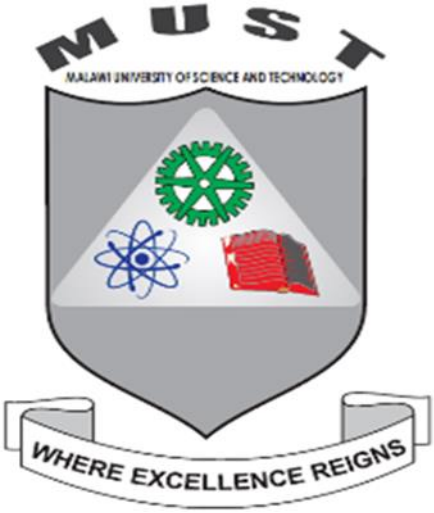


ASSESSMENT OF FACTORS THAT AFFECT FLOOD SEARCH AND RESCUE FROM THE AFFECTED COMMUNITIES' PERSPECTIVE IN CHIKWAWA DISTRICT

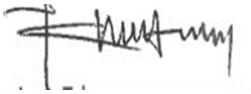
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Dissertation submitted to Ndata School of Climate and Earth Sciences of the Malawi University of Science and Technology in partial fulfilment of the requirements for the Bachelor of Science degree in disaster risk management

July, 2021

DISSERTATION APPROVED BY:

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19/07/2021

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DECLARATION

I **Hamson Gondwe** do declare that this is my own work 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 Bachelor of Science degree in Disaster Risk Management. No one has ever done this study in any university

Signature: 

DISCLAIMER

I declare that this dissertation is a product of my personal independent work. No part of it has previously been submitted for the award of any degree in any other university. I, therefore, submit it for the award of the Degree of Bachelors of Science in disaster at the University of Malawi science and Technology

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ABSTRACT

Malawi is prone to natural hazards almost after every three years it experiences flood and Chikwawa is one of the districts in southern region hit by floods. The methodologies used in this research study include Qualitative method where questionnaire was administered. Results indicate that crucial tools such as drones are not much considered as shown by the results that 97.5% of the interviewees responded that drones are not used during flood search and rescue while 2.5% said drones are used. Flood search and rescue is delayed, when flood occurs in Chikwawa search and rescue team from Malawi Defence force, Malawi red cross society and Malawi police take more than 10 hours to attend to those affected by floods. Results show poor institution participation in flood search and rescue, 57.5% of people responded that Malawi Defence force participates, 35% for Malawi red cross society and 7.5% for Malawi police. Poor awareness campaigns which affect communication procedures, results have shown knowledge of people in the community about which institutions to call for flood search and rescue. showing transportation used during flood search and rescue. From those who were interviewed 70% do not have knowledge of which institution to call for flood search and rescue and 30% do have knowledge The research shows that 22.5% means of transport used are helicopters and 77.5% for boats. Comments from the respondents have shown that flood search and rescue is done by the member of the villages who mobilise themselves to rescue others. There is ineffective flood search and rescue since factors that affects flood search and rescue remain undressed. Technically this research involves carrying out an investigation on what affects the effectiveness of flood search and rescue in order to find solution to the existing flood search and rescue problem, if possible. This research was carried out in Chikwawa district located in southern region of Malawi.

ACKNOWLEDGEMENTS

First and for most, I would like to thank God for the wisdom, protection and guidance, without Him I could not make it. I would also like to thank my sister Teleza Gondwe and my girlfriend Suten Simkoko for their great support and encouragement during the long years of my study.

I would like to express my profound thanks to my supervisor, Dr I Tchuwa and for his tireless assistance, guidance and constructive criticism throughout the research work.

My special thanks go to the Dean of Department of Ndata Dr E Kadewa who would advise us to work hard.

TABLE OF CONTENTS

1. Chapter 1: General Introduction 1

1.1 Introduction 1

1.2 Background information 1

1.3 Problem statement.....4

1.4 Hypothesis.....5

1.5 Main Objective.....5

1.6 Specific Objectives.....5

1.7 Research questions.....5

1.8 Significance of study.....6

2. Chapter 2: Literature review 7

2.1 Chapter Introduction.....7

2.2 The concept of Search and Rescue.....7

2.3 Coordination and assessments in Malawi.....10

2.4 The role of national Drm institutions.....12

2.5 Chapter Conclusion 16

3. Chapter 3

3.1 Methodology.....18

3.2 Study area.....18

4. Results and discussion.....22

5. Conclusion and Recommendations.....29

6.References.....33

7.Appendices 35

ACRONYMS/ABBREVIATIONS

DoDMA	Department of Disaster Management Affairs
MRCS	Malawi Red-cross Society
CBO	Community based organization
EOC	Emergency Operational center
DoCC & MS	Department of Climate Change and Meteorological Services
NEOC	National Emergency Operations Centre
UAS	Unmanned aircraft systems
CPC	Civil Protection Committees
REOC	Regional Emergency Operations Centre
NGO	Non-Governmental Organization
MDG	Millenium Development Goals
MDF	Malawi Defence Force
IC	Incident Command
NCP	National Contingency plan
CEMP	Comprehensive Emergency Management Plan
HCI	Human-computer interaction
NEOC	National Emergency Operations Centre
UNDAC	United Nations Disaster Assessment and coordination
IMWG	Information Management Working Group
REOC	Regional Emergency Operations Centre
INGOs	International Non-Governmental Organizations

LIST OF FIGURES

Figure 1 showing the study area……...19
Figure 2 showing the drone usage during flood search and rescue……..……22
Figure 3 showing arrival time of search and rescue team on flood scene..……23
Figure 4 showing institutions participation in floods search and rescue……..…24
Figure 5 showing transportation means used during flood search and rescue ……..25
Figure 6 showing knowledge of which institutions to call for flood search and rescue……26

1. CHAPTER 1

1.1. Introduction

Research have been conducted over the previous years on issues concerning search and rescue in general. However, regardless of published research articles and reports, an overview indicates that most research projects have focused much on fire search and rescue compared to flood search and rescue in other countries and Malawi. In Malawi Flood search and rescue research has not been conducted before living a gap that has to be covered with more thorough research data. The aim of research is about assessing factors that affects flood search and rescue, to contribute scientific data that would influence formulation of policies, for effective flood search and rescue. The specific objectives include to find out the tools used during search and rescue, to determine time taken for search and rescue team, to find out level of participation for flood search and rescue institutions, to find out means of transport during flood search and rescue and to determine communication procedures for flood search and rescue

1.2. Background Information

Natural disasters are increasingly common as climate change becomes more severe. Search and rescue operations become more important to societies worldwide. Rescue services are often engaged in missions in rural areas, treating the injured or searching for missing persons. Often, time is an essential factor for a positive outcome of search and rescue missions. Due to their capacity for flexible deployment, drones have a great potential to be deployed in search and rescue scenarios and thus reduce the rescue time. Drones can effectively assist rescue crews in their mission to save human lives. (Mayer et al., 2019)

Emergency and disaster management is organization and management of resources and responsibilities for addressing all aspects of emergencies, in particular preparedness, response and initial recovery steps. An emergency is a threatening condition which requires urgent action. Effective emergency action can avoid the escalation of an event into a disaster. It involves plans and institutional arrangements to engage and guide the efforts of government, non-government, voluntary and private agencies in comprehensive and coordinated ways to

respond to the entire spectrum of emergency need (UNISDR, 2009). The expression "disaster management" is sometimes used instead of emergency management. (Agency et al., 2011)

The Executive Manager or any other officer designated by the DDRMC or any other competent authority is the Incident Commander (IC). The Incident Commander will decide to set-up a temporary operations Centre in proximity of the disaster site for effective coordination and quick response. The number of such centers may be more than one, if needed and are rounded up once the rescue and relief operation is over. All agencies involved in the response and relief operation must operate under the command of Incident Commander. The DDRMC members will provide support to the Incident Commander. The IC is overall in-charge of the response and has to discharge the following duties to establish the immediate priorities in consultation with DDRMC, approve the implementation of response plan, ensure that adequate safety measures are in place, coordinate with key people and officials. approve requests for the release of resources, keep agency administrator informed of incident status, periodic release of information to media. And order the demobilization of the incident in consultation with DDRMC(Overview, no date)

Procedures, protocols and plans for disaster response activities were developed to govern staff operations at the Escambia Emergency Operations Center and in the field. These were in the form of the corresponding Appendices, Incident Annexes, Support Annexes and Standard Operating Procedures, which describe Emergency Support Function (ESF-9) capabilities. Periodic training and exercises were also conducted to enhance effectiveness. In a large event requiring local and State mutual aid assistance, ESF-9 worked with its support agency counterparts to seek and procure, plan, coordinate and direct the use of any required assets. Throughout the response and recovery periods, ESF-9 evaluated and analyzed information regarding search and rescue, and prevention requests for response, develop and update assessments of the search and rescue situation and status in the impact area, and do contingency planning to meet anticipated demands or needs. When an event is focused in scope to a specific type or response mode technical and subject matter expertise may be provided by appropriate personnel from a supporting agency with skills pertinent to the type

of event, who advises or directs operations within the context of the Incident Command System structure. (Division et al., no date)

Case of Malawi, Search and rescue

Malawi is exposed to various hazards, both natural and human induced. Recently, the country has witnessed an increase in the frequency and magnitude of these hazards, which often culminate into disasters leading to damage to infrastructure, loss of lives, property and livelihoods, among others. Disasters have also impacted on the socio-economic development of the country, while eroding efforts and gains in infrastructural development and other spheres of lives. (DODMA,2019)

Coordination of disaster response in Malawi. The structure generally works in the way that the DRM coordinates all disaster risk management activities, whilst the Technical Committee functions as the entity that effectively implements the various policies and the district, area and village protection committees feed into the activities of the Technical Committee. The draft DRM Bill proposed to improve the structure by among others, replacing the current civil protection arrangement with Local Authority Risk Management Committees, but also outlining their specific roles. In a bid to strengthen the disaster preparedness system for effective response and recovery at all levels, the draft NDRM Policy decentralized disaster risk management structures by creating Civil Protection Committees which would be responsible for coordinating the implementation of the policy at city, municipal, district, area and village levels. In this regard, the draft DRM Bill establishes Area and Village Disaster Risk Management Committees. The composition of the said committees does not specifically include the Malawi Red Cross Society (MRCS). The draft DRM Bill however, proposes that local representatives of community based and humanitarian organisations sit in these committees. The role of the local communities is considered key in disaster risk management. To this extent, DoDMA is required to consult with, among others, the local communities in the development, consolidation, implementation and maintenance of disaster risk management plans. DoDMA effective performance in this regard rests on its capacity to sensitize the local communities on the disaster risks, impacts and appropriate responses and strengthen their ability to reduce,

prepare for and respond to disasters as well as build on their resilience. Although the draft NDRM policy emphasizes the need to coordinate with other stakeholders, the Malawi Red Cross Society is not mentioned as one. In fact, the policy does not recognize Malawi Red Cross Society as part of the coordination mechanisms in international relief response although this would make sense, considering its being part of the international Red Cross and Red Crescent Movement. ('International Disaster Response Law (IDRL) in Malawi', no date)

The Malawi Red Cross Society (MRCS) is established under the Malawi Red Cross Society Act of 1968 (MRCS Act). It is recognized as a voluntary aid society auxiliary to the public authorities. In other words, although there is a mandate for independent and voluntary disaster response, the meaning of auxiliary in this respect is not elaborated on. In addition, it does not expressly include a mandate for disaster preparedness, risk reduction and early recovery, and the principle of neutrality is lacking. Thus, the nature and practice of MRCS activities in support to its government are not fully reflected. ('International Disaster Response Law (IDRL) in Malawi', no date)

1.3. Problem Statement

The area of Traditional Authority Makhwira in Chikwawa District, southern Malawi almost after every three years is hit by floods. However, flood search and rescue challenges remain and unaddressed as there is still ineffective flood search and rescue. search and rescue operation for people affected by floods in Group Village Headman Chikuse Area of Traditional Authority Makhwira in Chikwawa District, southern Malawi is delayed. Since Malawi red-cross society focus on provision of relief items rather than flood search and rescue in Chikwawa district and Malawi Defence force take more than 10 hours to arrive on the flood scene. Flood search and rescue is done by the members of the villages. Furthermore, insufficient data of search and rescue operation affects consideration of making or reviewing policies on disaster response especially search and rescue operation.

1.4. Hypothesis

Addressing challenges that affect flood search and rescue will significantly increase the number of people who lose their lives due to floods and property damages

1.5. Main objective

The study aims at assessing factors that affects flood search and rescue in Group Village Headman Chikuse Area of Traditional Authority Makhwira in Chikwawa district.

1.6. Specific Objectives

- To find out the tools used during search and rescue
- To determine time taken for the search and rescue team to arrive at the scene of Flooding and also time taken for search and rescue operation
- To find out the level of participation for search and rescue institution for flood victims and also the relationship of search and rescue institutions with the people
- To find out means of transportation for search and rescue operation team
- To determine Communication procedures during search and rescue operation

1.7. Research questions

The major question to be answered in research are

- What are the tools used during search and rescue?
- How long does the search and rescue team take to arrive at the scene of flooding?
- What is the level of participation for search and rescue institution for flood search and rescue?
- What are the means of transportation for search and rescue operation team?
- What are the communication procedures followed during flood search and rescue?

1.8. Significance of the study

Assessing factors that affect flood search and rescue would facilitate that people lives and properties should be saved. A huge population is at risk of losing their lives during floods due to lack of efficient and effective search and rescue institution responsible for floods. Most districts in the southern region experience floods. So, there was a need to assess factors that affects flood search and rescue operation this will help for appropriate consideration of search and rescue operation to floods in development plans. Furthermore, the study has contributed crucial scientific data that will support the introduction of good plans, policies and structures flood for effective disaster response especially search and rescue operation.

The study was very important in bridging the information gap needed in addressing search and rescue operation to floods. It also helped in provision of baseline scientific data for designing monitoring programs of flood search and rescue institutions in Malawi. The information will help decision makers to understand search and rescue operation requirements and how to address poor search and rescue operation to floods.

2. CHAPTER 2: LITERARURE REVIEW

2. Chapter Introduction

The literature review chapter critically review the literature related to the present study. It discusses the conceptual issues concerning flood search and rescue and identifies existing research gaps.

2.1. The concept of Search and Rescue

Malawi has a total population of 17.6 million, of which 49 percent are male and 51 percent are female while 84.5 percent of the population resides in rural area. About 44 percent of the rural population lives in permanent houses 36 percent lives in semi-permanent houses and 20 percent live in traditional houses. Semi-permanent and traditional houses are particularly vulnerable to natural disasters. Those dwelling in these structures are typically the poorest and most vulnerable segments of the population, including women, widows, people with disabilities, orphans and the elderly. ('Malawi 2019 Floods Post Disaster Needs Assessment Report', 2019)

Despite significant resources allocated to disaster preparedness and response capabilities nationally, preparedness and response for vulnerable and special needs populations is still largely lacking. Public health agencies could not possibly meet the disaster preparedness and response needs of all vulnerable and special needs populations especially in inner cities where populations are often quite diverse. As a result, increased attention has been given to innovative and unique approaches to strengthen community-based organizations' (CBOs) capacities as partners in emergency preparedness, response and recovery. Just as preparedness and response strategies play key roles in agencies responding to public health emergencies and natural disasters, CBOs must have enough capacity for disaster preparedness and response that allows them to continue operations before, during and after disasters. Capacity for disaster preparedness and response is rarely within the scope of most struggling nonprofit organizations. however, the relationships they have formed to meet the needs of their

vulnerable clients may contribute to this capacity. The study was conducted in the past to explore the relationship between the number and types of inter organizational relationships that CBOs use to serve clients, their disaster preparedness and response capacities. How these relationships may be leveraged was also explored as part of the strategy of enhancing the overall level of an organization's capacity for preparedness and response. Mixed methods were employed to investigate the potential number and type of inter-organizational relationships, organizational capacities and communication mechanisms associated with and influencing the disaster preparedness and response capacities of CBOs serving the homeless. The percent potential leverage, an organization's potential for using inter-organizational relationships for disaster preparedness and response related activities, was determined for each organization. Factors that contributed to disaster preparedness and response capacity for CBOs serving the homeless included types of organizations CBOs had relationships with, leadership at the organization, evidence of a culture of preparedness, working with or support from external organizations, a tendency of continual improvement and proximity of collaborators and resources. A summary of survey results was provided. In the struggle to incorporate disaster preparedness and response activities into the organizational structure and functioning of CBOs serving vulnerable populations, CBOs may find it useful to look at their inter-organizational relationships more closely to determine which ones may also be used for disaster preparedness and response activities. The results of the study offered opportunities for public health to build relationships with CBOs serving vulnerable populations before, during and after crises and likewise for CBOs to tap into many of the services provided by public health to build relationships that are more meaningful.(Date, 2012)

In recent years, people's safety has been greatly threatened by frequent natural disasters such as earthquakes, fires and floods. They have attracted extensive concern. Although people have improved their alert and response capabilities to various disasters, there are still fewer adequate preparations for devastating disasters. Many people still die because of unprofessional and time pressure rescue operations. A new field and challenge were in robotic research on how to effectively fuse the multidisciplinary knowledge such as robotic technology, rescue technology and disaster science, hence develop intelligent robots for the

search and rescue operations. According to the time when a disaster occurs, a disaster rescue operation can be divided into three stages these include the pre-disaster rescue operation, the on-disaster rescue and the post-disaster rescue operation. The pre-disaster rescue operation mainly aims at the disasters known in advance. The pre-disaster rescue operation includes disaster prevention and elimination of catastrophes, evacuation and transfer of materials. The on-disaster rescue operation aims at time-consumed disasters such as fire, flood, gas and radioactive substances. It mainly includes fighting against disasters. The post-disaster rescue refers to taking the search and rescue operation afterwards short-time disasters such as an earthquake and floods. There is no clear boundary among the above three stages. However, the rescue operation in all stages has two problems such as the complexity of the environment and unpredictable dangers. Taking an urban environment as an example, the population of cities and the urban population density have quickly increased, which leads to that high-rise buildings, underground projects, large business establishments and cultural or entertainment facilities have been rapidly built. All these make the rescue operation too complicated to be dealt with. In some extremely dangerous catastrophes including the fire in an explosion, the flammable, explosive and toxic gases and the easily second-collapse building site after an earthquake, the rescue staff are eager to know the inner situation when they cannot perform an in-depth reconnaissance. In such a case, search and rescue robots can improve the efficiency of the rescue operation and medical treatment to reduce the casualties. They can not only help the rescue team in rescue operations, but also replace rescue staff in search and rescue missions. Generally, robots can play an increasingly important role in a disaster rescue operation.(Jinguo *et al.*, 2007)

In search and rescue scenarios, time is often the most critical factor as lives are at risk. Often the time factor is combined with uncertainty as the exact location of the person concerned is not known. Thus, search and rescue services are required to search a vast area within a very short period of time. Emergency services have already started to deploy unmanned aerial vehicle (UAV) in an attempt to search a larger area in a shorter time span. Time and the vast space are the most common critical factors in these missions, but natural disasters often cause constraints which cannot be overcame by humans. Avalanches, floods, and wildfire are

among the most common natural disasters which make search and rescue missions extremely hard for humans. (Mayer *et al.*, 2019)

UAVs had a number of advantages over humans. Firstly, UAVs could be sent to any location without the operator knowing the exact conditions in the target area. This reduces the possibility of rescuer injury or death. Moreover, using the latest tracking and communication techniques, UAVs can scan a large area in a short time span. Here RGB, infrared, and thermal cameras combined with state-of-the-art machine learning (ML) can be used for identifying and tracking humans. However, a number of factors are still hindering the effective deployment of UAVs for rescue operations. While swarm intelligence can be used to control and operate a large number of UAVs at the same time, the general control concept is still unclear. Today, most of the time one UAV is operated by one pilot which makes scalability insufficient as intensive labour is required. Multimodal interaction coupled with ML can support pilots in operating one or multiple UAVs at the same time. Moreover, the to be rescued person could control UAVs and thereby for instance send information to the search and rescue troops. Firstly, map the possible deployment scenarios for UAV in search and rescue. Then, outline challenges and opportunities from a human-computer interaction (HCI) perspective but also beyond this scope (Mayer *et al.*, 2019)

Research have been conducted over the previous years on issues concerning search and rescue in general. However, regardless of published research articles and reports, an overview indicates that most research projects have focused much on fire search and rescue compared to flood search and rescue in other countries and Malawi. In Malawi Flood search and rescue research has not been conducted before living a gap that has to be covered with more thorough research data. Drones' usage has not been much integrated in flood search and rescue

2.2. Coordination and assessments in Malawi

To ensure better coordination for the disaster assessment and emergency response, at operational level, ten clusters were activated. These clusters are coordination, communication

and assessment, Food Security, Agriculture, Water and Sanitation, Health, Nutrition, Education, Shelter and Camp Management, Protection, and Transport and Logistics. The clusters are led by government and co-led by UN agencies, and the Malawi Red Cross Society and most developed response plans to address the 2015 flood response. A National Emergency Operations Centre (NEOC) was established at DoDMA with support from United Nations Disaster Assessment and coordination (UNDAC). Cluster's representatives were operating from the Centre. UNDAC also facilitated the establishment of an Information Management Working Group (IMWG) at national level comprising of representatives from all clusters. The IMWG facilitated sharing of information on who was doing what, where and when. A Regional Emergency Operations Centre (REOC) was established in the Government District Offices in Blantyre. The Centre coordinated transport and logistics of relief commodities in the Southern Region but also organized cluster coordination meetings. The UNDAC team also facilitated establishment of District Emergency Operations Centre in the four most affected districts of Nsanje, Chikwawa, Phalombe and Zomba and deployed officers to the four districts during the duration of the mission to assist in coordination. DoDMA also deployed officers in the four districts to assist in coordination. The Malawi Defence Force deployed officers in three districts of Nsanje, Chikwawa and Phalombe to be in charge of operations and logistics in support of District Commissioners in the districts.(Needs and Report, 2015). Search and rescue operation are sidelined, there is no specified cluster for search and rescue.

The DRM Policy is aligned to the Hyogo Framework for Action (HFA: 2005-2015) adopted by the United Nations World Conference on Disaster Reduction in 2005 of which Malawi is a signatory, the Millennium Development Goals (MDGs), the United Nations Framework Convention on Climate Change, the Africa Regional Strategy for Disaster Risk Reduction and the SADC Disaster Risk Reduction Strategy. It highlights a set of key priority areas and strategies for making Malawi a nation resilient to disasters. It also provides a common direction Background of the 2015 Floods to all government, non-governmental organizations, private sector organizations, media and development partners at national and local levels on how to effectively implement disaster risk management programs and

activities. Furthermore, Malawi has a progressive national gender policy and the legal environment including the Gender Equality Statutes and the National Gender Policy which provides the guidance to integrate gender into all development plans including Disaster Risk Management (Needs and Report, 2015). Search and rescue policy is not considered

DoDMA set up Emergency Response Operations Centers. To better respond to disasters, it was recommended that DoDMA sets up one National EOC and two regional EOC's (Lilongwe, Blantyre and Mzuzu respectively) together with 3 district EOCs in Nsanje, Chikhwawa and Karonga. The National EOC should be permanent while the others should be operationalized within 24hrs. There was also a need to provide equipment and build capacity of existing and additional personnel in the management of EOCs both at national and district level. The districts EOC should coordinate and facilitate 'safe spaces for women and children' managed by UN, INGOs and local women's organizations. Despite the establishment of Emergency Response Operations search and rescue to floods is still not effective.

2.3. The role of national Drm institutions

National DRM systems and institutions are the driving forces to plan, implement, monitor and evaluate DRM processes and products within a country and to ensure coordination among all stakeholders involved in any phase of DRM. In addition, they play a pivotal role in integrating DRM efforts into development policies and programmes, in order to reduce the vulnerability of rural livelihoods to natural hazards.

The national DRM institutions developed policy frameworks, disaster management plans and codes of conduct in relief and development, they guide and assist in developing early warning systems, and in declaring states/phases of emergency during disasters and they lead the communication with the general public and sectoral agencies at different levels. The existence (as a basic requirement) and coordinating role of DRM institutions are essential, though not sufficient, to ensure that DRM systems are functional and operational. Equally important are the formal links with sectoral line agencies which have complementary sectoral responsibilities

for DRM, and thus need to integrate DRM aspects into their regular development work. Although there is a growing emphasis on disaster risk reduction in most developing countries, the mandate of the national DRM institutions usually focuses on coordination of and advocacy for prevention and mitigation strategies. The ultimate implementation of prevention and mitigation actions and the direct responsibility for the emergency response, however, remain the task of the sectoral line agencies. Therefore, depending on the entry point of the assessment, relevant sectoral agencies should be included in the analysis. Agriculture is used to illustrate sector-specific issues, questions, demands and challenges in the context of DRM.(*Disaster risk management systems analysis A guide book N AT U R A L systems analys i s*, no date).However, assessment are conducted pertaining to the emergency response, still search and rescue operation to flood not effective.

Natural hazards often cause disasters that have a severe adverse impact on the lives and livelihoods of humans. Looking at the average number of deaths globally over the past few decades, approximately 60,000 people have died from natural hazards every year. Low-frequency, high-impact events such as earthquakes are not preventable, but the loss of such a high number of human lives. Disaster related deaths could be reduced through earlier prediction, more resilient infrastructure, emergency preparedness, and response systems. Disasters severely disrupt normal socioeconomic activities and cause damage and possible casualties. Some studies have attempted to quantify the damage, for example, in terms of monetary losses and the number of people killed. However, the total number of deaths of a disaster can only represent the degree of impact of said disaster, rather that reveal the progress of the search and rescue (SAR) process hence, the quantitative efficiency of the SAR of each post-disaster response remains unknown. In the wake of a disaster, time is crucial, and SAR work should be carried out promptly. To save lives within the effective treatment period, quick organization of local self-aid groups and external rescue teams is essential.(Chiu *et al.*, 2020)

The Remotely Piloted Aircraft Systems (RPAS) are becoming more and more powerful and innovative and they have an increased interest in civil applications, in particular, after natural

hazard phenomena. The RPAS is useful in search and rescue missions in high mountain where scenarios are unfriendly and the use of helicopters is often not profitable. First, the unmanned configuration is safer because there are no hazards for human life that is not on board. Moreover, it is cheaper due to the use of electric propulsion instead of internal combustion engine and to its small dimensions and weights. Finally, the use of the RPAS is faster while the helicopter is often not available because is involved in other missions or it cannot be used if the search mission is in impervious scenario, such as forests with thick vegetation. (Novaro, M *et al.* 2016).

Unmanned aircraft systems (UAS), colloquially called drones, are used commonly for military, government, and civilian purposes, including both commercial and consumer applications. During a search and rescue mission in Oregon, a UAS was used to confirm a fatality in a slot canyon, this eliminated the need for a dangerous rappel at night by rescue personnel. A second search mission in Oregon used several UAS to clear terrain. This allowed search of areas that were not accessible or were difficult to clear by ground personnel. UAS with cameras may be useful for searching, observing, and documenting missions. It is possible that UAS might be useful for delivering equipment in difficult areas and in communication. (Van Tilburg, C. (2017)

The international framework, for maritime search and rescue relies on state actors establishing regions of responsibility supported by private shipmasters acting in compliance with traditional duties to rescue persons in distress at sea. Despite revisions to the framework foundational treaty, questions persist about the extent of state responsibilities and the interaction between those responsibilities and international human rights law. Over the past three years, non-governmental organization. (Smith A, 2017)

Search and rescue were optimized (SAR in disaster relief through agent-based simulation. Rescue teams search behaviors with the improved Truncated walks was stimulated. Then a cooperative rescue plan was proposed based on a distributed auction mechanism, and illustrate it with the case of landslide disaster relief. The simulation was conducted in three scenarios, including fatal, serious and normal. Compared with the non-cooperative rescue

plan, the proposed rescue plan in the paper would increase victim relative survival probability by 15%, increase the ratio of survivors getting rescued by 12.9%, and decrease the average elapsed time for one site getting rescued by 21.6%. The robustness analysis shows that search radius can affect the rescue efficiency significantly, while the scope of cooperation cannot. The sensitivity analysis shows that the two parameters, the time limit for completing rescue operations in one buried site and the maximum turning angle for next step, both have a great influence on rescue efficiency, and there exists optimal value for both of them in view of rescue efficiency. (Jian T, 2017).

The accumulated of research on search and rescue (SAR) allows us to identify repeating patterns that should be considered in the development of an effective plan for national emergency response. firstly, SAR is not simply an organizational activity, it necessarily includes the social and collective behavior of volunteers, preexisting and emergent organizations, social statuses and social identities, such as neighborhood and work place relationships and family and neighborhood social identities, serve as a basis for the emergence of new SAR groups and constitute the fundamental concepts and categories that are needed to understand and improve SAR activities, SAR activities do not emerge from a vacuum, as an example of the principle of continuity advocated by Quarantelli and Dynes (1977), there are always elements of the traditional social structure embedded within collective behavior entities, and their emergent division of labor, role structure, and activities are also dependent on prior social relationships and forms of social organization in the community or region and breakdown models of social organizational patterns in disaster are not useful to understand SAR. Television reports and misinformed reporters often misinterpret throngs of people moving seemingly at random at the sites destroyed by various hazards, and assume that the people were disoriented immediately after impact and had lost their ability to enact social roles. Despite these reports, scientific research shows the widespread confusion, lack of coordination, and panic. The seeming disorganization and aimless movement of people is the result of their individual and collective acts as they try to accomplish multiple individual and collective goals under severe time constraints. Creative problem-solving and rationality is a more accurate way of understanding their actions. In short search and rescue (SAR) activities

are part of the complex emergency response system that emerges in response to disasters. (Trainor, 2008)

There is increasing interest in using Unmanned Aircraft Systems (UAS) in flood risk management activities including in response to flood events. However, there is little evidence that they are used in a structured and strategic manner to best effect. An effective response to flooding is essential if lives are to be saved and suffering alleviated. The study done by Salmoral evaluated how UAS could be used in the preparation for and response to flood emergencies and develops guidelines for their deployment before, during and after a flood event. A comprehensive literature review and interviews, with people with practical experience of flood risk management, compared the current organizational and operational structures for flood emergency response in both England and India, developed a deployment analysis matrix of existing UAS applications. An online survey was carried out in England to assess how the technology could be further developed to meet flood emergency response needs. Those organizations responsible for overseeing flood risk management activities including the response to flooding events would have to keep abreast of the rapid technological advances in UAS if they are to be used to best effect. (Salmoral *et al.*, 2020)

2.4. Chapter Conclusion

The interesting issues discovered in the peer-reviewed literature of different authors include plans and institutional arrangement towards search and rescue, (Agency et al., 2011). The other interesting point is the incident command system, (Overview, no date). expertise from a supporting agency with skills pertinent to the type of event or hazard and periodic training and exercises (Division et al., no date). The disaster risk management policy does not recognize Malawi Red Cross Society as part of the coordination mechanisms in international relief response despite here in Malawi we rely on it for search and rescue. the relationship between the number and types of inter organizational relationships that CBOs use to serve

clients, their disaster preparedness and response capacities (Date,2012). UAVs being used for search and rescue and they have a number of advantages over humans, (Mayer et al., 2019). The national DRM institutions develop policy frameworks, disaster management plans (Disaster risk management systems analysis A guide book NATURAL systems analysis, no date) and to save lives within the effective treatment period, quick organization of local self-aid groups and external rescue teams is essential (Chiu et al., 2020). A good number of studies have been done concerning search and rescue to different events or hazards worldwide. But Malawi is yet to conduct effective search and rescue since the issues explained above have not been considered to be incorporated in search and rescue to floods. This study is based on assessing factors that affect flood search and rescue in regard to the issues that challenges Malawi to effective search and rescue operation to floods.

3. CHAPTER 3: METHODOLOGY

3.1. Research design

The village heads men from Wilson and Chikuse villages were consulted to seek permission and the informed consent were read to the respondent before the administering of the questionnaire. The qualitative method was used where questionnaire was administered, People above 18 years of age were considered to be the respondents, since adults are believed to give the accurate information than children

3.2. Study area

Chikwawa is located in the Southern Region of Malawi on the west bank of the Shire River. It lies almost 50 kilometres south of Blantyre, the commercial capital of Malawi. Chikwawa district covers an area of 4,755 km.² and has a population of 356,682. Chikwawa GPS coordinates: 16° 2' 0.67" South, 34° 48' 3.28" East. Distance from equator: 1782.8 km South. The study was conducted in Group Village Headman Chikuse Area of Traditional Authority Makhwira in Chikwawa District. It comprised of two villages and these are Wilson and Chikuse. Chikuse is the main area that is hit by floods almost every year. This area is located along the Shire River and gets flooded due to several rivers pouring their water in this Shire River. Among these rivers is Mwanza River. The area has an altitude of 100m above the sea level or below. The land is almost flat with several river tributaries. The area has good and fertile soils that attract people for cultivation of crops without applying inorganic fertilizer

AREA OF TRADITIONAL AUTHORITY MAKHWIRA IN CHIKWAWA DISTRICT

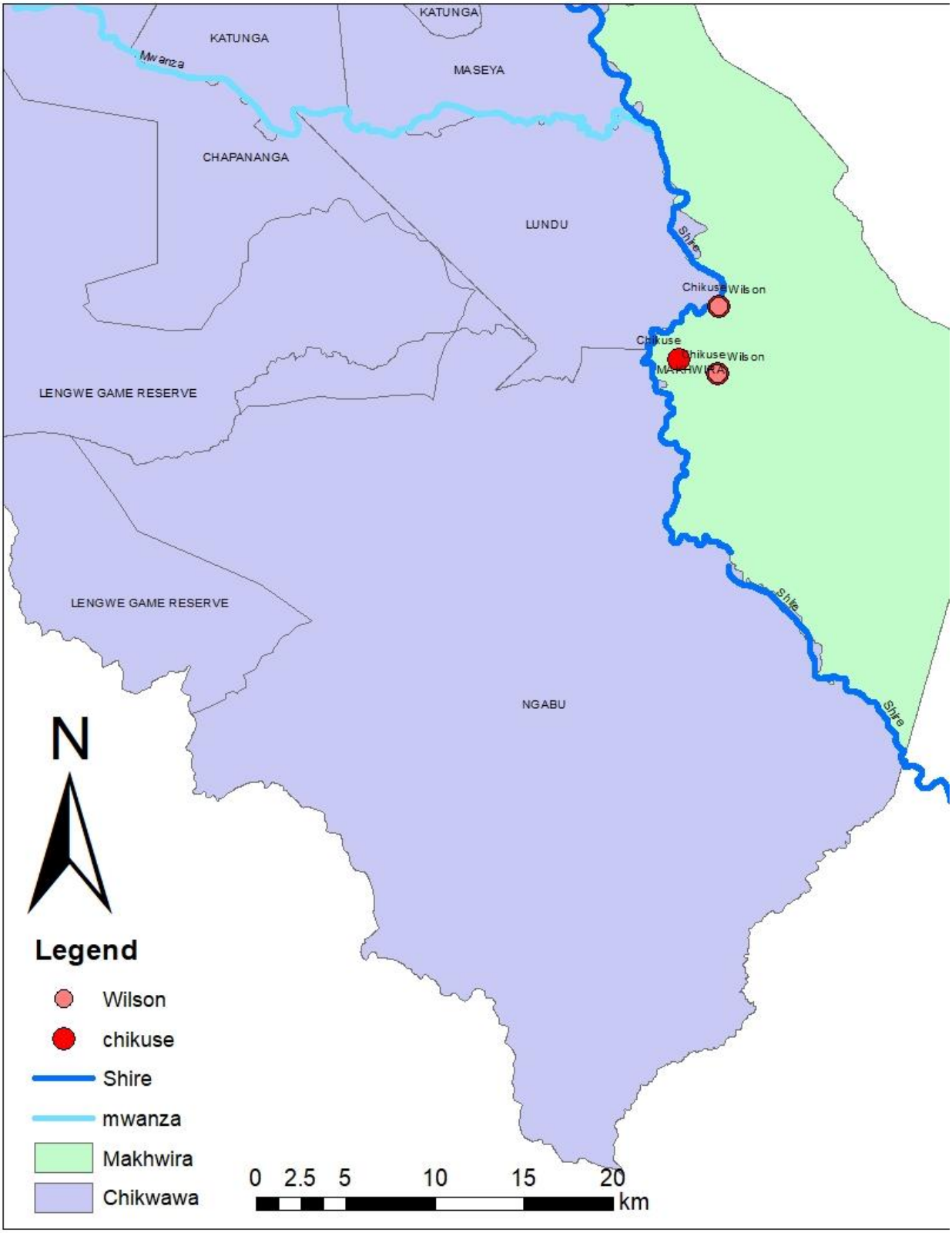


Figure 1, Source: Produced from ARC GIS

3.3. Material and Methods

3.3.1. Qualitative study

Qualitative research involves collecting and analyzing non-numerical data to understand concepts, opinions, or experiences. Qualitative research approach adopted was about phenomenological research where Researchers investigate a phenomenon or event by describing and interpreting participants' lived experiences. Qualitative study is flexible, the data collection and analysis process can be adapted as new ideas or patterns emerge. They are not rigidly decided before hand and it gives meaningful insights where detailed descriptions of people's experience, feelings and perceptions can be used in designing, testing or improving systems or products.

3.3.2. Material

Questionnaires and pen

3.4. Sampling-technique.

The Study used purpose sampling technique. The researcher used judgement to choose the participants to serve the purpose of study. Purpose sampling is cost effective and time effective sampling methods.

3.5. Sample Size

From this technique sample size will be obtained from the target population which will be selected randomly by using the proportions of participants' formula below;

$n=Z^2(P)(1-P)/e^2$

where n= sample size, Z=value of normally distributed standard variate which states different values with a given confidence interval value, p=proportion of the participants with the attribute under study out of the total population in the study area and the value 0.5 was used for p ever since the population is unknown and e=is the allowable error or the desired level

of accuracy, so in this case, the formula was calculated at 95% confidence interval, which gives 1.96 as the value of Z and an allowable error of 10%. By apply the formula above the sample size (n) was found to be 96.

3.6. Data analysis

Data analysis involved the use of statistical package for social sciences (SPSS), Content analysis was also used to analyze the qualitative data collected. The researcher analyzed the content of responses from questionnaires to find the meanings and relationships of concepts or themes.

4. CHAPTER 4: RESULTS AND DISCUSSION

4.1. Tools used during search and rescue

Drones are one of tools used during search and rescue. Results show that 97.5% of the interviewees responded that drones are not used during flood search and rescue while 2.5% said drones are used. This imply that drones are not considered as crucial tools, this affects efficiency of flood search and rescue, since drones are fast hence aid in saving time. Figure 2 below showing the drone usage during flood search and rescue

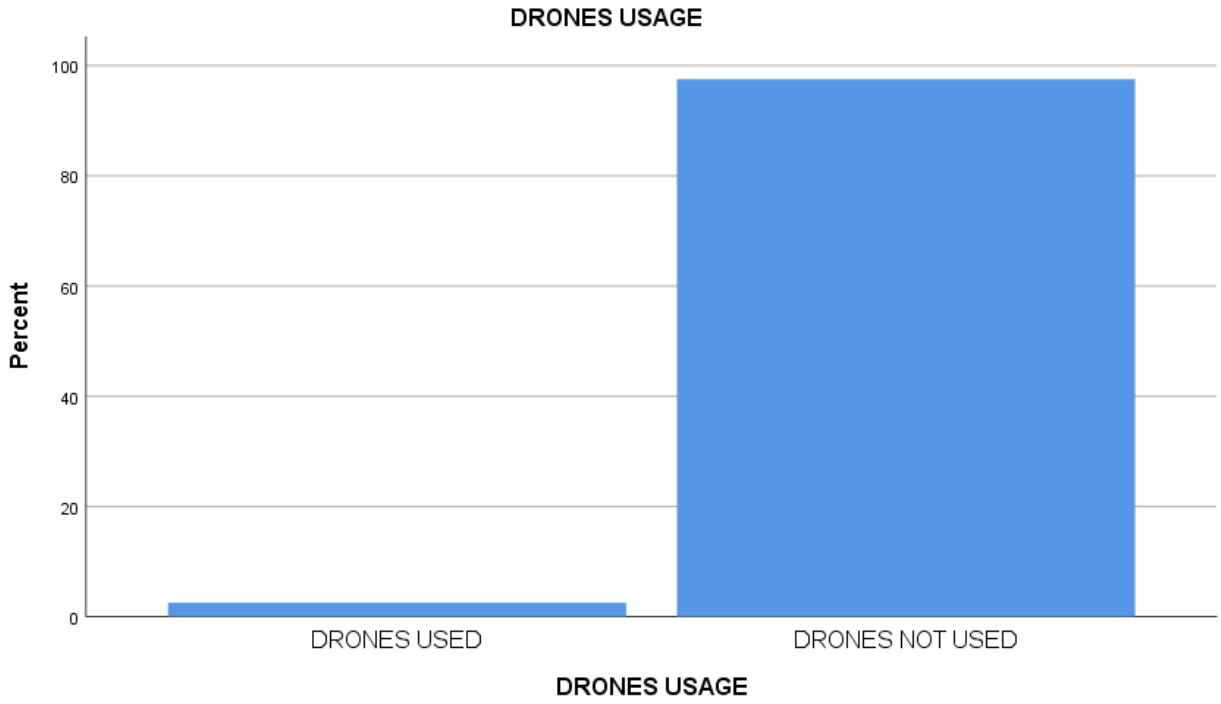


Figure 2: Showing drone usage

4.2. Time taken for flood search and rescue team to arrive on flood scene

The figure 3 below, showing the time for the search and rescue team to arrive at the scene of Flooding and also time taken for search and rescue operation. When flood occurs in Chikwawa search and rescue team from Malawi Defence force, Malawi red cross society and Malawi police take more than 10 hours to attend to those affected by floods. Delayed flood search and rescue means less people and properties would be saved.

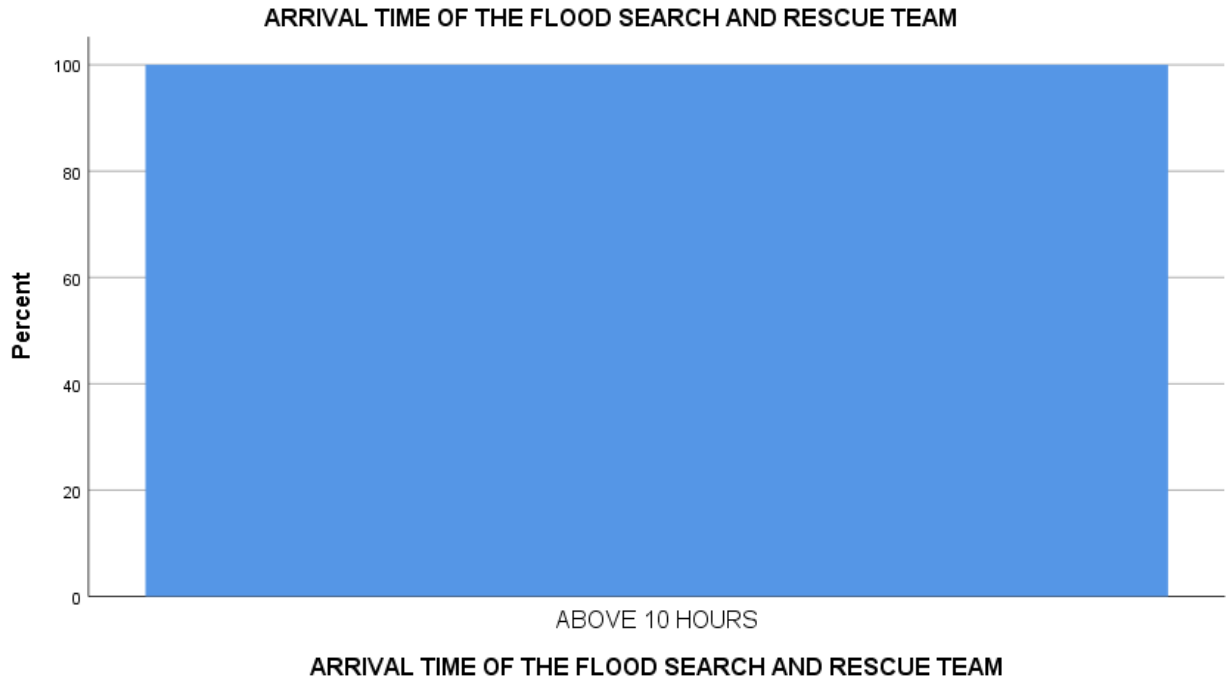


Figure 4: Showing arrival time of flood search and rescue team on flood scene

4.3. Institution's participation in flood search and rescue

The figure 4 below, showing the institution participation in flood search and rescue, 57.5% of people responded that Malawi Defence force participates, 35% for Malawi red cross society and 7.5% for Malawi police. Despite having Malawi red cross society and Malawi police in Chikwawa district their level of participation for flood search and rescue is lower than that of Malawi Defence force, this raises question to say may be the institution in the district do not have expertise, equipment or else not committed for flood search and rescue.

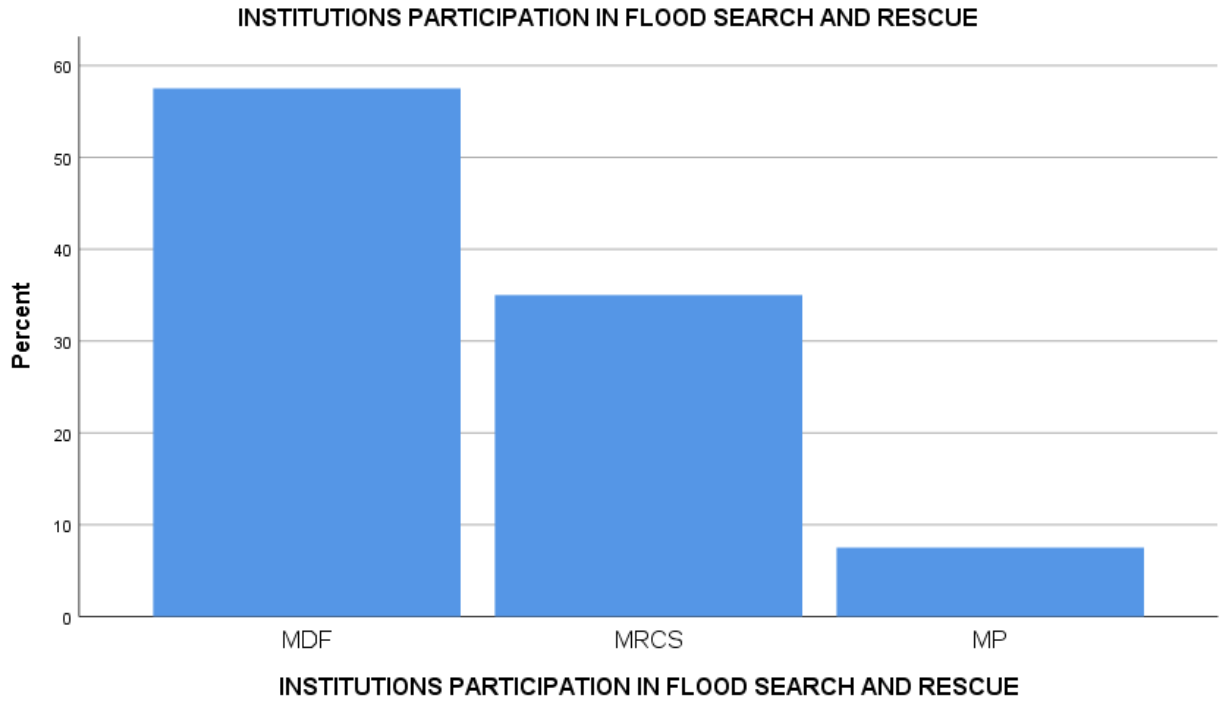


Figure 4: showing institutions participation in flood search and rescue

4.4. Transportation means used during flood search and rescue

The figure 5 below. showing transportation used during flood search and rescue. The research shows that 77.5% of means of transport used are helicopters and 22.5% for boats. Malawi red cross society and Malawi Police do not have helicopters for flood search and rescue in Chikwawa district, this contributes to poor flood search and rescue.

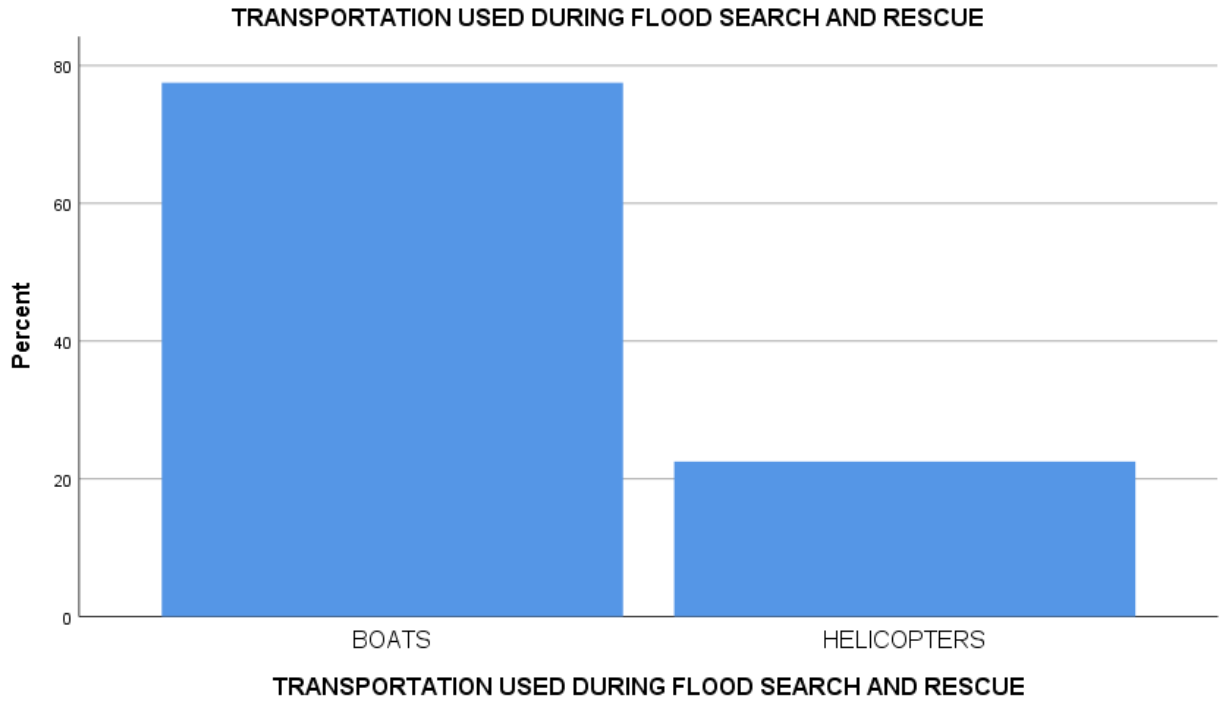


Figure 5: Showing transportation used during flood search and rescue

4.5. Knowledge of which institutions to call for flood search and rescue

The figure 6 showing knowledge of people in the community about which institutions to call for flood search and rescue. From those who were interviewed 70% do not have knowledge of which institution to call for flood search and rescue and 30% do have knowledge. This indicate either awareness campaigns are not there or they are ineffective.

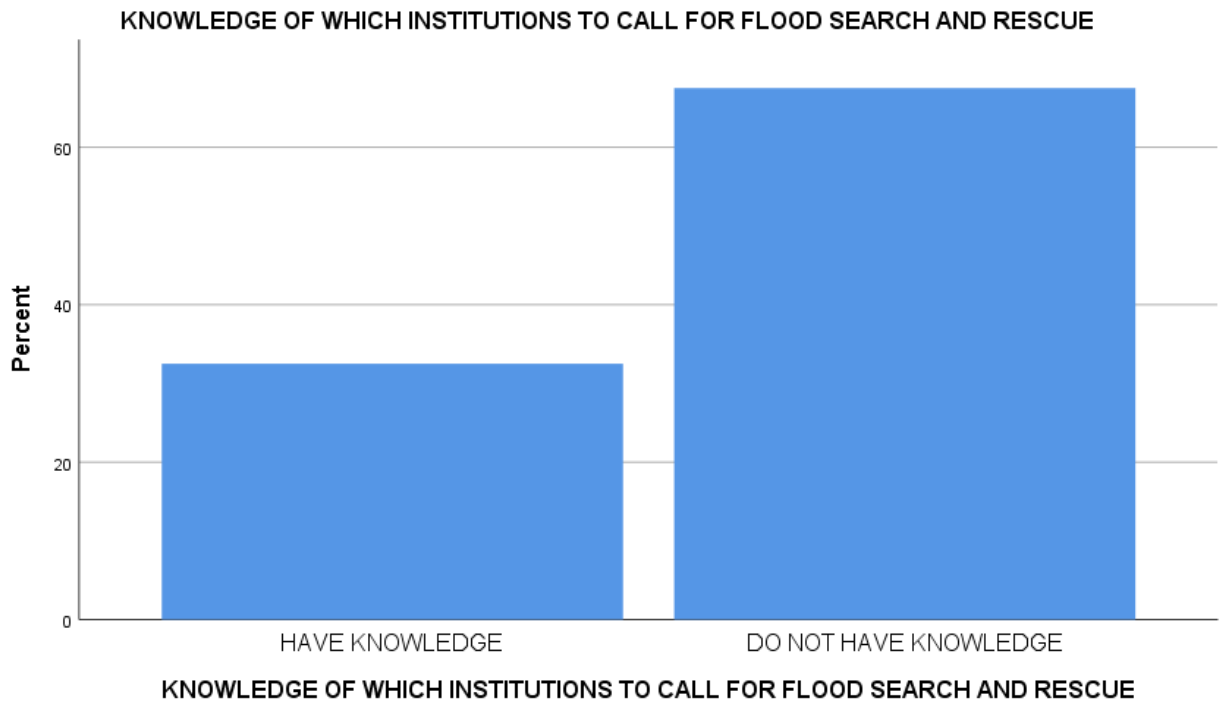


Figure 6: showing knowledge of which institution to call for flood search and rescue

DISCUSSION OF RESULTS

The general overview of the factors that affects flood search and rescue have been drawn from the results. It has been noticed that Malawi red-cross society focuses on provision of relief items and, flood search and rescue is conducted by the people in the village who mobilize themselves to rescue others using non-engine boat owned by some village members, during flood occurrence. The flood impact shows that 7.5% of people died, 75% of the people from two villages Chikuse and Wilson their crop fields were damaged and 17.5% were not affected by floods. It is surprising to learn that despite having good policies such as disaster risk management policies and contingency plan policies with decentralized disaster risk management structures Malawi red-cross society, Malawi Defence force and Malawi police in Chikwawa take longer time to respond to flood despite that, and Malawi red-cross society focuses on humanitarian aid. Without non-engine boats owned by a member of the village more people could have died, drones are not much used for flood search and rescue. Furthermore, since Chikwawa is prone to floods this is big concern to the vulnerable people in the villages. They said in the villages there are representatives of Malawi red-cross society but those people do not have equipment such as engine boats, drones, ropes and skills their role is to warn people during floods to wake up if they are sleeping and climb into the trees. Hence, this has also resulted to ineffective flood search and rescue. Despite, having disaster risk management arrangement structure, implementation is the problem. Results show that 97.5% of the interviewee responded that drones are not used during flood search and rescue while 2.5% said drones are used. Furthermore, it has been found out from the results collected that the search and rescue teams arrive at the flood scene often 10 hours later after the onset of flooding. Malawi Defence force participate the most in flood search and rescue but there is no any barracks in Chikwawa district, this affects effectiveness of flood search and rescue, seconded by Malawi red-cross society then Malawi police. Means of transportation used during flood search and rescue are air and water, from the results 77.5% of the respondents said boats are used and most of these boats are owned by the village members while 22.5% responded helicopters are used. From the results drawn from the questionnaire indicate 70% of the people do not have knowledge about which institutions to call for flood

search and rescue which shows there is no awareness campaigns or they are not effective about flood search and rescue institutions.

The disaster risk management arrangement structure generally works in the way that the DoDMA coordinates all disaster risk management activities, whilst the Technical Committee functions as the entity that effectively implements the various policies and the district, area and village protection committees feed into the activities of the Technical Committee. In a bid to strengthen the disaster preparedness system for effective response and recovery at all levels, the draft NDRM Policy has decentralized disaster risk management structures by creating Civil Protection Committees which would be responsible for coordinating the implementation of the policy at city, municipal, district, area and village levels. In this regard, the draft DRM Bill establishes Area and Village Disaster Risk Management Committees. The composition of the said committees does not specifically include the Malawi Red Cross Society (MRCS) which is surprising since during floods, Department of disaster management affairs assign Malawi red-cross society to search and rescue. The role of the local communities is considered key in disaster risk management. To this extent, DoDMA is required to consult with, among others, the local communities in the development, consolidation, implementation and maintenance of disaster risk management plans. DoDMA's effective performance in this regard rests on its capacity to sensitize the local communities on the disaster risks, impacts and appropriate responses and strengthen their ability to reduce, prepare for and respond to disasters as well as build on their resilience. Although the draft NDRM policy emphasizes the need to coordinate with other stakeholders, the Malawi Red Cross Society is not mentioned as one. In fact, the policy does not recognize Malawi Red Cross Society as part of the coordination mechanisms in international relief response although this would not make sense, considering its being part of the international Red Cross and Red Crescent Movement

The village civil protection committee assess and report occurrences of disasters to the area civil protection committee. The area civil protection committee also assess and report occurrence of disasters to the District Civil Protection Committees in liaison with the Village

Civil Protection Committees and District Civil Protection Committees notify DoDMA of the occurrence of floods. So DoDMA coordinates and plan all disaster risk management activities and inform communities in disaster risk areas as they develop. Conduct joint assessments, provide recommendations on response required. Rescue operations are conducted by MRCS, MDF, MPS. The communication procedure is lengthy as it involves more committees for information to reach DoDMA hence taking more time to deploy Flood search and rescue team, and this leads to poor search and rescue. Results indicate that MDF participates the most in flood search and rescue seconded by MRCS then Malawi police, but the community members play crucial role in saving lives since they are the first to respond to floods by searching and saving the trapped people, using their own boats.

Helicopter is most used during flood search and rescue compared to boats but Malawi red cross society and Malawi police do not have helicopters. Malawi Defence force has helicopters unfortunately, there is no any barracks in Chikwawa. They rely on cobbe barracks from Zomba district. In addition, MRCS and MP do not have enough boats since people in the affected villages use boats owned by some people in the villages.

5. CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

In fulfilling its primary role of protecting the lives of its citizens during disasters, government developed a National Contingency Plan (NCP) that is updated annually to reflect the changing weather patterns as forecast by the Department of Climate Change and Meteorological Services (DoCC & MS). Contingency planning allows government and its partners to plan for disasters with the aim of minimizing damage to property and loss of life. This is becoming especially important given the impact of climate change. Government has the primary responsibility to protect life and property of its citizens. One of the ways of ensuring this is through the contingency planning process. The National Contingency Plan (NCP) enables government and its partners to anticipate and prepare for disasters. Disaster preparedness ensures that loss of life and property is minimized. However, this plan is broader in scope than past plans and addresses not only floods and dry spells but also earthquakes, strong winds and disease outbreaks (plan,2013). Despite contingency plan is being updated

annually, the institutions responsible for flood search and rescue take more than 10 hours to attend to those affected by floods which shows preparedness does not serve its purpose, there is poor means of transportation and communication procedures, in addition poor level of participation by flood search and rescue.

The Disaster Preparedness and Relief Act of 1991 was enacted by Parliament to make provision for the coordination and implementation of measures to alleviate the effects of disasters. But are still disaster risk management gaps such as lack of resources, for instance drones, boats and helicopters. Poor coordination of government stakeholders, no real institutional commitment, lack of enforcement, no community reach in form of communication and unavailability of multilevel platforms between civil society, national planning institutions and development organizations to come together. As shown by the results, 70% of people do not have knowledge of which institutions to call for flood search and rescue compared to 30% of people who have knowledge, this implies absence of awareness campaigns or poor awareness campaigns.

Policy Priority Area number 6 of national disaster risk management is strengthening preparedness capacity for effective response and recovery, strengthening preparedness capacity is key to ensuring rapid and effective response. Effective disaster response and recovery is dependent on stakeholders and communities being in a state of preparedness to deal with different types of disasters which the country is prone to. Preparedness involves different types of activities such as the development and regular testing of contingency plans, the establishment of emergency funds to support preparedness, response and recovery activities and the building of capacity of disaster risk management structures to respond to disasters. Strengthening preparedness capacity is, therefore, key to ensuring rapid and effective disaster response.

There is still flood search and rescue despite National Disaster Risk Management Technical Sub-Committees established multi-disciplinary Technical Sub-Committees (TSCs) for proper

coordination and guidance in the planning and implementation of disaster prevention, mitigation, preparedness, response and recovery programmes. ('NATIONAL DISASTER RISK MANAGEMENT', 2015).

According to this research investigation, there is ineffective flood search and rescue and has led to the loss of lives of people. No intervention has been done to improve the operation of flood search and rescue. Malawi red-cross society in Chikwawa is not active to flood search and rescue rather to provision of relief items. Furthermore, this has caused some people in the villages to say no one cares about them as flood search and rescue is done by themselves. This is so while Malawi disaster risk management arrangement structures are formulated. Frameworks and policies for disaster risk management are formed but implementation is the problem due to lack of seriousness. People in the community mobilize themselves for flood search and rescue and do not have skills and equipment for the flood search and rescue tasks, flood is a natural hazard that is rapid onset event which requires urgency attention.

This paper has demonstrated that, there are many challenges to disaster management in Malawi, these include poor transportation, poor communication procedure, effective tools not much considered for flood search and rescue while contingency plans are in place and reviewed annually.(Plan, 2013)

5.1. Limitations

- Delayed release of funding. The money for research was borrowed
- 82 Households where questionnaire was administered instead of 96 because, I fall short of accommodation and upkeep money in Chikwawa.

5.2. Implications

The research will contribute crucial scientific data that will influence formulation of policies that will address challenges of flood search and rescue to ensure effective flood search and rescue

RECCOMENDATIONS

When a disaster strikes, the first to respond are the people living in the affected area, and this is why MRCS has to work with a community-based disaster management approach. By training teams of volunteers in disaster-prone areas, communities become better equipped to deal with disaster, which could help to save lives and livelihoods. ('Strategic Plan 2015-2019', 2019)

Enhance disaster preparedness for effective response, train the existing workforce and volunteers in disaster response.('Sendai Framework for Disaster Risk Reduction 2015 - 2030 1', 2015). To prepare or review and periodically update disaster preparedness and contingency policies, plans and programmes with the involvement of the relevant institutions, considering climate change scenarios and their impact on disaster risk, and facilitating, as appropriate, the participation of all sectors and relevant stakeholders. Furthermore, To invest in, develop, maintain and strengthen people-Centred multi-hazard, multi-sectoral forecasting and early warning systems, disaster risk and emergency communications mechanisms, social technologies and hazard-monitoring telecommunications systems to develop such systems through a participatory process; tailor them to the needs of users, including social and cultural requirements, in particular gender; promote the application of simple and low-cost early warning equipment and facilities; and broaden release channels for natural disaster early warning information. To train the existing workforce and voluntary workers in disaster response and strengthen technical and logistical capacities to ensure better response in emergencies. ('Sendai Framework for Disaster Risk Reduction 2015 - 2030 1', 2015).

The Government of Malawi needs to formulate policies which should address flood search and rescue challenges. Since disaster risk assessment is not adequately conducted, it is not taken into account in land use planning and zoning especially in rural areas. As such, people are still living in risky areas. In some cases, communities have opted to remain in risky areas because of cultural and heritage issues. In addition, many households do not have adequate resources to invest in risk reduction measures by themselves, including financial risk sharing and livelihoods diversification.('NATIONAL DISASTER RISK MANAGEMENT', 2015)

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7. Appendices

APPENDIX 2: FLOOD SEARCH AND RESCUE QUESTIONNAIRE

RESEARCH QUESTIONNAIRE FOR FLOOD SEARCH AND RESCUE

Do you agree to participate? Yes☐ No☐

SECTION A: PERSONAL DETAILS

Name of the respondent_____

Village Name_____

Interviewee's Age_____

Gender Male☐ Female☐

SETION B: FLOOD

1. Have flood ever occurred in your area?

   Yes☐ No☐

2. Did flood affect your family?

   Yes☐ No☐

3. How did floods affect you?

   ☐Loss of the loved ones or relatives

   ☐Damage of household properties

   ☐Suffered injuries

4. How often does flood occur in your area?

   - Every year ☐
   - After two years ☐
   - After three years ☐

- After four years ☐
- After five years ☐

SECTION C: COMMUNICATION PROCEDURES

1. Does any member of the household own a phone?

   Yes ☐ No☐

2. Does any member of the household own a radio?

   Yes ☐ No☐

3. Is the network of phones efficient in an area?

   Yes ☐ No☐

4. Do you know which institution to call for search and rescue when flood occurs?

   Yes☐ No☐

5. are awareness campaigns for search and rescue to flood conducted?

   Yes ☐ No☐

6. Do you have any knowledge about flood search and rescue?

   _____

   _____

7. Is there any early warning system for flood in your area?

   Yes☐ No☐

8. What do you think affects the communication for flood search and rescue?

   _____

   _____

   _____

SECTION D: TIME TAKEN FOR FLOOD SEARCH AND RESCUE TEAM

9. How long does the rescue team take to arrive on the flood scene?

   ☐Less than an hour

   ☐1 hour to 2 hours

   ☐2 hours to 3 hours

   ☐3 hours to 4 hours

☐Above 4 hours

SECTION E: TOOLS USED IN SEARCH AND RESCUE

1. Are drones used in flood search and rescue?

   ☐Yes ☐No

2. Are life jackets used during search and rescue?

   Yes☐ No☐

3. Are there other tools used during flood search and rescue?

   _____

   _____

SECTION F: MEANS OF TRANSPORT

1. Are the roads accessible during flood?

   Yes☐ No☐

2. Which mode of transport do the search and rescue team use?

   ☐Vehicles

   ☐Helicopter

   ☐Bicycle

   ☐On foot

   ☐Boats

   If boats (I) What are types of boats

   ☐Engine boat

   ☐Non-engine boat

   If no, Skip to question to

3. Do you know any evacuation routes in your area?

   Yes☐ No☐

4. Suggest what affects transportation during flood search and rescue_____

_____

SECTION G: LEVEL OF PARTICIPATION FOR FLOOD SEARCH AND RESCUE

1. Which organization or institution participates for search and rescue to flood here in Chikwawa district?

   ☐Malawi Defence Force

   ☐Malawi Police

   ☐Malawi red-cross society

   ☐None

2. Do the community members participate in any flood search and rescue activities?

   Yes☐ No☐

3. are awareness campaigns for search and rescue to flood conducted?

   Yes ☐ No☐

4. Do you have any knowledge about flood search and rescue?

   _____

   _____

5. What do the people in this village do, when search and rescue team delays?

   _____

   _____

6. Is there any difference between search and rescue conducted by institution personnel's and the people in the village?

   Yes☐ No☐

   If yes, what is the difference_____

   _____

Thank you, for your participation.