawi exemplifies the intersection of geographic vulnerability and socio-economic fragility. Most of its population resides in floodplains and relies on rain-fed agriculture, placing them precariously close to natural hazards. The country has endured over 19 major flood events since the 1990s, affecting more than 3.6 million people between 2000 and 2022 (Government of Malawi, 2019; EM-DAT, 2025). Catastrophic events such as the 1991 Phalombe flash floods, Cyclone Idai (2019), and Cyclone Freddy (2023) underscore the recurring, devastating impacts of floods on vulnerable communities (Unicef, 2025).The DCCMS with support from the CREWS initiative, has enhanced forecasting infrastructure using tools like ENACTS and Maproom (DCCMS, 2024). Chinguwo and Deus (2022) conducted an assessment of CBEWS across southern region, they found that river gauge systems, though present at both national and community levels, suffer from poor linkage, bureaucratic delays, and lack of CPCs, making warnings often late and ineffective. The study highlights that while the systems exist, failures outweigh successes in translating warnings into action (Dickson D. Chinguwo & Dorothea Deus, 2022)

Summary And Research Gap

Existing literature supports pairing EWS with AA to mitigate disaster impacts, but notable gaps remain in Malawi. Much evidence comes from short-term, donor-funded pilots, raising concerns about scalability and sustainability. In Malawi, technical forecasting has improved, yet empirical research on how rural households in high-risk districts particularly

Phalombe (T/A Chiwalo) receive, interpret, and act upon warnings is limited. Institutional bottlenecks further impede translating national policies into timely local action. Global recognition of EWS and AA does not guarantee effectiveness in Malawi, where coordination, communication, and local ownership are often weak. Many studies emphasize technology at the expense of community-level processes that determine action. This research seeks to bridge the "warning-to-action". The expected contribution is actionable guidance for improving the design, dissemination, and uptake of EWS and AA, strengthening district-level resilience.

Chapter 3: Methodology

3.1 Research Design

This study adopted a mixed-methods approach to assess the effectiveness of early warning systems (EWS) in enhancing anticipatory action (AA) in T/A Chiwalo, Phalombe District. Household surveys generated quantitative evidence on awareness, access, and responses to warnings, while KIIs and FGDs provided qualitative insights into institutional coordination, perceptions, and barriers within the warning-to-action chain.

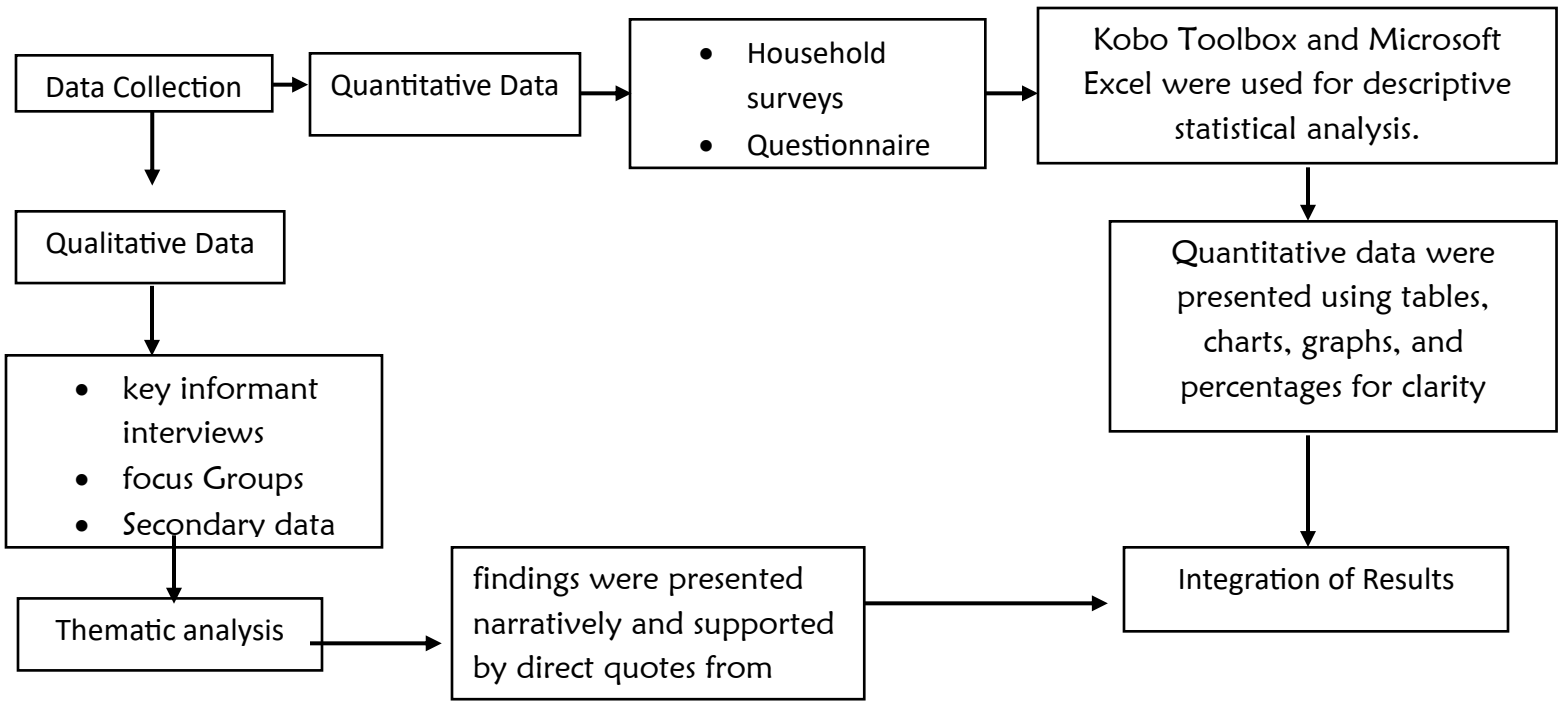


Figure 2: showing Research design

3.2 Site Selection

The research was conducted in Traditional Authority (T/A) Chiwalo, located in Phalombe District, one of the most disaster-prone areas in Malawi. The district's steep terrain, proximity to river systems, and dependence on subsistence farming expose it to recurrent hazards such as floods. According to IFPRI (2019), Phalombe has had the highest poverty incidence in Malawi (83.2%), with fragile infrastructure that compounds disaster risks. Its history of devastating floods including the 1991 Napolo disaster, Cyclone Idai in 2019, Cyclone Freddy in 2023 and Cyclone Jude 2025 makes it a suitable case study area for the research.

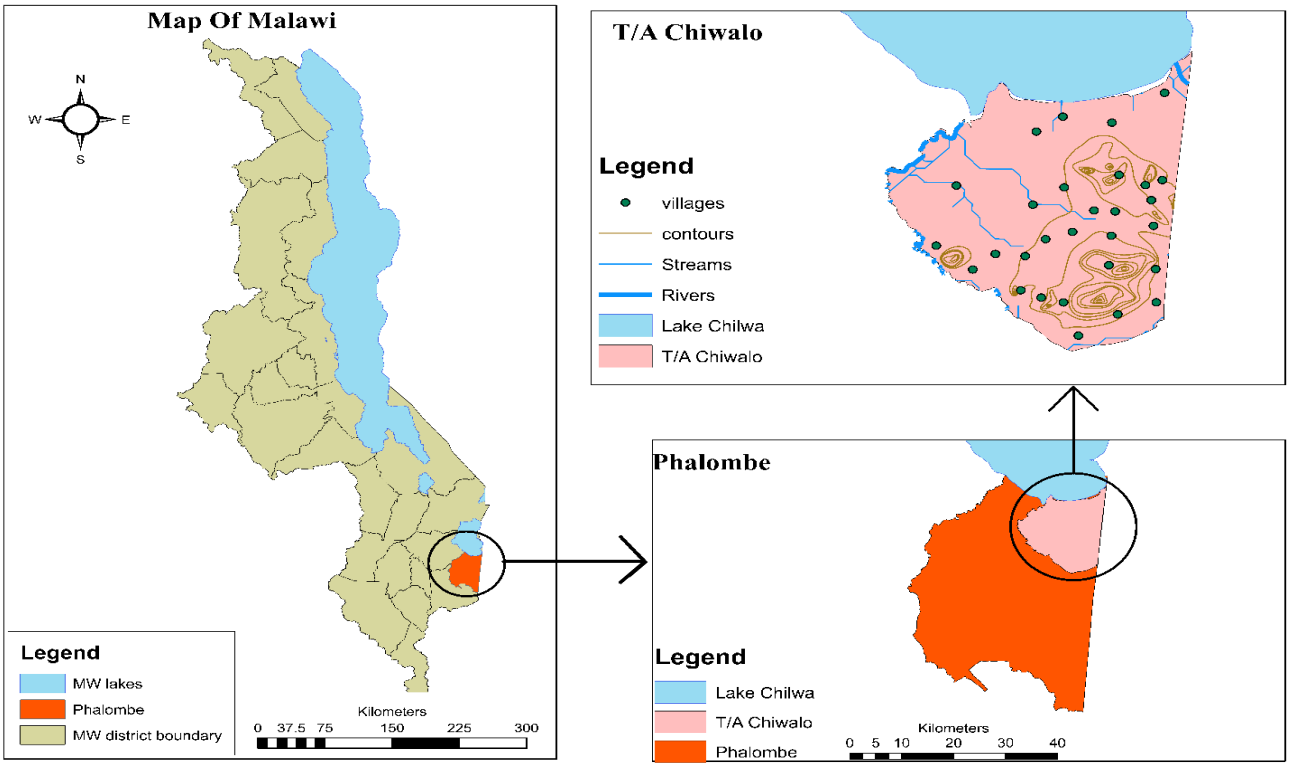


figure 3: showing area study map

3.3 Target Population

The study focused on households in flood-prone communities of T/A Chiwalo. Household heads available at the time of the survey were targeted, provided they had experienced

one or more of the recurrent disasters affecting the area. Participants were selected across different age groups, gender, socio-economic status, and disability categories to capture diverse perspectives.

3.4 Sampling and Sample Size

The study employed stratified random sampling that ensured representation across demographic and socio-economic groups (e.g., age, gender, income levels, and community roles). This method reduced bias and ensured that results are generalizable to the wider community. The sample size was calculated using Taro Yamane's formula (1967):

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

Where:

- n = sample size
- N = total population
- e = margin of error (15%)

For T/A Chiwalo's population of 43,933. According to 2018 national censors' data (NSO, 2018):

$$n = \frac{43933}{1 + 43933(0.15)^2}$$

n=44 (to the nearest whole number)

A sample size of 44 households was obtained. Although the sample size was relatively small, it was considered adequate for an exploratory study given time and resource constraints e.g. financial resources

3.5 Data collection

The study utilized both primary and secondary data sources. Primary data were collected through household surveys, 6 Key Informant Interviews (KIIs), and 5 Focus Group Discussions (FGDs). Household surveys targeted heads of households in flood-prone areas using random sampling to ensure representation across gender, age, and socio-economic

characteristics. KIIs were conducted with officials from the Area disaster risk management committee (ADRMC) and Malawi red cross society, FGDs involved men, women, and youth using a participatory approach. Secondary data was obtained from Post-Disaster Needs Assessments (PDNAs), district reports, and publications from UN agencies and NGOs.

3.6 Data Analysis

The collected data were analyzed using both quantitative and qualitative approaches. Quantitative data obtained from household surveys were processed using Kobo Toolbox and Microsoft Excel. Descriptive statistics, including frequencies and percentages, were used to summarize patterns of early warning system awareness, communication channels, and anticipatory actions taken by households. Qualitative data from Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) were transcribed and analyzed thematically. Responses were grouped into key themes such as communication challenges, resource constraints, institutional gaps, and infrastructure limitations to provide deeper insights into the effectiveness of anticipatory actions.

Triangulation was employed by comparing findings from different data sources to enhance the validity and reliability of the results.

3.7 Data Presentation

Quantitative results were presented using tables, charts, graphs, and percentages to enhance clarity and interpretation. Pie charts and bar graphs were used to illustrate proportions of responses. Qualitative findings were presented narratively and organized into themes based on participants' experiences and perceptions.

3.8 Ethical Considerations

Ethical approval was obtained from the Malawi University of Science and Technology (MUST) Research Ethics Committee under the Ndata School of Climate and Earth Sciences. Local approval was also obtained from the Group Village Head in T/A Chiwalo. Participants were informed about the purpose of the study, the voluntary nature of

participation, and their right to withdraw at any time. Informed consent was obtained prior to participation. Confidentiality was strictly maintained, and data were used solely for academic purposes.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results of the study in relation to the research objectives, beginning with the most significant findings and supported by statistical and thematic analysis.

4.2 Socio-Demographic Characteristics of Respondents

A total of 44 respondents participated in the study. Their socio-demographic characteristics are summarized as follows:

4.2.1 Age distribution

The majority of respondents (34.1%) were aged between 26–35 years, followed by those aged 18–25 (27.3%) and 36–45 (18.2%). Smaller proportions were observed in the 46–60 (13.6%) and over 60 (6.8%) age groups, as Illustrated in the table 1.

Table 1: Showing age distribution

Age Group	Frequency (n= 44)	Percentage %
26–35	15	34.1
18–25	12	27.3
36–45	8	18.2
46–60	6	13.6
60+	3	6.8

4.2.2 Gender Distribution

Out of the 44 respondents, 26 (59.1%) were male while 18 (40.9%) were female.

Gender	Frequency (44)	Percentage (%)
Male	26	59.1
Female	18	40.9

Table 2: Showing gender distribution

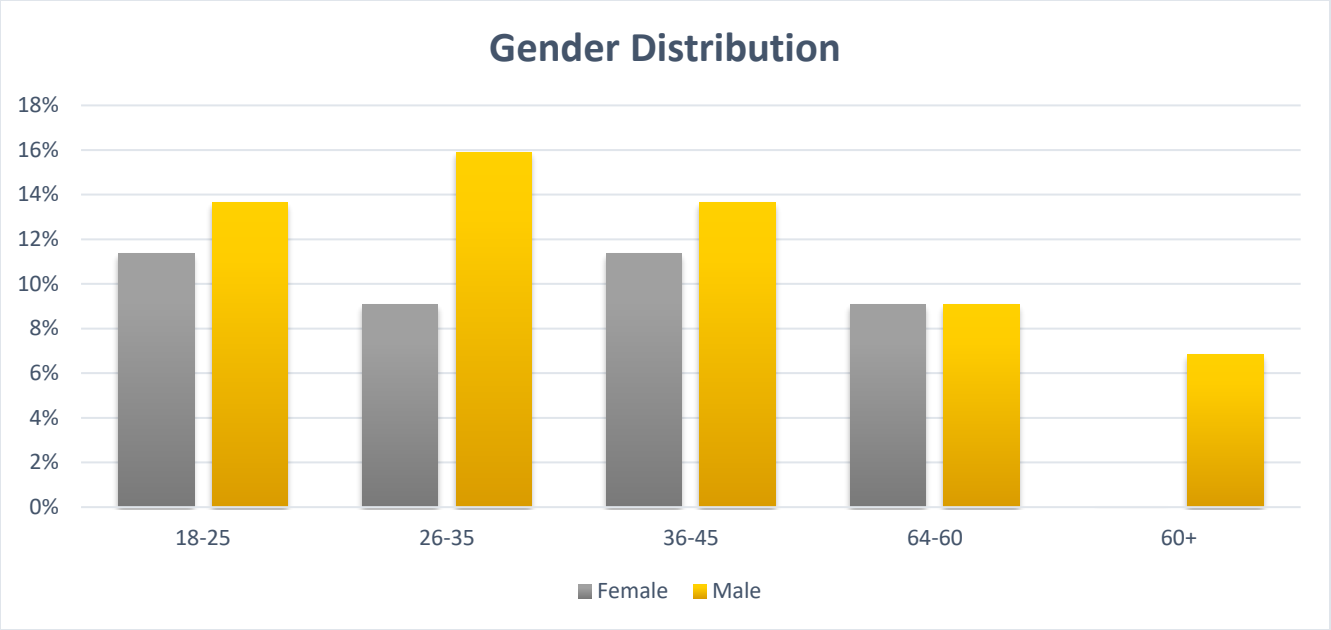


Figure 4: Showing age group distribution by gender

4.2.3 Main Source of Livelihood

The findings show that business is the main source of livelihood for the largest proportion of respondents (36.36%), followed by casual labour (27.27%) and farming (25.0 %), while only a small proportion are formally employed (11.36%) as illustrated in table 3. This indicates that the majority of respondents rely on informal and climate-sensitive livelihoods, which may limit their capacity to respond effectively to early warning messages. This reliance on informal livelihoods increases household vulnerability and reduces the ability to implement anticipatory actions such as evacuation or asset protection, thereby affecting the effectiveness of early warning systems.

Sources of livelihood	Frequency (N=44)	percentage (%)
Business	16	36.36
Casual labour	12	27.27
Farming	11	25.0
Formal employment	5	11.36

Table 3: show main sources of income

4.2.4 Exposure to flood hazards

A large majority of respondents (81.8%) reported that their households had been affected by floods represented by figure 5.

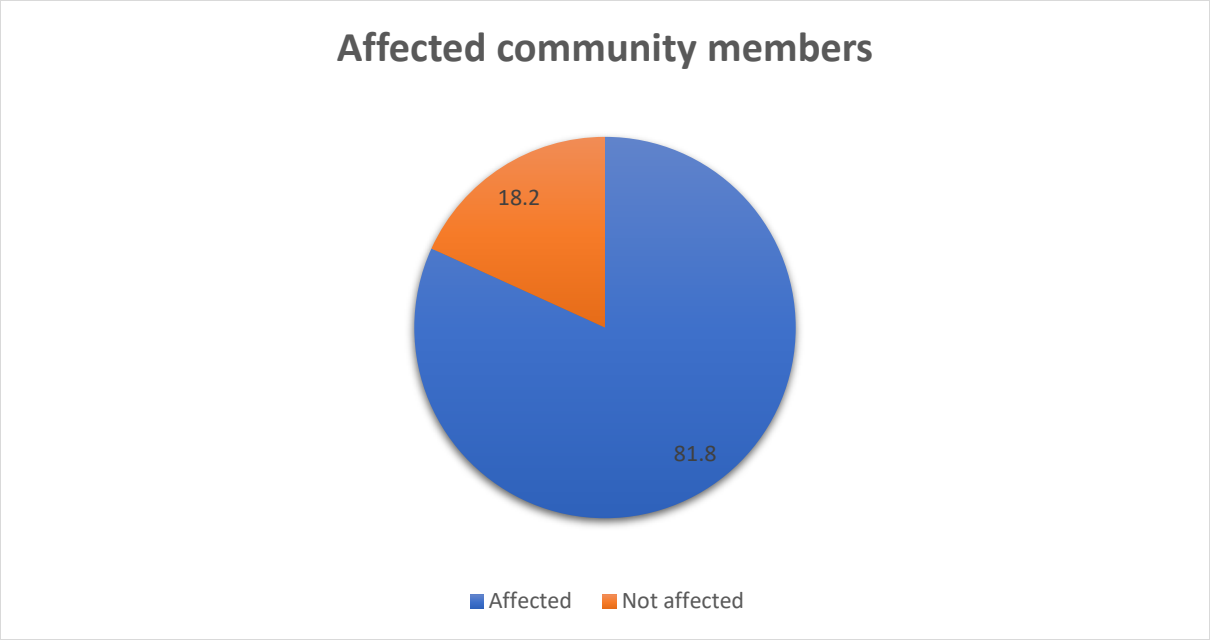


Figure 5: Affected community members

4.2.5 Awareness and Existence of Early Warning Systems in the Community

The findings in figure 6 indicate that 56.8% of respondents were aware of early warning systems, while 43.2% were not aware. Indicating that although a majority of households have access to early warning information, a substantial proportion of the population remains excluded from these systems. This gap in awareness highlights limitations in the reach and effectiveness of early warning dissemination, which may undermine the ability of all households to take timely and appropriate anticipatory action.

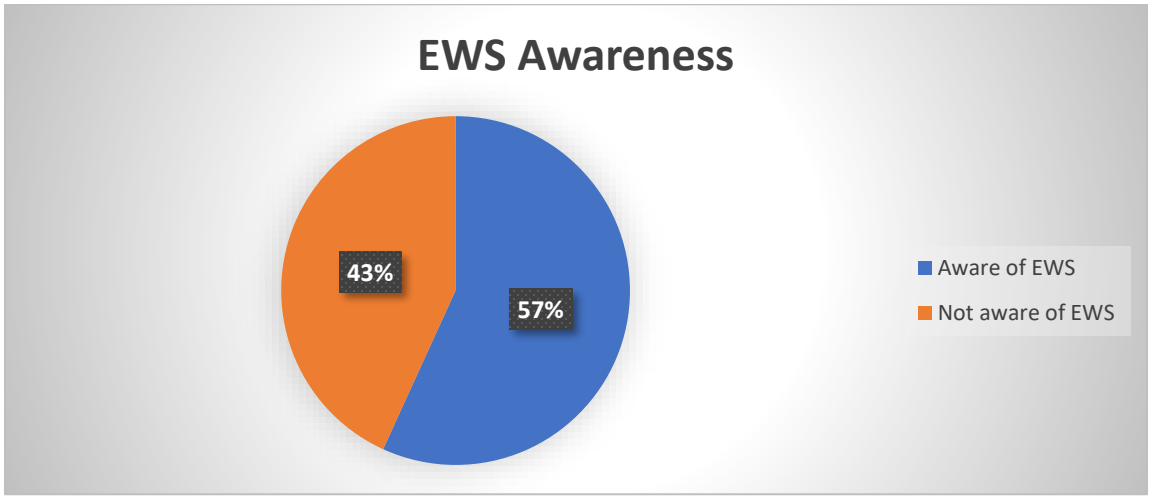


Figure 6: shows an awareness pie chart

4.2.6 Identified Early Warning System

The findings indicate that river gauges are the most commonly identified early warning system in the community, with the majority of respondents who were aware of EWS recognizing them followed by DCCMS weekly reports, and lastly by information from community members. As illustrated in Figure 7.

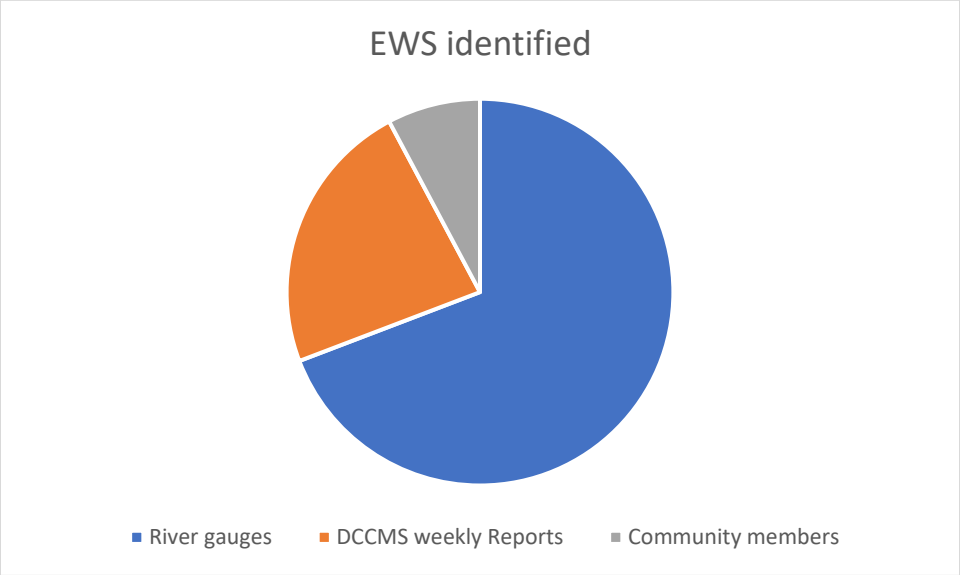


Figure 7: EWS present

4.2.7 Channels Used to Receive Warnings

The results show that information from mobile phone sms are the most common channels (41% each), followed by radio (30%) and disaster committees (16%). NGOs and neighbours play a smaller role (7% each).

Channel	Frequency (44)	percentage
Mobile phone SMS	18	41%
Radio	13	30%
NGOs	7	16%
Community leaders	3	7%
Neighbors	3	7%

Table 4: channels present

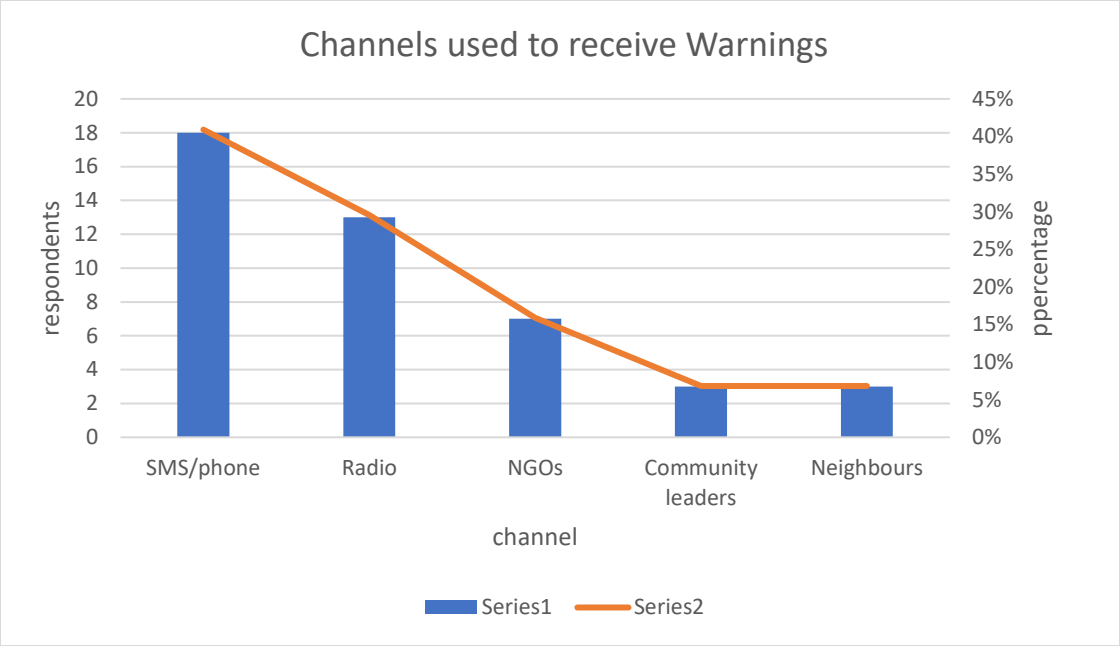


Figure 7: channels used for communication

4.2.8 Dissemination Methods

The main method of dissemination is through megaphones (57%), followed by phone messages (34%), while community meetings (7%) and door-to-door communication (2%) are less common.

Channel of communication	Frequency	Percentage
Megaphones	25	57%
Phone messages	15	34%
Community meetings	3	7%
Door-to-door communication	1	2%

Table 5: channels of communication

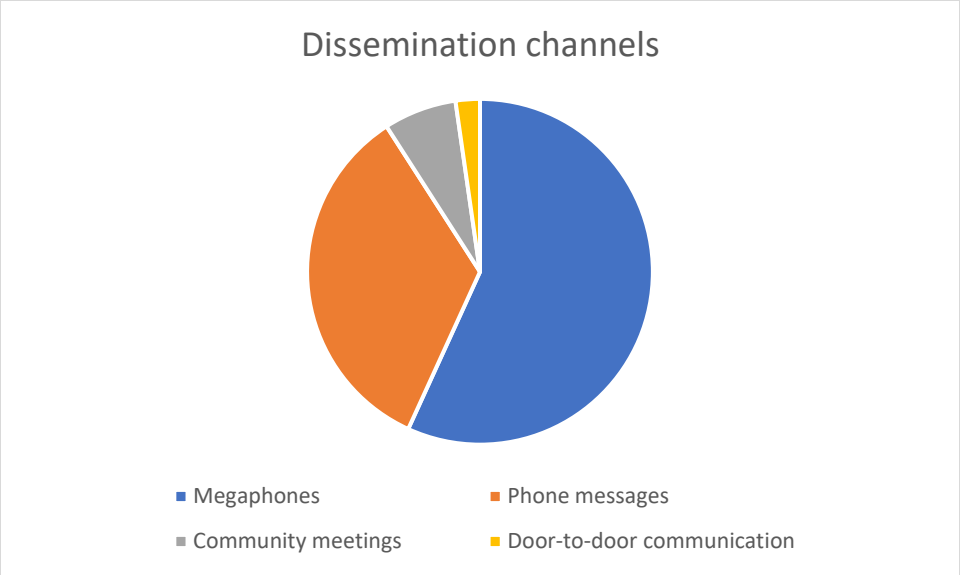


Figure 8: dissemination channel

4.2.9 Barriers to Receiving Warnings

The most significant barrier identified is language barriers (48%), followed by lack of communication tools (20%) and lack of clear instructions (16%). Other challenges include false alarms (9%), late information (5%), and lack of trust (2%).

Barrier	Frequency	Percentage
Language barriers	21	48%
Lack of communication tools	9	20%
Lack of clear instructions	7	16%
False alarms	4	9%
Late information	2	5%
Lack of trust	1	2%

Table 8: barriers to receiving EWS

4.3 Anticipatory Actions Taken

The findings indicate that the most common anticipatory action taken by respondents is evacuating family members (43%), followed by moving household assets (23%) and relocating livestock (14%). Other actions include preparing food supplies (11%) and harvesting crops early (7%), while only 2% reported taking no action.

Anticipatory Action	Frequency	Percentage
Evacuate family members	19	43%
Move household assets	10	23%
Move livestock	6	14%

Prepare food supplies	5	11%
Harvest crops early	3	7%
Do nothing	1	2%

Table 9: AA taken

4.3.1 Perceived Effectiveness of Early Warning Systems in Reducing Flooding Impacts

These findings provide direct evidence in relation to the research problem, which highlighted that although early warning systems exist in Phalombe District, their effectiveness in triggering timely and appropriate anticipatory action remains limited. While a majority of respondents reported reduced losses, the presence of uncertainty and non-reduction of damage indicates that early warning systems do not consistently translate into effective action at the household level. The study demonstrated that 61.4% of respondents who took anticipatory action reported reduced disaster losses, indicating that early warning systems have a measurable impact at the household level. However, 34% were uncertain about the extent of loss reduction, while 4.5% indicated no reduction in damage, highlighting variability in outcomes.

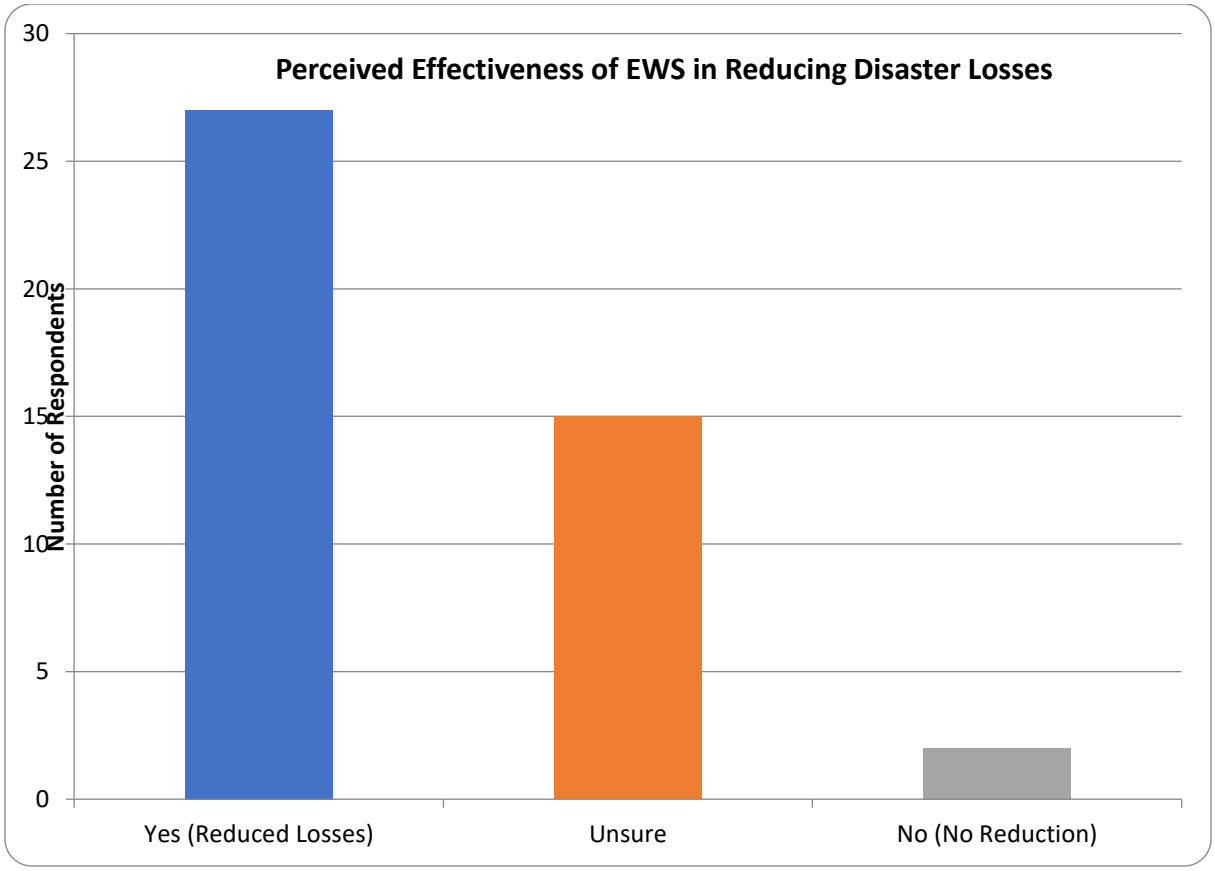


Figure 9: Effectiveness of EWS in Reducing Disaster Losses

These findings provide evidence in support of the research problem, which highlighted that although early warning systems exist, their effectiveness in triggering timely and appropriate anticipatory action remains limited.

4.3.2 Statistical Analysis of Relationships Between EWS and Anticipatory Action

4.3.2 Correlation Analysis

To further strengthen the analysis, a correlation analysis was conducted to assess the relationship between awareness of early warning systems and household preparedness. The results revealed a strong positive relationship (r = 0.84). Figure 10 indicates that households with awareness of early warning systems had significantly higher levels of preparedness compared to those without awareness. Households with awareness of early warning systems were more likely to undertake anticipatory actions before flood events occurred. This demonstrates that access to early warning information strongly influences preparedness behavior, although additional socio-economic and institutional factors may also affect preparedness outcomes. Households with awareness of early warning systems were more likely to undertake anticipatory actions. This demonstrates that access to early warning information plays a role in influencing preparedness behavior, although the relationship is not strong, suggesting the influence of additional factors.

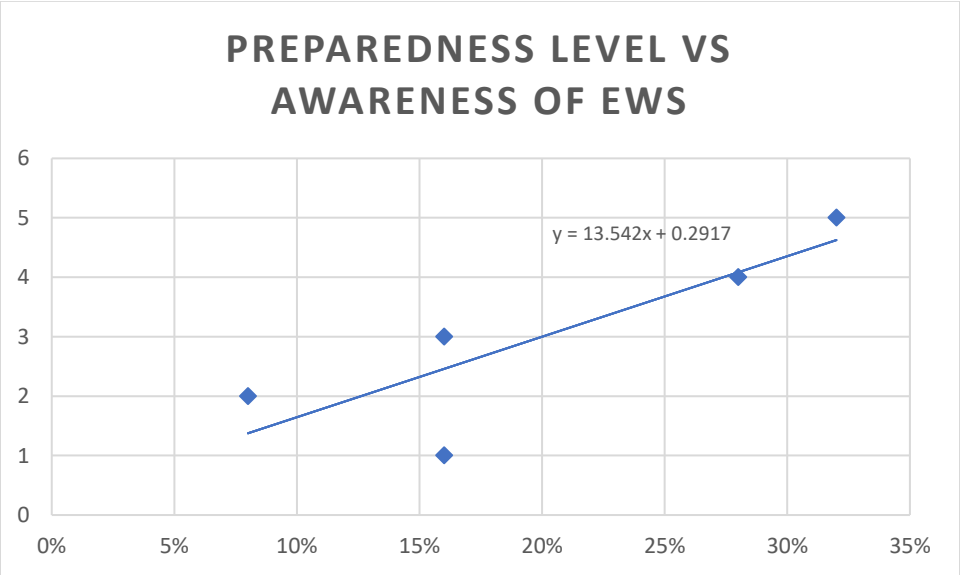


Figure 10: correlation bar chart of preparedness by awareness of EWS

4.3.3 Interpretation of Statistical Findings

The statistical analysis establishes a sequential relationship in which awareness of early warning systems influences preparedness, which in turn contributes to reduced disaster losses. This confirms that early warning systems operate indirectly through preparedness mechanisms. However, the moderate strength of these relationships indicates that early warning systems alone are insufficient, and their effectiveness depends on the strength of the entire warning-to-action chain.

4.4Thematic Analysis of Community Experiences and Suggestions

In addition to the quantitative findings, qualitative from the KII and FGDs data were analyzed thematically to provide deeper insights into community experiences and perceptions regarding the effectiveness of anticipatory actions.

Theme	Key issue	Implication for EWS Effectiveness
Communication Issues	Unclear messages Language barriers Delayed warnings	Poor communication weakens the *last-mile delivery* of warnings, limiting the ability of households to take timely and appropriate anticipatory action.
Resource Constraints	Limited financial capacity - Inability to secure assets	Anticipatory action depends not only on information but also on the capacity to act, meaning vulnerable households remain at risk despite receiving warnings.
Institutional Gaps	Weak coordination Delayed response from authorities Limited committee presence	Weak institutional structures reduce trust and reliability of early warning systems, affecting community response behavior.
Capacity and Training Limitations	Lack of awareness on actions Limited training Weak community preparedness	Without proper training, warnings do not effectively translate into action, reducing the overall impact of EWS.
Infrastructure Limitations	Poor road networks Unsafe relocation areas	Infrastructure is a critical enabler of anticipatory

	(use of school buildings)	action; without it, exposure to flood risk remains high.
Community Suggestions for Improvement	Use local languages Provide timely warnings Offer financial/logistical support Strengthen committees Improve training Build shelters	Incorporating community-driven solutions can enhance the effectiveness, inclusiveness, and sustainability of early warning systems.

4.4.1 Experiences of Failed Anticipatory Action Interventions

The thematic analysis of responses from T/A Chiwalo reveals that while early warning systems are present, their ability to translate into effective anticipatory action is significantly constrained by interconnected challenges related to communication, resources, infrastructure, and system reliability. A critical failure identified was the inability of households to evacuate despite receiving warnings through channels such as SMS, megaphones, and community networks. The absence of safe and accessible evacuation shelters forced many households to remain in high-risk areas, highlighting a gap between warning dissemination and practical response capacity. This is particularly concerning given that 81.8% of respondents had experienced flooding, yet structural preparedness remains inadequate. Financial constraints further compounded this challenge, as households lacked the means to reinforce homes, relocate assets, or arrange transport, reflecting the vulnerability associated with reliance on informal livelihoods such as farming, casual labour, and small businesses.

In addition, the effectiveness of anticipatory actions was undermined by unreliable forecasts, delayed warnings, and unclear messaging. Respondents reported that agricultural strategies such as early planting often failed due to unpredictable rainfall, weakening trust in forecast-based decisions. Similarly, technical failures in warning systems and late dissemination reduced the time available for meaningful preparation. Communication barriers, including language limitations and lack of actionable guidance, led to misinterpretation, resulting in delayed or inappropriate responses. Furthermore, support mechanisms such as cash transfers and pre-positioned resources were insufficient to sustain preparedness efforts throughout disaster periods. Collectively, these findings reveal that the effectiveness of early warning systems in T/A Chiwalo is not determined by their presence alone, but by the strength of the entire warning-to-action chain, where gaps in communication, capacity, and infrastructure continue to limit the realization of reduced disaster impacts.

4.4.2 Suggestions for Improving and leveling Up Anticipatory Actions

Respondents in T/A Chiwalo proposed a range of context-specific strategies to enhance the effectiveness of anticipatory actions, reflecting their direct experiences with flood hazards and early warning systems. A central recommendation was the need to strengthen community-level capacity building, as many respondents indicated that although warnings are received, there is limited understanding of how to interpret and act on them. They emphasized the importance of regular training through local structures such as village civil protection committees to improve preparedness, evacuation planning, and risk reduction practices. In addition, improving communication systems was identified as critical, with respondents calling for warning messages to be delivered in local languages and accompanied by clear, actionable guidance. Strengthening informal communication networks, including community leaders and neighbors, was also seen as essential for improving last-mile delivery.

Furthermore, respondents highlighted financial constraints as a major barrier to effective anticipatory action, recommending increased and timely cash transfers to enable households to reinforce homes, secure assets, and evacuate safely. Strengthening institutional coordination between district authorities, NGOs, and community structures was also emphasized as a means of improving the reliability and timeliness of warning dissemination and response. Finally, respondents underscored the importance of integrating indigenous knowledge with scientific forecasts to enhance trust, accuracy, and local relevance of warning systems. Overall, these findings suggest that improving anticipatory action in T/A Chiwalo requires a holistic, community-centered approach that simultaneously addresses communication, capacity, resources, institutional coordination, and contextual relevance.

The findings of this study confirmed the research problem that, despite the presence of early warning systems in T/A Chiwalo, their effectiveness in enhancing anticipatory action is constrained by multiple factors. While early warning systems contributed to reduced disaster losses for a majority of respondents, challenges related to communication, financial capacity, institutional coordination, and infrastructure limit the consistent translation of warnings into action. This demonstrates that the effectiveness of early warning systems depends not only on their availability but on the strength of the entire warning-to-action chain.

4.4.3DISCUSSION OF FINDINGS

4.4.4 Introduction

This chapter discusses the key findings of the study in relation to the research objective of assessing the effectiveness of early warning systems (EWS) in enhancing anticipatory action in flood-prone communities of T/A Chiwalo in Phalombe District. The discussion integrates both quantitative and qualitative findings and interprets them within the broader context of disaster risk management.

4.4.5 Effectiveness of Early Warning Systems in Enhancing Anticipatory Action

This study found that early warning systems contribute to anticipatory action, with 61.4% of respondents reporting reduced disaster losses after acting on warnings. This suggests that early warning systems are effective in creating opportunities for households to take protective measures before flood events occur. However, the presence of 34.1% of respondents who were uncertain, and 4.5% who reported no reduction, indicates that effectiveness is uneven and not guaranteed.

This variation can be explained by the fact that early warning systems primarily provide information rather than capacity to act. While warnings may be received, their effectiveness depends on whether households can interpret them correctly, trust them, and mobilize the necessary resources within the available time. In this study context, delays in communication, financial constraints, and lack of infrastructure reduce the ability of households to translate warnings into effective action.

These findings are consistent with Coughlan de Perez et al. (2015), who argue that early warning systems only reduce disaster impacts when they are linked to anticipatory action mechanisms (De Perez et al., 2015). Similarly, UNDRR and WMO (2023) emphasize that early warning systems are necessary but, insufficient for disaster risk reduction on their own, as effectiveness depends on the integration of communication, preparedness, and response capacity (UNDRR & WMO, Global Status of Multi-Hazard Early Warning Systems, 2023).

However, this study extends these findings by demonstrating that even when anticipatory actions are taken, their outcomes vary significantly. This supports the critique by FAO and WFP (2023) that many anticipatory action interventions show short-term success but face limitations in sustainability and effectiveness at scale (FAO & WFP, 2023). Additionally, Chaves-Gonzalez et al. (2022) highlight that delays in resource mobilization and

operational bottlenecks often reduce the effectiveness of anticipatory actions (ChavesGonzalez et al., 2022).

In contrast, studies from Bangladesh and the Philippines WFP 2022 and IFRC 2023 report stronger effectiveness of anticipatory action, largely due to higher levels of institutional support and pre-positioned resources (WFP, 2022; IFRC, 2023). The difference in findings can be attributed to contextual factors, as those settings benefit from stronger financing mechanisms and institutional coordination compared to Malawi. This suggests that the moderate effectiveness observed in T/A Chiwalo reflects systemic constraints rather than failure of early warning systems themselves.

4.4.6 Influence of Communication on EWS Effectiveness

This study found that communication is a critical factor influencing whether early warning systems lead to effective anticipatory action. Although multiple communication channels were used, respondents reported challenges including language barriers, delayed warnings, and lack of clear instructions.

This suggests that the effectiveness of early warning systems depends not only on the transmission of information but also on its clarity, timing, and usability. When warning messages are unclear or delayed, households are unable to interpret risks correctly or take timely action. In this study, communication failures directly contributed to uncertainty in outcomes and reduced effectiveness of anticipatory action.

These findings align with Tall et al. (2018), who found that climate information services in Africa often fail to influence behavior due to poor communication and lack of user-friendly messaging (Tall et al., 2018). Similarly, WMO (2024) reports that last-mile communication remains one of the weakest components of early warning systems globally (WMO, State of the Climate in Africa , 2024).

Furthermore, Nigussie et al. (2025) demonstrate that integrating local knowledge into early warning systems improves understanding and trust, suggesting that communication must be context-specific to be effective. This supports the findings of this study, where respondents relied heavily on informal channels such as neighbors, indicating gaps in formal communication systems (Nigussie et al., 2025).

However, unlike studies that emphasize technological solutions, this study highlights that communication challenges are largely social and institutional rather than technical. This supports the critique by Piñeros and Julián (2020), who argue that disaster risk frameworks often overemphasize technical solutions while neglecting social dimensions of vulnerability (Piñeros & Julián , 2020).

4.4.7 Role of Household Capacity in Influencing Anticipatory Action

The study found that household capacity significantly influences the ability to act on early warning information. Many respondents relied on informal and climate-sensitive livelihoods, limiting their financial capacity to implement anticipatory measures.

This indicates that early warning systems alone cannot ensure effective anticipatory action. Instead, they must be supported by household-level capacity, including access to financial resources, transport, and safe shelter options. In this study, even when warnings were understood, lack of resources prevented households from acting effectively.

This finding supports Hallegatte (2016), who argues that poverty is a key determinant of disaster vulnerability, as low-income households are less able to invest in risk reduction measures (Hallegatte S. , shock waves: managing the impacts of climate change on poverty, 2016). Similarly, Van Aalst et al. (2008) emphasize that adaptive capacity is critical for effective disaster response (Aalst et al., 2008).

Additionally, FAO (2021) highlights that anticipatory action programs are more effective when households have access to financial support mechanisms such as cash transfers (FAO & WFP, 2023). This contrasts with the situation in T/A Chiwalo, where such support is limited, explaining the weaker outcomes observed.

4.4.8 Institutional and Infrastructure Constraints

The study found that institutional coordination and infrastructure limitations significantly affect the effectiveness of early warning systems. Weak coordination, delayed response, and lack of evacuation shelters were identified as key barriers.

This suggests that even when early warning systems function effectively at the technical level, their impact is constrained by institutional and structural weaknesses. For example, evacuation is not feasible without safe shelters, and delays in institutional response reduce trust in warning systems.

These findings align with Chinguwo and Deus (2022), who found that community-based early warning systems in Malawi are often undermined by weak institutional linkages and delays in information flow (Dickson D. Chinguwo, 2022). Similarly, Chaves-Gonzalez et al. (2022) highlight operational bottlenecks as a key challenge in anticipatory action implementation (ChavesGonzalez et al., 2022).

However, this study further demonstrates that these institutional weaknesses directly affect household-level outcomes, creating a disconnection between warning dissemination and

action. This supports Tye and Suarez (2021), who argue that effective anticipatory action requires strong coordination across institutions and governance systems.

4.4.9 Integrated Interpretation of Findings

The findings of this study demonstrate that early warning systems operate within a complex system where multiple factors interact to determine outcomes. While correlation results show that awareness influences preparedness, these relationships are moderate rather than strong.

This indicates that early warning systems function as an enabling mechanism, rather than a standalone solution. Their effectiveness depends on communication clarity, household capacity, institutional coordination, and infrastructure availability.

This supports the broader literature which argues that disaster risk reduction requires a systems-based approach (UNDRR, 2015; WMO, 2024). The study therefore confirms that the "warning-to-action" gap is not a failure of early warning systems alone, but a reflection of broader structural and socio-economic constraints.

4.5.0 Implications for Improving EWS Effectiveness

The findings suggest that improving the effectiveness of early warning systems requires: Strengthening communication systems, enhancing community capacity through training increasing financial support mechanisms, improving institutional coordination and investing in infrastructure such as evacuation shelters

These measures would strengthen the entire warning-to-action chain and improve the ability of households to respond effectively to flood risks.

4.5.1 Policy Implications

The findings of this study have significant policy implications for strengthening early warning systems (EWS) and anticipatory action (AA) in Malawi, particularly within the framework of the Malawi Disaster Risk Management Act and the Sendai Framework for Disaster Risk Reduction.

Firstly, the study highlights the need to operationalize people-centered early warning systems, as emphasized under Priority 4 of the Sendai Framework, which focuses on enhancing disaster preparedness for effective response. While the Malawi DRM Act (2023) provides for the establishment of coordinated disaster risk management structures, the findings reveal that gaps persist in translating warnings into effective community-level action. This suggests that policy implementation should go beyond dissemination of warnings to ensure that communities have the capacity, resources, and guidance required

to act. Strengthening the "last-mile" component of early warning systems should therefore be prioritized within national and district-level DRM strategies.

Secondly, the study underscores the importance of anticipatory action financing, which aligns with the Sendai Framework's emphasis on reducing disaster risk through proactive investment. Although the Malawi DRM Act (2023) establishes institutional frameworks for disaster management, it provides an opportunity to further integrate forecast-based financing and contingency funding mechanisms. The findings show that financial constraints significantly limit household response, indicating that policies should institutionalize early action financing instruments such as pre-arranged cash transfers to enable timely preparedness at the community level.

Thirdly, the findings point to institutional coordination challenges, which relate directly to Sendai Framework Priority 2 on strengthening disaster risk governance. The Malawi DRM Act (2023) mandates coordination through structures such as the Department of Disaster Management Affairs (DoDMA). However, the study reveals gaps in coordination and communication between these structures and communities. This suggests a need for policy emphasis on clearly defined roles, accountability mechanisms, and improved vertical and horizontal coordination to ensure efficient warning dissemination and response.

Fourthly, the study highlights critical infrastructure deficits, particularly the lack of evacuation shelters and reliable communication systems. This aligns with Sendai Framework Priority 3, which calls for investing in disaster risk reduction for resilience. The Malawi DRM Act (2023) provides a framework for resilience-building, but the findings suggest that greater policy focus is needed on targeted investments in high-risk areas such as Phalombe. Infrastructure development should prioritize evacuation facilities, transport accessibility, and communication systems that support effective anticipatory action.

Additionally, the study emphasizes the need for capacity building and community engagement, which are central to both the Malawi DRM Act (2023) and the Sendai Framework. The findings indicate that limited understanding of warning messages reduces effective response. Policies should therefore strengthen continuous training of VDRMC and communities, ensuring that early warning information is actionable and context-specific.

Finally, the findings support the integration of indigenous knowledge with scientific early warning systems, consistent with the Sendai Framework's emphasis on inclusive and locally relevant approaches. Policymakers should promote hybrid systems that combine local environmental knowledge with formal forecasting to improve trust, accuracy, and uptake of warnings at the community level.

Overall, this study demonstrates that achieving effective early warning systems in Malawi requires not only compliance with existing policy frameworks but also strengthened implementation mechanisms that address communication, capacity, financing, and infrastructure gaps. Aligning national and local practices with the provisions of the Malawi

DRM Act (2023) and the priorities of the Sendai Framework will be critical in closing the gap between early warning and anticipatory action.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study assessed the effectiveness of early warning systems (EWS) in enhancing anticipatory action (AA) in flood-prone communities of T/A Chiwalo, Phalombe District. The findings show that EWS play a significant role in triggering anticipatory actions at the household level, with 61.4% of respondents reporting reduced disaster losses. Common actions included evacuation, relocation of assets, and protection of livelihoods, indicating that EWS can contribute to reducing exposure and vulnerability.

However, the effectiveness of EWS remains uneven, as 34.1% of respondents were uncertain about loss reduction and 4.5% reported no improvement. This variation highlights that the presence of warning systems alone is insufficient. Instead, effectiveness is shaped by the strength of the entire warning-to-action chain. Communication challenges, including delayed, unclear, and inaccessible messages, limit timely response, while financial constraints restrict households' ability to act even when warnings are received. Institutional weaknesses and infrastructure gaps, such as lack of evacuation shelters, further reduce the practical impact of anticipatory actions.

Overall, the study concludes that while EWS contribute to enhancing anticipatory action, their effectiveness depends on integrated support systems that address communication, capacity, resources, and infrastructure.

5.2 Recommendations

To enhance the effectiveness of EWS in strengthening anticipatory action, the following measures are recommended:

Improve communication systems by ensuring timely, clear, and locally understandable warning messages with actionable guidance, while strengthening last-mile delivery through community structures.

Strengthen community capacity through regular training on preparedness, evacuation procedures, and interpretation of warning information to improve response behavior.

Enhance financial support mechanisms, including timely cash transfers and pre-positioned resources, to enable households to act effectively on warnings.

Improve institutional coordination between government, NGOs, and community structures to ensure efficient warning dissemination and response.

Invest in critical infrastructure, particularly evacuation shelters and accessible transport networks, to support safe and timely action.

Integrate indigenous knowledge with scientific forecasts to improve trust, relevance, and community uptake of warnings.

Adopt a holistic approach that strengthens all components of the warning-to-action chain, ensuring that early warnings translate into effective and timely action.

5.4 Limitations of the study

The study faced several limitations. First, the relatively small sample size of 44 households limits the generalizability of the findings. This was primarily due to time and financial constraints. Second, some respondents were unwilling or unable to provide complete information, resulting in minor inconsistencies in the dataset. Additionally, resource and methodological constraints may have affected the depth of analysis. Future studies should consider larger sample sizes and more advanced analytical techniques to enhance reliability and generalizability.

6.0 References

Nigussie, L., Bekele, T. W., Haile, A. T., Mdee, A., Nicol, A., Cohen, J., . . . Demissie, K. (2025, February 4). *Does a Citizen Science Approach Enhance the Effectiveness of Flood Early Warning Systems? Evidence from the Akaki Catchment, Ethiopia.* Retrieved from Citizen Science: Theory and Practice: https://theoryandpractice.citizenscienceassociation.org/articles/10.5334/cstp.763

Tall, A., Coulibaly, J., & Diop, M. (2018). Do climate services make a difference. *A review of evaluation methodologies and practices to assess the value of climate information services for farmers: Implications for Africa,, 11*, 1-12. https://doi.org/https://doi.org/10.1016/j.cliser.2018.06.001.

Aalst, v., Burton, I., Cannon, T., & Maarten K. (2008). Community level adaptation to climate change. *The potential role of participatory community risk assessment,, 18*(1), 165-179. https://doi.org/https://doi.org/10.1016/j.gloenvcha.2007.06.002.

Caritas, M. (2023). *Post-Cyclone Freddy disaster response report.* Retrieved from https://www.caritas.org/where-caritas-work/africa/malawi/

ChavesGonzalez, J., Milano, L., Omtzigt, D., Pfister, D., Poirier, J., Pople, A., . . . Zommers, Z. (2022, December 08). Lessons for the future. *Anticipatory action*. https://doi.org/10.3389

DCCMS, D. o. (2024, April 23). Early Warning Systems, Making Malawi More Resilient. Retrieved from https://www.metmalawi.gov.mw/news/early-warning-systems-making-malawi-more-resilient

De Perez, C., van den, H., Aalst, v., Jongman, T., K., & P., S. (2015). an approach for catalyzing humanitarian action based on extreme weather and climate forecasts. *Forecast-based financing, 15*(4). https://doi.org/https://doi.org/10.5194/nhess-15-895-2015

Dickson D. Chinguwo, D. D. (2022, March 31). *Assessment of community-based flood early .* Retrieved from Research Gate : https://www.researchgate.net/publication/359768112_Assessment_of_community-based_flood_early_warning_system_in_Malawi

Disasters. (2021). *45*(4), 887-912. https://doi.org/ https://doi.org/10.1111/disa.1244

EM-DAT. (2025). Retrieved from Emergency Events Database (EM-DAT): https://public.emdat.be/data

FAO, & WFP. (2023). *FAO-WFP Anticipatory Action Strategy.* Rome.

FEWS NET, F. E. (2024). *Crisis (IPC Phase 3) persists in southern Malawi, driven by cyclone impacts.*

Fred , B., Cheng, A., Sengupta, R., Kumar, A., Amlang, S., Allis, E., . . . Fontan, A. C. (2022). The Global Multi-Hazard Alert System Framework Supporting alerting capacities of Members in the climate crisis. *71*(1). Retrieved from https://wmo.int/media/magazine-article/global-multi-hazard-alert-system-framework-supporting-alerting-capacities-of-members-climate-crisis

GDPC, G. D. (2024). *Knowledge, Attitudes and Practices on Flood Early Warnings and Early Action among local communities inZomba and Phalombe, Malawi.* Retrieved from Anticipation-hub.org.

Gettliffe, E. (2022, March). *MALAWI ANTICIPATORY ACTION: process of learning on trigger development .* Retrieved from Centre for Disaster Protection : https://www.disasterprotection.org/publications-centre/malawi-anticipatory-action-process-learning-on-trigger-development

Government, B. (2024, March 18). *Anticipatory Action Activation Bangladesh, July 2024.* WFP.

Hallegatte, S. (2015, July 20). *The Indirect Cost of Natural Disasters and an Economic Definition of Macroeconomic Resilience*. Retrieved from World Bank Gruop : https://hdl.handle.net/10986/22238

Hallegatte, S. (2015, February 16). *Recent Floods in Malawi Hit the Poorest Areas*. Retrieved from worldbank.org: https://blogs.worldbank.org/en/voices/recent-floods-malawi-hit-poorest-areas-what-implies

Hallegatte, S. (2016). *shock waves: managing the impacts of climate change on poverty.* World Bank Publications.

IFRC. (2020). *Launch of the FbF Practitioners Manual*. Retrieved from German Red Cross: https://www.forecast-based-financing.org/2020/04/27/launch-of-the-fbf-practitioners-manual/

IFRC. (2023, January). *Anticipatory action in practice: acting early ahead of typhoons in the Philippines.* Retrieved from Anticipation Hud: https://www.anticipation-hub.org/Documents/Briefing_Sheets_and_Fact_Sheets/Acting-early-Philippines_FINAL.pdf

IFRC, I. F. (2020). *From early warning to early action*. Retrieved from Forecast-based financing: https://www.forecast-based-financing.org/

IOM. (n.d.). *Anticipatory action*. Retrieved from International Organization for Migration: https://www.iom.int/anticipatory-action

ISC. (2023). *Report for the Mid-Term Review of the Sendi Framework For Disaster Risk Reduction.* International Science Council. https://doi.org/10.24948/2023.01.

Malawi, G. o. (2019). *Malawi 2019 Floods Post Disaster Needs Assessment (PDNA).*

Marchezini, V., Horita, F. E., Matsuo, P. M., Trajber, R., Rangel, M. A., & Olivato, D. (2018, November 10). A Review of Studies on Participatory Early Warning Systems (P-EWS). *Pathways to Support Citizen Science Initiatives*. https://doi.org/10.3389

Migration, I. I. (n.d.). *Emergency preparedness, Anticipatory action*. Retrieved from International Organization for Migration.org: https://www.iom.int/anticipatory-action#:~:text=Anticipatory%20action%20is%20defined%20as%20acting%20ahead%20of,livelihoods%20and%20humanitarian%20needs%20before%20they%20fully%20unfold.

MRCS. (2025, March 19). *The Malawi Red Cross Society distributes anticipatory cash ahead of Tropical Cyclone Jude*. Retrieved from Anticipation Hud : https://www.anticipation-hub.org/news/the-malawi-red-cross-society-distributes-anticipatory-cash-ahead-of-tropical-cyclone-jude

NSO. (2018). *Population and Housing Census*. Retrieved from national statistics office : https://www.nsomalawi.mw/census/2018

Philippines, g. (2022). *Philippines Anticipatory Action Framework.* Retrieved from UNOCHA.org: https://www.unocha.org/publications/report/philippines/philippines-anticipatory-action-framework-2022-revision

Piñeros, O., & Julián , D. (2020). A Critique of the Sendai Framework 2015-2030. *Technocracy, Disaster Risk Reduction and Development, 47*. https://doi.org/https://doi.org/10.18601/01229893.n47.10

Ritchie, H. (2024, May 20). The world has become more resilient to disasters, but investment is needed to save more lives. Retrieved from https://ourworldindata.org/the-world-has-become-more-resilient-to-disasters-but-investment-is-needed-to-save-more-lives

Societies, I. F. (2025, june 4). *Malawi | Tropical Cyclone Freddy - Final Operation Update (MDRMW018).* Retrieved from Reliefweb: https://reliefweb.int/report/malawi/malawi-tropical-cyclone-freddy-final-operation-update-mdrmw018

Times. (2016, March 10). *Phalombe Disaster: 25 years later*. Retrieved from Times Group: https://archive.times.mw/index.php/2016/03/10/phalombe-disaster-25-years-later/

Times, M. (2025, March 13). *Floods displace families in Phalombe as cyclone Jude looms*. Retrieved from Malawiana Times: https://www.malawianatimes.com/2025/03/13/floods-displace-families-in-phalombe-as-cyclone-jude-looms/#:~:text=Heavy%20rainfall%20in%20Phalombe%20district%20has%20caused%20the,Sangale%20Primary%20School%20in%20Group%20Village%20Headman%20Sabuni.

Trogrlić, R. Š., den Homberg, M., & Netherlands Red Cross. (2022, Decmber 14). *Indigenous knowledge and early warning systems in the lower Shire Valley Malawi.* Retrieved from European Union : https://capacity4dev.europa.eu/library/indigenous-knowledge-and-early-warning-systems-lower-shire-valley-malawi

UNDP. (n.d.). *Saving Lives and Protecting Agriculture-based Livelihoods in Malawi: Scaling Up the Use of Modernized Climate Information and Early Warning systems (M-CLIMES).* Retrieved from https://procurement-notices.undp.org/view_notice.cfm?notice_id=47327&_gl=1*dotz2t*_ga*MTc4MzEwMjE2NC4xNzU3NTQ1MTYw*_ga_PBF14M9C6G*czE3NTc1NDUxNjAkbzEkZzAkdDE3NTc1NDUxNjAkajYwJGwwJGgw

UNDRR. (2015, june 29). *Sendai Framework for Disaster Risk Reduction 2015–2030.* Retrieved from United Nations Office For Disaster Risk Reduction: https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030

UNDRR. (2017). *Programme of Action for the Implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030 in Africa .* Retrieved from UNDRR: https://www.undrr.org/publication/programme-action-implementation-sendai-framework-disaster-risk-reduction-2015-2030

UNDRR, & WMO. (2023). *Global Status of Multi-Hazard Early Warning Systems.*

Unicef. (2025, January 1). *Malawi Humanitarian Situation Report No. 2.* Retrieved from Unicef: https://www.unicef.org/documents/malawi-humanitarian-situation-report-no-2-mid-year-01-january-30-june-2025

WFP. (2022). *Bangladesh 2022 Annual Country Report Summary.*

WMO. (2024, September 02). *Africa faces disproportionate burden from climate change and adaptation costs*. Retrieved from World Meteorological Organization: https://wmo.int/news/media-centre/africa-faces-disproportionate-burden-from-climate-change-and-adaptation-costs

WMO. (2024, September). *State of the Climate in Africa .* Retrieved from World Meteorogical Organisation E-Library: https://library.wmo.int/idurl/4/69495