

Integrating Indigenous Knowledge into Westernised Disaster Risk Management Policy and Legislative Frameworks of the Buffalo City Metropolitan Municipality

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ABSTRACT

Although the local people have utilised indigenous knowledge since time immemorial as a mechanism to survive disastrous events and health ailments, it is still undervalued, and it is side-lined in disaster risk management. The main challenge is that indigenous knowledge is passed down orally through generations without any documents to serve as a point of reference and some of those who had the historical context of this knowledge have already passed on. This is one of the reasons why the disaster risk management practitioners and stakeholders' question and doubt its application in the development practice. As a result, indigenous knowledge is not given the attention it deserves since it is seen as being incompatible with modern society and development. For this reason, western knowledge is used more frequently than indigenous knowledge in disaster risk management, and this creates a gap that needs to be filled by integrating the two knowledge systems.

However, disaster scholarship and research are advocating for the simultaneous use of the indigenous knowledge into westernised disaster risk management. The simultaneous use will empower the people that are involved in disaster management to take all initiatives that are aimed at reducing the likelihood of disasters. Moreover, one prominent area of intervention is in the disaster risk management legislations and policies which represent the governments' goals in resolving the problems and the demands that are affecting the local communities. These intervention areas are significant because they have an impact on the Disaster Risk Management practice. Unfortunately, there is currently no framework that illustrates how the indigenous and the western knowledge systems can be integrated into the disaster risk management policies. The aim of the study is to evaluate whether both indigenous knowledge and western knowledge are integrated into disaster risk management policy and legislative frameworks of the Buffalo City Metropolitan Municipality.

The study was carried out by using a qualitative approach with data being collected through the content analysis of the legislative and the policy documents as well as through semi-structured face-to-face interviews from study participants such as community members' political leaders, proportional representation councillors, traditional leaders and participants from various departments within the municipality. Content analysis, and more especially the conventional content analysis methodology was applied to ascertain whether the indigenous and western knowledge are integrated or used into the Buffalo City Metropolitan Municipality's disaster risk management policy and legislative frameworks. There were 13 policy documents from the BCMM that were reviewed. The study found that only the western knowledge dominates in the BCMM's disaster risk management policy which does not integrate both the IKS and the WKS. Furthermore, a total of 58 participants were purposefully selected to

participate in the study. The study participants were carefully chosen through snowball sampling, considering their understanding of both western and indigenous knowledge systems for disaster risk management in line with the policies. Semi-structured interviews were used to collect data from the individuals in the community, as well as from the traditional authorities, the political leaders and from the officials within the different BCMM directorates. The collected data was analysed using content analysis and it was presented thematically.

Moreover, the findings of the semi-structured interviews reveal that the majority of the participants are not familiar with how the IKS and the WKS are integrated into the disaster risk management policies. This is so despite the use of the IKS and the WKS methodologies by the BCMM locals as survival techniques and as disaster prevention strategies. To lessen the negative effects of such disaster risks, the study gave BCMM the means it needs to develop a framework or policy that is based on integrating the IKS and the WKS. Essentially, this is crucial in developing a policy that concentrates on the causes and the effects of the disaster risks inside the municipality to address the scope and the ramifications of such disasters, their broad effects as well as the reported and the unreported casualties.

The study makes a number of recommendations, some of which include developing and putting into practice a variety of plans, policies, and strategies on using the IKS and the WKS simultaneously in disaster risk management as this will assist to increase the capability and the effectiveness of these systems in the disaster-related situations. The study also recommends that more research must be done to ascertain how to bridge the gap between the use of the IKS and the WKS in the disaster risk reduction policies and frameworks to discover a long-term and resilient solution to the current disaster difficulties. More importantly, the study created valuable awareness to the political leaders, the councillors and the senior managers of the BCMM on the importance of incorporating the IKS in the policies and in the legislative documents not only for DRM but for other fields as well.

For the purposes of this study, integrating the IKS and the WKS is an important strategy to create a community that is resilient from disasters and to put policies in place that lessen the threat of the physical hazards and the linked human, sociological, and cultural factors that intensify the disasters. Taking into account a number of multi-hazard situations that often affect the locals in the BCMM, it is crucial to develop a DRM policy that integrate both the IKS and the WKS to addresses the severity and the ramifications of such disasters.

Keywords: Integration; Indigenous Knowledge; Western Knowledge; Disaster Risk Management; Policy; Legislative Frameworks

TABLE OF CONTENTS

ABSTRACT	1
List of Tables.....	xii
List of Figures	xiii
List of Acronyms.....	xiv
CHAPTER ONE.....	1
AN OVERVIEW OF THE STUDY.....	1
1.1 Introduction	1
1.2 Study Area and Context	2
1.3 Problem Statement and Justification	3
1.4 Research Questions Aim and Objectives	5
1.4.1 Research Questions.....	6
1.4.2 Research Aim.....	6
1.4.3 Research Objectives	6
1.5 Conceptual Framework	6
1.5.1 Disaster	7
1.5.2 Disaster Risk	7
1.5.3 Disaster Risk Management	7
1.5.4 Disaster Resilience	8
1.5.5 Hazard	8
1.5.6 Indigenous Knowledge	8
1.5.7 Integration.....	9

1.5.8 Sustainability.....	9
1.5.9 Western Knowledge	9
1.6 Research Methodology	10
1.6.1 Research Approach.....	10
1.6.2 Document Content Analysis.....	10
1.6.2.1 Collected Documents.....	11
1.6.2.2 Content Analysis of documents.....	11
1.6.3 Empirical study.....	12
1.6.3.1 Sampling.....	12
1.6.3.2 Data collection.....	12
1.6.3.3 Data analysis.....	13
1.7 Significance of the Study.....	13
1.8 Ethical Considerations.....	14
1.9 The Study's Limitations	14
1.10 Chapter Layout.....	14
1.10.1 Chapter 1: Overview of the study	14
1.10.2 Chapter 2: Theoretical Conceptualisation of Indigenous and Western Knowledge ...	15
1.10.3 Chapter 3: Integration of Indigenous and Western Knowledge in disaster Management Policies and Legislative Frameworks: a Literature Review.....	15
1.10.4 Chapter 4: Research Methodology	15
1.10.5 Chapter 5: Findings of the study and analysis	15
1.10.6 Chapter 6: Conclusions and Recommendations	15

Chapter Summary.....	15
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CHAPTER TWO 17

INDIGENOUS AND WESTERN KNOWLEDGE: THEORETICAL CONCEPTUALISATION17

2.1 Introduction	17
2.2 Defining Indigenous Knowledge	17
2.2.1 Historical Background of Indigenous Knowledge.....	19
2.2.2 Benefits of using Indigenous Knowledge in DRR.....	21
2.2.3 Indigenous Knowledge Best Practices for DRR.....	24
2.3 Defining Western Knowledge	27
2.3.1 Historical Background of Western Knowledge	29
2.3.2 Benefits of using Western Knowledge in DRR.....	31
2.3.3 Western Knowledge Best Practices for DRR	32
2.4 Significance of Synergising Indigenous and Western Knowledge in DRM	36
2.5 Benefits of Simultaneous Use of Indigenous and Western knowledge Systems	38
Chapter Summary	41

CHAPTER THREE..... 42

INTEGRATION OF INDIGENOUS AND WESTERN KNOWLEDGE SYSTEMS KNWOLEDGE: A LITERATURE REVIEW 42

3.1 Introduction	42
3.2 Strategies and frameworks that have shaped the need for and the importance of the integration of IKS and WKS in DRR.....	43

3.2.1	International frameworks promote the use of both indigenous and western knowledge systems in disaster risk reduction.....	43
3.2.2	The role of DRR policy and legislative frameworks in promoting the use of both indigenous and western knowledge.....	45
3.2.3	South African National Policy and the Legislative Frameworks promoting the use of IKS.....	47
3.2.3.1	South Africa Green Paper on Disaster Management (1998)	48
3.2.3.2	White Paper on Disaster Management (1999)	48
3.2.3.3	South Africa National Disaster Management, 57 of 2002.....	49
3.2.3.4	Indigenous Knowledge Systems (IKS) Policy 2004.....	49
3.2.3.5	South Africa National Disaster Management Policy Framework, 2005.....	50
3.3	Ways in which the indigenous and western knowledge systems can be incorporated in DRR Policies and Legislation.....	51
3.4	Assessing the gaps and opportunities in the simultaneous use of indigenous and western knowledge for effective disaster risk management.....	55
	Chapter Summary	60
	CHAPTER FOUR.....	62
	METHODOLOGY OF THE STUDY	62
4.1	Introduction	62
4.2	Study area and context	62
4.2.1	Population of Buffalo City Metropolitan Municipality	64
4.2.2	Landscape of the BCMM	65

4.2.2.1 Topography	65
4.2.2.2 Geology and Soils	65
4.2.2.3 Climate	65
4.2.2.4 Vegetation	66
4.2.2.5 Land Use in Cities and Rural Areas.....	66
4.2.2.6 Hazards and the vulnerabilities in the BCMM	66
4.3 Study Design.....	67
4.4 The Study Population	70
4.5 Sample Size and Sampling Procedures	70
4.5.1 Sampling Procedures	71
4.5.2 Sample size.....	71
4.6 Data Collection Methods	72
4.6.1 Primary Data	73
4.6.2 Data Collection Tools: Interviews	73
4.6.3 Document Content Analysis.....	75
4.6.4 Data Capture, Storage and Security.....	76
4.6.5 Reliability of data.....	76
4.6.5.1 Credibility	76
4.7 Data Analysis Technique.....	77
4.7.1 Thematic Analysis	77
Chapter Summary	79

CHAPTER FIVE.....	80
FINDINGS AND DATA ANALYSIS.....	80
5.1 Introduction.....	80
5.2 Findings of the Study.....	80
5.2.1 Biographical information of the participants.....	81
5.2.2 Respondents' understanding of the concepts of the indigenous and the western knowledge systems.....	82
5.2.3 Respondents' views on the application of indigenous and western knowledge systems in disaster risk management.....	84
5.2.4 Integration of Indigenous Knowledge into Westernised Disaster Risk Management Policy and Legislative Frameworks.....	86
5.2.4.1 Findings about the integration of IK and WK in Disaster Risk Management from the document content analysis.....	87
5.2.4.2 Findings about the integration of IK and WK in Disaster Risk Management from the semi structured interviews.....	88
5.2.5 Integrating/using Indigenous and Western Knowledge in Disaster Risk Management Policies: Importance and Challenges.....	90
5.2.5.1 Importance of integrating Indigenous and Western Knowledge in Disaster Risk Management.....	90
5.2.5.2 Challenges of integrating Indigenous and Western Knowledge in Disaster Risk Management Policies.....	91
5.2.6 Strengthening the Simultaneous use of both IKS and WKS in the Policies and Legislative Frameworks of BCMM.....	93
5.3 Discussion of the Findings.....	94

Chapter Summary	95
CHAPTER SIX.....	97
CONCLUSION AND RECOMMENDATIONS OF THE STUDY.....	97
6.1 Introduction	97
6.2 Summary of the Study Chapters.....	97
Chapter One - Overview of the study.....	97
Chapter Two - Theoretical Conceptualisation of Indigenous and Western Knowledge.....	98
Chapter Three - The integration of Indigenous and Western Knowledge in Disaster Risk Management Policy and Legislative Frameworks, a literature review.....	98
Chapter Four - Research Methodology.	98
Chapter Five - Empirical findings of the study.	98
Chapter Six - Conclusions and Recommendations.	98
6.3 Achievement of research objectives	98
Objective One: Elucidate the Theoretical Underpinning of Indigenous and Western Knowledge System and the need for their Integration in Disaster Risk Reduction	98
Objective Two: To investigate the need for Indigenous and Western Knowledge Systems in disaster risk reduction thereof.....	99
Objective Three: Assess the Perceptions of the Key Informants and Communities of Buffalo City Metropolitan Municipality on the use of Indigenous and Western Knowledge Systems in Disaster Risk Reduction.....	99
Objective Four: Generate ideas and draw recommendations on ways to integrate both Indigenous and Western Knowledge systems in Disaster Risk Reduction	

Policies and Legislative Frameworks.....	99
6.4 Summary of findings of the Study.....	100
6.4.1 Conceptualisation and Application of Indigenous and Western Knowledge Systems for Disaster Risk Management.....	100
6.4.2 Integration of Indigenous and Western Knowledge in Disaster Risk Management Policy and Legislative Frameworks.....	101
6.4.3 Integrating/using Indigenous and Western Knowledge: Importance and Challenges.....	102
6.5 Recommendations.....	103
6.5.1 Develop policies that take into account the integration/use of indigenous and western knowledge in disaster risk management.....	103
6.5.2 Create strategies to strengthen the role of indigenous and western knowledge to disaster risk management.....	103
6.5.3 Establish platforms where appropriate Indigenous and Western Knowledge-holders can engage to improve the integration of IK and WK in DRM Policies.....	104
5.6 Areas for Future Research.....	104
Chapter Summary.....	105
References.....	106
 ANNEXURE A: Interview Schedule.....	 152
ANNEXURE B: Policy Documents Reviewed.....	156

LIST OF TABLES

Table 3.1: Warning Codes used to inform communities in the event of a disaster Adopted from Victoria (2008).....	59
Table 4.1: Study Representation.....	72
Table 4.2: Reviewed Documents.....	75
Table 5.1: Profile of participants in the semi-structured interviews.....	80

LIST OF FIGURES

Figure 1.1 Location of Buffalo City Metropolitan Municipality (BCMM), Eastern Cape.....	2
Figure 2.1 Framework for Local Knowledge on Disaster Preparedness.....	
Adopted form Dekens (2007)	23
Figure 2.2 IKS and WKS in disaster management towards Sustainable Development.....	37
Figure 2.3 Process of Integrating Indigenous and Western Knowledge.....	39
Figure 3.1 Relay of Information to the Community through the Kanungkung.....	
Sourced: Victoria (2008)	60
Figure 4.1: BCMM Community Wards. From Socio-economic consultative council (2017) ..	63

LIST OF ACRONYMS

BCMM	Buffalo City Metropolitan Municipality
BCMMDMC	Buffalo City Metropolitan Municipality Disaster Management Centre
BDCC	Barangay Disaster Coordinating Council
CCA	Climate Change Adaptation
CDCC	City Disaster Coordinating Council
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DST	Department of scientific and Technology
EWS	Early Warning System
FAP	Focus Area Programme
GOSDC	Government Office for Science Disaster Concerns
HFA	Hyogo Framework for Action
IDP	Integrated Development Programme
IK	Indigenous Knowledge
IKS	Indigenous Knowledge Systems
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
IPF	Integrated Probability Forecast
IUCN	International Union for Conservation of Nature
IUHPS	International Union of the History and Philosophy of Scientific
KAS	Knowledge Advancement and Support
KI	Key Informants
KPA	Key Performance Area
KPI	Key Performance Indicators
LINK	Local and Indigenous Knowledge
NDMF	National Disaster Management Framework
NDRRMP	National Disaster Risk Reduction and Management Plan

NIKSO	National Indigenous Knowledge Systems Office
NRF	National Research Foundation
NSTP	Bangladesh's National Science and Technology Plan
NWU	North West University
PAHO	Pan American Health Organisation
PMC	Programme Management Committee
PNG	Papua New Guinea
RSA	Republic of South Africa
SADC	Southern African Development Community
SDG	Sustainable Development Goals
STI	Science, Technology and Innovation
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNIDNDR	United Nations International Decade for Natural Disaster Reduction
UNISDRR	United Nations International Strategy for Disaster Risk Reduction
WCDE	World Commission on Environment and Development
WK	Western Knowledge
WKS	Western Knowledge System
WSF	World Science Forum

CHAPTER ONE

AN OVERVIEW OF THE STUDY

1.1 Introduction

For centuries, many communities throughout the world have used indigenous and western knowledge as independent approaches to deal with the effects of disasters (Tinnaluck, 2004:71). The terms indigenous, traditional and/or local knowledge are used interchangeably to refer to the indigenous knowledge system. Ngulube (2002:95) defines indigenous knowledge as unwritten knowledge that is passed down verbally through imitation, and through rituals, institutions, connections, and practices. Meanwhile, western knowledge system is a systematic process that develops and governs the knowledge about the world in the form of explanations and hypotheses that can be examined using scientific procedures (Merriam-Webster, 2018:1). The integration of these knowledge systems has been identified as a key opportunity for moving toward more sustainable and resilient DRM at the multiple scales (Hill *et al*, 2020). However, the challenge is that there is no well-articulated framework illustrating how the two can be used simultaneously to reduce disaster risk (Mercer *et al*. 2010). As a result, the gap between IK and WK remains too wide, thereby leading to a heightened bias in favour of the use of the WK system in DRM.

The focus of this study is to evaluate whether both indigenous knowledge and western knowledge are integrated into disaster risk management policy and legislative frameworks of the Buffalo City Metropolitan Municipality. The study sought to understand how the integration of IK and WK in the DRM policy and legislative frameworks can be effectively used to manage the disasters in the BCMM. What follows is a report of the research that was done. Firstly, in Chapter 1 the study is introduced by providing an overview of the study and its context. This includes the problem statement, the theoretical framework and research aims, the objectives and a summary of the methodology that was applied in the study. Chapter 2 and Chapter 3 elucidate on the theoretical conceptualisation of the IKS and the WKS and their integration thereof. Chapter 4 further elaborates on the research technique and the methodologies that were utilised in this study. Thereafter, the findings of the study and data analysis are presented in Chapter 5. In the final chapter, which is Chapter 6, the main points from the research are summarised by demonstrating how the objectives of the study were met. The last section of the final chapter presents a summary of the recommendations to close the identified gaps and to suggest further areas for future research.

1.2 Study Area and Context

The Buffalo City Metropolitan Municipality is located on the East Coast of the Eastern Cape Province of South Africa (32.9344° S, 27.6435° E) with its major towns being East London, Bisho and King William's Town (Figure 1.1). BCMM was created as a local municipality in the year 2000 after the re-organisation of South Africa's municipal areas (BCMM, 2018/19). In 2003, the metro developed Disaster Management Centre considering the strengths and weaknesses that were found after the 2002 floods (BCMM 2014/15). This was before to 2011, when the BCMM separated from the Amathole District Municipality to become a metropolitan municipality (BCMM, 2019/2020). In 2012, BCMM created a Disaster Risk Management Policy with the intention of providing "a coherent, transparent and inclusive policy on disaster management topics" and ensuring disaster risk management implementation (BCMM, 2012).

BCMM disaster risk management policy framework serves as the cornerstone of disaster related structures such as: (i) political forum in charge of managing disaster risk and coordinating events that are or may become disasters and (ii) committee responsible for disaster management oversees and approves all BCMM policies related to disaster risk management (BCMM 2014/15). Furthermore, the Buffalo City Metropolitan Municipality Knowledge Management Unit created community practices for policy implementation to help standardise and harmonise policies throughout the municipality (BCMM 2014/15). Unfortunately, none of the BCMM Disaster Risk Management policies included indigenous knowledge or an integration of indigenous and western knowledge, which solely predominates in the western knowledge.

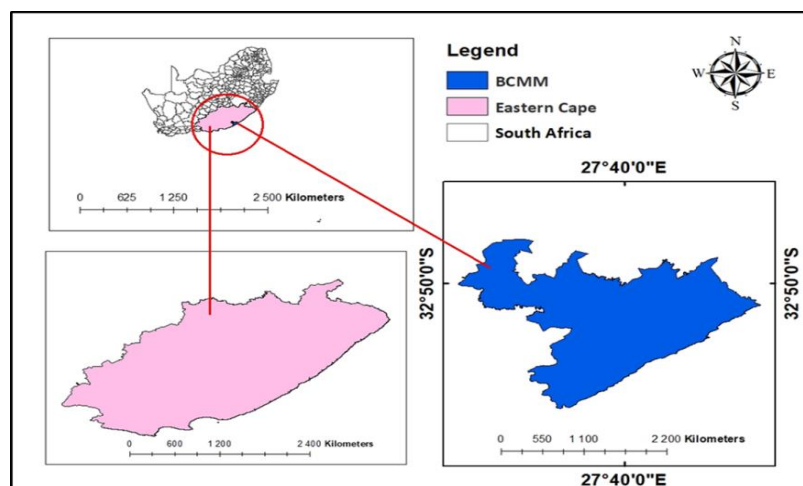


Figure 1.1: Location of Buffalo City Metropolitan Municipality (BCMM), Eastern Cape, South Africa (2021).

The study area has a well-developed seaport that is in East London, hence making the major development of the municipality to rely on coastal trade (B/52 Profile and Analysis District Development Model, 2020). The area enjoys an average rainfall of about 850 mm per annum, with all-year sunshine and a mild climate condition. The temperature in the coastal zone is between (8°C to 39°C) and the area has an annual warm temperature value of 21°C (BCMM, 2017; Statistics South Africa, 2016). The BCMM population is around 834,997 people, with a majority being African people (85%), white people (7%) and the minority being from the Indian community of (0, 90%).

Given the richness of the streams, the rivers, and the coastal natural resources in this region, the BCMM is no exception to vulnerability and to the exposure to catastrophes, particularly in the settlement level where problems are aggravated by multifaceted risks such as (i) The flooding that is caused by the heavy rains; (ii) The shack fires that are perpetuated by illegal electricity connections and human carelessness actions; (iii) Drought as well as the incidence of the Covid-19 pandemic (BCMM 2014/15; BCMM, 2018/19; Kienast, 2020; Writer, 2020). These problems arise as a result of a complex interplay of social, economic, spatial, structural, and environmental vulnerabilities that expose people, their livelihoods, and the environment to the dangers that are posed by trigger events that cause widespread human, economic, and environmental losses (BCMM, 2018/19).

1.3 Problem Statement and Justification

Even though the locals have long utilised indigenous knowledge as a means of surviving calamitous occurrences and medical conditions (Maferethane, 2012), it is still marginalised and underappreciated in disaster risk reduction. This is so despite the many approaches that are offered by IKS to address the different types of disasters and in the process empowering the members of a community to take leading roles in activities that are aimed at reducing disaster risk. To the contrary, a western knowledge system continues to enjoy the benefit of being used in the disaster management fraternity. This is so despite the fact that indigenous knowledge and modern scientific knowledge are interrelated with the results that indigenous knowledge is considered as a foundation for scientifically proved knowledge (Amentie *et al.*, 2022). Kelman *et al.* (2012) argue that indigenous knowledge contributes to disaster risk reduction and complement western knowledge in disaster risk management. Domfeh (2007) opines that indigenous knowledge can be used as a critical entry point for a contextualised science-based intervention that aims at building on what the communities understand.

Unfortunately, the knowledge, the contributions, and the health expertise that the indigenous people utilise for their overall well-being continues to be marginalised (Mashego *et al.*, 2021). Mashego *et al.* (2021), argue that this is because of the poor understanding of indigenous knowledge and as such it is subjected to ridicule by the western scientists. Iloka (2016) argues that indigenous knowledge is not entirely trusted by many stakeholders, as well as by disaster risk reduction practitioners. The scepticism by the disaster risk reduction practitioners regarding the use of indigenous knowledge arises as a result of the fact that such knowledge lacks documentation (Banda, 2008; Senanayake, 2015). The biggest challenge is that the use of indigenous knowledge is still questioned and doubted by the disaster risk management role players, including the practitioners and the scientists that are responsible for the disaster risk-related matters (Munsaka & Dube, 2018). Munsaka and Dube (2018) are also of the view that the indigenous knowledge systems are perceived to be incompatible with modern society and development and as such they do not receive the attention they deserve. Iloka (2016) points out that there are still communities that do not understand its significant contribution in the disaster risk management related matters. This is caused by the lack of verified scientific records and the diminutive application in the development practice (Briggs, 2013; Tanyanyika & Chikwanha, 2011; Iloka, 2016). The main challenge is that the older generations who had the indigenous knowledge background in disasters have passed on and there is no inclusion of the senior citizens and the local communities in the design of the disaster risk reduction policies (Iloka, 2016; Nkabane & Nzimakwe, 2017; Syahputra, 2017). Due to the lack of documented information on indigenous knowledge, the local people are excluded from the processes of decision making, although they are the ones that are mostly affected by the adverse events (United Nations Development Programme, 2008).

Nakata *et al.* (2014) recommend that the indigenous communities should support and embrace the Western programmes and policies that recognise the value of indigenous knowledge for the benefits of building resilient communities. One of the critical priorities of any government is to protect its citizens through strengthening the disaster risk management measures and policies to build sustainable communities (Nkabane & Nzimakwe, 2017). However, the existing policy and institutional frameworks appear to be inadequate to support and nurture the protection and the promotion of the indigenous knowledge systems across the globe. Recognising the importance of indigenous and western knowledge in the disaster risk reduction policies, Dekens (2007) made initial steps towards the integration of DRM into IK and WK by introducing a comprehensive framework for the collection and analysis of these knowledge systems to foster disaster preparedness.

On the other hand, Mercer *et al.* (2010) developed a procedural framework to demonstrate how indigenous and western knowledge can be integrated to mitigate the community susceptibilities which focus on the four main factors which are: (i) The identification of risk factors within the communities, (ii) The formulation of integrated policies in disaster risk reduction; (iii) The identification of indigenous and western strategies and (iv) The promotion of community participation. Taking into cognisance the effective role that is played by the IKS and the WKS, each country should endeavour to introduce a knowledge integrated policy that seeks to facilitate a better understanding of the historical background and the scientific practices to future adversities (Domfeh, 2007).

Incorporating IK and WK will explore a broad realm of methods to share and deliberate over numerous sets of knowledge of the complex change processes (Bohensky & Yiheyis, 2011). These include futuristic planning, partnerships in action, as well as a reflection on how well the strategies can work in real-world implementation (Nyong *et al.*, 2007). The technical and social processes of coordinating different types of knowledge across spatial scales create tension between the scientists which has led to various dialogues and debates among the disaster risk reduction stakeholders. Hence, the need exists to collaboratively engage in long-term programs and to consider measures to manage the environment sustainably, bearing in mind the integration between IK and WK (Busayo & Kalumba, 2021; Caniglia *et al.*, 2021). In the quest to make indigenous knowledge productive in development, there should be a shift from the division of indigenous and western knowledge; hence, there is a need to build bridges across the dichotomy of indigenous and western knowledge. This would involve the simultaneous use of indigenous and western knowledge without bias (Kagan *et al.*, 2018). This study sought to investigate the simultaneous use of indigenous and western knowledge in the BCMM's policies and legislative frameworks. The simultaneous use of both systems will demonstrate some level of integration. The question under investigation in this study is whether indigenous and western knowledge are integrated in the disaster risk management policies and in the legislative frameworks of the BCMM. The research question is answered by addressing the research's questions, aim and objectives.

1.4 Research Questions, Aim and Objectives

The research's questions aims and objectives define certain research subjects based on what the researchers hope to achieve through their research (Thomas & Hodges, 2010). The research's questions, aims and objectives are outlined below.

1.4.1 Research Questions

The following are the study's research questions:

- How integration of Indigenous and Western Knowledge currently used in Disaster Risk Management Policy and Legislative Frameworks of the Buffalo City Metropolitan Municipality?
- What are the perceptions of the Buffalo City Metropolitan Municipality communities on the integration of Indigenous and Western Knowledge in Disaster Risk Management Policy and Legislative Frameworks?
- Which theoretical indigenous and western strategies that can be applied to reduce disaster risk in Buffalo City Metropolitan Municipality?
- What conclusions and recommendations can be made to improve the integration of Indigenous and Western Knowledge in Disaster Risk Management Policy and Legislative Frameworks?

1.4.2 Research Aim

The aim of the study is to evaluate whether both indigenous knowledge and western knowledge are integrated into disaster risk management policy and legislative frameworks of the buffalo city metropolitan municipality.

1.4.3 Research Objectives

The specific objectives of the study are:

- To elucidate the theoretical underpinning of the indigenous and the western knowledge system in disaster risk reduction.
- To investigate the need for indigenous and western knowledge systems in disaster risk reduction thereof.
- To assess the perceptions of the key informants and the communities of the Buffalo City Metropolitan Municipality on the use of the indigenous and the western knowledge systems in disaster risk reduction; and
- To generate ideas and draw recommendations on the ways to integrate both the indigenous and the western knowledge systems in the disaster risk reduction policies and legislative frameworks.

1.5 Conceptual Framework

Throughout this study, several concepts and words are used. It is vital to define these terms and phrases to understand the context in which they are used in this study.

1.5.1 Disaster

The term disaster comes from the French word "desastre," which is a combination of two terms "des" which means "bad" and "aster" which means "star". As a result, disaster refers to a "bad or evil star" (Khan *et al.*, 2008:43). Joshi (2011:1) alludes that the term disaster which is "bad star" in Greek, is derived from an astronomical concept in which the ancients referred to the destruction or the deconstruction of a star as a disaster. When paying much attention to the historical evolution of the term "disaster", it becomes clear that there has been a gradual shift in the understanding of the term, from seeing it as an act of God or as the "wrath of nature" to a more layered perspective that considers the role of humans, as well as the social, political, and economic factors in the creation of a disaster (Weichselgartner & Bertens, 2000). In the past, a disaster was thought to be caused by an unfavourable star, but currently, the term "disaster" refers to any unusual event natural or man-made, that has a disastrous effect on the affected community (Jha, 2017:5). The United Nations (2016:13) defines a disaster as a "serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts".

1.5.2 Disaster Risk

A disaster risk is believed to be influenced by hazards, exposure, and vulnerabilities. The risk that a system, a civilisation, or a community would experience a death, an injury, or have their property destroyed or damaged over the course of a specified time period is the most common way to describe this (UN, 2015:13). The risks can be intensive or extensive. An intensive disaster risk for example is associated with large concentrations of people, property, and activities that are exposed to intense hazard events such as in cities, whereas an extensive disaster risk is associated with sparsely distributed people, properties, or activities that are exposed to low intensity but high frequency hazard events (Yawson *et al.* 2016).

1.5.3 Disaster Risk Management

Disaster risk management is defined as the use of disaster risk reduction policies, processes, and activities to prevent new risks, by reducing the current risks that are associated with disasters, and by managing the residual risks that enhance resilience (UN, 2015:13). Disaster risk management is structured as a systematic approach to managing uncertainty and the potential negative consequences of a natural hazard event, by involving a risk assessment process and the development of strategies as well as specific actions to control, reduce risks, and prevent vulnerability and exposure to hazards while increasing coping and response capacity (Yawson *et al.* 2016).

1.5.4 Disaster Resilience

Department for International Development (2011a:6) defines resilience as the capacity of the nations, communities and households to manage change by sustaining or improving the living standards in the face of shocks or stresses such as earthquakes, droughts, or armed conflict without jeopardising their long-term prospects. United Nations (2005b:4) “the capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure”. Disaster resilience is the capacity of people, communities, and nations, as well as their institutions to absorb shocks and recover from them while constructively adapting and changing their structures and ways of life in the face of long-term changes and unpredictability (OECD, 2013b:1).

1.5.5 Hazard

The UN (2015:19) describes a hazard as a phenomena, condition, circumstance, event, human activity, or substance that has the potential to inflict personal injury, property or environmental damage, or the disruption of livelihoods and social services. The hazards can come from a variety of places such as geological, hydro-meteorological, biological, technical, or anthropogenic causes (Schneiderbauer & Ehrlich, 2004). Urbanisation, environmental degradation, and climate change are all regarded as the hazard drivers that can affect the location, occurrence (frequency), and the intensity of the natural disasters (UN Office for Disaster Risk Reduction, 2021).

1.5.6 Indigenous Knowledge

For more than 40 years, the United Nations has been concerned about the plight of the world's indigenous knowledge, but it has never accepted a legal definition of the term "indigenous," not even in the 2007 United Nations Declaration on the Rights of Indigenous Peoples (Barratt & Afadameh-Adeyemi, 2011). The term has become commonly used, yet there is no agreement on what it means exactly (Coates, 2004). Some researchers argue that determining the status of an indigenous is difficult, and as a result, they avoid using the word indigenous in favour of traditional knowledge (Moatlhaping, 2007:26). IK comes from the colonial time, where the native people of a certain area/land were suppressed after they were invaded by the colonial powers (Kuhnlein, 2013). The IKS has a long history with pre-invasion and the pre-colonial societies that developed on their territories and perceived themselves as being distinct from the other sectors of society that currently exist in those lands and consider themselves to be unique (Ferreira, 2013). The non-dominant sectors of society are determined

to conserve, develop, and transmit to future generations, their ancestral lands, and ethnic identities as the foundation of their continuous existence as peoples, in accordance with their own cultural patterns, social institutions and legal frameworks (Banda, 2004).

1.5.7 Integration

Fox and Meyer (1995:65) define integration as the process of bringing together smaller parts or information that are held in several subsystems to create a single functional entity. Murphy and Poist (1996) describe the integrating departments' results in a high level of satisfaction for the concerned functions. The level of integration refers to how much the two functions' operations help one another (Vaarela, 2007). Integration involves the efficient coordination, linkages and communication that all contribute to the achievement of the desired outcome (Basnet, 2012). It is characterised by high level values, similar objectives and cooperative conduct (Souder & Sherman, 1993).

1.5.8 Sustainability

The United Nations (2007) defined sustainability as “meeting the needs of the present without compromising the ability of future generations to meet their own needs”. The idea of sustainability has been enshrined in the traditions of many indigenous people; for instance, it was a principle of the Gayanashagowa, or the Great Law of Peace, of the Iroquois Confederacy, wherein the chiefs took into account how their choices would affect the seventh generation to come (Heinberg & Lerch, 2010). The term sustainability first appears in Europe in the *Sylvicultura Oeconomica* work by the German scientist and forester Hans Carl von Carlowitz (Heinberg & Lerch, 2010). Later, the practice of planting trees was adopted by the English and French forestry experts as a means of establishing “sustained-yield forestry” (Heinberg & Lerch, 2010).

1.5.9 Western Knowledge

The origins of western science can be traced back to 3000 to 1200 BCE in the Ancient Egypt and Mesopotamia, with their contributions in medicine and shaped classical Greek natural philosophy, in which formal attempts were made to provide explanations for phenomena in the physical world based on natural causes (Lindberg, 2010). The knowledge of the Greek worldviews decreased in Western Europe throughout the early Middle Ages (400 to 1000 CE) with the fall of the Western Roman Empire, but it was preserved in the Muslim world during the Islamic Golden Age (Subramanian & Pisupati 2010). From the 10th to the 13th centuries, the recovery and the assimilation of the Greek works and Islamic inquiries into Western

Europe revived the "natural philosophy," which was later transformed by the Scientific Revolution, which began in the 16th century and saw new ideas and discoveries departing from the previous Greek conceptions and traditions (HKT Consultant, 2020). The western scientific method began to play a larger part in knowledge generation in the 18th century, but many of the institutional and professional elements of science, as well as the change from "natural philosophy" to "natural science," did not emerge until the 19th century (Schafersman, 1994).

1.6 Research Methodology

This section summarises the research methods that were used in this study. A detailed research methodology and the study design are provided in Chapter 4.

1.6.1 Research Approach

In this study, a qualitative research design was adopted with data being gathered through interviews and the content analysis of the policy and the legislative documents. Cropley (2019:5) and Haradhan (2018:2) define the qualitative research technique as a process that examines and scrutinises how people use their intelligence based on their observations and experiences by using non-numerical data to interpret the meaning of the integrated, collected, and presented data through understanding the social reality of the targeted population or a specific area. Specifically, the study utilised a conventional content analysis to examine the integration of the indigenous knowledge into westernised disaster risk management policy and legislative frameworks of the buffalo city metropolitan municipality.

1.6.2 Document Content Analysis

The study utilised a conventional content analysis to evaluate if the indigenous and the western knowledge systems are integrated in the disaster risk management policy and in the legislative frameworks of the BCMM. Conventional content analysis is normally used when the existing theory or the research literature on a phenomenon is limited (Hsieh & Shannon, 2005). Since the study intended to enhance a body of knowledge to improve the integration of the indigenous and the western knowledge systems in the disaster risk management policy and regulatory frameworks, the conventional content analysis was particularly appropriate to address the study's objectives. The study focused on the content analysis of the policy document to understand policy content and processes of BCMM regarding to the integration of indigenous and western knowledge systems in disaster risk management policy and legislative frameworks.

1.6.2.1 Collected Documents

The study gathered information from a wide range of BCMM documents to determine whether the municipality is considering the integration/use of indigenous and western knowledge in the disaster risk management policy and in the legislative frameworks. Approximately 13 documents were gathered from the municipal websites and archives, and they included the: (i) BCMM Disaster Management Policy/Report (2); (ii) BCMM bylaws (1); (iii) BCMM Integrated Development Plans (3); (iv) BCMM Policy on Long-Term Financial Planning (1); (v) BCMM Medium-Term Revenue and Expenditure Frameworks (1); (vi) BCMM Annual Report (2); (vii) BCMM Local Spatial Development Frameworks (2) and (viii) BCMM Built Environment Performance Plan (1). The study also reviewed seven national policy documents, as this is the level at which the policies are formulated to determine whether the integration of indigenous and western knowledge into the national disaster management policies has been taken into consideration. These documentations are as follows; (i) Constitution of the Republic of South Africa 106 of 1996; (ii) Green Paper on Disaster Management (1998); (iii) White Paper on Disaster Management (1999); (iv) National Disaster Management, 57 of 2002; (v) Indigenous Knowledge Systems (IKS) Policy 2004; (vi) National Disaster Management Policy Framework, 2005 and (vii) Intellectual Property Laws Amendment Bill (2007). The study's documents were chosen based on a number of criteria, including but not limited to knowledge management, applicability, and the integration into the disaster management policies. It is crucial to scrutinise the policies in-depth because they provide direction, consistency, accountability and efficiency (Torjman, 2005; Cardno, 2018).

1.6.2.2 Content Analysis of documents

Multiple methods of the content analysis of the policy documents have been used in the study. Firstly, the relevant literature was reviewed and assessed before the documents were compiled and examined. This has established the theoretical basis for the investigations that aimed to guide the examination of the text in the documents. Secondly, the documents' contents were analysed and categorised after being read several times. The process of identifying the word patterns that were repeated, as well as the checking of the comparable phrases and concepts served as the foundation for the development of the categorised structures. This led to the identification of the sub-categories and the themes within these categories. Thirdly, the documents were frequently annotated with labels that were developed through repeated readings of the content, and these were refined to provide a coding guide. Lastly, the collected documents were examined using a thematic analysis technique to identify the themes that are important for furthering research or for stating a problem. Cardno (2018) states that "it is important to analyse the content of policy documents to establish not only

what is said but also what is not said". Annexure B in this dissertation presents the analysis' findings of the policy documentation.

1.6.3 Empirical study

This subsection reflects on the ways in which the empirical study was conducted.

1.6.3.1 Sampling

Snowball sampling was used as a starting point as the study's participants were well selected due to their insight, competence and connection in the topics pertaining to the indigenous and the western knowledge systems in disaster risk management in line with the policies. Snowball sampling was deemed suitable for the study since there was no census that was required for the study's population (Burns & Grove, 2005). The study also used purposive sampling to identify the key informants in the municipality who could help to achieve the study's goals. Purposive sampling is a method of selecting participants who have information that is valuable and relevant to the study's subject (De Vos *et al.*, 2011). A total of 58 participants, including 30 Key Informants (KI) and 28 community members participated in the study, as the KI included the three BCMM political leaders; ten Proportional Representation (PR) Councillors; five traditional leaders as well as 12 participants from various departments within the municipality.

The sample size employed for the study was limited by the 28 community members out of the 834,997 total populations at the BCMM (see section 1.2). The researcher argues that to ensure the validity of the results, this type of study needs a longitudinal survey with many more participants. Hence, combining snowball and purposive sample techniques, the researcher was able to overcome the limitations and biasness of each approach and obtain a deeper comprehension of the target population. In this study, both samples were essential because purposive sampling ensures that participants were selected in accordance with the particular needs of the research to yield valid study results, while snowball sampling gives the researcher access to communities that are hidden or difficult to reach.

1.6.3.2 Data collection

For this study, data was gathered through semi-structured interviews as well as content analysis of policy and legislative documents. Firstly, conventional content analysis of the policy documents was applied to ascertain whether the indigenous and western knowledge are integrated or used into the Buffalo City Metropolitan Municipality's disaster risk management policy and legislative frameworks. The advantage of using conventional content

analysis in this study is that it lets the researcher to gather data directly, without jeopardising the existing knowledge (Hsieh & Shannon, 2005). After conducting a thorough review of policy documents, the data was gathered through semi-structured face-to-face interviews with the selected participants to gain their perspectives on the integration of both knowledge systems in disaster risk management policy and legislative frameworks.

The face-to-face interviews are well known for their ability to boost respondent participation and motivation through direct human interaction (Neuman, 2012). The study benefited from the acquired data because it offered insightful and accurate information to support the study's overall conclusions (Kabir, 2016). By utilising semi-structured interview, a researcher was able to examine the participant's feelings, understandings and ideas towards the integration of indigenous knowledge into westernised disaster risk management policy and legislative frameworks of the Buffalo City Metropolitan Municipality. Semi-structured interviews are a useful method for collecting data from important participants who have insights and experiences related to the subject matter being studied (DeJonckeere and Vaughn, 2019:2).

1.6.3.3 Data analysis

The study included a thorough examination of the acquired data, as well as the use of the relevant methodologies such as mind-mapping to translate the data into themes for evaluation purposes. According to Welman et al. (2005) and De Vos et al. (2011), the themes are the umbrella structures that are identified by the researcher before, during, and after data collection. In the analysis and presentation of data, the verbatim quotes from various participants' statements are used to support the findings.

1.7 Significance of the Study

Integrating the IKS and the WKS is an important approach to build a community that is disaster-free and to put policies into place that reduce the threat of physical hazards and the related human, sociological and cultural variables that exacerbate disasters. In the broad context of sustainable development, it might be defined as, "the systematic creation and use of policies, strategies, and practices to minimise vulnerabilities, risks, and the unfolding of disastrous consequences throughout a society" (UNISDR, 2004). Hence, there is a need to integrate the IKS and the WKS. Despite the fact that research and public policy have acknowledged the reality and significance of the IKS and the approaches in DRR, there is a lack of implemented strategies' that have been documented through the official channels. The need for strong connections between indigenous and western knowledge clears the way for sociocultural and technological disaster risk reduction methods. Considering the future, the indigenous and western knowledge-based applications would ensure sustainable use and

management of natural resources, environmental conservation, and the local people's resilience even in difficult and complex situations (Bohensky & Maru, 2011). The idea of sustainability must be balanced to allow for socioeconomic progress and environmental preservation among the vulnerable people.

1.8 Ethical Considerations

The study was approved by the North West University, Faculty of Natural and Agricultural Science Ethics Committee (NWU-FNAS REC) (NWU - 0 0 5 4 0 - 2 1 - A 9). Prior to starting the study, the researcher emailed the City Manager's office and the traditional authorities' council within the municipality, requesting permission to conduct the study in their respective areas. The researcher was asked to provide a supporting document from the North West University by the offices. After sending the letters, the offices responded that, owing to the Covid-19 epidemic, the researcher had to present the study's aim to the superiors through email to adhere to the municipal procedures. The requests were recommended and accepted when the study proposal was submitted to the municipality. The prospective participants were given a letter requesting their permission to participate in the study. The purpose of the study was stated in the letter, as well as the type of cooperation that the participants (respondents) were expected to provide. As an additional measure, verbal consent regarding the participants' anonymity and confidentiality, voluntary participation and the recording of the discussions was also obtained from the participants during the interviews. The participants were also informed that no one would be forced to participate, and that they were able to discontinue with the interviews at any stage during the research endeavour.

1.9 The Study's Limitations

The 28 community members out of the population of 834,997 people at the BCMM (see section 1.2) pose a limitation in the sample size that was used for the study. The researcher submits that this kind of study requires a longitudinal survey involving many more people to make the findings robust.

1.10 Chapter Layout

1.10.1 Chapter 1: Overview of the study

This chapter provided an overview of the study and its context, as well as the foundation for the study's importance, the problem statement, the theoretical framework, the research questions, as well as the aim and objectives.

1.10.2 Chapter 2: Theoretical Conceptualisation of Indigenous and Western Knowledge

In this chapter a review of the literature on the indigenous and the western knowledge systems is conducted.

1.10.3 Chapter 3: Integration of Indigenous and Western Knowledge in Disaster Risk Management Policies and Legislative Frameworks: A Literature Review

This chapter reviews the literature on the integration of the indigenous and the western knowledge systems in disaster risk management.

1.10.4 Chapter 4: Research Methodology

The detailed research techniques and the methodologies that were utilised in this study are presented in this chapter.

1.10.5 Chapter 5: Findings of the study and analysis

The data from the content analysis as well as the findings of the semi-structured interviews are presented herein.

1.10.6 Chapter 6: Conclusions and Recommendations

The chapter concludes the dissertation by demonstrating how the objectives of the study were met. The last section of the final chapter presents a summary of the recommendations, and it suggests the future areas of research.

Chapter Summary

This chapter oriented and introduced the research. In addition, to introduce the phenomenon under investigation, a problem statement was employed. The study's key research questions, as well as its objectives were clearly stated. The methodology of the study was examined, as well as the significance of the key concepts and the terminology. Furthermore, a dissertation proposal was made available in this chapter. The next chapter gives the reader an in-depth look into the integration of the indigenous and the western knowledge systems into the disaster risk management policy and the legislative frameworks. A wide range of national and international legislative frameworks, regulatory documents, and other resources related to the integration of the indigenous and the western knowledge systems into the disaster risk management policy and the legislative frameworks are discussed and reviewed. This chapter has identified the gaps based on existing data, as well as the merits and the drawbacks of incorporating these knowledge systems into the disaster management policy and the

legislative frameworks to use the disadvantage of this knowledge integration in building the reduction mechanisms to overcome future disasters.

CHAPTER TWO

INDIGENOUS AND WESTERN KNOWLEDGE: THEORETICAL CONCEPTUALISATION

2.1 Introduction

The disasters have long been thought to be produced by supernatural powers as acts of God and were considered unavoidable (Manyena, 2013). The indigenous people, particularly on the African continent, had managed to live and adapt before the introduction of Western education, and they consider this knowledge as being important to devising the sustainable policies to handle future concerns (Iloka, 2016). This home-grown knowledge brings generations together via its unexpected qualities which have evolved into a type of solution to many developmental difficulties (Agrawal, 1995). The emergence of enlightenment secularism and the development of western knowledge as a new source of information, on the other hand, changed the people's perceptions of the disasters from acts of God to acts of nature (Reale, 2010). Since its adoption, western knowledge has been dominant in disaster risk reduction and in the disaster risk management practices. The application of indigenous and western knowledge in disaster risk management has demonstrated their efficacy for coping with disasters for the communities that have sustained ongoing losses (Munsaka & Dube, 2018). Despite the effectiveness of the adaptive techniques in reducing disasters, the indigenous and western knowledge systems have failed to tackle a number of challenges particularly when they are used independent of each other to address such concerns (Jacobs, 2015). Indigenous knowledge is claimed to be less recorded and unrecognised by numerous authors due to a lack of formal education (Ezeanya-Esiobu, 2019; United Nations, 2009). However, western knowledge has proven its ability to deliver modernised answers based on scientific facts and experiments (Rull, 2014), but it also has the capacity to be considered to be evil (Uko, 2010). For example, the vaccines and the poisons that are used to eradicate dangerous illnesses have the potential to harm the environment (Uko, 2010). This lack of communication and misunderstanding between these knowledge systems has the potential to cause a breakdown, thereby limiting the progress in resolving the crisis concerns (Džeroski *et al.*, 2007).

2.2 Defining Indigenous Knowledge

Indigenous knowledge is a local communal inventiveness that is born of different generations' experiences and observations of the environment (Flavier & Erickson, 1995:479; Chikaire *et al.*, 2012:202). Noyoo (2016:167) and Sithole *et al.* (2015:7) define indigenous knowledge as "native information on sympathies, values, beliefs, and ideas that has been rooted and

constituted over centuries by elders to the local people on how to respond and interact with nature in order to strengthen and build community resilience”. Mascarenhas (2004:5) further defines indigenous knowledge as a collection of data and relevant skills that are inherited from a community's elders and passed down from generation to generation. Rao and Ramana (2007) as well as Senanayake (2015) state that indigenous knowledge is associated with the cultural and the traditional activities which are likely to be employed by the local community to cope with any potentially disastrous situations. Furthermore, Vitale (2017:7) opines that the indigenous ideas include self-determination, territorial protection, heritage, spiritual knowledge, and cultural vindication as vital accelerators for resilient development. Maferetlane (2013) describes indigenous knowledge as an “all-encompassing knowledge that incorporates technologies and practices that have been and continue to be used by indigenous and local people for survival, adaptation, and existence in a variety of settings”. Agrawal (1995) share similar views and indicate that in some theories indigenous knowledge has been described as being methodical, analytic, and culture-based in various ideas.

According to Grenier (1998), indigenous knowledge is “a unique, traditional, local knowledge that exists within and develops around specific conditions of indigenous women and men in a certain geographic location”. Local knowledge and rural knowledge are part of the indigenous knowledge system which promotes sustainable development in the local environmental contexts (Langill, 1999). The worldviews of the indigenous knowledge system are based on the aboriginal research involving the indigenous people and the history with a variety of characteristics, including: (i) Knowledge that interconnects different generations; (ii) Knowledge of the perception of reality based on linguistic structure or ways of communicating and (iii) Knowledge of unseen powers in the ecosystem (Levac *et al.*, 2018). The elders supervised and used appropriate methods to gain access to this knowledge through dreaming and visioning (Michell, 2005).

The aboriginal knowledge was produced outside of the formal education system, and it is passed down orally through generations (De Guchteneire *et al.*, 2004; Warren, 1998), within the basis of the survival strategies to assist the vulnerable communities to overcome the daily threats to their well-being (Maferetlane, 2013). The UNESCO's Local and Indigenous Knowledge Systems (LINKS) project defines local and indigenous knowledge as the “understandings, skills, and philosophies produced by societies with lengthy histories of engagement with their natural environment” (Hiwasaki *et al.*, 2014). The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) defines indigenous and local knowledge as “the diverse arrays of knowledge, know-how, practices, and representations that guide civilisations in their multiple interactions with their natural surroundings” (MoSTE, 2015). Based on the above definitions, it appears that virtually all the definitions stress the

key characteristics of IK, such as its unwritten origins, dynamism, and the fact that it is given meaning by a specific community in a unique environment. The above definitions show that IK appears to have a number of linked pieces that are more or less unique. It is clear that indigenous knowledge does not have a single, straightforward definition. However, the heart of the foregoing definitions is that indigenous knowledge is a distinctive aspect of a community's lives, with its notion based on activities such as culture, tradition, history, and a community's way of life.

Furthermore, the criteria suggest that indigenous knowledge encompasses the people's experiences, facts, and insights. The definitions, above all, encompass how the individuals apply this information in their daily lives. For this study, IK is described as an institutionalised community-based coping mechanism that provides socio-cultural information necessary for the community's survival and flourishing within its local environmental, geographical, and cultural context, as well as facilitating communication and decision-making within the community. This knowledge is vital not just to the society in which it emerges, but also to the scientists and the planners striving to improve their living conditions. It also noted that, through the community's resourcefulness and experimentation, this knowledge forms the foundation of the community development processes such as food preservation and the storage of water for cultivation, the indigenous construction of houses, ethnic medicine and the interpretation of meteorological and climatic phenomena. Therefore, with the valuable use of indigenous knowledge, the communities need to take a leading role in the activities aimed at reducing disaster risk and dealing with various disasters to build a resilient and sustainable environment. The next section illustrates the origin of indigenous knowledge.

2.2.1 Historical Background of Indigenous Knowledge

In the 16th century, indigenous knowledge came from the Latin word "indigenus," and it was first used in the 1640s to describe the plants and the cultures in the New World (Western Hemisphere) (Peters & Mika, 2017). It also arose from the colonial experience in which the local people of a particular area/land were oppressed after being invaded by the colonial powers who were then in control of the former occupants (Kuhnlein, 2013). Since the time of colonisation, the indigenous people have recorded a history of resistance, interaction, and collaboration with the colonial governments, thereby proving their belief and resolve to maintain their separate sovereign identities (United Nations, 2009). In disaster risk management, indigenous knowledge has gained popularity as a term to describe the aboriginal local people's values, ideas, and conceptions, which have been rooted and built over centuries to deal with calamities (Silito, 2004). Various tribal groups and the first nations people have opposed the names indigenous and Aborigine (and its cognates), yet the

governments all over the world continue to use them (Peters & Mika, 2017). The phrase first nation is becoming more popular, despite the fact that it is increasingly being used in legal discourse, particularly in Canada, to refer to members of the legally recognised reserve communities (Béteille, 1998; Peters & Mika, 2017).

Some academics argue that the collective nouns that are used to name the world's tribal groups have become increasingly problematic and that the terms are frequently derogatory, historically inaccurate, and they are contaminated by a colonial past that is based on the dehumanisation of the primitive people and the assumption of western cognitive superiority (Peters & Mika, 2017). For instance, the word Maori was established to eliminate the diversity of New Zealand's indigenous tribes (Rangihau, 1992). Meanwhile, the tribe of indigenous knowledge has had a tumultuous past (Peters & Mika, 2017). Even finding a definition that went beyond the previous ideological implications of the term that it had received from its 19th century colonial disciplinary origins, where the idea of a tribe denoted a certain type of civilisation, and a stage of evolution was more difficult (Béteille, 1998). Nevertheless, the indigenous tribes consider themselves as being distinct from the other sectors of society in their territory because of their historical continuity with the pre-invasion and the pre-colonial traditions that originated on their lands (Eyong, 2007). Its historic significance has been useful in developing appropriate research, development, and the extension initiatives that are relevant to the local situations (Chadwick *et al.*, 1998).

The local communities and farmers have benefited from the cognisance function of this knowledge, resulting in a rich knowledge base for anticipating climatic and weather occurrences based on but not limited to the observations of animals, plants, and celestial bodies (Acharya, 2011). These environmental indicators are crucial in alerting the local people to unforeseen disaster-related incidences so that alternative solutions can be introduced in a timely manner (Roncoli *et al.*, 2002). Moreover, indigenous knowledge has evolved as part of societies' relationships with their environment since the beginning of time, and hence it has the potential to enrich the current environmental research, policy, and the operations on Disaster Risk Reduction and Climate Change Adaptation (Jha & Jha, 2011). Even the scientists consider this knowledge to be the most effective tool for managing the resources in the construction of a resilient community, which includes the environmental and the social challenges such as agriculture, agroforestry, water management, food production, plants, animals, soils, water, and the weather (Emery, 1996). According to the World Bank (2009), indigenous knowledge is used in the development process, particularly when creating or implementing the development programmes or initiatives.

Additionally, this knowledge system has been proven to be beneficial in different platforms of disaster risk reduction, such as in policy formulation, community education, and in awareness campaigns (Iloka, 2016:1; Baumwoll, 2008). This demonstrates that indigenous knowledge is a vital resource that can help to improve the development process' efficiency, efficacy, and long-term sustainability. For instance, the United Nations Educational, Scientific and Cultural Organisation (UNESCO) (2016) states that the adoption of the 2030 sustainable development agenda provided an exceptional opportunity to align indigenous knowledge with national strategies and planning, such as (i) Persistent poverty and marginalisation of indigenous people (ii) Sustainable development, (iii) Climate change actions, (iv) Conservation agendas. Incorporating indigenous knowledge into existing practices and policies promotes the impacted communities to participate in disaster risk reduction initiatives, and it also empowers them to take the lead as well as provides them with a sense of belonging in disaster related matters (Shaw *et al.*, 2008). The next section highlights the advantages of using indigenous knowledge in disaster risk management.

2.2.2 Benefits of using Indigenous Knowledge in DRR

The value of using indigenous knowledge to reduce disaster risk is rapidly being recognised and quantified globally (Nkabane & Nzimakwe, 2017). Its significant role can be transferred and adapted by the communities in ways that encourage community participation and empower communities in disaster risk reduction (Munsaka & Dube, 2018) as well as provide invaluable information about the local context, to serve as a model for disaster risk reduction education through non-formal means (Iloka, 2016). Mutasa (2015) states that indigenous knowledge is the knowledge system that is critical in community development planning. This demonstrates that indigenous knowledge may be utilised by the local people as a planning tool. For instance, a community with extensive indigenous disaster risk reduction expertise is capable of taking care of itself and dealing with calamities with minimal external assistance (Iloka, 2016). Therefore, for effective disaster risk reduction planning, it is critical to respect the culture of the afflicted community. This is due to the fact that the effective indigenous coping mechanisms cannot be established without including the local people themselves and ensuring that the techniques that are decided upon stay on their own (Scott *et al.*, 2013). According to the United Nations International Strategy for Disaster Reduction (UNISDR) (2015), mainstreaming local knowledge in disaster risk reduction has the following long-term benefits (Shaw, Uy & Baumwoll, 2008):

- Adapting various local disaster-prevention measures to other communities in comparable conditions;

- Using local knowledge in project implementation to aid in the understanding of the local context. Offering an effective paradigm for DRR education based on the generational transmission of local knowledge;
- Encouraging impacted communities to take the lead in disaster risk reduction activities by encouraging their participation and empowerment.

Despite the positive examples and benefits, it is important to remember that local knowledge and practice are a component of local culture and customs, which may have an acceptable or long-term impact on the disaster risk reduction in practice (Shin, 2017). A variety of examples illustrate that culture has operated as a barrier to effective the DRR efforts in various cases (Kulatunga, 2010; Oliver-Smith, 1996). Culture can sometimes result in environmental damage or in an increased risk to the communities by preventing an immediate evacuation (Shin, 2017). The anthropologists believe that the cultural factors influence the people's behaviour when they are confronted with a threat (Oliver-Smith, 1996). In other words, in a dangerous situation, "people prioritise factors such as social values, religious beliefs, traditions, and attachment to a location" more than the danger they might face" (Kulatunga, 2010). In Bangladesh, for example, the "purdah" norm can prohibit the women from getting important information about the hazard forecasts, as they are not allowed to enter the markets for early warnings where the radio warnings are heard for information sharing (Dekens, 2007).

During the eruption of the Merapi volcano in Indonesia, some people refused to abandon their settlements and relocate until they received instructions from their cultural leader (Lavigne *et al.*, 2008). Instead, they followed the Mbah Maridjan, or the "gatekeeper," who insisted on appeasing the spirits by "brewing rage" (Ouariachi-Peralta & Fakhruddin, 2014). Many people who practiced this culture were killed as the scorching ash clouds descended (Sagala *et al.*, 2009). As a result, it is vital to evaluate the possible benefits as well as the drawbacks of incorporating the traditional beliefs, the customs, and the culture into the disaster risk reduction strategies. According to Chang'a *et al.* (2010), various environmental and astronomical indications such as plant phenology, the behaviour and migration of birds, animals, and insects, are commonly employed in many regions of the African continent to predict rainfall. The local people's capacity to anticipate the weather conditions using indigenous knowledge has remained critical in reducing the environmental damage that is caused by the natural hazards (Macherera & Chimbari, 2016). This demonstrates that the indigenous climate projections provide insight into the components of climate that are most important to farmers, as well as the type of climate information that the farmers require to reduce the agricultural risks (Mafongoya *et al.*, 2017).

On the other hand, the African traditional healers are able to cure a specific sickness with certain herbs by using their indigenous knowledge of the plant species (Kaya & Seleti, 2013:31). With all of the sustainable indigenous means, the continent's intellectual, cultural, and spiritual inheritance has not been fully obliterated by colonialism and by the apartheid history (Kaya & Seleti, 2013). Figure 2.1 represents the connectedness of the indigenous people with their local knowledge in disaster preparedness to establish a sustainable and resilient living environment. The framework aids in the identification of the connections and the links between the local knowledge and practices as well as the disaster risk reduction, and the variables that affect them (Dekens, 2007a). Dekens created a framework in 2007 that allows for an analysis of indigenous knowledge and its use in disaster preparedness.

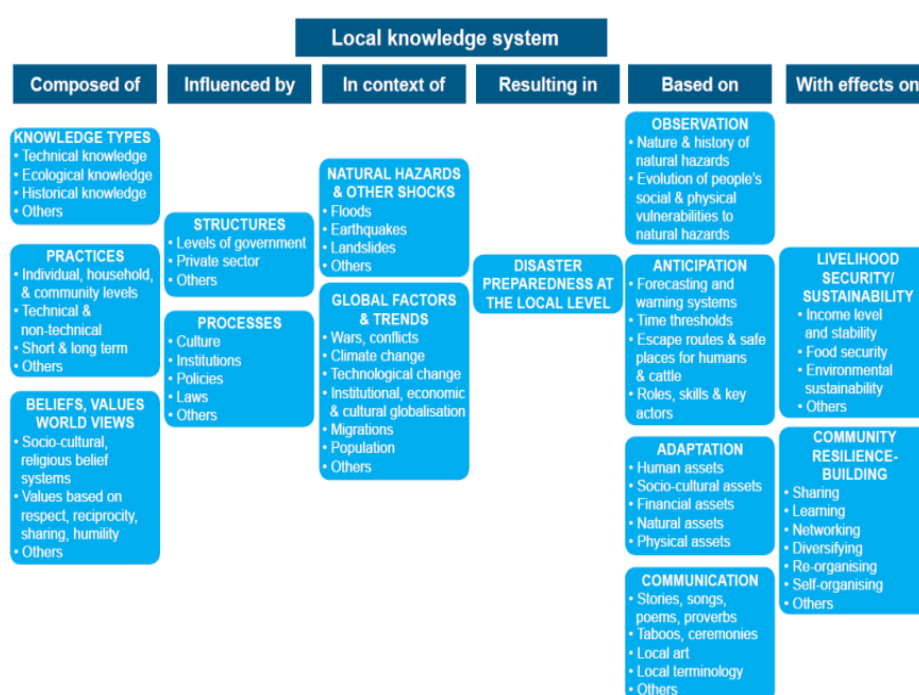


Figure 2.1: Framework for Local Knowledge on Disaster Preparedness: Adopted from Dekens (2007).

Mercer *et al.* (2007) state that indigenous knowledge also plays a critical role when making decisions on the matters relating to but not limited to food security, human and animal health, education, and natural resource management. The adaptability and the originality of this knowledge has proven to be the most efficient means of enhancing the local living conditions through primal knowledge and abilities (De Guchteneire *et al.*, 2004; Senanayake, 2006; Noyoo, 2007). Many people and communities still rely on the local and traditional knowledge of nature as well as the natural phenomena in this day of technological growth (Sithole *et al.*, 2017). In the meantime, the lack of assimilation of the indigenous knowledge into the policies and frameworks has led the government authorities to devalue indigenous knowledge in decision-making and execution (Lwoga *et al.*, 2010). This is evidenced by the fact that the

policymakers are not indigenously grounded and their lack of awareness of the cultural composition of indigenous populations may also contribute to these risk factors (Scott *et al.*, 2013). In the next section, the best practices of indigenous knowledge for disaster risk reduction are explored and how they are being implemented in the different countries.

2.2.3 Indigenous Knowledge Best Practices for DRR

Several countries have a multifaceted set of indigenous skills, early warning indications and well-developed mechanisms that allow the local communities to use their collective expertise to overcome disasters (Habane, 2010). This knowledge has also shown to be an effective tool and it is a preventative measure for the local communities when dealing with a variety of disaster risk implications (Syahputra, 2017). According to the United Nations International Strategy for Disaster Reduction (UNISDR) (2008), the Simeulueans living off the coast of Sumatra, Indonesia, and the Moken living in the Surin Islands off the coasts of Thailand and Myanmar both used the knowledge that was passed down orally from their ancestors to survive the 2004 Indian Ocean earthquake and the tsunami. The Indonesian community (population 80,500) living near the area that was affected by the Indian Ocean earthquake and the tsunami was able to flee the disaster by running to the adjacent hills in accordance with the long-held traditional knowledge about the behaviour of their buffaloes, and just seven individuals from the village died (McAdoo, 2006). The community received the renowned United Nations Sasakawa Award for Disaster Reduction through its leader in honour of their use of indigenous knowledge in saving thousands of lives (UNISDR, 2008). This highlights the applicability and the significance of indigenous knowledge in natural hazards scenarios.

In eSwatini where drought and occasional floods are common disasters, the communities use various methods to predict the disasters (Musa & Omokore, 2011). For example, they utilise the cries of certain birds to forecast rain, and the yields of wild fruit plants to foretell famine, and wind direction. The crescent moon's form and the behaviour of specific animals are among the Swazi's other indigenous ways for predicting the natural hazards (United Nations Environment Programme, 2008). Similarly, when floods are expected, the nests of the thick-billed weavers' birds (*amahlokohloko*) are high up in the trees and when the floods are doubtful, the nests are low down (Musa & Omokore, 2011). In Kenya, on the banks of Lake Victoria, the Banyala village in Budalang'i had a well-organised strategy which is the dugout canoe that was ready for transport in case of heavy flooding. The people also dig trenches to control the water around the homestead and around the farmlands to avert approaching calamities (Mwaura, 2008). The Luo people of the Lake Victoria region had a large variety of climate monitoring indicators that helped them to know when to start planting in preparation

for the rains or when to preserve and store food in preparation for a dry season (United Nations Environment Programme, 2008). Joseph (2010) argues that the animals, birds, reptiles, amphibians, insects, plants, trees, the winds, the temperatures, and the celestial entities such as the size of the moon and the stars, are usually used as forthcoming indicators of disasters. In addition, when significant flooding was expected, the communities were urged to avoid ploughing along the lake borders and to capture fish during the rainy season of April to August, when the fish was a lot, and to preserve them by drying and smoking them for use when the fish was scarce (Dharmasena & Jayathilaka, 2008).

In Tanzania, the animals feature prominently in the prediction of drought and famine. For instance, by reading the signs on the goat's intestines, the specialised Maasai elders can divine drought and predict incoming famine or diseases (Dharmasena & Jayathilaka, 2008). The hunters, the gatherers, and the herders that were questioned in the UNEP research in the Russian Federation's Nenets autonomous Okrug and Kamchatka revealed how the careful observation of animal behaviour, as well as the look and colour of the sky is utilised as the early warning of natural hazards (Habane, 2010). In the Nigerian villages, they planted bamboo and raffia palms to prevent soil erosion and landslides (Nwaihu *et al.*, 2015). In India, the communities living in rural Rajasthan used to construct houses out of local materials and they used indigenous techniques (Shaw *et al.* 2008). These houses were usually built in such a way that the wind and the sun paths provide adequate ventilation and thermal comfort, which is crucial given the region's high summer temperatures of around 50°C. The apertures are relatively small to decrease the heat input and to reduce vulnerability to the sandstorms, which are a common local concern (Shaw *et al.*, 2008:10). These indigenous knowledge mechanisms are deeply embedded and grounded in the local communities, thereby allowing them to observe the climatic patterns to issue early warnings (Chinlampainga, 2018). In this regard, the governments are being urged to assist the indigenous people in preserving and maintaining their knowledge practices to encourage them to share the benefits of the indigenous knowledge inventions and practices (Baumwoll, 2008).

Moreover, there is evidence that countries such as India, Indonesia, Zimbabwe, and Kenya have excelled in disaster management by utilising the indigenous knowledge of the disaster-affected locals as a strategy (Iloka, 2016; Rahman, Sakurai & Munadi, 2016; Sethi *et al.*, 2011). The countries dominated by the indigenous communities respond by bringing together all their knowledge and practice strategies, which have evolved over generations, and they will continue to evolve in the future (Sithole *et al.*, 2017). The local knowledge and the coping strategies are becoming more important in the national initiatives (Mawere, 2012). Recognising the value of IK in participatory policymaking, the Botswana government has devised a systematic and comprehensive strategy that is based on the concepts of integrated

water resources management and in an ecosystems approach to aid the farmers in the face of disastrous disasters (Motsumi *et al.*, 2012). The aim of this strategy is to integrate indigenous knowledge into the government participatory policy decision-making processes to improve the environmental and the developmental conditions of the Botswana communities (Motsumi *et al.*, 2012).

In South Africa, Xhosa communities send their young men to initiation schools where they learn about a variety of topics, including beliefs about how to observe behaviors, such as the migration patterns of birds and prey, as indicators of weather patterns or the approaching arrival of heavy rains; hunger accompanied by lightning or the approaching of a drought, so that communities could prepare ahead of time for safety measures and disaster mitigation (Vincent 2007). In addition, the people of rural southern KwaZulu-Natal, particularly in Mtwalume and Izingolweni, have demonstrated their understanding of weather systems by building storm drains, wind break structures, walls and homestead fences as a means of foreseeing disasters (Nkabane and Nzimakwe, 2017). South Africa, on the other hand, has made considerable progress in trying to address the complex disaster concerns that are faced by the disadvantaged people by highlighting the relevance of indigenous knowledge for disaster risk reduction in its IKS Policy of 2004 (Republic of South Africa, 2005).

In February 2018, the Canadian government took some steps forward by introducing proposed legislation (Bills C-68 and C-69) that established new rules to protect the environment, the fish and fish habitat, and the waterways to ensure public confidence in how the resource development decisions are made (Government of Canada, 2019). The policy framework is intended to aid in the implementation of the indigenous knowledge requirements in Bills C-68 and C-69 (Government of Canada, 2019). The policy framework was developed in collaboration with the indigenous people, and further feedback was sought from the indigenous people, the governments, the communities, and the organisations through a series of dialogues and workshops on the indigenous knowledge that is held across Canada (Government of Canada, 2019; McGregor *et al.*, 2019). The Nepal Disaster Reduction Policy also emphasises the need for strengthening the community coping mechanisms by utilising the indigenous knowledge in the disaster recovery activities (Nepal Centre for Disaster Management and Oxfam-Nepal, 2007).

De Guchteneire *et al.* (2004) corroborate this by stating that the human beings have developed knowledge and methods through many millennia that allow them to survive in a balanced relationship with their natural and social settings. For example, the Matengo people, who are thought to have lived in the steep slopes of the Matengo Highlands in Tanzania since the Iron Age, developed a sophisticated agricultural technique that allowed them to grow crops

on the hillsides while regulating soil erosion and improving soil moisture and fertility (UNEP, 2008). Shaw *et al.* (2009) further state that the human methods that have evolved over the ages have been time-tested and demonstrated to be helpful in preventing the disasters and in managing the unavoidable threats. For instance, many indigenous communities in Asia and in the Pacific have documented a wealth of indigenous knowledge that has been used over time to mitigate or lessen the disaster risks and impacts to preserve their existence for future generations (Shaw *et al.*, 2009). The small-scale farmers in Zimbabwe have relied on their indigenous strategies to survive droughts and other disasters for ages (Mutasa, 2015). The indigenous knowledge systems have long been a component of human life, and this practice is significant in shaping how people interact with their surroundings (Munsaka & Dube, 2018). The following section presents several definitions for the term western knowledge as defined by various scholars and researchers.

2.3 Defining Western Knowledge

The term western knowledge is derived from the Latin word *Scientia*, which means knowledge, and it comprises of any methodical field of study, or the information that is collected from research, or the structure of knowledge that is obtained by observation and experiment to identify and explain a phenomenon (Uko, 2010:1). Noyoo (2007:167) defines western knowledge as the ability to attentively observe, examine, analyse, and confirm western documentation. Angioni (2016:2) defines it as a higher-level knowledge that requires an acceptable explanation for the truth of a claim. This knowledge system generates new ideas and approaches for resolving issues, as well as higher standards and more evidence-based regulations (Basher, 2013). For example, the western scientific expertise has aided in the creation and implementation of significant worldwide disaster risk reduction initiatives, such as the Hyogo Framework for Action 2005-2015 (Shaw *et al.*, 2016:329). Alabdulkareem (2013:2106) states that western knowledge is a body of knowledge that applies facts and honesty to a specific problem, in which raw data is collected, coded, saved, and analysed to generate information about the problem and its tendencies.

Western knowledge is organised, and it is used to guide, coordinate, standardise, validate, and provide information to enhance the existing situations for future goals (Basher, 2013). According to Ravetz (1995), western knowledge is the research outcome of all the procedures, which involve the formation of skills, practices, and the experiences of various authors' worldviews. The conventional early warning systems are based on western understanding, monitoring, and on the warning indicators that are generated from the geophysical observational data (Basher, 2013). The western knowledge enabled the disaster management

stakeholders to adopt the strategies and the policies to limit the risks and to create resilience to the natural and the human-induced disasters, thereby allowing them to continue advance response processes (Aitsi-Selmi *et al.*, 2015a). Taking inspiration from the Covid-19 situation where vast numbers of community members around the world were placed under lockdown to reduce the virus' destructive impact, people now converse and engage with one another through technology. The efficiency of this knowledge system in reducing disaster risk is dependent on its execution (Weichselgartner & Pigeon, 2015).

Unfortunately, when planned or existing scientific endeavours have the potential for long-term unknown negative health consequences, the lack of correct scientific evidence is frequently cited as an excuse for delay (Martuzzi & Tickner, 2004). Poljanšek *et al.* (2007) argue that the Sendai Framework is taking into consideration the role that is played by the western community in improving the understanding of risk and in applying the new information to the threats they face on a daily basis. De Groeve and Valles (2015) state that western knowledge has a role in monitoring the adverse event of disaster risk such as (i) precautionary measures; (ii) drafting plans and regulations; (iii) policy networks and (iv) value added in dealing with new scenarios and gain information to strengthen community resilience. Jensen, Richter and Vendelø (2003) state that western knowledge also plays an essential role in the economic, environmental, and social contexts by providing the societies with the information and technology they need to deal with adversity. This knowledge can help to identify the challenges, as well as to generate an understanding from research influence policy and practice, thereby making a difference in the impacted populations by disseminating the DRR solutions to reduce the disaster impacts (Aitsi-Selmi *et al.*, 2015).

Western knowledge plays an important role in community resilience through early warnings, as well as information dissemination and it assists in the policy making procedures (Aitsi-Selmi *et al.*, 2015). Therefore, it is critical that all the spheres of government must identify the needs and the new knowledge gaps to make western knowledge more widely available and accessible. According to the Government Office for Science Disaster Concerns (GOSDC), an effective solution for DRR will be accessible by 2040, and it will be based on the western scientific advancement strategies that will be employed to try to mitigate the adverse effects of disasters (Government Office for Science, 2012). The information comes from recent scientific and social studies, as well as the lessons learned from a range of ongoing DRR activities (Government Office for Science, 2012). This approach focuses on how research and evidence may be used to better understand the future disaster risks to anticipate hazards and implement risk-reduction strategies (GOS, 2012). For that reason, combining improvements

in western thinking with the DRR strategies is even more vital to provide alternate solutions to the various issues that the vulnerable communities face.

The above definitions describe western knowledge as a body of knowledge that is based on specific rules that have been developed through the application of scientific method to the events in the real world. However, the essence of the above definitions revealed that the western knowledge capacities are interpreted broadly to include all the relevant resources and skills of a scientific and technical nature in activities such as natural, environmental, social and economic, as well as in the health and engineering sciences (UNCTAD, 2021). At the same time, it is noted that western knowledge has a magnificent part in investigating the impact of the disaster occurrences on natural and constructed environments in an interdisciplinary perspective. This entails defining the risks based on a basic understanding of the natural hazards, as well as an awareness of the sources of susceptibility and exposure to mitigate the disaster risks. For instance, disaster risk reduction has benefited from the Early Warning Systems (EWS) that spot danger at different geographical and temporal scales, as well as the design approaches that strengthen the resilience of the buildings and the infrastructures to a variety of disasters (WMO, 2018). Therefore, it is recommended that during the crises/disasters, the various DRM stakeholders should collaborate to build stable, innovative solutions for the benefit of long-term development. It is important to think about how western knowledge has evolved in the field of DRR and how it has been used throughout the study after having a strong understanding of what WKS is and its history. The next section illustrates the origin of western knowledge.

2.3.1 Historical Background of Western Knowledge

The western scientific knowledge has its roots in ancient philosophies (Egyptian and Greek), and it may be traced back to the major socioeconomic shifts in Europe (Aikenhead & Ogawa, 2007). Between 3000 and 1200 BCE, the contributions of Ancient Egypt and Mesopotamia to medicine inspired ancient Greek's natural philosophy, in which the formal attempts were made to establish the explanations for the occurrences in the physical world based on the natural causes (Lindberg, 2010). The fall of the Western Roman Empire reduced the knowledge of the Greek worldviews in Western Europe during the early Middle Ages (400–1000 CE), but it was retained in the Muslim world throughout the Islamic Golden Age (Subramanian & Pisupati 2010). The recovery and the assimilation of the Greek works and the Islamic inquiries into Western Europe from the tenth to the thirteenth centuries resurrected “natural philosophy” (HKT Consultant, 2020). This was later transformed by the Scientific Revolution, which began in the 16th century, and it saw new ideas and discoveries departing from the previous Greek

conceptions and traditions (HKT Consultant, 2020). In the 18th century, the western scientific method began to play a bigger role in knowledge creation (Schafersman, 1994). But many of the institutional and professional aspects of science, as well as the transition from "natural philosophy" to "natural science," did not appear until the 19th century (Schafersman, 1994).

The west has been defined by the philosophers and the historians as the "knowledge produced at a definite moment in history," and it was commonly considered that the Ionian school of Thales was the first to develop science through time (Liebenberg, 2013). The Western Scientific Revolution is regarded as having occurred during the Renaissance and the founding of "science" is tied to names such as Copernicus, Kepler, Galileo, and Newton from a Western European viewpoint (Huff, 2017). Western knowledge, which arrived with the colonists, and which was inspired by Western ethnocentrism, forced a homogeneous worldview on the colonisers, thereby giving the Europeans authority and control (Akena, 2012). The western scientific knowledge is viewed as being primarily forward thinking, with the goal of uncovering previously unknown occurrences, as well as broadening the understanding of the world, and proposing new solutions to the current issues (National Academies of Sciences, Engineering, and Medicine, 2019). Nevertheless, western knowledge took on a fundamentally new perspective, which accelerated with the advent of industrialisation at the end of the 18th century. This change therefore occurred during the Industrial Revolution, and it became a worldwide pursuit in the 20th century (Memmi, 2019; Rörsch, 2014).

Particularly, in the 19th century, many scientists were aware of the fundamentally creative nature of their work, and they did not hesitate to construct self-justifying historical portraits to increase the appreciation of their own contributions (Memmi, 2019). This knowledge is characterised as a turning point in the development of a field of knowledge that presents a new theoretical framework or a new systematisation and modernisation of notions (Le Grange, 2004). In 2019, the International Decade for Natural Disaster Reduction celebrated its 30th anniversary since it began in 1990 (Shaw, 2020). In the three decades, there have been substantial advances in science and its application in disaster risk reduction decision-making (Shaw, 2020). As a result, the disasters have impacted 200 million people worldwide since 1994, with the number growing every year (Rahman *et al.* 2017; Hiwasaki *et al.* 2014). In such cases, the western experience is usually used to develop a precise and scientific method to quickly deal with the disaster risk implications and the unplanned events (Martuzzi *et al.*, 2004). Over the last three decades, disaster science has evolved from a specialist technical study that is focused largely on reacting to emergencies to a broad-based worldwide movement that is intimately tied to Disaster Risk Reduction (DRR), sustainable development, and climate change (Aitsi-Selmi *et al.*, 2015). Western knowledge, which is constantly growing, becomes an essential and integral part of the disaster risk management systems (Schmid &

Hegg, 2006). Its evolution has also marked a shift in the role of science in risk and hazard management at the policy level, including disaster risk reduction practices, plans and ideas (Albris *et al.*, 2020). Implementing plans based on WK has also shown greater development sustainability, particularly in hazard monitoring and early warning systems, which has saved thousands of lives and represents a worldwide success story (Calkins, 2015; Pearson & Pelling, 2015). The next section concentrates on the benefits of using western knowledge to reduce disaster risk.

2.3.2 Benefits of using Western Knowledge in DRR

Over the past years, significant advancements in the integrated approach to the problem of natural hazards have been made due to the breakthroughs in the western knowledge of natural hazards and the related coping methods (Rathore, 2016). This transition, which has continued throughout the 20th century's industrial revolution and it, has resulted in swift, constructive improvements that have helped the disadvantaged communities (Chen *et al.*, 2021). This modernised knowledge has opened new channels and techniques for overcoming and managing the natural processes such as the sharing of information and providing education and training to empower the local populations to respond to the disasters (Chowdhooree, 2019). Furthermore, western knowledge drives progress by producing new ideas and ways, as well as by providing better standards for gathering the information about the hazards and their consequences (Basher, 2013:4; De Groeve & Valles, 2015).

Western knowledge has also proven to be essential in comprehending the features of the natural hazards originating from the atmospheric, geological, hydrological, and biological sources, as well as analysing how these risks become disasters (Natural Hazard Working Group, 2005). This demonstrates the knowledge's versatility in coping with both the predicted and the unforeseen disasters. The importance of western knowledge in providing policy evidence is expanding, as the need for multidisciplinary research to solve the complex and interconnected challenges of climate change, disasters, and sustainable development grows (Hellmuth *et al.*, 2011). Nonetheless, it would be amiss not to mention the significant positive benefits and contributions of such western knowledge to the field of environmental disaster and risk reduction such as the use of scientific data in flood forecasting and warning (Chowdhury, 2000). The other benefits are achieved through the use of Geographic Information Technology and the comprehensive datasets to identify the landslide-prone areas (Guinau *et al.*, 2005), or the use of complex scientific instruments to establish the up-to-date topographic data enabling the modelling of landslides (Stevens *et al.*, 2004). For instance, knowledge has demonstrated its magnificent role in August 2003, when a heat wave swept

Western Europe, particularly France, with temperatures reaching 40°C in Paris and causing approximately 14,800 deaths (Southgate *et al.*, 2013).

The French government took the lead in developing a scientific heat wave strategy by monitoring operations, as well clinical treatment recommendations for heat-related illness, and techniques for identifying susceptible people. There were also infrastructural upgrades, and home visiting programs that were in response to the event (Southgate *et al.*, 2013; World Health Organisation, 2004). In July 2006, France was plagued by yet another severe heat wave, with temperatures reaching 39°C and in this case much less deaths were caused with 2,065 fatalities (Southgate *et al.*, 2013). These negative consequences of the unforeseeable natural hazards are frequently the result of poor planning and decision-making (Pelling *et al.*, 2004). As a result of these disaster-related concerns, western knowledge has been chosen as a rapid response technique since it brings up new scientific and technical options for disaster mitigation (Basher, 2013). While the severity of disasters may be beyond human control, the risks and vulnerabilities they entail might be lessened through the advancement of western scientific knowledge, thereby giving rise to the concept of disaster risk reduction. Therefore, for western knowledge to be more widely adopted into disaster risk reduction, it must be useful, practical, and applicable in adversity to eliminate the calamities. The best practices of western knowledge for disaster risk reduction are discussed in the next section, as well as how they were used in the study.

2.3.3 Western Knowledge Best Practices for DRR

Recognising the best practice of integrating western knowledge into disaster risk reduction, the United Nations General Assembly Resolution declaring the International Decade for Natural Disaster Reduction (1990-1999) called for a concerted global effort to use existing scientific and technical knowledge, supplemented with new knowledge as needed, to underpin the adoption and implementation of the disaster prevention policies (International Strategy for Disaster Reduction, 2001). For instance, the International Decade for Natural Disaster Reduction was established with the assent of the United Nations member states in 1990, thereby marking a watershed moment in disaster risk reduction. Science, technology and engineering were important factors in the decision to develop the international natural disaster reduction decade (Shaw, 2020). However, its origin goes back to 1984, during the 8th World Conference on Earthquake Engineering in San Francisco, when Frank Press, the President of the National Academy of Sciences of the United States at the time, stated, "I believe there is a significant need, and much support can be found to establish an International Decade of Hazard Reduction" (UN, 1993). This resulted in a UN General Assembly resolution in 1987 and in the creation of the first decade of disaster reduction in 1990 (Shaw, 2020).

In 1991, the IDNDR formed the Scientific and Technical Committee (STC) (Shaw, 2020). The STC convened a formal conference in 1993 to push the science-based disaster risk reduction agenda further (UN 1993). The UN IDNDR did not have national representation at the time, the science and technology focal points from various nations were enlisted to discuss and promote disaster reduction with their governments (Shaw, 2020). In 1993, the third meeting of the committee on national programs, initiatives, and strategies for building and growing national competencies was held (UN, 1993; Shaw, 2020). The IDNDR Secretariat released Paper IDNDR/STC/1992/3 which detailed the state of national disaster mitigation initiatives that were based on the data that was given by the National Committees and Focal Points (UN, 1993; Shaw, 2020). The IDNDR committee members from Australia, China, Colombia, Costa Rica, Jamaica, Japan, Spain, Switzerland, Tunisia, and the United States gave presentations on the IDNDR country programs and progress in the disaster mitigation activities at the national level, while an STC member reported on the IDNDR developments in Africa (Shaw, 2020). In 1994, the World Conference on Disaster Reduction was developed in Yokohama, Japan and it formulated the Yokohama Strategy and Plan of Action for a Safer World (UN 1994). This document stressed the importance of research and technology, with more accessible technologies, as well as an emphasis on the early warning systems and it expanded ability across the nations to generate new science while also exploiting existing science (Shaw, 2020). Among the key points that were mentioned in the document were the importance of local and traditional knowledge, and its proper validation and acknowledgement, as well as the need to broaden the scope of science and technology to include the natural hazard-induced technological disasters (Shaw, 2020).

The International Decade, which took place in Geneva from July 5 to 9 in 1999 established a mandate on disaster reduction (IDNDR, 1999). As the disasters continue to damage the social and economic infrastructure of all the countries, the International Decade for Natural Disaster Reduction developed a strategy plan titled, "A safer world in the twenty-first century: risk and disaster reduction" (IDNDR, 1999). This strategy was established in recognition of the need for the international community to demonstrate firm political determination in reducing vulnerability to the natural and environmental hazards while also taking into account the needs of developing countries (IDNDR, 1999). Even though the natural hazards have particularly severe long-term implications for the developing countries, and they inhibit their long-term development, the natural hazards remain a major source of uncertainty for them (IDNDR, 1999). Even after then, western knowledge continues to display substantial advances in research and technology, as well as its application into disaster risk reduction decision-making. In another instance, the Hyogo Framework for Action 2005–2015 (HFA) was adopted as the first disaster framework to be implemented by the UN member states during the Second

World Conference on Disaster Reduction in Kobe, Japan, in 2005 (UN, 2005). While science and technology play a role in all five priorities of the framework, they are specifically mentioned in Priority 2, "Identify, assess, and monitor disaster risks and improve early warning," and Priority 3, "Use knowledge, innovation, and education to build a culture of safety and resilience at all levels" (Shaw, 2020).

The biennial World Science Forum, in its 5th edition was held in Budapest from November 17 to 19 in 2011, with major participants from around the world, including parliamentarians, scientists, policymakers, media representatives, and members of the civil society (UNESCO, 2011). These participants were gathered to discuss the emerging and existing global scientific concerns under the theme "The Changing Landscape of Science: Challenges and Opportunities" (UNESCO, 2011). Taking into account the reports of the biennial World Science Forum (WSF), as well as the debates and conclusions of this World Science Forum on the "Changing Landscape of Science: Challenges and Opportunities," these participants endorsed the current declaration (World Science Forum Budapest, 2011). One of the Forum's goals was to create a multidisciplinary and policy environment in which the participants could discuss how to improve science governance while safeguarding everyone's long-term future, including policy implications and science and technology powerhouses (UNESCO, 2011).

The 6th World Science Forum was held in Rio de Janeiro, Brazil, from November 24 to 27 in 2013, with the theme of "global sustainable development" in the forefront of participants' comments on western scientific challenges (UNESCO, 2013). The World Forum was founded in 1999, following the World Science Conference in Budapest, and it was co-organised by UNESCO and the International Council on Science (World Science Forum Budapest, 2013). The importance of science in innovation, as well as the linkages between science policy and governance, science and engineering education, and scientific integrity, was examined to establish updated scientific approaches for disaster response (UNESCO, 2013). At the conference, the scientists, parliamentarians, non-governmental organisations, educational and research institutions as well as the scientific journalists shared their thoughts on global sustainability, science policy, and governance to prepare for the future (World Science Forum Preparatory Meetings, 2013).

The Hyogo Framework evolved into the Sendai Framework for Disaster Risk Reduction 2015–2030 (Atisi-Selma *et al.*, 2016b; Shaw *et al.*, 2016). The Sendai Framework (UN 2015) aligns with the global frameworks such as the Sustainable Development Goals (SDGs) and the Paris Agreement, thereby emphasising the importance of the development-disaster nexus. In this context, the 2014 International Disaster Risk Conference (IDRC) in Davos analysed and presented the crucial issues addressing the current level of disaster risk reduction research

and technology (IDRC 2014). The conference stressed the importance of shifting from a "science of what" to a "science of how," to appropriately employ key skills and knowledge bases and to solve the "last mile" risk reduction problem (Shaw, 2020). The governments were advised to employ science and technology to develop their national disaster risk reduction platforms at the 2015 Tokyo Conference on the International Study of Disaster Risk Reduction and Resilience (Shaw *et al.* 2016).

According to the 2015 Tokyo Statement outcome paper, the governments must empower the national platforms to perform evidence-based disaster risk reduction for sustainable development (SCJ, 2015). The Sendai Framework (2015) clearly defines the roles of western knowledge in developing a comprehensive Disaster Risk Reduction strategy, including the cultural, social, economic, and the natural scientists working together as a distinct (collective) stakeholder (Calkins, 2015). The scientific and technology road map to assist the implementation of the Sendai Framework for Disaster Risk Reduction, which was later amended in 2019, was produced by the UN Office for Disaster Risk Reduction (UNISDR (2016), which became the UNDRR on 1 May 2019 (UNDRR, 2019b and Dickinson *et al.*, 2016). The road map includes 51 initiatives for each of the Sendai Framework's four priority areas (Chen *et al.*, 2021). These initiatives attempt to accomplish four objectives which are, expanding current information, promptly disseminating actionable knowledge to relevant users, statistically measuring progress toward DRR, and developing the decision-making skill at various levels (Chen *et al.*, 2021).

After Sendai in 2016, the inaugural Scientific and Technology Conference on the Sendai Framework for Disaster Risk Reduction 2015–2030 was convened in Geneva, and a worldwide science and technology roadmap to execute the Sendai Framework was agreed upon (Shaw, 20202). The main outcomes of the Science and Technology Conference were: (i) launching the UNISDR Science and Technology Partnership to support the Sendai Framework's implementation; and (ii) generating discussion and agreement on the content and endorsement process of the UNISDR Science and Technology Roadmap to Support the Sendai Framework's Implementation 2015–2030 (Aitsi-Selma *et al.* 2016a). "To assist the implementation of the Sendai Framework Science and Technology Road-map, the UNISDR Global Science and Technology Advisory Group has been enlarged in terms of scope and resources," said the UN Secretary-General in his 2018 report to the General Assembly (Shaw, 20202). Western knowledge is also recognised as being important in the 2030 Agenda, with Science, Technology, and Innovation (STI) being identified as a crucial instrument for implementation (Chen *et al.*, 2021). The Technology Facilitation Mechanism, which was started in September 2015 in compliance with the Addis Ababa Action Agenda, has also been formalised by the UN (Walsh *et al.*, 2020. It aims to increase international cooperation to

improve access to and the exchange of technology and information for sustainable development by boosting STI through multi-stakeholder engagement to accomplish the Sustainable Development Goals (Walsh *et al.*, 2020).

All of the above activities and initiatives demonstrate the importance of science and technology in monitoring the hazards and vulnerabilities, thereby creating knowledge of their ever-changing patterns, and establishing tools and procedures for disaster risk reduction. In changing societies, the scientific and technological community should focus on spreading and applying novel techniques and processes to protect lives, livelihoods, and property. The limits of science and technology in resolving the people's problems and detecting as well as mitigating threats, on the other hand, must be properly recognised. At the same time, an overemphasis on the technological talents at the expense of the human factors that make up society's economic, social, and political dimensions would provide unsatisfactory outcomes in the long-term risk reduction efforts. In particular circumstances, science and technology can be misapplied in specific situations, thereby posing or exacerbating risks. Therefore, it is critical to synergise both the indigenous and western knowledge strategies into a robust and long-term solution that benefits the present and the future generations. The next section discusses the importance of synergising indigenous and western knowledge in disaster risk management.

2.4 Significance of Synergising Indigenous and Western Knowledge in DRM

Simultaneously using both western and indigenous knowledge is not a new phenomenon. An important concern is that the two were not clearly defined and conceptualised (Kaya & Seleti, 2013) based on their historical context, as well as their philosophies and also based on their distinguishing qualities (Tinnaluck (2004). Lander (2000) and Chavunduka (1995) believe that there has been a lack of understanding of the holistic character and the approach of the non-western means of knowing and the knowledge generation since the arrival of the western worldview in Africa and in other non-western nations (Kaya & Seleti, 2013). Since time immemorial, indigenous knowledge has had a close relationship with western knowledge, and both systems give actual facts and insights that may be applied to a range of challenges (Agrawal, 1995). A growing number of academics advocate the amalgamation of these two knowledge systems by claiming that indigenous knowledge must first be integrated with a western understanding before it can be employed in disaster risk management policies and practices (Hiwasaki *et al.*, 2014b).

The indigenous and western disaster risk management knowledge and the practices complement each other in enhancing the indigenous people's resilience to the natural hazards

(Balay-As *et al.*, 2018). Furthermore, when beneficial local knowledge is joined with appropriate western methodologies, a blend of effective and usable knowledge is created, which could lead to new disaster risk management opportunities (Gaillard & Mercer, 2013). This approach was promoted during the United Nations General Assembly's International Decade for Natural Disaster Reduction, when a resolution called for a concerted global effort to use the existing western, technical, and local knowledge in each country, while adding new knowledge as needed to underpin the adoption and the implementation of the disaster prevention policies (United Nations International Decade for Natural Disaster Reduction (UNIDNDR, 1994).

The western predictions are increasingly being combined with the indigenous forecasts to enhance the weather and seasonal climate information at the local level (Nyadzi, 2020). For example, the farmers in Northern Ghana are dissatisfied with the accuracy of the western forecast data, so they rely on their own indigenous predictions to make adaptive decisions. As a result, they devised a strategy to address the problem which was developing an Integrated Probability Forecast (IPF) method that combines the western and the indigenous forecasts into a single forecast and testing its reliability (Nyadzi, 2020). Even though there is widespread agreement among the scientists that the indigenous and the western knowledge systems have a great potential to strengthen the socio-ecological resilience through the development of sustainable environmental management strategies, very few ecological studies have attempted a pragmatic and deep integration of these knowledge sources (Vadigi, 2016). This is due to the lack of a comprehensive process implementation policy on how indigenous and western knowledge can be best synergised (Booth *et al.*, 2020:6; Patnaik & Bhowmick, 2020).

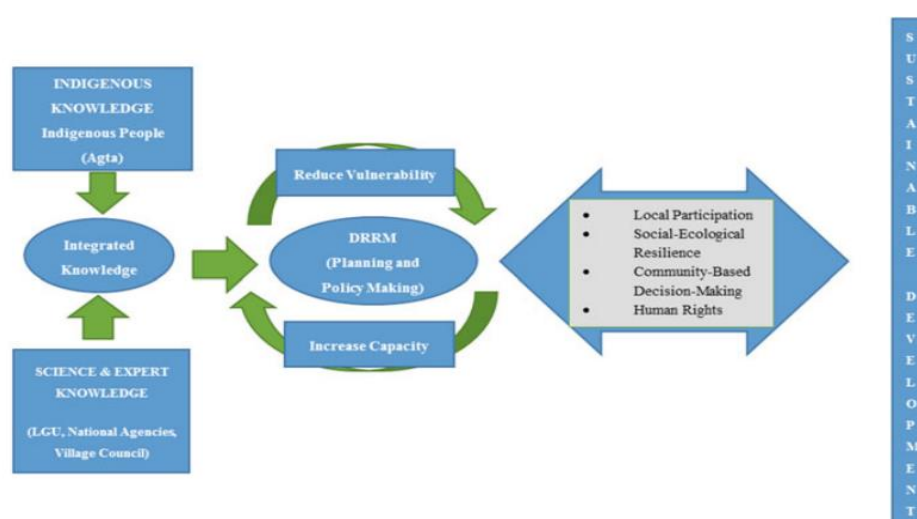


Figure 2.2: Indigenous and Western Knowledge in DRM towards Sustainable Development. Source: Shaw (2015)

The framework in Figure 2.2 highlights the interaction of the disaster risk management stakeholders and the importance of DRR as a foundation for effective long-term development, given the large number of disasters which have resulted in, depleted resources, a weak economy, and rising poverty (Pelling *et al.*, 2014). In many cases, the disasters destroy livelihoods and assets on a huge scale, thereby slowing development and trapping the most vulnerable such as the indigenous people to the vicious cycle of poverty (Uitto & Shaw, 2016). This fact exemplifies the tight relationship between the disasters and development which disproportionately impacts the poorer countries (Collins 2013). This framework also recognises the importance of the indigenous people' and the scientific specialists in contributing to the development of sustainable development in their respective fields (Uitto & Shaw, 2016). The biggest challenge is a lack of leadership and stakeholder participation in the disaster-related matters (Mtshengu, 2017).

The trend seems to be that western knowledge is still predominant and it seems to be the preferred choice when it comes to the disaster management strategies (Poljansĉk *et al.*, 2017). It is essential to reinforce the existing theories and policies as well as to foster effective disaster risk reduction through the incorporation of indigenous knowledge and western knowledge (Booth *et al.*, 2020). Naidoo (2007) and Iloka (2016) suggest that these knowledge systems should complement each other so that their integration would achieve more than when they are separated. This growing trend of combining both knowledge systems could aid the policymakers in developing multi-level, multi-hazard, and multi-disciplinary disaster management policies (Karki *et al.*, 2011). This process necessitates a reciprocal comprehension of each other's cultural and material foundations for the benefit of sustainable development (Agrawal, 1995). The next section discusses the benefits of using both the indigenous and the western knowledge systems simultaneously in DRM.

2.5 Benefits of Simultaneous Use of Indigenous and Western knowledge Systems

Since the early 1970s, indigenous knowledge has enhanced disaster preparedness (reducing the negative impact of natural disasters of varying scale, intensity, and severity), albeit slowly in the disaster risk reduction area (Hiwasaki *et al.*, 2014a). This knowledge has also helped the communities to cope with a variety of unfavourable disasters such as droughts, floods, as well as epidemic disease outbreaks and it is still relevant today as the local communities face the problem of rapid population expansion and the overexploitation of the natural resources (Nyong *et al.*, 2007). The citizen research for disaster risk reduction on the other hand has shown great potential in terms of expanding western knowledge by giving early warnings of hazards, and by contributing to impact assessment and management (Hicks, 2019). Albris *et al.* (2020) further allude that western knowledge is gradually becoming a vital and integrated

element of the disaster risk management systems in development, thereby resulting in a spectacular role in the western risk and hazard management at the policy level, including in practices, plans, and policies. This demonstrates the need for amalgamating knowledge since one's weakness becomes another's strength. The Philippines usually incorporates the local data for disaster risk reduction into a Geographic Information System (GIS) to map the landforms and topographic landmarks, land cover and use, and infrastructure with the help of the indigenous people, the planning officers, the local Non-Governmental Organisations as well as the municipal councillors (Wang *et al.*, 2019). Such collaboration demonstrates the effective relationship between knowledge integration (Wang *et al.*, 2019). Therefore, it is very vital to use each knowledge system's strengths to build a balance so that one's weaknesses may be compensated for by the strengths of the other (Hiwasaki *et al.*, 2014a).

Figure 2.3 depicts the process of integrating indigenous and western scientific knowledge into disaster risk management. According to Mercer *et al.* (2010), this framework arose from a participatory research effort in three rural communities in Papua New Guinea (PNG) that had been impacted by landslides, floods, and volcanic eruptions. The figure shows how the communities could recognise the value of indigenous and western scientific knowledge in preventing the disasters (Méheux *et al.*, 2006; Kelman *et al.*, 2006). By following the steps provided in the model, the vulnerable communities may build solutions that blend the indigenous and western scientific knowledge systems in a more culturally and compatible approach to reduce disaster risk susceptibility (Pelling & Uitto 2001; Kelman *et al.*, 2006; Méheux *et al.*, 2006; Mercer *et al.*, 2007; Kelman, 2007).

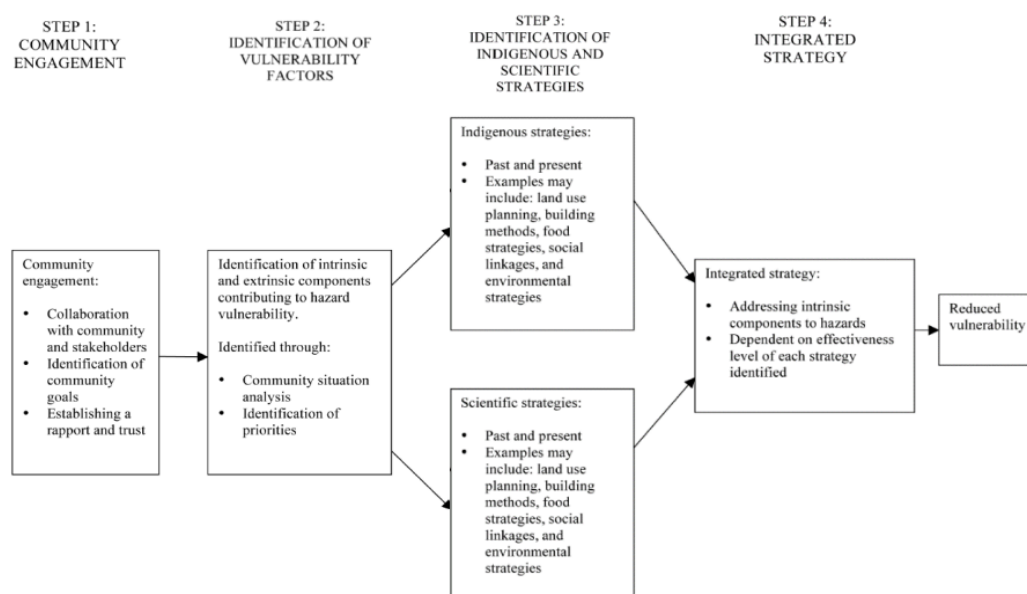


Figure 2.3: Process of Integrating Indigenous and Western Knowledge. Source: Mercer *et al.* (2010)

The approach is useful for identifying the indigenous knowledge that is utilised by the communities in the Buffalo City Metropolitan Municipality to cope with disaster risk, with the ultimate goal of determining how this knowledge may be integrated into western scientific knowledge and into the disaster risk reduction policies to further reduce vulnerability. Simultaneously, the legislative framework process in disaster risk management provides a platform for developing the strategies that promote the reduction processes among the policymakers, as well as among the spheres of government from the district, and the provincial, and the national levels, by devising measures or strategies (to prevent disasters or mitigate the effects of disasters if they do occur), and putting designed plans into action to provide well-being (Pelling & Holloway, 2006:7; Nkabane & Nzimakwe, 2017).

Moreover, the above framework offers guidance on how to implement new and existing instruments, policies, programs, guidelines, and standards to support the risk reduction strategies based on the following priorities: (i) Understanding disaster risk, (ii) Improving disaster risk governance to manage disaster risk, (ii) Investing in disaster risk reduction for resilience, and (iii) Improving disaster preparation (Zuccaro, 2020). However, there has been much debate over the last several decades about the best methods to deal with the impacts of the natural hazards and how to shift the disaster risk reduction strategies to more proactive expenditures in prevention and preparedness. Unfortunately, the ways to manage the consequences of the natural hazards are less than the current challenges (Scolobig *et al.*, 2015).

Additionally, knowledge is required for informed decision-making and for coordinated action in the disaster risk management policy and legal framework (Weichselgartner & Pigeon 2015). For instance, South Africa's efforts to develop the DRM legislation which began in 1994 demonstrate the critical importance of skilled and insightful political stewardship; the sustained individual energy and the required commitment of those at the forefront of the reform process. The efforts also highlight the positive value of the coherent and consistent messages from the international partners supporting the reform process (Pelling & Holloway, 2006). This means that the legislative framework should include the prescriptive and the policy instruments that assign the roles and responsibilities to various public sectors, businesses, academia, and civil society, as well as allow for the implementation of the DRM actions in each sector that is aimed at improving citizen participation and facilitating access to the information by the stakeholders or by those who require it (Weekes & Bello, 2019). The problem is that improved knowledge has not been enough to reverse the downward trend in community resilience, so the question remains as to why the existing knowledge is not always applied or used appropriately, and how the existing knowledge, particularly community knowledge can be maintained by improving the existing knowledge (Rahman *et al.*, 2017).

Chapter Summary

This chapter presented an overview of the indigenous and western knowledge argument by focusing on the field's development and the reasons for their popularity in disaster related matters. According to various academics, the local and indigenous knowledge are more committed to their history and to the elders' teachings since their knowledge is passed down from generation to generation and the information from outside their community is more difficult to absorb. Other academics on the other hand, demonstrated that western knowledge gives capabilities and coping mechanisms that aid in the speedy recovery from calamities. Other academics have however shown that indigenous knowledge has been overlooked since western knowledge was assumed to contain all the answers to the disasters.

However, things are beginning to change as both the knowledge systems are exhibiting important worth in addressing the unsolved disaster risk concerns for long-term development. From the discussion, it is evident that both indigenous and western knowledge have provided the local communities with diverse advantages and techniques for overcoming adversity. This has been established on several occasions where these knowledge systems have showed that they have a plethora of information and experience in their various domains of expertise. As such, the study recommends that the IK from the local people and the WK from the DRR role players must collaborate to avoid and overcome many hazardous events. Therefore, it is critical to integrate the indigenous and scientific information and to apply it to the DRR and the DRM activities, such as the developing frameworks and the conceptual models for the development of knowledge in disaster related matters.

CHAPTER THREE

INTEGRATION OF INDIGENOUS AND WESTERN KNOWLEDGE SYSTEMS KNOWLEDGE: A LITERATURE REVIEW

3.1 Introduction

The advocacy for the use of both the indigenous and the western knowledge systems is gaining prominence globally (Bacud, 2018; Ramutsa, 2020). This increased appreciation of the importance of using both knowledge systems has generated ideas for its application in DRR with the aim of developing long-term solutions (Mercer *et al.*, 2009). The integration of the two forms of knowledge in DRR aims to reduce the risks and the impacts of disasters and to improve the communities' resilience to the hazards (Balay-As *et al.*, 2018). Dei (2000) opines that the indigenous and western knowledge systems are incorporated into the daily social activities using adaptable concepts to expand their collective bodies of knowledge. Simultaneously, the effective DRR policies are also recognised as being critical for protecting the livelihoods because they provide an environment in which the people and the families may establish and adapt livelihood opportunities (Domfeh, 2007).

However, the existing policies and frameworks appear to be insufficient to support and foster the global knowledge promotion and preservation (Domfeh, 2007). These DRR frameworks tend to place a greater emphasis on western knowledge than on indigenous knowledge (Domfeh, 2007). This is traceable to the fact that the indigenous knowledge practices are not written down which poses challenges in terms of preservation and in terms of the protection of the disaster related matters (Msuya, 2007; Hilhorst *et al.*, 2015). As a result, the disaster risk management practitioners ignore the indigenous knowledge practices while dealing with the disasters (Agrawal, 1995; Briggs, 2005; Dube & Munsaka, 2018).

The objectives of the study were to evaluate the current theoretical underpinnings pertaining to the integration of IKS and WKS in the DRM policies, identify the IKS strategies to close the gaps from western knowledge as well as to draw recommendations on the ways to integrate both knowledge systems in the DRM policy. This chapter examines the strategies and the frameworks that have influenced the importance of integrating IKS and WKS within DRR. Further, the chapter discusses how the indigenous and the western knowledge systems may be included into the DRR policy and legislations. After that, the gaps and the opportunities in the simultaneous application of indigenous and western knowledge for successful disaster risk management are discussed and lastly, the conclusions for the chapter are provided.

3.2 Strategies and frameworks that have shaped the need for and the importance of the integration of IKS and WKS in DRR

The local and international frameworks as well as the initiatives emphasise the importance of incorporating indigenous and western knowledge into the disaster risk management interventions in the local communities (Mercer *et al.*, 2010). In the next sections, the importance of international and national disaster risk reduction policy and legislative frameworks in enabling the implementation of both the indigenous and the western knowledge systems is discussed.

3.2.1 International frameworks promote the use of both indigenous and western knowledge systems in disaster risk reduction

Globally, integrating the indigenous and the western knowledge systems has been seen as a crucial possibility for moving towards more sustainable and resilient development (Hill *et al.* 2020:10). For instance, the paper titled "Western and indigenous knowledge", in 2001, as well as the International Union of the History and Philosophy of Scientific (IUHPS) motivate the scientists to learn from the aboriginal fundamentals of indigenous knowledge for a brighter tomorrow (Bala & Gheverghese-Joseph, 2007). However, there is currently no well-articulated framework demonstrating how the two might be linked to lessen the disaster risk hazards (Mercer *et al.* 2010). Due to the lack of knowledge about how to integrate the two knowledge systems into disaster risk management policies and frameworks, the gap between them remains too wide (Nkabane & Nzimakwe, 2017). This shows that more work needs to be done and that there is a need for the specific merits of both the western and the local initiatives to be evaluated to establish their long-term sustainability in lowering community vulnerability.

Nevertheless, The Hyogo Framework for Action 2005 was approved during the Second World Conference on Disaster Reduction (UNISDR, 2015). The HFA was the first worldwide strategy to establish a commitment across all the levels of government to improve and build the resilience from the countries to the communities to prevent, reduce and mitigate the negative consequences of disaster risks (UNISDR, 2015:11). The HFA Conference also emphasised the significance of integrating indigenous knowledge into the community resilience and development efforts (ISDR, 2005). This Framework has also been acknowledged in the note "support the development and sustainability of western knowledge and institutional capacities needed to research where possible forecast natural and related hazards vulnerabilities and disaster impacts". This shows that the HFA understands the value of indigenous and western knowledge in the communities, as well as their relevance and effectiveness in the disasters.

However, despite making substantial progress in the western and indigenous capacities in DRR throughout the implementation of the HFA, western knowledge and academic community have made ongoing promises to help in the implementation of the Sendai Framework (Shaw *et al.*, 2016).

The Sendai Framework dramatically expanded the scope of DRR to include both the natural and the man-made disasters, as well as the related environmental, technological, and biological risks (UNISDR, 2015). The indigenous people were specifically mentioned in two sections of the Sendai Framework (2005): Section 24 (i) of the Sendai Framework (2015-2030) to ensure the effective and efficient use of indigenous peoples, including their local knowledge and activities, as well as the appropriate complementary use of indigenous and western knowledge in disaster risk assessment, sustainable development, and the implementation of policies, strategies, plans, and programs for multi-sectoral and multidisciplinary knowledge practice. Section 36 (a) (v) states that the indigenous peoples play a critical role in building community resilience and in strengthening sustainable development. They also ensure that the plans and the coping mechanisms such as early warnings and information dissemination are properly implemented based on their experience and traditional knowledge.

The Sendai Framework has also acknowledged the importance of western knowledge and there is a significant push to further it (Shaw *et al.*, 2016). Simultaneously, Priority 1 of the Sendai Framework encourages the use of appropriate and robust generally accepted processes and the WK to improve national risk assessment and disaster loss accounting (UNISDR, 2015). This priority can be effectively accomplished by improving the western community's research and innovation capabilities, as well as the DRR practitioners' understanding of the applicability of the novel tools and approaches (Shaw *et al.*, 2016:340). Priority 3 of the Sendai Framework encourages the diverse stakeholders to collaborate to improve western knowledge investment (UNISDR, 2015). This means that meaningful research and the expanded access to higher education can help the communities and society to become more resilient through education and training (Shaw *et al.*, 2016).

Priority 4 of the Sendai Framework includes the evidence-based models for increasing resilience through the recovery processes by promoting enhanced, pre-disaster recovery that is supported by WK to improve the effective implementation of the disaster recovery efforts (UNISDR, 2015). The Sendai framework emphasises the need to "enhance western knowledge on DRR through the coordination of existing western research institutions at all levels and in all regions" (UNISDR 2015b). This framework calls for a stronger science-policy interface to support all four priority areas which are: understanding disaster risk, disaster risk

governance, investing in DRR for resilience, and enhancing disaster preparedness for response and recovery (Shaw, 2017). It also recommends for the direct integration of the local indigenous and western methods that were developed by experienced people in the disaster risk reduction plans and policies (Lambert & Scott, 2019:5). Unfortunately, tracking the progress in proper indigenous community involvement remains a big theoretical and practical challenge (Lambert & Scott, 2019).

All the above-mentioned initiatives demonstrate the significance of integrating IKS and WKS into the disaster risk-related matters to develop new modernised mitigation strategies, while also providing alternative solutions to the hazardous situations. Therefore, it is worth noting that integrating policies and legislation into IKS and WKS with the government spheres has a big influence on developing the DRR plans for future occurrences since one of the major tasks of any government is to ensure the safety of its citizens using different disaster risk reduction approaches. In the next section, the role of the national DRR policy and legislative frameworks in promoting the use of both the indigenous and the western knowledge systems is illustrated.

3.2.2 The role of DRR policy and legislative frameworks in promoting the use of both indigenous and western knowledge

Indigenous knowledge provides a firm foundation for establishing the local and national adaptation policies as well as the action plans while combining the indigenous and western knowledge systems to make the policies more practical and cost-effective when dealing with unexpected events (Karki *et al.*, 2011). Many countries throughout the world have employed indigenous and western knowledge systems as stand-alone approaches to deal with disasters (Mercer *et al.*, 2009:158) since there are no policies or frameworks for integrating indigenous and western knowledge in disaster risk reduction (Nkabane & Nzimakwe, 2017).

The Philippines have stressed the importance of the indigenous people in the Disaster Risk Reduction Act. The Philippine Disaster Risk Reduction and Management Act of 2010 established the foundation for a paradigm shift from disaster preparedness and response towards Disaster Risk Reduction and Management (DRRM). The Act emphasises the critical importance of institutionalising the DRRM policies, structures, coordination mechanisms, and programs, as well as continuing the budget appropriation for DRR from the national to the local levels by using coping mechanisms that are based on western scientific knowledge and continuous learning through knowledge development as well as the management of good DRRM practices on the ground. This Act also highlights the importance of western expertise in areas such as early warning systems, better construction techniques, more appropriate education and a stronger focus on communication as well as community participation.

Bangladesh has several laws, policies and regulations on disaster risk reduction (Shaw *et al.*, 2017). However, the appropriate role and responsibilities of science and technology in DRR related decision- making, policy formulation and implementation processes are still not clearly defined and/or negligible (Shaw *et al.*, 2017). Nonetheless, Bangladesh's National Science and Technology Plan (NSTP) aim to help the country to accomplish its development goals by utilising science and technology effectively (Bangladesh Government, 2011). The reviewed NSTP's main goal is to ensure that Science, Technology, and Innovation (ST&I) are used to achieve long-term economic growth while paying special emphasis to job creation, poverty reduction, gender equity, and environmental sustainability (Bangladesh Government, 2011). The government of Bangladesh believes it is time to revise its national science and technology policy (Shaw *et al.*, 2017).

Bangladesh currently recognises that overcoming the mounting difficulties of satisfying the people's basic needs, maintaining a good standard of life, and speeding up economic development would require the support of science and technology, given the limitations of her factor endowments (Bangladesh Government, 2011). As a result, it is critical to give scientific and technological issues a high national priority in the country's overall development strategy (Shaw *et al.*, 2017). In contrast to the Sendai Framework for Disaster Risk Reduction, the following actions have been identified as being vital for successful risk reduction and sustainable development at the global to the local level in Bangladesh through various plans, policies: (Shaw *et al.*, 2017).

- Reducing disaster risk by incorporating traditional, indigenous, as well as local knowledge and practices;
- Encouraging scientists, policymakers, the private sector, and the community leaders to form intergenerational partnerships;
- Establishing collaborations between the scientific and the technological communities as well as the disaster risk management institutes and agencies;
- Encouraging the use of information and communication technologies as well as real-time or near-real-time access to credible data;
- Using a multi-hazard approach that incorporates the lessons learnt from the trans-boundary, the biological, and from the technological risks;
- Developing inter-disciplinary national science and technology strategies to support the Sendai Framework's implementation by focusing on the disaster risk management plans at the universities and at the colleges;
- Strengthening the collaboration between the local governments, academia, and the other partners to promote the local communities' knowledge and traditions, as well as to sustain and reproduce numerous local science-based decision-making best practices;

- Creating and strengthening the links between the Science, Technology, and Academia (STA) institutions, as well as forming a network of associated governmental, regional, and worldwide organisations.

In Indonesia, the Law No. 24/2007 on Disaster Management has served as the foundation for disaster management in the country (Indonesian Government, 2007). In the country, the advancement of western knowledge is a necessary condition for the creation of the DRR programs (Indonesian Government, 2007). The development of western knowledge is carried out through ministries and institutes such as but not limited to the Meteorology and Geophysics Agency, the Geological Agency, and the Ministry of Public Works. However, as more disaster risk challenges emerge, the western knowledge developments in the realms of disaster assistance and climate change are becoming increasingly important (Shaw *et al.*, 2017).

Moreover, the Indonesian disaster risk reduction action plans are evidence-based, and the disaster risk assessments are based on scientifically validated data and procedures (Indonesian Government, 2007). This demonstrates the critical role that is played by western knowledge in boosting Indonesia's disaster risk reduction system, as well as in improving science and technology which directly increases a country's capacity to cope with disasters and climate change (Shaw *et al.*, 2017). Section 7(e) of Law No. 24/2007 on Disaster Management requires the government to develop a policy on the use of western knowledge in the event of a probable disaster threat or a hazard to minimise its impact.

The purpose of Law No. 24/2007 is to establish a national DRR movement that is people-centred, comprehensive, as well as fair and sustainable. The purpose is also to practice effective risk governance which is supported by western knowledge as well as local knowledge. This legislation also defines and assigns the tasks and responsibilities in disaster risk reduction to the government and to the other stakeholders at all levels, thereby allowing DRR to be used as part of the country's national development plan and international diplomacy (Indonesian Government, 2007). However, despite the fact that tremendous progress has been achieved, the Indonesian government has developed a road map for the National Disaster Risk Reduction Plan through 2030, with the goal of incorporating the Sendai Framework for Disaster Risk Reduction into national the disaster risk reduction initiatives (Indonesian Government, 2007).

3.2.3 South African National Policy and the Legislative Frameworks promoting the use of IKS

The studies across Africa have shown that the majority of the people, including those in South Africa, still rely heavily on IK to survive in the face of disaster risk difficulties (Limpopo

Department of Agriculture, 2008). In South Africa, IK began to emerge and gain respect in 1994 following the fall of the apartheid regime. After 1994, IK according to Akenji (2009:25) became a crucial part of the rebuilding of the South African Science and Technology space. Many locals have successfully used IKS to construct their own coping mechanisms over time to make the most of their natural surroundings (LDA, 2008). Realising the importance of IKS, every country should make an effort to put in place an IKS policy that fosters a better understanding of the significance of indigenous and local communities and their historical and cultural context (Domfeh, 2007). Although, it does not seem like that the current policy and legislative frameworks are sufficiently supporting the promotion and preservation of IKS around the world (Domfeh, 2007), South Africa has worked to increase the place of IKS in the country's social and economic growth by promoting and protecting it through policy and legislations (Shonhai, 2016). One of South Africa's regulations that demonstrate its commitment to encouraging the promotion of IKS in policy and legislative frameworks by working to increase the significance of DRM in the subsequent years is the policies and frameworks that are listed below.

3.2.3.1 South Africa Green Paper on Disaster Management, 1998

In 1994, the South African government made the decision to take a more comprehensive approach to managing disaster risk. The Green Paper on Disaster Management was the first policy document that was integrated on disaster management as the addition after the Civil Protection Act of 1977 (Zuma, 2012). The Green Paper approach was developed as a theoretical foundation for disaster management and risk reduction (Vermaak & Van Niekerk, 2004). The Green Paper on Disaster Management, 1998, showed recognition of IKS in Section 6.1, which encouraged and supported the use of IK, new technologies, and the research advancements in risk reduction and disaster management initiatives. The policy placed a strong emphasis on the benefits of enhancing the relationship between indigenous and western knowledge systems in order to lower the likelihood of disasters and provide coping strategies for individuals who might be adversely affected.

3.2.3.2 South Africa White Paper on Disaster Management, 1999

In 1999, the White Paper on Disaster Management outlining the government's plan for managing South Africa's disaster risk was released (NDMC & Reid, 2008a). The White Paper on Disaster Management which builds upon the original work of the Green Paper, clearly focuses on risk and disaster reduction with a focus on the regional and global patterns as well as on development (Vermaak & Van Niekerk, 2004). Nevertheless, the White Paper introduced a new paradigm in the management of disasters, by placing an emphasis on risk

reduction and preparedness, in addition to the historical response and recovery function of civil protection (BCMM, 2012). In the White Paper on Disaster Management, the indigenous knowledge was acknowledged as being significant. For example, Section 2.1.2 emphasises the value of indigenous and western knowledge in managing the disaster threats since they might have a significant impact on the local forecasts of technology and environmental issues. This policy encourages the integration of western and indigenous knowledge as early warning systems to help communities prepare for and manage disasters before, during, and after they occur.

3.2.3.3 South Africa National Disaster Management Act, 57 of 2002

The Disaster Management Act 57 of 2002 was passed by the South African government in January 2003 (South Africa, 2002). The Disaster Management Act of 2002 (South Africa, 2002) Section 17(2) Sub section (g) acknowledges the significance of indigenous knowledge. The DMA made it clear that the electronic database that was created by the NDMC must include comprehensive data on the disasters that have occurred or may occur in Southern Africa and the DRM issues including the data on IK pertaining to DRM. This act provides a national, provincial, and municipal disaster management policy that focuses on disaster risk reduction, disaster severity mitigation, emergency preparedness, rapid and effective disaster response, as well as the post-disaster recovery to minimise any disastrous outcomes. The Disaster Management Act, Section 53 (2) (f) emphasises the importance of taking indigenous knowledge into account when preventing unfavourable events. The traditional council's significance and involvement in fostering indigenous knowledge for sustainable development and disaster risk reduction is also acknowledged in the Act. The aim of this Act is to give all levels of government the guidance on how to conduct disaster management to reduce, mitigate, and prevent the disaster risks and occurrences.

3.2.3.4 Indigenous Knowledge Systems (IKS) Policy 2004

According to Mosimege (2005), in November 2004, the Cabinet approved the Indigenous Knowledge Systems Policy, thereby marking the beginning of South Africa's efforts to identify, affirm, develop, promote, and defend the indigenous knowledge systems. It is established that indigenous knowledge has always been and will continue to be the most important component in the majority of the South Africans survival and well-being (Department of Science and Technology, 2004). David Hanekom, a Deputy Minister of Science and Technology reported that the policy aims to improve the awareness of the historical and cultural context, as well as the value of the indigenous and the local communities, by acknowledging the IKS on its own terms which brings together essential variables that function as the catalysts for the IKS holders and for the practitioners' development and economic viability. The policy will also

benefit from the inborn strategies to respond positively to a rapidly changing environment through which the indigenous and local communities as well as the individuals can share equitably on the social and economic opportunities of South Africa. Rob Adam, a Director-General of the Department of Science and Technology further alludes that the necessity of both discovering and conserving indigenous knowledge is garnering growing attention from the policymakers around the globe as there are laws and legislative frameworks that are being formed. The Republic of South Africa declares its commitment to the acknowledgment, promotion, development, protection, and to the affirmation of the IKS (Department of Science and Technology, 2004).

3.2.3.5 South Africa National Disaster Management Policy Framework, 2005

The National Disaster Management Framework was published in the Government Notice 654 of April 2005 as the legal instrument to create a consistent, open-book, and inclusive policy on disaster management for South Africa (NDMC, 2009). The National Disaster Management Framework is made up of four Key Performance Areas (KPAs) and the three supporting enablers that are needed to accomplish the KPAs' goals (NDMC & Reid, 2008a). The specific objectives and the Key Performance Indicators (KPIs) as mandated by the Act are used to inform the KPAs and the enablers to direct and monitor progress (NDMC, 2009). Additionally, each KPA and enabler closes with a set of recommendations that will be shared by the NDMC to help the framework to be implemented in all the three realms of the government (NDMF, 2005). Section 1.3.2.2 of the National Disaster Management Policy Framework, 2005, stipulates that indigenous knowledge and the traditional leaders' involvement must be taken into account in all the efforts to create communities that are aware, vigilant, and self-fulfillment. This section also requires the municipalities to prioritise the initiatives that are aimed at DRR in their IDPs, as well as to enhance the community comprehension of the concepts and the values of DRR and involve the local populations in the construction of disaster risk profiles. Section 1.2.2.2 emphasises the importance of the effective communication channels to the communities for disseminating the information on the DRR strategies, preparedness, response and recovery in DRM, as well as by giving communities the access to the resources in the event of an emergency. Section 1.3.2.2 states that as disaster risk reduction is a community-driven strategy, all the community needs and goals must be taken into account when assigning the tasks and developing projects and programs.

The aforementioned discussions have highlighted the activities for acknowledging Indigenous knowledge. The discussion made it evident that the efforts to preserve indigenous knowledge predate the 1990s; even before that time, they had a significant impact on disaster risk reduction. Even though the initiatives to advance indigenous knowledge have just recently

started, great progress has been made in its advancement and preservation. The national and international initiatives in terms of policies, regulations, and programs serve as evidence of this. The following section discusses the best ways to make use of indigenous knowledge.

3.3 Ways in which the indigenous and western knowledge systems can be incorporated in DRR Policies and Legislation

Roba (2008:60) defines the integration of the indigenous and western knowledge systems as a process of merging logical decision-making information exchange and the understanding of the differing views between the indigenous populations and the western scientific educated specialists. Berkes *et al.* (2007) argues that the integration of the indigenous and western knowledge systems is a process including the active engagement of the indigenous peoples and their knowledge, as well as an equitable sharing of authority and duties between the scientists and the indigenous people. The integration knowledge systems may play a critical role in the disaster risk reduction strategies and policies which can be applied in the local communities (Lambert & Scott, 2019). The local knowledge can help to improve the government policies and to encourage the impacted communities to participate in policymaking (Mercer *et al.*, 2009). The International Scientific Community backs the aforementioned statement, which acknowledges the importance of IK and approves it by recommending that the IK and the WK be included in the DRR policy so that their critical role can be recognised (Mwaura, 2008). Millar (2007) states that the combination of both the knowledge systems into policies can empower the communities to take a more proactive role in mitigating and preventing the localised hazards to a greater extent and more effectively, thereby meaning that the complete integration of the two systems is the solution to their problems. However, despite prioritising the need to adapt to the effect of disasters, the policymakers should work to integrate the local knowledge with the current western knowledge by learning from the local communities who have long adapted to those socioeconomic changes (Karki *et al.*, 2011). This growing trend combines both the knowledge systems depending on the local circumstances which could aid the policymakers in developing multi-level, multi-hazard, and multi-disciplinary adaptation plans, as well as policies, strategies, and programs to improve resilience (Karki *et al.*, 2011).

The Pan American Health Organisation (PAHO) (2014) has developed a strategy on the indigenous peoples and disaster risk reduction that aims to improve the knowledge and the understanding of the disaster risk related matters and needs that are faced by the indigenous peoples, as well as to develop a mechanism to better protect and improve their health during and after the disasters. In 2011, a project focusing on the local and the indigenous knowledge that is connected to the hydro meteorological disasters and climate change in Indonesia was

formally established (Hiwasaki *et al.*, 2014b). This initiative was executed in close collaboration with the government agencies, the research institutions in the three nations and with the Japanese specialists by the United Nations Educational, Scientific, and Cultural Organisation (UNESCO) Jakarta Office. After two years, the project has produced the tools for integrating the indigenous and the western scientific knowledge to assist the communities in predicting, mitigating, and adapting to the hazards, as well as the education and communication materials on hydro-meteorological hazard risk reduction and climate change impacts (Hiwasaki *et al.*, 2014b).

The World Conference on Science issued the "Declaration on Science and the Use of Western Scientific Knowledge," which calls for the broad collaboration between the science and the local cultures in addressing future challenges (Hiwasaki *et al.*, 2014b). The conference noted that the "traditional and local knowledge systems" are the "dynamic expressions of perceiving and understanding the world, which can make and historically have made, a valuable contribution to science and technology" (ICSU 2002). This initiative which focuses on integrating the Local and Indigenous Knowledge (LINK) and Practices with scientific information was developed on the assumption that both types of knowledge are equal, with the goal of emphasising the former's beneficial impact in Disaster Risk Reduction and Climate Change Adaptation. As a result, the research relies on the work of Dekens (2007a), who built a framework for collecting and analysing the indigenous and western scientific data (Mercer *et al.*, 2010). In the years 2006 - 2007, Papua New Guinea (PNG) conducted research in three remote indigenous villages in the Morobe and the Madang Provinces which are: Singas, Kumalu, and Baliau, by focusing on the integration of indigenous and western scientific knowledge for disaster risk reduction (Mercer, 2010). Mercer (2010) further states that, the Kumalu and the Singas villages were both affected by the hydro meteorological hazards that might be increased by climate change, but Baliau was primarily affected by a volcanic hazard. All the three tribes, however, rely mostly on subsistence agriculture, and climate change has the potential to wreak havoc on their livelihoods. The study yielded a DRR structure that identifies how the indigenous and the western knowledge might be combined for disaster risk reduction (Mercer *et al.*, 2010). This has been updated to include the climate change issues (Kelman *et al.*, 2009).

This DRR structure was created as a community tool to lessen susceptibility to the disasters by integrating indigenous and western scientific knowledge (Mercer *et al.*, 2010). A 'guided discovery' technique was used, in which the community members were aided in identifying facts, issues, and solutions on their own, with minimum intervention from the facilitators (Mercer *et al.*, 2008, 2009, 2010). Therefore, it is possible that in the rural areas with indigenous knowledge systems, there would be a need to completely involve the traditional

leadership and the community members as a prelude to the full integration of indigenous knowledge into the municipal disaster management frameworks (Nkabane & Nzimakwe, 2017). This knowledge was and continues to be widely accepted by the majority of the communities in whom it has been kept (Nkabane & Nzimakwe, 2017). Indigenous knowledge helps these communities to grasp the current scientific principles for environmental management, such as disaster prevention, preparedness, response, and mitigation (Kamara 2009).

Nevertheless, Dekens (2007) took the lead in developing a framework for the disaster risk management policy that recognises the value of indigenous and western knowledge. This framework paved the way for the integration of both the knowledge systems into disaster risk management by presenting a comprehensive framework for the gathering and the analysis of these knowledge systems in disaster preparedness (Shin, 2017). The framework is designed to help the people to become more aware of and to comprehend the local disaster preparedness knowledge (Dekens, 2007). The framework also provides for a proper understanding of the local and indigenous knowledge by conducting the systematic research of multiple components of local knowledge, such as the background, the development influencing variables, and the local knowledge and practice dissemination channels (Shin, 2017).

Dekens (2007) recommends that when integrating the local and western knowledge into the disaster preparedness policies, important steps should be taken, such as (i) Assessing the approaches to integrating the local knowledge into the disaster management-related activities, (ii) Evaluating the effective means of integrating the local knowledge into policies; and (iii) Determining the knowledge integration and policy strategies that can be used to improve the disaster preparedness activities. On the other hand, Mercer *et al.* (2009) constructed a procedural framework to show how the indigenous and western knowledge may be used to reduce communal susceptibilities by focusing on four primary factors: (i) Identifying risk factors in communities, (ii) Developing integrated disaster risk reduction policies, (iii) Identifying indigenous and western techniques and (iv) Encouraging community engagement. This framework is not about discovering new information; but it is about figuring out how the current knowledge might be used to help the indigenous populations to lessen their exposure to the environmental risks (Mercer *et al.*, 2010). The aim of this framework is to avoid such a disaster by allowing the indigenous peoples to come to an agreement on how to address their susceptibility to the environmental risks (Mercer *et al.*, 2009). The local communities may use this framework to develop new integrated coping strategies that are based on the local and western knowledge to deal with the anticipated future hazards (Shin, 2017).

Additionally, Hiwasaki, Emmanuel, Syamsidik, and Shaw (2014a) established a framework for integrating the local and indigenous knowledge on the hydro-meteorological risks and climate change with the western knowledge as part of a study with coastal and small island communities in Indonesia, the Philippines, and in Timor-Leste. This framework introduces a strategy for disseminating the integrated local information for the use by scientists, practitioners, and policymakers, as well as a set of "scientific criteria" for integrating the local knowledge, as well as the scientific explanations for each local knowledge (Shin, 2017). The aim of this framework is to give a broader perspective on the local knowledge and practices by classifying the LINK that is based on its scientific relationships as well as the DRR and Climate Change Adaptation (CCA) considerations (Hiwasaki *et al.*, 2014a).

Its method is unique in that it allows the communities to (i) Discover information that can be integrated with science and that can subsequently be distributed for use by the scientists, the practitioners, and the policymakers, as well as (ii) Protect and valorise the knowledge that cannot be explained scientifically. Taking into account the important role that is played by the indigenous and the western knowledge systems, each country should work to implement a knowledge-integrated policy that aims to improve the awareness of the historical context and the scientific methods in the face of future challenges (Domfeh, 2007). The Sendai Framework for Disaster Risk Reduction encourages the governments to interact with the community members especially the indigenous peoples to develop disaster risk reduction policies and initiatives (UNISDR, 2015).

The framework acknowledges that the local knowledge and practices should be used to complement the western scientific expertise in disaster risk assessment as well as to develop the policies, the strategies, and the plans for disaster risk reduction at the regional and national levels (UNISDR, 2015). Shin (2017) argues that by developing a new vision of LINK integration before establishing the principles of national DRR policies from which new ideas may be built would be exceedingly difficult. As a result, Dekens (2007), Hiwasaki *et al.* (2014), and Kelman *et al.* (2009) argue that increasing local knowledge by combining it with other forms of knowledge such as western knowledge, is necessary to better prepare the communities for future pressures and shocks. This will supplement the existing local knowledge's shortcomings in dealing with increasingly complex and unpredictable disaster patterns, as well as to accommodate the communities' preferred needs in dealing with future vulnerabilities (Shin, 2017).

According to Mercer *et al.* (2010), the indigenous early warning methods have the same impact on disaster mitigation or on reduction as the western scientific early warning systems. Since a

result with the comprehensive integration of indigenous and western knowledge systems in disaster management is required, Nkabane and Nzimakwe (2017) suggest that in the rural areas where the indigenous knowledge systems exist; the traditional leaders and community people should be extensively engaged as a precondition to complete the integration of indigenous knowledge into the municipal disaster management frameworks. These communities may be able to relate to this information, which may be paired with modern scientific understanding strategies to transform the current difficulties into opportunities (Kamara, 2009). The next section assesses the gaps and the opportunities for the disaster risk management policies and frameworks between the indigenous and the western knowledge.

3.4 Assessing the gaps and opportunities in the simultaneous use of indigenous and western knowledge for effective disaster risk management

In most nations, there are difficulties in reconciling the contemporary western knowledge with the indigenous knowledge without substituting one for the other (Iloka, 2016). Several academics have examined the areas where indigenous and western scientific knowledge intersect and diverge (Barnhardt & Kawagley, 2005; Berkes, 2012). The other academics argue that in practice, the disparities are not as significant (Agrawal, 1995). As a result, integrating the indigenous and the western epistemologies/methodologies as an indigenous researcher may be challenging (Singh & Major, 2017). Briggs (2005) and Wang *et al.* (2019) claim that several issues and tensions have resulted in indigenous knowledge not being as useful as hoped for or as assumed. Such issues include a focus on the binary tensions between the western scientific and the indigenous knowledge systems, which include a lack of communication, mistrust, ideological clashes, a lack of knowledge of the local setting, as well as the problem of differentiation and power relations (Briggs 2005; Wang *et al.* 2019).

On the other hand, the indigenous people are frequently deprived of their ancestral lands and survival resources both physically and culturally, thereby further reducing their ability to cope with natural and man-made risks (Scott *et al.*, 2013). The integration of indigenous and western knowledge remains a challenge (Bohensky & Maru 2011; Hill *et al.* 2012). Due to the processes of superiority and inferiority, there is political antagonism between the indigenous and the western knowledge, even if the participatory approach is encouraging to these knowledge systems (Agrawal, 1995; Jackson *et al.* 2014). Sometimes, indigenous knowledge is disregarded, and it is undermined by the other developing countries' knowledge systems which classify this knowledge as being non-scientific and non-universal knowledge (Iloka, 2016; Munsaka and Dube, 2018). Most of the time, this is where western knowledge takes

precedence over indigenous knowledge owing to the belief that it is superior to such knowledge (Mafongoya & Ajoyi, 2017).

Sillitoe (2006) further argues that the indigenous communities have little formal education, and their knowledge is primarily created locally, but western knowledge requires the trained scientists doing a multidisciplinary study. Meanwhile, one of the most important aspects of policy and the development processes in developing nations is the competition between western expertise and indigenous knowledge (Motsumi *et al.*, 2012). Several studies have linked the policy failure to a lack of stakeholder involvement and to a failure to include the indigenous knowledge into the development process (Briggs, 2005; Agrawal, 1995). Many indigenous efforts have fallen far short due to the methodological and epistemological discrepancies that are based on the worldviews and the strategies for interpreting reality (Agrawal, 1995; Wilson 2003; Nadasdy, 2005). For instance, a traditional healer who can cure a certain illness with specific herbs has the expertise and the comprehension of the plant species and their characteristics (Kaya & Seleti, 2013). In that case, there is still a lot of discussion over whether or not the traditional medication can be used to treat and prevent the spread of the corona virus (Covid-19).

Similarly, Madagascar's President Sari (2020), astonished many people when he stated that an African herb might cure Covid-19, but the World Health Organisation dismissed this claim, by noting that it was not scientifically proven (Burdon-Manley, 2020). The debate between Madagascar's President and the World Health Organisation highlights the current inequities in the use of indigenous and western knowledge. In other words, this might be viewed as a competition between the indigenous and the western knowledge in terms of their application in minimising the disaster-related issues. Nkabane and Nzimakwe (2017) argue that the reason for the large gap between the indigenous and the western competence is a general lack of awareness and understanding of the importance of merging several specialities into a unified mitigation DRR approach.

Martuzzi and Tickner (2004) suggest that the government-authorised institutions must be held liable since they often wait until damage has been shown beyond a reasonable doubt before intervening to prevent harm. On the other hand, the western knowledge has appropriated the indigenous capabilities, rather than acknowledging the collective and ongoing collaborative nature of knowledge creation and the value it brings to the communities. The western researchers have frequently integrated the indigenous knowledges into the theories as their own innovations (Dei, 2000). Most DRR agencies nowadays tend to be unsure about traditional knowledge, as well as its relevance and efficacy for DRR due to biased attitudes and seeing traditional knowledge as being limited, unscientific and primitive (Pandey &

Basnet, 2020; Gad-el-Hak, 2008; Munsaka & Dube, 2018). However, the indigenous knowledge has been a key in the communities' ability to survive disasters, whereas in some cases, this knowledge has operated as a roadblock to the effective DRR initiatives (Kulatunga, 2010).

Additionally, western knowledge in the modern world DRR programmes was formerly thought to be the one-and-only solution to disaster management (Rai & Khawas, 2019), although there are still some reservations regarding the modern science's capacity to predict the disasters (Pandey & Basnet, 2022). Nevertheless, the discussions on the new models of knowledge production have primarily been framed in the western terms (Le Grange, 2004). Nkabane and Nzimakwe (2017) suggest that the only way to close the gap between the indigenous and the western knowledge systems as well as the DRR policies is to provide ongoing education and training programs that deliver identifiable and long-lasting resolutions. Meanwhile, there is a rising awareness of the need to think differently about integrating the indigenous and the western methods of knowing. There is also a scarcity of information on how these knowledge systems may coexist and how to account for the variety within them (Levac *et al.*, 2018). Ludwig (2016:36) argues that western knowledge frequently reproduces the inequities by ignoring indigenous knowledge and failing to address the needs of the local communities.

Raymond *et al.* (2010) further state that knowledge integration has been critiqued for being excessively simple since it ignores how the individuals absorb different forms of information or the impact that the social settings may have in knowledge acquisition. Moreover, knowledge integration offers nothing to explain how or why people or groups may foresee and overcome the environmental or social change since it does not influence how the stakeholders understand the crucial structural and functional components of the social ecological system of which they are a part of (Gray *et al.*, 2012). This implies that there is still a lot of work to be done in merging indigenous and western scientific knowledge, since the disasters continue to expose nature with no well-articulated framework for avoiding the disastrous outcomes (Mazzocchi *et al.*, 2018).

The United Nations International Strategy for Disaster Reduction (2014) suggests that it is also critical to look at the issues that obstruct the seamless construction of the DRM policy and the legislative frameworks to achieve the aims of connecting the indigenous and western knowledge to improve the disaster risk management results. The advancement of the DRM policy and the legislative frameworks is hampered by the problems in the information distribution and disaster preparedness, disaster recovery, and in disaster plan knowledge (Dekens, 2007). Disaster recovery is also a major issue that the DRM policy and the legislative

frameworks should address to have a strong basis on how the effective public policy and the legislative frameworks can help to speed up recovery (Hedger *et al.*, 2010).

The epistemological aspect of disaster preparedness is the knowledge about the disaster plans which requires community awareness, local involvement, resource contributions, and community planning to produce a comprehensive disaster plan (UNISDR, 2010). For example, a Geographic Information System (GIS) may be used to map the disaster-prone areas, and ethnographic research can be conducted using a human-centered approach. These approaches serve as a foundation for developing policy and legislation to govern disaster risk management in the future (NDMF, 2005). Furthermore, the themes for the long-term adaptation and the adaptive capability are critical in the development of policy and the legal frameworks that are based on indigenous and western knowledge (Karki *et al.*, 2011).

The multi-stakeholder forum for progress is successful in pooling the resources and knowledge, particularly in encouraging cross-border and cross-sectoral risk management (UNISDR, 2010). The International Union for Conservation of Nature (IUCN) and the World Commission on Environment and Development (WCDE) have stated that the only way to address the current disastrous challenges is to develop a technological foundation that incorporates both the indigenous and the modern problem-solving methods (Rengalakshmi, 2013). This may be accomplished by respecting these two sets of values and by capitalising on their own strengths to solve today's developmental difficulties (Rengalakshmi, 2013). Mazzocchi *et al.* (2016) further suggest that a framework for knowledge amalgamation must be developed in which the fundamental concerns between the two knowledge systems are addressed because the future of human knowledge depends on successful decisions.

The integration of the knowledge systems has played a pivotal role in areas such as Dagupan City in the Philippines, where the communities are frequently flooded, thereby causing tremendous damage (Molina, 2016). The *barangays* (villages) of Dagupan City rely on the *kanungkong* (indigenous tool), which is constructed of bamboo, and it emits a sound when it is struck with a stick, thereby alerting the entire village to any calamity. The use of the *kanungkong* has the advantage of allowing the whole community to appropriately prepare for and respond to the disaster (Victoria, 2008). In the olden days, the people from Dagupan City used this tool for several reasons, such as for inviting the community to a meeting at the village hall, warning the locals of a late-night robbery, summoning the midwives to help a pregnant woman who was about to give birth, and for calling the children home (Victoria, 2008).

Table 3.1: The warning Codes that are used to inform the communities in the event of a disaster. Adopted from Victoria (2008)

Colour	Alert Level	Warning Signal by the Kanungkung
White (Ready)	Normal	
Yellow (Get Set)	Alert (warning, there is danger)	5 strikes of the kanungkung at 20 minutes interval
Orange (Go)	Prepare for evacuation or proceed to holding area (heavy flooding approaches)	10 strikes at 20 minutes interval
Red	Full evacuation (evacuate from homes to designated safe areas) Forced evacuation	Non-stop (15 strikes at 10 minutes interval) Non-stop (20 strikes at 5 minutes interval)
Green	Back to normal	

The flood markers have been set in key locations around the communities to monitor any potential event (Victoria, 2008). The *barangay* warning and the communications team use a hand-held radio to monitor and report the flood level information from the staff gauge to the Barangay Disaster Coordinating Council (BDCC) (Iglesias, 2007). The *kanungkung* is then played and passed from house to house (every 5 households). The government of Dagupan City in collaboration with the disaster stakeholders has opted to employ this indigenous technique in disaster monitoring, combining it with the western scientific warning codes (Table 3.1), which help in categorising the threats and the intensity of a disaster for community safety (Molina, 2016). In response to the persistent problem of flooding in the Dagupan City, an integration of the indigenous and the western scientific knowledge has been shown to be successful (Victoria, 2008). This also aids in the mobilisation of local capability, as well as in the revival and in the maintenance of a local disaster preparedness practice (Molina, 2016). This highlights how important it is to use both the knowledge systems in the disaster management cycle (preparedness, mitigation, response, and recovery) to reduce the disaster adversities. Each Barangay Disaster Coordinating Council has a radio link to the City Disaster Coordinating Council (CDCC), and information is sent from one to the other via radio through the BDCC's Emergency Operations Centre (Victoria, 2008). Figure 3.1 depicts the flow of the early warning system in the Dagupan City.

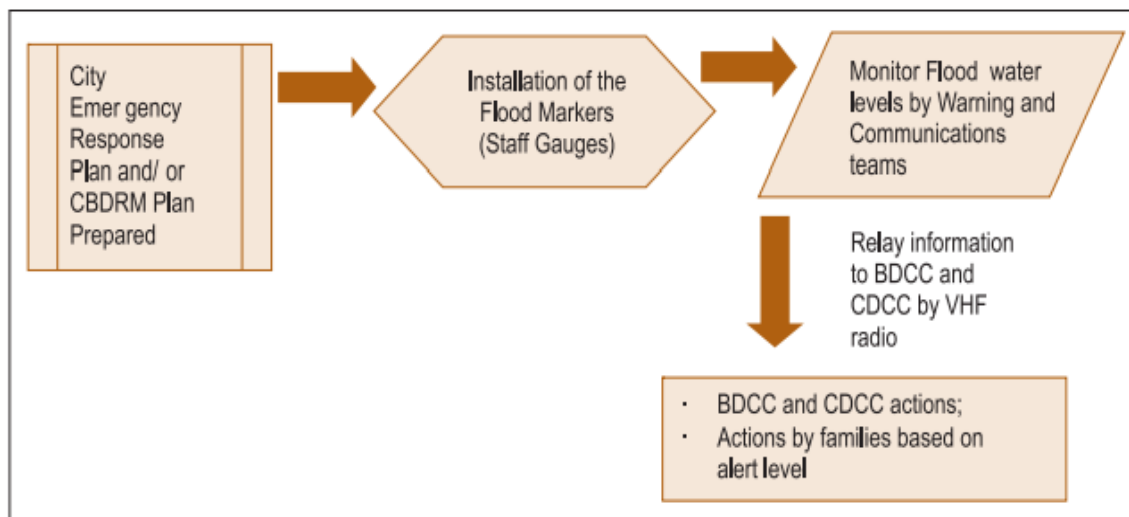


Figure 3.1: Relay of Information to the Community through the Kanungkung. Source: Victoria (2008)

The indigenous and the local knowledge holders, as well as the scientists have a variety of reasons for working together, and it should in principle, result in a win-win scenario in terms of building sustainable and resilient communities (Wheeler & Root-Bernstein, 2020). These knowledge integration approaches are founded on a socio-ecological system's ability to withstand disturbance without losing its structure or function (Walker *et al.* 2006), as well as its ability to adapt to the changing environmental and the social conditions (Redman & Kinzig 2003). The integration of the indigenous and the western knowledge systems, for example has provided for the integrated disaster risk solutions in the Dagupan City communities while also mitigating and preventing the unexpected, as demonstrated in Table 3.1 and in Figure 3.1. This demonstrates how properly integrating the indigenous and the western knowledge equips the communities with a wide range of skills and capabilities to mitigate and prevent the disasters in a timely manner, thereby allowing them to make well-informed risk-reduction decisions (Rahman *et al.* 2017). Therefore, it is suggested that these two forms of knowledge must stop competing with one another and instead they must collaborate to provide long-term solutions to the rapid increase that is caused by the disasters.

Chapter Summary

A number of conclusions may be drawn from this study. Firstly, the study reviewed the international and the national policies and frameworks that have influenced the need for as well as the significance of IKS and WKS integration in disaster risk reduction and it was discovered that they hold a lot of potential for reducing the disaster risk and the effects. Secondly, the study also discovered that knowledge integration provides valuable means and capabilities for pre-planning and for preventing the future disasters which may be implemented into the DRR policies and the legislation. Thirdly, the study also revealed that the disaster

management experts have devised a number of mitigation strategies to aid the local communities in reducing the vulnerability among those who are most vulnerable to the hazards, but the biggest challenge is that these strategies are based on the economy, which has led to a number of failures. The researcher believes that it is critical for the DRR role actors to supplement their western scientific knowledge with the local indigenous knowledge to make alternative disaster risk reduction and management approaches more effective and efficient. The study suggests that historical disaster risk reduction and management strategies must be developed alongside the current strategies to better the advancement of disaster risk reduction and the management activities for the benefit of resilient and sustainable development. It is part of the study's recommendations that various plans, policies, approaches and strategies, as well as more studies on the integration use of indigenous and scientific knowledge systems should be developed and implemented to improve the role and the capacity of these knowledge systems in the disaster related matters. Lastly, the study recommends that empirical research must be conducted to determine how the government can best bridge the gap between indigenous and western knowledge in disaster risk reduction policies and in the frameworks to find a long-term and resilient solution to the current disaster challenges.

CHAPTER FOUR

METHODOLOGY OF THE STUDY

4.1 Introduction

This chapter provides the details of the research methodology that was used in the study by expanding on the summary that was provided in Section 1.6. The research methodology is the “general approach the researcher takes in carrying out the research project; to some extent, this approach dictates the particular tools the researcher selects” (Leedy and Ormrod, 2005:12). Babbie and Mouton (2006:75) define the research methodology as “strategically process focuses on the individual (not linear) steps in the research process and the most objective (unbiased) procedures to be explored”. The methodological choice in this chapter was guided by the philosophical stances and by the research topic. Bryman (2008) describes the philosophical stances as the sets of ideas that govern what should be investigated, as well as how the research should be conducted, and how the findings should be understood. This chapter discusses the research paradigm, the target population, the sample as well as the data collection techniques that were utilised in this study. The chapter also includes the study area selection, the research procedure, and the data analysis. It further explains the ethical considerations, the limitations of the study, the theorem that underpinned the study and the chapter conclusion.

4.2 Study area and context

The Buffalo City Metropolitan Municipality is bound by the Great Kei Local Municipality, the Amahlali Local Municipality, the Nkonkobe Local Municipality, and the Ngqushwa Local Municipality in the Eastern Cape Province (BCMM Integrated Development, 2020/21). It is bordered to the south-east by the Indian Ocean's lengthy shoreline. Buffalo City is a metropolitan municipality in the Eastern Cape Province of South Africa that is located on the east coast. East London, Bisho, and King William's Town, as well as the major townships of Mdantsane and Zwelitsha, are all part of it (Draft IDP/Budget/PMS Process Plan 2021/2026). The municipality was created as a local municipality in 2000, following the reform of the municipal regions in South Africa, and it is named after the Buffalo River which has the country's sole river port near its mouth (BCMM Integrated Development, 2020/21). The Municipality area is a mixed Metropolitan region with 154 informal communities, 230 rural villages, and significant stretches of rural land including commercial farming, tribal land, and subsistence farming (Buffalo City Metropolitan Municipality Integrated Development Planning, 2018\9). It was split from the Amathole District Municipality, and it was transformed into a

metropolitan municipality on May 18, 2011 (Draft IDP/Budget/PMS Process Plan 2021/2026). The map (Figure 4.1) depicts the Buffalo City Metro Municipalities, with the cities, towns, and wards.

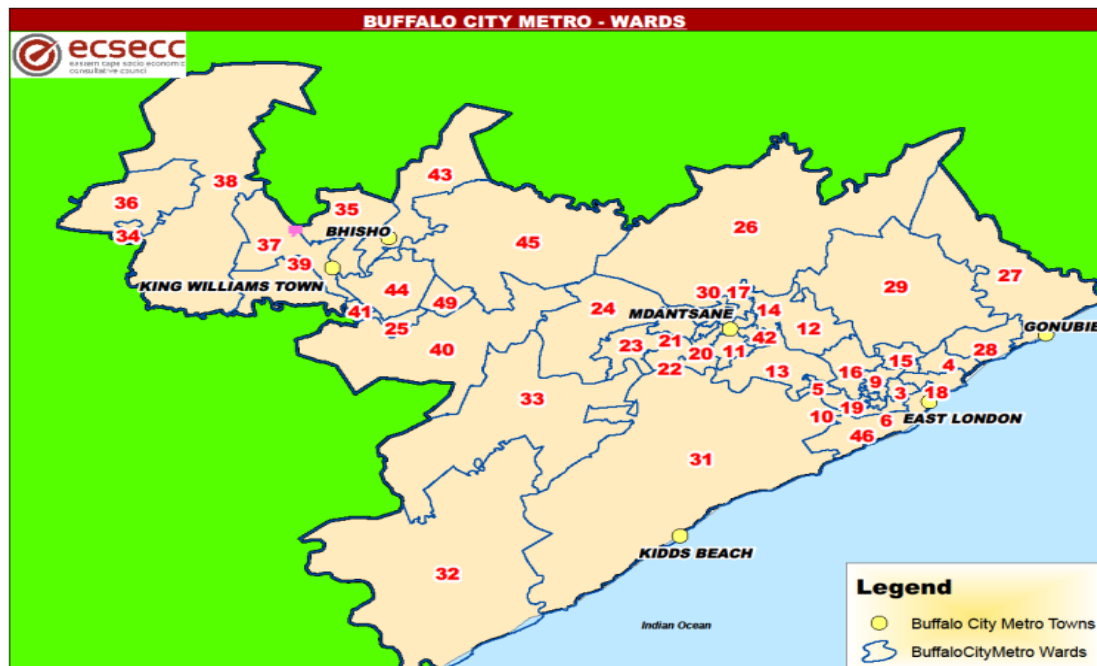


Figure 4.1: BCMM Community Wards. Source: Eastern Cape Socio-economic consultative council (2017).

The Buffalo City Metropolitan Municipality operates under Section 8 (g) of the Local Government Municipal Structures Act (Act 117 of 1998), which combines an executive mayoral administration with a ward participation system. The mayoral committee is made up of ten councillors, with a Council that is led by the Speaker and 99 elected councillors, which makes it 100 Councillors in total including the Speaker (BCMM, 2019). The community wards are represented by 50 councillors and the other 50 Councillors remain in the municipal council committee. This is in accordance with the provisions of the establishment, the recognition of the traditional leaders, the kingship, the queenship and the fostering of good working relations between the royals and the elected Councillors with the responsibilities of promoting service delivery in the rural communities and working hand in hand with the councillors to assist the poor (BCMM, 2019).

According to the Municipal Development Framework (2019/24), there are currently some issues (uncontrolled urbanisation) in the BCMM which are most evident in the city's urban portion, but they are also a characteristic of the settlement dynamics and the desire for land in the peri-urban and in the rural regions (especially for settlement reasons). The Corporate Government and Traditional Affairs (2020) indicates that the population growth patterns in the

BCMM are growing owing to the present trend of people relocating in pursuit of better economic opportunities and greater access to services which continue to have an influence on the settlement landscape. The lack of well-maintained infrastructure, services, and facilities inside and throughout the BCMM's sprawling and fragmented settlement pattern is putting a strain on the organisation's limited resources (Municipal Spatial Development Framework, 2019/24). Consequently, this element warns against pursuing the opportunistic land development projects in the inconvenient locations that may become a future burden and jeopardise the BCMM's financial viability. The following section details the background of the selected study area.

4.2.1 Population of Buffalo City Metropolitan Municipality

The Metro has a population of 893 157 people, thereby accounting for 1.5% of the total population of South Africa (BCMM, 2020). Between 2008 and 2018, the population growth averaged 1.11% each year which is over half of South Africa's overall growth rate (1.61 percent), compared to the Eastern Cape's annual growth rate of 0.94% (Corporate Government and Traditional Affairs, 2020). There were 51.9% females and 48.1% men in total (BCMM, 2020). This is in contrast to the Eastern Cape Province as a whole, where the females made up 52.45% of the overall population. According to the Local Government Handbook of South Africa (2017) and the Buffalo City Metropolitan Municipality Strategy Vision for 2030, the Buffalo City Metropolitan Municipality's population grew by 7% between 2011 (704 855) and 2011 (755 200). Due to urbanisation, the Buffalo City's population has been growing at a 1.0% yearly pace from 884 000 in 2018, and it is expected to be 929 000 in 2023 (Corporate Government and Traditional Affairs, 2020). Table 4.2 shows the yearly rise in the BCMM's population from 2006 to 2016.

With an average annual growth rate of 1.09%, the East London sub-metro region grew the fastest in terms of population, followed by the Mdantsane, Chalumna sub-metro region with an average annual growth rate of 1.08% (IDP, 2018). Within the Buffalo City Metropolitan Municipality, the Macleantown, Sandisiwe sub-metro area has the lowest average annual growth rate of 0.70% when compared to the other sub-metro regions. The Buffalo City's population was expected to rise at an annual rate of 1.1% from 848 000 in 2016 to 898 000 in 2021, based on the age-gender composition and fertility, as well as the mortality, and migration rates (Eastern Cape Socio-economic consultative council, 2017). Between 2016 and 2021, the Buffalo City Metropolitan Municipality's population projections indicate a 1.1% average yearly growth rate (ECSCCC, 2017). For the Eastern Cape Province and South Africa, the average annual population growth rate throughout the anticipated period is 1.0% and 1.4%, respectively (ECSCCC, 2017).

4.2.2 Landscape of the BCMM

This section provides a thorough discussion of the geographic location and the distinguishing features of the study area.

4.2.2.1 Topography

The area's geography is defined by a series of incised river valleys that run roughly parallel to one another in a South-Easterly direction through the municipality and it is cut in half at regular intervals (IDP, 2018/9). The lack of huge stretches of flat land in this topography has a considerable influence on the population's patterns and on the expense of providing the services in the area.

4.2.2.2 Geology and Soils

The area's geological strata are typical of the Karoo system, comprising mostly of the mudstones and the sandstones intruded by the dolerite dykes and the sills (IDP Review, 2019/2020). The high salinity of the groundwater in the region is due to much of the geology being of marine origin (Dlani *et al.*, 2015). The soils in the region are mainly moderate to deep clayey loams with a medium to low erodible index (IDP Review, 2019/2020).

4.2.2.3 Climate

The temperature is mild for the majority of the year, with hot periods in the inland parts from December to February (Dlani *et al.*, 2015). Despite the fact that the region receives rainfall all year, it is largely a summer rainfall zone, with June and July being the driest months of the year. Within the BCMM, the rainfall ranges from around 1 000mm along the coastal stretch between East London and Kwelera, to 500mm in the higher sections of the Tsholomnqa, the Keiskamma, and the Umkhangiso Rivers (IDP, 2018/9). The mean annual precipitation increases to between 1 000 and 1 500mm in the north-western section of the area, near the Amatole Mountain Range (IDP Review, 2019/2020). The Buffalo City Metro Municipality includes ten main river systems, nine of which are classified as being "endangered," and the Buffalo River system is classified as being "vulnerable" (IDP, 2020/21). The National Wetlands Inventory lists a total of 2 064 wetland areas in terms of the aquatic systems. In general, the region's groundwater potential is poor, thereby resulting in low borehole yields (usually less than 2 l/s) and high salinity fluids (IDP, 2018/9).

4.2.2.4 Vegetation

The BCMM features a diverse range of plant types, with the most common forms comprising of 252 577.5 hectares (IDP, 2020/21). The plant types may have an influence on the community's livelihoods to some extent since they define the field's carrying capacity in terms of the livestock units (IDP, 2018/19). According to Dlani *et al.* (2015), four biomes are represented in the BCMM: Albany Thicket (66.82%); Savannah (29.24%); Forest (2.73%); and Grassland (1.14%, with Mucina and Rutherford (2006) classifying 12 plant types. The IDP 2021/2026 estimates that 26.8% of the BCMM region is still devoid of natural habitat. There are no critically endangered or vulnerable terrestrial habitats within the Municipality according to the South African National Biodiversity Institute (SANBI) (Dlani *et al.*, 2015).

4.2.2.5 Land Use in Cities and Rural Areas

In BCMM, 9% of the land is cultivated for semi-commercial or subsistence purposes, while the municipality's land cover has deteriorated by more than 10% (Dlani *et al.*, 2015). The urban land which is also known as the built-up residential land accounts for 7.8% of the total land area or for 19127 hectares (IDP, 2020/21). There are 230 rural communities totalling 13 339 hectares, according to the IDP (2018/19). Buffalo City's rich and diverse biodiversity has been threatened by large-scale habitat change and fragmentation (Municipal Spatial Development Framework, 2019/24). In many sections of the municipal area, this has been caused by unsuitable development and inadequate land-use management practices. The metro's two maritime reserves and 12 terrestrial protected areas which comprise of 21% of the territory are insufficient for biodiversity conservation (Municipal Spatial Development Framework, 2019/24). Outside of the protected areas, the framework suggests that land use planning should include additional biodiversity priority regions and places with sensitive environmental qualities.

4.2.2.6 Hazards and the vulnerabilities in the BCMM

The BCMM community is frequently endangered by multiple-hazard events such as the flooding that is caused by the heavy rains, the shack fires that are perpetuated by illegal electricity connections and human carelessness, drought as well as epidemic diseases (BCMM, 2014/15). These hazards mostly affect the disadvantaged communities, and they cause significant harm including human deaths, economic losses, and environmental degradation. The fifteen study wards that were selected are the most disaster-prone informal communities. The BCMM is among the municipalities that had a significant population increase, thereby demonstrating the Eastern Cape's high-density communities (41.5 persons

per square kilometre), when compared to the rest of South Africa (45.6 per square kilometre) (BCMM, 2017). The lives of the informal settlement dwellers in particular are made more difficult by the densification conditions, as they lack proper houses and have poor storm-water drainage systems. There are also exacerbating challenges such as pollution, insufficient water and sanitation.

The interaction of social, economic, political, and environmental elements is driving these issues, thereby making the communities increasingly vulnerable to the localised disaster risks (BCMM, 2018/19). The other difficulties that were encountered by the BCMM were the scarcity of land in close proximity to the city, the land invasions, and the unregulated migration of people from South Africa and beyond to the BCMM in search of a better quality of living (Parliamentary Monitoring Group, 2012). Nevertheless, the National Department of Human Settlements (NDOHS) planned to develop a policy and strategy for improving the living conditions of the people living in the informal settlements and in the marginalised areas in the BCMM (BCMM, 2018/9). This process will be done through the help of the National Upgrading Support Programme (NUSP), as well as through the upgrading of plans for 32 identified informal settlements through the participatory planning processes (Department of Human Settlements, 2014). The Municipality received a preliminary draft of the Policy and Strategy in August 2014, and a final presentation was done in December 2014.

The reason for the upgrade of the marginalised and the informal settlements is that these areas do not allow for the development of the old patterns (BCMM, 2018/9). Some of these settlements are located in the hazard prone areas which are not suitable for human habitation (Mshumpela, 2020). However, despite the substantial progress in data gathering, as well as in policy formulation, financial and legal change to assist the upgrading of informal settlements and the new laws that were aimed at improving the deplorable living circumstances of those living on the outskirts of the cities; there is still a long way to go (Kienast, 2019:5). There is also a lack of legislative measures for incremental tenure security as well as a lack of clear change of policy in many areas, including in the Buffalo City Metropolitan Municipality and in South Africa in general (Kienast, 2019:5). The next section contains a detailed description of the methodologies and the procedures that were used in the investigation.

4.3 Study Design

The qualitative research design was utilised with the collected data from the interviews and the content analysis of the policy and legislative documents. This inductive (qualitative) research is a type of social activity that focuses on how the people interpret and make sense of their experiences to better understand their social realities (Haradhan, 2018). Akhtar

(2016:68) defines a study design as a plan, or a framework, or an approach and a line of investigation that are tailored to ensure that the study question is addressed. A research design establishes the technique for collecting and analysing the needed data, as well as how all of this will be used to answer the research question (Grey, 2014). As the aim of the study was to evaluate the integration of the indigenous knowledge and western knowledge in disaster risk management policy and legislative frameworks of the Buffalo City Metropolitan Municipality, a qualitative approach to investigate how the knowledge interacts with policy in disaster scenarios to enhance future responses was utilised for this study. This approach was underpinned by the constructivist framework which views reality as being within the human mind and relying on the human experiences and interpretation (Lotz-Sisitka *et al.*, 2013).

The same framework views reality as being socially created and having several meanings, rather than being ethnographical (Lunga, 2012). This is especially evident in this study, which emphasised the relevance of the experiences that the participants in the study have had and how these experiences have honed their senses to respond to and learn from the disasters. It is worth noting that qualitative research was beneficial in obtaining the data in this study, since this approach has the ability to represent a community's culture, local knowledge, behaviours, attitudes, values and beliefs (Lotz-Sisitka *et al.*, 2013). The researcher believes that contextualising a phenomenon is the most efficient way of comprehending it. The use of the qualitative approach in this chapter perpetuated the ontological assumptions about the world. The ontological assumptions are defined as a strategy in which the researchers assume that the world they are investigating is populated by humans with their own thoughts, perceptions, and meanings (Ahmed, 2008:2). According to Krauss (2005), the qualitative researchers do not believe that there is a single unified reality that is separate from the human experiences. This implies that reality exists in a variety of forms. While Dobson (2002) claims that all the critical realists believe that the native knowledge of reality is a consequence of the social conditioning and hence it cannot be understood without the participation of the social actors in the knowledge derivation process.

The study chose exploratory research to pay attention to various paths of the study, including reviewing the limited literature on the IKS and the WKS in disaster risks, the policies and capitalising on the identified core challenges to gain new insights, to find new ideas and to increase the knowledge of the phenomenon to find sustainable solutions. Exploratory research is undertaken when there is a lack of knowledge regarding a phenomenon or an issue that has not been properly identified (Saunders *et al.*, 2007). Its main objective is not to offer definitive solutions to the research questions, but rather it is to investigate the study issue in various depths (Lelissa, 2017). The study used interviews and the qualitative content analysis of the policy and legislative documents to acquire the data that is needed for the

study. The study used the primary data that was provided by the participants through the interviews. Meanwhile, qualitative content analysis is a method for systematically analysing and inferring from the text and the other types of qualitative data (United States Government Accountability Office, 2013). The researcher can use content analysis to investigate the theoretical concerns and to gain a better grasp of the data (Elo & Kyngäs, 2008).

The purpose of using a qualitative content analysis in this study was to go beyond the current indigenous and western scientific difficulties in DRM in the context of policies and legal frameworks to discover consistent and long-term solutions. It is critical to note that content analysis necessitates the researcher explaining the selection of instances and themes in sufficient objective detail for the others to repeat the processes (Hall & Wright, 2008). The study utilised the conventional content analysis to determine how the IK and the WK are mainstreamed in the disaster risk reduction/management policy and in the legislative frameworks. In this inductive approach, the coding themes were developed straight from the study data (Crossman, 2019). This design is typically utilised when the current theory or literature on a phenomenon is minimal (Hsieh & Shannon, 2005).

In this study, the benefit of using conventional content analysis is the fact that it allows the researcher to get direct information from the study participants without imposing pre-existing classifications or theoretical viewpoints (Hsieh & Shannon, 2005). Due to the limited knowledge on the integration of the indigenous and the western knowledge systems in disaster risk management policies and legislative frameworks to deal with disaster-threatening challenges, particularly in informal settlement and marginalised rural areas, the conventional content analysis approach was appropriate for this study. The study further used exploratory research to look at several paths of the study, including reviewing the limited literature on the indigenous and the western knowledge in disaster risks policy and legislative related matters as well as capitalising on the identified core challenges to gain new insights, to find new ideas, and to increase the knowledge of the phenomenon to find sustainable solutions. The aim of this research fieldwork was to define priorities, perceptions, attitudes, opportunities, challenges and alternatives, rather than to quantify them. In many aspects of life, including assessing the sustainability of various courses of action, it is necessary to portray the dynamism of the rural communities, as each community has its own culture, customs, and values, in which these factors influenced their inclusion in the research. In the next section, the study population and size as well as the sample procedures are discussed.

4.4 The Study Population

A total of 15 wards such as 1, 2, 6, 7, 8, 10, 13, 17, 24, 28, 29, 31, 38, 39 and 50 were chosen from a total of 50 and each ward was headed by the ward councillor and the traditional leaders. The wards were chosen because they are particularly susceptible to several hazards, including flooding, shack fires, disease outbreaks and electrocution due to the illegal power connections to the shacks (BCMM, 2014/15). The key informants and 28 community members participated in the study, as the KI included three BCMM Political Leaders, ten Proportional Representation (PR) Councillors, five traditional leaders and 12 participants from various departments within the municipality. The target population is the process of selecting appropriate persons, entities or events to represent the study's whole population (Sekaran & Bougie, 2010b). Both young and old people were important because the older people have more of the indigenous knowledge and the younger people have more western knowledge.

Barnsbee *et al.* (2018) define a target population as the set of people who will be studied, and from whom conclusions will be drawn from the intervention. To define the target population, one must operationalise the units of interest features based on the research variables or qualitative experience, so that the study's findings may be correctly inferred or translated back to the population of interest (Ackerman *et al.*, 2019). The researcher believed that the selected population had specific traits that they wanted to find out about (Bless & Higson-Smith, 2000). There were 13 documents that were gathered from the BCMM online municipal archives and websites including: (i) BCMM Disaster Management Policy/Report (2); (ii) BCMM bylaws (1); (iii) BCMM Integrated Development Plans (3); (iv) BCMM Policy on Long-Term Financial Planning (1); (v) BCMM Medium-Term Revenue and Expenditure Frameworks (1); (vi) BCMM Annual Report (2); (vii) BCMM Local Spatial Development Frameworks (2) and (viii) BCMM Built Environment Performance Plan (1). Taking into account a variety of multi-hazard circumstances that frequently affect the locals in the BCMM, it was crucial to review the identified policy documents to determine that the IKS and the WKS are integrated in such policies as they play a significant role in DRM.

4.5 Sample Size and Sampling Procedures

Selecting sampling techniques and determining sample size in a study is critical to draw accurate findings (Singh & Masuku, 2014). This section describes the study's sampling process and the sample size, as well as how they contributed to the study's main objective.

4.5.1 Sampling Procedures

Snowball sampling was used as a starting point, as the study's participants were well selected due to their insight, competence and connection in topics pertaining to the indigenous and the western knowledge systems in disaster risk management in line with the regulations. Snowball sampling is a popular sampling strategy in qualitative research that heavily relies on networking and referral elements (Parker *et al*, 2019:3). The selection of the study area and the key participants from an entire BCMM population was done purposively. Purposive sampling is a strategy for discovering and selecting instances that will efficiently employ limited research resources (Palinkas *et al.*, 2015). This approach is also known as judgmental sampling, as it is carried out based on a stated scope and intended consequence (De Vos *et al.*, 2011). It is "used to choose respondents that are most likely to give relevant and meaningful information" (Kelly, 2010). Jawale (2012) defines a sample as a specific plan for determining what data will be gathered for the researcher to get a sample representing a certain demographic. Brink (1996) further states that sampling is the process of selecting a sample of people from a larger group to estimate the characteristics of the entire group. The researcher determines what information is required and sets out to identify the persons who are capable of and are willing to supply information based on their expertise or experience (Etikan *et al.*, 2016; Cresswell & Clark, 2011). In qualitative research, the key informants are frequently given precedence because they have more knowledge than the ordinary group members and/or are better equipped to engage and offer the needed data due to their position or expertise (Welman *et al.*, 2005). Through the integration of snowball and purposive sample methodologies, the researcher surmounted the constraints and partiality inherent in each strategy and achieved a more profound understanding of the study population. Purposive sampling guarantees that participants were chosen in accordance with the specific needs of the research to produce valid study results, and snowball sampling allows the researcher access to communities that are hidden or challenging to reach, which makes both samples crucial to this study.

4.5.2 Sample size

The study had a total of 58 participants. The 58 participants included 28 members of the general public within the area of the 15 wards. The remaining 30 participants consisted of three BCMM Political Leaders, ten Proportional Representation (PR) councillors, five traditional leaders and 12 participants from various departments within the municipality (see Table 4.1). The purpose of interviewing these participants was to ascertain the integration of indigenous knowledge and western knowledge in disaster risk management policy and legislative frameworks of BCMM. Given that some of the key participants are also decision-

makers, it was crucial to pay attention to what they have to say as they are the ones with the power to decide and whether they are conscious of their responsibility for putting such policies into action. The gathered data from the participants helped to answer the research questions and to fulfil the study's research objectives as stated in Chapter 1.

Table 4.1: Study Representation

Study Participants	Target Population	Sampling Population
BCMM Political Leaders	Selected from the BCMM	3
BCMM PR Councillors	Selected from the BCMM Directorates	10
BCMM Traditional Leaders	Selected from three BCMM regions	5
BCMM Administration	Selected from the various Departments within the BCMM	12
Community Members	Selected from three BCMM regions	28
Total number of participants in the study		58

Source: Own compilation (2022)

In qualitative studies, saturation is a crucial factor to take into account because it calls for a researcher to interview the informants until there is no more data that is left to gather (Mwita, 2022). Therefore, it was essential to use the qualitative research technique to ensure the accuracy and the reliability of the data that was used in the study, and it saves time as well as the effort that is needed by the researcher to gather the data from the participants. In the above table, the target population is represented by the second column which lists the number of people from each area. The third column represents the study's sampling population.

4.6 Data Collection Methods

Both primary and secondary sources in gathering the data for the study were used. Primary data was gathered with the goal of obtaining a solution to a problem by obtaining information directly from the people who have first-hand experience with the subject of investigation, whereas secondary data was gathered with the goal of scrutinising the information that was produced by various authors to address the core problem that this study aimed to address (Ajayi, 2017). Data collection is the systematic process of obtaining the needed information with the least degree of distortion possible so that the analysis may produce trustworthy and

logical responses for the study (Sapsford & Jupp, 2006). The qualitative researchers use a variety of approaches and data sources to investigate the spoken and the written representations and the records of human experience (Punch, 1998). These are gathered through in-depth conversations with individuals or through focus groups, direct observations, artefacts, documents, and cultural record studies as well as through the use of visual resources or personal experience (Denzin & Lincoln, 2003). A primary source (the researcher is the first to receive the data) or a secondary source (the researcher obtains data that has previously been gathered by other sources, such as data published in a scientific journal) can be used to collect data (Mesly, 2015).

4.6.1 Primary Data

The researcher collected the primary data directly from the selected study participants through the interviews (Parveen & Showkat, 2017). The data was gathered through semi-structured face-to-face interviews with the selected participants, including the political leaders, the PR councillors, the traditional leaders, the participants from different departments within the municipality and the community members, to gain their perspectives on the integration of both the IKS and the WKS in the disaster risk management policy and in the legislative frameworks. The semi-structured interviews are useful in interpretative research because they allow the researcher to get in-depth information about the participants' viewpoints and they make sense of their stories and experiences (Balushi, 2018). The semi-structured interviews are an efficient and cost-effective way to collect qualitative data in an unobtrusive and in an open way (O'Keeffe, 2016). The face-to-face interviews are well known for their ability to boost respondent participation and motivation through direct human interaction (Neuman, 2012). The researcher contacted the potential participants who were reminded by cell phone to enquire about their availability for interviews. Some of the participants were interviewed virtually as they could not be interviewed in person due to work responsibilities. The researcher's method of supporting and organising the research activities provided for a more natural environment and a more productive process by including an interview guide as one of the tools that were used throughout the interactive process. The primary data from the key informants and the interview guidelines are demonstrated in the next section.

4.6.2 Data Collection Tools: Interviews

In this study, an interview was crucial for the data collection because it allowed for the extraction of more in-depth details and a thorough comprehension of the study (Abouelazm, 2023). An interview guideline was created to properly handle the interview sessions. This guideline was broken down into three parts: (i) The preliminary phase which included an

introduction, the interview goals, the ethical concerns, and the interview duration; (ii) The main phase which included open-ended and probing questions; and (iii) The final phase which included the closing part and appreciation. Kvale (1996) argues that there is an exciting component to interviewing by pointing out that an interview is literally an interchange of viewpoints between two persons conversing on a topic of mutual interest. Each interview lasted about 45 minutes, during which all the interviewees had the chance to expound and ask questions about the research issue. The researcher facilitated the participant discussions by using the interview guide as guidance. It was important that each participant had an opportunity to contribute and express themselves on the study's subject matter (Bloor *et al.*, 2001).

Prior to the interview section, the researcher explained the reasons for conducting the study. According to Mathers *et al.* (1998), it is the responsibility of the interviewer to obtain the respondent's informed consent to engage in the research, as well as to explain why the study is necessary. In this study, the interview questions were written in English, but when a participant could not understand, the researcher translated them into a language that the interviewees could understand to make sure that they understood everything the letter of consent said and the specifics of the study so they could give informed consent. In a primary interview, the interviewer must justify the open-ended inquiries to communicate more about the research with the participants before starting the interview, so that anything that needs clarification gets clarified (Ilami & Winter, 2021). This method allows the researcher to collect detailed information regarding the topic under investigation (Ilami & Winter, 2021).

The participants were asked open-ended questions to allow them to share their stories about how the IK and the WK have helped them to cope with the life-threatening challenges that were brought on by the disasters. Again, the researcher opened an opportunity for the participants to express their ideas about how these knowledge systems could be integrated into the policies in dealing with the disasters. During the interview, the participants narrated their stories and experiences with using IK to overcome the different problems that were provided by the disasters, as well as how the WK has brought value to their original talents. Another crucial aspect of the interview was that when the issues to be discussed were completed, a short pause was offered with no more replies or suggestions. The first four major items on the interview guide were evaluated for short breaks. The interviews were considered complete once all the questions had been completed and no one had any more questions. Each participant was grateful for the time spent with the researcher and the knowledge exchange that helped to make this study successful.

4.6.3 Document Content Analysis

Based on the content analysis of the policy documents, 13 documents were gathered from the municipal websites and from the archives (See Table 4.2). The document review is the process of collecting information from the reliable publications or from the research that is relevant, significant, and legitimate and combining it into a study under the investigation to find solutions (O’Gorman & MacIntosh, 2015). These documents demonstrated their critical role in disaster risk reduction, including, but not limited to, (i) Reducing disaster-related matters and addressing the climate issue by enhancing and protecting the people, the places, and the environment; (ii) Creating a legal framework for the use of disaster management in the Buffalo City Metropolitan Municipality; and (iii) Reporting on the significant disasters that have occurred in the municipality. Despite the significance that these documents have played in DRM, none of them have included indigenous knowledge or an integration of indigenous and western knowledge, which solely predominates in the western knowledge

Table 4.2: Reviewed Documents

Policies, Frameworks, Reports and Plans	Local
BCMM Bylaws, 2019	✓
BCMM Disaster Management Policy, 2012	✓
BCMM Disaster Management Report, 2014/15	✓
BCMM Local Spatial Development Framework, 2013 and 2019 - 2024	✓
Built Environment Performance Plan, 2018/19	✓
BCMM Integrated Development Plans, 2016/17, 2018/19 and 2020/21	✓
BCMM Policy on Long-Term Financial Planning, 2019	✓
BCMM Medium-Term Revenue and Expenditure Frameworks, 2018/19	✓
BCMM Annual Report, 2018/19 and 2021/22	✓

Source: Own compilation (2022).

Document analysis was used to evaluate the integration of indigenous knowledge into westernised disaster risk management policy and legislative frameworks Buffalo City Metropolitan Municipality. Wach and Ward (2013) define document analysis as a research approach for analysing the contents of written documents in a systematic and rigorous manner. Bowen (2009) advocates that it is critical to skim the documents to acquire an

overview, then reading to identify the appropriate categories of analysis for the total collection of documents and then analysing the body of documents.

4.6.4 Data Capture, Storage and Security

The researcher transcribed all of the interviews. The researcher emailed the transcriptions, and the hard copy versions were placed on Google Drive, with the hard copies being preserved in the storage room after they were correctly indexed. This allowed the researcher to quickly refer back to them as needed. To preserve the information and to protect all the files on the devices, the study used the hardware and the Google Drive devices for data storage, and the data was full disk encrypted to maintain the authenticity of the received data. It is more critical to keep the human subject data safe while maintaining the appropriate amount of confidentiality and the privacy of study participants, the researchers and the institutions (Stanton, 2004). Before moving on to data analysis, the data quality control was executed as presented in the next section.

4.6.5 Reliability of data

The trustworthiness or the rigour of a study refers to the degree of confidence in data interpretation and the methods that are used to ensure the quality of a study (Pilot & Beck, 2014). Although most experts agree that trustworthiness is necessary, there are debates that have been waged in the literature as to what constitutes trustworthiness (Leung, 2015). As opined by Nowell (2017), it is necessary to use the components of trustworthiness to generate the validity and the reliability of the acquired data as outlined in the section below.

4.6.5.1 Credibility

The study established that credibility requires making efforts to ensure that the conclusions are obtained from the collected data and that data interpretation increases the credibility of the findings (Anney, 2014:276). The semi-structured data collecting method was created to achieve this goal by generating useful first-hand information from the participants' experiences with the topic under investigation. This study connected the participants' meanings to the themes and to the conclusions that were gleaned from the interviews. The validity of the findings is also enhanced by triangulation. As a result, the researcher contrasted the findings of the respondent interviews with the examination of the documents including the laws, the regulations and the literature. Data analysis is covered in the next section.

4.7 Data Analysis Technique

The study used qualitative data analysis to identify and explain the procedures for carefully analysing the data that was gathered to deliver the findings (Srivastava & Hopwood, 2009:76). The qualitative data analysis is described as the classification and the interpretation of linguistic (or visual) material to make claims about the material's implicit and explicit dimensions and the patterns of meaning-making, as well as what it represents (Flick, 2013). Analysing qualitative data usually entails submerging oneself in the data to become familiar with it, then looking for patterns and themes, searching for various relations between data that assist the academics to know what they have, and finally visually displaying and writing up the information (Kawulich, 2004). Qualitative data analysis may also be used to detect and explain the problems in the field, as well as the routines and the procedures (Srivastava & Hopwood, 2009:76). Albertse (2007) states that qualitative research data speaks for itself in terms of improving one's comprehension, interpretation, and extrapolation. This section explains how thematic analysis was utilised to reflect on the selected respondent's knowledge and experiences, as well as how conventional content analysis is used in contemporary documentation policies. The next section demonstrates the type of analysis that was used to analyse the data.

4.7.1 Thematic Analysis

The researcher in this study used the thematic analysis to connect a frequency analysis of a theme to one of the full contents (Alhojailan, 2012). The term "thematising" refers to the number of replies inside a data set (Namey *et al.*, 2008:138). Thematic analysis is a technique for methodically discovering, organising, and inferring patterns of meaning (themes) in a dataset (Braun & Clarke, 2012). Qualitative data analysis is essential in the reduction, in the thematisation, and in the reintegration of data into a cohesive conceptual interpretation (Vlaederen, 2003). The data in this study was analysed depending on the researcher's perspectives (exploratory framework) and how she viewed the data (Vlaederen, 2003). Burns and Grove (2001) describe exploratory research as a study that is undertaken to obtain new insights, to find new ideas, and to get a better understanding of a topic. The study explored the indigenous and the western knowledge experiences in the disaster risk management policies and in the legislative framework from the people who are knowledgeable about the topic under investigation. This exploratory philosophy was also used to analyse the data in this study so that the participants' genuine knowledge and western scientific expertise in disaster risk management could be acknowledged within their own settings and frames. According to Guest and MacQueen (2012), thematic analysis goes beyond merely counting words in a text to identify the explicit and the implicit concepts within the data. The utilisation

of thematic analysis in this study was to originate the meaning from the data while still adhering to the underlying theoretical assumptions (Braun & Clarke, 2006). During the interviews, the participants' interactions and personalities were taken into account.

On the integration of the indigenous knowledge and western knowledge in disaster risk management policy and legislative frameworks, the data was also examined depending on the characteristics of the respondents. To gain a picture of the phenomena under investigation, the whole data sets were read. The data was scrutinised again in search of trends. Morse *et al.* (2002) highlighted that it is the researcher's obligation to conduct a valid and reliable analysis utilising a self-correcting technique rather than ways such as member checking or audit trails for post-hoc review at the conclusion of the research. From the participants' perspective, a description of how the events were understood was created. The themes and code advancements were the focus of the study.

According to Krauss (2005), a theme is the principal outcome of the data analysis that produces practical results in the field of research, whereas coding is the line-by-line evaluation of the participants' speech. The researcher transcribed the interview material since they were present throughout the interviews, and they had direct knowledge of both the verbal and the nonverbal exchanges between the selected participants (Holcomb & Davidson, 2006). A continuous comparative analysis was carried out during the open-coding process to record what happened during the interviews using the participants' words. The respondents were assigned numbers to follow each other's contributions. The researchers use a range of methods and degrees of coding to code their recorded data (Jewitt, 2012). Strauss and Corbin (1998) define open coding as an analytic process of identifying the ideas and discovering their attributes and dimensions in data.

According to De Vos *et al.* (2005), open coding is the process of naming and categorising phenomena by closely examining the data. The study used axial coding to link the ideas together, with the extraneous information being removed. Considering the nature of the investigation, the researcher in this study used conventional content analysis. The transcripts were interpreted using conventional content analysis, which was guided by the naturalistic paradigm. In a principled categorisation process, it gives a subjective interpretation of information (Hsieh & Shannon, 2005). Conventional content analysis, also known as inductive content analysis in the literature, is utilised when the goal of the study is to characterise a phenomenon for which there is little literature and no current theory (Elo & Kyngas, 2008). This type of an analysis was employed to determine if the indigenous and the western disaster risk management knowledge is reflected in the policies or in the legislative frameworks. The values that are held by the dominating institutions, as well as the decision makers in South

Africa's local municipalities in terms of indigenous and western knowledge, disaster risk management and vulnerability reduction may be revealed in conventional content analysis.

Chapter Summary

The multifaceted and varied data from the significant participants and from the literature review that was discussed in the earlier chapters on the conceptualisation, the application of the IKS and the WKS, as well as their integration into the DRM policy and the legislative frameworks, were synthesised in this chapter for presentation and analysis in Chapter 5. Data screening was based on empirical research, and on the interpretive analysis of how the IKS and the WKS were applied in the disaster-related concerns, as well as their integration into the BCMM's DRM policy and the links to the relevant literature. The synthesis and analysis of data in Chapter 5 clearly responds to the thesis's stated aims, as evidenced by the convergence of the empirical findings with the thesis' evaluation of the literature. It is now clear that taking into account the empirical data that is based on knowledge comprehension and application to disasters themes provided by the data could aid the BCMM in integrating the IKS into Westernised DRM policy. This is due to the fact that the data addressed the central issue of the thesis, which was how to integrate indigenous knowledge and western knowledge in disaster risk management policy and legislative frameworks.

CHAPTER FIVE

FINDINGS AND DATA ANALYSIS

5.1 Introduction

In Chapters 2 and 3, various theories and approaches were examined to elicit the ways in which the IKS and the WKS can be assimilated. These chapters also assessed the degree to which the knowledge integration systems are currently present in DRM and the extent to which the knowledge amalgamation has affected the DRM policy formulation globally. In this chapter, the study's findings are thoroughly explained and discussed in relation to how the IKS and the WKS should be integrated into the policy/legislative frameworks for DRM. Data analysis yields information that is concise, accurate and easy to understand for the numerous readers of the study report (Roboji, 2014). This chapter is structured as follows: the introduction, the content analysis of the policy documents and the summaries of the participants' profiles. The empirical study's findings, which are arranged according to themes, make up the majority of this chapter. The findings' discussion and conclusions come after the analysis has been completed.

5.2 Findings of the Study

5.2.1 Biographical information of the participants

The socio-demographic characteristics of participants are presented in Table 5.1.

Table 5.1: Profile of participants in the semi-structured interviews

Respondents Category	Description	Gender		Age		
		Male	Female			
BCMM Traditional Leaders	Coastal (2), Midland (1) & Inland (2) within the BCMM	2	3	31-40 yrs (1) 51-60 yrs (1)	41-50 yrs (2) 61-70 yrs (1)	
BCMM Political Leaders	Political leaders within the BCMM	2	1	41-50 yrs (1) 61-70 yrs (1)	51-60 yrs (1)	
BCMM PR Councillors	BCMM Directorates	4	6	<30 yrs (1) 51-60 yrs (4)	31-40 yrs (1) 61-70 yrs (2)	41-50 yrs (2)
BCMM Administration	Various Departments within BCMM	5	7	<30 yrs (2) 61-70 yrs (3)	41-50 yrs (4)	51-60 yrs (3)
Community Members	Fifteen BCMM Wards	13	15	<30 yrs (3) 51-60 yrs (5)	31-40 yrs (5) 61-70 yrs (3)	41-50 yrs (6) Over 70 (6)
Overall Total		= 58				

Source: Own compilation (2022)

With the objective of a better understanding and gathering a variety of data from the selected study population, a gender-related data was crucial since the researcher wanted to investigate how different sexes respond to and are capable of preventing and managing the disaster risks and how the genders relate their experience to the IK or the WK and if there is a difference. A total of 32 out of the 58 participants in the study were women, thereby showing a predominance of women in this study. The researcher was reminded by the enthusiasm shown by the women that the disaster risks have the greatest impact on women. The United Nations Population Fund (2010) states that the women are frequently considered to be more vulnerable to the consequences of the natural hazards, although this subject is still largely unaddressed in the field of disaster management.

Due to the nature of the study, both the older and the younger individuals of the various communities were required to participate. The study found that the elder generations had a stronger understanding of indigenous knowledge than the younger generations had of the western knowledge. The findings in the table 5.1 demonstrate that the majority of the participants who participated in the study were primarily between the ages of 41 and 70. This is consistent with the findings from Tanyanyiwa *et al.* (2011) and Lunga (2015) which showed that the adults over 40 were more interested in the indigenous knowledge system than the people under 40, who are influenced by the western education. The data collection included the data about the participants' ethnic identification as this also determines a great deal on how the different groups relate to the different types of information systems. In this study, 45 out of the 58 individuals were blacks. The participants' educational backgrounds were also collected as the researcher wanted to see if there was a specific pattern that emerged in relation to the people's different levels of education. The findings revealed that 27 of the participants obtained tertiary qualification. This data was crucial because it influences how quickly the education, the training, and the awareness campaigns are implemented in the local governments and in the communities to prepare for and to prevent future disasters.

Moreover, religion was included as part of the data to get more information about the participants' religious activities. This was done to learn more about the participants' religious beliefs as the study discovered that certain beliefs have an impact on the likelihood of the hazards occurring (Schipper, 2008). The majority (34) of the 58 study participants were Christian with traditional beliefs. The data based on how long the participants resided in the study area allowed the researcher to better understand how familiar the participants were with the history of the area in terms of the disaster risks and disaster management. The individuals who were most impacted by the disaster risks were also the ones who contributed the most to a greater understanding of the subject by drawing on their personal experiences.

5.2.2 Respondents' understanding of the concepts of the indigenous and the western knowledge systems

The participants were asked to share their views on how well both the knowledge systems were understood as well as how they applied both knowledge systems to deal with the negative impacts of the disaster risks. To ascertain whether the participants were familiar with the terms "indigenous knowledge" and "western knowledge," as well as how they were applied in disaster risk management, the participants were requested to explain in their own understanding how they understand the two knowledge systems and how they applied them in the actual disaster risk scenarios.

From the interviews, it was discovered that all of the traditional leaders who took part in the study clearly understood what the indigenous knowledge is. They associated the indigenous knowledge with home grown and deeply rooted local knowledge that has been used for a very long time by the elders to survive and that has been orally passed from generation to generation. This demonstrates how the traditional leaders especially view the IK as knowledge that becomes a component of their belief system to support the local communities through difficult times.

The statements below from some of the participants capture the essence of the traditional leaders' views:

"Indigenous knowledge as the knowledge gathered through social ties with nature within local people's informal experimentation and transmitted over time to generations"
Traditional leader, BCMM.

The participants from the municipal administration all agreed with one another that indigenous knowledge provides the communities with the knowledge and the practical skills that they need to direct and manage their own development. They relate indigenous knowledge with local knowledge that has been acquired through first-hand experience, as it develops in the local context and is thus specifically tailored to the needs of the local community and the environmental conditions. The municipal political leaders were of the view that the indigenous knowledge is amassed by the people in a specific community over time and it is always expanding and modifying to suit the new conditions. While the municipal councillors considered indigenous knowledge to be the knowledge that combines both the fundamental components of ancestor knowledge with the cultural strategies that provides the local people with a means of survival.

However, the community members had a clear understanding of what IK is, a mere three participants were unsure. The majority of the community members' link indigenous knowledge to the knowledge that has influenced who they are, and it has given them the respect and the morality that have allowed them to persist for as long as they have. One of the members of the community went on to explain that "*indigenous knowledge is our culture, which tells us what to do in Kwantu (indigenous nations) to preserve the izithethe namasiko (tradition and customs) that were inherited from our elders*". This shows how the society has ingrained the native knowledge customs as the knowledge that has instructed the morals and the respect for the environment for survival and development.

Therefore, the findings of the study show that the majority of the participants had a clear understanding of what the IK is, since they interpreted it mostly based on their own observations, however, their personal experiences varied. Only the few participants who were unsure of what IK is did; however, make an assumption that it referred to the knowledge from the ancient times, as they perceived the western knowledge to hold substantial influence in the present.

When asked about the WKS, it was found that the participants from the municipal administration and from the municipal council members all demonstrated a solid understanding of western knowledge. They tie western knowledge to the written word which organises information and creates explanations as well as predictions about the world that can be tested. This is due to the fact that these participants are exposed to and work with the western expertise which is prevalent in the government structures and in organisations. In a similar vein, all the municipal political leaders understood what western knowledge is. They were of the view that it is the application of the principles and the concepts that are developed through a scientific method to explain and provide verified evidence. One of the political leaders further explained that "*western knowledge has the capacity to transform outdated methods into effective modern methods to raise living standards*". This demonstrates how the political leaders acknowledge the scientific methodologies that were created by the western knowledge which provides fact-based knowledge to provide advancement. Alabdulkareem (2013) states that the reason why western knowledge applies the facts to a particular issue to provide a route for growth. Three out of the five traditional leaders have distinctly divergent viewpoints, believing that the development of skills and practices using westernised methods dims the existence of IK and supplements this knowledge that was already known to exist. This shows that even though the traditional leaders acknowledge that WK has created modernised abilities and practices, they believed that the presence of the western expertise had diminished the existence of IK. Despite the diversity of viewpoints among the community

members, most participants understand western knowledge as a knowledge developed through educated methods that excluded the uneducated, thereby generating a division in the communities where the wealthy remained wealthy, and the poor remained poor. They highlight that western knowledge builds on many people's experiences to develop modernised strategies that meet the demands of the local people.

Given the perspectives on the participants' understanding of both IKS and WKS, it is vital to concentrate on how they applied both knowledges in disaster risk management. The following section focuses on the application of indigenous and western knowledge in disaster risk management.

5.2.3 Respondents' views on the application of indigenous and western knowledge systems in disaster risk management

From the interviews, it was discovered that the majority of the participants apply IKS to manage and prevent the impacts of disaster. All of the study's participants had experiences with the IKS techniques for DRR, which varied from community to community. The majority were members of the community, especially those who were hardly affected by the disasters for a number of times and who had mostly resided in such susceptible areas for longer than 20 years, which could best relate on how the IKS are applied in DRR. The application of IKS, according to the participants who reside in the informal settlements, is relevant to them since, in their view, it gives them the necessary knowledge and skills to deal with the disasters. They mentioned the DRR practices that they learned from their elders, such as (i) Digging trenches to divert water away from their homes, (ii) Building their homes out of stone and wood on high foundations to prevent flooding and (iii) Constructing shacks at least five meters apart to prevent shack fires.

The community members from the rural areas claimed to possess indigenous risk-adaptation abilities that are essential for reducing disaster risks through signs of animal behaviour and vegetation movement. For instance, a community member revealed that, *"We can tell when heavy rain is coming when snails (sinyeke) climb specific trees, earthworms (intshulube) crawl widely, ants (imbovane) go to safer places, and insects (izinambuzane) fly in large numbers"*. The findings of this study and from the earlier studies conducted elsewhere are in convergence in terms of the early warning systems based on indigenous knowledge. In Kenya, on the banks of Lake Victoria, the Banyala village in Budalang'i had a well-organised strategy such as a dugout canoe that was ready for transport in case of heavy flooding. They also dug trenches to control the water around the homestead and around the farmlands for averting approaching calamities (Mwaura, 2008).

All the traditional leaders who took part in the study shared their thoughts on how indigenous knowledge is contributing to survival in a variety of ways. They mention that they provide medical care utilising indigenous knowledge, including the use of African plants such as *uMhlonyane* and gum trees to treat fevers, as they believe that these traditional treatments were crucial during Covid-19. Though the municipal administration demonstrated how some of the IKS for disaster prevention such as observing the sun and listening for a certain bird's cry could be used to forecast the rainy season for farming, they also mentioned witnessing most birds construct their nests higher up, which is a sign of flooding. In eSwatini, the other traditional methods for foretelling natural hazards include wind direction, the shape of the crescent moon, the behaviour of particular animals and the cries of certain birds to forecast rain and the yields of the wild fruit plants to presage famine (United Nations Environment Programme, 2008).

Although the participants' beliefs about these tactics vary, from the data it was clear that they are all in agreement that animal behavior, as well as the changing and movement of plants/grass are the most common indigenous coping mechanisms that are used as the early warning signs to prepare for disasters. However, the municipal political leaders and the council members indicated that they have a concern about the accuracy of these IKS methods since they feel that due to unstructured hearsay, the references are not any evidence to back the IKS methods up and that they can be applied in DRR.

On the WKS's application in disaster risk reduction, the majority of the participants' ideas and thoughts were positive, thereby demonstrating how western knowledge had enhanced early warning systems and policies that aid in dealing with localised disaster risks in the BCMM, such as flooding, drought, strong winds, shack fires and illegal electrocution. The participants further indicated that in the event of a disaster, the early warnings are distributed through the print and electronic media with the help of the South African Weather Services through print and electronic media so that the residents can be prepared for such disasters. One of the community members noted importantly that, *"it gets difficult when a household in need doesn't have even the basic resources to be able to receive those early warning"*. Aruleba and Jere (2022) argue that the rural communities struggle to maintain the rate at which digital connectivity grows and that it is difficult to penetrate due to the fact that the majority of them are uneducated and they have difficulties in acquiring the IT skills and the high cost that is involved in purchasing the technology-enabled devices.

With the assistance of western knowledge, the municipal councillors revealed that the BCMM Disaster Centre frequently raises the community's awareness. This awareness is raised through but not limited to the municipal road shows and showcasing the methods the

municipality is using to prevent the multiple risks. These types of campaigns also equip the communities with the necessary skills to survive the hazards they encounter. The municipal administration and the political leaders were in agreement that the municipality has a modernised, western system in place, such as a GIS, which helps to identify the risk zones and supports the risk reduction initiatives in the areas that are frequently affected by the disasters.

Additionally, the municipal political leader, the councillors and the administration indicated that the communities receive training in disaster planning and the response applies western best practices to prevent the disasters. Some of the study participants from the community made mention of the risk assessment that the BCMM Disaster Management Centre (BCMMDMC) conducted in 2019. This included the training on the use of drones and GIS. The wards where training was done included Wards 1 and 2 which are among the selected study areas. One of the municipal political leaders further revealed that *“the metro has established a technological radio network so that any emergency may quickly reach the responsible stakeholders in time to minimise the damage”*. Although the majority of the participants agreed that western knowledge predominates and is used by the people all over the world to make decisions, these participants felt as though they were in agreement that western knowledge dominates, but the problem is that not everyone has access to this knowledge. However, the problem was exacerbated by the fact that only the minority of the community participants applied it due to its applicability and affordability for the underprivileged communities.

The study's findings demonstrated that the participants had a deeper understanding of both knowledges and how they could be applied to lessen the impacts of the disasters, but what is striking about these findings is that despite people having both knowledges risk reduction strategies at their disposal; the disasters continue to claim many lives every day. Nevertheless, the people utilised both IKS and WKS as a strategy to overcome the negative impact of those disasters and to reduce the severity and intensity to withstand adversities, as discussed in the next section.

5.2.4 Integration of Indigenous Knowledge and Western Knowledge in Disaster Risk Management Policy and Legislative Frameworks

In this theme, the findings of both document content analysis and semi structured interviews are presented.

5.2.4.1 Findings about the integration of IK and WK in Disaster Risk Management from the document content analysis

The study reviewed a number of policy documents to gather information on the policies that may have an impact on how the indigenous and western knowledge are integrated into the disaster risk management policies. All of these policy documents were thoroughly read and reread to establish the categories from the data itself and to evaluate the accuracy of the acquired information. The headings that appear throughout several readings were frequently annotated on the documents and these headings were then modified to serve as a coding guide. This was crucial in detecting the repeated word patterns and similar phrases that helped structure the categories and develop the subcategories and themes within them. The study used a variety of approaches to deal with consistency, including document selection and analysis. The primary focus of document selection was on the government documents at the local level, with indigenous and western expertise in the policies and the frameworks being taken into account. This section presents the findings from the content analysis of the study's reviewed policy documents, as seen in the demonstration in Table 4.2 and Annexure B.

A total of 13 policy documents from the BCMM website and the archives were reviewed to ascertain that both the indigenous and the western knowledge are included into these policies. These policy documents include: (i) The BCMM Bylaws, 2019; the BCMM Disaster Management Policy, 2012; (ii) The BCMM Disaster Management Report, 2014/2015; (iii) The BCMM Local Spatial Development Framework, 2013 and 2019/2024; (iv) The Built Environment Performance Plan, 2018/19; (v) The BCMM Integrated Development Plans, 2016/17; 2018/19 and 2020/21; (vi) The BCMM Policy on Long-Term Financial Planning, 2019; (vii) The BCMM Medium-Term Revenue and Expenditure Frameworks, 2018/2019 and (viii) The BCMM Annual Report, 2018/2019 and 2021/22. The main focus of the study was to ascertain whether the identified policy documents integrates and/or uses indigenous knowledge and western knowledge in disaster risk management policy and legislative frameworks of the Buffalo City Metropolitan Municipality. Unfortunately, no policy document integrates and/or uses both the IKS and the WKS. Instead, all of the documents mostly use western knowledge with indigenous knowledge not being used let alone mentioned at all in the policies. Reichmann and Wieser (2022) state that western knowledge is essential for influencing policy because it equips the decision-makers with the facts and information they need to make wise choices. This clearly demonstrates that despite the BCMM's policies being in existence, the indigenous knowledge is not taken into consideration. Even though the municipality has a Disaster Management Policy from 2012 which aims to establish a legislative framework for the application of disaster management, the policy shows no results

on the integration of indigenous and western knowledge in DRM, let alone acknowledges the importance of indigenous knowledge in DRM.

5.2.4.2 Findings about the integration of IK and WK in Disaster Risk Management from the semi structured interviews

With the integration of the IKS and the WKS in the disaster risk management policies, the study discovered that community participants were unfamiliar with the integration of the IKS and the WKS in the disaster risk management policies and the others claimed that the municipality has not yet taken into consideration the BCMM disaster risk management policies. The participants provided an explanation as to why they were unfamiliar with and/or this strategy as it is not taken into account in the BCMM disaster risk management policies. All the traditional leaders and the community participants expressed scepticism regarding the BCMM's IKS and the WKS considerations in their DRM policies and they expressed disappointment that the BCMM did not take the people's views into account or consult with the necessary custodians while drafting its policy. They argue that even if they did exist, they may just exist in paper, and they have never been put into practice.

The municipal administration believed that the integration of IKS and WKS into the BCMM disaster risk management policies lack the information and the abilities to be integrated together, which results in these knowledge systems functioning independently, despite their shared objective of enhancing community resilience. One of the municipal administrators that were assigned the responsibility at the municipality stated that:

“The municipality is not going far enough in this regard, when implementing policies, which most of the time favors western knowledge over indigenous knowledge”.

The municipal councillors and administration participants thought this is due to the fact that the informal hearsay references about the indigenous knowledge are challenging to substantiate and they should not be used in the formal documents such as in policy. They also indicated that the political factors resulting from the power imbalances among the involved parties frequently prevent the integration of the IKS and the WKS, with the safety of the local people receiving less importance than the political considerations. The majority of the participants thought that the local government had widened the distance between the two knowledge systems, thereby making it impossible for them to be integrated into the DRR policy. They thought that the gap between the two is a result of the local authorities' preference for western knowledge over indigenous knowledge, which makes it difficult to use both the knowledges equally in policy. The community participants claimed that the situation is made

worse by the government structures' continued use of the western knowledge to implement their policies while leaving out the indigenous knowledge from those policies.

The municipal administrations were of the view that the western knowledge set the bar for determining the truth, which is why the government institutions' goals are based on the policies that necessitate accurate information. They emphasised further that because of the serious issues that are posed by the disasters which necessitate accurate decisions to be taken, western knowledge is constantly growing and becoming an integral part of the disaster risks. However, the community participants stated that despite the IK being used by the locals as a coping strategy to prevent disasters, its significance in disaster risk reduction has not yet received the substantial attention that it deserves. The municipal councillors made the argument that perhaps, now that the founding elders of indigenous knowledge are no longer alive, their relevance has decreased, particularly in the eyes of the younger generation, which is unaware of its significance. The municipal political leaders said that this is the reason why it is difficult for everyone to understand the indigenous customs because the people have a propensity to misinterpret information that could be harmful or that could delay action when a disaster strikes, and the right decisions need to be made. The majority of the participants felt that the gap would continue to widen as long as the knowledges are still applied as rival competitors rather than integrating it into a single strategy that could be used to reduce the disaster risks.

The majority of the study participants, on the other hand, continued to state that integrating the IKS and the WKS is essential as a cornerstone for the western approaches working with the locals who believe in their own coping mechanisms and connecting expertise of these knowledges to create safe and resilient communities. They stated that this is an important factor because, while the policies normally represent the government's aims for resolving the challenges and needs affecting communities in their areas, they also need to appropriately reflect those needs. However, a political leader further explained that *“the policy that would be based on the integration of two knowledge systems may be significant in supporting the impoverished in overcoming challenges”*. But the greatest challenge still lies on how the two might be integrated, as there is currently no framework that demonstrates how the two can be integrated. Despite the fact that the two knowledge systems have demonstrated capabilities for disaster risk management, there are certain advantages and disadvantages of integrating both knowledges in disaster risk management.

5.2.5 Integrating/using Indigenous and Western Knowledge in Disaster Risk Management Policies: Importance and Challenges

The participants' answers to the questions had an impact on their ability to distinguish between the importance and the challenges of integrating the IKS and the WKS into the disaster risk management policies. To ascertain whether they were able to distinguish the differences between the two knowledges, they were asked to identify whether there are any potential implications that the differences may have in preventing the integration of indigenous and western knowledge. The participants' views on how the two knowledge differences may be able to complement one another varied widely; some thought it should be possible, while others did not. Even so, the participants were able to pinpoint some of the problems that are associated with western knowledge to reduce the risks associated with the disasters that can be addressed by indigenous knowledge. Based on their varied perspectives, the participants identified the following as the advantages and the disadvantages of integrating/using indigenous and western knowledge in disaster risk management.

5.2.5.1 Importance of integrating Indigenous and Western Knowledge in Disaster Risk Management

On the subject of integrating indigenous and western knowledge in DRM, the study found that there are certain advantages of the integration that were identified by the participants. The majority of the participants have based the advantages of integrating or using indigenous and western knowledge on their own experiences with how the two knowledge systems are benefiting them in protecting both the people and the environment they live in. The municipal political leaders stated that the indigenous and western knowledge systems are the cornerstone of disaster risk management since they have the broad-ranging ability to prevent disasters and their occurrences. The municipal administration agreed that the advantage of integrating IKS and WKS is that both produced a unified approach to DRR, and they gave both systems a chance to express their roles and principles while showcasing their expertise in preventing disaster risks. They continued by saying that it is advantageous that both indigenous and western knowledge have a strong capability to prevent unforeseen calamities and that both educated and uneducated people are accommodated to be able to use them to prevent disasters. Similar to this, the municipal councillors noted that the advantage of integrating/using IKS and WKS for disaster risk management is that it provides a well-established strategy that accommodates both the rich and the poor under one risk reduction umbrella while directly addressing the challenges of the community in each knowledge system's particular way. They think that the advantage of integrating indigenous and western

knowledge can help to transform the challenges associated with disaster risks into risk reduction opportunities.

The community participants have differing views; some see these advantages, while others do not. Though, the majority of the community participants believed that integrating indigenous and western knowledge would benefit disaster risk management because both knowledge systems have strengths in their own distinctive areas that may be used to suit people based on their local acceptable conditions. While only five out of 28 community participants disagreed, they believed that there is no need for the integration because those indigenous and western knowledge systems both had their own radically different methods of doing things that would only exacerbate conflict rather than resolve it. Moreover, the participants also acknowledged some of the advantages of using indigenous knowledges in addressing the knowledge difficulties that are faced by the western knowledge. The majority of the participants expressed concern over the present load shedding problem, which is affecting everyone. The participants mentioned that they used the sun as an indigenous solution in the past to charge batteries for radios and heat water for bathing, but that they now use solar power to run modern electric appliances since there is a problem of load shedding.

The community participants also raised the issue of how certain western medications are created from locally grown plants, using aloe as an example, which is an indigenous remedy for stomach aches. Furthermore, they pointed out that vegetation is essential in minimising the high winds and in preventing flooding during the rainy season as it is replaced with modernised concrete and drainage systems. Another point that was brought forward by the municipal administration was the fact that eucalyptus is produced from gum trees which are an indigenous plant, and that it was made marketable for commercial usage by the west, more especially during Covid-19 when the pandemic was based on western treatments with the failure to locate even one. Therefore, this demonstrates that both knowledge systems have significant contribution to an integrated strategy that might provide a long-term sustainable approach in preventing the disaster risk impacts. However, the question still stands as to how crucial it is for these knowledge systems to be acknowledged in legal documents so that their crucial function may be understood.

5.2.5.2 Challenges of integrating Indigenous and Western Knowledge in Disaster Risk Management Policies

The study found that using both indigenous and western knowledge systems in disaster risk management has disadvantages, as these limitations usually impede the development of knowledge integration in DRM. More criticisms from the participants were made; some of them were constructive in the sense that they offered ideas that were beneficial to the study's goal,

while others did not support integrating the two knowledge systems at all. The majority of the participants indicated that the major limiting factor to the integration of the IKS and the WKS is the lack of a legal framework that may help to provide guidance for the knowledge integration in disaster risk management policies. Furthermore, the municipal councillors believed that there is a bias in favour of the WKS in all the government policies which led to a lack of recognition of the IKS due to ignorance, which made it impossible to integrate both the IKS and the WKS into the disaster risk management policies. They also stated that the lack of working relationship between those who create policies and the DRM stakeholders as well as the local leadership structures and community members shows that such policies are still in the early stages of development.

The municipal political leaders shared the view that there was a lack of awareness of the indigenous customs that was brought on by people starting to believe false information, and this was the main disadvantage to the integration of the IKS and the WKS. For this reason, they thought that it is challenging to integrate the indigenous and the western knowledge systems in DRM because the individuals have divergent views about them. The municipal administration claimed that the problem stems from a lack of political will to integrate the indigenous and the western knowledge systems into the mainstream DRM policies, as well as from the marginalisation of indigenous knowledge in disaster risk reduction by the researchers and the scientists. One of the administrators said, *"I believe the disadvantage is that policymakers are not indigenously grounded and their lack of awareness in providing indigenous foundation on the use of indigenous knowledge in disaster risks is the reason the policies are more westernised"*.

Given the current condition of the IK which is that it is not as evolved as the WK, the participants' biggest concern was that no one will be discussing about the usage of indigenous knowledge in the centuries to come with the current generation. However, the community participants felt that while both knowledge systems are capable of averting disasters, it is a disadvantage that they believe that each is meant for certain people when it comes to preventing disaster practicalities. They thought that the IK is for the poor because the locals use old indigenous materials from the natural resources to prevent disasters while the WK is for the rich because everything is done using money for advanced technology to acquire scientific early warning information, thereby making it inaccessible to the locals due to its unaffordability. This being the case, the community participants stated that integrating both the IKS and the WKS systems for disaster risk management is detrimental, as each has a unique method for approaching problems, some of which may be at conflict with the other side of knowledge. The traditional leaders argued that all of these issues are brought on by the lack of a clear path for integrating the IKS and the WKS and by a lack of a deeper understanding

of how to do so in disaster risk reduction. Therefore, to strengthen its application in disaster risk problems, a clear method of integrating both the IKS and the WKS into disaster risk management strategies is required.

5.2.6 Strengthening the Simultaneous use of both IKS and WKS in the Policies and Legislative Frameworks of BCMM

With a focus on strengthening the use of indigenous and western knowledge systems in disaster risk management, the majority of the participants emphasised the need for education, training and public awareness as part of reinforcement. The municipal administrations stated that the knowledge-based programs needed to be developed by all levels of government, by the private sector and the non-governmental organisations, and even in the school curricula, to strengthen the application of the IKS and the WKS for disaster risk management. One of the senior administrators stated that, *“this integration of indigenous and western knowledge must be encouraged so that the future generation will be made aware of the significant role it played in reducing disaster risks at a young age”*. Similarly, the majority of the community participants and the traditional leaders agreed that building knowledge databases and libraries based on integrating the IK and the WK systems in the DRM policies that increase the peoples' levels of education and training facilities will strengthen the integration of knowledge.

The community participants further stated that by creating the channels of communication and by making information broadly accessible to everyone, the role of integrating and utilising the IK and the WK in DRR will be strengthened. They stated that the municipality creates disaster management bylaws that would enable the people to express their opinions on how the policy could take into account their knowledge and viewpoints so that they could feel included in its execution. Furthermore, the municipal councillors proposed that *imbizo's* (community meetings) must be held at the community level and seminars as well as workshops must be held at the government level to strengthen the integration of the IKS and the WKS in DRM and to allow everyone to express their views to the best of their knowledge and experience. They went on to say that conducting Disaster Management Advisory Forums would help to strengthen the integration of the IKS and the WKS and that the community, the traditional leaders as well as the external stakeholders would play a key role in implementing the DRM policies.

The traditional leaders and the municipal political leaders also indicated a critical issue of consulting the custodians of both the IKS and the WKS to gain their views on how to strengthen the use of the two knowledge systems for DRM. They believed that a number of disaster risk reduction strategies had failed because they could not be applied locally thus, they advised integrating the IKS and the WKS with the DRR strategy to be mindful of the cultural context

that suited the locals. The municipal troika emphasised the significance of promoting public awareness to inform the populace of the value of utilising both the IKS and the WKS in the disaster risk concerns and the role that both knowledges play in the DRM policy. Therefore, a thorough research is needed to provide guidance on how each critical viewpoint that was voiced by the participants could be merged to provide a practical answer on how to integrate the IKS and the WKS to strengthen its implementation into the DRM policy.

5.3 Discussion of the Findings

A total of 13 BCMM policy documents were thoroughly analysed to ensure that both indigenous and western knowledge were taken into account. The study used a variety of approaches to deal with consistency, including document selection and analysis. The analyses showed that the BCMM does not have a policy or framework that integrates and/or uses indigenous and western knowledge in disaster risk management. Instead, all of the documents mostly reflect the western knowledge, and the indigenous knowledge is not mentioned at all. Even though, the study found that the municipality has the disaster management framework from 2012, but nowhere in that document does it mention integrating the IKS and the WKS in disaster risk management.

Furthermore, it was evident from listening to the different participants that the BCMM does not integrate IKS into their disaster risk management policies and plans, despite providing communities with the disaster risk management tools developed from the WKS. It was observed through the participants' facial expressions that the BCMM were unaware of whether the IKS and the WKS were integrated into the disaster risk management policies. Despite the fact that the BCMM locals use the IKS and the WKS approaches as disaster preparedness strategies and as survival skills to prevent disasters, it was noted that the majority of the participants did not necessarily recognise the value of the IKS in DRM, thereby indicating that it would take some time for indigenous coping mechanisms to be integrated to strengthening the simultaneous use of both the IKS and the WKS in the policies and in the legislative frameworks of the BCMM.

With regard to the indigenous knowledge's early warning systems, the findings of this study and those of the earlier research that was undertaken elsewhere are in convergence. The study discovered that animal behaviour and the changing or the movement of vegetation are the most frequently used indigenous coping methods that are utilized as the early warnings for disaster preparation. In Zimbabwe and Uganda, the communities frequently wait for tree flowering, the development of new branches, as well as the appearance of termites, ants, butterflies, and frogs, all of which indicate the impending rainfall (Okonya & Kroschel 2013;

Jiri *et al.*, 2016). This is crucial in assisting the local and the traditional communities to prepare for and to lessen the potential harm that a potentially dangerous event can bring.

The study discovered that the complementary use of both the indigenous and the western knowledge systems considerably enhances the development of safe and resilient communities. The early warning indications of disaster have been recognised using indigenous wisdom for many years. This has recently been supplemented with the western data from SAWS. Drawing from Chinlapianga (2018), this study implies that the local people's weather knowledge could be combined with the western planning methods in the mitigation and in the adaptation initiatives. The findings of this study are consistent with those of the earlier ones. For instance, Jha and Jha (2011) state that the IKS and the WKS are systematic theories that can facilitate the process of disaster risk mitigation, preparedness, response, and recovery in a way that is resilient, sustainable, cost-effective, and participative.

The research's conclusions support the body of knowledge that has already been written about the application of indigenous and western knowledge in disaster risk management. The data collected for this study showed that the populations under investigation use the integration of indigenous and western knowledge to mitigate disaster risk, albeit to varying degrees. It might therefore be argued that these findings are in line with the literature review in Chapters 2 and 3.

Chapter Summary

A number of significant findings were presented in the study, many of which are in agreement with the findings of various authors who have already conducted research in similar studies. The first part of the section concentrated on the profile of the respondents in terms of their gender, age, education, ethnicity religious beliefs and the period lived in BCMM community. The purpose was to present a participant's profile and investigate any possible impacts it might have on DRM. It is plainly clear from the facts provided and from the interpretation that a community's features influence how it will react to the risks and to the disasters. This assertion is supported by Wisner *et al.* (2004), who argue that factors such as gender, age and ethnicity as well as physical conditions influence how susceptible people are to disaster risks. The study found that the BCMM disaster risk management policy does not integrate the IKS and the WKS; in this regard, even the participants were not aware that such a policy existed. The participants in the discussion determined the reasons why there is not such a policy in place, and they provided solutions. Moreover, the findings of the research that are presented in this chapter show that the local communities in the BCMM have a variety of knowledge skill practices that are used in the DRM initiatives, including those that are related to disaster

preparedness and prevention. This chapter has shown how people in the BCMM use both indigenous and western knowledge- based strategies to prevent, mitigate and to deal with disasters. It can be inferred from the data in this study that the participants have a clear understanding of the indigenous and the western knowledge because their understanding was largely based on their own observations and experiences, though there were some differences in how these knowledge systems were applied in the communities. The study's conclusions and some recommendations for developing disaster risk management frameworks that integrate both indigenous and western knowledge are covered in the chapter that follows.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS OF THE STUDY

6.1 Introduction

The reality is that the disaster risks have a continuing effect on the communities of the Buffalo City Metropolitan Municipality. The study provides the means for BCMM to build a policy/framework that is based on integrating the IKS and the WKS into disaster risk management to reduce the detrimental effects of such disaster risks. This is essential in designing a policy that focuses on the causes and the effects of disaster risks inside the municipality to address the scale and repercussions of such disasters, their extensive effects and the reported and unreported casualties. The local communities are particularly at risk for disasters because of the intricate relationships between the anthropogenic activity, human error and the natural disasters that put people, their way of life, and the environment in danger from the threats that are brought on by the trigger events that cause significant human, economic, and environmental losses. To understand the dynamic nature of the disaster risks and to be able to develop a plan that is focused on solving the needs and issues affecting local people, the municipality requires a clear policy that integrates both the IKS and the WKS in DRM. In addition, understanding the impact of a disaster's intensity and severity is crucial for the local communities to assess the risks and to devise effective strategies for minimising any potential triggering disasters. Shaw and Baumwoll (2008) state that the policies must accurately reflect the community needs because they frequently reflect the government's objectives for resolving the challenges and the needs affecting the citizens in those communities. This chapter provides a summary of the study's conclusions. It also includes an overview of the study's objectives and a description of each critical role that was played for the study to accomplish its main objective. Lastly, the chapter provides some recommendations that can be used to strengthen the integration of indigenous knowledge and western knowledge in disaster risk management policy and legislative frameworks to make the BCMM more equipped to resist the disasters.

6.2 Summary of the Study Chapters

Chapter One - Overview of the study: The chapter provided an overview of the study and its context, as well as the foundation for the study's importance, the problem statement, the theoretical framework, the research questions, as well as the aim and objectives.

Chapter Two - Theoretical Conceptualisation of Indigenous and Western Knowledge:

The chapter examined the reviews, and it critically evaluated the literature on the indigenous and the western knowledge.

Chapter Three - The integration of indigenous knowledge into and westernised disaster risk management policy and legislative frameworks, a literature review: Previous literature on the integration of the indigenous and the western knowledge systems in disaster risk management policy and legislative frameworks was outlined and investigated. Specifically, the chapter looked at the fundamental philosophical perspective that underlies some key arguments that are relevant to the findings of the study.

Chapter Four - Research Methodology: The chapter presented the research technique and the methodologies that were utilised in this study as well as a detailed description of the study area.

Chapter Five - Empirical findings of the study: The data analysis, document analysis, and the study's main findings were covered in this chapter.

Chapter Six - Conclusions and Recommendations: The dissertation's main points and findings regarding the integration of indigenous and western knowledge in disaster risk management policy and legal frameworks in the studied area are summarised herein. This chapter also identifies some of the study's weaknesses as well as the research gaps that should be addressed in the future.

6.3 Achievement of research objectives

This section assesses the degree to which the study's objectives laid out in Chapter 1 were accomplished.

Objective One: Elucidate the theoretical underpinning of the indigenous and the western knowledge system in disaster risk reduction.

This objective was achieved by reviewing a literature of the theories from various authors regarding the integration of indigenous and western knowledge in the disaster risk reduction policies in Chapter 2 and 3. Various strategies are described in the literature, some of which are based on the frameworks that have shaped the need for and the significance of the IKS and the WKS's integration in DRR. While the other theories emphasised how the DRR policy and legislative frameworks served to encourage the usage of IKS and WKS as well as their integration into the DRR policies, it was in the best interest of the study to suggest such

research because of the various disaster risks that exist within the BCMM. When it comes to issues that have an impact on the communities, the implementation of policies that address the detrimental effects of disasters and the vulnerability they bring to people's lives serves as the voice of the people for the voiceless. Section 24 of the Constitution of the Republic of South Africa, 1996 states that everyone has the right to reside in a place that is not harmful to their health or wellbeing. The review of the literature also included the ideas that analyse the gaps and the opportunities in the simultaneous application of the IKS and the WKS for successful disaster risk reduction. All of these efforts are made with the objective of providing the BCMM a strategy that addresses the difficulties that are related to the disasters that the metro is currently facing by giving the best plan that focuses on the integration of both the IKS and the WKS in disaster risk management.

Objective Two: To investigate the need for indigenous and western knowledge systems in disaster risk reduction thereof.

This objective was addressed by the empirical findings. The need for indigenous knowledge to be integrated into western knowledge disaster risk management policies and legislative frameworks was strongly supported by the participants' use of first-hand experience to highlight the important role that both indigenous and western knowledge played in addressing the negative effects of disaster risks in their local communities.

Objective Three: Assess the Perceptions of the Key Informants and Communities of Buffalo City Metropolitan Municipality on the use of Indigenous and Western Knowledge Systems in Disaster Risk Reduction.

The empirical findings covered this objective. Generally, the informants understood the IKS and the WKS in disaster risk reduction, but they were not familiar with these knowledge systems as they related to the Buffalo City Metropolitan Municipality DRM policy. Though the informants also identified the IKS and the WKS as essential coping mechanisms that are used to lessen the effects of disaster risks, the argument was that the municipality had not yet taken into account the BCMM Disaster Risk Management policies.

Objective Four: Generate ideas and draw recommendations on ways to integrate both indigenous and western knowledge systems in disaster risk reduction policies and legislative frameworks.

The final objective of this research was achieved, and it provided the recommendations on how to include both the IKS and the WKS in the disaster risk reduction policies and legislative frameworks of the BCMM, along with some lessons with a broader application in the DRR

policy. Thus, there will be quite a number of recommendations that are provided in the later stage of this chapter.

6.4 Summary of findings of the Study

6.4.1 Conceptualisation and Application of Indigenous and Western Knowledge Systems for Disaster Risk Management

The findings of the study demonstrated that the participants understand both the indigenous and the western principles and how to apply them to disaster risk management to reduce the likelihood of disasters. The study found that the participants' understanding regards indigenous knowledge as the knowledge that is locally sourced, that was long used by the elders to live, and that was passed down orally by the generations. On the other hand, the study found that the participants understood western knowledge as being based on an updated experience and on the research observations, which were then used to back up their statements with scientific evidence. Nevertheless, the study discovered that despite the significance of indigenous knowledge in reducing disaster risks, many people continue to question its efficacy because there is no indigenous documentation to use as a point of reference. The participants provided instances of how the indigenous and the western knowledge capacities are applied in the disaster risk management initiatives. The study noted that these indigenous and western knowledge capacities provide prevention, preparedness, response, early warnings and education measures to reduce the effects of the disasters.

The BCMM local community has been relying on these indigenous precautions for years to prevent, mitigate and reduce the negative impact of the disaster risks. Although based on participant's views and experiences, the participants' knowledge and understanding of the significance of indigenous knowledge and how it affected their daily lives varied from community to community, the study also revealed that the BCMM communities have access to print and electronic media that assist by providing the education on disaster related lessons and the early warnings on weather forecast updates with the aim of helping the communities to get ready for any disaster-threatening situation. Despite the widespread dissemination of western knowledge, the study found that due to its unaffordability and accessibility issues, not everyone is able to understand how it is applied. It became evident that the participants' viewpoints on the indigenous and the western knowledge systems and how those systems relate to the disaster risk scenarios were equivalent to those of many authors who had written and published on related topics. The study discovered that although the participants valued western knowledge, they were also firmly rooted in indigenous knowledge, which is affected by the BCMM's rural setting and by the authority of the traditional authorities.

6.4.2 Integration of Indigenous Knowledge and Western Knowledge in Disaster Risk Management Policy and Legislative Frameworks

The findings of the semi-structured interviews revealed that the integration of the indigenous and the western knowledge systems is not yet taken into consideration in the Buffalo City Metropolitan Municipality's disaster risk management policies. However, the BCMM has a framework for disaster management that prioritises and makes use of western knowledge. The study noted that even the participants are unaware of the Buffalo City Metropolitan Municipality's disaster risk management policies, and they are unsure if any such policies ever existed. The key challenge that was identified by the study was a lack of engagement between the local government authorities and the general public, as well as between the traditional leaders and the western expertise, who are believed to be the custodians of knowledge management. Another reason was that the municipality is not going far enough regarding the indigenous and western knowledge. It is even worse integrating the two knowledges in the DRM policies, which favours the WKS over the IKS. Furthermore, the study discovered that the other contributing challenges were the inability to implement the disaster risk management processes and the lack of knowledge and experience in integrating both the indigenous and the western information systems. The study also discovered that the influence of the power imbalances among the stakeholders, the political leading party and the opposition parties who are the decision makers in the local municipalities is preventing the growth of such matters relating to the knowledge integration in the DRM policies, as the people are mostly concerned with leading positions.

The study noted that the BCMM documentation is dominated by western knowledge and that the degree of preservation of indigenous knowledge varied according to the values of the community. It was revealed in the study that the western knowledge is dominant because it is constantly evolving, whereas the indigenous knowledge has lost some of its significance because the elders who first developed it are no longer alive. The study raised concerns that even the current generation will not be interested in discussing the application of the IK in the centuries to come considering how far behind it is compared to the WK in terms of development. The study revealed that one of the reasons why the indigenous knowledge is restricted in every aspect when being applied to western knowledge is that it has not received as much attention as it should. The evaluation of the policy and the legislative documents of the BCMM reveal that the IKS is not integrated in the policies and in the legislative documents as they prioritise the WKS. Moreover, none of the reviewed documents makes mention of the word IKS to show acknowledgement of its importance or use in the municipality. Thus, the BCMM policies and the legislative frameworks continue to prioritise the western paradigms over the IKS.

6.4.3 Integrating/using Indigenous and Western Knowledge: Importance and Challenges

The study discovered that integrating the indigenous and the western knowledge into the policies encourages the affected communities to participate and it equips its members to take the initiative in all the activities that are aimed at reducing the likelihood of the disasters. This is a crucial aspect because while the policies frequently reflect the government's goals for resolving the difficulties and the needs affecting the citizens in their communities, they must also accurately reflect those needs. The study found that the indigenous and the western knowledge systems are both fluid amalgams of framed experiences and contextual knowledge that serve as a framework for assimilating the new experiences on their areas of specialisation. The study also established the crucial finding that when the indigenous and the western knowledge systems are integrated or applied to disaster risk management, they strengthen one another's abilities and capabilities in situations where one or both knowledge systems are incapable of coming up with a solution on their own. The study found that a community in the Philippines serves as a best example of how to integrate indigenous and western knowledge to lessen the severity and the magnitude of the disasters in their locality. For instance, the government of Dagupan City uses the *kanungkong* (an indigenous tool) that has long been used by the local communities and it integrates it with the western warning codes to help to categorise the threats of a disaster for community safety where it warns the community at the same time notifying the disaster management role-players to take alternative intervention (Molina, 2016).

However, it became clear that one of the main shortcomings to the integration of indigenous and western knowledge systems is the absence of a legislative framework that may serve as guidance for the knowledge integration in disaster risk management policies. Among others, the challenge discovered by the study was that only a minority of the people considered that the integration and application of knowledge systems had a major influence on DRM. This is caused by a lack of understanding of the platforms and the content to communicate about the significance of integrating both indigenous and western knowledge systems in disaster risk management, which prevents many individuals from learning more about knowledge integration in the disaster-related matters. There is also a perception that the policymakers lack an indigenous perspective, and they are unaware of the multiplicity of cultures that are found within the indigenous people, which explains why the policies have a propensity to lean more toward the western values. This is traceable to the fact that there are no reliable records for indigenous knowledge which can be passed down through generations by oral tradition and there is concern that this means of transmission could occasionally lead to erroneous

information through the generations. The study discovered that both the indigenous and the western knowledge systems have standards, customs and values that differ from one another and that are applied to the disaster risk issues in differing degrees, which is one barrier to integrating various knowledge specialities into a unified disaster risk management. It was revealed that the people's perspectives have changed as a result of assimilating the western ways of life, thereby making it challenging for them to even see the limitations of this knowledge system and only use indigenous knowledge when the western approaches failed to provide the answers. Though, the integration of indigenous and western effort has fallen far short due to the methodological and the epistemological discrepancies based on the worldviews and the strategies of interpreting reality, there is no formal framework or legal strategy that exemplifies how to integrate the indigenous and the western knowledge systems into disaster risk management.

6.5 Recommendations

Below is a summary of the recommendations that emanate from the study.

6.5.1 Develop policies that take into account the integration/use of indigenous and western knowledge in disaster risk management.

The study recommends that the DRM policies that integrate both the IKS and the WKS must be developed to strengthen the application of both knowledges in DRM. The study's findings have shown that a major challenge to the integration of both knowledges into the BCMM's DRM policies is a lack of understanding of how to put them into practice, as well as the political imbalances among the stakeholders. The integration of both knowledges into the formal DRM policy can serve as a base for improving the preparedness and the response plans to prevent the multiple-hazard events that frequently affect the BCMM communities, as described in Chapter 4. The DRM priorities and activities in these policies must be made clear during the development process to allow for consistent interpretation and implementation by a variety of stakeholders in accordance with the national regulatory standards.

5.6.2 Create strategies to strengthen the role of indigenous and western knowledge to disaster risk management

Education, training and research are crucial DRM approaches when it comes to strengthening the role of integrating and using the IKS and the WKS. The study suggests that the IKS and the WKS must be integrated into the primary and the secondary school curricula to educate and establish a solid basis for the future leaders who will employ these policies to avert disasters. Furthermore, it is essential to develop training programs that mainstream DRM and incorporate all significant role-players, thereby allowing each emergency responder the

chance to be adequately prepared for the worst-case scenarios. On the other hand, it is also crucial to develop studies that will assist them in identifying the possibilities and the obstacles so that they can utilise them as steppingstones to find ways for enhancing the integration and the application of the IKS and the WKS to DRM.

6.5.3 Establish platforms where appropriate Indigenous and Western Knowledge-holders can engage to improve the integration of IK and WK in DRM Policies.

Platforms for the development of indigenous and western knowledge practices should be established, so that the stakeholders in DRM may have discussions about how to effectively integrate both the knowledge systems into the DRM policies. The establishment of appropriate community-level organisations that allow the traditional leaders and the community members to actively participate in decisions that have an impact on their lives may be one way to develop the platforms for the exchange of knowledge and expertise. There must be an inclusion of the representatives from the government and from a wide range of custodians from both the IKS and the WKS who could serve as mentors and provide advice on how to use both knowledges when developing the DRM legislation. This can be achieved by conducting seminars, workshops, and community gatherings where a range of stakeholders can exchange knowledge and expertise on how to enhance the integration of the IKS and the WKS in the DRM policy.

All the recommended measures are proposed with the aim of improving the Buffalo City Metropolitan Municipality's DRM policies' use of both the indigenous and the western knowledge systems. They highlight the critical changes that must be made to the way the policy is currently being implemented to effectively minimise the local people's vulnerability through the integration of indigenous and western ideas into the DRM policies of the BCMM.

5.6 Areas for Future Research

- Evaluating the effectiveness of integrating the indigenous and the western knowledge systems in the disaster risk management policies of the Buffalo City Metropolitan Municipality.
- Researching on the indigenous knowledge's influences and the custodians' perceptions in relation to disaster risk reduction.
- Furthering studies on the integration of the indigenous and the western knowledge systems, with a focus on the unexplored areas of disaster risk management.
- The studies in larger sample sizes can be escalated in some areas of South Africa.

Chapter Summary

The study sought to evaluate the integration of indigenous knowledge and western knowledge in disaster risk management policy and legislative frameworks to make the BCMM more equipped to resist the disasters of the Buffalo City Metropolitan Municipality. The study revealed that the Buffalo City Metropolitan Municipality's communities regularly use both indigenous and western understanding while responding to disasters. However, this is not documented in any of the policies and in the legislative document of the municipality. The use of IK and WK by the local communities strengthens the community's capacity to build sustainable communities and it contributes to the strategies for disaster prevention, preparedness, response, early warnings and education initiatives. Even though both the knowledge systems contribute significantly to reducing the disaster risks, the western knowledge predominates in the disaster risk management policies. On the other hand, the indigenous knowledge differs from community to community, and it is dependent on how each community interprets it which is distinct from how the other communities view it.

Despite the fact that there are currently no policies for disaster risk management that take into account both knowledge systems, more work needs to be done at the DRM policy level to enable the long-term integration processes of the indigenous and the western knowledge systems in coping with the disaster consequences. These approaches must be inclusive of all the parties to rejuvenate the DRM regulations, the laws and the institutional frameworks at the national to the local levels of government as well as at the traditional institutions to encourage the establishment and the integration of the knowledge systems. Once more, these measures should be supported by the relevant research that will help to document the relevant data and create efficient educational initiatives to raise public awareness and the knowledge management matters. Therefore, closing the enormous gap between the two knowledge systems will be a panacea in designing a comprehensive DRM policy that integrates both knowledge systems to decrease the disasters that pose as a threat to human life.

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ANNEXURE A: Interview Schedule

1. Biographical Information

1.1 Wards

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29	
31	
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39	
50	

1.2 Gender

Male ☐ Female ☐

1.3 Age

Less than 30	
31 – 40	
41 – 50	
51 – 60	
61 – 70	
Older than 70	

1.4 Ethnic Group

Black	☐	White	☐	Indian/Asian	☐
Other	☐				

If you answered other, please specify

.....

1.5 Education

Primary	☐	Secondary	☐	Tertiary	☐
None	☐				

1.6 Religion

Christian	☐	Muslim	☐	Jewish	☐
None	☐	Other	☐		

If you answered other, please specify

.....

1.7 How long have you lived in this community? (Year/s)

Less than a year 1 - 5 years 6 - 10 years 11- 15 years

16 – 19 years More than 20 years

SECTION B

2 Briefly explain the concepts Indigenous and Western Knowledge to the interviewee then provide their examples and ask whether they make use of them.

2.1 What do you understand about Indigenous and Western Knowledge?

2.2 In what way are you making use of Indigenous and/or Western Knowledge in dealing with disasters?

2.3 Do the Disaster Risk Management Policies of the Buffalo City Metropolitan Municipality take into account the usage of both Indigenous and Western Knowledge Systems? Explain (why/ why not).

2.3.1 Which knowledge system is predominant in Buffalo City Metropolitan Municipality Disaster Risk Management Policy and Legislative Frameworks?

2.3.2 Do the Buffalo City Metropolitan Municipality's Disaster Risk Management Policy and Legislative Frameworks have any gaps in Western knowledge that may be addressed by Indigenous knowledge?

2.4 What would you say about the implementation of Buffalo City Metropolitan Municipality Disaster Risk Management policies in relation to indigenous and western knowledge?

2.5 What are your thoughts on the effective simultaneous use of Indigenous and Western knowledge in the Buffalo City Metropolitan Municipality's Disaster Risk Management Policy and Legislative Frameworks?

2.6 What are the challenges in integrating/using both Indigenous and Western Knowledge for Disaster Risk Management in Buffalo City Metropolitan Municipality?

2.7 What would you recommend to improve the use of Indigenous and Western Knowledge for Disaster Risk Management in Buffalo City Metropolitan Municipality?

SECTION C

3 The interviewee asks about the value of Indigenous Knowledge when integrated with Western Knowledge in Disaster Risk Management and asks whether they use it.

3.1 How would you explain as the benefits of integrating/using indigenous and western knowledge for disaster risk management?

3.2 What are the disadvantages of integrating/using both Indigenous and Western Knowledge systems for Disaster Risk Management?

3.3 How can the role of integrating/using Indigenous and Western Knowledge in Disaster Risk Management be strengthened?

ANNEXURE B: Policy Documents Reviewed

POLICIES, FRAMEWORKS, REPORTS AND PLANS	PURPOSE	INTEGRATION/USE OF INDIGENOUS AND WESTERN KNOWLEDGE			
		1 = Not Reflected	2 = Partially Reflected	3 = Reflected	Frequently
BCMM Bylaws, 2019	Regulates the affairs and the services it provides within its area of jurisdiction.	✓			
BCMM Disaster Management Policy, 2012	Establishes a legal framework for the application of disaster management in the BCMM.	✓			
BCMM Disaster Management Report, 2014/15	Reports on significant disasters that have occurred in the municipality.	✓			
BCMM Local Spatial Development Framework, 2013 and 2019 - 2024	Develops a land development strategy to manage the sustainability of both new and ongoing developments.	✓			
BCMM Built Environment Performance Plan, 2018/19	Reduces disaster related matters and helps to address the climate issue by enhancing and protecting people, places and the natural environment.	✓			
BCMM Integrated Development Plans, 2016/17, 2018/19 and 2020/21	Synchronises the local government's efforts into a cohesive plan to raise the standard of living for everyone in an area.	✓			
BCMM Policy on Long-Term Financial Planning, 2019	Ensures that the municipality has adequate and efficient funding to meet its long-term goals by putting the medium-term operational and capital budgets into action.	✓			

BCMM Medium-Term Revenue and Expenditure Frameworks, 2016/17- 2018/19	Ensures that the budgets give substance to the government's pledges to development and reconstruction and represent the government's social and economic priorities.	✓			
BCMM Annual Report, 2018/19 and 2021/22	Outlines the municipality's situation, operations, financial results and the performance that are relative to the established goals, including financial management practices.	✓			