SOUTH AFRICAN DISASTER MANAGEMENT FRAMEWORK: ASSESSING THE STATUS AND DYNAMICS OF ESTABLISHING INFORMATION MANAGEMENT AND COMMUNICATION SYSTEMS IN PROVINCES

by

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DECLARATION

I, Olivia Kunguma, declare that this work submitted to the University of the Free State – Disaster Management Training and Education Centre for Africa (UFS-DiMTEC) in the fulfilment of the requirements for a Doctor of Philosophy Degree in Disaster Management, is, in all honesty, my work. I adequately and appropriately acknowledged all the consulted sources. This work was not submitted previously to another qualification and a different University. I am fully aware of the University of the Free State's policies and have taken the precaution to comply with the regulations.

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ABSTRACT

South Africa is suffering from a magnitude of increasing human and weather-induced hazards such as drought, diseases, water shortage, urban-flooding, coastal flooding, wildfires, social unrest, and storms. In turn, these hazards instigate devastating social, economic, environmental, physical, political instability and devastating impacts. Due to increased hazards, disaster management activities have gained momentum. Activities such as preparedness, prevention, mitigation, response, and recovery, require up-to-date reliable data, properly managed information, and organised communication systems. In building community resilience, the disaster management field can, thus, not avoid emerging information, communication and technological developments. In various ways, the Fourth Industrial Revolution (4IR) is making enormous waves and can aid risk reduction to build resilience. Considering the above, the need for reliable data to manage disasters influenced the research into investigating the information management and communication systems in the South African Provincial Disaster Management Centres (PDMC). Additionally, the research into the status quo of the PDMCs and the dynamics surrounding the establishment of these systems added value to the study investigation. The South African Disaster Management Act 57 of 2002 (as amended, Act 16 of 2015) (DMA), the National Disaster Management Framework of 2005 (NDMF), and international agreements like the Sendai Framework for Disaster Risk Reduction (SFDRR) stress the importance of information management and communication systems for effective disaster management.

This study was anchored in the constructivist philosophical worldview that integrates well with the mixed-methods approach. Questionnaires that allowed for semi-structured interviews during administration and an observational walk comprising of photo-taking at the Centres, contributed immensely to the empirical evidence. The study was exploratory in nature because the South African disaster information management and communication systems have not been studied more clearly. A literary study was conducted to explore information and communication-related legislation, good practices, as well as asserting the significant link between disaster risk governance and management of information as the key to successful disaster management. An in-depth literature review, together with the comparative analysis of the Stakeholder Theory, Model of an Integrated Information Management and Communication System for Disaster Risk Management, the Information and Knowledge Management for Disaster Risk Reduction Framework and the Model of Policy Implementation Process, led to

an empirical inquiry into the disaster risk governance of the South African National Disaster Management Centre (NDMC), as well as the nine PDMCs. Following the mixed-method approach, a field study comprised a face-to-face administering (interview style) of a closed and open-ended questionnaire, allowing the respondent to discuss and comment on each question posed. The key informants comprised mainly of the heads of the Centres and deputy or assistant directors from each directorate in the Centre. Using a thematic analytic approach, the empirical data were analysed against themes derived from the research questions and literature review. The data were then presented in a narrative report chapter, comprising of pictures from the observational walk-about at the Centres. A descriptive analysis of the quantitative findings entailing summarising and finding certain patterns was presented. Both the qualitative and quantitative findings were presented sequentially.

Visits to the PDMCs revealed that integrated information management and communication systems were not established, including the NDMC. In an era where technology is increasing in speed, breadth, and depth, the study found disaster management officials collecting information informally without a formal methodology, storing information on personal computers and limited information dissemination methods like emails, as the main platform. The only systems developed since the promulgation of the DMA and the NDMF are fragmented and reactive in nature. The systems were mainly for reporting incidents contradicting the proactive approach mandated by the DMA and the NDMF. The study also confirmed that the governments idealised policy is not being implemented as expected by the government. The implementing institutions are under-capacitated in terms of human resources, irrelevant and inadequate qualifications and infrastructure. Also, politicians are not in full support or do not comprehend the disaster management function. Therefore resulting in the low prioritisation of the investments into integrated systems. Despite the dynamic setbacks, information management and communication systems remain a pivotal component to disaster management. Hence, the study recommends the national government takes the lead in establishing a uniform and integrated system that cascades down to the lower spheres of government.

Based on the in-depth literature review and empirical findings, the study proposed a holistic and effective integrated framework to guide the PDMCs in developing, managing and comprehending the components of information management and communication systems. Also, the Framework guides in understanding the systems' support for each key performance area and enablers as prescribed in the NDMF. Through strategic disaster risk governance

recommendations, the study ensured the prioritisation and placement of information, its management, and dissemination at the epicentre of disaster management operations. Disaster management practitioners need to start thinking creatively, find new methods to build resilience and accept some of the latest developments in science and technology that can provide disaster management solutions. Subsequently, good stakeholder relations and good governance practice might help lessen disaster impacts and improve the response to the earlier mentioned devastations.

The main recommendation for further studies included a critical analysis of an established fully functional and integrated disaster information management and communication system. As well as determining the effects of this system on disaster risk reduction in communities.

Keywords: Disaster, Disaster Risk Reduction, Disaster Management, Information Management, Communication System, Decentralisation, Policy Implementation, Disaster Risk Governance, Technology, Fourth Industrial Revolution, Stakeholders Theory

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List of Acronyms

The following acronyms listed here are the ones that are used often in the thesis and are explained in full on the first use. Acronyms that are used once do not appear in this list. The list serves as an easy reference for the reader.

4IR	Fourth Industrial Revolution
ACN	Automatic crash notification
ADMS	Advanced disaster management simulator
AEL	Air Emission Licence
AWGDRR	Africa Working Group on Disaster Risk Reduction
CAD	Computer-aided design
CBO	Community Based Organisations
CDA	Civil Defence Association
CERC	Crisis and Emergency Risk Communication
COE	Common operating environment
COGHSTA	Co-operative Governance, Human Settlements and Traditional Affairs
COGTA	Cooperative Governance and Traditional Affairs
CSIR	Council for Scientific and Industrial Research
DDG	Deputy Director-General
DLG&EA	Department of Local Government and Environmental Affairs
DMA	Disaster Management Act
DMISA	Disaster Management Institute of Southern Africa
DRC	Democratic Republic of the Congo
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
ECR	Emergency Communication Room
EMIS	Emergency information systems
EMS	Emergency Management Services
EWS	Early warning system
FAO	Food and Agriculture Organisation
FDI	Fire Danger Index
FEWS	Famine Early Warning System
GDP	Gross domestic product
GIS	Geographical Information System

GM	General Motors
GPDRR	Global Platform for disaster risk reduction
GPS	Geographical Positioning Systems
GTAC	Government Technical Advisory Centre
HFA	Hyogo Framework for Action
IBP	International Business Publication
ICASA	Independent Communications Authority of South Africa
ICDC	Interdepartmental Civil Defence Committee
ICDM	Intergovernmental Committee on Disaster Management
ICT	Information and communication technology
IDI	ICT development index
IDNDR	International Decade for Natural Disaster Reduction
IDP	Integrated Development Plans
IDTT	Inter-Departmental Task Team
IFRCRCS	International Federation of Red Cross and Red Crescent Societies
IIAG	Ibrahim Index of African Governance
IIMCS	Integrated Information Management and Communication System
IKMDRRF	Information and Knowledge Management for Disaster Risk Reduction Framework
IMCS	Information management and communication system
IMC	Information Management and Communication
IMCU	Information management and communication units
IMSMA	Information management system for mine action
ISDR	International Strategy for Disaster Reduction
JOC	Joint Operations Centre
KPA	Key Performance Area
KPI	Key performance indicators
KZN	KwaZulu Natal
MDG	Millennium Development Goals
MEC	Member of the Executive Council
MIIMCSDRM	Model of an Integrated Information Management and Communication System for Disaster Risk Management
MPIP	Model of the Policy Implementation Process
NCOP	National Council of the Provinces

NDMC	National Disaster Management Centre
NDMF	National Disaster Management Framework
NDF	National Defence Force
NDMIS	National Disaster Management Information System
NGO	Non-Governmental Organisations
NJDCC	National Joint Drought Coordinating Committee
NQF	National Qualifications Framework
OFM	Orange Free State (Media)
PDMAF	Provincial disaster management advisory forums
RSDFB	RS Demountable Flood Barrier
SAAQIS	South African Air Quality Information System
SADC	Southern African Development Community
SAPS	South African Police Services
SAQA	South African Qualifications Authority
SAWS	South Africa Weather Services
SETA	Sector Education and Training Authorities
SMS	Short message service
SOP	Standard Operating Procedures
ST	Stakeholder Theory
SRS	Situation Reporting System
StatsSA	Statistics South Africa
TMC	Transport Management Centre
UK	United Kingdom
UN	United Nations
UNISDR	United Nations International Strategy for Disaster Reduction
USAID	United States Agency for International Development
WCPDMC	Western Cape Provincial Disaster Management Centre
VR	Virtual Reality

DEFINITION OF KEY TERMS

Information – Is what is communicated or facts provided or learnt about something, as well as the reception of knowledge or intelligence (Merriam Webster Dictionary, 2018:1). Information is data that has been transformed or processed to help understand something and draw conclusions. Information is contextual.

Communication – Involves the creation of messages and sharing of knowledge verbally and non-verbally through the integrated use of traditional and new media to transmit information. Through this process, the creation of a shared understanding becomes an effective transmission of information (Tourish and Hargie, 2004:160; Barker, 2016:10). Barker (2013:104) further argues that communication is a strategic, interactive and integrated process of information-sharing to establish mutual understanding and beneficial relationships between an organisation and its stakeholders. Ultimately, communication is the sharing or transmission of information from one stakeholder to the other, and vice versa.

Information management and communication system (IMCS) – A system is an organised set of detailed methods, procedures and routines created to carry out a specific activity. It is a purposeful structure that consists of interrelated and interdependent elements that continuously influence each other. The purpose is to help maintain the existence of the elements to achieve the system's main goal. An information system, together with knowledge systems, is a system with the capability to provide answers to questions of *"where", "who", "when", "what", "how"* and *"why"* (Business Dictionary, 2018:1; Banks, 2002:195). Therefore, information management and communication system is a system with the capabilities to identify sources of information, assist with data collection, analyse the data, store the data and disseminate the processed information to the relevant stakeholders.

Media – Is the main means of mass communication (broadcasting, publishing and internet), regarded collectively (Oxford University Press, 2017). Media is the tool used to share messages, ideas and information with other people (Jennings, 2018:6). Media is a platform used before, during or after a disaster, to disseminate information to relevant and targeted stakeholders.

Stakeholder – Is any group or individual who can affect the achievements of the organisations' objectives or adversely affected by them (Friedman & Miles, 2006:19). Moreover, a

stakeholder is an individual or group of people who have an interest in an organisation or that organisation has an interest in them.

Governance – Governance is the interactive processes through which society and the economy are steered towards collectively negotiated objectives to achieve long-term sustainability (Ansell & Torfing, 2016:4). Governance is all processes of governing; it is undertaken by a government, market, network, family, tribe, formal or informal organisations, or territory and can be through laws, norms, power or language (Bevir, 2012: 1). Governance is, therefore, a multi-stakeholder approach to public consultation, influencing, negotiating, decision-making and taking action, concerning public life. Unlike management, governance is about the development of policies while management entails the implementation of the policies.

Provincial disaster management centre – a Centre established in the administration of a province in terms of Disaster Management Act 57 of 2002, section 29, and subsection 1. (Republic of South Africa, 2003:30). Having said this, a provincial disaster management centre is a tactical management level that implements plans developed at a strategic level through the formulation of budgets and acquiring resources for the lower spheres of government.

Key performance area (KPA) – Is the overall scope that an organisation is supposed to achieve. Specific objectives inform the key performance area (Republic of South Africa, 2005:4). Key performance areas are four specific areas of focus in the National Disaster Management Framework of South Africa, with set objectives to guide the design and implementation of disaster management activities.

Enabler – Enablers are required to achieve the objectives, set out in the key performance areas (Republic of South Africa, 2005: 4). It is an object that makes something possible or it is a structural, cultural, technological and human practice that can be used to support the implementation of a goal (Muller, 2017:69). An enabler supports the achievement of objectives in each key performance area in the South African National Disaster Management Framework.

Key performance indicators (KPI) – are means and core measures used to gauge the organisation's past or current performance in a particular area; they inform management how the organisation is performing (Parmenter, 2015:4; Bergeron, 2017:39). The South African National Disaster Management Framework lists a set of key performance indicators that guide and monitor the implementation progress of the objectives in the key performance areas and enablers.

Disaster risk reduction – Involves the identification of the causal factors of disasters. Following this, systematic efforts to analyse, reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events and manage the causal factors that are implemented (UNISDR, 2009). Disaster risk reduction involves activities that prevail after risk assessments to reduce, prepare or prevent the likelihood of occurrence or possible impacts of a disaster.

CHAPTER 1: INTRODUCTION AND BACKGROUND OF THE STUDY

1.1 Introduction

South Africa is suffering from a magnitude of increasing hazards such as drought, epidemics, water shortage, floods, fires, social unrest and storms. Most of these hazards rank top on South Africa's 2017 risk profile list (Institute of Risk Management South Africa [IRMSA], 2017; Humby, 2012:5). These hazards in turn trigger social, environmental, physical, political instability and economic devastation (Omelicheva, 2011: 465; Louw & VanWyk, 2011:16). Recurrent drought is one of the most problematic hazards in South Africa. In 2018, it was declared a national disaster (Macharia & Heinrich, 2018), later in 2020 on the 5th of March, the country declared another national drought disaster (Cooperative Governance and Traditional Affairs [COGTA], 2020). The country ranks the 30th driest country in the world (Shange & Gerbi, 2018:1; Chernick, 2017:1). Others have reported that it is ranked 39th out of 182 countries, based on the annual rainfall of about 464 mm, while the world's average is around 860 mm (Alexander, 2018; Makou, 2016:1).

According to Working on Fire [WOF] (2018:1); Reed, Swigert and Malina (2018:1); Scasta, Weir and Stambaugh (2016:198), increased drought frequencies exacerbate the incidence of fire risks. This has been evident in the Knysna and Plettenberg Bay fires that destroyed 600 properties, displaced 10 000 people, damaged properties worth R6 billion and killed seven people. The damages caused by the fires resulted in insurance claims estimated at R600 million (Ruzicka, 2017; Wilson & Marais, 2017). Also, social unrest incidents like xenophobia between the year 2000 and 2015 led to more than 62 deaths and hundreds of foreign nationals displaced (The Guardian, 2015; Qukula, 2015). The storms that hit Gauteng and Kwa Zulu-Natal Province in 2017 left more than seven people dead (Eyewitness News [EWN], 2017; News24, 2017). Following this was the Novel Coronavirus declaration as a global pandemic by the World Health Organisation, and soon after South Africa declared the drought a national disaster. On 15 March 2020, South Africa declared COVID-19 a national epidemiological disaster (COGTA, 2020; Department of Health [DoH], 2020). The emergency events mentioned are just a few cases amongst many experienced in South Africa.

With disaster management gaining momentum globally, activities such as preparedness, prevention, mitigation and response, require up-to-date and accurate information management

and organised communication systems. Besides, the Fourth Industrial Revolution (4IR) is making waves and aiding risk reduction. The COVID-19 global pandemic has revealed the need for reliable information and communication and most 4IR solutions, such as online video conferencing and drones are proving useful during the COVID-19 pandemic. Subsequently, good stakeholder relations and good governance practice help lessen disaster impacts and improve the response to the earlier mentioned devastations (Poser & Dransch, 2010: 89; United Nations International Strategy for Disaster Reduction [UNISDR], 2015; Mudavanhu, Manyena, Collins, Bongo, Mavhura & Manatsa, 2015:267; UNISDR, 2017; Shin, 2017). Disaster management is new in South Africa and the Disaster Management Act 57 of 2002 (as amendment Act 16 of 2015) (DMA) and National Disaster Management Framework of 2005 (NDMF) that facilitated the shift from disaster response and civil protection to risk reduction were promulgated only in 2002, a decade and a few months ago. The disaster managers tasked with the job of disaster management are still struggling with the implementation, as noted by Humby (2012:71) who asserts there is a struggle, because most initiatives carried out by disaster managers are focused on emergency response mostly, instead of DRR as well. Research on information management, communication systems, DRR governance and stakeholder relations could prove valuable in addressing Humby's concern.

Information and communication are pivotal in disaster management because they preserve institutional knowledge, perceived self-efficacy, knowledge and effective response (Sanquini, Thapaliya & Wood, 2016:347; Rattien, 1990:36). International declarations and agreements, like the Sendai Framework of Action 2015-2030[1], highlights the importance of DRR in strengthening educational resilience and improved understanding of disaster risks through information management and communication (United Nations International Strategy for Disaster Reduction [UNISDR], 2015). Under Priority 1 of the Sendai Framework for Action on "*understanding risk*", the priority stresses out the promotion of relevant data collection, analysis, management and appropriate dissemination. Real-time access using geographical information systems and remote sensing are also emphasised (UNISDR, 2015: 10; Teeuw, Leidig & Morris, 2013:113). Even the African Union established the New Partnership for Africa's Development (NEPAD) in 2001 and later on established the Africa Working Group on Disaster Risk Reduction (AWGDRR) to facilitate and mainstream DRR in all phases of

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[1] The Sendai Framework for Disaster Risk Reduction 2015 – 2030 is the successor instrument to the Hyogo Framework for Action (HFA) 2005 – 2015: Building the resilience of Nations and Communities to Disasters. The framework is a 15-year, voluntary, non-binding agreement that recognizes that, the State has the primary role to reduce disasters (UNISDR 2015).

development in Africa. The AWGDRR identified inadequate information management and communication (IMC) during its commission on assessing the status of DRR in Africa (African Union, 2005). The African Union's recognition of the lack of IMC in DRR is a step towards the identification of its importance and hence a need to invest in research.

The South African NDMF, section 6.5.3, states that communicating DRR activities before a disaster occurs is a fundamental principle that risk managers should acquire. Consequently, proactive communication and information management to reduce the potential risk of disasters are fundamental (Kunguma & Skinner, 2017; Skinner & Rampersad, 2014:2; UNISDR, 2015; Republic of South Africa, 2005). The NDMF further highlights that disaster management is a community-based driven process that requires the involvement of all stakeholders in the development of risk profiles for aiding risk reduction activities. Stakeholder relations and involvement may not be possible if disaster managers do not exercise mutual information management and communication about disaster management activities with the relevant stakeholders. Stakeholders need to know what is happening in and around their environment as an on-going element of disaster management. Important to note is that disaster preparedness planning must be developed from bottom-up, as guided by the national policy (Sahni & Ariyabandu, 2010:109). Such a process helps to identify community needs and is linked to all spheres of government.

Disaster managers, together with other relevant stakeholders, must take into consideration that their information needs are not homogeneous. The stakeholders are instead comprised of subgroups with diverging socio-economic capabilities, challenges, interests and needs (Figueroa, Lawrence, Manju & Gary, 2002). Reaching the stakeholders through diverse means and channels before a disaster occurs, might help build sustainable knowledge for reduced vulnerability. Achieving sustainable knowledge and reduced vulnerability in communities, therefore, requires effective management of information and proper communication systems in place (Van Riet, 2017: 96; Shaw, Pulhin & Pereira, 2010:344; Republic of South Africa, 2005:31; Republic of South Africa, 2003:50).

According to Twigg (2015:133), Chagutah (2014:12), Twigg (2004:16), UNISDR (2005:1) and the NDMF (Republic of South Africa, 2005:28), informed stakeholders on DRR initiatives increase public awareness, knowledge and resilience. Likewise, a disaster management centre with functional information management and communication system (IMCS) that has strategic plans in place, is a critical element of disaster management. Further, if the people at risk are

well informed about measures they can take to mitigate their vulnerability, then the impact of the hazard can be reduced extensively (Pal & Ghosh, 2018:1). These scholars also emphasise that all DRR initiatives should incorporate information and communication as a central and continuous element and with a clear strategy for doing so.

Accordingly, this study sought to understand and explore the underlying forces that contribute to the lack of will in establishing IMCSs as a requirement of the DMA and NDMF. The purpose of the study was to use the results obtained to provide useful advice to the Provincial Disaster Management Centres (PDMC) on how to move forward effectively concerning their IMCSs. Secondly, to assess the National Disaster Management Centre's (NDMC) progress in developing guidelines for the establishment of IMCSs. Lastly, based on international IMCS good practices, literature review and empirical findings, this study contributed to the body of knowledge. The study modified the existing Model of an Integrated Information Management and Communication System for Disaster Risk Management (MIIMCSDRM), through the inclusion of components from the Stakeholder Theory (ST), the Model of the Policy Implementation Process (MPIP) and the Information and Knowledge Management for Disaster Risk Reduction Framework (IKMDRRF), to develop a framework for establishing an IMCS. The framework developed, serves as a proposal for consideration by the PDMC and NDMC. Chapter 2 provides a detailed discussion of the MIIMCSDRM and other models and theories.

Having discussed the above, this chapter focused on the background to the study and the description of the study area in the context of the issue under investigation. The chapter discussed in detail the theoretical and conceptual frameworks that form the foundation of the study. Further, the chapter identified and unravelled the research design and methodology that helped answer the research problem, research questions and objectives. Lastly, the contribution of the study, limitations, delimitations, and chapter layout formed part of the discussion in this chapter.

1.2 Background of the study

After the long apartheid rule, in 1994, South Africa commenced the re-designing of its governance system. The government re-engineered its legislative authority to form a national, provincial and local sphere of government (Republic of South Africa, 1996; Feinstein, 2015). In this whole re-engineering process, the Department of Provincial and Local Government (now known as the Department of COGTA), formed part of the promulgation of the DMA and then the NDMF. The decentralisation of powers and administrations, as set out in the

Constitution, Chapter 4, Schedule 43, did not leave out the disaster management function. The promulgated DMA prescribed the demarcation of disaster management powers and administration from the national level, where the DMA clearly states in Chapter 3, section 8, that a national disaster management centre must be established. Further, Chapter 4, section 29, of the DMA mandates each province to establish a disaster management centre. In Chapter 5, section 43 of the DMA, all the metropolitan and district municipalities must establish a disaster management centre for their municipal area. However, a local municipality does not need to establish a disaster management centre, but it should establish the capacity for the coordination and implementation of the function.

The promulgation of the DMA and the NDMF placed South Africa at the international forefront of DRR (Van Niekerk, 2014:858; Holloway & Pelling, 2006:16). The promulgation of the DMA and the NDMF led to the decentralisation of disaster management activities in all spheres of government. This made South Africa part of the regional, continental and global frameworks that provide for policy and institutional architecture, for ensuring and implementation of DRR and their communication (Humby, 2012:5; Van Niekerk, 2014:859; Skinner & Rampersad, 2014:2; Chagutah, 2014:156; Van Niekerk, 2014:863).

The disaster management fraternity in South Africa is a decade and a few months old, from the 2002 to 2020 and has made enormous progress in the decentralisation of the disaster management function. As young as the function is, it is also new at disaster risks' governance and is faced with many challenges. Briefly, the critical function and scope of practice of the disaster management fraternity in South Africa is to promote an integrated and coordinated system of managing disasters. Despite this function, there are still discrepancies in the placement of the disaster management field in the government structure, inadequate functioning of the Centres', varying job designations of the heads of the Centres, limited comprehension of disaster management by various stakeholders, insufficient human resources to govern the field and most importantly, a lack of information management and communication systems (Van Niekerk, 2014:869; Botha, Van Niekerk, Wentik, Coetzee, Forbes, Maartens, Annandale, Tshona & Raju, 2011:9; Van Niekerk, 2005:97). Van Riet and Diedericks (2009) also adds that disaster management centres have inadequate capacity, and lack qualified personnel, equipment and funding. Van Niekerk (2014:865) concurs with Van Riet and Diedericks on the issue of inadequate funding as a major challenge (76% of respondents in his study identified inadequate funding as a barrier to implementing the DMA

and the NDMF). Van Niekerk's study further identifies maladministration, limited understanding of the legislation and placement of the disaster management function in a line ministry, instead of the highest political office.

To show some discrepancies with the implementation of the disaster management legislation, the NDMF states that the national disaster management centre must be located in the President's Office, the provincial disaster management centre in the Premier's Office and the metropolitan disaster management centre in the Mayor's office, but unfortunately, that is not the case (Republic of South Africa, 2005:9). As a coordinating function, the placement of the Centre has some implication on the full implementation of the legislation. Moreover, the displacement of the disaster management office affects decision-making. Van Niekerk (2014:858) brings forth an argument in his article on the critical analysis of the DMA and NDMF, that good policy does not necessarily translate into good practice. He found that the DMA and the NDMF do not give clear guidance to municipalities on how to implement the policies. Van Niekerk's (2014) critical analysis of the DMA and NDMF fails to identify the establishment of IMCSs, as a significant component and cross-cutting issue in the successful implementation of the legislation.

Besides, scholars like Collins, Jones, Manyena and Jayawickrama (2015:67) debate that the realities of governance in Southern Africa where disaster risk solutions take place, in specific political, economic, environmental, and sociocultural contexts, cannot be ignored and also play a vital role in the implementation of legislation.

1.2.1 The South African disaster management legislation

According to the South African local government handbook on municipalities, South Africa has nine provinces (Municipalities, 2020). Each province, except for Limpopo, Mpumalanga, Northern Cape and North West province have metropolitan municipalities. Subsequently, each district municipality has at least three to eight local municipalities (Municipalities, 2020). The various spheres of government are required to have a disaster management centre and according to the DMA (as amended), Chapter 3, section 15 and subsection 4, the national centre must liaise and coordinate its activities with the provincial, metropolitan and local municipal disaster management centres throughout the country.

The NDMF further supports the implementation of the DMA as listed in the four key performance areas (KPAs) and three supportive enablers. The enablers are required to achieve the objectives set out in the KPAs. Specific objectives inform the KPAs, as well as the enablers,

as required by the DMA. Additionally, there are key performance indicators (KPIs) set out to guide and monitor the progress of the implementation of the objectives. Each KPA and enabler concludes with a list of guidelines that the NDMC must disseminate to support the implementation of the NDMF in all three spheres of government. Since the promulgation of the DMA and NDMF, the NDMC has not developed some of the guidelines, which in turn poses challenges for the implementation of the legislation, in particular enabler 1.

Important to note, the DMA and the NDMF are termed 'Disaster Management', however, the significant part of the NDMF refers to 'Disaster Risk Management'. The entire NDMF uses the DRM term 492 times. The Model of an Integrated Information Management and Communication System for Disaster Risk Management (MIIMCSDRM), which is significant to this study, contains the DRM term. This is regardless of the NDMF document that is termed 'Disaster Management'. Having said that, this reveals some discrepancies within the legislation and because both the DMA and the NDMF are termed disaster management, this study used the term 'Disaster Management'. Where there are direct quotes from the DMA and the NDMF, the study did not change the term from DRM to disaster management.

Nevertheless, the focus of this study is on enabler 1, namely: *"Information management and communication systems" (IMCS)*. This enabler is explicit about the importance of the collection, analysis, storage and dissemination of disaster risk information. The NDMF recommends that the cost of developing an IMCS should form part of the start-up costs of establishing disaster management centres (section 7.4 of the NDMF). This means the development of a disaster management centre and an IMCS must be concurrent. However, this was not the case with all the disaster management centres, in this case, the provincial centres. Section 30(c) of the NDMF states that the provincial centre must act as a repository and conduit for information on disaster management in the province. Effective service delivery concerning DRR and disaster management requires proper information management and dissemination to stakeholders concerned. Seeing that the Centres are operating without the systems, as mandated by the NDMF, places the various stakeholders concerned at risk.

1.2.2 Information and communication
Just like many authors believe (Safaie, 2017:8; Williams & Phillips, 2014:7) and according to the legislation (Republic of South Africa, 2005:86), this study argues that there is a need for PDMCs to act as repositories of information and conduits for disaster information dissemination. The study further argues that an IMCS is a "*nerve centre*" (meaning the control

centre of an organisation or operation) for all disaster management centres and an important tool for lessening disaster risks (Tad & Janardhanan, 2014:16; Williams & Phillips, 2014:8). As stated in the NDMF, establishing communication links with various stakeholders also forms part of the study (Republic of South Africa, 2005:63). It is evident in most South African municipal disaster management centres, as observed by Humby (2012) and Chagutah (2014:14) when they mentioned that municipalities that wish to communicate disaster risks showed a lack of direction with no dialogue, no opportunity for stakeholder participation in planning, as well as lacking in the management of information.

According to Skinner and Rampersad (2014:4), a disaster management information and communication strategy includes specific communication actions and activities that enable all stakeholders to participate in decisions that build partnerships for a resilient community. However, this is not the case as identified by Humby (2012) and Chagutah (2014). Therefore, Argenti, Howell and Beck (2005) suggested that organisations should develop an integrated strategic approach to communications, which becomes integral to the formulation and implementation of the organisation's strategy as a whole. Excellent strategies to this effect are recommended by Skinner and Rampersad (2014:2), suggesting that communication should take place in the context of risk assessment, risk intervention and risk evaluation, making it a strategy that is executed within disaster management. enabler 1 supports this approach, *see Figure 1.1.*

Argenti, Howell and Beck (2005:87) further argue that it seems impossible to execute a strategy that cannot be communicated. Hence, models like the MIIMCSDRM, shown in Figure 1.1, illustrates how the information and communication system is set to achieve the objectives of each KPA and enablers (Republic of South Africa, 2005:133). The MIIMCSDRM also includes an information dissemination plan, supporting Argenti, Howell and Beck's (2005) earlier statement of executing a communicable strategy where they emphasis that once a strategy is developed, for example, a disaster risk reduction plan (KPA 3) can prove effective once communicated to the relevant stakeholders.
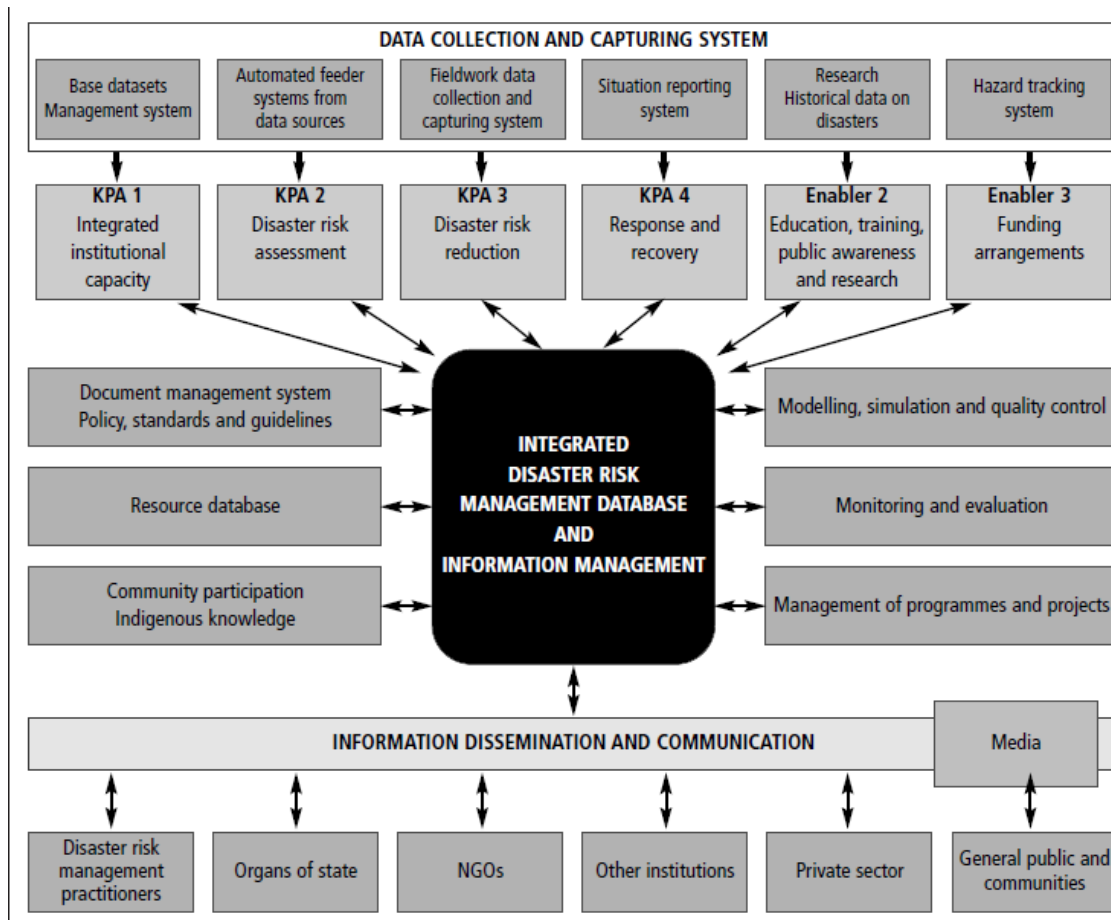
Figure 1.1*Model of an Integrated Information Management and Communication System for Disaster Risk Management*
Source: (Republic of South Africa, 2005:65)

The following section discusses in detail information management and communication from the context of the South African Disaster Management legislation.

1.2.3 South African disaster management legislation: information and communication

Even though the DMA and the NDMF make provision for information, communication and stakeholder relations in disaster management, some discrepancies exist in this regard. These discrepancies make the establishment of IMCS and their prioritisation inadequate. As mentioned earlier, the NDMF has objectives that are set out in four KPAs and three supportive enablers that are required to achieve them. The NDMF also has a KPI that guide and monitor progress. Key Performance Area one on establishing the necessary institutional arrangements for implementing DRM within the three spheres of government, states that the NDMC is responsible for establishing an Intergovernmental Committee on Disaster Management (ICDM). The ICDM must consist of cabinet members who should be involved in the management of disaster risks. The NDMF lists 17 out of 28 ministerial portfolios (Republic of

South Africa, 2005:6; Parliament, 2020:1). It is of the study's concern that there is no mention of the Ministry of Communications. This portfolio is responsible for the Department of Communication, the Government of Communication and Information Systems (GCIS), the Independent Communications Authority of South Africa (ICASA), the South African Broadcasting Corporation (SABC), Brand South Africa, Media Development and Diversity Agency and the Film and Publication Board. The Department of Communication is the stakeholder primarily tasked with managing government information and public communication (GCIS, 2018). Despite the omission of this portfolio in the NDMF, there are, however, sections that recognise the establishment of integrated communication links.

In an email conversation with Nzuza (personal communication, 15 January 2018) the Deputy Director of Disaster Risk Management Advocacy and Public Awareness from the NDMC, he indicated that the national centre does not have the information management and communication policy and that their communication activities are guided by a broader departmental communication policy. The NDMC however, have an Information Technology, Intelligence and Information Management Services Directorate. It can guide the establishment of provincial information and communication systems by providing guidelines stipulated in the NDMF. However, Nzuza further stated that none of the nine South African Provincial Disaster Management Centres has an IMCS, as stipulated in the NDMF. Nzuza's view corroborates with the study's empirical findings, namely that the Centres do not have an IMCS.

It can, therefore, be assumed that with the above-discussed gaps and discrepancies in disaster management legislation and policy and its implementation, the establishment of IMCSs is compromised.

Several scholars like Jin (2017); Bates & Benjamin (2016); Wakefield and Hornik (2010) believe that the improvement in information and communication technologies in today's world is exceptional. Chagutah (2014) argues that despite huge technological advances in monitoring and forecasting extreme weather, local mechanisms for knowledge-sharing and promoting a culture of avoiding risk among communities threatened by hazards, remain underdeveloped. Correspondingly, South Africa is one such example experiencing these challenges in identifying, developing and implementing an appropriate risk-reduction strategy to promote a culture of avoiding risk (Reddy, 2010:6).

1.3 Problem statement

Based on the evidence put together in the background study discussion and a two-year preliminary study, this study found that not all PDMCs have IMCSs. The study assumed that the earlier identified gaps in the disaster risk governance of the NDMC and PDMCs could be some of the root causes of the lack of IMCSs. Typically, the NDMC, as the overseer of the legislation implementation, seems to be unsupportive in this regard, because they have not yet developed guidelines for the establishment of the IMCS, as stipulated in the NDMF (Republic of South Africa, 2016). Further, the unclear disaster management legislation, as highlighted by authors like Van Niekerk (2014:866), Sithole (2014:45), Van Niekerk and Visser (2009) and Holloway (2009), seems to affect the establishment of IMCSs and the general disaster risk governance of the Centres. Consequently, the poor disaster risk governance of the Centres identified in the background might be affecting the establishment of the IMCSs. Moreover, the lack of IMCSs questions the effective operations of the Centres in building resilient communities. Important to note is the possible lack of recognition of IMCSs by senior management and involvement of other stakeholders in the establishment and functioning of the IMCSs (Robertson, 2005; Kibera, 2013; Basco-Carrera, Callejo-Veracc, van Beek, Mendoza-Bruckner & Werner, 2015).

The outlined background and problem statement translate into the research questions and objectives.

1.4 Research question

What are the dynamics for establishing operational IMCS in the South African provincial disaster management centres and what should such systems entail, concerning the systems, as well as what is the current status quo at both national and province?

To accomplish the main research question, the research addressed the following critical questions:

i) How does the implementation of disaster management legislation affect the establishment of information management and communication systems?

ii) What is the current state of the South African Provincial Disaster Management Centres, concerning information management and communication systems for achieving disaster management goals?

iii) What efforts have the National Disaster Management Centre put in place in assisting the Provincial Disaster Management Centres to establish information management and communication systems?

iv) How can the theories and models discussed in this study contribute to the development of a framework for establishing information management and communication systems for disaster management?

1.5 Primary objective

The study aimed to assess the dynamics for establishing and investigating the status of IMCSs for disaster management in South African provincial disaster management centres, according to the NDMF, enabler 1. The intention was to suggest relevant recommendations that may contribute to strengthening disaster management and governance for prepared and resilient stakeholders. This was done through the development of a Strategic Framework for Developing and Managing an Integrated Disaster Information Management and Communication System.

The research aimed to achieve the aforementioned primary objectives by addressing the following critical secondary objectives:

i) To investigate the effects of disaster management legislation implementation on the establishment of information management and communication systems;

ii) To investigate the disaster managers' challenges in establishing operational information management and communication systems according to enabler 1 of the South African National Disaster Management Framework of 2005;

iii) To examine the extent to which the South African National Disaster Management Centre support the establishment of information management and communication systems within the provincial centres;

iv) To determine how best the variables from the chosen theories and models can be integrated into the proposed framework for establishing Information Management and Communication System;

1.6 Research design and methodology

This study was guided by the constructivist worldview, which is a philosophical worldview. It helped with the selection of participants and methods that the study used (Creswell, 2014:37; Denzin & Lincoln, 2011:91; Ponterotto, 2005:128). The constructivist worldview is typically seen as an approach to qualitative research where the researcher seeks to understand the world

in which the research participant(s) live and work, and in return, develop the subjective meaning of their experiences towards certain things. The philosophical anchor, which the constructivist paradigm assumes is that of ontology, which refers to the nature of reality and suggests that there are multiple realities (Ponterotto, 2005:130; GeorgeLee, 2012:406). Therefore, the researcher looked for the complexity of views by conducting lengthy discussions with experienced and knowledgeable participants for their views on IMCS and disaster management governance of PDMCs (Ponterotto, 2005:134; Given, 2008:17).

The data and information utilised in this research were 60% qualitative and 40% quantitative. A qualitative approach is an empirical method, which involves the collection, analysis, and interpretation of data (Ponterotto, 2005:128). In this case, the spatial status of the Centres was observed through a walkabout and photo-taking. Walking and observing the data collection area added rigour to the research findings (Pierce & Lawhon, 2015). This study made use of a qualitative phenomenological research design, which is common to qualitative studies (Vagle, 2018:11; Given, 2008:117). The phenomenological design describes the lived experiences of several individuals about a phenomenon, as described by the participants (Bloomberg & Volpe, 2018:110; Vagle, 2018:11; Ponterotto, 2005:128).

The phenomenological enquiry makes use of the purposive sampling technique for the selection of cases to participate in the qualitative study (Vagle, 2018:11). It is important to note that numerous factors determine the size of a qualitative study sample. The factors are: saturation, diminishing return, focus on meaning to avoid generalised hypothesis and the labour-intensive nature of qualitative research (Mason, 2010:2; Ritchie, Lewis & Elam, 2003; Crouch & McKenzie, 2006). Leedy and Omrod (2001:158) also support the fact that qualitative studies require a lot of time. The phenomenological enquiry contributes to the justification of the sample size of the study. Creswell (1998:64) and Morse (1994:225) state that the sample size for the mixed-method can be from 5 to 25, or even six participants.

This study's research questions and objectives warranted the data to be collected at South African national and provincial level. This was because the national government and provinces are responsible for the administration of the legislature and facilitation of economic activities. They supervise the local government to ensure harmony in the functioning of South Africa (National Treasury, 2019; Mathenjwa, 2014:180). The provinces were made "*watchdogs*" on behalf of the national government for the implementation of the legislation, as well as making municipalities exist at their mercy (South African Local Government Association [SALGA],

2017; Department of Provincial and Local Government [DPLG], 2007: 9). Typically, the provincial disaster management centre must liaise with the national and municipal disaster management centres, recommending, advising and acting as a consultative body to all stakeholders (Republic of South Africa, 2005:12; Republic of South Africa, 2003:30). Accordingly, the empirical findings from the NDMC and provinces led to "*transferability*", a more preferred term in qualitative studies (Lincoln & Guba, 1985). Hence, the findings are transferable to the metropolitan, district and local municipality disaster management centres. The findings are also transferable to other sector departments. This study employed the multistage sampling technique that involved the selection of a community or organisation in the first stage and then in stage two, the selection of household or employees (Leon, 2003:58; Singh & Mangat, 1996:222). Table 1.1 illustrates the multistage sampling procedures. Further, the study employed purposive sampling as a non-random and non-probability sampling technique. The purposive sampling technique was most effective because the study needed to explore a certain cultural domain with experts and key informants within the domain (Etikan, Musa & Alkassim, 2016:3; Palinkas, Horwitz, Green, Wisdom, Duan & Hoagwood, 2015:534; Tongco, 2007:147). Purposive sampling was the best method to obtain information-rich cases

Following the multistage sampling technique, the study purposively selected two spheres of the South African government. The first stage entailed the purposive selection of the head of centres, the head of the NDMC and the nine heads of the PDMCs. According to the NDMF, the key responsibilities of a PDMC are to implement the KPAs and enablers objectives as shown in Table 1.1.

Table 1.1 *Outline of the South African National Disaster Management Framework*

1	KPA 1	Integrated Institutional Capacity
2	KPA 2	Disaster Risk Assessment
3	KPA 3	Disaster Risk Reduction
4	KPA 4	Response and Recovery
5	Enabler 1	Information Management and Communication
6	Enabler 2	Education, Training, Public Awareness and Research
7	Enabler 3	Funding Arrangements

Source: (Adapted from the Republic of South Africa, 2005)

Hence, the study assumed that the organisational structure of the NDMC and each PDMC should have a manager in charge of each KPA and enabler, as according to the NDMF. However, this was not the case. The actual events are presented in Chapter 6 with more details about the research design and methodology. Table 1.2 shows the initially anticipated sample selection and the study's intended sample size which was N=80.

Table 1.2 *Multistage sampling procedure*

	NDMC	PDMC									TOTAL SAMPLE
		FS	KZN	NW	L	G	M	EC	WC	NC	
HEAD	1	1	1	1	1	1	1	1	1	1	10
KPA 1- Manager	1	1	1	1	1	1	1	1	1	1	10
KPA 2- Manager	1	1	1	1	1	1	1	1	1	1	10
KPA 3- Manager	1	1	1	1	1	1	1	1	1	1	10
KPA 4 - Manager	1	1	1	1	1	1	1	1	1	1	10
Enabler 1- Manager	1	1	1	1	1	1	1	1	1	1	10
Enabler 2- Manager	1	1	1	1	1	1	1	1	1	1	10
Enabler 3- Manager	1	1	1	1	1	1	1	1	1	1	10
TOTAL	8	8	8	8	8	8	8	8	8	8	**80**

(Source: Authors own)

For empirical research, the study collected data from the respondents through a questionnaire with closed-ended and a few open-ended questions (Hofstee, 2010; King & Horrocks, 2010). The researcher went through the questionnaire one-on-one with the interviewees. During the questionnaire administration session, some of the questions asked and issues discussed by the respondents, varied, because of their different lived experiences. Litchtman (2010) argues that this is a normal experience. Nevertheless, this approach assisted the researcher in obtaining in-depth and detailed information. Moreover, the open-ended sections make the questionnaire a socially acceptable method of understanding respondents' beliefs, opinions and experiences (Mann, 2016). Even with closed-ended questions, the participants provided more information together with their choices.

During the visit to all the disaster management centres, the researcher and the research assistants took a guided walkabout to observe the technological infrastructures in the PDMCs. The walk helped inform the IMCS status of the PDMCs. The observational walking contributed to the triangulation of the data collected through the questionnaires. The researcher had an observational walk guide and a camera for recording findings, like the infrastructure, technologies, notice boards, furniture and so on (Struwig & Stead, 2015:100).

The study employed both elements of quantitative and qualitative data analysis processes, prescribed by Creswell (2009:245). Creswell shows that data analysis is an ongoing process that does not only wait for the end of the study. Miles, Huberman and Saldana (2014:14) concur with Creswell, adding that data analysis is a continuous and iterative enterprise. The mixed-method design makes use of a sequential explanatory technique, characterised by the analysis of quantitative data, followed by the analysis of qualitative data. Initial analysis entailed quantitative data using descriptive statistics. Having presented the quantitative data, the qualitative data analysis obtained during the administration of the questionnaire and the observation followed. Further, the qualitative data included the coding of datasets and

categorising them into themes to produce a narrative report and even personal experiences (Bryant, 2008). Part of the analysis also involved comparing the generalisations with the body of knowledge or theories (Miles, Huberman & Saldana, 2014:14; Silverman, 2016:333; Creswell, 2009:32; Fairclough, 2013:132; Flick, 2014:1).

The process ended with a written report containing a representation of text and numeric information in figures, tables and pictures, verbatim notes and personal interpretations, relating to the research questions. Important to note is the fact that mixed-methods generate numeric and narrative data (Leavy, 2017 and Creswell, 2009:45). A detailed discussion of the research design and methodology is in Chapter 6.

1.6.1 Preliminary empirical research to inform Chapter 5

Chapter 5 on good practices was informed by data collected through interviews. The interviews were carried out because the scholarly research on IMCS in South Africa and the NDMF is limited. The preliminary research was also to test the quality and validity of the possible empirical results and to try out the research approach and identify potential problems (Blessing & Chakrabarti, 2009:114). Five disaster managers were purposively selected and emailed a set of questions. One disaster manager was from the NDMC and the other four from the PDMCs. Due to a lack of response to the emails, telephone interviews were carried out. The data collected was arranged logically. The data were presented according to specific categories, such as the Centre's disaster management information and communication systems, hardware and software used, specific events where the system was activated and challenges experienced. The data collected informed the write-up of the case studies. All case studies contained conclusions that helped uncover possible solutions (Leedy & Ormrod, 2013:149). Also, the researcher reviewed books and journals on international information management and communication systems. The case studies obtained from the literature review helped to benchmark against South African standards.

1.7 Theoretical framework

Peterson and Bredow (2012:432) argue that theories assist in the explanation of the nature of any study. Taking into consideration Peterson and Bredow's argument, the research will explore relevant theories that may guide the study in answering research questions and objectives. Theories are not topic-specific, but abstract in nature. Hence, the study will consider a selection of relevant theories and models for the empirical testing of the study (Aparasu, 2011:7).

1.8 Key theories and models

The study used theories and models that support disaster risk governance, policies, information management and communication, stakeholder relationships and symbiotic relationships. The theories and models are as follows:

i)   Stakeholder Theory by Edward Freeman (2010),

ii) The Model of the Policy Implementation Process by Smith (1973),

iii) The MIIMCSDRM by the South African National Disaster Management Framework of 2005,

iv) The Information and Knowledge Management for Disaster Risk Reduction (IKM4DRR) Framework by the IKM4DRR Community (2013).

Other theories and models that were initially considered for this study are discussed in detail in Chapter 2.

1.8.1 The Stakeholder Theory

Ian Mitroff initially developed the Stakeholder Theory (Smartsheet 2018, Freeman, *et al.,* 2010) in 1983; however, he detailed it as the Shareholder Theory. To a certain extent, Edward Freeman opposed this thinking and introduced new thinking, which he propounded as the Stakeholder Theory in his book titled "*Strategic Management: A stakeholder Approach*", published in 1984. Ian Mitroff argued that a company is beholden or accountable to its shareholders only. Freeman then argued that it should be termed Stakeholder Theory, because shareholders are just one of the many stakeholders in a company and that it involves everyone who has invested in the company. Stakeholders are people dealing with the organisation; they are also people whom the organisation's decisions affect. An organisation's success lies in satisfying all its stakeholders. This study of disaster management borrows the theory and suggests disaster managers and other disciplines working with disaster managers, such as other government departments, non-governmental organisations, the private sector, donors and community members as stakeholders.

This researcher suggests that the involvement and management of stakeholders are important for the disaster management field. The Stakeholder Theory is important for the establishment of integrated information management and communication systems because it helps identify all the stakeholders that must be involved in building an informed resilient community. The Stakeholder Theory also matches with the MIIMCSDRM, as seen in the various KPAs that require different stakeholders to achieve the objectives. The Stakeholder Theory challenges the South African disaster management disconnection from other spheres of government.

1.8.2 A Model of the Policy Implementation Process

In 1973, Smith formulated the Model of the Policy Implementation Process after the realisation that public policies generate tensions in societies. Smith argues that the government enacts policies that bear a burden on the implementing institution, evoking strain and conflict. The whole purpose of the government policies is to establish new transaction patterns or institutions or to change established patterns in old institutions. Smith identifies four components that form the tension-generating matrix. The components of the policy implementation process are as follows: (i) the idealised policy, (ii) the target group, (iii) the implementing organisation, and (iv) the environmental factors. These components give rise to tensions, both within and between the components. An example of tension is a discrepancy in the implementing organisation where an administrative unit, instructed to implement a policy, does not have adequate personnel. Therefore, the lack of adequate personnel compromises the implementation of the legislation.

This model contributes to answering the research questions, in particular, how the implementation of policy affects the establishment of IMCS. Smith arguably states that some policies are ambitious, sweeping programmes designed to bring about development and social reform and most of them were formulated immediately following independence or the overthrow of old regimes. South Africa is not unique in this.

1.8.3 Model of an Integrated Information Management and Communication System for Disaster Risk Management

The MIIMCSDRM is a model in the NDMF (Republic of South Africa, 2005: 65). This model illustrates that the objectives of each KPA and enablers can succeed through the practical application of the MIIMCSDRM. Besides, the NDMF argues that assigning specific responsibilities of the different components of the MIIMCSDRM to different stakeholders makes it possible to achieve the KPA and enabler objectives. Further to this, the NDMF expects the NDMC to develop specific guidelines that can assist with the achievement of the stated objectives. When referring to this issue, the NDMF uses the term "*must*" as an indication of importance (Van Niekerk, 2014:871). Consequently, for this study, the MIIMCSDRM served as a guiding tool to investigate the disaster managers' comprehension of information management and communication systems and challenges encountered in this regard.

1.8.4 Information and Knowledge Management for Disaster Risk Reduction Framework

The IKM4DRR community at the Global Platform developed the IKM4DRR for Disaster Risk Reduction on 20 May 2013 (UNISDR, 2013:2). The community argues that informed decision-making requires solid information management and communication systems, as well as skilled and dedicated stakeholders. The community further identifies a strong knowledge base as imperative to informed decision-making. The IKM4DRR Framework intends to guide the initiation, creation and sustainability of information and knowledge management for improved disaster management. Secondly, to help improve the interoperability of information knowledge management for DRR efforts (UNISDR, 2013:2).

1.9 Significance of the study

The focus of the study was to contribute to the improvement of service delivery in the disaster management field through researching issues of IMCS. Findings of this study contributed to the design and improvement of disaster management information and communication systems in South Africa, especially considering that information management and communication is significant for managing disasters and ensuring community resilience. The increase in peoples' vulnerability and exposure to hazards justifies the need for a strategic focus on collection, analysis, management of data and dissemination of information. Thus, disaster management centres that will apply the recommended approach derived from the results of this study might be able to establish, operate and maintain the IMCS effectively together with relevant stakeholders. There may also be fundamental issues that the NDMC must do but have not done entirely since the promulgation of the DMA and NDMF. For this reason, the study questioned their governance capabilities. Therefore, the findings of the study also challenged the duties of the NDMC tasked with the responsibility of promoting an integrated and coordinated national disaster risk policy.

To this end, the study challenged and contributed to enhancing the legislation on disaster information and communication systems. The study challenged the revision of some of the sections in the NDMF, in particular, enabler 1 in the NDMF. Ultimately, the empirical findings influenced the framework and methodology that the study developed. The development of a framework premised as a contribution to the body of knowledge that aims to assist the PDMCs in establishing or enhancing their systems.

1.10 Delimitation of the study

According to Leedy and Ormrod (2013), the researcher should state what they do not intend to do in their study. The focus of this study is on the dynamic experiences encountered by South African PDMCs in establishing IMCSs. Even though the Stakeholder Theory underpinned the study, stakeholders external to the PDMCs employees were not part of the empirical study. The study did not investigate who the stakeholders are or should be or which stakeholder is the most important. The main target audience for this study was the disaster managers working within the PDMCs' and some key staff members at the NDMC. The focus of the study was on the provincial level, because it is an influential strategic sphere of government, focusing on legislation (IFRCRCS & UNDP, 2015:9). This study did not investigate the inconsistencies in the DMA and the NDMF, in particular, the use of terminology such as, 'Disaster Risk Management' and 'Disaster Management'. For this study, the term 'Disaster Management' was used in the entire study because the South African Disaster Management operations are governed under the 'Disaster Management Act' and not the 'Disaster Risk Management Act'. This was also important to note because the NDMF, IMCS model (Model of an Integrated Information Management and Communication System for *Disaster Risk Management*) used in the study is termed DRM instead of the DM. In that case, the model name was referred to as is in the NDMF. Also, some of the sections in the 'Disaster Management Act' are termed 'Disaster Risk Management', but where the study made direct references, the terms were used as they are from the DMA or NDMF.

1.11 Chapter outline

CHAPTER 2 – THEORETICAL FRAMEWORK	Provides an overview of theories and models related to this study.

CHAPTER 3 - ENABLER 1 OF THE SOUTH AFRICAN NATIONAL DISASTER MANAGEMENT FRAMEWORK: UNDERSTANDING THE INFORMATION MANAGEMENT AND COMMUNICATION SYSTEM	Since the NDMF, enabler 1 forms the foundation of investigation of this study, it was imperative to have a chapter that discusses and critically analyses it. Partially, this chapter addresses the research question on the perceptions of the NDMF by the provincial disaster managers, where it critically analyses the specific section in the legislation. The chapter provides a detailed background of the study as a whole and provides an in depth understanding of the Integrated Information Management and Communication Systems Model. The chapter also connects well with Chapter 4 as well as the other chapters .in the entire study.
CHAPTER 4 - DISASTER RISK REDUCTION GOVERNANCE: DEVELOPMENTS OF NATIONAL AND INTERNATIONAL LEGAL AND INSTITUTIONAL ARRANGEMENTS	

It provides a detailed discussion of governance, placing an emphasis on the fact that good governance is at the heart of the effective functioning of any organisation. Communication is one of the central factors crucial for building good governance of organisations mandated to carry out disaster risk reduction. The chapter gives a detailed discussion of disaster risk reduction national and international policies, the evolution, status and thereafter-critical analysis of the policies. South Africa might have the best policies but because of some governance issues, implementation becomes difficult. It is important to note that good policy does not necessarily translate into good practice. However, this chapter also notes that there is no legislation that is perfect, there are still gaps and room for improvement.

CHAPTER 5 – NARRATIVE CASE STUDIES OF DISASTER MANAGEMENT INFORMATION AND COMMUNICATION SYSTEMS	This chapter takes the reader around the world and to different sectors. It highlights the various information management and communication systems that other disciplines use and which the disaster management fraternity can incorporate in it works.

CHAPTER 6 – RESEARCH DESIGN AND METHODOLOGY	A detailed description of all the qualitative (observational tour and photo-taking in the Centres and in-depth discussions with interviewees during the surveys) and some quantitative (questionnaire) phases employed in the study.

CHAPTER 7 – DATA PRESENTATION AND ANALYSIS	This chapter presents the data in a sequential manner. First, the data obtained from the closed-ended part of the questionnaire. Second, the data obtained from the open-ended section and general discussions held between the interviewee and interviewer and the pictures obtained during the observational tour around the PDMCs and the NDMC. In addition, the chapter revisits the findings in the literature
CHAPTER 8 – RECOMMENDATIONS AND CONCLUSION	

This chapter revisits the research questions and objectives of the study and makes necessary recommendations. In this chapter, the researcher presents and discusses the recommended framework and concludes the entire study.

Figure 1.2 *Chapter outline*
Source: (Authors own)

1.12 Conclusion

The focus in this chapter was to elaborate on the background of the study with emphasis on the significance of information management and communication systems. The chapter highlighted the parameters of the study by posing research questions and objectives. The theories, models and frameworks underpinning the study, as well as the research design and methodology, were articulated. This chapter laid a sound foundation for the study. The next chapter explores the theoretical framework that details the foundation of the entire study.

CHAPTER 2: THEORETICAL FRAMEWORK

2.1 Introduction

Just like any study, theory analysis and evaluation are important (Peterson & Bredow, 2012:39; Homberg, 2007:427; Alderson, 1998:1007), and disaster management is not exempt from theory analysis. To be able to explore and understand the dynamics experienced in establishing IMCS at the provincial level of government, it is prudent to analyse and evaluate relevant theories. As alluded to by the above authors, theories are important for both research and practice, as they serve as a heuristic function to stimulate and provide a rationale for a study. Theories also guide the selection or answer to research questions and variables (Peterson & Bredow, 2009:35). Further, McKenna, Pajinkihar and Majda, (2014:4); Smith and Liehr (2014:8); Hart and Gregor (2010:4); identify specific reasons to address the significance of evaluating theories. The following are some of the reasons:

To assist in the explanation of the nature of any research;

i) To decide which theory will be more appropriate for that specific research as a framework;

ii) To be able to identify applicable theories that will guide the development of that research project;

iii) For comparing and contrasting different explanations of the same phenomenon;

iv) For defining priorities of research;

v) To help assess the ontological beliefs and schools of thought in a discipline; and

vi) To identify epistemological approaches of a discipline through attention to the socio-cultural context of the theorist and the theory.

This study made use of the Stakeholder Theory by Edward Freeman (1984), and the MIIMCSDRM by the South African National Disaster Management Framework (NDMF) of 2005 and the Information and Knowledge Management for Disaster Risk Reduction (IKM4DRR) Framework by the IKM4DRR Community (UNISDR, 2013) and the Model of Policy Implementation Process (Smith, 1973).

2.2 Rational: selected theory

Just like some other fields of study, disaster management lacks a strong body of well-developed theories. To deal with this limited body of theories, the study, in this case, disaster management, can borrow theories from other mature fields (Flak & Rose, 2005:642; Peterson & Bredow,

2012:28). Authors like Aparasu (2011:7) supports the selection of relevant theories and models for the empirical testing of the study. The researcher had the opportunity to review a significant number of theories and models before arriving at the relevant theories and models. The theories are:

i)   Crisis and Emergency Risk Communication (CERC) by Reynolds and Seeger (2005);
ii) Uncertainty Reduction Theory by Berger and Calabrese (1975);
iii) Maslow's Hierarchy of Needs as proposed by Abraham Maslow (1943);
iv) Information Processing Theory by George A. Miller (1956);
v)   Information Theory by Claude E. Shannon (1948).

The theories above led to the discovery of the theories and models that were finally selected for the study. These earlier stated theories and models will, however, not be discussed to allow for an in-depth focus on the relevant ones. Nevertheless, Wright (2018:1) likens the Stakeholder Theory to Maslow's Hierarchy of Needs Theory proposed by Abraham Maslow in 1943. Abraham Maslow suggests that for an individual to achieve true happiness, one must go beyond material wealth towards a state of self-actualisation. This belief is way beyond Ian Mitroff's thinking, the creator of the Shareholder Theory in 1983. Ian argues that a company is beholden or accountable to its shareholders only. This thinking leads to the belief that only money makes people feel a sense of achievement. As a result, Freeman expounded on Ian's postulations and initiated the Stakeholder Theory in 1984, propounding that interests and the well-being of those who can assist or hinder the achievement of the organisation's objectives are imperative (Phillips, Freeman & Wicks, 2003:481). Hence, the Stakeholder Theory, which values the interests of all stakeholders for the success and benefit of both the organisation and its warm bodies, is significant to this study.

The researcher considered a selection of the Stakeholder Theory, IKM4DRR framework, MIIMCSDRM and the Model of the Policy Implementation Process for the empirical testing of the study (Aparasu, 2011:7). Since the disaster management field is multi-disciplinary and multi-sectoral in nature, the Stakeholder Theory proves to be the most relevant theory to help answer the research questions and objectives of this study (Republic of South Africa, 2003:7). The Stakeholder Theory has its roots in strategic management, but this study adapted it to the public sector (Flak, 2005:644). The NDMF immensely supports collaboration with diverse stakeholders in the disaster management field. The MIIMCSDRM was selected because it is

the recommended model for establishing information management and communication systems in South African disaster management centres (Republic of South Africa, 2005:65).

2.2.1 Stakeholder Theory (ST)

The Stakeholder Theory developed by Freeman in 1984, underpins this study. It helps to illustrate the significance of stakeholder involvement in an organisation to contribute to building efficient disaster risk reduction governance and resilient communities.

Edward Freeman detailed the Stakeholder Theory in his book titled: *"Strategic Management: A Stakeholder Approach"* published in 2010. He made emphasis on the principle of who and what counts. The theory emerges from the business environment as a concept of strategic management, organisational management and ethics (Phillips, Freeman & Wicks, 2003:480). Stieb (2009:405) defines the Stakeholder Theory in two parts, the first one is the *redistribution of benefits to stakeholders* and the second one is the *redistribution of the important decision – making powers to the stakeholders*.

Before looking into the two parts of Stakeholder Theory, it is imperative to first define the term *"stakeholder".* The Merriam Webster Dictionary (2019), defines a stakeholder as a person who has an interest or investment in something and is impacted by the course of its action. According to (Freeman, 2004:229; Freeman, 2010:11-53), a stakeholder is an individual or group that can be affected or affect the achievement of an organisations purpose. In their article on stakeholder analysis, Reed, Graves, Dandy, Posthumus, Klaus, Morris, Prell, Quinn and Stringer (2009:1934), cited an author by the name Checkland, who suggested that whoever owns a problem should be a co-owner of the problem-solving process. The authors, later on, provided an example of what a stakeholder is from an environmental pollution field. The authors argue that, in this scenario, stakeholders are both the polluters and victims. Where polluters could affect through polluting and the victims are directly or indirectly affected. The NDMF and the DMA are also explicit in their mention of stakeholders, for example, the mentioning of custodians from various sectors and disciplines. Further, since disasters and their management affects everyone in society, then all the society members are stakeholders.

This study draws from the various scholars mentioned earlier and suggests a possible definition of a stakeholder. A stakeholder is any individual or organisation affecting or affected directly or indirectly by the mandate of the disaster management operations. The stakeholders are disaster management centres from all spheres of government, national and provincial line departments, other government sectors and disciplines, the private sector, Non-Governmental

Organisations (NGOs), Community Based Organisations (CBOs) and communities. Alternatively, a stakeholder is any person or group that can benefit, affect or be affected by the disaster management mandates, such as disaster mitigation, prevention, preparedness, response and rehabilitation activities.

The following are the two parts of Stakeholder Theory:

i) **Redistribution of benefits to stakeholders** – Every organisation should interact with all community members it affects or is affected by, through investigating their perspectives, paying attention to their preferences and evaluating the impact of any such actions on the community members and the organisation. Such an interaction entails a lot of co-operation, participation, moral obligation and collaboration.

ii) **Redistribution of the important decision – making powers to the stakeholders** – Stakeholder Theory values each stakeholder by giving each stakeholder a voice and efficacy in making decisions. The theory argues that stakeholders should participate for some benefit and for determining the future direction of the organisation. The theory proposes that the stakeholders who will participate in decision–making and developing strategies for the organisations, should be identified and allowed to do so. As a result, the organisation identifies who benefits from the outcomes of the decision-making. Important to note, information is fundamental to the effective participation of stakeholders when making decisions (Phillips, Freeman & Wicks, 2003:487).

Freeman (2004:236) mentions a few examples of stakeholders, such as employees, customers, government and others. However, Freeman argues that the Stakeholder Theory fails to distinguish clearly between stakeholders and non-stakeholders. Reed, Graves, Dandy, Posthumus, Klaus, Morris, Prell, Quinn and Stringer (2009:1934) support this argument, stating that there is a difference of opinion among various authors over who or what exactly stakeholders are. Freeman (2010:36-52) postulated and propounded the belief by Ackoff (1974), that many societal problems could be solved by the support, participation and interaction of multiple stakeholders in pursuing the organisation's mission. Correspondingly, the researcher shares a similar thinking.

2.2.1.1 Strategies, processes or methodologies for selecting and analysing stakeholders
Various scholars like Reed, Graves, Dandy, Posthumus, Klaus, Morris, Prell, Quinn and Stringer (2009), Flak and Rose (2005), Donaldson and Preston (1995) in their research on the

Stakeholder Theory analysis, suggest different strategies, processes and methodologies that organisations can use to identify and analyse stakeholders. As stated in Torraco (1997); James and Jacoby (2010); Saron and Riggan (2017) and Robert and Staw (1995), the purpose and the role of a theory means improving professional practices through providing members of a particular professional discipline with a common language and a frame of reference. A theory also defines the boundaries of their profession, in this case, disaster managers in South Africa.

The enterprise strategy is one of the strategies identified (Freeman, 2010:80; Steyn, 2004:8). Imperative to corporations, as well as to disaster management organisations, is that they must answer the question: *"what do we stand for?"* Freeman (2010:90) and Clark (2017:1) identifies this strategy as an enterprise-level strategy and proposes to define enterprise strategy as the answer to the question: *"what do we stand for?"* Enterprise strategy is about the relationship of the organisation with the society. Freeman (2010) argues that every organisation should have an appropriate enterprise strategy for it to be socially viable and avoid turbulence. He identifies three processes that can be used to formulate enterprise strategy, namely: *Stakeholder analysis*; *Values analysis*, and *Societal issues analysis* (Freeman, 2010:91).

Stakeholder analysis poses the question: who is the group or individual that can affect or is affected by the organisation's purpose? (Eeden, 2013:12; Reed, 2008:1; Reed, Graves, Dandy, Posthumus, Klaus, Morris, Prell, Quinn & Stringer, 2009:1933). It is therefore important to note that the effects of the individual, group or organisation can be political, economic, social, technological and managerial (Costa & Pesci, 2016:102; Overseas Development Institute, 2009: 1). Values analysis is the analysis of the values of individuals, groups or organisation, for example intrinsic, instrumental, religious, moral, personal and others. Value analysis is also determining the best value for money for a service (Bowen, Pearl, Cattell, Hunter & Kelly, 2007:59). Lastly, societal issues analysis is for the organisation to understand its social context, for example, the question: what are major issues facing society today and in the future? The schema of political, economic, social, technological and managerial, can be applied (Freeman, 2010:100).

Freeman (2010:54); Reed, Graves, Dandy, Posthumus, Klaus, Morris, Prell, Quinn and Stringe (2009:1933) state that to enhance an organisation's stakeholder management, the process must begin with asking the question: who are the groups and individuals that can affect or be affected by an organisation's purpose? Then secondly, to implement a historical analysis of the organisation and lastly, to construct the *"stakeholder map"* of the organisation. Flak and Rose

(2005:651) support Freeman's (2010:54) thinking about placing the decision-makers at the centre of the firm, and the firm at the centre of its stakeholders. Figure 2.1 illustrates a generic stakeholder map from Freeman (2010:55), Flak and Rose (2005:651).
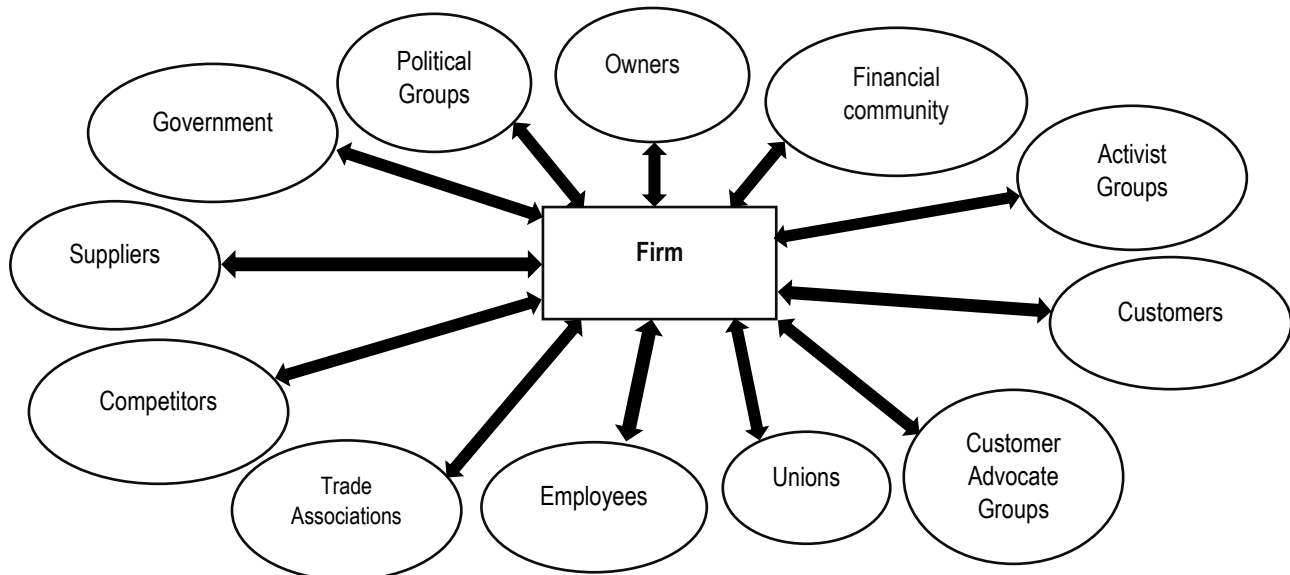
Figure 2.1 *Generic stakeholder map of a large organisation*
Source: (Freeman 2010:55, Flak and Rose, 2005: 651)

In addition to the processes of formulation, Freeman (2010:91) identifies five different types of enterprise strategies, which are a particular set of responses and actions an organisation should take when encountering a specific situation. The five types are: (i) *specific stakeholder strategy*; (ii) s*tockholder strategy*; (iii) *utilitarian strategy*; (iv) *rawsian strategy* and (v) *social harmony strategy*. Of these five strategies, the utilitarian one is most suited to the disaster management fraternity, as it seeks to develop, maximise and improve the quality of life of the society. The utilitarian strategy or approach is, according to Uys and Harty (2019:3), an approach of ethical standards. Uys and Harty (2019:3) define the utilitarian approach as an ethical action that produces the greatest good and does the least harm for all stakeholders, through dealing with consequences and increasing good and reducing the harm done.

The utilitarian strategy has a hypothesis which is: *"If the actions of a firm are perceived by its managers to have a wide range of effects on stakeholders, and if the managers have utilitarian values, then they should maximise the social welfare as far as possible. If there are a wide range of social issues that affect the firm, then the firm will adopt a utilitarian strategy to maximise the welfare of as many stakeholders as possible"* (Freeman, 2010:105). The utilitarian strategy tries to improve the quality of life in society, raise the welfare and contribute to community development. It aims to maximise benefits to all stakeholders, maximise the

average welfare level of all stakeholders, and maximise benefits to the society. Based on the utilitarian strategy hypothesis, similar traits are seen within the disaster management fraternity such as the need to maximise the social welfare of all the stakeholders affected by a hazard.

According to Sachs and Ruhli (2011:10), Freeman (2010), and Olsen and Olsen (2005:19), there must be a strategy for each group of stakeholders, a sense of purpose and value creation. In one of his articles on the stakeholder theory, Freeman (2004:229) explains the definition of stakeholder by arguing from the viewpoint of senior managers of an organisation. He mentions that if a group of individuals could affect an organisation or be affected by it, then the managers should worry about that group in the sense that it has to develop explicit strategies for dealing with them. Holloway, Bryde and Joby (2015:2) and Freeman (2010:126) further postulate prioritising and development of specific programmes for each stakeholder group, as a way of implementing the stakeholder ideology. Lindgreen, Maon, Vanhamme, Florencio, Vallaster and Strong (2019:300), support Freeman through encouraging engagement activities for stakeholders, as a way of offering them opportunities to learn about an organisation's activities and their potential impacts and benefits for them.

Primarily, the programmes will depend on the stakeholder behaviour analysis and the ability of managers to clarify their theories and models for stakeholder action (Freeman, 2010:126). Further to the formulation of stakeholder programmes, the programmes must be translated into action plans, with questions such as "*who does what*?" and "*by when*?" (Freeman, 2010:156). However, if there are any existing programmes, the managers can consider re-evaluating them. In support of programme development and implementation, the managers should provide several organisational units with resources for effective programme execution.

Freeman (2010:155-164), Fontaine, Haarman and Schimid (2006:20), argue that to determine if a particular strategic programme can be implemented and gain commitment, there are several issues, which should be taken into consideration and they are as follows:

i) **Allocating resources –** Follow a formalised budgeting process for resource allocation. The allocation can be based on the organisation's historical past to help justify yearly increments.

ii) **Gaining commitment –** Managers should determine how committed the different organisational units are. To get the units' commitment, management can introduce incentives and shared values by involving the different units.

iii) **Changing the transaction process** – Managers decide to take certain action against some stakeholders**,** for example, *ignoring certain stakeholders,* by not allocating resources or the *public relations approach* of telling the organisation's story through an opinion leader. It can also be through *implicit negotiation* where the organisation takes into consideration the concerns of the stakeholder when formulating programmes or e*xplicit negotiation* where there is two-way communication, informal negotiations, win-win solutions, as well as unilateral action (taking action without prior communication, and this is done by organisations that decide to ignore their stakeholders).

Kinyua, Amuhaya and Namusonge (2015:154) and Freeman (2010:171) suggest that just as important strategy formulation and implementation is, so is the monitoring and evaluation process. Freeman identifies four basic concepts or controlling strategies for consideration in controlling organisational performance. The basic concepts are as follows:

i) *Implementation control* (did we do what we said we will do and were the resources enough, if not why?);

ii) *Control of strategic programmes* (were milestones reached and behaviours monitored);

iii) *Control of strategic decisions* (is the programme taking the organisation in the desired direction);

iv) *Control of what we stand for* (is there an enterprise strategy to analyse the stakeholders' values and the societal context in which they liaise with their firm).

2.2.1.2 Strengths of the Stakeholder Theory

This study adapted the Stakeholder Theory, a concept from the business environment, specifically from strategic management. Disaster management is a multi-disciplinary and multi-sectoral field (Republic of South Africa, 2003:45) and with this, stakeholder management is important for devising methods to manage the myriad groups and relationships strategically. Handayani and Mustikasari (2018:2) state that establishing the involvement of stakeholders and their roles, is imperative to the success of implementing disaster management activities. Stakeholder Theory is important to the disaster management field because it starts with strategic planning and requires an effective disaster logistics management system, information management system and coordination, as well as cooperation among organisations (Handayani & Mustikasari, 2018:2). The definition of a stakeholder as alluded to earlier relates greatly to the multi-disciplinary and sectoral nature of disaster management. Hence, the decision to make the Stakeholder Theory a relevant theory for application to this study.

2.2.1.3 Weaknesses of the Stakeholder Theory

Stieb (2009:402) postulates that it is important to critique the Stakeholder Theory because it is one of the most important or prominent theories of business management. He states that the theory only urges organisations to take care of those that affect it most and less on those who do not and this seems like advocacy of managerial capitalism (Stieb, 2009:405). It supports the notion that one group of stakeholders should get more than another. It does not say who gets what among the two groups. The theory does not say who should receive more power, in reality, we are not all equal. Freeman (2010:42), the author, argues that the most important stakeholders to benefit from the organisation and make a decision, are those that make a difference to the organisation. This statement is rather egotistical. The Stakeholder Theory is unable to distinguish between stakeholders and non-stakeholders (Freeman, 2004:236).

Phillips, Freeman and Wicks (2008:480) indicate that the Stakeholder Theory is primarily concerned with the distribution of financial outputs. All stakeholders must be treated equally, irrespective of the fact that some stakeholders contribute more and some are affected more than others. This, however, might not be realistically possible. Freeman, Parmar, Harrison, Wicks, Purnel and deColle (2010:9) urge scholars to take note that the Stakeholder Theory does not mean that representatives of these groups must sit on governing boards of the organisation. It implies that the interest of stakeholders should be taken into consideration and the focus is on how the organisation can create value for the stakeholders' interests (Kinyua, Amuhaya & Namusonge, 2015:141).

Miles (2012:286) argues that there is a lot of conceptual confusion, which comes with the definition of the concept "s*takeholder*". Miles' (2012) detection of the confusion that surrounds the term "s*takeholder*" is also noted by Edward Freeman, the advocator of the Stakeholder Theory. Freeman (2010:63) acknowledges the limited acceptance of Stakeholder Theory as a theory to the ambiguity of the concept "*stakeholder*". To mitigate this ambiguity, the study defines a stakeholder as an individual or group of people who have an interest in an organisation or that organisation has an interest in them, which supports the multi-disciplinary and multi-sectoral nature of disaster management.

2.2.2 A Model of the Policy Implementation Process (MPIP)

Policies formulated by the government to establish new patterns or institutions or to change patterns in old institutions, do not always succeed. In general, the government designs policies intended for inducing societal changes. However, the assumption that once policies have been

formulated and then they will be implemented, is what Smith (1973) condemned, especially in the third world countries. Smith's disapproval is attributed to the hindrances, which generate discrepancies like government bureaucracies, limited capacity, politicians, lack of qualified personnel, corruption, opposition to the policy itself, insufficient direction and control from politicians, tension, strain and conflict among the policy implementers and the society (interest groups), affected by the policy. Smith (1973) proposes a Model of the Policy Implementation Process and argues that the policy implementation process considers four components: (i) The idealised policy, (ii) the target group, (iii) the implementing organisation, and (iv) environmental factors.

The central core of the policy implementation process is presented in Figure 2.2. The figure illustrates that initially, the policy is processed, however, when it is implemented, there are discrepancies and tensions, due to interactions within and between the components of the policy implementation system. The tensions lead to a build-up of transactions (related to the aims and goals of the policy) and the transaction patterns may or may not give rise to institutionalisation. The newly created transaction patterns or institutions may be a catalyst for new and powerful tensions that may support or disrupt the new or modified patterns of relationships. Feedback is sent back to the matrix from the resulting tensions (either increased or relieved), brought about by the transaction patterns and probably institutions formed.
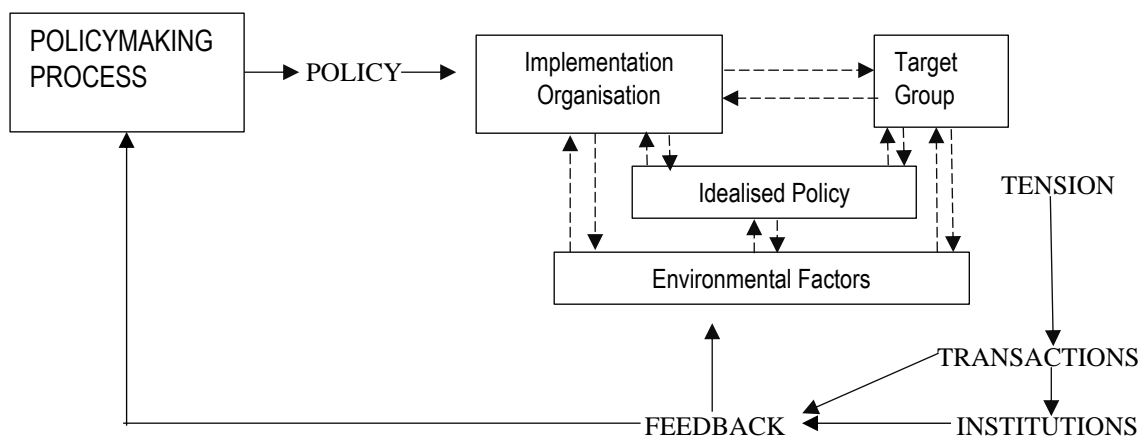
Figure 2.2 *Model of the Policy Implementation Process*
Source: (Smith, 1973)

i) **IDEALISED POLICY** is what the policymakers are attempting to induce. The Idealised Policy carries with it four relevant categories. The first one is the ***Formal Policy*** that is the law or programme the government is attempting to implement. The second category is the ***Type of Policy***, which is classified into three categories *(a) Policies may be complex or they may be simple in nature, (b) Policies may be*

categorised as organisational or non-organisational, and (c) Policies are also classified as distributive, redistributive, regulatory, or emotive-symbolic. The third category of the Idealised Policy is ***The Programme***, which entails three aspects of the policies programme. They are: *(a)* Intensity of support, *which is the degree to which the government is committed to the implementation of the policy, (b)* The source of the policy*, this is where the policy is required to satisfy needs and demands in the society and was formulated with little demand and support*, (c) Scope *is the magnitude of the policy in terms of universal, geographic or subject area*. The fourth category is the ***Images of the Policy,*** which is the consideration of the images the policy invokes in the society of those affected by the policy and those who implement the policy.

ii) **THE TARGET GROUP** are those expected to adopt the policies of new patterns of interaction. These are the people within organisations or the groups that are most affected by the policy. The organisations and groups are expected to change to meet the policies' demands. Amidst this, there are certain factors to take into consideration, which are: (a) The degree of organisation or institutionalisation of the target group, (b) The leadership of the target group, (c) The prior policy experience of the target group.

iii) **THE IMPLEMENTING ORGANISATION**, this is the organisation responsible for policy implementation. This organisation is usually a government bureaucratic unit. When implementing the policy, three variables for consideration are:

(a) *structure and personnel* is the administrative structure of the organisation and the qualifications of employees,

(b) *leadership of the administrative organisation* refers to the style and nature of the leadership, and then,

(c) *implementing programme and capacity* is the attention and care taken to meet the objectives of the programme when implementing.

iv) **ENVIRONMENTAL FACTORS** are factors that can influence or be influenced by the implementation of the policy. Hence, differing kinds of policies, differing cultural, social, political, and economic conditions may prevail.

Some certain tensions and transactions affect the above-discussed components in the policy implementation process, which are as follows:

Tensions occurs both *within* and *between* the four component categories of idealised policy, implementing organisational, target group, and environmental factors. There could be a

within discrepancy in the implementing organisation, such as insufficient personnel or lack of policy implementation skills. A *between* tension could be between the target group and the idealised policy, where the target group is not conforming to the new policy. Tensions are prevalent at various societal levels, which is *individual*, *group* and *structural*. Individuals have varying opinions about something, groups have a shared opinion, so whom to trust or hear out the most? At the structural level, skilled personnel are fundamental for policy implementation, if not, the tension is definite.

Several discrepancies can occur at the three various levels, namely the individual, group and structure. For example, *a discrepancy between what is an ideal state and an actual situation.* Smith (1973) gives an example of an ideal situation where a government office should have full administrative personnel. However, the actual situation is that most posts are vacant. This then leads to structural level tension, due to the discrepancy between the idea and the actual situation. Another example Smith provides is the *discrepancy between an actual situation and an expected situation*. For example, a researcher sent from a central government to a district government with the expectation of finding orderly and up-to-date records but the actual keeping of records by the district is not in order or as expected.

Transaction Patterns are an important phase of patterns that are responding to tensions, stresses and strains within and between the parts of the policy implementation context. In most cases, governmental policies are intended to result only in transaction patterns and not in the establishment of permanent institutions. Even though institution-building may be one of the prime goals of governmental policy, these institutions may not be formed. It is important to take note that the process of implementing policy is ongoing and may not have a final definite end.

Institutions are usually formed after an idealised policy, if they are formed, institutionalisation can be determined by several guidelines such as (a) the institution's ability to survive in its environment, (b) the extent to which the institution is viewed by surrounding societal components to have value (both autonomy and influence), (c) whether the relationship patterns become normative for other social components.

Governments must establish administrative or political organisations to implement policy.

Feedback is the transaction patterns that emerge after institutionalisation has occurred, they might serve as tension-generating entities. The tensions might not generate back into the

implementation matrix, as illustrated in *Figure 2.2*. There might be completely new changes in the system. There is no assurance that the former state of the system will come into existence again. There is also no guarantee that there will be a distinct end to any implementation process. The new tensions may be supportive or disruptive to the new patterns and institutions, brought about by the policy implementation. In most cases, the new tensions created might lead to the reshaping of governmental policy. Smith argues that the feedback phase of the model is a clear indication that the policy process is ongoing.

Smith (1973:209) concludes the discussion of the model by giving an example relevant to the South African government situation, *"Disruptive tensions might be brought about by the establishment of a viable system of autonomous local government so that it can process problems in its jurisdiction. The efficient and effective functioning of this local government system may evoke tension from some ruling leaders at the national level who feel that local units should be tightly controlled by the central government."* Smith (1973) then states that these new tensions might then lead to the reshaping of governmental policy and the issuance of instructions to administrative units to exercise more control over local government. Based on the study findings in Table 7.12, the NDMC as the central disaster management office stated that it is considering the re-engineering of the disaster management structure from a decentralised one to a centralised one. In the study's opinion, this might be the answer to the slow progress in policy implementation.

2.2.2.1 Strengths of the Model of the Policy Implementation Process
This model is significant to this study, because of its grounding in policies. It would not make sense to carry out a policy-related study without the inclusion of this model on the policy implementation process. It is even more relevant following the promulgation of the Constitution of South Africa, the government promulgated the DMA and NDMF and certain transactions and patterns were expected. Hence, with the guidance of the variables mentioned in this model, the study was able to reveal where the South African disaster management institution is in the current space.

2.2.2.2 Weaknesses of the Model of the Policy Implementation Process
Smith (1973) highlights the fact that regardless of the feedback process being a fundamental component of the model, the policy process is continuous and does not have a definite end. This infinite process somehow makes it difficult to evaluate the implemented policy. There is also no guarantee that the application of the model by policymakers will mitigate disruptive tensions, which cause the outcomes of the policy not to meet the intentions of the policy.

2.2.3 Model of an Integrated Information Management and Communication System for Disaster Risk Management (MIIMCSDRM)

The MIIMCSDRM was detailed in the NDMF. The MIIMCSDRM is a system that illustrates all the functions of enabler 1[2], and it encompasses the following primary functions (Republic of South Africa, 2005:65):

i) Data acquisition system (data gathering and collection);

ii) Support for KPAs (Institutional capacity; Disaster risk assessment; Disaster risk reduction; Response and recovery);

iii) Support for the enablers (Education, training and research; funding);

iv) Additional functionalities required;

v) Integrated disaster management database and information management; and

vi) Information dissemination and communication links that facilitate information flow between role players.

The NDMF emphasises that each component of the system must be assigned to specific role players for it to be developed and maintained (Republic of South Africa, 2005:65). This is in line with the principles of the Stakeholder Theory. The MIIMCSDRM is a valuable tool that illustrates a structure that leads to tangible and practical suggestions for successful integrated disaster management. The disaster management framework states that, if the information management and communication system for a disaster management centre is effective and operational, then the centre's system will be able to receive, disseminate and exchange reliable hazard and disaster risk information (Republic of South Africa, 2005:63) with the potential of building a resilient community.

2.2.3.1 Strength of the MIIMCSDRM

As mentioned earlier, the MIIMCSDRM is the recommended model for establishing an information and management system in South African disaster management centres, and it is then important to assess it from this study's point of view. The strengths and weaknesses identified for this model are derived from the review of the Stakeholder Theory and its

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[2] The structure of the South African National Disaster Management Framework of 2005 is as follows: KPA 1, KPA 2, KPA 3, KPA 4, ENABLER 1, ENABLER 2 and ENABLER 3. The title of enabler 3 is Information management and communication. The definition if an enabler is something that is required to achieve the objectives set out in the key performance areas (Republic of South Africa 2005: 4). It is an object that makes something possible or it is a structural, cultural, technological and human practice that can be used to support the implementation of a goal (Muller 2017:69).

principals, as well as the IKM4DRR framework. The following are the MIIMCSDRM strengths:

i) The MIIMCSDRM acknowledges the involvement of stakeholders. This is as supported by authors like Clark (2017), (UNISDR, 2013) Stieb (2009), Reed, Graves, Dandy, Posthumus, Klaus, Morris, Prell, Quinn and Stringer (2009), Flak and Rose (2005) and Freeman (1984), just to mention a few. We see stakeholder acknowledgement through the following key statements, extracted from the framework, but not limited to:

"...establish integrated communication links with all disaster risk management role players" (Republic of South Africa, 2005:63)

"Disaster risk management is a collaborative process that involves all spheres of government, as well as NGOs, the private sector, a wide range of capacity – building partners and communities" (Republic of South Africa, 2005:64)

"... targeting information for primary interest groups" (Republic of South Africa, 2005:64)

"Responsibility for the different components of IIMCSMDRM need to be assigned to specific role players" (Republic of South Africa, 2005:65)

"... data custodians/data owners" (Republic of South Africa, 2005:66)

ii) The model acknowledges that each Key Performance Area and each enabler requires an information management and communication system to function properly and effectively.

2.2.3.2 Weaknesses of the MIIMCSDRM
Like every model, the MIIMCSDRM also has its weaknesses, which are as follows:

i) Even though the MIIMCSDRM acknowledges the involvement of stakeholders, it is not explicit on which key or rather a specific stakeholder(s) per KPA and enabler need to be actively involved;

ii) The MIIMCSDRM cannot function fully with an individual manager or management by internal stakeholders only; it will require the input and operation by external, specialised departments or sector-specific hazards or data custodians as explained in the framework:

"To obtain access to data required for disaster risk management activities, provision must be made for important data from the identified existing database and GIS systems

owned and used by other organs of state and organisations to perform their primary activities e.g. department of statistics" (Republic of South Africa, 2005:66).

    iii)   The National Disaster Management Framework of 2005 expects the National Disaster Management Centre to develop guidelines for the development of a MIIMCSDRM. However, through preliminary research carried out in this study, it has been noted that these specific guidelines have not yet been developed. The lack of these guidelines from the NDMC might lead to the limited comprehension of the disaster management policy.

2.2.4 Information and Knowledge Management for Disaster Risk Reduction Framework (IKM4DRR)

In attempting to find a model that is relevant to the study, the study reviewed the IKM4DRR framework. The IKM4DRR framework was developed by the IKM4DRR community at the Global Platform for Disaster Risk Reduction in May 2013 (UNISDR, 2013:2). A few discrepancies that were identified in the disaster risk reduction domain globally, led to the development of this framework. Figure 2.3 lists all the issues that were identified and later on informed the development of the framework.

• Information is scattered among various agencies and institutions with limited coherence, coordination and sharing.
•Information about hazard events, exposure, vulnerability, and the impacts of disasters are often not systematically collected.
•There has been limited analysis to understand the trends, spatial and temporal impacts of potential disaster risks and their impacts.
•Risk information is not systematically used for policy and decision-making
•There are no agreed-upon standards and shared definitions in IKM (Information and Knowledge Management) for DRR (Disaster Risk Management) and CCA (Climate Change Adaptation).
•There is little integration of knowledge systems at regional, national and community levels.
•There is inadequate collaboration between the different organisations working in DRR or related areas such as CCA and the environment.
•Civil society and private sector involvement are often limited.
•Resources allocated and used for translating information collected in different languages are insufficient.
•Cultural context as a major influence on approaches in disaster risk reduction and disaster risk management is rarely considered.
•Incentives and political backing for information-sharing are insufficient or lacking. Moreover, there is a lack of defined responsibilities and accountabilities for IKM.
•Issues of power and competition at institutional and other levels get in the way of sharing information.
•Dedicated capacity and skill development in information and knowledge management are lacking.
•Resources are not committed to sustainable IKM initiatives.

Figure 2.3 Issues in Disaster Risk Reduction Information and Knowledge Management
Source: (UNISDR, 2013: 5)

2.2.4.1 Strength of the IKM4DRR

The IKM4DRR concedes with the ST and the MIIMCSDRM in that there should be engagement and communication with all concerned stakeholders (UNISDR, 2013:6). Even

though the IKM4DRR was developed to address similar issues to those faced in South Africa and has some strong facets, the MIIMCSDRM is the preferred model because of the strengths mention earlier. However, the study borrowed some of its facets for the development of this study's integrated information management and communication system framework.

2.2.4.2 Weaknesses of the IKM4DRR

The IKM4DRR is a broad and general framework, which does not provide specific guidance on how to apply it to the establishment and management of an information and communication system.

2.3 Proposed integration of the ST, MIIMCSDRM, IKM4DRM and the MPIP

The study borrowed some variables of the ST, MIIMCSDRM, IKM4DRR and MPIP. The borrowed variables informed the development of a framework for establishing information management and communication systems. The integration of these models pronounces support for the multi-sectoral and multi-disciplinary nature of disaster management (Republic of South Africa, 2003:9). The MPIP highlights the need for government policymakers, especially those in the third world countries to devote more time and effort in understanding and mastering policy implementation strategies. The ST argues that all individuals and groups that can be affected or affect the organisation's purpose, should benefit from the value created by the organisations. The MIIMCSDRM postulates that a disaster management centre needs to have an effective and operational information management and communication system to receive, disseminate and exchange reliable hazard and disaster information to different role players. The IKM4DRR enables and sustains informed decision-making for disaster management. The integration process was as follows:

i) First, the study assessed the tensions that exist in the South African disaster management institutions, based on the MPIP.

ii) The study developed processes or methodologies that disaster managers can use to identify stakeholders affected or that can affect the governance of each KPA and enabler. The process proposed a stakeholder analysis method informed by historical data and other data.

iii) The framework proposed that once stakeholders were identified, stakeholder prioritisation methods should be proposed, illustrating the internal and external stakeholders of a specific KPA and enabler.

iv) Stakeholder identification and prioritisation led to understanding stakeholders to determine the interests and needs of each stakeholder towards the successful operation of the MIIMCSDRM.

v) According to Lindgreen, Maon, Vanhamme, Florencio, Vallaster and Strong (2019:300) and Freeman (2010:126), it is important to develop specific programmes, followed by key activities for each stakeholder group, as a way of implementing stakeholder ideology. Thus, the integration will also indicate components of stakeholder support, which is also a requirement of section 5.2 of the disaster management framework of 2005, where it is stated: "*Responsibility for the different components of the integrated information and communication system needs to be assigned to specific role players. This will ensure that the functionalities required to support the system are developed and maintained. The components must be integrated into a single standardised system that is user-friendly, scaleable per component, and easy to maintain and upgrade*" (Republic of South Africa, 2005:65).

vi) Lastly, it is important to determine which stakeholders contribute to the successful operation of each KPA and enabler and which ones affect the functioning of each. Alternatively, to determine which KPA and enabler functioning can affect stakeholders.

Important to note and take into consideration amongst various other issues, when doing this integration, are the several issues mentioned earlier. The issues are the allocation of resources, gaining commitment from managers and changing the transaction process (Freeman, 2010:155; Fontaine, Haarman & Schimid, 2006:20).

2.4 Conclusion

This chapter detailed the ST, the MIIMCSDRM, the IKM4DRR and the MPIP as models and theories that formed the foundation of the study. The identified theories and models are relevant and underpin the study. The other theories initially considered for this study do not illustrate the link and significance of stakeholder relationship-building for disaster risk information management and communication systems. Additionally, the chapter identified theories and models' strengths and weaknesses in the context of the study. To conclude, the study discussed the proposed strategy for the integration of the empirical findings.

CHAPTER 3: NDMF, ENABLER 1: UNDERSTANDING THE INFORMATION MANAGEMENT AND COMMUNICATION SYSTEM

3.1 Introduction

This study is informed by the South African Disaster Management Act 57 of 2002 (DMA) (as amended Act 16 of 2015) and the National Disaster Management Framework of 2005 (NDMF). The areas of interest in the DMA are sections 7(2)(i)(m), 15(1)(b), 16, 17(2)(3)(i), 18, 19(a)(b)(e), 21(a)(iii), 24, 25(3)(a), 32, 36, 38(3)(a), 39, 46, 49, 52(2)(a) and 53. In the amended Act, section 24, (,4), (a), (e) and (h) were incepted, relating to information required on the occurrence of a disaster, leading to a declaration. In the NDMF, the area of focus is enabler 1 that supports all key performance areas (KPA) and the other enablers.

In this chapter, enabler 1 is discussed in detail. For a better comprehension of the enabler, most of the sections are illustrated in figures, as adopted from the description in the framework. This study perceives Chapter 3 as the most significant one because it sets the scene for the entire research. The contents of this chapter are from the NDMF pages 130 to 155. This is an important chapter because it unpacks the foundation of the study, as well as the core function for disaster management operations. In conclusion, the chapter provides general comments about the enabler. The comments partially attempt to answer and understand the research question: *"What is the current state of the South African Provincial Disaster Management Centres', concerning information management and communication systems for achieving disaster risk management goals?"* Ultimately, of importance is the comprehension of what is an IMCS and its meaning to the disaster management fraternity.

3.2 Overview of enabler 1: Information Management and Communication Systems

The objective of enabler 1 as extracted from the NDMF is to: *"Guide the development of a comprehensive information management and communication system and establish integrated communication links with all disaster risk management role players"* (Republic of South Africa, 2005:130). Figure 3.1 was adapted from the MIIMCSDRM.
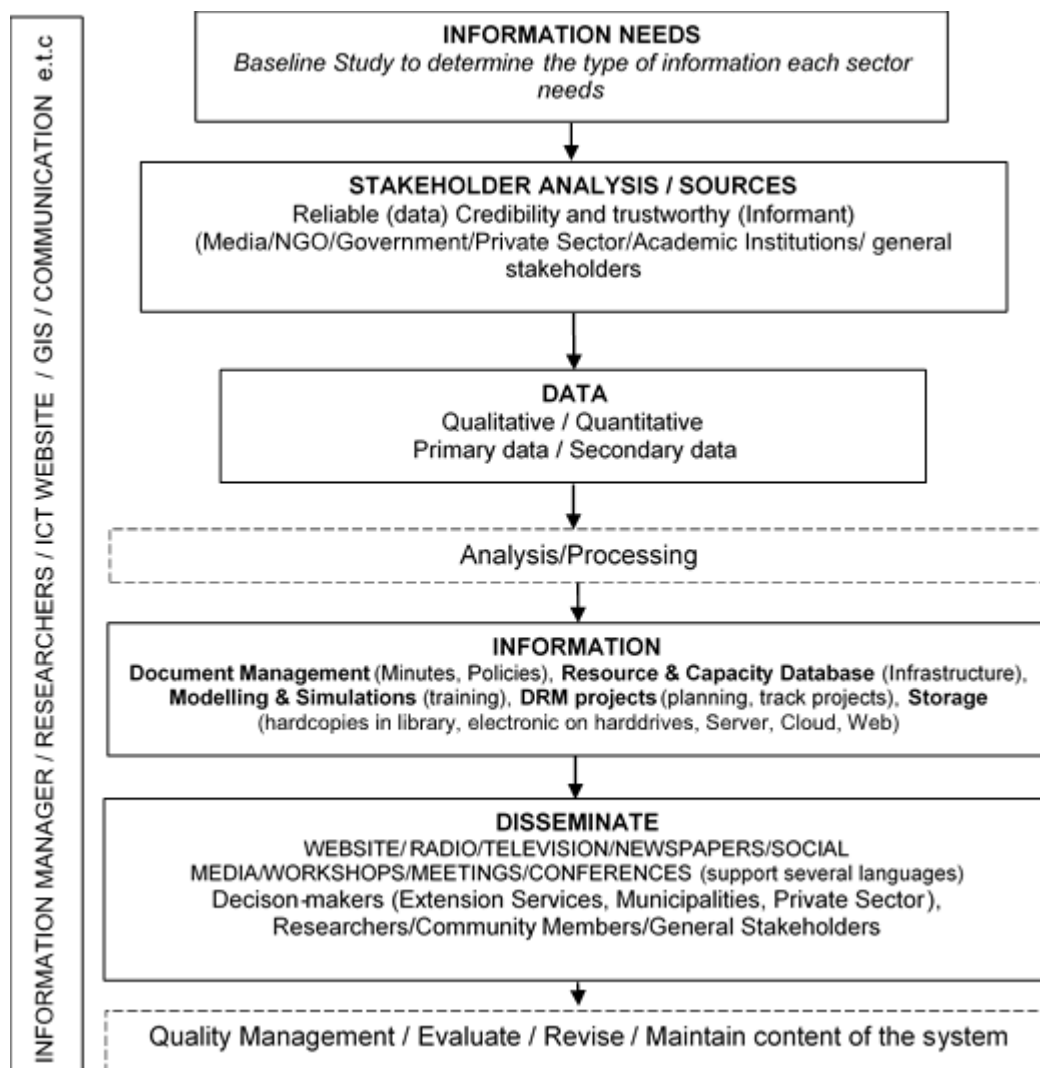
Figure 3.1*Generic information management and communication system*
Source: (Adapted from Republic of South Africa, 2005: 130)

As illustrated in Figure 3.1, the following capabilities are required to achieve the objective of enabler 1:

i)   needs analysis (added to the capabilities),

ii) acquire data (added to the capabilities),

iii) sort data,

iv) store data/information,

v)   analyse data,

vi) information-sharing with targeted interest groups,

vii) Geographical Information Systems (GIS) for mapping and information display, and

viii) Standardised multi-media communication capabilities (Republic of South Africa, 2005:63).

As postulated in the Stakeholder Theory, enabler 1 shows that disaster risk reduction and management is a collaborative process that should involve all spheres of government, non-governmental organisations and the private sector and society (Freeman, 2010; Stieb, 2009; Freeman, 2004; Freeman & Phillips, 2002; Freeman & McVea, 2001). Specific capabilities are required to carry out all the risk reduction and management activities. Further, access to reliable hazard and risk information is required to receive the information, exchange it and disseminate it. For all of this to occur, effective information management and communication systems are required. Figure 3.2 illustrates the systems and processes for the effective functioning of disaster management.
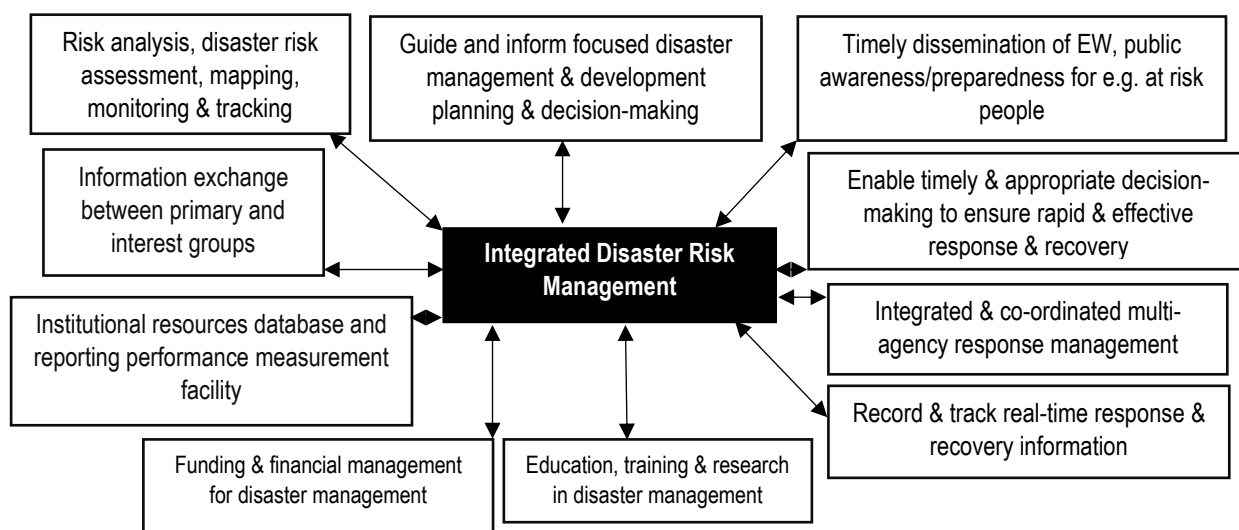
Figure 3.2 *System & processes for the effective functioning of disaster management*
Source: (Adapted from Republic of South Africa, 2005: 63)

Enabler 1 has seven key sections that it addresses. Section 3, 4, 5, 6 and 7 have KPI to indicate successful development and implementation of the system. The KPI guides and monitors the progress of each key section. At the end of the enabler, there is a section titled: *"Guidelines to be disseminated"*. The NDMC is supposed to develop the guidelines (Republic of South Africa, 2005). These are guidelines for the implementation of the Integrated Information Management and Communication System's (IIMCS) in all spheres of government; guidelines for disaster management programmes and projects and guidelines for a disaster management performance measurement, monitoring and evaluation systems.

3.3 Key sections of enabler 1

This section briefly lists and describes all the key sections in enabler 1. The key sections serve as a guide for the operationalisation of the disaster management centre through the information management and communication system.

3.3.1 Section 5.1 Establishing Information Management and Communication System

The system must be integrated and uniform, so that it provides for information exchange between all relevant stakeholders, especially disaster managers through various communication mechanisms and media. The system should be able to receive, store, analyse and disseminate information, in general, it must establish communication links, as well as a mandate of the stakeholder theory (Freeman, 2010; Stieb, 2009; Freeman, 2004; Freeman & Phillips 2002; Freeman & Phillips, 2002; Freeman & McVea, 2001). Not all disaster management centres are located in urban areas; hence, each centre must take into account the limited technological infrastructure in communities at risk. This will require a back-up system or other means of communication that are less technical. The NDMC and the PDMC must work together in establishing and maintaining the system.

3.3.2 Section 5.2 Integrated Information Management and Communication Model

Establishment of the system through the incorporation of the MIIMCSDRM can contribute to the achievement of the objectives set in the KPAs and the other two enablers. This model is mandatory for the operation of the disaster management centre. The system must be able to do the following activities as illustrated in Figure 3.3 (Republic of South Africa, 2005:134).
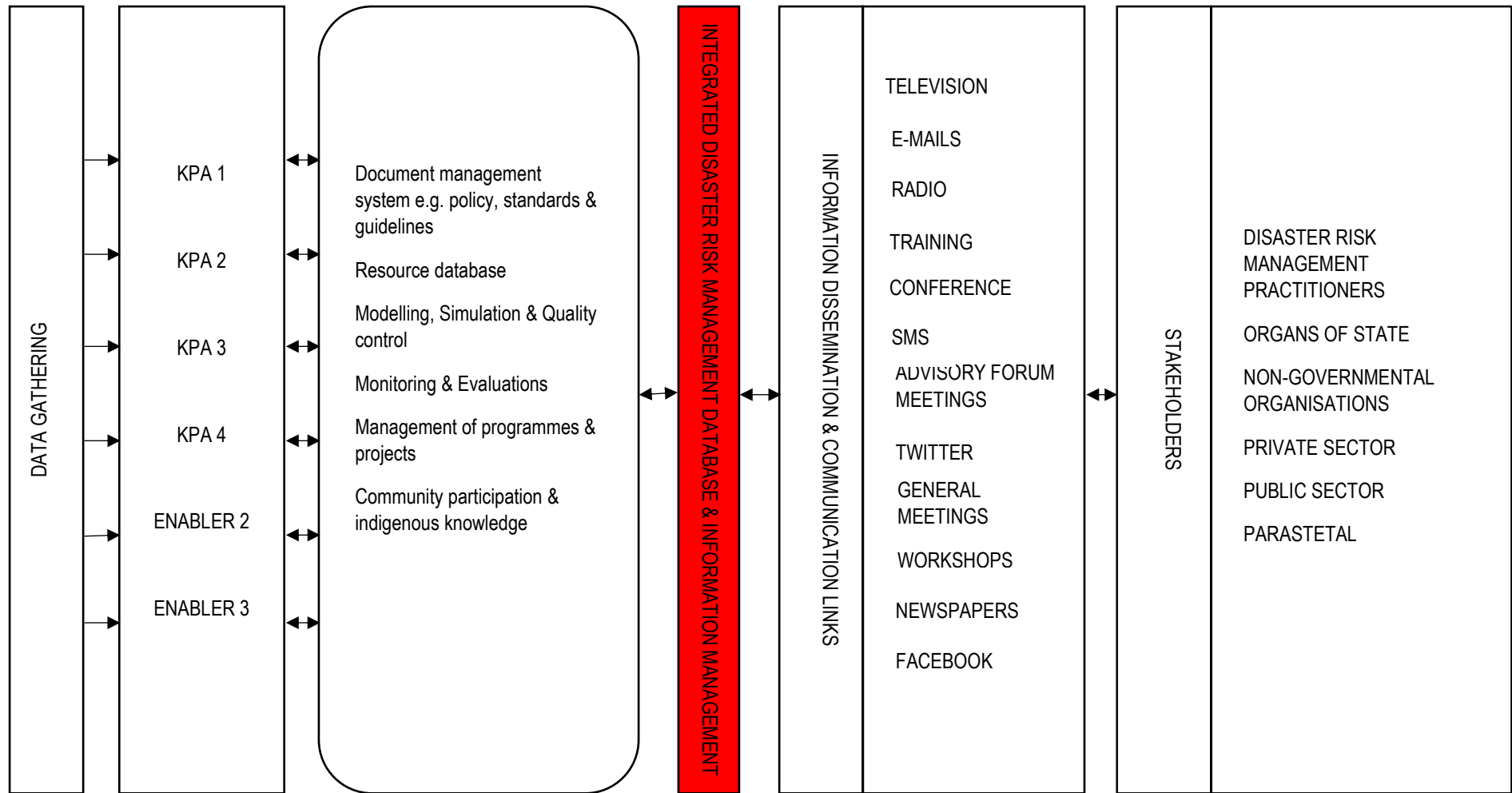
Figure 3.3 *Functioning illustration of the Integrated Information Management and Communication Model*
Source: (Adapted from Republic of South Africa, 2005:134)

According to the NDMF, responsibilities for the different components of the MIIMCSDRM require the assignment of different responsibilities to specific stakeholders. This is to ensure development, maintenance and accountability of the system. Subsequently, the MIIMCSDRM system should be user-friendly, interoperable, easy to maintain and easy to update.

3.3.3 Section 5.3 Data acquisition (data collection and capturing)

The NDMF expects the NDMC to do a data needs assessment for each KPA and other two enablers to meet the objectives of the DMA and NDMF. The NDMC must identify data sources or data owners, for example, South Africa Weather Services (SAWS), Statistics South Africa (StatsSA) and others. In this case, they should have MOUs in place with these data owners, to freely access data as an NDMC and the other disaster management centres. With this in mind, the NDMC must negotiate with data custodians to have access to relevant datasets. Figure 3.4 illustrates the procedure for obtaining data.
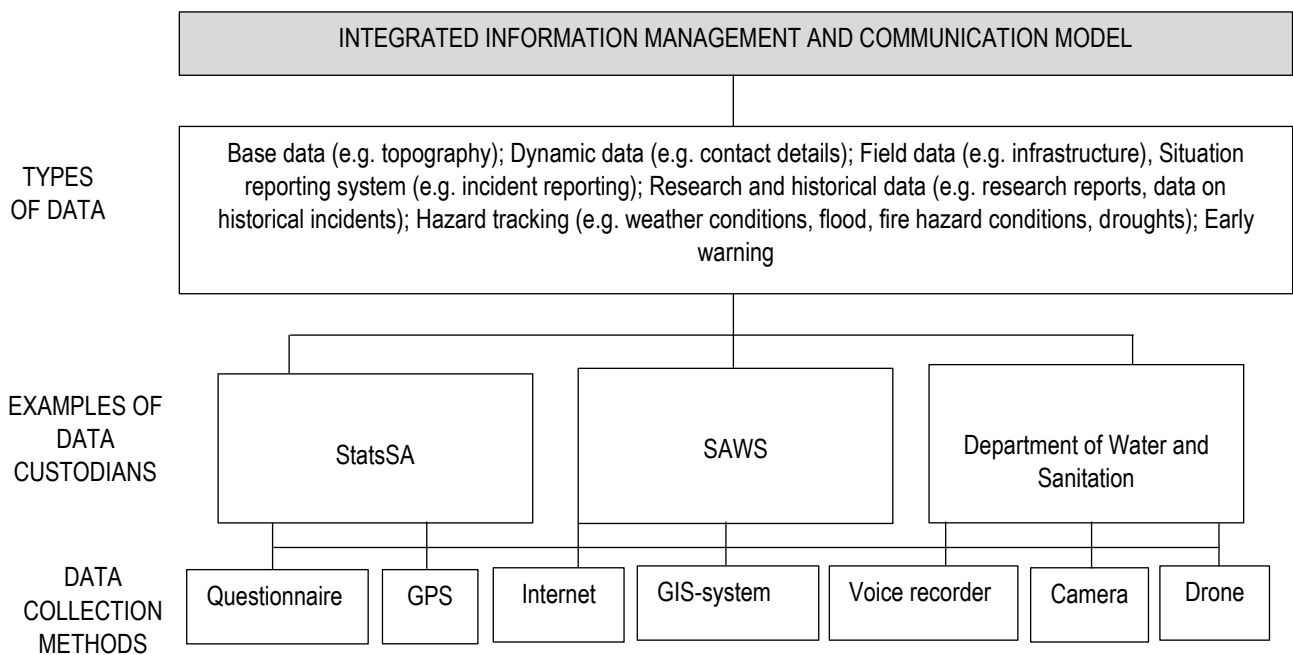
Figure 3.4 *Data acquisition strategies and methodologies*
Source: (Adapted from Republic of South Africa, 2005:136)

Section 5.3 ends with KPI, which states that the NDMC must have identified and defined data needs and sources. The NDMC must have developed and implemented data collection and capturing methodologies. Lastly, the NDMC must have identified, negotiated, signed agreements and verified the responsibilities of data custodians as a way of ensuring availability, quality and reliability.

3.3.4 Section 5.4 Information Management and Communication support for Key Performance Areas and enablers

For each KPA and enabler to be fully functional and operational, it requires some basic information management and communication system features. In that case, enabler 2 recommends the following features required for each KPA and enabler. The features are as follows for each KPA and enabler:

KPA 1 – Integrated Institutional Capacity for Disaster Risk Management

i)   Develop and maintain a directory (of national, provincial and municipal names, contact details and their roles and responsibilities),

ii) Develop, record and regularly update a directory of ICDM,

iii) Develop a directory of all members of the NDMAF, as well as mechanisms for accessing emergency resources and their control,

iv) Decisions and recommendations made by ICDM and NDMAF must be disseminated to role players,

v)   Develop a directory of project teams and minutes of meetings must be recorded and the records must be kept,

vi) Establish a 24-hour communication facility for receiving, managing and disseminating early warning, as well as for coordinating the response in the case of an event,

vii) Recording and updating international cooperation, multilateral agreement and mutual assistance agreements,

viii) Establish and maintain an accurate record-keeping system, incorporate disaster management, disaster risk reduction, project plans, contingency plans, minutes, reports, memoranda and correspondence,

ix) Maintain comprehensive records of volunteers (skills and capabilities),

x)   Establish and maintain a directory of community participants,

xi) Keep a record of performance measurement and monitoring of disaster management centres and other stakeholders.

KPA 2 – Disaster Risk Assessment

Spatial and non-spatial information is required for the critical analysis and implications of different types of hazards. Other requirements include scenario planning for different hazards, cost-benefit analysis and determination of acceptable risk. Such information assists in identifying hazards and their impacts, mapping hazards and risks, planning DRR measures,

monitoring and tracking hazards for early warning, facilitating response, assessment damage and planning response and recovery measures and lastly, the evaluation of appropriateness and effectiveness of DRR response and recovery.

For disaster risk assessments, information management systems must produce electronic GIS-based risk profiles, generated from the following input sources:

i) Hazard and disaster event identification and tracking,
ii) Vulnerability monitoring,
iii) Historical reviews of disasters,
iv) Scientific research,
v) Field consultations,
vi) Capacity.

The hazard and vulnerability function must allow the presentation of information for disaster risk assessment in the form of GIS-based risk maps. The maps should have different layers that have data and certain features. Maps are a result of captured information about calculated indicators. Maps are produced for fires, floods, drought, transport incidents and infrastructure collapse, political boundaries, transport networks, settlements and natural resources, population distribution, drainage, landform and land-use or land cover and soils. Besides, the vulnerability of communities and businesses is determined by overlaying risks maps.

KPA 3 – Disaster Risk Reduction

The provincial disaster management centre must develop an indicative disaster risk profile and a detailed resource database to assist role players in all spheres of government, to not only update their disaster management plans but to also facilitate risk reduction, contingency planning, development initiatives and programmes. There is also a need to collect information on DRR actions performed by other sector departments, provinces, municipalities, non-governmental organisations and the private sector.

The DRR component must facilitate the inclusion of DRR strategies in the Integrated Development Plans (IDPs). The system must store related documentation, templates, recordings and plans to the GIS, for easy retrieval and updating.

KPA 4 – Response and recovery

Response and recovery component

This component facilitates the management of response and recovery operations and other activities during a disaster. This component must also be limited to the information and communication system. The following should be included in the system:

i) The area affected,

ii) Type of event e.g. magnitude,

iii) Analysis of statues of critical lifeline infrastructure,

iv) Analysis of reported impacts and monitoring progress,

v) Situation reporting e.g. search and rescue,

vi) Response and recovery resource database,

vii) Contact details of primary agency and standard operating procedures,

viii) Resources and support agencies' contact details,

ix) List relevant services provided,

x) Contingency plans,

xi) Resources should be available and where to obtain them.

Most important, response and recovery features must be in the form of templates and drop-down menus for easy information access. Also, to make provision for real-time manipulation of data, which enables the disaster managers to analyse the data as soon as it becomes available for immediate insight or conclusions (Crosby, 2020).

Mobilisation and communication component

An interoperable communication system that can support and identify various methods of communication is determined with the various stakeholders. However, the system must be able to use landlines, cellular telephones, radio-enabled radio systems and two-way radio communication facilities.

Event logging and tracking management component

The system must record and log all messages received and sent, directives communicated and decisions made. The system must allow recording and storage of voices, pictures, documents, as well as their retrieval.

Enabler 2 – Education, training, public awareness and research

The information and communication system must be able to record and monitor education and training programmes, related to disaster management in all spheres of the education system.

Once the training of professionals, volunteers, communities and learners is complete, the system should record the content and records. The system must be able to keep a register and records of Sector Education and Training Authorities (SETAs), as well as research programmes and projects. To ensure synergy and avoid duplication among stakeholders, the system should record all public awareness programmes, implemented by all spheres of government. The framework concludes this section by stating that the NDMC is responsible for the development of such a system.

Enabler 3 – Funding arrangements for disaster risk management

The system must support a database for funding mechanisms and record the different funding mechanisms and budgets for all disaster management aspects (Republic of South Africa, 2005:70).

3.3.5 Section 5.5 Specialised system functionalities

The system must allow for the following functions: first, a **document management system** that can store and allow retrieval of documents (Republic of South Africa, 2005:70). It should allow for the classification of the documents e.g. disaster management (policies, regulations and guidelines), institutional capacity (minutes of meetings) and disaster risk reduction (action plans and standard operating procedures). The NDMF states that the NDMC is responsible for the development of guidelines that all spheres of government can use.

Secondly, the **resource and capacity database** is a prerequisite for the NDMC to develop and maintain (Republic of South Africa, 2005:71). Further, the database ensures the support of the activities described in KPA's and enablers, for example, the capturing of data related to human resources, infrastructure, facilities and equipment. The NDMF emphasises the designation of the regular updating of the database to officials from relevant organs of the state (Republic of South Africa, 2005:71).

The third specialised system functionality is **modelling and simulation functionality.** If certain events occur, the modelling and simulation activities help prepare for awareness and allocation of resources, training programmes and influence policies for best practices.

Monitoring and evaluation systems are the fourth functionality that the NDMF insists on the NDMC to develop. It should be a uniform monitoring and evaluation system and that all organs of state in all spheres of government must use the system to report their activities. The system must record annual reports (Republic of South Africa, 2005:71).

The fifth functionality that needs to be included in the system, is the **management of disaster risk management programmes and projects**. The NDMC needs to develop and implement this functionality. It must be an integrated portfolio of the projects and programmes that all stakeholders from all spheres of government can access to update existing information and track progress and cost information securely.

The sixth and final functionality is **quality management systems**. It forms an integral part of the disaster risk database. The functionality further ensures the quality of management and operational processes, conducted by stakeholders. There must be a designated person within each centre to perform the quality management function, according to the requirements of the International Organisation for Standardisation (ISO 9001). The designated person must report to the head of the centre. Each functionality discussed, concludes with key performance indicators to help measure the success of the implementation.

3.3.6 Section 5.6 Development of integrated information management and communication system

The system is said to have minimum requirements, which are: (i) the system must be developed in the context of the DMA and NDMF objectives; (ii) it must be flexible; and (iii) must provide the platform for a single, shared disaster risk data (Republic of South Africa, 2005:71). Also, the system must achieve a common operating environment (COE). This COE must facilitate an interoperable communication system with clear roles and responsibilities for the provision and governance of the IMCS. The support stakeholders must be assigned appropriate primary roles and responsibilities. Further, the users must carefully formulate requirements, securely trust, and access the system. The system must be able to produce reports, keep the flow of the data and there must be continuous training on working with new digital tools.

3.3.7 Section 5.7 Information dissemination and display system

This section discusses the various communication media required to enable the receipt, dissemination and exchange of information. According to the NDMF, the NDMC should take it upon itself in consultation with other stakeholders to help build an interoperable system (Republic of South Africa, 2005:72). Integral to the system is the identification of the information needs of stakeholders, appropriate communication channels and systems available in several languages. The NDMC must develop, implement and maintain a website with information available to all stakeholders free of charge. This functionality must support a facility for two-way communication before, during and after a significant event or disaster. The systems information must be visual, audio and hardcopy. The system must also allow for the

visual display of GIS-related information and for functionality to connect and publish information on the internet.

3.4 General comments about enabler 1

As mentioned earlier in the introduction of this chapter, enabler 1 is in support of all the KPAs and the other enablers. This qualifies it as a significant section of the NDMF, as well as signifies it as a pillar for the disaster management functions. The framework provides a detailed description of what enabler 1 (Information management and communication systems) encompass. However, some impediments might hinder its comprehension and practical application.

i) The objective of enabler 1 qualifies it as a multi-stakeholder component of disaster management that an individual cannot head on their own. Moreover, to establish and implement this enabler, various stakeholders are prerequisite.

ii) The enabler requires experts to manage the entire system, for example, experts in Geographical Information Systems, Information Technology, research experts in different subject fields related to DRR and response, Qualitative and Quantitative Researchers, Media and Communication and SETAs.

iii) Most sections in the NDMF are broad and therefore require the guidelines, which NDMC "*must*" develop, for example, section 5.2 mentions that the "*media*" is required for information dissemination and communication, however, the NDMF does not list the specific type of media to use and at what phase of disaster management. For example, during an onset flooding incident, a newspaper will not work to warn people to evacuate. However, if it is a slow-onset hazard like drought, a newspaper might be sufficient to warn people at risk (Kunguma & Skinner, 2017).

iv) According to an interview with a legal expert (Brandt, personal communication, 9 May 2018), the development and implementation of the enabler are not feasible if the guidelines from NDMC are not developed. She was of this opinion, because of the vagueness and technical terminologies used in the NDMF. Some vague and technical terminologies might be difficult to comprehend for someone who just has basic reading skills. The NDMF contains words or statements like "*critical lifeline infrastructure*", "*suppression*", "*alpha and digital*", "*management common operating environment*", "*interoperability*" and "*collaborative*", just to mention a few. Therefore, if an organisation employs personnel qualified in disaster management and have the right skills and experience in the field, such type of terminology would not be technical.

v) Issues of accountability and obligation are also not clear, which makes the enabler (NDMF) a difficult document to enforce.

vi) Basic disaster management legislative and institutional arrangement training should be mandatory for disaster management practitioners to comprehend the legislation used to govern disaster management.

vii) Any organisation endeavouring to establish an IMCS to enhance its operations should take into consideration various factors. First, that the components of an IMCS are contextual to the purpose of the organisation, contextual to the political, social and economic environment in which the organisation operates, as well as contextual to the organisation's policies and procedures.

viii) Drawing from the literature and review of enabler 1 on IMCS, the study identified some crucial issues that might contribute to establishing an IMCS and achieving the KPA and enabler objectives. To start, Freeman's (2010) stakeholder mapping and analysis method contribute to identifying data custodians for the IMCS. Following this, a defined methodology for data collection, analysis and dissemination, contribute to the smooth operation of the IMCS. An ideal example of a good methodological approach is the waterfall method (Centres for medicare and medicaid services [CMS], (2008); Avison & Fitzgerald (2006). Hua and Herstein (2003) found that organisations responding to disasters, collect and make available disaster risks data. Hence, an IMCS must be able to collect this data, store, analyse and make it easy to access for users. In turn, this contributes to the achievement of the KPA and enabler objectives.

The IMCS can make use of storage software recommended by Ziembicki and Tulloch (2014:14), such as cloud-integrated storage software, a Microsoft package that provides primary storage, backup, archive and disaster recovery. Moreover, data archiving systems help to preserve institutional knowledge. Examples of knowledge include, but are not limited to best practices, lessons learnt and costs of disaster damages (Kiregyera, 2015:130). Access to this knowledge in the future might strengthen disaster risk reduction and response. In this information technology-rich world, the successfully operational system must have up-to-date technology and people with relevant expertise. The system must identify the advantages and disadvantages of each information dissemination system for effective communication. Policies and procedures, like information security and communication procedures before, during and

after a disaster are imperative to the full functioning of the system. Maintenance, monitoring, evaluation and templates for the system are also significant.

3.5 Conclusion

Chapter 3 provided a detailed discussion of enabler 1 that underpins the study. The chapter translates most sections from the NDMF into illustrations for easier comprehension. The chapter provided a general critique of the enabler from the subjective perspective of the researcher. Chapter 4 discusses disaster risk governance in South Africa and beyond its borders.

CHAPTER 4: DISASTER RISK REDUCTION GOVERNANCE: DEVELOPMENTS OF NATIONAL AND INTERNATIONAL LEGAL AGREEMENTS

4.1 Introduction

It is crucial for disaster management organisations to adhere to legislative mandates and frameworks developed to govern risk reduction, mitigate disaster impacts, save lives and protect the environment. Hence, good governance must be at the heart of the effective functioning of all spheres of government through information management, communication, good leadership and the existence of effective state institutions (Sithole, 2014:15; Tshiyoyo, 2012:56; COGTA, 2018); Communication for Governance and Accountability Programme [CommGAP], 2007:8).

Poor governance, policies, and institutional capacities, relating to disaster risk reduction make communities less resilient to possible disasters (Humayun & Al-Abyadh, 2005:5; Riele & Gorur, 2015:5). Good governance includes clear guidance on how to implement policies (as alluded to in the Model of Policy Implementation Process by Smith 1973 in Chapter 1 and 2), adequate funding, comprehension of legislation and specific guidelines from the NDMC. Unfortunately, these issues are deficient as identified in Van Niekerk's study (Van Niekerk, 2014:858). Lack of funding was identified during the promulgation of the 1st Draft Bill on Disaster Management, that disaster management centres were incapacitated without proper funding (Parliamentary monitoring group [PMG], 2000). Based on Van Niekerk's (2014:858) findings, the slow progress in establishing information management and communication units (IMCU) in South African provincial disaster management centres can be attributed to similar issues.

For this study to determine the slow progress in the implementation of disaster management legislation, the role of governance must be discussed, because governance is central to all studies about politics, economics, environmental, spatial planning and social issues (Rothstein & Varraich, 2017:126; Levi-Faur, 2012:3). Erasmus (2009:48) recommends that risk reduction governance should be increased to ensure implementation, enforcement and accountability. Jordaan (2018:17) supports Erasmus by affirming that vulnerability and resilience of society are greatly impacted by governance. This thinking is better explained in the "*Singapore Paradox*", to be explained later in the study. This chapter discusses the progress made in the

disaster management policies and legislative developments. It also provides a detailed discussion and critique of the South African National Disaster Management Framework of 2005, with a particular focus on the information management and communication enabler (Republic of South Africa, 2005:63).

4.2 Defining governance

The provision of political, social, economic services and public goods to every citizen who has the right to expect it from the state, and the state has the responsibility to deliver to its citizens, is the definition of governance as given by Ibrahim (2018:7). Ibrahim's definition differs slightly from other scholars who define governance as all processes of governing undertaken by public, private and civil society through laws, norms and powers (Bevir, 2012:1; Ansell & Torfing, 2016:2). Unlike Ibrahim and Bevir (2012), Ansell and Torfing (2016) include in their definition of governance the private sector and legislations, while Ibrahim focuses on the provision of services by the government that influence the social environment of the citizens. Agbadam (2017:1) provides a unique angle where he defines governance as the processes of decision-making on which decisions are implemented, while Calder (2008:3) defines governance as the system by which organisations are directed and controlled. Ansell and Torfing (2016:4) define governance with an emphasis on interactive dimensions of public governance, by saying that governance is the interactive processes through which society and the economy are steered towards collectively negotiated objectives.

Sithole (2014:16) reiterates Ansell and Torfing's definition by stating that the United Nations (UN) sees governance as a process of decision-making and by which decisions are implemented or not. Governance brings together the actions of several actors at all levels, including government, ministries, international organisations, non-governmental organisations, research and academic institutions and finance institutions. Disaster risk governance is defined by the United Nations (UN) as the system of institutions, mechanisms, policy and legal frameworks and other arrangements to guide, coordinate and oversee disaster risk reduction and related areas of policy. The UN further provides an annotation of the above-mentioned definition, where they say good governance must be transparent, inclusive, collective and efficient to reduce existing disaster risks and avoid creating new ones (United Nations General Assembly [UNGA], 2016:15).

Ansell and Torfing (2016:4), UNGA (2016:15) and Sithole's (2014:16) definition of governance is more grounded since they argue that no individual or entity can govern alone.

This definition brings to the fore the Stakeholder Theory that campaigns for various stakeholders' to participate for the achievement of good governance. Also, interaction and resources are needed to reach the desired outcomes of good governance. Henceforth with this study in mind, communication is crucial, and stakeholder interaction is key to adhering to the mandate of the legislations set towards risk reduction and building resilience.

Given the above definitions of governance, this study defines governance in the context of disaster management as all processes of stakeholder engagement through the implementation of laws and resources to make decisions that will reduce risks and build resilience.

4.3 Contextual governance concerning national imperatives

Despite the exposure of a country to exogenous shocks, it can still manage to attain a high GDP per capita with good governance and planning (Naude, Santos-Paulino & McGillivray, 2013:49; Briguglio, Cordina, Farrugia & Vella, 2009:22). Some countries can still withstand the exogenous shocks, because of good governance, with or without available resources. Briguglio (2004) has termed this phenomenon the "*Singapore paradox*". Briguglio (2004) propounded a methodological approach to how this phenomenon can be possible. He argued some countries build inherent resilience through good governance and they can recover from external shocks, despite the lack of natural resources. Recovery is due to governance strategies, for example, the situation in Singapore, Vietnam, Rwanda and Netherlands (The New Times 2010; Ministry of the Interior and Kingdom Relations, 2009; Pham, 2017). Recovery is dependent on the countries' policy-makers and a strong private economic sector (Briguglio, Cordina, Farrugia & Vella, 2009:22). Socio-economic, political and economic recovery is also dependent on the recipients. These authors state that Briguglio's methodological approach led him to the identification of four possible scenarios to help identify a country's vulnerability and resilience characteristics. The four categories are:

i.) *"Self-made"*, is a country with a high degree of inherent economic vulnerability and is economically resilient through the adoption of appropriate policies and governance strategies. These are policies and governance strategies that can enable the country to withstand and cope with the inherent vulnerability effects.

ii.) *"Prodigal-son"* country scenario is a country with a low degree of inherent economic vulnerability. However, the country's policies and governance ways are harmful to economic resilience, exposing the country to negative effects of shocks. Examples of prodigal son countries are Zimbabwe, Mozambique, Democratic Republic of the

Congo (DRC), and Malawi, just to mention a few. Zimbabwe has poor monetary policies, media and telecommunication policies and land policies. Mozambique has high poverty and inequality, attributed to poor governance. Every sector and society in the DRC is deeply rooted with endemic corruption, and in general, poor governance in all forms. Malawi is highly vulnerable to natural hazards and has about 41% of its population living in poverty, exacerbated by an unfavourable policy environment (United States Agency for International Development [USAID], 2019; Arndt & Tarp, 2016; Zvobgo, 2018; News Day, 2017;).

iii.) *"Best-case"* category is a country that is not inherently vulnerable, has sufficient resources and can adopt policies that are resilience building. Examples of "*best-case*" countries in Africa are South Africa and Botswana, in Europe, Germany and the United States of America (USA) (African News Agency [ANA], 2019; Mabasa, 2018; Parson & Ackerstain, 2017; Lewin, 2011; Organisation for Economic Co-operation and Development [OECD], 2014).

iv.) To conclude, a country falling within the "*worst-case*" category is a country experiencing numerous adverse impacts of inherently high vulnerability. The "*worst-case*" country manages to fall within this category because it adopted policies that affect economic resilience. Examples of "*worst-case*" countries poorly governed are Lesotho and Swaziland; they also experience political instability and limited resources (Machuga, 2016; News24, 2015).

According to scholars like Agbadam (2017:1) and Augustin (2017), there is strong evidence that governance, particularly poor governance, affects the growth of Africa and this is observed in poor countries that suffer from high corruption, as compared to developed countries that show that their superior performance is due to good governance. Augustin (2017:3) further state that poor governance is a major culprit for Africa's poor state of economic health and also leading to policy syndromes, which are situations that are detrimental to growth, for example, poor allocation of resources. Agbadam (2017) further reiterates that poor governance in Africa has led to socio-political and economic instability, which has manifested through ineffective rules of law and institutions like Zimbabwe. Poor governance in Africa is caused by incompetence, ignorance, lack of capacity from leaders, inadequate infrastructure, corruption and poor institutions among other causes. These causes are an indication of the "*worst-case*" countries, as described in the "*Singapore Paradox*" by Briguglio (2004).

Pal and Shaw (2017:9) regard governance as one of the key issues in reducing disaster risks. This view is supported by Agbadam (2017) who adds communication media as a key stakeholder that plays a crucial role in disseminating and disclosing the societies' opinion on socio-political views, as well as act as supervisors of the public sector (Schillemans & Pierre, 2019:8). However, promotion of freedom of expression in Africa has been difficult, because most of the media institutions are state-owned, censured, and biased towards the governing parties and there are financial constraints to support media independence (Aceproject, 2019; Bizcommunity, 2016; Rawlence, 2010:1).

On the contrary, the *"Mauritian Paradox"* opposes the Mauritius experience to other African countries, especially those in the Southern African Development Community (SADC) region. Mauritius was successful because of the favourable colonial inheritance, accommodation of diverse minority groups into the policy process and good leadership among many other issues. Also, Mauritius's healthy performance is attributed to the public and private sectors' adaptation of a mix of policies that help the country to cope with global changes. Its capital markets are well developed as compared to other African economies. Mauritius's has a free printed press, radio and television broadcasting and was categorised generally as a "*free*" country by the Freedom House. The government even provides a wealth of information on its official portal (Ramola & Eriksen, 2018:78). To guarantee transparency, effective decision-making and support the free circulation of information, the government introduced the Freedom of Information Act, which is legislation that the media enjoys widely. Surely, other African countries, especially those in the SADC have a lot to learn from Mauritius' governance system.

4.3.1 Governance in South Africa and SADC countries: the Ibrahim Index analysis
Regionalism, a phenomenon of regional integration of inter-governmental organisations lead to the development of the Southern African Development Community (SADC) in 1974 (Muntschick, 2018:83). South Africa is amongst the 16 member states; the other countries are Comoros, Zimbabwe, Zambia, Angola, Tanzania, Botswana, DRC, Lesotho, Swaziland, Seychelles, Namibia, Mozambique, Mauritius, Madagascar and Malawi. The main aim of the SADC organisation is to achieve development, peace and security, economic growth, alleviate poverty, enhance the standard and quality of life and support the socially disadvantaged (SADC, 2020; Nyathi, 2019:10; Muntschick, 2018:92; Nathan, 2012:1).

To assess South Africa's and the rest of SADC's governance, this study uses the Ibrahim Index of African Governance (IIAG) (Ibrahim, 2018; Jordaan, 2018; Falola & Mbah, 2014:185). The

IIAG uses four categories to analyse governance in Africa (Ibrahim, 2018:7). The categories are *safety and rule of law*; *participation and human rights*; *sustainable economic development*, and *human development* (Jordaan, 2018:17; Ibrahim, 2018:7). Societal vulnerability is a major disaster risk reduction goal and according to Jordaan (2018:17), the above-mentioned categories are closely related to societal vulnerability. Table 4.1 illustrates South Africa and SADC countries governance scores in terms of the IIAG four categories.

Table 4.1 *South Africa and SADC countries 2017 IIAG scores and ranking*

IIAG Categories and countries	Score	Rank out of 54 African countries	Rank out of 16 SADC countries	
South Africa (overall governance)	**68**	**7**	Mauritius	1
Safety and Rule of Law	66.7	9	Seychelles	2
Rule of law	90.2	3	Comoros	3
Transparency and Accountability	57.4	7	Namibia	4
Personal safety	33,5	47	Botswana	5
National security	85.7	21	South Africa	6
Sustainable Economic Opportunity	65.1	4	Tanzania	7
Public management	62.6	4	Lesotho	8
Business environment	67.6	3	Zambia	9
Infrastructure	65.9	8	Malawi	10
Rural sector	64,1	9	Mozambique	11
Participation & Human Rights	74,4	4	Madagascar	12
Participation	80,7	7	Zimbabwe	13
Civil Rights & Liberties	71.3	4	Angola	14
Gender	71.3	5	DRC	15
Human Development	65.6	8	Swaziland	16
Welfare	57.1	10		
Education	62.9	10		
Health	76.8	12		
OTHER SADC COUNTRIES				
Angola	38.3	45		
Botswana	68.5	5		
Comoros	47.9	3.9		
DRC	32.1	47		
Lesotho	57.1	16		
Madagascar	49,0	31		
Malawi	55.8	19		
Mauritius	79.5	1		
Mozambique	51.0	25		
Namibia	68.6	4		
Seychelles	73,2	2		
Swaziland	32	48.7		
Tanzania	58.5	14		
Zambia	56.2	18		
Zimbabwe	39	44.7		

Source: (Ibrahim, 2018: 116)

In the rank out of 54 countries column, specific IIAG categories of South Africa are presented and the overall governance score allocated to South Africa is 68. In the next column, South Africa ranks 6 out of 16 SADC countries. It seems South Africa's overall governance as

compared to other countries is average and still requires some improvement especially in the welfare of its human development which scores the lowest.

In the case of the other countries, a total score is given from all the categories and then a ranking is allocated in comparison to the other countries. Governance in Mauritius is good as it is ranked number one in SADC and DRC is ranked number 47 in Africa as the last one in SADC, making it a country with poor governance, because of government corruption (Boslaugh, 2013:107). South Africa is scored 68, placing it on position number 7 in Africa for average good governance, as compared to other SADC countries. Jordaan (2018:18) believes that DRR programmes should consider the different indicators in the IIAG as a basis for DRR strategic planning. As mentioning earlier, communication is key to obtaining good governance, hence effective information management and communication should be pivotal to DRR strategic planning (Haas, Mazzei & O'Leary, 2007:24).

Based on the "*Singapore Paradox*", South Africa is between *"Self-made"* and *"Best case"* countries. South Africa is possibly a country with medium inherent economic vulnerability and able to adopt policies that are economically resilient building. A considerable number of scholars have supported this thinking, for example, in a study conducted by Lewis (2001:4), South Africa has policies that have restored and maintained macroeconomic stability amidst a difficult global environment. There is a consensus on this phenomenon from authors like Humby (2012:22) who argue that South Africa's GDP per capita of almost $7574.43 (STATSSA, 2019) per annum, indexes South Africa as an upper-middle-income country. In the same vein, South Africa has a well-developed set of policies and laws, especially in the context of disaster management (African New Agency [ANA], 2019; Van Niekerk, 2014:862; Humby, 2012:27). It is even ranked number 7 out of 54 African countries in the 2018 Ibrahim Index of African Governance. All this might place South Africa at a reasonably economic resilient level amongst other African countries. Important to note is that South Africa also experiences a fair share of poor policy implementation practices, for example, inequality (the highest unequal country in the world with a Gini coefficient of 0.63 in 2015) and poverty that exposes them to economic vulnerability (Smith, 2019).

4.4 Strengthening and reviewing legislation and institutional agreements: Panacea for poor governance in disaster risk reduction

As highlighted by Agbadam (2017:1) and propounded by Naude, Santos-Paulino and McGillivray (2013:49) and Briguglio, Cordina, Farrugia and Vella (2009:22), poor governance

is a manifestation of ineffective laws and institutions. In this section, it is imperative to discuss the national and international legislation and institutional arrangements within which the disaster management fraternity operates. There is a possibility that the slow progress in establishing information and communication systems in South African provincial disaster management centres is attributed to poor governance, limited comprehension and implementation of the disaster management policies. According to the International Federation of Red Cross and Red Crescent Societies [IFRCRCS] and United Nations Development Programme [UNDP] (2015:4), laws and regulations serve as a foundation for building resilience through ensuring that hazards do not translate into disasters, reducing risks of those exposed to hazards, creating an enabling environment, making communities safer and preventing new risks from arising.

Adhering to legislation, effective implementation and prioritising key functions, like information and communication, could see an organisation obtaining recognition of good governance (Sithole, 2014:16; Agbadam, 2017:1). Sithole further supports this by stating that an organisation that has been awarded the status "*good governance*", adopts and promotes robust sound policies, legislations, coordination mechanisms and regulatory frameworks (Naude, Santos-Paulino & McGillivray, 2013:49; Briguglio, Cordina, Farrugia & Vella, 2009:22). This study believes or rather argues that a lack of information management and communication system in a disaster management centre, is a sign of poor governance and poor policy implementation.

4.5 Developments of South African disaster management related legislations and frameworks

The management of disasters has seen dramatic shifts over the past years (for example, since the 1994 First World Conference on Natural Disasters in Yokohama, with the latest 2015 Sustainable Development Goals) and has attracted renewed policy alterations from global policymakers (Kar-Purkayastha, Clarke & Murray, 2011:2; Birkland, 2007:4). Over time, several policies have been developed, some of them will be discussed in this section.

The devastating effects of large-scale disasters have led many countries to develop, revise and improve their legal frameworks for DRR, as well as adopting new international DRR laws (IFRCRCS and United Nations Development Programme [UNDP], 2015:4). The revision of legal frameworks is currently stated in the recent 2015-2030 Sendai Framework for DRR (United Nations Institution for Disaster Risk Reduction [UNISDR]:13). It is imperative for countries to be accountable and continuously develop, adopt and revise their policies as an

effort to build resilient communities and reach for the goal of attaining the good governance status (Pal & Shaw, 2017:128).

The General Assembly of the United Nations, 42nd session in 1987, gave birth to discussions on the shift away from an emphasis on the hazard to human impact (Erasmus, 2009:2). The International Decade for Natural Disaster Reduction (IDNDR) was initiated in 1990 with a focus on mitigating natural disasters (Sithole, 2014:120). The IDNDR was built on three goals, namely (i) goal 1: to increase public awareness of risks, (ii) goal 2: obtain public authorities' commitments to reduce risks to people, their livelihoods and infrastructure, and (iii) goal 3: to engage public participation at all levels of disaster risk reduction implementation. Adhering to these goals in disaster management contributes to good governance. In 1992, the United Nations Rio Earth Summit in Brazil, which was convened by over 178 countries, gave birth to a non-binding agreement termed Agenda 21. The United Nations Agenda 21 covered issues relating to citizen participation, environmental and developmental issues, gender and poverty (United Nations [UN], 1992). South Africa also adopted Agenda 21 and initiated a national strategy for achieving sustainable development for South Africa (Enviropaedia, 2007). Succeeding these initiatives was another legislative tool, which provides landmark guidance on reducing disaster risk and impacts of disasters, termed The Yokohama Strategy for a Safer World: Guidelines for Natural Disaster Prevention, Preparedness and Mitigation and its Action Plan was adopted in 1994. The Yokohama Strategy was reviewed and one of the gaps that were identified and later on informed the development of the Hyogo Framework for Action 2005-2015: Building the resilience of nations and communities to Disasters (HFA), was governance: organisational, legal and policy frameworks.

In September 2000, world leaders gathered in New York to embark on developing the United Nations Millennium Summit with the main goal of eliminating poverty. Millennium Development Goals (MDGs) were agreed on at the summit. The goals were further broken down into 18 targets, which were measured by 48 key indicators. All these goals were to be achieved by the year 2015. To continuously fight disasters and reduce risk, policy development and review did not come to a halt. United Nations member states adopted the International Strategy for Disaster Reduction (ISDR) in the year 2000. ISDR's main goal was to build resilient nations as an essential condition for sustainable development. The United Nations International Strategy for Disaster Reduction (UNISDR) was the focal point for the

implementation of yet another tool, which is the Hyogo Framework for Action (HFA) 2005-2015: Building the resilience of nations and communities to Disasters.

The HFA made headlines when it was adopted by 168 United Nations (UN) heads of states. The HFA was a demonstration of the remarkable recovery from the Great Hanshin-Awaji Earthquake of 17 January 1995 (United Nations International Strategy for Disaster Reduction [UNISDR], 2005:2; IFRCRCS and United Nations Development Programme [UNDP], 2015:6). One of the HFA's objectives was to review the Yokohama Strategy to update the framework on disaster risk reduction for the twenty-first century. The HFA also pushed for an increase in the awareness of the importance of DRR policies, increase reliability and availability of DRR information and implementation of DRR policies. After the HFA was the Sendai Framework for Disaster Risk Reduction 2015-2030 (Sendai Framework for DRR).

Strengthening disaster risk governance to manage disaster risk reduction is a key imperative to this study. This key imperative was identified as one of the four priorities for action in the Sendai Framework for DRR (UNISDR, 2015:12). The framework also recognises the importance of stakeholders and their roles, which is significant in this study (UNISDR, 2015:5). The importance of information and communication is highlighted in the Sendai framework. Priority one on understanding disaster risk requires the collection, analysis and dissemination of information (UNISDR, 2015:10); Priority two on strengthening disaster risk governance to manage disaster risk, requires the establishment of common information systems (UNISDR, 2015:12), Priority three is on investing in disaster risk reduction resilience (UNISDR, 2015:15) and Priority four on enhancing disaster preparedness for effective response and to *"build back better"* in recovery, rehabilitation and reconstruction (UNISDR, 2015:17). All these priorities, at a local, national and regional level, require information and communication systems to be in place. The South African government subscribes to the Sendai framework, as an international best practice, which prioritises information and adoption of DRR communication policies. Once laws and regulations are improved and their implementation is strengthened, then good governance is promoted. This is illustrated through the *"Singapore Paradox"* and the "*Mauritian Paradox*" (Briguglio, 2004; Ramola & Eriksen, 2018).

4.6 International media stakeholder agreements: pushing the disaster risk reduction agenda

Leoni (2017:1) summarised the significance of driving the DRR agenda through the media. Leoni identified several media channels like the International Broadcasting Federations, Asia-Pacific Broadcasting Union and the European Broadcasting Union who pledged at the 2017 Global Platform for disaster risk reduction (GPDRR) in Cancun, Mexico to support government DRR efforts through spreading information about DRR to their audiences. These broadcasting organisations believe they play an important role in implementing the Sendai Framework through informing, alerting and educating the population (Fowler, 2015:1). Other media outlets in the African region, like Malawi TV and Nigeria Radio, agreed to this movement. They also pledged to act proactively through the production of creative, quality media coverage of efforts to mitigate risks. They also acknowledged that this movement requires multiple sectors and disciplines to ensure professional, accurate, timely and cogent risk messages. At the Global Platform, a call to see information, communication and media, better integrated into national disaster risk reduction decision-making processes was emphasised (Aitsi-Selmi, Murray, Wannous, Dickinson, Johnston, Kawasaki, Stevance & Yeung, 2016:4). These authors further state that the media needs to be part of the conversation and play a much bigger role in DRR processes. After all, disaster management without information, communication and media, might be ineffective (Bradley, McFarland & Clarke, 2014:2; Sjoraida & Anwar, 2018:4).

4.7 Developments in the South African disaster management legislation and frameworks

The legislation is meant to protect people it governs and keep them safe from harm (Shlapentokh, 2015), however, the South African native laws (*Native Building Workers Act 27 of 1950, Native Service Levy Act 1952, Native Urban Areas Amendment Act 1952, Native Labour Settlement of Disputes Act 48 of 1953, Native Urban Areas Amendment Act 1955, Urban Areas Amendment Act 1956, Urban Administration Amendment Act 42 of 1956, Native Urban Areas Amendment Act 77 of 1957, Native Labour Settlement of Disputes Amendment Act 1959*) led to the death of many people and settlement in poorly planned and unserviced townships, exposing them to risks (South African Government, 2019; O'Malley, 2019). Thereafter, the initial legislation enacted in South Africa to help govern the public's safety was the Public Safety Act 3 of 1953 (South African History [SOHO], 2016). The Safety Act made provision to empower the Governor-General (The Governor-General was then the president of the Republic of South Africa with non-executive powers) to declare a state of emergency and provide for the safety of the public and maintain public order (O'Malley, 2019; SOHO, 2016;

Dyzenhaus, 1991:159). The Safety Act was usually reserved for times of war and considered not applicable to situations of a natural disaster. Other supporting legislations in this regard were promulgated, which is the Defence Force Act 44 of 1957 and the Police Act 7 of 1958. Following the global threat of possible nuclear war in 1957, a civil defence function was established in 1959, to deal with the possibility of a war break-out and boost the morale of the population during a conflict (Smit, 1981:89). The civil defence organisation was under the Secretary for Justice Administration.

Civil defence was also established and supported in international law in 1977 after 100 nations signed an agreement to the 1949 Geneva Convention. Back in 1966, in the Republic of South Africa, and the Emergency Planning Civil Defence Bill was drafted to support the establishment of an Emergency Planning Civil Defence Directorate in the Public Service. Public services were housed in the Department of Justice. Under the Department of Justice was also a Civil Defence Directorate, operating together with the Emergency Planning Civil Defence. The Emergency Planning Civil Defence Directorate was later on transferred to the Civil Defence Directorate and this was effected by the Civil Defence Act 39 of 1966 (Amended Civil Defence Act 69 of 1967). The defence act was a reactive instrument, meant to protect the civilians from military threat. It was later realised that the implementation of the Civil Defence function was ineffective as the officials who volunteered to work in the unit were not knowledgeable about civil defence. Most of the officials only had a legal background since they were employed in the Department of Justice. With each province having a civil defence official, support was limited from local authorities, because they thought that their authority was being undermined (Sithole, 2014:100; Smit, 1981:17).

After the government realised that local authorities' support was imperative for the functioning of the civil defence function, because of their closeness to the society, an Interdepartmental Civil Defence Committee (ICDC) was appointed. The ICDC supported that the civil defence function must be delegated to local authorities and not only at the ministerial level. The ICDC then concluded that the civil defence act should provide for the role of local authorities. This decision led to the promulgation of the Civil Protection Act 67 of 1977. In this case, the provinces were then made *"watchdogs"* on behalf of the national government for the implementation of the legislation (Sithole, 2014:102; Humby, 2012:27; Department of Provincial and Local Government [DPLG], 2007:9).

The dramatic and complex socio-political, economic and environmental disruptions brought about by natural and man-made disaster impacts, informed the continuous revision of the civil protection or disaster management frameworks and legislations (Vermaak & Van Niekerk, 2004:565). The Disaster Management Institute of Southern Africa (DMISA), who used to be known as the Civil Defence Association (CDA), realised disparities in the Civil Defence Act of 1977 and then suggested amendments and it became the Civil Defence Act 82 of 1990. The new act entailed a revised definition of a "*disaster*", which included consequences or sabotage of service delivery, the influx of refugees and consequences of terrorism.

Later on, in 1993, the civil defence issues were moved to the Department of Provincial and Local Government, which was previously known as the Department of Local Government and National Housing. Discussions regarding the inclusion of services like fire, traffic and ambulance services not limited to these, also commenced in 1993. Civil protection structures existed at municipal and provincial levels and at the national level, it was the Directorate of Civil Protection and Fire Brigade Services. Since 1994, discussions to address the concept of a disaster were taking place with relevant parties. For a period of over eleven years, from June 1994 to April 2005, changes to the South African disaster management policy and legislation was taking effect (Erasmus, 2009:1). In 1994, a devastating flooding event hit the Cape Flats in Cape Town, increasing the urgency for further legislative reform (Sithole, 2014:122; Humby, 2012:27; Republic of South Africa, 2005:1; Vermaak & Van Niekerk, 2004:565). Later on, in 1997, an Inter-Ministerial Committee on Disaster Management was established to drive these discussions. The outcome of the discussions was the release of the Green Paper on Disaster Management in February 1998 (Wentink & Van Niekerk, 2017:3; Humby, 2012:27; Pelling & Holloway, 2006:19). In 1999, subsequently, a White Paper on Disaster Management was developed (Republic of South Africa, 2005:77). This White Paper advocated for risk reduction. Following the White Paper development, the National Disaster Management Centre was established in the same year (Sithole, 2014:125; Humby, 2012:6; Pelling & Holloway, 2006:19).

It is important to note that in some countries, when the state fails to protect its citizens from the impacts of disasters, as well as expose them to a continuous breakout of disasters, such exposure is seen as an unspoken breach of a social contract (Bankoff, Frerks & Hilhorst, 2004). Hence, the importance to continuously review and strengthen policies. In a continuous legislation review effort, the South African policymakers embarked on a process of reforming

its approach to civil protection from reactive to proactive. In the year 2000, discussions to enact a Disaster Management Bill commenced and in 2002, the Disaster Management Bill was passed (Pelling & Holloway, 2006:13). However, the Disaster Management Bill, which became the Disaster Management Act, was initially argued to be rather named the Disaster Management and Risk Reduction Act, but the proposal was rejected, because it was assumed to potentially confuse. Even authors like Humby (2012:28) states that many scholars argue that the Disaster Management Act does not reflect a strong Disaster Risk Reduction focus, but rather a stronger focus on emergency response and relief. Both the DMA and NDMF do not contain the word *"risk",* which contradicts some of their objectives and contents (Erasmus, 2009:1). The Disaster Management Act 57 of 2002 was then promulgated (Humby, 2012:27; Pelling & Holloway, 2006:16).

A call for the development of a National Disaster Management Framework (NDMF) emanates from the Disaster Management Act. Section 6 of the Act stipulates the development of the NDMF. The purposed framework is to guide and inform all aspects of disaster management in South Africa. In April 2004, a draft National Disaster Management Framework was gazetted (Pelling & Holloway, 2006:22). After the public consultations and comments, the National Disaster Management Framework of 2005 was promulgated in May 2005. Development of this Framework was a strategy for aligning the South African disaster management legislation with international best practices.

Table 4.2 provides a summary of the evolution of disaster management in South Africa. A list of the legislation that contributed to the risk reduction and management of disasters in chronological order is illustrated in this table. Disaster management is a multi-disciplinary and multi-sectoral fraternity, hence the legislation and institutions, which mandate and govern this field are also diverse. Most of the legislations have a direct bearing on the issues of disaster management and must be consulted and used in conjunction with the DMA and the NDMF, depending on the situation prevailing.

Table 4.2 *The chronological evolution of disaster management in South Africa*

YEAR	LEGISLATIONS	PURPOSE
1913:	Native Land Act No. 27 of 1913	Promoted segregation by designing areas for occupation by white and occupation by black people (Braun, 2015:356)
1953:	Public Safety Act 3 of 1953	The safety act made provision to empower the Governor-General to declare a state of emergency and provide for the safety of the public and maintain public order (South African Government, 2019).
1957:	Defence Force Act 44 of 1957	Imposed censorship of information dissemination during a state of war (O'Malley, 2019).
1958:	Police Act 7 of 1958	Ensured the safety and security of all persons and property in the national territory, through safeguarding fundamental rights of every person and respecting victims of crime (South African Police Service, 2012)
1966:	Civil Defence Act 39 of 1966	Made for the provision of protection of certain places, the Minister to take necessary steps concerning a state of emergency, have the power to take steps concerning fire-fighting, rescue and evacuation, medical treatment, emergency housing and food, maintenance, warning communication (Civil defence act 39 of 1966, 2019)
1972:	State Security Council Act 64 of 1972	Made provision for the combating of any particular threat to the security of South Africa (South African History Online, 2019).
1977:	Civil Protection Act 67 of 1977	The 1977 act revived and replaced the Civil Defence Act 39 of 1966. This one placed more emphasis on the use of lights and sirens (South African Government, 2019).
1977:	Community Council Act 125 of 1977	The act marked the reversal of the Native land act; black people where now able to reside in urban areas. It possibly created safety living and access to serviced locations (O'Malley, 2019).
1978:	Fund-Raising Act 107 of 1978	Made provision for the establishment of a disaster relief fund, as well as the declaration of certain disastrous events as disasters (Fundraising act 107 of 1978, 2019).
1990:	Civil Defence Amendment Act 82 of 1990	Repealed the Civil Defence Act 39 of 1966; it made certain amendments such as the definition of the term *"disaster"* and *"minister"* (Civil defence amendment act 82 of 1990, 1990).
1995:	State of Emergency Act 86 of 1995	Provides for the declaration of a state of emergency where South Africa is threatened by war, invasion and disorder. Declarations were to be made by the President (South African Government, 2019).
1994:	Public Services Act 105 of 1994	Provision was made for the administration of public services with a focus on employment (Public service act 103 of 1994, 1994).
1995:	South African Police services Act 68 of 1995	Made provision for the control of the South African Police Services (South African Police Services Act 68 of 1995, 1995).
1996:	Constitution of South Africa Act 108 of 1996	This is the highest law in South Africa; it makes provision for human rights, equality, freedom and security, privacy and other matters concerning the governing of South Africa (Constitution of the Republic of South Africa 108 of 1996, 1996).
1997:	Defence Amendment Act 4 of 1997	Made provision for the Secretary for Defence and the Chief of the South African National Defence Force to be on the same hierarchical level in the Department of Defence (Defence Amendment Act 4 of 1997, 1997).
1998:	Green Paper on Disaster Management	It was a call to all stakeholders who deal with or are affected by disaster management issues to participate in the development of a policy framework for disaster management (Green Paper on disaster management, 1998).
1999:	White Paper on Disaster Management	The document discusses the problems encountered with the implementation of the national policy on disaster management in South Africa (PreventionWeb, 1999).
2000:	Promotion of access to information Act 2 of 2000	The act makes provision for the access to information held by the state or any other person. Public safety or environmental risk, protection of individuals and

		property safety is considered in this act when concerning the release of information (Promotion of access to information act 2 of 2000, 2000).
2000:	1st Draft Bill on Disaster Management	The purpose of this bill was to capture the new pre-disaster risk reduction approach relating to the prevention, preparedness and mitigation of disasters without neglecting the post phase. The intentions were to replace the outdated Civil Protection Act, 1977 for a uniform approach towards disaster management in the country (Parliamentary monitoring group, 2000).
2002:	Disaster Management Act 57 of 2002	This act makes provision for an integrated and coordinated disaster management policy that focuses on pre-disaster and post-disaster recovery, the establishment of disaster management centres at all three spheres of government and recognition of volunteers (Republic of South Africa, 2003).
2004:	Draft National Disaster Management Framework	In April 2004 this draft framework was gazetted for public comment (Sithole, 2014:129). *"Initially six KPAs were identified namely:* *i. KPA1: Institutional capacity for disaster management.* *ii. KPA2: Risk assessment and monitoring.* *iii. KPA3: Disaster management planning and implementation.* *iv. KPA4: Disaster response and recovery, rehabilitation and* *reconstruction.* *v. KPA5: Public awareness, education, training and research.* *vi. KPA6: Monitoring evaluation and improvement"* (Van Niekerk 2005: 188).
2005:	National Disaster Management Framework of 2005	This is a legal instrument specified by the Disaster Management Act 57 of 2002 to guide the implementation of disaster management. The Framework has four KPA's and three supportive enablers, which are informed by objectives to help guide and monitor progress in all three spheres of government (Republic of South Africa, 2005:2).
2012:	1st Draft of the South African Disaster Management Act 57 of 2002 (Amendment Bill)	On the 27th of May 2015, legal advisors of the Department of COGTA, the State Law Advisors and the Committee set to discuss the amendment of the Disaster Management Act 57 of 2002. Some wording, reporting structures and definitions were amended.
2015:	Disaster Management Amendment Act 16 of 2015	Amended the Disaster Management Act 57 of 2002, to substitute and insert certain definitions. More focus was on rehabilitation and functioning of disaster management centres, strengthen platforms, support for other policies, strengthen the participation of traditional leaders, adaptation to climate change, disaster management education and funding mechanisms (South African Government, 2019).

Source: (Adapted from Van Niekerk 2005: 112; Sithole, 2014: 129)

Having discussed the evolution of disaster management legislation in South Africa as presented in Table 4.2 above, the following section discusses other legislations supporting disaster management from the context of information and communication.

4.8 Other legislations supporting disaster management, in information and communication, South Africa

The multi-disciplinary and multi-sectoral nature of disaster management requires the support of other legislations and departments in dealing with disaster management issues (Rahman, Khan & Shaw, 2015; Republic of South Africa, 2003:11; Valdiya, 2004:256; Republic of South Africa, 2005:51). In addition to legislation support, effective communication, collaboration and coordination are key aspects to the successful implementation of the multi-disciplinary and sectoral activities carried out in disaster management (Christopher & Thatham, 2011). In a

consensus with the earlier-mentioned authors, Mishra and Mishra (2009:433) describe communication as the human activity that links people together and in turn, creates relationships. Llosa and Zodrow (2011:2) strongly believe that legislation promotes accountability and coordination, hence for this study to identify other legislation, regulations, standards and strategies that support disaster management could be beneficial.

Table 4.3 illustrates the chronological developments of statutes that promote the access and use of information, communication, broadcasting, licencing and promotion of the use of technology.

Table 4.3 *The chronological evolution of information and communication legislations in South Africa*

YEAR	LEGISLATIONS	PURPOSE
1993:	Independent Broadcasting Authority Act 153 of 1993	This act was promulgated under the presidency of Nelson Mandela in the Ministry of Posts, Telecommunication and Broadcasting, headed by Mr Pallo Jordan and then in 1996 replaced by Mr Jay Naidoo. Promulgated to provide for the regulation of broadcasting activities in the public interest. Broadcasting licences should comply with community health and safety.
1994:	Proclamation No.55 of 1994	An official public announcement was made for changing the IBA Act 153 of 1993.
1995:	Independent Broadcasting Authority Amendment Act 36 of 1995	Promotes the issuing of broadcasting licences.
1996:	Independent Broadcasting Authority Amendment Act 4 of 1996	Regulates broadcasting usage within certain territories.
1996:	Telecommunications Act 103 of 1996	Promotes the regulation of other telecommunication activities other than broadcasting for example radio frequency, licencing, mobile cellular services and regulation of infrastructure e.g. water pipes, trees, etc, that might distract telecommunication lines.
1998:	State Information Technology Agency Act 88 of 1998	The South African government promulgated this Act to promote the establishment of a company as its agent that will provide information technology, systems and related services on behalf of participating departments.
1999:	Broadcasting Act 4 of 1999	It repealed the Broadcasting Act 73 of 1976 to regulate broadcasting activities.
2000:	Promotion of Access to Information Act 2 of 2000	It is a constitutional right to access information held by the State and any other person.
2000:	Independent Communications Authority Amendment of South Africa Act 13 of 2000	Promulgated to amend all the broadcasting acts.
2002:	Promotion of Access to Information Amendment Act 54 of 2002	Amended to provide for the training of presiding officers in magistrates courts.
2002:	Broadcasting Amendment Act 64 of 2002	To convert the old corporation into a public company, allow for competition, penalties, licencing fees, the appointment of inspectors and so on.
2002:	Electronic Communications and Transactions Act 25 of 2002	Promulgated for the regulation and governance of e-commerce in South Africa. Legal requirements for websites and so on.
2003:	The Financial Intelligence Centre Act 38 of 2001	Came into effect on 1 July 2003. based on the fact that Information and Communication Technology has become a convenient form for electronic transactions hence, opening doors to financial crime such as money

		laundering, tax evasion and so on. This Act was promulgated to help fight financial crime.
2005:	Regulation of Interception of Communications and Provision of Communication Related Information Act 70 of 2002 (RICA)	Came into effect on 30 September 2005. This law makes it compulsory for everyone in South Africa to register their cellphone number.
2011:	Consumer Protection Act 68 of 2009	Came into effect on 1 April 2011 to promote fairness, openness and good business practices. This is due to an increase in electronic commerce and the use of mobile phones.
2013:	Protection of Personal Information Act 4 of 2013 (POPI)	Promotes the protection of and establishment of minimum requirements of processing personal information among public and private bodies. Also to regulate the flow of information and supports the rights of persons regarding any kind of electronic communication.

Source: (Adapted from various legislations)

Some of the statutes stated in Table 4.3 support the functioning of disaster management. For example, the Electronic Communication Act 36 of 2005, as amended Act 1 of 2014 and the Promotion of Access to Information Act 2 of 2000, can be used to help regulate and contribute to disaster management information in South Africa immensely. The Electronic Communication Act (as amended) mandates the Minister to establish a public emergency communication centre that should be known as the *"112 Emergency Centre"*. The Promotion of Access to Information Act mandates individuals or organisations that might have information to release it. It could be information that is detrimental to the safety of others or information that can contribute to the success of disaster risk reduction or response. The Regulations of Interception of Communications and Provision of Communication-related Information Act (ROIOCAPOCIA) 48 of 2008, regulates certain communications and provision of communication-related information under certain circumstances. Section 7 of the ROIOCAPOCIA states that there should be an interception of communication to prevent serious bodily harm. In section 8 of the same act, the identification of an individual or groups of people possibly in danger, the act allows for their location to be communicated (Republic of South Africa, 2008).

Further, Sithole (2014:36-37) identifies in his study the standards that help enhance the organisation's operations and ensure that their operations are viable. The standards identified are the South African National Standards (SANS) 25777: 2010-Information and Communications technology management – Code of Practice related to standards in communication. Then the International Organisation for Standardisation (ISO) that apply to the disaster management environment. He also identified the ISO 27001: 2005: Information Technology – Security techniques-information security management systems-requirements policy.

The identification of statutes listed in Table 4.3, agrees with Choo's (2005:8) suggestion that information is one of the key factors in effective disaster management. The power of information communication before, during and after a disaster has been felt in many disaster occurrences, like the 2011 Japan earthquake and tsunami and the 2001 September 11 incident, the 2015 South African Xenophobia attacks, just to mention a few (Finn, 2018:30; Crush, Chikanda & Skinner, 2015:20; Republic of South Africa, 2005:96; Sithole, 2014:26).

4.9 The South African National Disaster Management Framework

There are several international disaster management agreements, like the Sendai Framework for Disaster Risk Reduction 2015-2030 (UNISDR 2015) and the 17 Sustainable Development Goals (United Nations General Assembly 2015) that have been developed to govern and measure the success of disaster management activities. These frameworks have qualitative and quantitative indicators to help measure the success of disaster management implementation (Van Niekerk, 2005:v; UNISDR, 2015:12-14). The NDMF that was developed in alignment with some of the earlier mentioned international best practices also has indicators and bears the main goal of disaster risk reduction. The NDMF, as well as the Act, are considered to be one of the best world-class disaster management legislation in the world, with some of its sections being adapted in other parts of the world, such as India (Humby, 2012:25; Van Niekerk, 2005:189; Jordaan, 2018:10). Specific sections in the NDMF are intended to answer the main objective of this study, hence it is imperative to provide a detailed discussion of the South African framework with a focus on communication.

4.9.1 Aims of the National Disaster Management Framework

Section 6(1) (a) of the DMA, prescribes that the Minister must develop a subsequent National Disaster Management Framework (Holloway, 2009:102). Section 7(1) of the DMA further states that the NDMF must provide a coherent, transparent and inclusive policy on disaster management, appropriate for South Africa. The DMA further states that the NDMF must cover disasters of different kinds; their severity and magnitude that may occur in Southern Africa, and also to emphasise the measures that reduce the vulnerability of disaster-prone areas, communities and household, as specified in terms of section 7(2) of the DMA (Van Niekerk, 2014:859; South Africa, 2002:14).

In line with the international best practices, the NDMF as legal policy, emphasises disaster risk reduction (Van Niekerk, 2014:858; Pelling & Holloway, 2006:4). As part of DRR, preparedness, prevention and mitigation are core principles to help guide the management of

disasters in South Africa and Southern Africa. The other aim of the NDMF is to facilitate South Africa's cooperation and support in regional and international disaster management (Republic of South Africa, 2003:14). This is reflected in all the international platforms where South Africa has made an immense contribution through the signing of agreements in networks, such as the Sendai Framework for Disaster Risk Reduction 2015-2030 and participation in the International Day for Disaster Reduction, held every 13 October (South African Government News Agency [SAnews], 2017; Pelling & Holloway, 2006:9).

The past decade has seen the outcome of the NDMF guiding the developments and implementation of disaster management within national, provincial and municipal organs of state. The NDMF has also facilitated the involvement of the private sector, non-governmental organisations, traditional leaders, volunteers and other experts in disaster management. The other aim of the NDMF is to encourage community participation and partnerships in disaster risk reduction (South Africa, 2002:14). Another stride in the past decade that has been evident in the NDMF, is the facilitation of capacity building, training, education and research to thousands of people. Institutions like the University of the Free State, Northwest University and the University of Venda as well as other South African Qualifications Authority (SAQA) recognised academic institutions, have trained the people (NDMC, 2013:22; Pelling & Holloway, 2006:24; Kreimer, Arnold & Carlin, 2003:204).

Section 7(2)(i) of the DMA states that the NDMF must guide the development of comprehensive information management and communication systems. The study focuses on this section and critically analyses it because of its lack of effective implementation within the South African provincial disaster management centres. The other aims of the NDMF are to consider and incorporate indigenous knowledge in all DRR activities, an initiative also recognised in the Sendai Framework, which is an important aspect for information management and communication (UNISDR, 2015:11; Dube & Munsaka, 2018:3; Van Riet, 2008:7). The NDMF provide a framework within which organs of state may fund disaster management with specific emphasis on disaster risk reduction and grants for post-disasters. Furthermore, they provide key performance indicators in respect of the various aspects of disaster management (Van Niekerk, 2010:7; South Africa, 2002:14).

4.9.2 Layout of the National Disaster Management Framework
According to Van Niekerk (2005:187), the initial development of the National Disaster Management Framework (NDMF) was tasked to a multi-disciplinary task team, consisting of

academics and disaster management practitioners. Thereafter, the public had an opportunity to comment on the first draft. As illustrated in Table 4.4, the NDMF first draft consisted of six KPA only without enablers.

Table 4.4 *National Disaster Management Framework 2004 first draft*

1.	KPA 1	Institutional capacity for disaster management
2.	KPA 2	Risk assessment and monitoring
3.	KPA 3	Disaster management planning and implementation
4.	KPA 4	Disaster response and recovery, rehabilitation and reconstruction
5.	KPA 5	Public awareness, education, training and research
6.	KPA 6	Monitoring evaluation and improvement

Source: (Republic of South Africa 2005; Van Niekerk, 2005:188)

Unfortunately, the first draft did not have the information management and communication systems as a KPA, which is a clear indication of the lack of recognition of its significance. In the year 2005, the final draft was promulgated and termed the National Disaster Management Framework of 2005 (Wentink & Van Niekerk, 2017:1; Van Niekerk, 2014:859, Llosa & Zodrow, 2011:5). The NDMF has four KPAs that are informed by specific objectives and as required by the Act. It also has three enablers that facilitate and support the achievement of the objectives set out in the KPAs. Each enabler supports all four KPAs, further highlighting inextricable interdependencies between each enabler where the needs of each KPA are addressed by the three enablers (Humby, 2012:33; Republic of South Africa, 2005; Sithole, 2014:44). The NDMF also has KPIs to guide and monitor the implementing of the objectives and the progress. Also, each KPA and enabler is concluded with a list of guidelines that are supposed to be disseminated by the NDMC to support the implementation of the framework in all three spheres of government.

KPA 1 – Integrated Institutional Capacity for Disaster Risk Management	KPA 2– Disaster Risk Assessment	KPA 3 – Disaster Risk Reduction	KPA 4 – Response and Recovery

OBJECTIVE

Establish integrated institutional capacity within the national sphere to enable the effective implementation of disaster risk management policy and legislations

OBJECTIVE

Establish a uniform approach to assessing and monitoring disaster risk management planning and disaster risk reduction undertaken by organs of state and other role players

OBJECTIVE

Ensure all disaster risk management stakeholders develop and implement integrated disaster risk management plans and risk reduction programmes in accordance with approved frameworks

OBJECTIVE

Ensure effective and appropriate disaster response and recovery by:
• implementing a uniform approach to the dissemination of early warnings
• averting or reducing the potential impact in respect of personal injury, health, loss of life, property, infrastructure, environments and government services
• implementing immediate integrated and appropriate response and relief measures when significant events or disasters occur or are threatening to occur
• implementing all rehabilitation and reconstruction strategies following a disaster in an integrated and developmental manner.

Key Performance Indicators (KPI) and Guidelines

Enabler 1 –Information management and communication	Enabler 2 – Education, training, public awareness and research	Enabler 3 – Funding arrangements for disaster risk management

OBJECTIVE

Guide the development of a comprehensive information management and communication system and establish integrated communication links with all disaster risk management role players

OBJECTIVE

Promote a culture of risk avoidance among stakeholders by capacitating role players through integrated education, training and public awareness programmes informed by scientific research

OBJECTIVE

Establish mechanisms for funding of disaster risk management in South Africa

Key Performance Indicators (KPI) and Guidelines

Figure 4. 1 *Outline of the South African National Disaster Management Framework of 2005*
Source: (Adapted from Republic of South Africa, 2005)

As discussed earlier, KPA 1 encourages the establishment of integrated institutional capacity at the national level to effectively implement a disaster management policy and legislation (Roberts, 2010:403). Further, co-operative governance and the involvement of all stakeholders in strengthening the capabilities of all spheres of government to mitigate risks and the severity of disasters is encouraged (Wentink & Van Niekerk, 2017:5). Therefore, the establishment of an ICDM, involving all the South African Cabinet members and representatives from all spheres of government, is mandatory (Llosa & Zodrow, 2011:10). Section 1.2.2.1 of the NDMF provides the key responsibilities of the NDMC, and two responsibilities, which are of interest to the study are as follows:

i) assist with the establishment of mechanisms for creating public awareness to inculcate a culture of risk avoidance,
ii) guide the development of comprehensive information management and communication systems.

There are sections in the NDMF about the PDMC that are of interest to the study. For example, section 1.2.4.1 of the NDMF states that the PDMC must:

i) establish integrated information management and communication systems that are consistent with arrangements established by the NDMC;
ii) ensure the establishment of a strategic provincial emergency communication system that is compatible with emergency communication systems used nationally, to enable communication between essential and emergency services for incident command and the management of joint operations;
iii) establish a system (including emergency communication mechanisms) for reporting, evaluating and disseminating early warnings on a 24-hour basis to ensure that threatened communities can respond appropriately and take risk-avoidance measures when a disaster occurs or is threatening to occur in their areas;
iv) act as a provincial reporting centre (Republic of South Africa, 2005:13).

Information management and communication systems are imperative to the full functioning of integrated institutional capacity (KPA 1), especially concerning the management of stakeholder database.

The second KPA focuses on the establishment of a uniform approach to assessing and monitoring disaster risks to help inform the planning of disaster management and reduction for

undertaking by the stakeholders (Roberts, 2010:403; Republic of South Africa, 2005:25). There are also clear outlines of the processes involved in carrying out a disaster risk assessment, whereafter it further addresses the processes of generating a National Indicative Disaster Risk Profile and the requirements for monitoring, updating and disseminating disaster risk information. Lastly, the KPA illustrates the measures of ensuring quality control in disaster risk assessment and monitoring. Imperatively, this KPA also stresses out the significance of community-based disaster risk assessment (Van Riet, 2008:8; Republic of South Africa, 2005:25).

Key Performance Area three ensures the development and implementation of integrated disaster management plans, which will inform risk reduction projects and programmes. It also encourages stakeholder participation and the use of approved frameworks. Eight key planning points for disaster risk reduction projects or programmes are also listed to help stakeholders. The KPA stresses out the implementation and monitoring of disaster risk reduction activities (Roberts, 2010:403; Republic of South Africa, 2005:39).

Key performance area four, which is on response and recovery, addresses key issues, such as the requirements for disseminating effective early warning; procedures and guidelines to be followed in respect of assessments, disaster classification and review; mechanisms for integrated response and recovery plans; relief measures to be followed and then rehabilitation and reconstruction processes following a classified event or disaster (Republic of South Africa, 2005:54). Despite the recent shift from disaster response to disaster risk reduction (Van Niekerk, 2014:858; Van Riet, 2008:1), this KPA is still an important phase in the disaster management process.

The first enabler on information management and communication provides a guide for the development of a comprehensive IMCS. This enabler encourages integrated communication links with all stakeholders (George & Kwansah-Aidoo, 2017:79). The enabler provides the basic requirements of the system; provides an outline of the IMCS model; provides the requirements for data collection to achieve all the acts and NDMF's objectives; identifies the requirements for the IMCS in respect of the KPA's and enablers; focuses on additional specialised functionalities to be included in the IMCS, the requirements for its development and then the various communication media required to enable receipt, dissemination and exchange of information (Republic of South Africa, 2005:64). In this regard, Christopher and

Thatham (2011:270) highlight the significance of information and communication. They state that communication and information systems assist in controlling relief operations, emergency planning, response and management.

Enabler 2 drives the mandate on disaster management education, training, public awareness and research. This enabler provides the mechanisms for the development of research needs and resource analysis and thereafter implementation of disaster management education and training frameworks. It also provides for the promotion of education for professionals in disaster management and primary and secondary school learners. Subsequently, this enabler addresses the development of training programmes and pushes for the development of an integrated public awareness strategy and promotion of risk-avoidance. The enabler also supports collaborative disaster management research as a priority (Republic of South Africa, 2005:76).

Funding of disaster management is set out in enabler 3, where it addresses the legislative framework, which guides the funding of disaster management activities by organs of state, as well as recommended funding arrangements (Van Niekerk & Visser, 2009:24). The enabler reviews principles underpinning funding arrangements and the requirements for establishing information management and communication systems for the effective implementation of the act. It also provides mechanisms for funding of risk assessments, disaster risk reduction strategies, post-disaster activities and addresses ways of funding education, training, public awareness and research (Republic of South Africa, 2005:88).

4.10 General discussion and critique of the South African DMA and NDMF

The KPAs as enablers are inextricably inter-dependent and inter-related. The NDMF is an inclusive policy that provides coherent and transparent guidelines for disaster risk reduction and management in South Africa. However, there are some discrepancies, which a significant number of scholars identified (Wentink & Van Niekerk, 2017; Van Niekerk 2014; Humby, 2012; Erasmus, 2009; Pelling & Holloway, 2006) and will be discussed in this section.

Even though the NDMF identifies specific guidelines in each KPA and enabler, these guidelines are generic and require further and more detailed elaboration within provincial disaster management frameworks and other plans for ease of implementation (Humby, 2012:33). Humby (2012:7) further critiques the NDMF for not providing or adequately addressing information and communication channels, relating to the transmission of disaster risk reduction messages to stakeholders and in particular early warning as stated in section

1.2.4.1 of the NDMF. Van Niekerk (2005:865) critiques the NDMF, stating that the funding mechanisms are not uniformly applied or implemented by all spheres of government; 76% of his respondents mentioned that inadequate funding is the biggest obstruction to implementing the policy and legislation (Wentink & Van Niekerk, 2017:1). The NDMF contains sufficient information and a specific mechanism for funding disaster risk reduction and management (Pelling & Holloway, 2006:4). It provides funding mechanisms and arrangements for integrated institutional capacity; disaster risk assessments; disaster risk reduction; response and recovery; information management and communication; as well as education, training, public awareness and research. Referring back to the main objective of the study, which is on investigating the dynamic experiences encountered by provincial disaster management centres in establishing communication unit, funding should not be a factor. Section 7.4 of the NDMF provides this statement:

> *"Enabler 1 focuses on the establishment of comprehensive information management and communication system to ensure that all role players have access to reliable hazard and disaster risk information for effective disaster risk management and risk reduction planning. The National Disaster Management Framework requires that the cost of developing an information management and communication system is incorporated into the start-up costs for disaster management centres (see subsections 1.2.2, 1.2.4 and 1.2.5 of the South African National Disaster Management Framework of 2005)".*

As it is clearly stated, provision of funds at the initial establishment of the disaster management centres could have encouraged the inclusion of IMCSs at the disaster management centres. From Van Niekerk's (2005:870) study, 24% of the respondents stated that there is a lack of clear guidance for policy and legislation implementation; 72% said there is a lack of understanding of the policy and legislation and 48% stated that there is a lack of adequate knowledge of disaster management. In his analysis of the South African policy and legislation, Erasmus (2009:41) realises that South Africa is lagging with regards to the implementation of the NDMF objectives. The NDMF clearly states that the NDMC *"must"* develop further guidelines for the establishment of various activities as per the NDMF (South Africa, 2009:2,11,13,15,28,32,41,43,58-78). However, these guidelines are not available and for stakeholders who do not comprehend the disaster risk management field and the policy, the legislation further makes its implementation difficult. A report by Erasmus (2009:45) unveiled that most organs of state, provincial departments included, showed below-average progress of below 50% completion or compliance with implementation.

On 21 April 2015, the COGTA invited stakeholders from disaster management academic institutions to share their perspectives on the 2002 DMA and Disaster Amendment Bill. The stakeholders included Johan Minnie, Andries Jordaan, Ailsa Holloway, Dewald Van Niekerk, Elmien Steynby and many other stakeholders. The stakeholders consulted during the amendment of the DMA 57 of 2002 to a DMA 16 of 2015, who commented on the old DMA and shared their expectations. They stated that the old DMA has specific limitations for consideration in the amendment of the new DMA. They mentioned that the disaster management function is underfunded and hence makes it difficult to implement at the provincial and local level (Wentink & Van Niekerk, 2017:1; Pelling & Holloway, 2006:4). They also argued that the placement of a disaster management function, as according to the requirements of the DMA, is restraining. Even more restraining is the fact that implementing spheres do not have full authority to access senior officials and the senior authorities cannot prescribe to them. Attendance to an advisory forum meeting is not a *"must"* in the DMA and if officials do attend, it is officials with no decision-making powers (Jordaan, 2018:71). The main argument during the critique was on the terminology in this field that is complex and still needs further clarification, for example, the differences between "*Disaster Management*", "*Disaster Risk Management*" and "*Disaster Management and Disaster Risk Reduction*"(Mdakane, 2015). Chapter 1 of this study refers to this effect, pointing out the differences in the name of the DMA and NDMF and the content thereof.

4.11 South Africa: the disaster management organisational levels

According to the 1996 Constitution of South Africa (Act 108 of 1996), there are three spheres of government, constituted as national, provincial and local (Republic of South Africa, 1996). The South African National Disaster Management Framework of 2005, as well as the Act 57 of 2002 (as amended Act 16 of 2015), state that each sphere of government should have a disaster management centre. Following these demarcations, this section details the distinction of the three key organisational management levels of disaster management functioning, that is strategic, tactical and operational. As can be seen, such an approach is strategic and strategy is a key factor in the success of any organisation (Railean, Elci & Elci, 2017:116). Within an organisation, the strategy is used to make an appropriate plan or methodology that will help achieve the overall organisation's objectives; an aspect mostly overlooked (Railean, Elci & Elci, 2017:116; Braun & Latham, 2014:117). Even though the three spheres of government are at different management levels, each sphere of government has different internal management levels. For example, in a PDMC, decisions are made at different levels of management, which

are strategic, tactical and operational (Lucey, 2005:172). Lucey further clarifies that the different management levels require relevant information (van Dam & Marcus, 2007:262; Lucey, 2005:6).

In assenting with Lucey (2005), Van Niekerk (2005:92) states that there are three levels of management in the public sector, that is the strategic (top management), tactical (middle management) and operational (junior management) levels (Lucey, 2005:6). Van Niekerk (2005:92) believes that planning and policy-making competence is related to the management level of the organisation (Worboys, Lockwood, Kothari, Feary & Pulsford, 2015:211). Van Niekerk (2005) further states that disaster management is a more tactical and operational materialisation of strategic decisions, such as policies, programmes and strategies. Van Niekerk's (2005:92) research determines that the National sphere's decision-making responsibilities are placed at the strategic level, the provincial sphere at the tactical level and the local sphere at the operational level.

Having determined that the PDMC is at the tactical level, it is of interest to note that the objectives of the strategic plan or policy are implemented. These authors (Worboys, Lockwood, Kothari, Feary & Pulsford, 2015:211) indicate that tactical plans help with the implementation of strategic plans. The PDMC is also in charge of developing functional policies and strategies (e.g. Provincial Disaster Management Framework).

4.11.1 Strategic disaster management
Van Niekerk (2005:16) describes strategic management as a level managed by the top and middle management who are involved in continuous, long-term planning processes to achieve the organisation's objectives. The undertaking of these processes is within an evolving environment, through the development of specific plans. The internal and external environment of the organisation has a great impact on the success of the strategic plan (Worboys, Lockwood, Kothari, Feary & Pulsford, 2015:211; Railean, Elci & Elci, 2017:16; Braun & Latham, 2014:117; Lucey, 2005:172). The study explores DMA and the NDMF at the strategic level of the organisation and further strategies and policies for handling disasters are developed (Ngubane, 2004:5).

4.11.2 Tactical disaster management
As mentioned earlier, tactical management entails the implementation of plans developed at the strategic level (Worboys, Lockwood, Kothari, Feary & Pulsford, 2015:211). This management phase ensures that middle managers (Lucey, 2005:172) implement the

organisation's objectives and strategic plans. This is a more realistic short-term activity that deals with people and actions. Tactical plans are for handling disasters at the provincial level (Ngubane, 2004:5). Furthermore, the middle managers at this level formulate budgets, acquire new resources and other issues (Van Niekerk, 2005:16).

4.11.3 Operational disaster management

From all the levels discussed, Worboys, Lockwood, Kothari, Feary and Pulsford (2015:255) conclude that the operational level is involved with on-the-ground enforcement of disaster management. These scholars and others, further state that the managers at the operational level require accessible, reliable and accurate information, as well as clearly defined communication links and channels (van Dam & Marcus, 2007:262). This management level supports the tactical and strategic management levels by implementing objectives identified at both levels. Middle managers support lower-level managers to develop operational plans and goals, thereafter they ensure the taking of specific actions towards achieving the operational goals (Van Niekerk, 2005:17). The operational level is a fundamental management level because it transforms and contributes to the creation of a service (van Dam & Marcus, 2007:347). At this level, people, structures and systems are explored to implement disaster management (Ngubane, 2004:5).

4.12 South African Provincial Disaster Management Centres: current status

The national, provincial and local spheres are the three spheres of government-mandated by the Constitution of South Africa (Picard, Buss, Seybolt & Lelei, 2015:302; Fox & Van Rooyen, 2004:99). Each of these levels has some form of autonomy. This section illustrates the typical structure of the South African disaster management centres.

National sphere of government
(NATIONAL DISASTER MANAGEMENT CENTRE)

Limpopo PROVINCIAL DISASTER MANAGEMENT CENTRE	Mpumalanga PROVINCIAL DISASTER MANAGEMENT CENTRE	North-West PROVINCIAL DISASTER MANAGEMENT CENTRE
Northern Cape PROVINCIAL DISASTER MANAGEMENT CENTRE	Western Cape PROVINCIAL DISASTER MANAGEMENT CENTRE	Free State PROVINCIAL DISASTER MANAGEMENT CENTRE
Gauteng PROVINCIAL DISASTER MANAGEMENT CENTRE	Eastern Cape PROVINCIAL DISASTER MANAGEMENT CENTRE	Kwa Zulu-Natal PROVINCIAL DISASTER MANAGEMENT CENTRE

8 Metropolitan, 44 District and 205 Local Municipalities
DISASTER MANAGEMENT CENTRES

Figure 4.2 *The South African sphere of government*
Source: (Adapted from Van Niekerk 2005:90; Municipalities, 2020)

4.12.1 Typical South African national and provincial government organisational structure

A depiction of the South African government organisational structure may be vital to understanding the governance of disaster risks, as well as decision-making capacity. The placement and classification of the South African disaster management centres affect their functionality (Jordaan, 2018:70; Van Niekerk, 2014). According to Jordaan (2018:70), another way to improve the coordination responsibility of disaster management is through the elevation of the PDMCs to branch level and in turn, improve their efficiency. The results chapter discusses the PDMC levels according to the depiction in Figure 4.3.
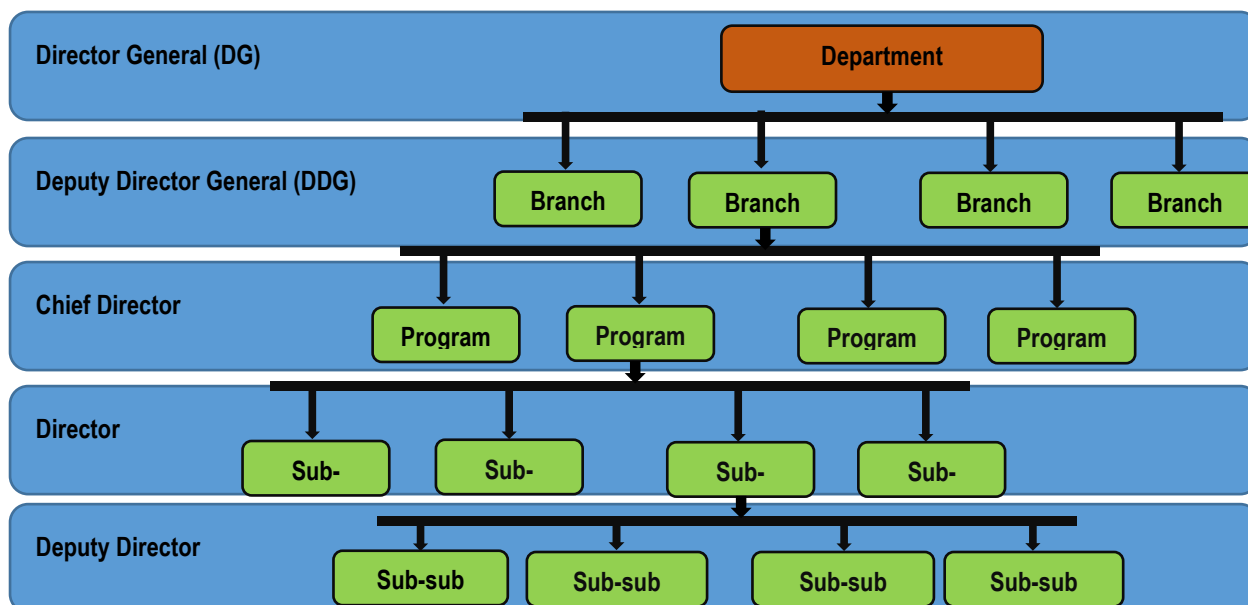
Figure 4.3 *Typical South African government structure*
Source: (Adapted from Jordaan, 2018: 69)

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4.13 Conclusion

This chapter found that governance plays a significant role in disaster management. The lack of and limited functioning of IMCS in provincial disaster management centres could be an indication of poor governance since good governance entails the implementation of policy amongst other things. Moreover, IMCS forms a bigger part of the South African disaster framework. The study's empirical inquiry will support this conclusion. Further, the chapter provided a detailed discussion of the national and international legislation, strategies, policies, agreements and arrangements. The development and continuous review of these promulgations lead to the promotion of good governance in disaster risk reduction. Despite other factors that affect disaster risk governance, effective information management and communication might be key to its promotion. The South African disaster management policy and framework have made great strides towards supporting and guiding the achievement of disaster risk reduction and effective management of disasters. It has also supported the management of information, media as an important stakeholder and communication in implementing all the KPAs and enablers in the NDMF. Before this, a detailed discussion of the South African government organisational levels in the government structure was provided and it was determined that where the Centres are located, according to the levels, affects their governance. Chapter 5 to follow will give a detailed discussion of the different types of information management and communication systems used in South Africa and globally. If adapted, knowledge of the various systems used in other institutions and countries can contribute to the success of disaster risk governance. The chapter narrates the different systems in case studies.

CHAPTER 5: DISASTER INFORMATION MANAGEMENT AND COMMUNICATION SYSTEMS AND THE FOURTH INDUSTRIAL REVOLUTION

5. 1 Introduction

The world is experiencing an accelerated transformation in technology. Hence, all organisations in the private, public, academia and non-governmental sector, ought to integrate and coordinate to keep up with this technological revolution. Citizens and investors are also responsible for guiding this evolution. This new era in human development, enabled by advances in technology is increasing in speed, breadth and depth. The new era the world is experiencing now is called the '*Fourth Industrial Revolution*' (4IR) and is making breakthroughs in the use of electronic and information technology, like artificial intelligence (e.g. drones and self-driving cars), data, software, internet of things, quantum computing, 3-D printing and mobile devices to improve livelihood qualities. The ability to perform transactions remotely is a thrilling experience in human development, as well as an intimation of enhanced livelihoods, such as the decline in the cost of living, because of a cut in transport costs when ordering food online or video conferencing that saves on time and travel costs. Also, Geographical Positioning Systems (GPS) add to human development by suggesting the fastest route to a destination. However, the downturn brought about by the Fourth Industrial Revolution could be resistance to adapt to or a disruption in the labour market. Many government officials in developing countries might not support the 4IR, because their manifestos include job creation (Schwab, 2019; Global, 2018; Mcginnis, 2018).

Despite the downturns brought about by the 4IR, the benefits are exceptional and since disaster management involves reducing vulnerabilities and increasing resilience, there is no doubt that the 4IR is a necessity for adaptation. Disaster management needs to adapt to 4IR. The author of the book, "*The Fourth Industrial Revolution*", Klaus Schwab, stated in his book that, just like the revolutions that preceded it, the Fourth Industrial Revolution has the potential to raise global income levels and improve the quality of life for populations around the world (Schwab, 2016:49). The 4IR builds on the foundations laid by the first industrial revolution (water and steam), the second industrial revolution (electric power) and the third industrial revolution (electronics and information technology). Figure 5.1 illustrates the transformation.
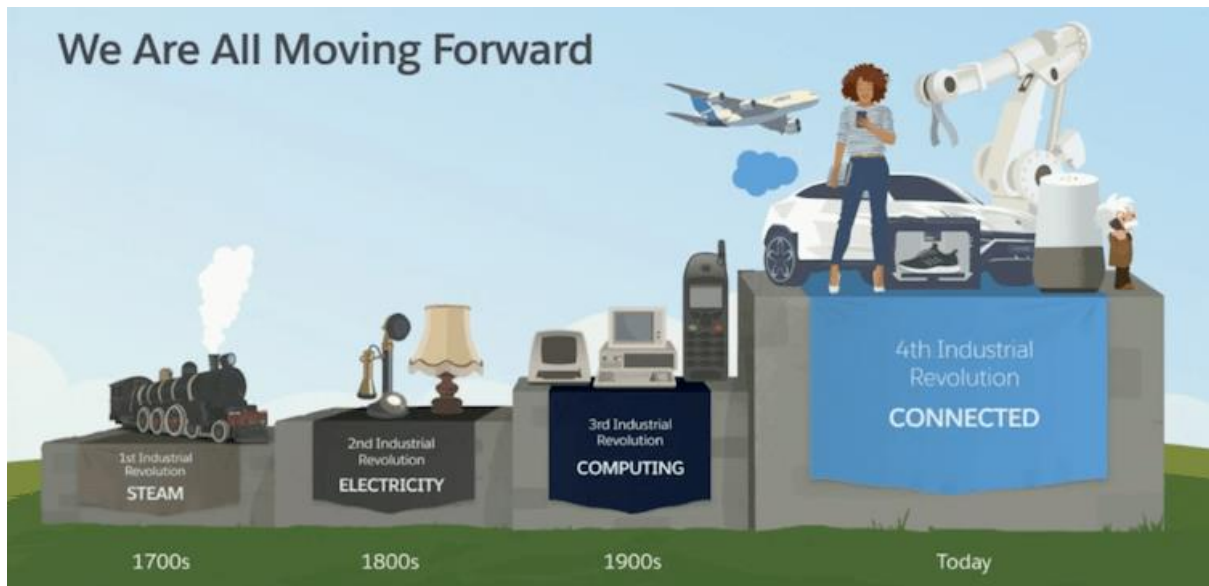
Figure 5.1 *The evolution of the industrial revolution*
Source: (Mcginnis, 2018)

Imagine disaster preparedness training that makes use of interactive virtual reality (VR) for real-time training simulation to train incident commanders and first responders. Providentially, in 1992, such a system and many others were already developed. For example, the advanced disaster management simulator (ADMS), provides a realistic 3D emergency and relies on physics built-in artificial intelligence. The ADMS includes disaster scenarios that consider the type of threat, time of the day, precipitation, wind, visibility, conditions of casualties, traffic and many other conditions. The training exercises allow the users to make interactive decision-making as an outcome of the training. Hence, it is not closed-ended. The New York City Office of Emergency Management, Florida State Fire College, St. Paul International Airport Minneapolis and Netherlands Institute have used this system among many others for Safety (Margrethe, Helsloot, Burke deVries & Post, 2010; Erich, 2016).

Hazards demolish homes and businesses that consequently damage hardware, sweep away electronic and physical data. Such type of disastrous events cause significant setbacks, affecting continuity and even disaster response. Fortunately, with the new computational technologies are becoming smarter. The computers (quantum computing technologies) can process large quantities of data faster, allowing organisations to store and access their information through the internet from anywhere, any time (Mcginnis, 2018; Business Blogs, 2012). Following the recent cyclones in Mozambique, GeoPoll, a mobile-based research company, that uses research experts to collect and analyse data through mobile phones, was able to support humanitarian response with real-time data. GeoPoll deployed a remote short message service (SMS) based survey to regions hardest hit in Mozambique to gather ground

data on damages and aid needs by communities (Becker, 2019; GeoPoll, 2019). The 4IR is an enabler to mitigating the impact of disasters and saving lives.

The South African National Disaster Management Framework of 2005 states that there is a need for IMCS to act as a repository and a *"nerve centre"* for the effective operation of any disaster management centre (Republic of South Africa, 2005:63). Van de Walle, Turoff and Hiltz (2010:9) support this thinking in their study on emergency information systems (EMIS), affirming that EMIS assist officials responding to disasters because the information is required for decision support. These authors further indicate that in a situation where disaster managers are reducing risks or responding to disasters, EMIS and information and communication technologies are critical and increasingly important for coordination with other stakeholders (Van de Walle, Turoff & Hiltz, 2010:ix). The Sendai Framework for Disaster Risk Reduction 2015-2030 states that understanding disaster risk is only possible through the promotion of relevant real-time data access, collection, analysis, management and dissemination. The Framework also states that investments into innovation and technological developments, such as space and in situ information, including GIS enhance the data processes (United Nations [UN], 2015: 10).

This chapter, therefore, discusses the global good practices of IMCS in general. It also unpacks the concept *"Information management and communication system"* and identifies key features and types of technologies that can add to the effective functioning of the system from a disaster management perspective. In doing so, the chapter attempts to identify where the South African disaster management fraternity could be in the 4IR era.

5.2 Understanding Information management and communication systems

Early warning information and communication systems are one of the tools for incorporating disaster risk reduction in national and international development agendas. The systems assist with mitigating the impacts of disasters. Good examples of such systems are food security early warning systems, supported by the Food and Agriculture Organisation (FAO) and the United States Agency for International Development (USAID). The system assists in providing seasonal conditions for crops and pastures timely. Direct communication of flood warning through radios to affected populations has also proven useful to countries like Nicaragua, Honduras and North Bangladesh (White, Pelling, Sen, Seddon, Russell & Few, 2004:50). Box

1 describes how local level community-based early warning systems for preparedness contributed to saving lives during Hurricane Mitch in Central America.

Box 1: Community-based early warning systems & preparedness in Central America

Hurricane Mitch swept through Central America in 1998, causing severe impacts in Honduras, Nicaragua, El Salvador and Guatemala. The death toll from the high winds, flooding and landslides generated by this storm reached 27,000. Mitch destroyed or severely damaged 80,000 homes, 2,000 drinking water systems and hundreds of bridges, and heavily affected the region's agriculture – causing damage to subsistence crops to the value of US$ 155 billion in Honduras alone. IFRC claims that the disaster put economic development in Honduras back 20 years. Osorio suggests that infrastructure damage 'set the Honduran water sector back in its water coverage services to a similar level to that of three decades earlier'. The impacts of Mitch fell most heavily on the poorest, especially on those living and working in marginal lands on steep slopes and floodplains. Nevertheless, a few examples have emerged from the region that illustrates how simple disaster risk reduction activities rooted within communities in hazard-prone locations may play a significant role in reducing local deaths. In contrast with neighbouring sites, there were no deaths among the inhabitants of La Masica on the coast of Honduras, where external agencies had supported a local capacity-building programme for risk reduction featuring a community-based flood early warning system linked to preparedness training. Similarly, there was no loss of life along the Coyolate River in Guatemala, where communities had jointly worked to map flood hazard, establish a high-rainfall alarm system, monitor river levels and build evacuation shelters.

Source: (White, Pelling, Sen, Seddon, Russell and Few 2004: 50; Blaikie, Cannon and Davis, 2004)

Consequently, technological early warning systems and many other technologies, like television, telephones and navigation systems are heavily dependent on satellites for full functioning. For example, in 1957, Sputnik-1 was launched to perform early warning, such as missile warning. This satellite would identify a missile and then immediately send out information to the targeted country to take action. In some instances, the satellite would even destroy the missile (Century of Flight, 2019). According to Akwei (2018), countries are ranked better than others, because of their developments in technology. According to Wikipedia (2019), as of 2018, 90 countries in the world have launched satellites into the earth's orbit. In this regard, the launching of a satellite into the orbit is a huge step towards the 4IR. The following is a list of African countries that have made these strides:

    i)   South Africa – launched its first biggest and private satellite in 1999 and another one in 2017. The nanosatellites were named the TshepisoSat (ZACube-1) and the other one the ZACube-2. The latest one captures images with a cutting-edge remote-sensing camera and offers communication services to South Africa and the region. It is designed for real-time monitoring of natural and man-made incidents and disasters (Mabuza, 2018).

ii)   Nigeria – In 2011, Nigeria launched two satellites, the NigeriaSat-1 and the NigeriaSat – 2, to monitor the weather.

iii)   Angola – the AngoSat was launched in 2017 to help improve Angola's telecommunication services.

iv)   Ghana – In 2017, Ghana launched the GhanaSat-1 to monitor the Ghanaian coastline for cartography and also to monitor illegal gold mining.

v)   Mauritius – Launched its Mauritian cube satellite in 2019 (Ministry of Technology Communication & Innovation, 2018). The purpose of the MirSat-1 is to increase the speed of data transfer, crop management and feed data to radio stations in the case of a natural disaster such as cyclones, tsunamis, flash floods and thunderstorms (Suddhoo, 2018).

Satellites have contributed to the improvement of people's lives through their facilitation of telecommunications, forecasting of the weather, improving agricultural yields and advances in medicine, amongst many other benefits (Kelly, Loverro, Case, Queruel, Marechal & Barroso, 2010). However, the question remains of whether organisations like disaster management are making use of such benefits to their maximum advantage.

5.2.1 Information management and communication systems in South Africa
Launching private satellites into space is a huge move for South Africa towards the 4IR because a majority of technological systems depend on the satellites. Despite the technological signs of progress, the participation of stakeholders, as well as the use of information systems in disaster management, remains limited (Van de Walle, Turoff & Hiltz, 2010:6). In South Africa, the NDMF defines an IMCS as a system that enables the receipt, dissemination, and exchange of reliable hazard and disaster risk information to support integrated disaster management operations. Figure 5.2 details what IMCS should do as obtained from the NDMF.

Integrated disaster risk management depends on access to reliable hazard and disaster risk information as well as effective information management and communication systems to enable the receipt, dissemination and exchange of information. It requires systems and processes that will:
- provide an institutional resource database, including a reporting and performance measurement facility
- facilitate information exchange between primary interest groups
- facilitate risk analysis, disaster risk assessment, mapping, monitoring and tracking
- guide and inform focused risk management and development planning and decision-making
- facilitate timely dissemination of early warnings, public awareness and preparedness, especially for at-risk people, households, communities, areas and developments
- enable timely and appropriate decision-making to ensure rapid and effective response and recovery operations
- facilitate integrated and co-ordinated multi-agency response management
- record and track real-time disaster response and recovery information
- facilitate education, training and research in disaster risk management
- facilitate funding and financial management for the purposes of disaster risk management.

The system must have the capabilities to acquire, sort, store and analyse data for the purposes of targeting information for primary interest groups. In addition, it must include
GIS (geographical information systems) mapping and information display applications, as well as standardised multimedia communication capabilities.

Figure 5.2 Expected functions of information management and communication system
Source: (Republic of South Africa, 2005: 63)

Contrary to the NDMF, and from a general global perspective, Van de Walle, Turoff and Hiltz (2010:4), identifies IMCS requirements for each disaster management cycle phase instead. The generic phases are pre-disaster, which includes prevention, preparedness, mitigation and early warning, the post-disaster phase includes response, recovery and rehabilitation. In the pre-disaster phase, the scholars provide an example of remote sensing for constant earth observation as an early warning system (EWS) to detect approaching hazards like a tsunami, food security and many others (Macherera & Chimbari, 2016:3). Other EWS developed, are for the agricultural sector and are the USAID's Famine Early Warning System (FEWS) and the Regional Famine Early Warning System (REFEWS), developed for the horn of Africa. The REFEWS monitors vegetation growth conditions and crop yields and then provides a precise warning on the food situation before the end of the season (Oroda, 2001:66); Macherera and Chimbari, 2016:4). The South African disaster management IMCS, should incorporate EWS for KPA on risk assessment, KPA on risk reduction and KPA on response and recovery. It should be mandatory for a PDMC to have an IMCS with emergency communication mechanisms that report, evaluate and disseminate early warnings on a 24-hour basis for communities to respond effectively (Republic of South Africa, 2005:14).

In the post-phase, Van de Walle, Turoff and Hiltz (2010:4) postulate that rapid and effective response requires very good information and communication technology (ICT), as well as a

great deal of preparedness from the pre-disaster phase. The 2011 Great East Japan Earthquake emphasised the significance of ICT. Sakurai and Kokuryo (2014:2) acknowledge that some hazards can destroy technology, but some systems continue to work. Examples are the packetised email system, TV tuners on smartphones, mobile phones, National Disaster Victims Support System that is Linux-based and is free and linked to other government departments. There are also other systems, which have proven to work during disaster response and recovery like Facebook, Twitter and WhatsApp for widespread dissemination of information to stranded people (Nace, 2017:1). For all these systems to work perfectly during a disaster there is a strong need for information management and communication systems. An example of such a system is that one with a modelling and simulation functionality that can direct responders to take effective courses of action in real-life situations (Republic of South Africa, 2005:71).

There are simulation models, which were developed by the Centres for Disease Control and Prevention (CDC) that help to provide data to decision-makers, to help respond to the next influenza pandemic. The planning or simulation models are FluAid, FluSurge and FluWorkLoss. The FluSurge for example, estimates surges in demand for hospital resources, like the number of available beds. (Meltzer, 2010:28). For recovery/ rehabilitation the IMCS must have business continuity plans to support the *"build back better"* principle (UNISDR, 2009:23).

In California, they use GIS to identify wind patterns that might bring fires to canyons. With such detection in place, the officials can put building codes for households in a specific area to have fireproof roofs. This mitigation tool used in California can be adapted to South African informal settlements and encourage the use of better building material that is fireproof. In South African shacks, they can start encouraging people to use fireproof materials and chemicals, like fire retardant for their shacks (Shange, 2018; Raborife, 2016; Lindup, 2015; Van DeWalle, Turoff & Hiltz, 2010:5).

The UNISDR (2009:25) indicates that preparedness requires solid linkages with early warning systems, contingency planning, business continuity planning, stockpiling of equipment and supplies, training, evacuations and simulation exercises. Having an operational information and communication system is preparedness because the system assists with command and control to help coordinate emergency personnel, locate resources and keep track of other activities. The South African Western Cape Provincial Disaster Management Centre has a system equipped for disaster preparedness. Sweta (2014:356) reaffirms the importance of

information requirements for all phases of the disaster management cycle, and he argued that obtaining the right information is useful for all phases in the cycle. Liu (2015:404), Van de Walle; Turoff and Hiltz (2010:13) add that the key functions of information management and communication systems are as follows: i) call centre services; ii) incident status board; iii) integrated message broadcasting system; iv) data management; v) asset management capacity; vi) contact management capacity; vii) task management capacity and viii) reporting capacity. Correspondingly, the study shares similar thinking with these authors, since most of the key functions are the same as those stated in the NDMF.

5.2.2 Components and technologies for disaster information and communication system

Rajaraman's (2018:1) definition of information technology supports the NDMF definition of information technology, which is the technology used to acquire, process, and disseminate data for use in specific applications after processing. This whole process leads to the production of *"information"* that is processed data. The information helps improve the knowledge that enables decision-makers to make timely decisions. The Merriam Webster dictionary (2018) defines technology as the application of scientific knowledge to the practical aims of human life or in a particular area to accomplish a task through technical processes. Disaster risk reduction is the fast-growing field that promotes the dissemination of non-sensitive information and data (UNISDR, 2015:13). It demands governments and communities to prepare and mitigate vulnerabilities; in this case, the need for information technology cannot be overemphasised (Earthquake management initiative [EMI], 2014).

Technologies are in two forms, namely: i) hardware, which is the physical equipment, for example, GPS and ii) software, which is the programme or codes that enable the hardware to perform a task, for example, GIS (Idreis, Siqueira & Levenstein, 2006:193). According to Van de Walle; Turoff and Hiltz (2010:4); Republic of South Africa (2005:66), there are different types of information systems. For example, there is the World Wide Web (WWW), a global wireless and mobile multimedia service, which is available on the internet to provide worldwide connectivity. Then there are GIS and GPS for real-time satellite photos, maps and other data. There are also earth observation technologies (EOT), such as space-based sensors for real-time mapping, as well as wireless satellite phones, facsimiles and drones for real-time data capturing and disseminating immediate relief. Then there are smartphones and social network systems for early warning communication (Chowdhury, Emelogu, Marufuzzaman, Nurre & Bian, 2017:168).

Practising disaster management requires effective management of information. Sasaki (2016:17) did a study on the 2011 earthquake and tsunami in Japan, where he mentioned that many buildings were destroyed, thousands of people injured and killed, and important documents destroyed. To mitigate the impact of losing documents, Sasaki (2016) recommended an IMCS that has a cloud server backup feature to help access lost documents. Sasaki's (2016) study focused on hospitals and he noted that decision-making on where to take patients was slow; hence, an IMCS, in this case, should be able to report the capacity each hospital can take without the responders having to inquire first.

It is important to note that information technology on its own is not sufficient for disaster management. Disaster managers need to analyse information and improve their practices to yield the full benefits of the systems (Sharman; Rao; Upadhaya & Cook-Cottone, 2010:13). There should also be a collaborative platform among various individuals, groups and, organisations to share information, make decisions and synergise response. Besides, there is a need for improvements in organisation processes, policies, infrastructure support, and system maintenance, ease of use, user adoption and training.

5.3 Case studies of information management and communication systems

This section discusses good practice case studies thematically obtained from interviews held with disaster management practitioners in South Africa and others from articles and books.

5.3.1 Mauritius

Mauritius launched its "*Digital Mauritius 2030 Strategic Plan*" in line with its "*Vision 2030*" of the Mauritian government. The project aims to transform the country into a high income and inclusive economy. Mauritius is emerging as a leader in Africa in information communication technology. The strategic plan emphasises the improvements in administrative processes, integrated services, big data, open data, data-sharing and smart mobile applications through a digital government. Set-up of the Mauritius Artificial Intelligence Council and the offering of 50 scholarships to students in technology and artificial intelligence, is one of the great actions Mauritius has taken towards stepping into the Fourth Industrial Revolution. Youth education supports the building of an innovation culture. As stated earlier, an even bolder and bigger move into the 4IR is the launching of the first Mauritian Cube Satellite in 2019. Mauritius also plans to build disaster recovery centres that are coupled with high-speed internet (Ministry of Technology Communication and Innovation, 2018). Karombo (2016) testifies to Mauritius'

big step towards the 4IR, by stating that Mauritius continues to retain the highest ICT development index (IDI) rank in Southern Africa.

5.3.2 Germany

While several countries affected by flooding in the world are still using sandbags as the traditional method for building temporary flood barriers (Ashley, Garvin, Pasche, Vassilopoulos & Zevenbergen, 2007:462), Germany designed state-of-the-art flood control systems in certain places, such as in the City of Koln. The system is a demountable barrier, engineered to provide a permanent flood defence, but is also removable when not in use. The RS Demountable Flood Barrier (RSDFB) panels protect structures from the flood as high as 4 metres, and they are lightweight, allowing for a single person to assemble. The RSDFB panels are strong and made of aluminium and have a locking mechanism, called compression clamps, to resist forces caused by floating debris (Flood Control Asia, 2019; Klippe, 2018). Germany has an excellent reputation in science, technology and engineering leadership (O'Reagan, 2019). So far, Germany has about 62 satellites launched in orbit; launching the first one in 1969 and nine in the year 2018 (N2YO, 2019). The satellites help Germany monitor the environment, more specifically the meteorological, and oceanographic images, as well as warning services to combatant commanders and others (Global Security, 2019).

5.3.3 United Kingdom Disaster Monitoring Constellation

As of 2018, United Kingdom (UK) is number 6 on the list of countries with the most satellites in the world, seating at 54 active satellites (Wood, 2019). In 2009, the U K launched the UK-DMC 2, a satellite dedicated to providing emergency earth imaging for disaster relief. Advancing even further into the 4IR, the UK went to launch the first smartphone-operated satellite, called the STRanND-1 (Worldatlas, 2019). During the presentation of the UNISDR Making Cities Resilient global campaign and its ten Essentials for Resilient Cities at the "*Technology for Disaster Risk Reduction: Structuring a Smart Disaster Risk Management Plan for Effective Safety and Security of Citize*ns" conference held in 2016, Korea, U K was used as a case study for one of the cities in the world that know how to identify, understand, as well as use current and future scenarios through the use of real-time data to assess safety and security (UNISDR, 2016). The U K ensures effective preparedness and disaster response through making available to its citizens a flood gauge and early warning platform. The U K also has a platform that features static open data and life data feeds, through public social media to respond to shocks like floods, storms and fires.

5.3.4 Information management system for Iraq mine action

In 2003, the Iraq Mine Action (MAP) programme lead to the development of an Information Management System for Mine Action (IMSMA) for support. The IMSMA was an UN-approved (United Nations) standard for information systems, supporting humanitarian demining activities. According to Van de Walle, Turoff and Hiltz (2010:14), Daniel Eriksson, a humanitarian consultant, reported his perceptions of the IMSMA. His report was based on participatory observation methods and his experience working in the Iraq humanitarian mine action.

The scholars' Van de Walle, Turoff and Hiltz (2010:14), together with Daniel Eriksson, claimed that an information management system should have a geographic information system interface. The system should contain disaster risk-related data, provide decision support functions, as well as support production of geographic maps (for example, maps of schools, hospitals, public halls, churches, historical data, past incidents, fire stations and other key points). The scholars and practitioner postulate further that a good system allows the disaster managers on-site to input data that will help determine the magnitude of the incident. They also say that on-site data inputting assists with monitoring the situation and allocation of resources.

Even though the United Nations approved the IMSMA, which was a successful system for the Iraq mine action, Daniel Eriksson identified some challenges associated with using it. The challenges were issues of security that led to the loss of staff members; lack of central governance; low staff retention; lack of decision support for the operational decision-makers that are working on-site; inefficient data collection methods; and a limited understanding of information systems. In conclusion, Daniel Eriksson concluded that international Consultants that develop some of these systems tend to ignore the environment in which the information system will be used (Van de Walle, Turoff & Hiltz, 2010:59).

5.3.5 Minnesota Inter-organisational Mayday Information System

Thomas Horan, Benjamin Schooley and Michael Marich from the University of Minnesota (UMN) did a study on time-critical information services for Emergency Management Services (EMS) in Minnesota in 2005 (Horan, Schooley & Marich, 2010:195). They designed the system for the Minnesota Department of Transportation, seeing that per annum, there were 35000 traffic accidents, of which, on rural roads, there were 60% deaths and on urban roads, there were 70% deaths out of the 35000 traffic accidents in Minnesota. The scholars focused their study on assessing the CrashHelp tool, developed to detect accidents and improve medical

emergency response in urban and rural Minnesota. The main purpose of the Mayday project was to develop a method that can mitigate the time taken to notify EMS and other stakeholders about the accident and respond. The automatic crash notification (ACN) system automatically creates incident reports for General Motors (GM) vehicles with crash detector sensors to pre-authorise emergency response and transport stakeholders, such as ambulances, police and the traffic department.

The advantages of this system were that it indeed minimised the response time of emergency services to the accident, communication was more effective and decision-making was more effective between stakeholders, like hospitals and emergency services. The system notification to the various stakeholders helps minimise stakeholder confusion on roles, responsibilities, and actions to take when responding to an incident.

Some interesting features about the system were that it already has the demographic data of the driver, such as age, which is relevant for EMS. Additionally, the system notifies the public travelling on the same route where there is an accident ahead. The system also warns of possible traffic congestion and it suggests alternative routes.

The information system must be able to facilitate coordination across all emergency services stakeholders, users must want to use it and be able to use it, the users must feel safe and secure when using the system and the system must leverage the use of smartphones, expansion of cell phone networks and the web. The system also helps eliminate redundant incident reporting, because the incident notification is distributed via both data and voice communication, which also launches resources more rapidly (Schooley, Horan & Marich, 2010:206).

The information system must be able to facilitate coordination across all emergency services stakeholders. Users must want to use it and be able to use it, the users must feel safe and secure when using the system, and the system must leverage the use of smartphones, expansion of cell phone networks and the web. The system also helps eliminate redundant incident reporting because the incident notification distributed via both data and voice communication also launches resources more rapidly (Schooley, Horan & Marich, 2010:206). Figure 5.3 illustrates the data routing system that detects the vehicle crash and then sends a message to the GM OnStar system.
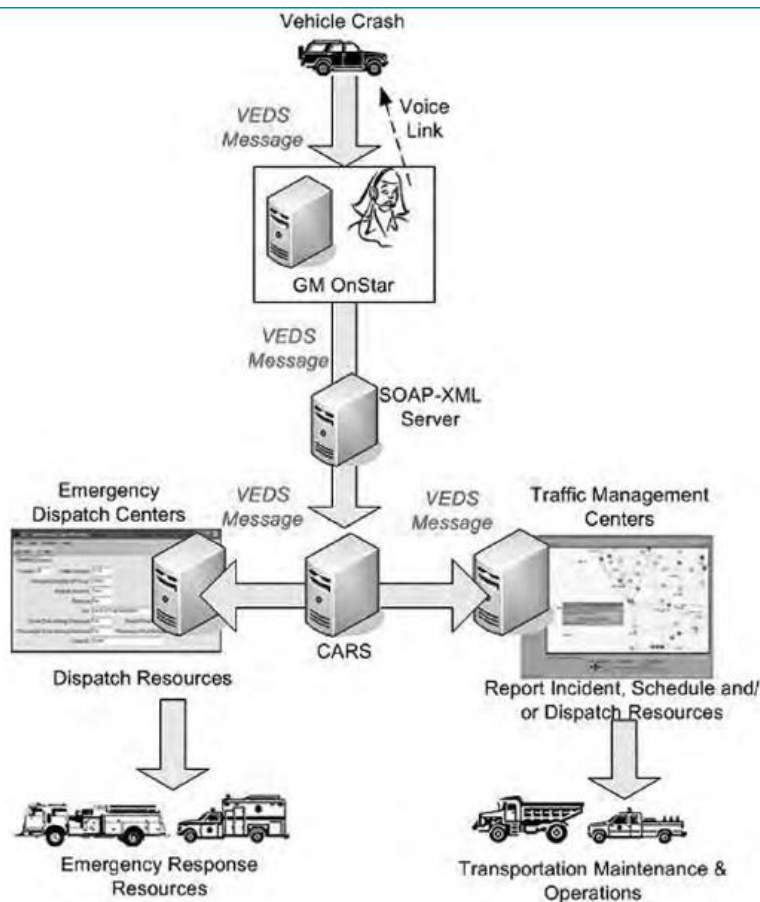
Figure 5.3 *Mayday emergency data routing system overview*
Source: (Schooley, Horan and Marich, 2010:204)

On receiving the message at the GM OnStar, the operator calls the driver for more information about the accident (thus the data communication plus voice communication for effective response). The relevant responders receive rich information about the incident, containing full details of the incident for effective response and treatment of the people involved in the accident.

5.3.6 South African Air Quality Information Systems

The South African Air Quality Information System (SAAQIS) is a web-based interactive information system for air quality. It provides the state of air quality information to various stakeholders. This system has proven to contribute to the strengthening and the development of the air quality policy. It has been functioning for more than 12 years and now has good historical data to help understand air quality trends and impacts. The National Environment Management Air Quality Act 39 of 2004 also supports the SAAQIS system (Republic of South Africa, 2004:13). The system contributes to the identification of areas with improving air quality and those with deteriorating air quality. This helps inform the development of

innovative technologies for use at the household level to improve community health. The SAAQIS expects municipalities and provinces with these systems to report their air quality data to the SAAQIS database. Besides, every industry that emits, needs to have an Air Emission Licence (AEL) for example, South African companies like the Global integrated chemicals and energy company/ South African Synthetic Oil Limited (SASOL) (Rannditsheni, 2010). Further, clinics and schools, just to mention a few, should have Ambient Monitoring Systems installed (De Veer, personal communication 16 October 2018). The reason for having such systems in places like these is because most schools are near industrial pollution sites or busy roads where vehicles emit gases that might be detrimental to children's health. As for clinics, they are highly exposed to gems because of the ill people visiting the clinics (Aeroqual, 2020).

There has been a growing concern for the need to reduce the risk of air pollution globally (Chen 2012). This concern requires disaster managers to tap into such air monitoring systems and engage the environmental specialists for assistance with monitoring and mitigating air pollution.

5.3.7 Western Cape Provincial Disaster Management Centre (WCPDMC) Systems

Most of the disaster practitioners in South Africa consider the Western Cape Provincial Disaster Management Centre (WCPDMC) system as the best in South Africa. The practitioners base their perception on the notion that other practitioners use it in their benchmarking tests to establish their system (Nokoyo, Rylands & Carstens, personal communication, personal communication, 20 August 2019). The interviewees stated that even though other Centres benchmarked against their system, it is not a state-of-the-art system nor is it according to the minimum standards alluded to in the NDMF.

The interviewees (Nokoyo, Rylands & Carstens, 2020) describe their system as a Disaster Management Support Tool (DMST). It has a web-based GIS, which identifies critical infrastructures, like water points, electricity points, high-risk areas, schools, hospitals and many other points. They also have an SMS dissemination system for early warning information. The WCPDMC collaborated with the Transport Management Centre (TMC) and Emergency Services in Cape Town so that they can have access to the Traffic Management Monitoring System.

The challenges WCPDMC encounter with the system is that the fragmented nature makes access to information and sharing difficult. Some of the information and systems are only

accessible to a few individuals; if those individuals are not available, then there is no access. The NDMF, enabler 1 states that there are information and communication needs for all KPAs and enablers, but the WCPDMC system does not support all of them.

5.3.8 KwaZulu Natal Provincial Disaster Management Centre (KZNPDMC) – Benchmarking towards the establishment of Information management and communication system

Adhering to the mandate of the DMA and the NDMF, section 29, the Department of COGTA embarked on a journey to establish a KZNPDMC. The NDMF, section 1.2.4.1, clearly states that "*The PDMC must establish integrated information management and communication system that is consistent with arrangements established by the NDMC*". Because of this mandate, Ndlazi (personal communication, 1 October 2018) the Chief Director of KZNPDMC, observed this mandate and commenced a benchmarking test for the establishment of an integrated disaster management information and communication system for KZNPDMC. Lessons learnt from the integrated information communication systems for emergency coordination in New York, as tabled by COGTA to the Cabinet Sub-Committee on South African International Relation in 2017, were also a motivating factor.

In his benchmarking report, Ndlazi acknowledges the prescriptions of the NDMF, enabler 1, on what an IMCS should entail. Ndlazi nominated an Inter-Departmental Task Team (IDTT) to assist him with the benchmark. The team members are as follows: COGTA communications, corporate services, ICT, Finance, Development Information Services, Public Participation and Ministry, ILembe District Disaster Management Centre, eThekwini Disaster Management Centre, Department of Transport, Department of Health and the Provincial Treasury. The task teams' roles were as follows:

i)   Needs analysis;
ii) Benchmark on the best practices locally and internationally;
iii) Provide technical support.

The nominated Inter-Departmental Task Team visited nine local and international institutions from March to July 2018 as part of the benchmarking exercise. The team found that the Department of Health Emergency Response Services (DoH-EMRS) in Pietermaritzburg makes use of bulk short messaging services (SMS) and two-way radio communication for incidents, like motor vehicle accidents (MVA's). The KwaZulu Natal Fire Protection Association – Lions

River and Howick, use fire detector systems, Fire Danger Index (FDI), telecommunications hardware and software and qualified staff.

5.3.8.1 National level: KZNPDMC benchmarking points of interest and lessons learnt

This section summarises all the points of interest and lessons learnt from the KZNPDMC benchmarking exercise. The South African Road Agency Limited (SANRAL) has electronic messaging boards on the roads, cameras on the roads and a communication centre for monitoring traffic. The Western Cape Provincial Disaster Management Centre, Cape Town, uses a system that links with other stakeholders and uses SMS to disseminate early warning messages. The City of Cape Town Municipality has a system linked with CCTV cameras and an operations centre installed with video conferencing. The South African NDMC has a GIS portal and the system has historic records of past disasters. The council for Scientific and Industrial Research (CSIR) in Pretoria has a web-based system that can track weather conditions such as storms.

5.3.8.2 International level: KZNPDMC benchmarking points of interest and lessons learnt

The Rockland County Operations and Dispatch Centre in New York has a community siren and loud hailing system that uses solar panels. The California Governor's Office of Emergency Services (Cal OES) manages and coordinates the states and federal response system, it has eight multi-disciplinary urban search and rescue task forces, twelve regional task forces, eighteen type 2 mobile rescue coaches and thirteen swift water and flood rescue teams. The Cal OES uses satellite phones, two-way radios and mobile communication vehicles. These mobile vehicles also have kitchens for emergency meals.

Despite some identified pitfalls in some information systems, the benchmarking test for KZNPDMC was successful and informative. It gave them rich ideas on what their system should look like. From all the organisations they visited, the task team nominated Cal OES as the best system. They look forward to entering into Memorandum of Understandings (MOU's) with different stakeholders, employ highly qualified and skilled personnel to run the centre and continue with this kind of research to better their system.

5.3.9 South African National Disaster Management Centre

In a telephone interview with Van Staden (personal communication, 1 October 2018) a geographical information systems specialist with the South African NDMC, agreed with the study's argument that IMCS is the *"nerve centre"* for any disaster management centre. Van Staden is the head of the directorate, *"Early Warnings and Capability Management Systems"*.

It is a directorate located within the chief directorate, *"Information Technology, Intelligence and Information Management Systems"*.

Van Staden stated that a good IMCS should accommodate current technologies. The IMCS should have a business intelligence technology with a strong database system for managing risks. The system should have a decision support system; an operational support system; email; GIS; and, strong bandwidth, just to mention a few. The NDMC uses a *"National Disaster Management Information System"* (NDMIS) as indicated in the DMA, section 17(1)-(4) (b). The NDMIS is a fragmented system with different support components. Van Staden stated that it is, however, not a limiting factor to the operational success of the NDMIS. The NDMC activated its system to the fullest in 2018 when they declared the drought a national disaster. The NDMC provided information to the National Joint Drought Coordinating Committee (NJDCC). However, during the empirical study, the NDMC respondents did not mention the NDMIS.

The NDMF states that the NDMC *"must"* develop guidelines that will help support the implementation of the framework in all three spheres of government (Republic of South Africa, 2005:2). In support of the mandate, NDMC has developed some guidelines, but the guidelines for the development and implementation of enabler 1 (IMCS) have not yet been developed. As the study argues, this might make it difficult for Provincial Disaster Managers in South Africa to develop and fully operate their own IMCSs. Van Staden states that the NDMF, in particular, enabler 1, is easy to comprehend. He, however, states that when the promulgation of the NDMF was made in the year 2005, it did not accommodate the future growth in technology. Smartphones came into the market in 1992, and as a new technology, they fought for their acceptance in the market (Tweedie, 2015). Social media was developed after 1997 (Hendricks, 2013) and trying to get the attention of the market. Van Staden added that even though enabler 1 is easy to understand, it still requires a reader with good interpretation skills and with the ability to stay abreast on new technological developments.

5.4 General comments on the case studies

Deriving from the case studies, information management and communication systems are contextual to the environment in which they are used. Some of the IMCS components might or might not be useful in certain environments. By environment, the study refers to hazards, work sector or discipline, community or country, geographic location and so on. Also, good

information management and communication systems should adhere to ethical issues when it comes to the reporting of disease outbreaks, dead or missing persons, as such information carry the risk of privacy and confidentiality infringement (Van de Walle, Turoff & Hiltz, 2010:59).

The scholars for the case study on the Mine Action in Iraq emphasise that a Geographical Information System interface is mandatory for an IMCS; yes, this might be an unnegotiable need, but might not be a requirement for some environments.

The scholars for the Mine Action case study in Iraq identify various challenges associated with the use of the mine action system, such as poor data collection methods and a poor general understanding of the system. These challenges are not immune to their system alone but apply to most systems globally. One prominent problem is the reliance on consultants, overseas countries or universities. These companies tend to ignore the environment in which the information system is going to operate.

A system like the Minnesota inter-organisational Mayday information system encourages the participation and involvement of various stakeholders. Such a system is relevant and applicable to disaster management because they make decision-making more effective through the identification of their roles and responsibilities. The system also supports profiling of the communities at risk, data that the disaster managers should have and constantly update in case of disaster response.

The KZNPDMC benchmarking test did not employ a methodology to illustrate how it decided on the task team, the institutions to visit and nomination of the best system. The NDMF states that each KPA and each enabler requires information and communication, as well as the need to establish communication links with stakeholders from all spheres of government (Republic of South Africa, 2005:3). In this case, the KZNPDMC task team is incomplete. This study encourages that someone knowledgeable of the contents of each, should manage each KPA and enabler as follows:

    i)   KPA 1 - Institutional Capacity Building or Stakeholder Expert;
    ii) KPA 2 - Risk Assessment and Monitoring Manager;
    iii) KPA 3 - Disaster Risk Reduction Plans and Programme Manager;
    iv) KPA 4 - Response and Recovery Manager;
    v) Enabler 1 - Information Management and Communication Manager;
    vi) Enabler 2 - Education, Training and Research Officer;

vii) Enabler 3 - Disaster Management Funding Manager.

Therefore, the KZNPDMC, in support of the requirements of the NDMF, should have included on its task team all the above-mentioned managers, because it did not include them as internal experts, forming part of its benchmarking test, which is a shortfall on the exercise. The conclusion can be that there is a gap in the South African disaster management centres concerning information management and communication systems, hence the study's research into the matter.

5.5 Conclusion

The chapter identified and discussed with practical examples some key features, functions and technologies used to support the operation of an IMCS. Interesting to note is the different needs, requirements and uses for IMCS in disaster management. The consultative process with the South African disaster management practitioners yielded informative good practice case studies. A literary review of works on information management systems for emergencies complemented the consultation with the practitioners. This process gave a local and international perspective of the various good practices in emergency response and disaster management. In the South African disaster management fraternity, there are different information and communication requirements for different KPAs and enablers. From a global perspective, some scholars identified different information and communication requirements for the implementation of disaster management cycle phases. However, the building and enhancement of the IMCS can consider both requirements. Lastly, the chapter discussed four case studies: the South African National Disaster Management information system, the Minnesota inter-organisational mayday information system, the information management system for Iraq mine action and the Western Cape Province disaster management centre. All the systems have advantages and disadvantages. One common advantage they all share is the full usage of geographical information systems and the common disadvantage shared is the full usage of information and communication in response situations and minimal usage in risk reduction. However, in conclusion, the South African disaster management fraternity has ample potential to adapt to the 4IR, because of its 46th out of 79 countries ranking, in terms of strides made in data centres, cloud services and broadband.

CHAPTER 6: RESEARCH DESIGN AND METHODOLOGY

6.1 Introduction

This chapter discusses the research design and methodology that the study employed to investigate the research questions and objectives. In this regard, to investigate the status quo and dynamic experiences encountered by the South African PDMCs in establishing IMCS. A constructivism philosophical worldview approach was well suited for this study in collecting and analysing the qualitative and quantitative data of participants' views. The study applied the mixed-method approach. This approach combines both qualitative and quantitative research components to understand the breadth and depth of the problem under investigation. Mixed-methods are commonly used in social sciences and help ascertain individual attitudes, beliefs and opinions of their experiences (Schoonenboom & Johnson, 2017). Additionally, Creswell and Clark (2011:4) meticulously defined mixed-methods, as that kind of research where the investigator collects and analyses data, integrates the findings and then draws inferences, using both qualitative and quantitative approaches in a single study.

Moreover, the chapter discusses the purposely-selected participants, as well as the questionnaire and observational walk that were an informant to the selected study areas. Purposive sampling is usually used when the researcher has access to the subjects, however, it sometimes opens the selection to bias (Leavy, 2017), therefore, methods for mitigating bias were discussed in the chapter. The study employed qualitative data analysis procedures, prescribed by the following authors, Miles, Huberman and Saldana (2014); Silverman (2016); Creswell (2009); Fairclough (2013) and Flick (2014), as well as a narrative inquiry proposed by Kim (2016). For quantitative data analysis, the study used descriptive analysis for summarising data and finding patterns for example frequencies (Garcia, 2018; Kemp, Hort & Hollowood, 2018). Further, the chapter provides strategies for validating the research findings, as prescribed by Creswell (2014). To conclude, the chapter discussed the anticipated ethical issues and the experienced limitations of the study. In this chapter, the researcher keeps in mind the research questions and objectives of the study listed in Chapter 1. This helps ensure that the data collection methods align with the questions and objectives (Kervin, Vialle, Herrington & Okely, 2006:79).

With that said, this chapter discussed the research paradigms, the research designs and methodology, the validation and reliability strategies and then ends with the limitations and ethical considerations.

6.2 Research paradigms

The researcher acknowledges that research should consider identifying a philosophical worldview assumption to bring to the study when planning it, as well as to identify the research methods to help translate the approach into practice (Creswell, 2014:34). Moreover, a philosophical foundation shapes research decisions and shapes how a person learns about human behaviour or phenomena (De Ploy & Gitlin, 2011:16). Figure 6.1 illustrates the framework of the research.
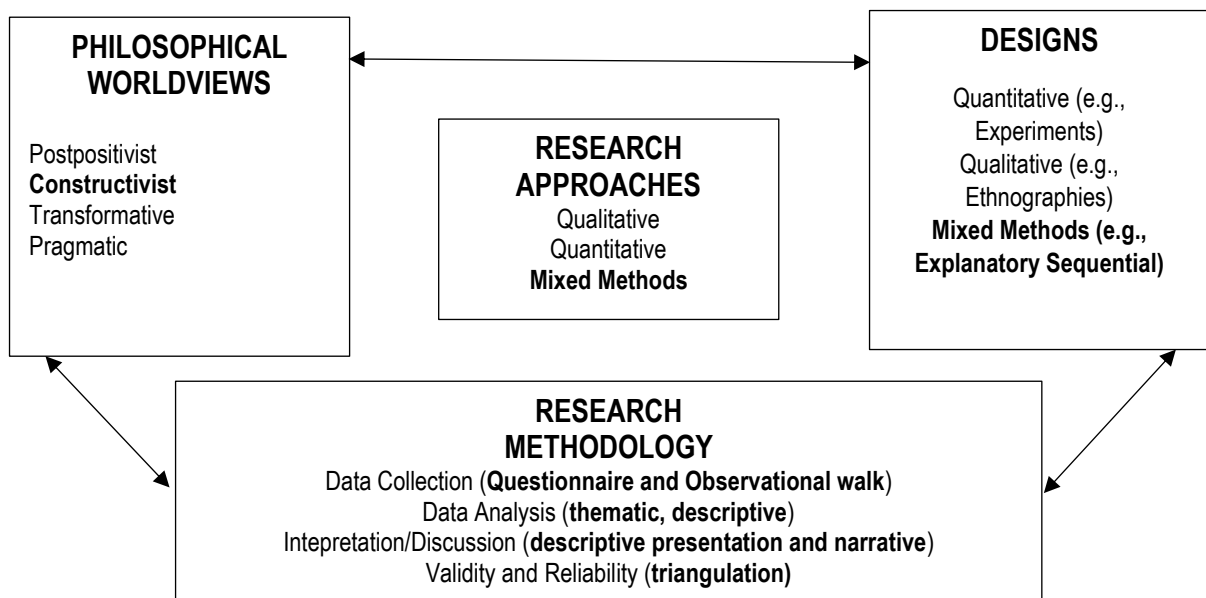
Figure 6.1 *Framework for research: The interconnection of Worldviews, Designs, and Research Methods*
Source: (Adapted from Creswell, 2014: 35)

In social science research, there are five paradigms of inquiry: first, *positivism*, second, *post-positivism*, third, *critical theory*, fourth, *constructivism* and *participatory*. The following inform these paradigms:

i) Ontological beliefs inquire about the nature of reality;

ii) Axiology addresses the nature of ethical behaviour;

iii) Epistemological assumptions inquire how we know what we know;

iv) Methodological assumptions relate to the process of research (Creswell, 2014:54; Killam, 2013:6; GeorgeLee, 2012:406; Lincoln, Lynham & Guba, 2011:97; Ponterotto, 2005:130).

Therefore, the constructivist approach supports the phenomenon this study investigated. Ontological beliefs also formed the foundation of this study, because they helped inquire about the nature of reality.

6.2.1 Constructivist approach to information management and communication systems

This study was guided by the constructivist worldview, which is a philosophical worldview that also guided the research in selecting participants and methods the study used (Creswell, 2014:37; Denzin & Lincoln, 2011:91; Ponterotto, 2005:128). The constructivist worldview is typically seen as an approach to both quantitative and qualitative research, where the researcher seeks to understand the world in which the research participant(s) lives and work and then in return develop the subjective meaning of their experiences towards certain things. For example, this study aimed to understand the provincial disaster managers experiences and perspectives on the different view of the phenomena. The researcher looked for the complexity of views through relying on a survey and discussion with experienced and knowledgeable participants in the field of disaster management for their views on IMCSs (Ponterotto, 2005:134; Given, 2008:17).

6.3 The study research design and methodology

The study applied a mixed-method design, exploring both qualitative and quantitative methods. Slevitch (2011:80) postulates that qualitative and quantitative methods can be used in a single study or a series of investigations. With the mixed-method approach, there are six design strategies which are: (i) sequential explanatory; (ii) sequential exploratory, (iii) sequential transformative, (iv) concurrent triangulation, (v) concurrent nested and lastly, (vi) concurrent transformative (Schoonenboom & Johnson, 2017; Creswell, 2003:211; Research Rundowns, 2019). This study made use of the sequential explanatory, which is characterised by the collection and analysis of quantitative data, followed by the collection and analysis of qualitative data.

The study employed a purposive sampling as a non-random and non-probability sampling technique. The purposive sampling technique was selected because it is most effective when one needs to study a certain cultural domain with experts and key informants within the domain

(Etikan, Musa & lkassim, 2016:3; FPalinkas, Horwitz, Green, Wisdom, Duan & Hoagwood, 2015:534; Tongco, 2007:147).

The qualitative approach is an empirical method, which involves the collection, analysis, and interpretation of data (Ponterotto, 2005:128). The qualitative approach explored was the phenomenological research design, which is common to qualitative studies (Vagle, 2018:11; Given, 2008:117). The phenomenological design describes the lived experiences of several individuals about a phenomenon as described by the participants (Bloomberg and Volpe 2018: 110; Vagle 2018: 11; Slevitch 2011:80; Ponterotto 2005:128). Quantitative methods explore the objectives of the study through the gathering and analysis of numerical data to help explain a particular phenomenon. In this case, the study made use of the survey design (Daniel 2010).

Mixed-methods explore and obtain a depth of understanding, the reasons for success or failure to implement or identify strategies for facilitating the implementation of something (Palinkas, Horwitz, Green, Wisdom, Duan & Hoagwood 2015:533). As discussed in Chapter 1, the disaster management fraternity is 18 years into the South African democracy, and reasonably new at the governance of disaster management. There are a significant number of activities that are still outstanding in the functioning of the disaster management centres (Van Niekerk, 2014:863; Botha, Van Niekerk, Wentik, Coetzee, Forbes, Maartens, Annandale, Tshona & Raju, 2011:9; Van Niekerk, 2006:97). Chapter 1 refers to the functions; however, of particular interest to this study was the lack of information management and communication systems. The study suggests that the absence of IMCSs in provincial disaster management centres was questionable and unacceptable. The NDMF clearly states that the cost of developing an IMCS must be incorporated into the start-up costs for disaster management centres (see sub-sections 1.2.2, 1.2.4, 1.2.5 and section 7.4) (Republic of South Africa, 2005:95). Therefore, the study sought to determine the experiences concerning this issue from the different disaster managers working in the PDMCs, through a quantitative and qualitative inquiry. The experiences were presented in the form of narrative case studies for each province in Chapter 7.

6.4 Selection of cases or sample size

The mixed-method approach makes use of five types of sampling techniques, namely: (i) basic mixed-methods sampling strategies, (ii) sequential mixed-methods sampling, (iii) concurrent mixed-methods sampling, (iv) multilevel mixed-methods sampling and, (v) sampling using multiple mixed-methods sampling strategies (Teddie and Yu, 2007). This study applied the basic mixed-methods sampling strategy because it makes use of the stratified purposive

sampling (Vagle, 2018:11). The basic mixed-methods sampling follows the multistage sampling technique procedures that involve the selection of a community or organisation in the first stage and then in stage two, the selection of household or employees (Onwuegbuzie & Collins, 2007; Leon, 2003:58; Singh & Mangat, 1996:222). Further, the study employed purposive sampling as a non-random and non-probability sampling technique. The purposive sampling technique was selected because it is most effective when one needs to study a certain cultural domain with experts and key informants within the domain (Etikan, Musa & Alkassim, 2016:3; Palinkas, Horwitz, Green, Wisdom, Duan & Hoagwood, 2015:534; Tongco, 2007:147).

The small number of cases obtained from the stratified sampling is characteristic of purposive sampling. The researcher identified groups of interest: first, the South African disaster management centres, second, the national and provincial disaster management centres and lastly, the head of the Centres and their immediate subordinates. An imperative dimension to this diverse sample was to ensure a precise coverage of the whole country and to promote the power of the study to offer conclusions (Littler, 2020). The NDMC was included because the study considered it a rich source of information for comprehending the objectives of this research. At the NDMC, the participants included the Deputy Director-General and the Chief Directors. At the PDMCs, the research participants varied; some were Chief Directors, some were Directors, while others were Deputy Directors or Assistant Directors. Table 6.1 shows the total number of respondents who participated in the empirical research. The respondents are shown in pseudonym names. However, the study did not allocate a pseudonym for the NDMC because there was no other way of concealing it. As discussed in Chapter 1, the study intended to obtain 80 participants; however, this was not the case during the fieldwork. Therefore, the study reached a total of n=34.

Table 6.1 *Total number of respondents*

| | NDMC | PDMC | | | | | | | | | TOTAL SAMPLE |
		PDMC 1	PDMC 2	PDMC 3	PDMC 4	PDMC 5	PDMC 6	PDMC 7	PDMC 8	PDMC 9	
Head of Centre	1	1	0	1	0	1	0	1	1	1	**7**
Director/Deputy Director/Assistant Director/Other	4	3	3	4	3	0	4	2	2	2	**27**
TOTAL	**5**	**4**	**3**	**5**	**3**	**1**	**4**	**3**	**3**	**3**	*n = 34*

Source: (Authors own)

6.4.1 Justification of the sample size
Important to note are the factors that determine the size of a qualitative study sample, which are: (i) saturation, (ii) diminishing return, (iii) focus on meaning and (iv) not making a

generalised hypothesis and then lastly, (v) qualitative research is labour-intensive (Mason, 2010:2; Ritchie, Lewis & Elam, 2003; Crouch & McKenzie, 2006). Leedy and Omrod (2001:158) further state that qualitative studies require a lot of time. The sample size for this study is justified by the chosen research design, which is a mixed-method. For this particular design, Slevitch (2011:78); Creswell (1998:64); and Morse (1994:225), assert that the sample size is irrelevant and that the number of cases can be from 5 to 25 participants. Besides, Teddie and Yu (2007:86) argue that the samples vary in size, depending on the research question. Further, the sample size for the mixed-methods varies from a small number of cases to a large number of units of analysis. This study's sample size was representative of the QUANT (quantitative) sources and the saturation of QUAL (qualitative) sources.

The research questions and objectives of this study warranted data collection at South African national and provincial level, merely because the national government and provinces are responsible for the administration of the legislature and facilitation of economic activities. They also supervise the local government to ensure harmony in the functioning of South Africa (National Treasury, 2019; Mathenjwa, 2014:180). The provinces were made *"watchdogs"* on behalf of the national government for the implementation of the legislation, rendering municipalities at their mercy (South African Local Government Association [SALGA], 2017; Department of Provincial and Local Government [DPLG], 2007:9). Typically, the provincial disaster management centre must liaise with the national and municipal disaster management centres, recommending, advising and acting as a consultative body to all stakeholders (Republic of South Africa, 2005:12; Republic of South Africa, 2003:30). Accordingly, the rich empirical findings from the NDMC and provinces led to the "*generalisability*" or rather "*transferability*", a more preferred term in qualitative studies (Lincoln & Guba, 1985). Hence the findings can be transferable to the metropolitan, district and local municipality disaster management centres.

6.5 Interviews to inform the good practice case studies in Chapter 5

Chapter five was informed by data collected through interviews. As part of the mixed-methods approach, Creswell and Clark (2011:6) support the commencement with interviews, analysing the information and then using the findings to develop a survey instrument. The researcher carried out interviews to collect background information because the scholarly research on disaster information management and communication systems in South Africa is limited. Secondly, to test the quality and validity of the possible empirical results and lastly, to try out

the research approach and identify potential problems (Blessing & Chakrabarti, 2009:114). Thirdly, to introduce the researcher to the participants (Durdella, 2019). Five disaster managers were purposively selected and emailed a set of questions. One disaster manager was from the NDMC and the other four from the PDMCs. An interview guide was emailed to them and due to a lack of response to the emails, telephone interviews were carried out.

The data collected were arranged logically. The order was according to specific themes, such as the Centres' disaster management information and communication systems, specific events where the system is activated and, challenges experienced. The data collected informed the write-up of the case studies. All case studies contained conclusions, which helped uncover possible solutions (Leedy & Ormrod, 2013:149). The possible solution was presented as general comments at the end of the chapter. Moreover, the researcher reviewed books and journals on international information management and communication systems. The case studies obtained from the literature review helped benchmark against the South African standards.

6.6 Data collection

Data were collected through an open and closed-ended questionnaire and an observational walk in the Centre capturing pictures.

6.6.1 Questionnaire

The questions posed in the questionnaire to the respondents ranged from opinion questions to a few yes or no questions (Hofstee, 2010; King & Horrocks, 2010). As supported by Litchtman (2010), some of the open-ended questions varied as the disaster managers shared different lived experiences and sought clarification on a particular section. The in-depth nature of open and closed-ended questionnaires makes them a socially acceptable method of understanding respondents beliefs, opinions, and experiences (Mann, 2016). The questionnaire helped to elicit detailed lived experiences and insightful account of the phenomenon from the participants (Turley, Monro and King 2016: 1). The questionnaire shed more light on the individuals past and present experiences, annual expenditure allocated to the Centre, comprehension of the NDMF and so on (Chon, 2013:8). For example, the annual amount the Centre receives triangulated with the reason why the Centre does not have a system in place. The questions in the questionnaire were mainly informed by the National Disaster Management Framework as well as the literature review findings.

Scholars further argue that it is best to start a discussion with questions that participants can answer easily and then proceed to more difficult questions (Gill, Stewart, Treasure & Chadwick, 2008:292). The respondents were asked about their biodata first, which helped put them at ease, build up confidence and rapport. Biographical data provided the background of each individual's life experiences (Zinn, 2004:8). Age, race, highest level of education, employment history, years of experience, current occupation, and training are some of the questions covered in biographical data (Schoumaker & Beauchemin, 2015:992; Cooper, Robertson & Tinline, 2003:136). The questionnaire required the respondents to answer multiple-choice questions for easier completion, but limited choices were a disadvantage (Catano, Wiesner, Hackett & Methot, 2009:302). To allow the respondents the freedom to share their opinions on the issue, the respondents were free to discuss the responses to the closed-ended questions. These discussions added to the qualitative data. However, the open-ended nature of the questionnaire helped yield more information than the closed parts (Gill, Stewart, Treasure & Chadwick, 2008:292). The following are the procedures the researcher followed:

i) The researcher called the PDMCs and the NDMC to introduce the study and to build rapport;

ii) An email was sent to the PDMCs and the NDMC requesting an appointment and reminding the potential participants of the study;

iii) Appointments were granted and were set a month in advance. The meetings were held at the PDMCs and the NDMC, because of the observational walkabouts;

iv) The questionnaires were emailed in advance;

v) The researcher, together with the assistants travelled to the Centres starting 27 September and ending 4 November 2019, spending a full day at each Centre;

vi) King and Horrocks (2010:43) and Jamshed (2014:87) indicated that interviews can be at least 1 hour; however, because the respondents were eager to share their lived experiences, the interviews were longer, lasting at least 2 hours per respondent;

vii) The researcher used an audio recorder, pen and paper with the research assistants assisting.

6.6.2 Observation walk
According to Hennink, Hutter and Bailey (2011:179) and Leedy and Ormrod (2013:153), observational walking in social sciences enable researchers to systematically observe and record people's behaviours, actions and interactions. On the other hand, Sreejesh, Anusree and Mohapatra (2014:18) challenge Hennink, Hutter and Bailey's (2011) definition of

observations, arguing that counting the number of vehicles passing through a junction can qualify as observation research. Even scholars like Bryant (2008) argues that, though observation is associated with ethnographic methodology, it can be used as part of other research designs. Therefore, with Sreejesh, Anusree and Mohapatra's (2014) definition of observations, this study informally observed the spatial environment of the disaster management centres. It should, therefore, be understood that this observational study was of the spatial area, infrastructure and work environment of the PDMCs and not so much of the participants.

Data collection for phenomenological research usually includes observations, because they are the most informative method of research (Creswell, 2014:42; Novikov & Novikov, 2013). The former authors and these authors, DeWalt and DeWalt (2002:92), further state that observations are qualitative researchers' most important tool because they support other's research tools like questionnaires. As a secondary data collection tool for this study, observations are important, because they enhance the quality of the entire data collected (DeWalt & DeWalt, 2011:10). According to Angrosino (2007:38), the moment the researcher enters the field setting, the observations begin. As supported by Pasco (2013:83), informal observation is taking note of possessions in a home or office and that it is a process that goes on during the whole process of data collection. The researcher intended to identify the spatial area with photo-taking and focusing on the list of components identified earlier and other relevant components that are not mentioned above. The purpose of observational walking is to develop a holistic understanding of the phenomenon under study (DeWalt & DeWalt, 2002:92).

The study developed an observational guide that was informed by the DMA 57 of 2002 Guidelines, Volume 1. This DMA identifies what various components a disaster management centres information technology and communication infrastructure should include. The main components are as follows, but not limited to:

i) Server room (housed onsite);
ii) Hardware (smart televisions, voice recorders, telephones, computers, fax machines, photocopiers, printers, document scanners, shredders, public address systems, network cables, routers, cabling, trunking etc.);
iii) Software (Word processors, spreadsheets, database programmes, e-mail programmes, Web browsers, development tools, drawing tools, paint tools, image editing, GIS, communication programmes);

iv) Data or databases (raw quantitative and qualitative data/information obtained for storage into the system);

v) Networks (computer networks that allow computers to share resources to communicate, high-speed internet using more than one connection type);

vi) Policies and procedures (purchasing policy, usage of personal devices policy, security policy, administrative policy, electronic transactions policy, service agreements, data backup and recovery policy;

vii) People (information technology and communication specialists and technicians) (Republic of South Africa, 2016:19);

The observational walk and capturing of images with a camera helped pinpoint the provincial disaster management centres' infrastructure, which in turn helped determine the status quo and existence of IMCSs. The walk further supported the data obtained from the questionnaire (Struwig & Stead, 2015:100; Flick, 2018:23; Seawright, 2016:4). The observational guide that was used for the study is in ANNEXURE 5.

6.7 Data capture, analysis and presentation

The study employed elements of quantitative and qualitative data analysis processes, prescribed by Samuel (2011), Creswell (2009:245) and Tesch (1990). These scholars emphasised that data analysis is an ongoing process that does not only wait for the end of the study. Miles, Huberman and Saldana (2014:14) concur with them, adding on that data analysis is a continuous and iterative enterprise.

For *qualitative data analysis*, this study used the narrative analysis method. The data were from the open-ended questions and semi-structured discussions, held during the questionnaire session. Additionally, the study obtained data from the observation walk. The thematic data analysis involved the following:

i) Familiarising with the dataset, general comments and pictures;

ii) Assigning themes to a set of items observed (e.g., infrastructure and so on);

iii) Sorting the themes assigned to the observation and relating them to some findings from the questionnaire;

iv) Noting unique items observed;

v) Elaborating on items observed and then comparing the findings with the body of knowledge or theories.

The study presented the qualitative data in a narrative format. To support the decision to narrate the findings, Kim (2016) borrowed this quote from the theorist Benedetto Croce, saying *"Where there is no narrative, there is no history"*. Based on this quote, the study explores this basic strategy of human expression to capture the experiences of disaster managers working in the provincial sphere of government. The study identified the narrative mode of thinking as the best way of using stories to better comprehend the measure of human actions, experiences, challenges, feelings, goals and perceptions. Narratives provide one of the best possible ways for researchers to obtain a wealth of personal qualitative data (Goodman, 2011). Correspondingly, this approach provides a clearer picture of the issues under investigation more than a quantitative approach. Further, Kim (2016) identifies narrative inquiry as a legitimate form of generating knowledge in social science research.

Data analysis of the quantitative questionnaire begun with the consideration of the format and content of the survey questions. Second, the provision for clear and justifiable links between indicators (the questions) and what was measured was made. The data were then prepared for entering into a spreadsheet (Excel). The study made use of the descriptive statistics analysis method. Descriptive analysis assisted the researcher with summarising the data and finding certain patterns. The following are some of the statistics:

i)   *Mean* for identifying a numerical average of a set of values;
ii) *Median* is used for identifying a set of numerical values;
iii) *Mode* is mostly common for value among a set of values;
iv) *A percentage* is for expressing how a group within the data relates to a bigger group of respondents';
v)   *Frequency* involves the counting of the number of times a value appears;
vi) *Range* entails the highest and lowest value in a set of values.

This study used percentages. After the data was captured and analysed, it was presented visually in tables, graphs and histograms (Leavy, 2017).

Mixed-methods generate both numeric and narrative data. Hence, this study's process ended with a written report entailing a representation of text and numeric information in figures, tables and pictures, verbatim notes and personal interpretations, relating to the research questions (Garcia, 2018, Miles & Silverman, 2016:333; Huberman & Saldana, 2014:14; Flick, 2014:1; Fairclough, 2013:132; Creswell, 2009:32).

6.8 Validation and reliability

For reliability and validity of the data, the researcher should follow certain procedures to check for the accuracy of the findings. Reliability and validity in mixed-methods research mean identifying the extent to which test scores are accurate, consistent, stable and the degree to which our statements are approximate to the truth. In their study on the typology of mixed-methods sampling in social sciences, Onwuegbuzie and Collins (2007:299), recommended a reconceptualisation of traditional validity concepts. They suggested the replacement of (i) internal validity (quantitative) to credibility, (ii) external validity (quantitative) to transferability, (iii) reliability (quantitative) to dependability and then (iv) objectivity (quantitative) to confirmability. The research questions and objectives of this study make it credible and transferable to other spheres of government, like the metropolitan, district and local municipalities.

It is important to clarify the concepts, because the way validity and reliability are tested and measured in a quantitative study, is different or cannot be applied to qualitative research (Smith & Noble, 2014). These scholars identify a number of reliability and validity strategies (Struwig & Stead, 2015:152; Creswell, 2014:253; 6 & Bellamy, 2012:22; Onwuegbuzie & Collins, 2007; Mouton, 2006:100). However, the researcher chose to use the following:

i)   The background of the researcher (a lecturer and publisher in the field of disaster management);

ii) The researcher worked with well-trained, supervised and mature research assistants. From the two assistants, the first one has a doctoral degree in disaster management and the second one is a PhD candidate in disaster management. Both these assistants contribute to the validity and reliability of the study, not only because of their qualifications but because of their interest in the study;

iii) The researcher took the consolidated findings back to some of the participants for commenting to check for accuracy and determine if the reports are accurate to provide them with an opportunity to comment on them;

iv) Triangulate – the use of a questionnaire and an observational guide helped build a coherent justification of themes through the collection and examination of data from different data sources;

v)   Spending prolonged time in the field; in this case, a whole day at each Centre helped the researcher develop an in-depth understanding of the phenomenon under study. This relates to the more experience the researcher has with the phenomenon under study;

vi) The study sought peer debriefing, asking questions about the study.

6.8.1 Efforts to mitigate research bias

Mitigating research bias is a key consideration from the first stage of designing to the undertaking (Smith & Noble, 2014). Bias is an unfair concentration and interest in one particular area or group. Since bias exists in all research, impacting on the validity and reliability of the study findings, understanding it is imperative. Therefore, to mitigate research bias, this study clearly defined the rational and chose the appropriate research design. Approval of the study research methods by the ethics committee might be a sign that there is no research bias. The study avoided leading questions that could have led to research bias.

6.9 Limitations

The heads of the Centres were a challenge to get hold of to participate in the study. For example, in PDMC 2, the head was not available. In PDMC 4, the head was also not available to participate in the study. Consequently, the study attributed the absence of the PDMC 4 head to their designation as a Chief Director in charge of three directorates. Possibly, this led to a limited focus on disaster management directorate. Hence, the participant for PDMC 4 was the subordinate, probably in the acting position indefinitely. In PDMC 8, the head of the Centre was unavailable; thereby the Office Manager participated on the head's behalf. This might have been a restriction on the quality of the data obtained. Obtaining appointments with the Centres was not an easy process. However, constant phone calls and emails to the Centres eventually helped. The study acknowledges that ethical research requires respondents to remain anonymous. Nevertheless, since the study had targeted respondents, it posed as a limitation on anonymity. To minimise this limitation, the study did the following as suggested by Grinyer (2009:49):

i)   The researcher should explain to the respondents that they have an option of choosing their name to appear in the data or to allocate a pseudonym;

ii)   Allow the respondents to reject the use of data-gathering devices, such as tape-recorders;

iii) Obtain consent from respondents to publish the data;

iv)   The study also limited sensitive questions posed to the respondents.

6.10 Ethical issues

Research studies include building relationships, encouraging voluntary participation, seeking informed consent, and the disclosure of the purpose of the study, respecting the site, as well as maintaining respect and privacy of the respondents. Hence, the researcher applied and received an ethical clearance letter from the University of Free State's Ethics Committee. This clearance helped the researcher to adhere to ethical principles, such as integrity, professionalism, maintaining the rights and dignity of others and non-discrimination (Struwig & Stead, 2015: 68; Creswell, 2014:132; Sanjari, Bahramnezhad, Fomani, Shoghi & Cheraghi, 2014:5). The researcher developed a contact detail and data collection schedule as outlined in Table 6.2 that shows the dates the researchers visited the PDMCs to collect data.

Table 6.2 Data collection schedule

	VISIT DATES	SOUTH AFRICAN PROVINCIAL & NATIONAL DISASTER MANAGEMENT CONTACT DETAILS
1	Friday 27 September 2019	Head of Centre: Mr Tebogo Gaolalowe Cell: 083 290 9039 / 076 173 8890; Tel: 053 807 9862 Email: tgaolaolwe@ncpg.gov.za; Alt email: kmokgele@ncpg.gov.za Address: 9 Cecil Sussman Road, Kimberley,8300
2	Monday 30 September 2019	Head of Centre: Mr Butler Markes Wayne Cell: 066 487 4896; Tel: 051 407 2001 Email: markes@fscogta.gov.za; Alt email: lizzy@fscogta.gov.za Address: Pelanomi Hospital, Bloemfontein
3	Wednesday 9 October	Head of Centre: Mr Rikhotso Masenyane Cell: 083 454 3350; Tel: 018 388 2386 Email: mrikhotso@nwpg.gov.za; Alt email: NMogoe@nwpg.gov.za Address: Corner Vryburg Road (N18) and Rhodes Crescent, Imperial Reserve, Mahikeng (near Police Station Headquarters)
4	Thursday 10 October 2019	Head of Centre: Sekonya Magerule Cell: 082 936 4454; Tel: 0800 222 111 / 015 284 5565; Michael Moja 083 455 9565, 015 294 5496 Email: sekonyamr@coghsta.limpopo.gov.za; Alt email: MojaMM@coghsta.limpopo.gov.za; Alt email: PhashaMM@coghsta.limpopo.gov.za Address: 20th street (From Market Street, Polokwane EXT 3, Polokwane
5	Friday 11 October 2019	Head of Centre: Mr Dhudhuhlu Silayiki Cell: 082 447 6001 Tel: 013 757 2081 Email: sdhludhlu@mpg.gov.za Alt email: rmanzini@mpg.gov.za / Ray Bheki Manzini 082 361 5711/Nozipho Nkosi 079 514 8737, 013 757 2005/ Khabo Thabethe 079 880 3290/ mr sikhathele shongwe 076 708 1145 Address: R40 road, Madiba, Mbombela, Nelspruit
6	Tuesday 15 October 2019	Head of Centre: Mabandla Philela Cell: Daniso 083 354 8317 / Mr Lunga 082 362 9178 / 073 649 4365 Tel: 040 602 6500 Email: philela.mabandla@eccogta.gov.za Alt contacts:Noxolo Mabilwana 073 264 4855 Noxolo.Mabilwana@eccogta.gov.za/ Puseletso Kolanchu 066 217 0827, 040 602 6500/ Address: Yellow Woods Road, Bisho
7	Thursday 17 October 2019	Head of Centre: Mr Colin Deiner Cell: 082 550 6770; Tel: 021 937 6301 Email: colin.deiner@westerncape.gov.za; Cell: 082 747 9605 / 083 382 6100 Shireen Kolbe; Alt email: shireen.kolbee@westerncape.gov.za; Alt email: Sonja.Chinnian@westerncape.gov.za Address: Francie Van Zijl Dr, Tygerberg Hospital, Cape Town
8	Wednesday 30 October 2019	Head of Centre: Mr Elias Sithole Cell: 082 490 9825 / 072 933 8977; Tel: 011 355 4018 Email: elias.sithole@gauteng.gov.za; Alt email: 072 324 1085 Lindokuhle.Ngubane@gauteng.gov.za / Ms Bongiwe Lisa 011 355 5760 bongiwe.lisa@gauteng.gov.za/ Mr Paul Molokamme 011 355 5760 paul.molokomme@gauteng.gov.za Address: 11 Janadel Avenue, Riverview Block B, Midrand, Gauteng
9	Thursday 31 October 2019	Head of Centre: Dr Tau Mmphaka Cell: 082 0529311; Tel: 012 334 0600 Email: MmaphakaT@ndmc.gov.za; Alt email: MeganL@ndmc.gov.za Address: Riverside Office Park, 1290 Heuwel Rd, Centurion Central, Centurion, 0046
10	Monday 4 November 2019	Head of Centre: Mr Jonty Ndlazi Cell: 082 260 3081 / 082 897 6696; Tel: 033 897 5627 Email: jonty.ndlazi@kzncogta.gov.za; Alt email:072 688 3803, 033 897 5627 thembeni.mncube@kzncogta.gov.za / Mr sibongiseni emmanuel ngema 066 475 2308/076 153 3685/ Thabisile Ntuli 078 193 5251 Address: Shortts Retreat Road, Pietermaritzburg

Source: (Authors own)

6.11 Conclusion

To conclude, this chapter narrated in detail all the relevant aspects of research design and methodology that helped answer the study's research questions and objectives. The research methods helped contribute to achieving practical and reliable findings that formed the basis for recommendations towards contributing to the success of IMCS establishment. The following chapter presents and analyses the outputs from the respondents' comments and those captured from the data collection.

CHAPTER 7: DATA PRESENTATION, ANALYSIS AND DISCUSSION OF RESULTS: A SEQUENTIAL EXPLANATORY DESIGN APPROACH

7.1 Introduction

The focus of this chapter was on the presentation and analysis of the empirical findings under the key goals of the research questions, which are as follows:

i.) Policy implementation effects on the disaster governance of the provincial disaster management centres, with a particular focus on the institution of IMCS;

ii.) Identification of the IMCS status of the PDMCs;

iii.) The national government's efforts into the establishment of the IMCSs at the provincial level.

The study applied a sequential research design methodology, starting with a presentation of quantitative findings, followed by a comprehensive presentation of qualitative results. This chapter concludes with a summary of the study findings. The analytical procedures lead to the ultimate contextualisation, comprehension and answers to the study research questions.

The quantitative results

This section made provision for the presentation of the data using graphs, charts, tables and other methods. The study used descriptive statistics to describe and provided simple summaries regarding the study and the measure done on the study sample.

7.1.1 Demographic data

The demographic section of the questionnaire posed questions on gender, age, education, work designation and years of work experience. This section provides empirical findings accordingly.

7.1.1.1 Gender distribution of the respondents

Figure 7.1 shows the total number of the respondents, demarcated according to their gender. Females accounted for 38%, while males accounted for 62% of the respondents. Males head all the disaster management centres. However, the study did not assess if gender affects the operation of the Centres. Nevertheless, interested researchers could consider this study in the future.

7.1.1.2 Age group range of the respondents

The age range of 25 to 34 years accounts for 6% of the respondents, while 29%, accounts for the 35 to 44 years age range, as indicated in Figure 7.2. A majority of the respondents account for 53% of the 45 to 54 years age range. It follows that the age range of 55 to 64 years accounts for 12%. Interesting to note is the fact that the heads of the Centres fall in the 45 to 54 years age range. Mature managers of at least 55 years of age are more likely to have a significant number of years of experience and the disaster management workforce is not exempt from this thinking (Taneva, Arnold & Nicolson 2016).
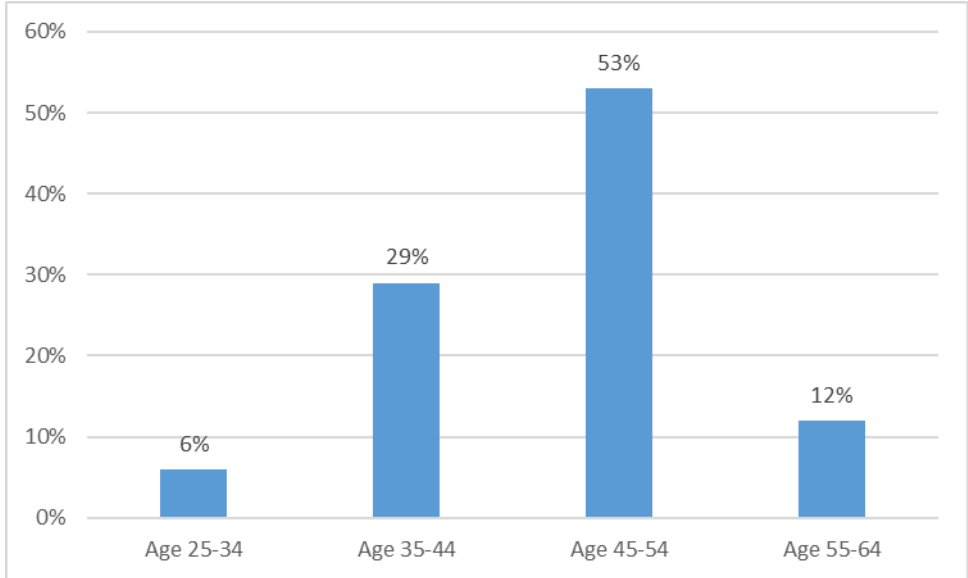
Figure 7.2 Age group range of respondents in years
Source: (Survey results, 2019)

7.1.1.3 Qualifications and suitability

Important to note is that appropriate and adequate training in the disaster management field to pursue enough capacity and ability in the disaster management centres is imperative. Recent studies assert the significance of the South African disaster management policies and most international agreements, like the Sendai Framework. It states the significance of adequate education for the successful management of disasters (Van Riet & Van Niekerk, 2012:7; UNISDR, 2015:10; Humby, 2012:70). Table 7.1 details the respondents work designation and their qualifications.

From the respondents shown in Table 7.1, 29% qualify in disaster management, and 6% of the respondents have qualifications in Information Technology. Another 6% hold qualifications in Fire Technology and the other 6% in Law. About 9% of the respondents have either a Geography, Geometrics or Geographical Information Systems qualification. It follows that 26% have MBA, Management, Public Management and Development Studies qualifications. At least the following qualifications account for 3%: first, Industrial Psychology, second, Health Education, third, Water Resources Management and the last, Education. Six per cent of the respondents only have Grade 12 Matriculant qualifications.

According to the NETaRNRA report (NDMC 2010), a disaster management qualification is the most relevant and suitable qualification for people working at a disaster management centre. The NDMF accords with the report by stating that the Head of the NDMC and staff must be qualified in disaster risk management (Republic of South Africa, 2005:11). Further, the NDMF states that holders of a disaster management qualification should at least have knowledge, skills and expertise in disaster risk reduction planning, disaster response, stakeholder coordination and the ability to understand and implement the disaster management legislation. The NETaRNRA report highlights the importance of such capabilities, as well as the need for competent and experienced practitioners and standardisation in disaster management activities across all spheres of disaster management (NDMC 2010).

Besides a disaster management qualification, an additional and suitable qualification could be Information Technology, because this study suggests that IMCS is the *nerve centre* of a disaster management centre. Also, people with these skills make a significant contribution to the disaster management field. Fire Technology is also suitable because COGTA is responsible for the administration of the Fire Brigade Act (99 of 1987) (COGTA, 2020). The Management qualifications are also suitable, however, their suitability depends on the responsibilities of the

personnel. This same situation applies to a Law qualification holder, which might only be suitable if the person manages legal issues like MOUs. The Geography qualifications might be suitable for people working with maps and remote sensing issues. The Education qualification is suitable for personnel responsible for enabler 2 on education, research, training and public awareness. The Water Resources Management qualification is suitable for an individual working in the Disaster Risk Reduction Planning and Development Directorate, focusing on water issues. The suitability of Industrial Psychology and Health is appropriate for personnel focussing on human resources and epidemiological issues, such as the coronavirus. As for the Grade 12 qualification, the personnel can be data capturers or support staff. Ultimately, all these qualifications are suitable for various departments in the disaster management centres if properly placed. With that said, at least personnel that qualify with a Masters in Disaster Management can be appointed as heads of disaster management centres, contrary to the status quo (Kesten, 2009; DMISA, 2002).

Humby (2012:70) postulates that South Africa has made excellent progress in the development of graduate programmes in disaster risk science.

However, as illustrated in Table 7.1 and the earlier discussion, it seems the disaster managers have not taken heed of the exploration of the discovered programmes. At least at the senior level, the NDMC, Deputy Director-General holds a PhD in disaster management. Unfortunately, the seniors at the PDMCs that participated in the study do not have qualifications in disaster management. Out of the 26 subordinates that participated in the study, at least 8 of them qualify in disaster management. The lack of senior managers that qualify in disaster management could be attributed to the lack of clear policy that mandates the appointment of senior managers that qualify in disaster management.

Table 7.1 *Respondent work designation and qualifications per centre*

Respondents Work Designation(s)	Highest Qualification(s)									
HEAD OF CENTRE	NDMC	PDMC 5	PDMC 7	PDMC 6	PDMC 8	PDMC 3	PDMC 9	PDMC 2	PDMC 1	PDMC 4
Deputy Director-General	PhD Public Management Development Specialising in Disaster Studies									
Chief Director										
Director			BA Honours in Industrial Psychology			MBA			Masters in Health Professions Education	
Deputy Director							Honours Degree in Geography			
Acting Director				Matric	National Diploma in Management Majoring in Disaster Management					Baccalaureus IURIS Law Degree
SUBORDINATE										
Chief Director 1	MBA									
Acting Chief Director	Masters in Information Technology									
Director 1	Masters in Development Management Majoring in Disaster Management	Masters in Disaster Management	Masters in Disaster Management							
Deputy Director 1	Honours Degree in Geomatics		National Diploma in Fire Technology			B-Tech Fire Technology	Diploma in Disaster Management	Bachelor of Technology	Masters in Public Administration	Postgraduate Diploma in Disaster Management

Deputy Director 2						Bachelor of Arts in Disaster Management		Masters in Disaster Management		BA LLB
Deputy Director 3						Masters in Business Administration		Honours Degree in Education		
Deputy Director 4						Honours in Development Studies				
Assistant Officer				GIS Certificate						
Assistant Director 1				Advanced Diploma in Management	National Diploma in Management				Masters in Public Management	
Assistant Director 2				Diploma in Disaster Management	Postgraduate Diploma in Integrated Water Resource Management				Advanced Diploma in Management	
Senior Admin Officer							Matric			

Source: (Survey results, 2019)

7.1.1.4 Work designations and operations of the PDMC

Chapter 4 discussed the placement and classification of the South African disaster management centres and the possible effects on their operations. As indicated in Figure 7.3, 44% of heads of centres appointed are designated as Chief Directors (PDMC 2, PDMC 4, PDMC 5, and PDMC 8), 44% as Directors (PDMC 1, PDMC 3, PDMC 6 and PDMC 7) and 11% as Deputy Directors (PDMC 9). As illustrated in Figure 4.3 in Chapter 4, Chief Directors are at the Program level and can report directly to the Deputy Director General (this is at the National Disaster Management Centre), which is on the Branch level. A Director is at a Sub-Program level, which means they report to the Chief Director, who must report further. A Deputy Director is on the Sub-sub program level, meaning, they report to the Director who in turn, reports to other higher offices. This limits the lower level designations because they operate in a red-tape bureaucratic government. Altunok (2018) defines bureaucratic red-tape as a negative organisational functioning that includes excessive workload, excessive use of documents and a long line of reporting. This implies that the lower level designation disaster managers might be experiencing operational difficulties. The PDMCs inconsistent designations show that there is a lack of uniformity within the disaster management fraternity in South Africa. The study attributes this inconsistency to the Constitution of South Africa that allows for the decentralisation of the spheres of government, hence the decision of where to place the PDMC, is a decision made by the Premier and the MEC (Member of Executive Council) of the province. Hence, the national government is unable to intervene entirely. This also reveals the prioritisation level of the disaster management function by the politicians in each province. Jordaan (2018:70) suggested that the elevation of the PDMCs to the Branch level, as well as improving their efficiency could lead to improved operations.
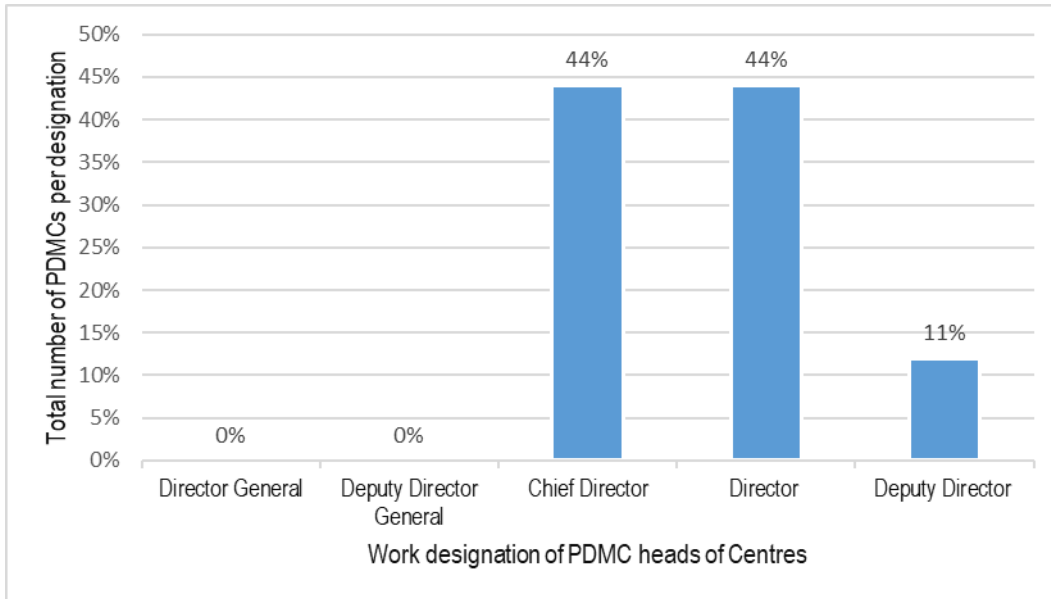
Figure 7.3 *Work designation of PDMC heads of Centres*
Source: (Survey results, 2019)

7.1.1.5 The respondents' level of education and decision-making

All respondents from the NDMC had tertiary education, while 79% of the respondents from the PDMCs had tertiary education and the rest (21%) had a high school education as the highest level of education. The significant number of respondents with tertiary education is an indication that the disaster management centres value high levels of education, especially at the strategic level. Additionally, it is important to note that experience is also important. However, employees with high school qualifications as the highest level of education may compromise the operations of the centres. This result supported Wentink and Niekerk (2017:7) findings, that provincial-level respondents in their study felt that training is lacking and in turn, neglect of disaster management duties was the result. As shown in Table 7.1, the Acting Director from PDMC 6 has a Grade 12 (Matriculate) high school qualification as the highest qualification. This finding was unexpected because to act in such a Director level position requires a person with a bachelor's degree at least (CollegeGrad, 2020). However, it is important to note that the years of experience in the field might be a good contribution to the operations. At least the other respondent with a matriculate qualification is not at a high-level position in the PDMC. However, as a Senior Admin Officer, they are entrusted with some decision-making. Therefore, the chances of compromising the operations are likely high. At least a high percentage of employees with high levels of education indicated that there is a possibility of proper decision-making. However, deriving from the discussion on the suitability of the qualifications, the quality of decisions made, might be deficient. Ultimately, the

governance of the Centres might be affected, because the disaster management mandates are improperly implemented.
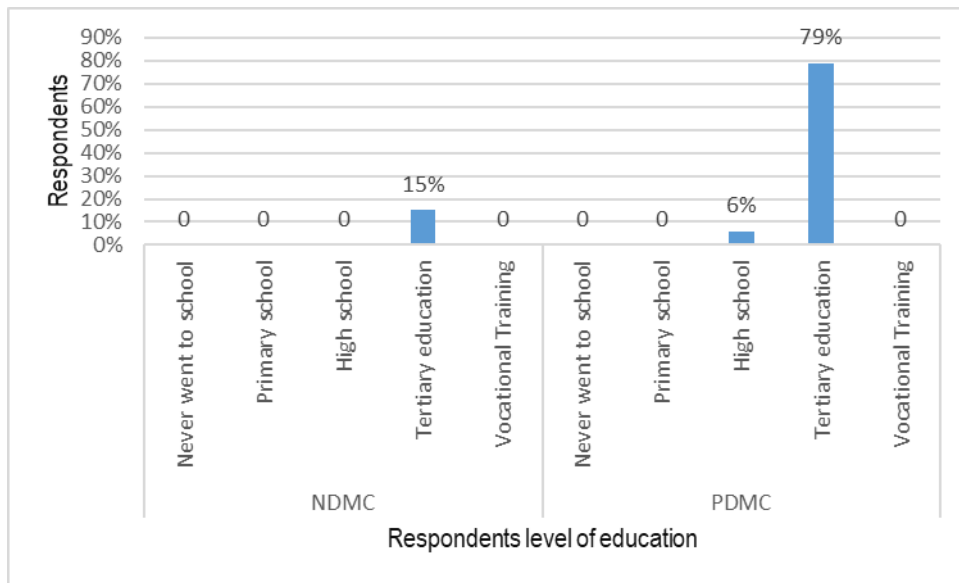
Figure 7.4 *The NDMC and PDMCs respondents' level of education*
Source: (Survey results, 2019)

7.1.2 The status quo of the provincial centres

This section details the developmental progress of the Centres since their inception and their current disaster risk governance status, relating to the implementation of all KPAs and enablers.

7.1.2.1 Year the centres were established

One of the questions asked, required the respondents to state when the Centre was established. With that in mind, the literature review found that the Constitution of the Republic of South Africa Act 108 of 1996, the Disaster Management Act 57 of 2002 (As amended Act 16 of 2015) and the National Disaster Management Framework of 2005, mandated the institution of disaster management centres. As indicated in Figure 7.5, the earliest operating Centres were PDMC 3 and PDMC 9, instituted in the year 1998. This was before the promulgation of the DMA and the NDMF. Thus, these PDMCs were developed under the Civil Defence Act 82 of 1990 and the February 1998 Green Paper on Disaster Management (Wentink and Van Niekerk, 2017: 3; Humby, 2012:27; Pelling & Holloway, 2006:19). According to the NDMF, the White Paper on Disaster Management paved the way for the promulgation of a disaster management act (Republic of South Africa, 2005:77). Accordingly, PDMCs 6 respondents stated that their Centre was formed in 2000. This showed that the White Paper served as a mandate for the PDMCs institution. The other respondents stated that their Centre, PDMC 8 was instituted in 2003, which was just after the DMA promulgation and PDMC 2 together with PDMC 5 in 2005 the same year the NDMF was promulgated. In the year 2007, PDMC 1 was established, the consequent year, PDMC 4 was established and the earliest PDMC 7 in the year 2015. The

study assumes that these later PDMCs were founded under the NDMF, which prescribed clear guidance on the components of a disaster management centre.
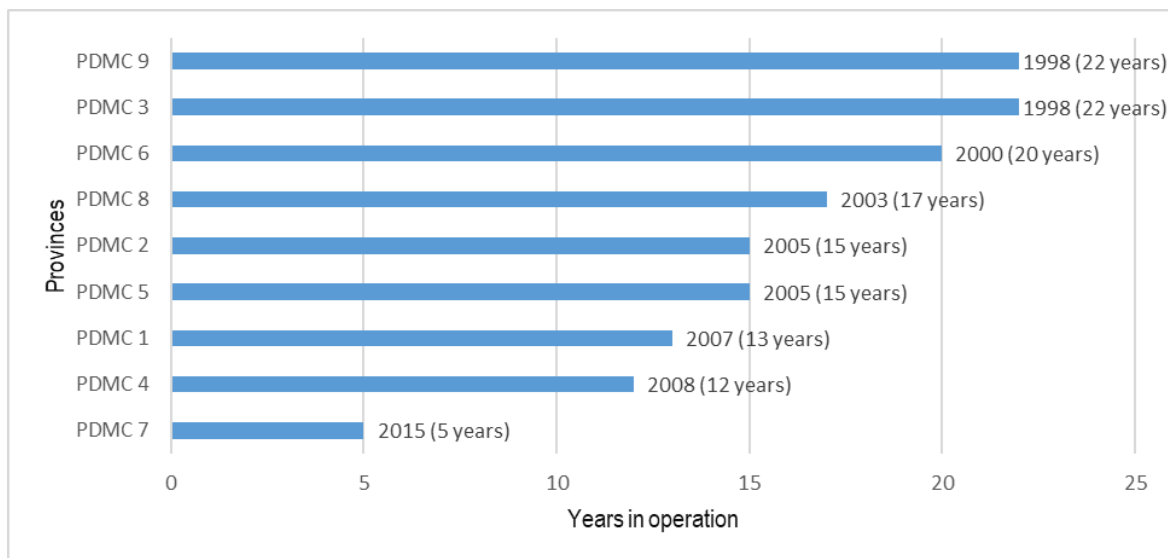
Figure 7.5 *PDMCs year of establishment*
Source: (Survey results, 2019)

7.1.2.2 Start-up costs and support from the NDMC to the PDMCs

All the PDMCs indicated that they did not receive the start-up grant from the national disaster management centre. The DMA mandated the provinces to begin the establishment of disaster management centres by 1 April 2004. This was two years after the promulgation of the Act. Further, the NDMF adds that, since this was urgent and that disaster management is a national priority, the government then should fund the start-up costs from a conditional grant (Republic of South Africa, 2005:95). Yet, based on the respondents' response, it seemed that the national government opted for not funding the institution of disaster management centres. In this case, the NDMF makes provision for two options, which state that the national government can fund through a centralised mechanism or it can decide to not fund, placing the responsibility on the provinces' equitable shares or revenues.

The status of the provinces shows the effects of the national governments' decision not to fund the institution of provincial disaster management centres. For example, it resulted in the inconsistencies in the work designations and several other discrepancies. The NDMC forfeited the advantages that come with a conditional grant, such as uniform and standardised infrastructure, adequate institutional capacity, efficient response capabilities and minimised inter-jurisdictional spillover in the case of a disaster (Republic of South Africa, 2005:96). Another effect could be that the NDMC cannot direct the PDMC what to do, nor can a PDMC make requests to the NDMC. It seems the Constitution of South Africa worsened this effect because it made disaster management a concurrent competency. Van Niekerk (2014:865)

supports this result, suggesting that the placement of the PDMCs affects the NDMCs authority to enforce the DMA and the NDMF.

7.1.2.3 Support from NDMC and level of satisfaction

The inherent support PDMCs received from the NDMC was tested to gauge the relationship between these two spheres of government. As shown in Figure 7.6, 67% (6) of the PDMCs stated that they receive support from the NDMC, while 33% (3) said that they do not receive any support.
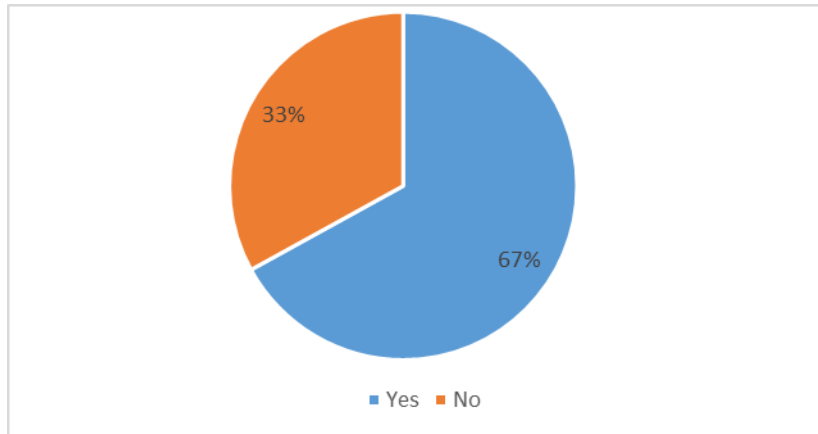
Figure 7.6 *Support from the NDMC to the PDMCs*
Source: (Survey results, 2019)

Table 7.2 shows a Likert scale that applied a grading between rating 1 and rating 5, starting with the lowest to the strongest option. Out of the nine PDMCs, 6 of them showed neutrality and 3 of them indicated they were satisfied with the NDMC support. The significant number of neutral ratings shows that the support received from the NDMC is unsatisfactory. This is regardless of the significant number of respondents who indicated that they get help from the NDMC as shown in Figure 7.6. The results show that the relationship between the national government and the provincial government is deficient. Further, this result supports the fact that the NDMC cannot enforce punitive measures as stated by Field, *et al*. (2012).

Table 7.2 *Level of satisfaction with support from the NDMC*

	1 Extremely Dissatisfied	2 Dissatisfied	3 Neutral	4 Satisfied	5 Very Satisfied
How satisfied are you with the support you receive from the NDMC?			PDMC 2 PDMC 3 PDMC 5 PDMC 7 PDMC 8 PDMC 9	PDMC 4 PDMC 6 PDMC 3	

Source: (Survey results, 2019)

Table 7.3 shows the results on the current help the PDMCs receive from the NDMC and the help that they expected.

Table 7.3 *Assistance currently received and expected from the NDMC*

PDMC	Assistance received from NDMC	Expected assistance from NDMC
PDMC 1	n/a	Assistance with making our centre fully functional
PDMC 2	n/a	The NDMC should lead the PDMC in the development of a uniform IMCS
PDMC 3	-Urban search and rescue -National drought planning, Training on ICT, Software like GIS and Situation Reporting Systems (SRS)	-There is no synergy between the NDMC and PDMC's as well as among the PDMC's. Hence NDMC can provide a shared vision for all centres to have one voice -The late developments of the expected guidelines as according to the NDMF affect the PDMC's. If the NDMC was to come and introduce the guidelines now or in the future, it will be like taking the centres aback. NDMCs communications strategy is not good, that is if they have one because communication with stakeholders is key, they only talk to us when they want information.
PDMC 4	-Workshops	-Nothing else
PDMC 5	-Advice and policy guidelines through workshops -Funding for the sector departments for relief, of which it is not assistance because it is inherent to their mandate.	We require the capacity to support, for example, the secondment of personnel to the various under capacitated disaster management centres. The NDMC must ensure that the sector departments have disaster management units. This is a call they can make in intergovernmental meetings
PDMC 6	-Marketing materials -Training e.g fire	-Funding
PDMC 7	-Technical Support e.g workshops	-Assistance with institutional capacity -Influence on policymakers or politicians
PDMC 8	-We report to them and they rarely assist us. We once asked for a declaration and classification document and the NDMC said they do not have time to send it and they never did. - Funding for the sector departments for relief	-Not needed
PDMC 9	-Participate in our advisory forum meetings - share reports	Assist with more research on the drought that is affecting the XXXXX *(name of the province removed)* -Lead the PDMC in the development of a uniform IMCS

Source: (Survey results, 2019)

Based on a theme count, at least 6 (67%) of the PDMCs stated that they receive help from the NDMC in the form of training and workshops. Then 2 (22%) indicated that they do not receive any help from the NDMC. The other respondents indicated that they receive help in the form of relief funding for sector departments. Yet, PDMC 5 argued that the help received in the form of funding for sector departments is not help but rather, it is an inherent requirement of the NDMC.

About the expected help, the respondents' expectations varied from (i) help with everything, (ii) improved communication, (iii) help with capacity, (iv) help with advocating for disaster management units in sector departments, (v) extra funding, (vi) political buy-in, (vii) help with research and (viii) development of uniform IMCSs. These results show that there is a neglect of duties by the NDMC, because of the unmet expectations from the PDMC. The result accords

with Smith (1973), who identifies a significant number of issues that hinder the implementation of policies, such as the conflict between the policy implementors and the developers. Additionally, the insufficient direction from the politicians and top management also deters implementation.

7.1.2.4 Operational running costs and human resource capacity of the PDMCs

Since funding was identified by several scholars as a gap in disaster management operations, the study investigated the amount the PDMCs expect and see sufficient (Wentink & Van Niekerk, 2017; Van Niekerk, 2014; Van Riet & Diedericks, 2009; Nomonde, *et al.* 2011).

Figure 7.7 illustrates the share each PDMC receives from each province's equitable share for their annual operations. Additionally, all the PDMCs indicated that the NDMC provides them with funds during a disaster. This assistance is according to the NDMF, section 7.7.1.2 mandate on disaster response and recovery operations. Amongst all the PDMCs, PDMC 9 did not indicate the amount they receive, which the study ascribe to the head of the Centres six months position on the job. Another reason for the head of Centres limited knowledge about funding could be the Deputy-Director appointment, restricting their knowledge of the department's operations and budget. The least equitable share receiver is PDMC 6, receiving R8 million, followed by PDMC 1 that indicated they receive R13 million, then PDMC 4, obtaining R15 million, followed by PDMC 2, which gets R16 million and PDMC 7 that receive R18 million. The highest equitable share receivers are PDMC 3, receiving R23 million, followed by PDMC 8 that obtains R30 million and PDMC 5 receiving the highest amount at R68.3 million.
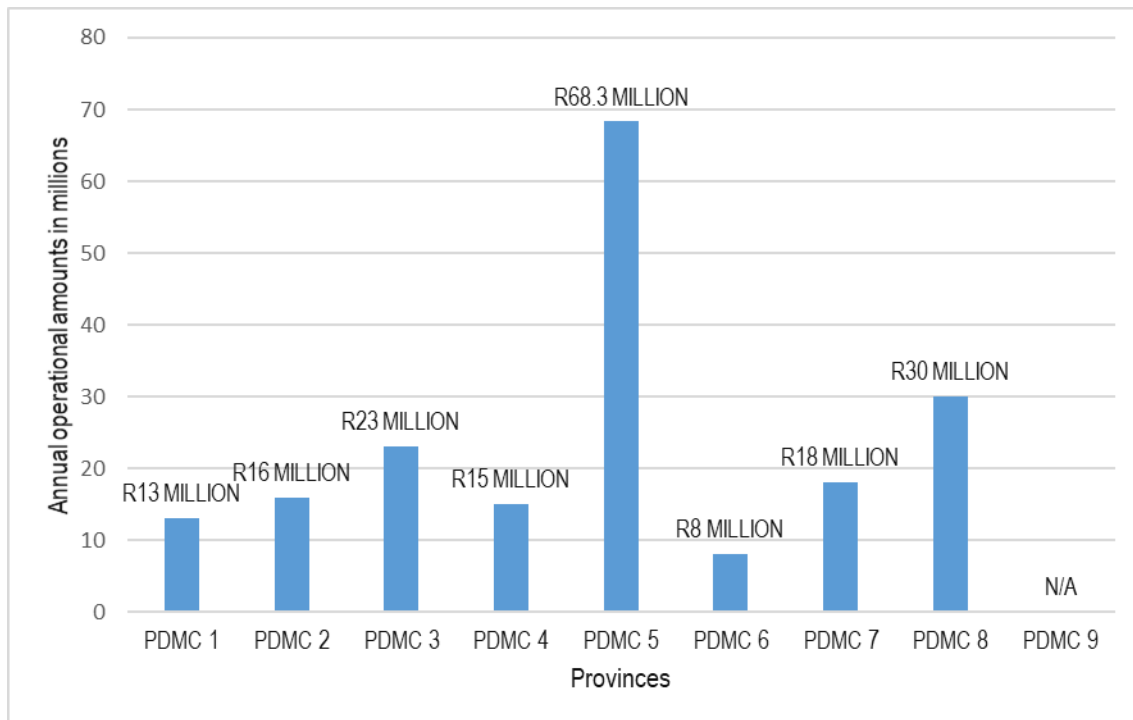
Figure 7.7 *Annual operational funds received*
Source: (Survey results, 2019)

The variations in the equitable shares per PDMC are based on the components of the equitable share by province, which are as follows: Education, Health, Basic, Institutional, Poverty, Population and Economic activity component (Roos, 2020). The specific allocation of shares to disaster management also depends on the political prioritisation of the function in that province. The consequence of these variations is that most provinces might not be able to reduce some disaster risks and respond to some disasters effectively. After inquiring about the operational amounts the PDMCs receive, the study asked the respondents about their satisfaction with the funds. Table 7.4 presents the respondents' responses to the question on satisfaction with funding received. Two PDMCs indicated that the funds received are satisfactory with PDMC 5, which receives the most funding, commenting that: "*We are satisfied with the funding we receive because it is sufficient for our capacity*". However, funding proved to be a problem with six of the PDMCs, indicating that they were not satisfied with the operational funds received. As expected, PDMC 9 could not comment on this issue, since they are not aware of the disaster management centres' operational funds.

Table 7.4 Satisfaction with funding received

	1 Yes	2 No	N/A
Are you satisfied with the funding you receive??	PDMC 5 PDMC 8	PDMC 1 PDMC 2 PDMC 3 PDMC 4 PDMC 6 PDMC 7	PDMC 9

Source: (Survey results, 2019)

The respondents were asked about the amounts that would be satisfactory and the results in Figure 7.8 showed that the estimate amounts expected either doubled or tripled the currently received amounts.
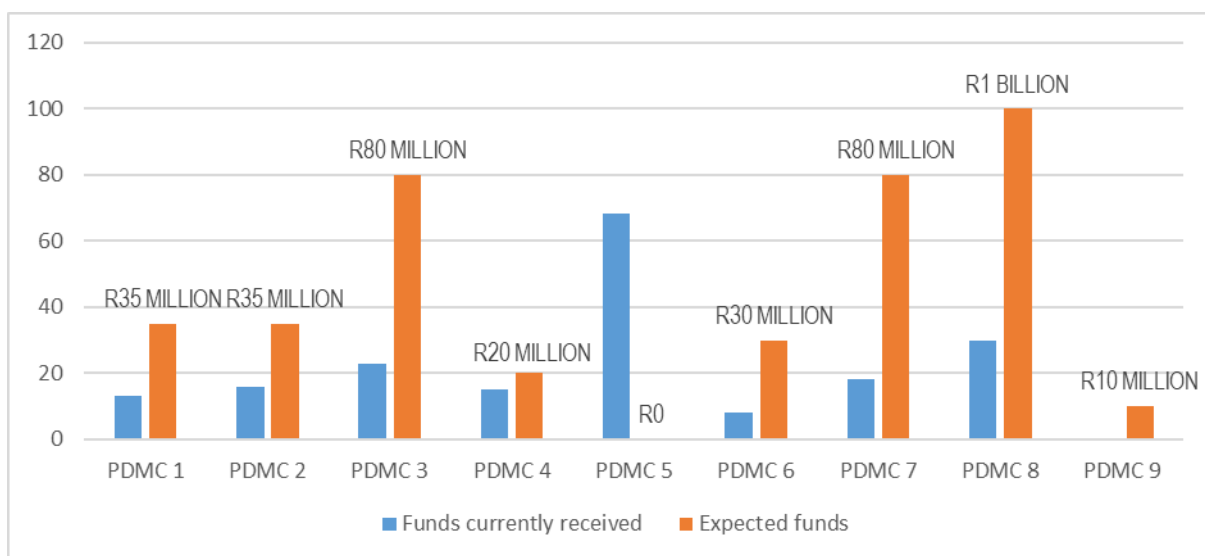
Figure 7.8 *Expected annual operational funds*
Source: (Survey results, 2019)

This shows that what was received was inadequate and insufficient for implementing the DMA and NDMF, in this case, enabler 1. Regardless of the unknown operational funds, PDMC 9 indicated that they at least expected R10 million. This expected amount is below average as compared to what the other PDMCs stated they are currently receiving. The PDMCs stated that they wanted more funds to implement the DMA and NDMF objectives reflected in the KPAs and enablers. PDMC 8 shared their specific plans for the requested extra funds: *"We would like to have our aircraft because to hire 1 aircraft for 1 hour to extinguish fire it costs R50 000".* PDMC 3 stated that *"More funds for municipal support, building, maintaining and continuity infrastructure (ICT, Water, Generators), funding for employing more personnel and better salaries".*

7.1.2.5 PDMCs personnel capacity and adequacy

Figure 7.9 shows the information on the total number of personnel for each province.
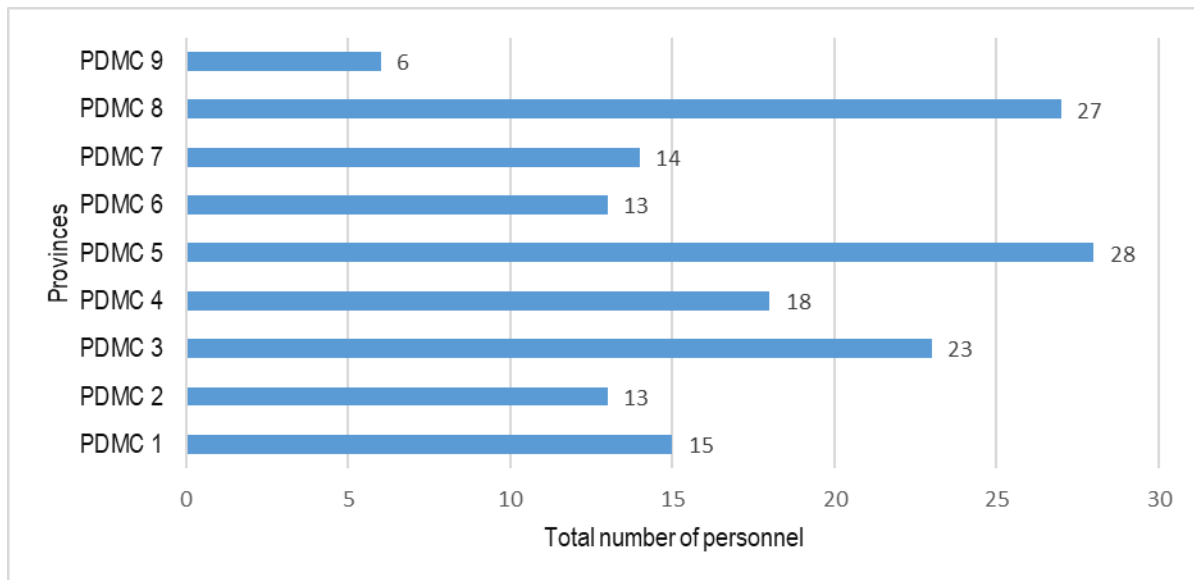
Figure 7.9 *Total number of personnel per PDMC*
Source: (Survey results, 2019)

The study tested the total number of personnel per province and their ability or adequacy to manage disaster management centres. The test included the identification of the total number of metropolitan, district and local municipalities, under the responsibility of each PDMC. Also, this section reflects on the year the Centres were established as shown in Figure 7.5. Section 1.2.4 of the NDMF mandates a PDMC to act as a primary functional unit for disaster management in the province with the key responsibility to provide support and guidance to the NDMC and the lower spheres of government. Some of the mandates include the gathering of infrastructure and resources (Republic of South Africa, 2005:12).

The following discussion exhibits each PDMCs' municipalities and total population, to determine each PDMCs adequacy and capability to manage the operations of the province:

- PDMC 1 was established in the year 2007 and had 15 personnel. This PDMC handles 1 Metropolitan, 4 District and 18 Local Municipalities. The province has a total population of about 2.9 million.
- Established in 2005, PDMC 2, with an estimated population of 11.2 million, has 13 personnel. The personnel should manage 1 Metropolitan, 10 District and 43 Local Municipalities.

- With 23 personnel, PDMC 3 established in 1998 is in a province with an estimated population of 4 million. The PDMC should manage 4 Districts and 18 Local Municipalities.

- While PDMC 4 has 18 personnel and established in 2008, it should manage 5 Districts and 22 Local Municipalities. This province has an estimated population of about 5.9 million.

- PDMC 5 established in 2005 has the highest number of personnel, at 28 that must manage 3 Metropolitans, 2 Districts and 6 local Municipalities. The population size for this province is about 15.2 million.

- With 13 personnel, PDMC 6 established in 2000 must manage 3 Districts and 17 Local Municipalities that house an estimated total population of about 4.6 million.

- PDMC 7 established in 2015, has 14 personnel in charge of 2 Metropolitans, 6 District and 31 Local Municipalities. This province has an estimated total population of about 6.7 million.

- With 1 Metropolitan, 5 District and 24 Local Municipalities, PDMC 8 established in 2003 has 27 personnel. The province is home to an estimate population of about 6.8 million.

- Since PDMC 9 has 6 personnel, the expectation is that it must manage 5 Districts and 26 Local Municipalities. This PDMC was established in 1998. Moreover, an estimated population of about 1.2 million resides in this province, which further escalates the impossibility of this centre's ability to manage the province with only 6 personnel (Municipalities, 2020; Statistics South Africa [STATSSA], 2019).

Based on the results of personnel shown in Figure 7.9 and the number of municipalities and population per province, this means that the PDMCs have a low personnel capacity and this can negatively influence their ability to fulfil their disaster management duties. Wentink and Niekerk (2017:1) found that a significant number of district municipalities, as well as other municipalities, have not succeeded in the implementation of basic disaster management structures. Based on the results discussed on the total number of employees and municipalities per each province, these scholars' finding does not come as a surprise, because the personnel in the province, which is expected to support the municipality, are inadequate. These scholars are also of the opinion that the municipal personnel should have the expertise, based on the KPAs and enablers. Ultimately, the year in which the Centres were established seems to not have a positive impact on the capacity of the PDMC.

7.1.2.6 Progress in achieving KPAs and enablers objectives, the status quo

The study pursued to examine the PDMCs progress in achieving the objectives set in each KPA and enabler. Figure 7.10 shows the level of achievement of each KPA and enabler for each PDMC.
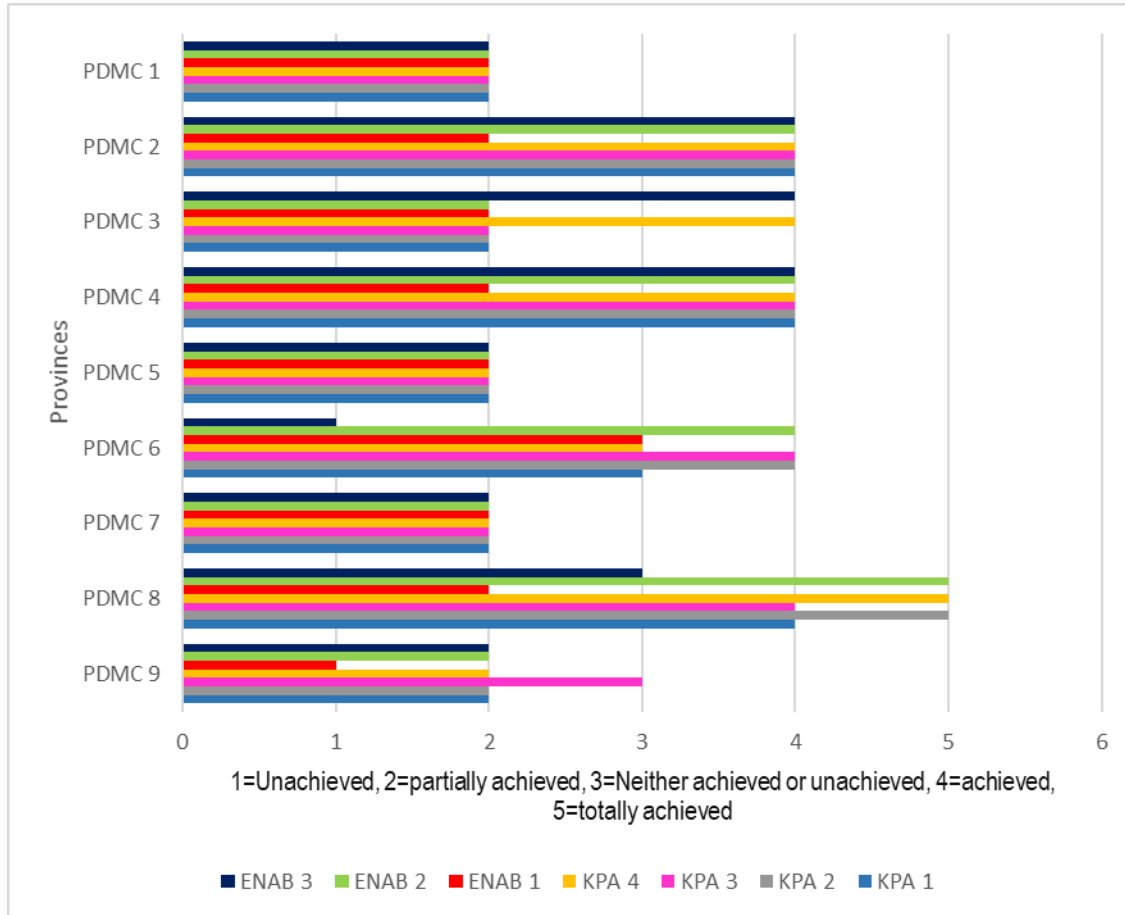
Figure 7.10 Progress in achieving KPAs and enablers objectives
Source: (Survey results, 2019)

PDMC 1, which has been operating for 13 years, indicated that the PDMC has 'partially achieved' the four KPAs and three enablers. This partial achievement could be that the head of the Centre holds an unsuitable qualification (Masters in Health Professions Education). PDMC 5 that has been operating for 15 years and PDMC 7 for 5 years, have similar results as PDMC 1. PDMC 5 shows these results probably because the Centre was renting offices for the past years and recently purchased new offices. PDMC 7 was also renting and recently purchased new offices. Another reason for the PDMCs rental situation could be that the Centre does not have a permanent head. The position is rotated among different PDMC employees. While this rotation might be beneficial for the PDMC individuals' growth, the constant change of leadership might hinder the PDMCs growth and stability.

As for PDMC 2 and PDMC 4, they both have similar results. PDMC 2 has been operating for 15 years, while PDMC 4 for 12 years. Both PDMCs stated that they 'achieved' KPA 1, 2, 3, 4 and enabler 2 and 4, however, they indicated that they have 'partially achieved' enabler 1. The reason for PDMC 2's status could be that they moved to new offices. The partial achievement of enabler 1 for PDMC 2 could be that they have an employee with a Bachelor in Technology. The status of PDMC 4 is ascribed to the fact that the head of the Centre is in charge of three directorates, including disaster management and this leads to a limited focus on the disaster management directorate. Wentink and Van Niekerk (2017:1) support this result, stating that the attention of disaster management personnel on disaster management activities is limited because they are working in other government departments.

Figure 7.10 further shows that PDMC 3 has 'partially achieved' KPA 1, 2, 3 and enabler 1. They also indicated that they 'achieved' KPA 4 and enabler 3. This PDMC has been operating for 22 years. The study accredited the Centre's status to the fact that they are in construction. They indicated that since their establishment in 1998, they have been renting office space. Tyrocity (2019) argues that sufficient office space and proper infrastructure is a requirement for the smooth functioning of any organisation.

PDMC 8 has been operating for 17 years and the respondents indicated that the PDMC has 'totally achieved' KPA 2, 4 and enabler 2, as for KPA 1 and 3 they have been 'achieved', while enabler 3 is 'neither achieved nor unachieved' and lastly, enabler 1 is 'partially achieved'. This is the only PDMC that shows the total achievement of at least 2 KPAs and 1 enabler. It is further shown in Figure 7.10 that PDMC 9 indicated that they have 'neither achieved nor unachieved' KPA 3, while KPA 1, 2, 4 and enabler 2, 3 are 'partially achieved'. The Centre further indicated that enabler 1 is 'unachieved'. This PDMC has been operating for 22 years.

In the coming section, the study reveals the other reasons for the status in achieving the objectives set in each KPA and enabler and further discussions in the qualitative section.

7.1.3 Enabler 1, Information Management and Communication System
As shown in Table 7.5, 100% of the PDMCs indicated that they do not have the information management and communication system (IMCS), according to the standards set in the NDMF, enabler 1. Some of the PDMCs shared some comments with their responses shown in Table 7.5. In summary, deriving from the comments in Table 7.5, it seems the PDMCs do not have IMCSs, because they are currently in the progress of establishing them. However, this should not be a valid reason, because the NDMF cleary mandates the PDMC at the initial start-up of

the Centre to establish the IMCS. DMA and the NDMF envisage the development of KPA 1 and enabler 1 at the initial start-up of a disaster management centre (Republic of South Africa, 2005). Correspondingly, this prescription emanates from the thinking that institutional capacity requires the identification of stakeholders to execute the legislative mandate and the IMCS ascertains that all role players have access to reliable disaster risk information. Figure 7.11 and Table 7.5 shows specific reasons the PDMC respondents shared, concerning the lack of IMCSs.

Table 7.5 PDMCs with Information Management and Communication Systems

PDMCs	YES	NO	COMMENTS
PDMC 1		✓	-We do not have political buy-in, if we had political buy-in, the Centre will be fully established
PDMC 2		✓	
PDMC 3		✓	-Establishment of the system is currently in the progress. We have signed MOUs with the relevant and various sectors
PDMC 4		✓	
PDMC 5		✓	-A system has been developed. We developed our user requirements specifications that informed the development of our IMCS. Champions to manage the system are currently in training. We are also in the process of signing MOUs with municipalities and various organisations to have access to their activities like real-time monitoring of disaster response. This will be through video halls where we can view their dashboards. The system will allow for central emailing, where emails go to a system and not necessarily to an individual are stored. The system also allows for telephone conversation recording.
PDMC 6		✓	-Partial
PDMC 7		✓	-In progress
PDMC 8		✓	-Currently in the process of procuring one. We even shared our specifications with the NDMC.
PDMC 9		✓	

Source: (Survey results, 2019)

Together with the comments made in Table 7.5, Figure 7.11 provides further reasons concerning the lack of IMCSs.
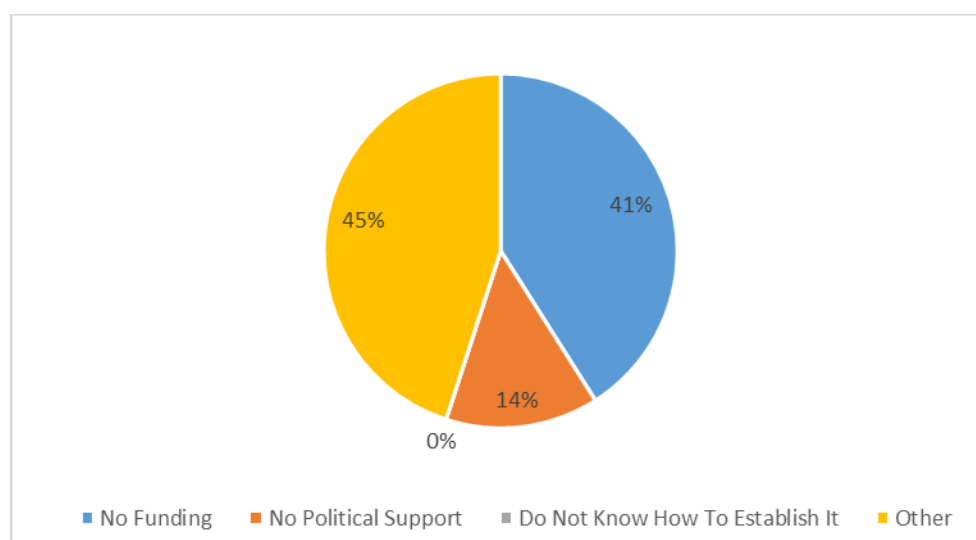
Figure 7.11 Reasons to lack of IMCSs in PDMCs
Source: (Survey results, 2019)

From the four choices provided, 41% of the respondents selected 'No Funding', while 14% of the respondents opted for 'No Political Support' and 45% opted for 'Other'. None of the respondents opted for 'Do not know how to establish it'.

Other reasons for lack of IMCS

Through a count of themes from the comments, the respondents shared to specify why they opted for 'Other'. Table 7.6 shows the respondents' comments. Lack of funding appeared 3 (10%) times and lack of political support appeared 3 (10%) times as well. Procurement and supply chain processes appeared 2 (7%) times, however, this seemed to be an issue experienced in one PDMC. Knowledge and willingness accounted for 4 (14%) of other reasons. The rest of the reasons included limited top management support, including the NDMC, move to a new Centre and the misconception of the disaster management function. Based on these results it seems the lack of IMCs is due to a significant and complex number of reasons. It could be that these shared reasons do not only affect the centre that mentioned them but all of the Centres.

Table 7.6 *Other reasons for lack of IMCS*

PDMCs	OTHER
PDMC 1	-Politicians do not want to commit to funding. They are under the impression that disaster management is a response function only. Hence, they argue that why is there a disaster management centre when there is South African Police Services and Emergency Management Services.
PDMC 2	-2 years ago, we developed a plan for the system and obtained funding for it but the procurement process has been difficult to get it approved. -Supply chain process takes a long time -We are struggling with establishing a system because of the top management within the COGTA Department
PDMC 3	-We have political support and funding. We could not have the system because we were still renting at the initial start-up of the centre -The Centre is new -Time and action -It is not a prioritised function of disaster risk management. In terms of departmental budgets, it receives the least funding. The Multi-Hazard System developed by the CSIR is now redundant; some features are not functioning properly. The system requires sufficient funding for maintenance and updating. Even continuous training to learn and know about current technology.
PDMC 4	-To show that there is a lack of political support and that politicians only want to benefit personally, during the 2010 World Cup, they procured a system (Uniti Software developed by Umoya) where all provinces were connected and reporting incidents. However, after the World Cup, that system disappeared.
PDMC 5	-
PDMC 6	-Lack of skills within the municipality -Lack of capacity -No political support as well. There is a lack of collaboration with other municipalities
PDMC 7	-I think the will is not there, even if we were to have the information system, no one will feed it with information
PDMC 8	No support from the NDMC
PDMC 9	We also lack the know-how of establishing such a system

Source: (Survey results, 2019)

7.1.3.1 Information-sharing and stakeholder relations

Several authors and policy documents attest to the notion that effective disaster risk governance is effective through appropriate and organised institutional arrangements (Barker, 2016:10; Friedman & Miles, 2006:19; United Nations International Strategy for Disaster Reduction

[UNISDR], 2009:11). Some authors and policy documents have shown interest in how good stakeholder relations and good governance practices help lessen disaster impacts and improve disaster response (Niemaan, 2005:27; Poser & Dransch, 2010:89; UNISDR, 2015; Mudavanhu, Manyena, Collins, Bongo, Mavhura & Manatsa, 2015:267; UNISDR, 2017; Shin, 2017). Therefore, Figure 7.12 shows the various institutions the PDMCs liaise with and share information.
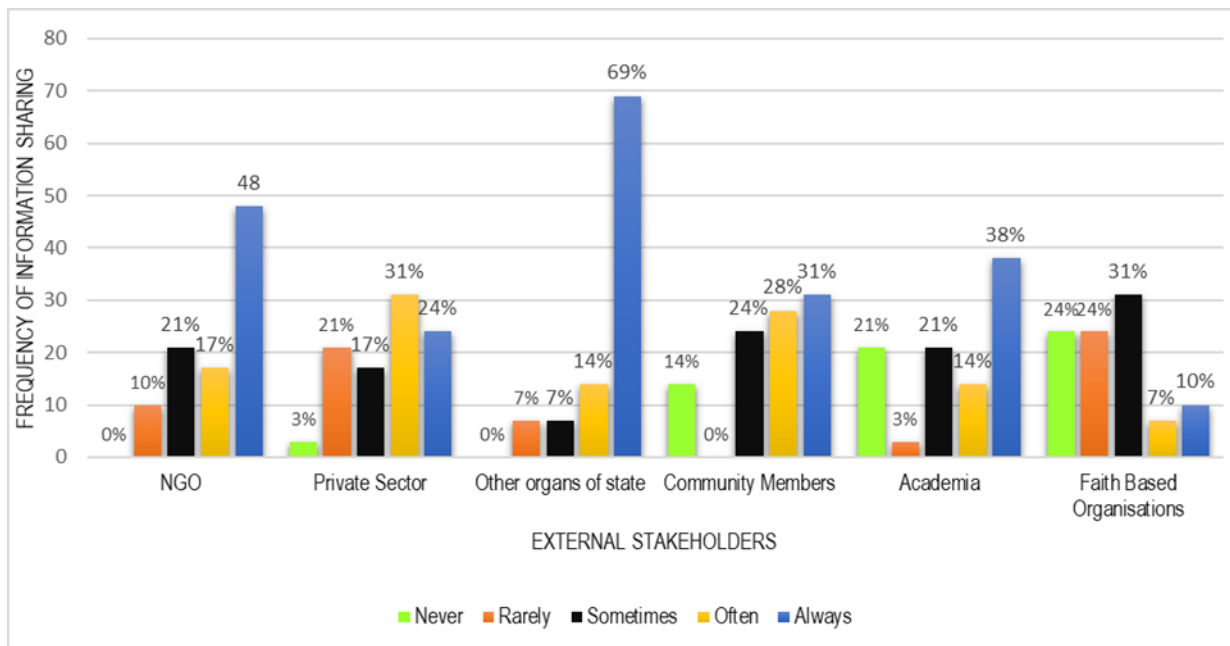
Figure 7.12 *Frequency of information-sharing with external stakeholders*
Source: (Survey Results, 2019)

With 48% of the respondents indicating that they 'Always' and 17% saying they 'Often' share information with the non-governmental organisations, it shows that the disaster managers have a good stakeholder relationship with the NGO's. With the private sector, 31% of respondents indicated that they 'Often', while 24% indicated that they 'Always' share information, which is also a sign of good stakeholder relationship. Organs of the state have the highest frequency of sharing information at 69%, while 14% indicate that they 'Often' share information. This could be that the 'Other organs of state' are a stakeholder accountable to the government and exercise their functions according to the South African Constitution. Besides, they are accountable for service delivery. Important to note is that the 'Other organs of state' are mentioned the most in the NDMF, compared to other stakeholders possibly making them seem like the most significant stakeholder in the disaster management fraternity. At least 14% indicated that they 'Never' share information with the 'Community members'. This could be that the PDMC is at a strategic level and have minimal contact with the community.

Information-sharing with 'Academia' accounted for 21% 'Never' and 3% Rarely. This could be that the PDMCs do not involve academia in research projects and training programmes. Faith-based organisations accounted for 24% 'Never', 24% 'Rarely' and the lowest 7% 'Often', and 10% 'Always' in information-sharing. This could be that disaster managers do not consider faith-based organisations as a significant stakeholder in disaster management. The unequal information-sharing with stakeholders contradicts with Freeman's (1984) thinking, namely that all stakeholders are affected by the organisation's decisions and that all stakeholders do affect the organisation's operations in some way. Unfortunately, the study missed the evaluation of the frequency of information-sharing with 'Traditional leaders'. Traditional leaders are an important stakeholder in the disaster management fraternity.

7.1.3.2 Information-sharing methods used by PDMCs with the stakeholders

Figure 7.13 shows a summary of the methods that all the respondents from the PDMCs indicated they use to share information with the identified stakeholders.
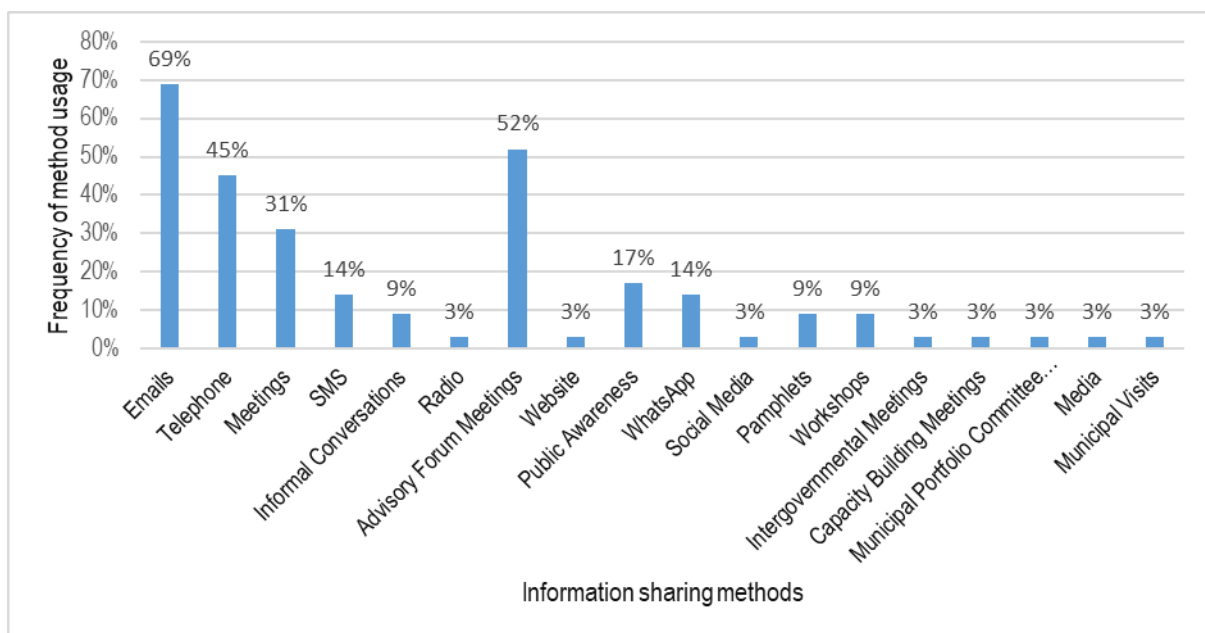
Figure 7.13 *PDMCs information-sharing methods*
Source: (Survey results, 2019)

The highest method of information-sharing is 'E-mails' at 69%. This method could be mostly for sending and receiving reports. It might be a good method, but it depends on the stakeholder that the PDMC is communicating with and for what purpose. The second highest method is 'Advisory Forum Meetings', accounting for 52%. The reason for the high usage of this method could be that the DMA and the NDMF promote co-operative governance through the involvement of all relevant stakeholders to consult and coordinate their activities for disaster management (Republic of South Africa, 2005:16). 'Telephone' usage accounts for 45%, while

'informal conversations' account for 9% of the information-sharing methods. Unless these two methods are recorded, then institutional knowledge is not preserved. 'Meetings' account for 31% of the methods, which is a low usage as meetings are a good platform for strategising. 'SMS' is a significantly important platform for risk reduction and disaster response information dissemination, however, they account for 14% of the methods. Seventeen per cent (17%) of the respondents mentioned 'Public awareness' as a method. The DMA and the NDMF stipulate that the PDMC frameworks must identify processes for building public awareness capabilities and IMCSs should facilitate public awareness. The legislations also mandate the development of integrated public awareness strategies to encourage risk-avoidance behaviour by all role players. The results showed that 14% of the respondents use 'WhatsApp'. The study attributes the minimal usage of 'WhatsApp' as compared to other methods to the thinking that it is not considered a formal method of communication yet. 'Pamphlets' and 'Workshops' are used by 9% of the respondents. The reason for the low usage of pamphlets is that public awareness campaigns are not implemented that much and that there is minimal co-operative governance and training, because of the low usage of workshops. Other information-sharing methods account for 3% usage (radio, website, capacity building meetings, municipal portfolio committee meetings, media and municipal visits). Ultimately, the study attributes the minimal usage of these platforms to poor institutional capacity and arrangements within the PDMCs.

7.1.3.3 Data sources, collection methods, storage, and information dissemination methods used by PDMCs

The NDMF prescribes that an IMCS should have capabilities to acquire, sort, analyse, store and share information with targeted interest groups (Republic of South Africa, 2005:63). Therefore, the study sought to investigate the PDMCs sources of data, methods of data collection, storage and dissemination methods. The respondents mentioned in an open-ended question the methods that they use.

Data sources

Figure 7.14 shows the sources that the respondents consult or use to obtain information.

DATA SOURCES

Source	Percentage
Scientific Reports (Jamba Journal)	3%
Advisory Forum Meetings	7%
Ward Councilors	3%
Community Members	3%
Toll Free	3%
SAPS	3%
Eskom email alerts	3%
Media	48%
Policies and plans	7%
Community Development Workers (CDW) and Extended…	10%
WhatsApp Groups	14%
Social Media	7%
Sector and Government Departments	41%
UN	3%
Municipalities	28%
SAWS	38%
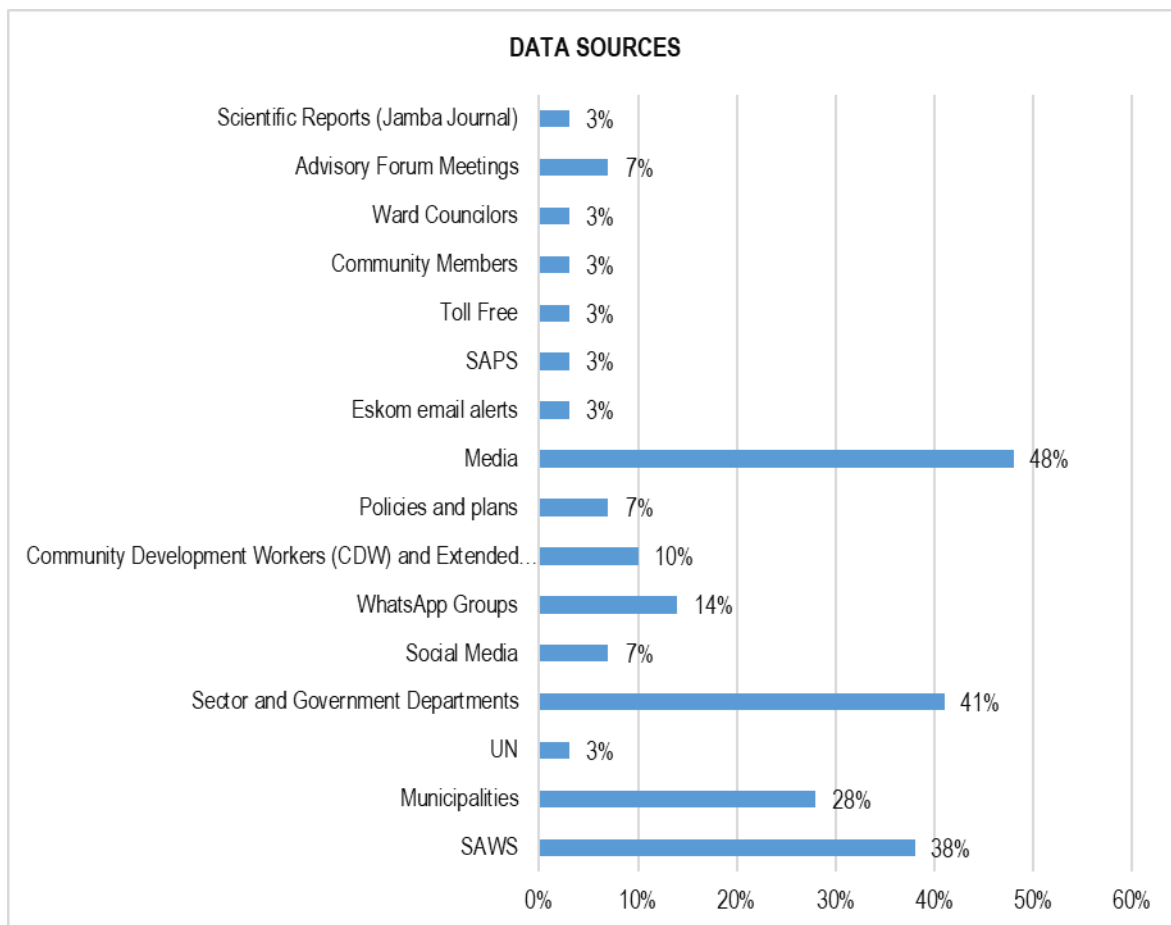
Figure 7.14 *Data sources consulted by the PDMCs*
Source: (Survey results, 2019)

The least consulted sources at 3% each are scientific reports, Ward Councillors, Community Members, Toll-Free numbers, SAPS, Eskom email alerts and the United Nations (UN). The reason for this minimal consultation is because these are preferred sources per province or individuals who participated in the study. With a 7% preference for each, the respondents consult these sources, advisory forum meetings, policies and plans (with a specific mention of Integrated Development Plans, Disaster Management Plans and Municipal Quarterly Reports) and social media. Fourteen per cent (14%) of the respondents use WhatsApp groups, while Municipalities are a preferred source by 28% of the respondents. The South African Weather Services (SAWS) is a source consulted by 38% of the respondents. Forty-one per cent (41%) of the respondents consult sector or government departments, with a specific mention of the Department of Health, Department of Human Settlement, Water and Sanitation, Working on Fire and CSIR. The most used source of information is the media accounting for 48% and with a specific mention of the radio (OFM, Motswading FM), Newspapers (Observer and Review)

and the Television. Concerning the media as a source of information, a respondent from PDMC 5 said: *"Information from the media is not 100% reliable because it is sensationalised. However, we use the media as a source from time to time"*. The lack of co-operative governance and uniformity among the PDMCs stands as a possible reason for the wide variation in the preferred data sources.

Data collection methods

Figure 7.15 shows the data collection methods that the respondents mentioned they use.

DATA COLLECTION METHODS

Method	Percentage
Desktop research	3%
Situational Reporting System	7%
Running Log Form	3%
Quarterly Report Template	3%
community based assessment questionnaire	3%
Checklist	3%
No methods	3%
Capacity Building Template	3%
Provincial Assessment Report Form	3%
Standardised disaster management template	3%
Hydronet (SAWS Monitoring & Evaluation Report	3%
Office shelves, hard copies	3%
Fieldwork	3%
Compliance template	3%
Informal interviews	10%
Review municipal reports	3%
Telephone Inquiries	10%
Predictive Assessment Template	3%
Resource Template	3%
Questionnaire	10%
Incident Report Template/Incident Assessment...	21%
Use Community Development Workers,Questionnaire	3%
Email Inquiries	17%
Monitoring and Evaluation Template	7%
Risk Assessment Reports	3%
GPS	3%

Figure 7.15 *Data collection methods used by the PDMCs*
Source: (Survey results, 2019)

Desktop research, Running log form, Quarterly report template, Community-based assessment questionnaire, checklist, Capacity-building template, Provincial assessment report form,

Standardised disaster management template, Hydronet, Hard copy reports on office shelves, Fieldwork, Compliance template, Municipal reports, Predictive assessment report, Resource template, Community development workers, Risk assessment reports and GPSs, accounted for the lowest data collection methods at 3%. The reason for the low usage of these data collection tools is because of the lack of guidance, planning, knowledge and poor leadership. Other tools with a low usage at 7% each are the Situational reporting system and the Monitoring and evaluation template. Other methods, which were unpopular, are Informal interviews, Telephone inquiries and Questionnaires that are used by 10% of the respondents each. Email inquiries were popular amongst 17% of the respondents, while Incident reports also known as Incident assessment forms, or Damage assessment forms, or Incident response forms were used by 21% of the respondents. Again, the lack of uniformity among the PDMCs is revealed by the inconsistent use of data collection methods.

Data storage methods

Figure 7.16 shows the systems and methods that the PDMCs use to store all their information.

DATA STORAGE METHODS

Method	%
Shared network drive	3%
Memory Stick	7%
Situational Reporting System	3%
Hard drives	3%
Chief Directorate development and planning	7%
Server	3%
CD's	3%
Storage Volt/Store Room	7%
Incident Comand Management System (Web-Based)	3%
Registry	7%
Hard Copy Files/Manual Filing	59%
Cloud Based	3%
Call log for calls coming in	3%
In reports to the NDMC	3%
Personal Computers	69%
Department archive/COGTA Server	7%

Figure 7.16 Data storage methods used by the PDMCs
Source: (Survey Results, 2019)

Facilities such as Shared network drives, NDMC reports, Situational reporting systems, Hard drives, Servers, Compact Disc's, Incident command management systems, Cloud-based systems and Call logs are each accounting for 3% of the respondents' usage. Among these facilities are significant and modern systems that are relevant to the 4IR era. Hence, it seems the limited usage of these facilities is ascribed to the unwillingness to learn and use new methods and poor leadership. The respondents made these comments concerning some of the methods used: *"We do not have a server of our own. There is a centralised server seating in the department COGHSTA. We expect the head of the centre to keep the Centres reports. When we need information we request for the plans from them"*, *"The Incident command system is not active"*, *"Annual Performance Plans are stored at the Chief Directorate Development and Planning",* referring to the Situational reporting system, *"Internal stakeholders do not use it to upload information"* and to the Shared network drive, *"Not used often".*

As supported by the comments made by the respondents, there is unwillingness, neglect of duties and poor management among the PDMC personnel. Memory sticks, Chief directorate development and planning, Storage volt or Storeroom, Registry and the COGTA department server accounts for 7% each. The study attributes this to the issue of red-tape bureaucracy where the disaster management directorate does not have a server but rely on the department for storing their data. Hard copies and manual filing account for the second-highest method of 59%, while the most significant storage method is Personal computers at 69%. The prioritised utilisation of manual filing and personal computer storage of files indicates that the disaster management centres operational methods are out of date. Moreover, the security of information is another concern and storing data on a personal laptop restricts other stakeholders from accessing the information.

Information dissemination methods

The respondents mentioned the information dissemination methods that they use as shown in Figure 7.17.
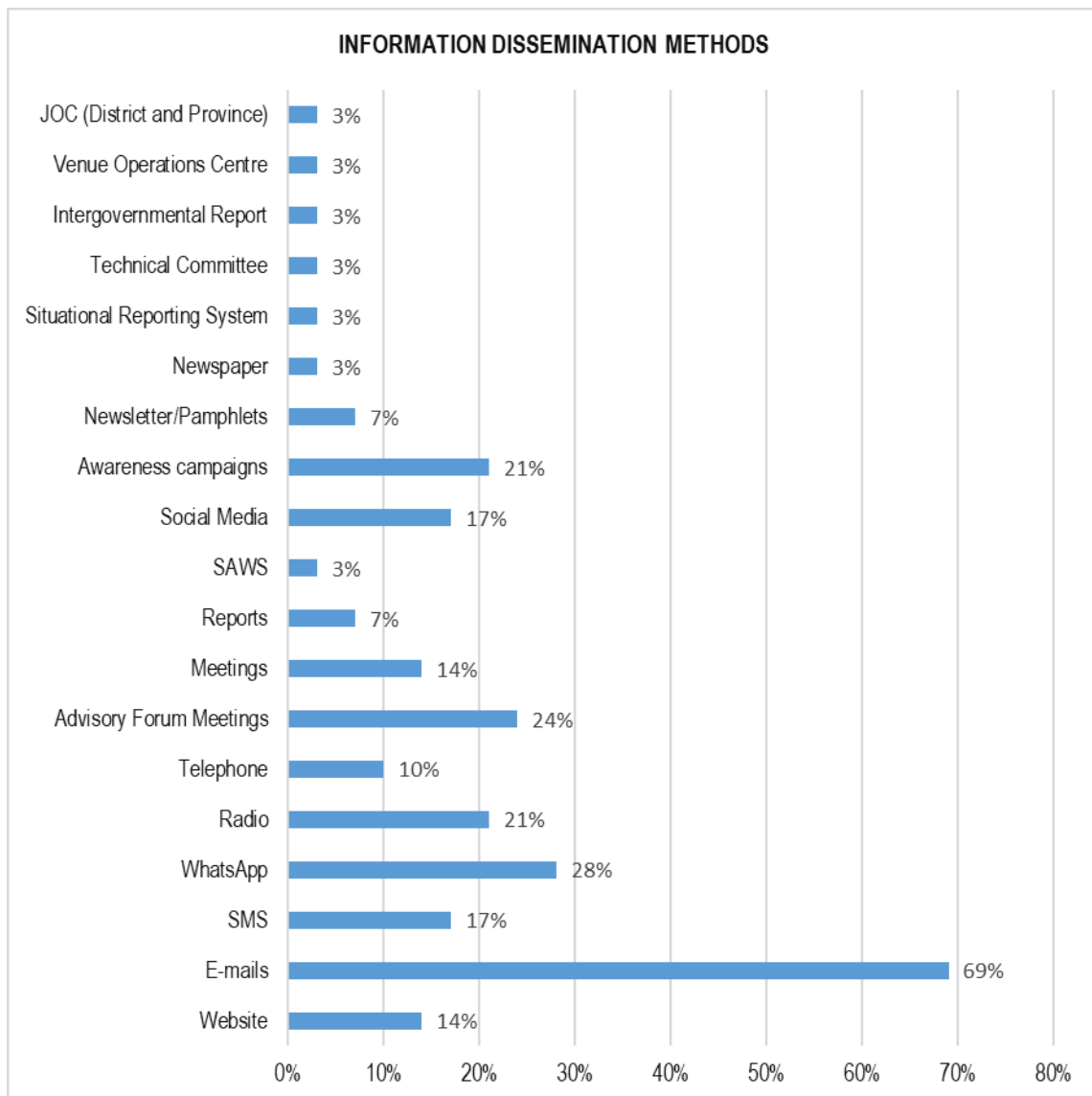
Figure 7.17 *PDMCs information dissemination methods*
Source: (Survey Results, 2019)

The least utilised dissemination methods at 3% each were as follows: Joint operation command, Venue operation centre, Intergovernmental report, Technical committee, Situational reporting systems, Newspapers and SAWS. Newsletters, Pamphlets and Reports accounted for 7% each, while Telephone use accounts for 10%. Each of the 14% of respondents indicated that they used Meetings and Websites. Social media, Facebook in particular, and SMS accounted for 17% each of the respondents.

A respondent concerning Facebook, *"We use the COGTA departments Facebook page, through the communications department"*, made these specific comments. Here we see another indication of bureaucratic red-tape, possibly affecting the PDMCs independence in decision-making. Awareness campaigns are utilised by 21% of the respondents, Advisory forum meetings by 24% and WhatsApp by 28% of the respondents. For disseminating information, we see WhatsApp as an acceptable platform, which is a good indication of a move to accepting technological change. E-mails account for 69% of utilisation by the respondents. However, this shows that the PDMCs are mostly disseminating information to a few stakeholders on a strategic level. Further, the limited use of some of these methods indicates a lack of communication strategy in the PDMCs.

7.1.3.4 Information and technological systems used by the PDMCs for combating hazards

Identifying specific information and technological systems for managing specific risks and responding to disasters, might be a necessary approach to effectively reducing the risks and responding to the possible disasters. The hazards shown in Figure 7.18 were summarised, based on what the respondents indicated in the open-ended question on hazards experienced in their province. Figure 7.18 unravels the respondents' most experienced hazards in their provinces and based on these hazards, they shared the information and technological systems that they use to manage them.
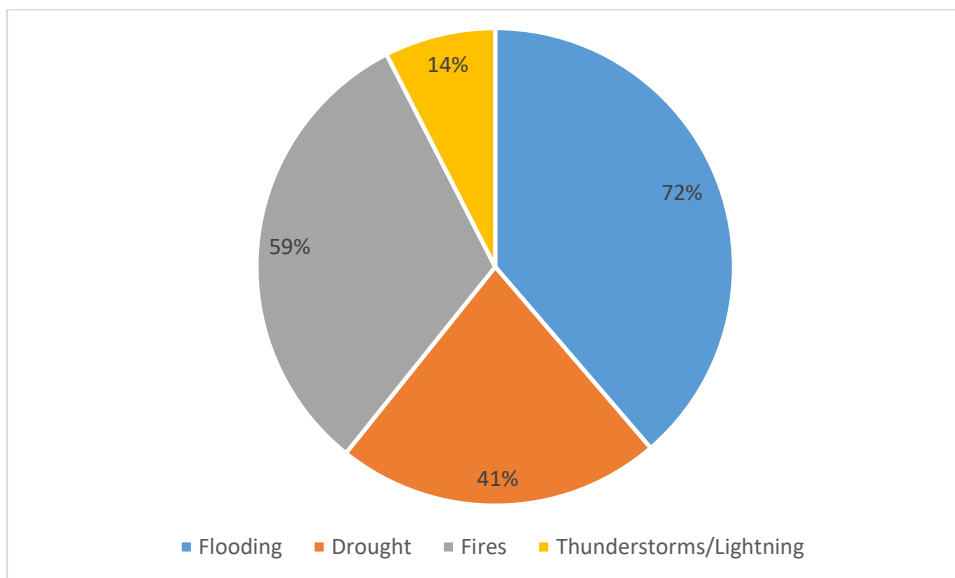
Figure 7.18 The most experienced hazards in the provinces
Source: (Survey results, 2019)

Thunderstorms and lightning are the least experienced as evidenced by 14% of the respondents, 41% of the respondents mentioned droughts and 59% mentioned fires. Flooding was the most

problematic hazard, accounting for 72% of the respondents' responses. The significant experience of fires and flooding could be accredited to the high number of informal settlements (which account for 13% of the South African population) who are at risk of fires and flooding (The Conversation Media Group, 2019; Williams, *et al.,* 2018).

Figure 7.19 indicates the information and technological systems the respondents use in combating hazards experienced in their provinces.
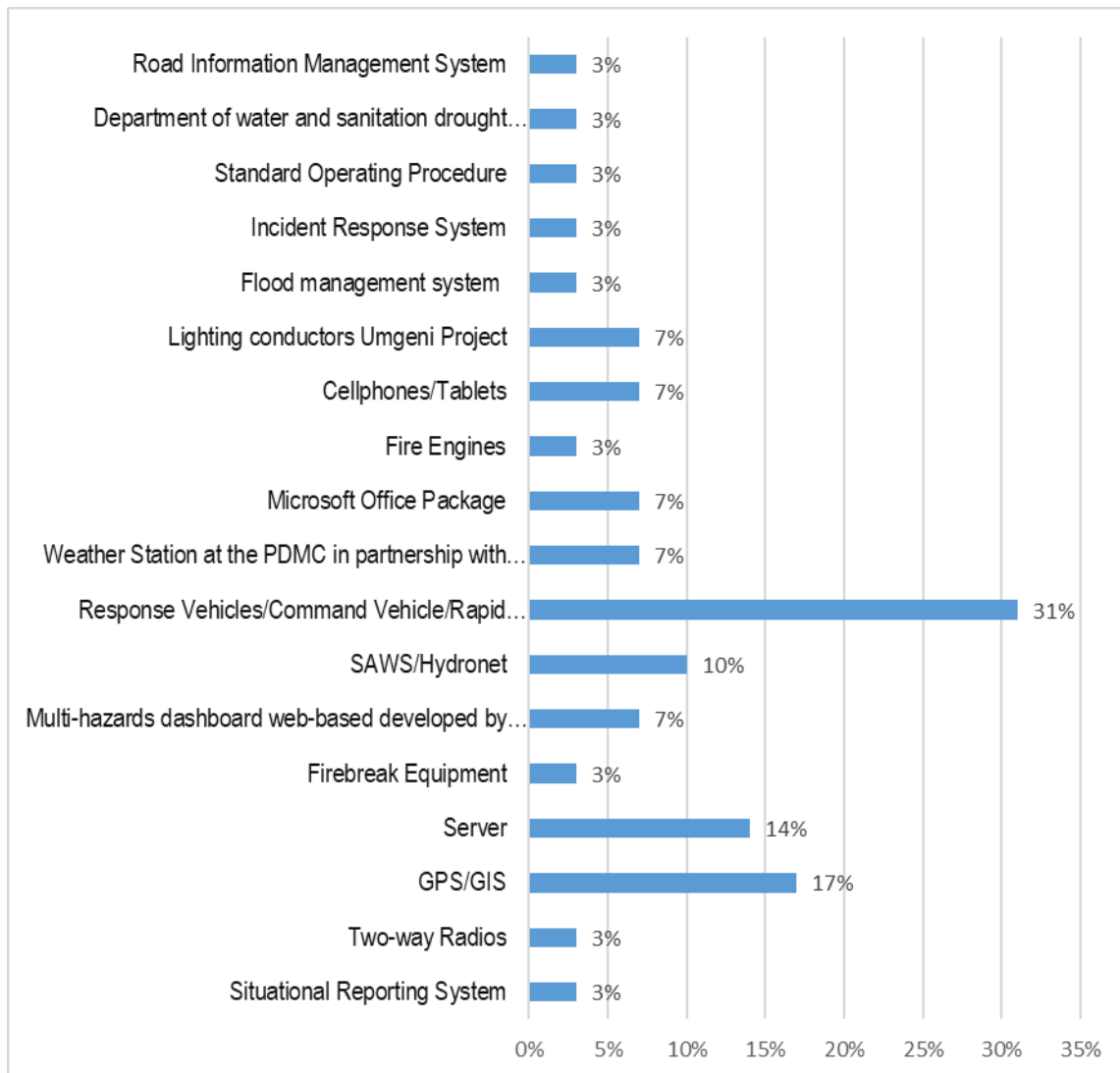
Figure 7.19 *Systems utilised in the PDMCs to manage disasters*
Source: (Survey results, 2019)

From the illustration in Figure 7.19, 3% of the respondents, for each system, mention the utilisation of these systems: the Road Information Management System, Department of Human Settlements, Water and Sanitation dam level monitoring system, Standard operating procedure, Incident response system, Flood management system, Fire engines, Firebreak equipment, Two-way radios and Situational reporting systems. All of these are very important systems that

require 100% use by all PDMCs, whether they are within the PDMC or the PDMC has acquired the systems for the municipalities in the province. According to Figure 7.19, 7% of the respondents and for each system, identified utilisation of the following, Lighting conductors, Cellphones or Tablets, Microsoft office package, Weather station and a Multi-hazard dashboard. This is still significantly low usage. The Hydronet system for monitoring and evaluation by the SAWS account for 10% of the respondents' utilisation, while Servers account for 14%. GIS and GPS systems account for 17% of the respondents' use. Response vehicles also mentioned as Command vehicles, Rapid response and Mobile units, dominated utilisation at 31% of the respondents. Responses to this question were difficult for most respondents because they could not state exactly which system they use for specific hazards. It could be that there are no strategic planning and approach to how they manage risks and respond to disasters.

7.1.3.5 PDMCs perceptions about information systems and decision-making

Table 7.7 illustrates the respondents' perceptions of information systems.

Table 7.7*PDMCs perceptions about the significance of Information Management*

	Strongly Disagree (1)	Disagree (2)	Not Sure (3)	Agree (4)	Strongly Agree (5)
1. Do you think a disaster management centre can operate effectively without Information?	96%		4%		
2. Do you think every disaster management centre should have a methodology/set data collection tools for the collection of data?			3%	11%	86%
3. Should an effective information management system be able to store information?			3%	4%	93%
4. Do you think an information management system requires skilled people to operate and manage it?		11%	3%	11%	75%
5. Do you think the management of information contributes to successful disaster risk governance?			4%	14%	82%
6. Do you think the PDMC must identify and analyse stakeholders for the effective management of the information management system?			4%	14%	82%
7. Do you think the PDMC's prioritisation of stakeholders within a centre and externally is important for the effective operation of the system?			3%	11%	86%
8. Do you think stakeholders can affect or be affected by the absence of information?			3%	18%	79%

Source: (Survey results, 2019)

With 96% of the respondents 'Strongly Disagreeing' that a disaster management centre cannot operate without information, signifies the importance of information in disaster management operations. Current research shows that information management is pivotal in disaster management because it enhances the preservation of institutional knowledge, good

governance, perceived self-efficacy, education and effective response (Sanquini, Thapaliya & Wood, 2016:347; Rattien, 1990:36; Haas, Mazzei & O'Leary, 2007:24). Eighty-six per cent (86%) of the respondents value the research methodology planning. Equally, 93% of respondents view a system that can store information as a very effective system.

The respondents 'Strongly Agree' at 75% that an information system requires skilled people to operate and manage it. However, 11% of the respondents 'Disagree' with this thinking. It could be that these respondents have limited knowledge of what information management entails. The respondents shared their thoughts on this matter, where respondent 1 said: "*Skilled personnel are not necessary*". In contrast, respondent 2 said, *"A lot of people are under the thinking that the system does not require skilled personnel but it does"*. Likewise, respondent 3 concurs with respondent 2, saying, "*Certain skills are needed yes, because if the technology or certain aspects of the system are more advanced than the skills one has, then there is a problem*". The responses from respondent 2 and 3 show that they concede that skilled personnel are required to operate this system. Respondent 4: "*Not necessarily, it should just be user friendly",* and respondent 5: "*Anyone can use it even if they are not experts"*. The Information and Knowledge Management for Disaster Risk Reduction Framework (IKM4DRR) argues that information management requires skilled and dedicated people because informed decisions have to be made (UNISDR, 2013). Similarly, van de Walle, Turoff and Hiltz (2010:9) argued that information systems assist officials responding to disasters because the information is required for decision support. The ability to perform informed decisions from existing information is a comprehensive account of the need for skilled personnel to manage the information systems. It can be argued that information systems do not require skilled personnel; they have to be very knowledgeable about the system.

As described in the literature review, functional information and communication systems should be able to receive, disseminate and exchange information for various disaster risk activities (*see figure 5.2 in Chapter 5*). This suggests that the identified activities for operating and managing the information system, require an analytical, critical, strategic thinker, planner and coordinator. Christopher and Thatham (2011:270) highlight the significance of these skills, reporting that communication and information systems assist in controlling relief operations, emergency planning, response and management. Finally, based on the activities the system must perform, it is evident that experts in indigenous knowledge, research, data capturers,

communication, human resources, educators, statistics, GIS experts and many more, are required (UNISDR, 2015:11; Dube & Munsaka, 2018:3; Van Riet, 2008:7).

A majority of the respondents at 82% 'Strongly Agree' that information aids in good disaster risk governance. At another 82% and 86%, the respondents 'Strongly Agree' that stakeholder management and prioritisation makes for effective information management. This could be that the NDMF mandates the identification of data custodians for the management of information (Republic of South Africa, 2005). Some respondents shared their thinking on this matter as follows:

- Respondent 1, *"It is important because all stakeholders will know their mandate. Sometimes during meetings, the sector departments do not respond or contribute because their roles and responsibilities are not clear"*,
- Respondent 2, "*The organs of the state do not have disaster management units, this then makes it difficult to share information because there is no specific person to work with. The lack of disaster management dedicated officials in sector departments makes it difficult to identify and analyse stakeholders because at every advisory forum meeting there is always a new representative. We need to legislate the sector departments to have officials solely for disaster management. The NDMC can assist with the legislation of disaster management focal points in sector departments because they have a sphere of influence through the national intergovernmental committee. I usually say to the politicians, if you want to win a second term in office, then disaster management should be your priority"*.

Stakeholders do affect and can be affected by the absence of information and this is indicated by 79% of the respondents who 'Strongly Agree' with this. One respondent said: *"It can have a huge impact in terms of support and knowledge of their roles and responsibilities"*. This also supports Freeman's (1984) propositions that stakeholders can affect or are affected by the operations of an organisation.

7.1.3.6 PDMCs perceptions about communication systems and information dissemination

Table 7.8 shows the respondents perceptions about communication systems and information dissemination.

Table 7.8 PDMCs perceptions about the significance of Communication Systems

	Strongly Disagree (1)	Disagree (2)	Not Sure (3)	Agree (4)	Strongly Agree (5)
1. Do you think a disaster management centre should have a **website** to help disseminate information to the online stakeholders?		4%	3%	7%	86%
2. Do you think a disaster management centre should keep abreast with the 4th industrial revolution in building more resilient communities?			4%	14%	82%
3. Do you think the categorisation of social and traditional media usage plays an important role in the successful dissemination of information to targeted audiences?			4%	15%	82%
4. Do you think an effective CS must be highly interoperable amongst stakeholders internally and externally?			4%	14%	82%
5. Do you think an effective CS must include other methods of communication like video-conferencing?			3%	11%	86%
6. Do you think an effective CS must include non-electronic information access and dissemination capabilities like two-way radios and public address system?			4%	21%	75%

Source: (Survey results, 2019)

A website is a great platform for information dissemination and this is reflected by 86% of respondents who 'Strongly Agree'. However, 4% of these respondents 'Disagree' with this thinking. One of the respondents shared their thoughts: "*Having an independent website from the Department is not mandatory for us because we are a coordinating function. Second, our province is 80% rural so the usage and access to online materials is not a need for the community. A website will be a 'Nice to have' platform but not mandatory".* The Fourth Industrial Revolution (4IR) is challenging the current way of doing things, regardless of this, the respondents 'Strongly Agree' that a disaster management centre should keep abreast with the 4IR to build resilient communities. Unfortunately, 4% are 'Not Sure' and one respondent said this: "*Our province is not yet there. We are very far from the 4IR".* Another respondent said "*We need to move towards a paperless system, for example, carrying out risk assessments with a smartphone were what we capture while in the field is sent directly and immediately to the main system. It is faster and risk-free".*

Stakeholder targeting during information dissemination requires proper categorisation of the type of media to use and 82% of the respondents 'Strongly Agree'. Some respondents indicated that: "*Strongly agree to cater for all audiences",* another respondent said: "*Categorising social and traditional media according to the target audience is important because they both still play*

an important role. Our communities are very diverse, some are tech-savvy and some are not and still rely on traditional methods of communications", while the third respondent shared this *"I strongly agree with the categorisation of media according to the target audience because here in XXXX traditional media is more acceptable. The locals usually buy into what the local radio DJ would have said than what would have been communicated online".*

Another 82% 'Strongly Agree' that a communication system must be highly interoperable among stakeholders. The NDMF mandates the IMCS for the disaster management centres built to be interoperable. *"Interoperability can be achieved by reaching service level agreements with various sector departments. We have to have access to their systems and they have access to ours"*, shared a respondent, while another one said: *"Information sharing policy must be adhered to".*

Video-conferencing has proven to be a significant tool, especially during the COVID-19 era when the nation went into lockdown (Dans, 2020). To attest to this, 86% of the respondents 'Strongly Agreed' that a communication system should include video-conferencing. One respondent mentioned this: *"We have office 365 which supports video conferencing"*, while the other respondent said: *"Technologies such as video conferencing will assist with the current issue of cost containment"* and the other one that *"Video conferencing is also good because it cuts costs on travelling and time".*

In a situation where electronic systems are offline, systems like two-way radios and public address systems are imperative and 75% of the respondents 'Strongly Agree'. The respondents shared their thoughts on this issue: *"non-electronic methods of collecting and accessing information are good for times when there is no electricity"*, and another said: *"Other non-electronic forms of obtaining information and communication are important. We saw this during the Knysna fires where all systems went down".*

7.1.4 Findings from the National Disaster Management Centre
After collecting data from the PDMCs, the last data collection point was the NDMC. The results from the NDMC sought to support the results from the PDMCs. The NDMC was included because the study considered it a rich source of information for comprehending the objectives of this research. The respondents from the NDMC included the head of the Centre and four subordinates, making the respondents a total of five. The NDMC questionnaire included mostly open-ended questions. This approach contributed to the acquisition of rich and in-depth information from the NDMC respondents.

7.1.4.1 Effects of different organograms on the NDMC and PDMC operations

Table 7.9 shows the respondents' views on ways the organogram variations affect disaster management operations. The effects include conflict in roles and responsibilities, the designation of PDMC heads, inconsistent operations and information-sharing barriers. In the qualitative research findings section, the study presents the organograms from each PDMC, as well as the NDMC. Deriving from the respondents' responses in Table 7.9, the different organograms in the PDMCs and the NDMC do affect the operations of both the spheres. The problem occurs when a PDMC is communicating with other PDMCs (Horizontally) and when a PDMC is communicating with the NDMC (Vertically).

Table 7.9 Respondent perceptions about the effects of different organograms

Respondent 1	To a certain extent, yes it does affect the operations because the provinces have the discretion to design their structures. The national centre cannot dictate to the PDMC's nor the PDMC dictate to Municipalities. This is made clear under Schedule 4, Part A of the Constitution of the Republic of South Africa, which clearly states that Disaster Management is a functional area of concurrent national and provincial legislative competence. "The constitution further states that each sphere has the autonomy to exercise its powers and perform its functions within the parameters of its defined space". The measures we have put in place to deal with such issues of autonomy, we have developed Technical Functions were various stakeholders play a key role in ensuring service delivery, such as Intergovernmental Committees and Advisory Forum Meetings.
Respondent 2	The functions of the disaster management mandate are different and these variations lead to roles and responsibilities conflict.
Respondent 3	The variations of the organograms affect the operations of the centre in so many ways, especially the designation of the PDMCs Directors. Willingness is also key, despite the structure of the centre to help overcome bureaucracies.
Respondent 4	Operations are affected; hence alignment must be established between NDMC's, PDMC's and MDMC's in terms of organisational structures.
Respondent 5	Similar organograms from the NDMC cascading down to the PDMCs and MDMCs might be an indication of integration and uniformity. Of course, organisations create organograms to suit the different environments, but the differences should not be major. Similar structures might be one of the strategies to promote effective information-sharing because there will be clear channels to follow when depositing information into the conduit/repository or requesting information from other organs of state or disaster management spheres of government.

Source: (Survey results, 2019)

7.1.4.2 Does the NDMC have an IMCS according to the NDMF?

One respondent said 'Yes' and 'No' while the other four said 'No'. The respondent who said yes and no, shared his/her views as follows: *"Yes and No, because since the inception of the NDMC, IMCS has been a priority and pivotal for the Centre. We have procured various products like 1. Situational Reporting System, 2. Website, 3. Stakeholder Database, 4. Database for Declared Disasters, 5. Common Alert Protocol from SAWS, 6. Impact based early warning system with SAWS, 7. Interfaces with other stakeholders like the Agricultural Research Council for SPI and Vegetation Condition Index), 8. Minort from the Department of Health that deals with a disease outbreak. We are in the process of developing a "Big Data Platform" with information from all the provinces. The challenge we now face is because of the Constitution, schedule 4, part A, we cannot enforce an integrated and interoperable system*

with the municipalities because they have the autonomy to procure their own". The other respondent said: *"Procurement of systems is shortlisted and limited to 5 years. After that period, you are faced with the challenge to change. The best approach will then be to develop an internal system but an internal system will not be feasible to maintain because of limited capacity"*. It seems the establishment of IMCSs is a cumbersome process, which might take a long time to eventually establish. Moreover, the uniformity expected by the PDMCs might not also suffice, because of the Constitution that grants autonomy. One system that concurs with some of the PDMC systems is the Situational Reporting System. This is the only system, which the NDMC has and some PDMCs have.

7.4.1.2.1 NDMC systems used to store and disseminate information

Table 7.10 shows the systems the NDMC uses to store information received from the lower spheres of government and other stakeholders. The table also shows the systems that the NDMC utilises to disseminate information to the municipalities and other stakeholders. Table 7.10 shows that one respondent indicated that information is stored with partners, such as SAWS.

Table 7.10 NDMC information storage and dissemination systems

	INFORMATION STORAGE SYSTEMS	INFORMATION DISSEMINATION SYSTEMS
1	Stored with partners e.g. SAWS, Agricultural Research Council	Website
2	Big Data Platform	Web Portal
3	Situation Report System	Publish in the Government Gazette
4	Personal Computers	E-mail
5	Database of plans on the website	Bulk SMS
6	Personal Cloud	Meetings
7	Personal External Hard drives	WhatsApp
8	NDMC server	Conference Presentations
		Advisory Forum Meetings

Source: (Survey results, 2019)

As a coordinating function, the disaster management centre should be the main central repository station for information and section 6.6.3 of the NDMF supports this (Republic of South Africa, 2005:86). The mention of a 'Big Data Platform' in Table 7.10 is not a true reflection of the systems the NDMC uses to store information. This is because the respondent in the first question on if the NDMC has an IMCS said that they are in the process of developing a 'Big Data Platform'. The 'Situation Reporting System' seems like the most common system known and used by the NDMC and some PDMCs. Storage of information on 'Personal Computers' is a popular storage system for both the NDMC and PDMC respondents. This shows that an integrated information system is lacking at both spheres. Storage of information on the 'Website' and 'NDMC Server' is good. However, the storage of information on

'Personal Clouds' and 'Personal External Hard Drives' is not efficient as it affects the preservation of institutional knowledge.

Concerning the 'Website' and having an online presence, one respondent shared this: *"An online presence is very important, however, for the NDMC to be very active, capacity is required. Social media platforms like Twitter and Facebook helped save lives during the Knysna Fires"*. It seems the NDMC does not have the adequate capacity to manage the vast social media platforms. Another respondent indicated that: "*An online presence is very important, however, we do not have an information and communication strategy, a media strategy in particular because we are subjected to the rules and regulations of the department COGTA. I strongly believe NDMC should have a strong online presence"*. Regardless of the disaster management function bearing the role of coordination, it seems they rely on the COGTA department, who in turn, is subjected to red-tape bureaucracy. Ultimately, the different systems mentioned by the PDMCs and the NDMCs show that there is variability among and between these spheres of government.

Additionally, the study sought to understand if the NDMC has developed and implemented any strategies to enhance disaster management governance through the application of the benefits of 4IR. One respondent said: *"The country is still struggling with the three industrial revolutions, as a government entity it is difficult to play in the 41R space like the private sector. Such a space requires highly qualified personnel and because of the competition in the job market, staff turnover is high. However, we are developing guidelines, improving our website portal and reporting systems. We are also developing a social media strategy and broadening our relationship with stakeholders. The 4IR is also affected by the supply chain processes which are tedious"*, the other respondent said: *"We developed tools for compliance like guidelines for establishing a disaster management centre. My wish for NDMC is to have a fully-fledged IT department. Technology is great but incorporating "back to basics" where we combine traditional methods and new methods will also do justice to the disaster management function especially during a disaster"*. Based on these responses, it seems there is some resistance to move towards the 4IR and if that is the case from a national government, then there is limited hope in this regard for the lower spheres of government. Supply chain processes are problematic, not only limited to the PDMCs but also experienced in the NDMC. The reason for this problem relates to the placement of the function.

7.1.4.3 NDMCs perceptions on start-up costs funding to the PDMCs

All the PDMCs indicated the absence of a start-up grant for establishing the PDMCs, in particular, KPA 1 and enabler 1. Thus, the study suggests that the decision made by NDMCs to refrain from funding the PDMCs, affected their operations, such as the placement of the Centres, the lack of uniform systems and resources. According to Table 7.11, the respondents argue that they made this decision because the Constitution provides the PDMCs with autonomy. Hence, they can fund themselves from the provinces' equitable shares. Respondent 2 disagrees with the study's hypothesis on the lack of start-up costs affecting the PDMCs operations. They argue that poor operations are because of an individual's dysfunctionality. Respondent 3 argues that the NDMCs decision to not fund is not a problem. These responses show that the NDMC prioritises the Constitution above the DMA and NDMF that governs disaster management operations.

Table 7.11 *NDMC Perceptions of start-up costs*

Respondent 1	The decision to not fund was because of the Constitution, which gives autonomy to the spheres. Second, because the municipalities receive equitable shares a financial allocation in the form of an unconditional grant for them to operate.
Respondent 2	I do not feel that the lack of guidelines is an excuse or affects the operations of the centre, because some PDMCs are functional without them. The guidelines embedded in the Act and the Framework are sufficient. Operational is an assumption and the PDMCs that are not functional is because of the individuals' dysfunctionality.
Respondent 3	It is not an issue to not fund, because the different spheres of government are funded according to the constitution and the provinces allocate funds according to priorities.

Source: (Survey results, 2019)

7.1.4.4 NDMC efforts to support PDMCs and placement of the disaster management function

The study credits the limited support to the PDMCs from the NDMC to the Constitution of South Africa. Respondent 1 supports this attribute as Table 7.12 illustrates. The NDMC finds fault in the Constitution; they assert that decentralisation results in a lack of accountability. Additionally, Respondent 2 indicates a lack of political will. Consequently, he/she calls attention to the displacement of the disaster management function to the Ministerial Committee. In contrast, Respondent 3 argues that centralisation does not work, thus, placing the function in a higher office causes some challenges. It seems the NDMC respondents disagree with how to support the PDMCs.

Table 7.12 *NDMC support to PDMCs*

Respondent 1	The structure mandated by the constitution, as well as the misplacement of the function outside the President's Office and the Premier's Office, affects accountability. NDMC is now in the process of proposing to re-engineer the structure. NDMC appointed the Government Technical Advisory Centre (GTAC) research on the possibilities of vertically integrating the disaster management function where the PDMC will start reporting directly to the NDMC. Authority will be centralised, but administration of responsibilities decentralised. The NDMC will present a business case to the Parliament for approval. Labour relations and legal implications might be a challenge for the new proposition.
Respondent 2	I attribute the misplacement of the disaster management centres in the various spheres of government is attributed to the lack of political will. Political will is required for the effective functioning of disaster management centres. We referred the misplacement of the function to the Ministerial Committee.
Respondent 3	The NDMC appointed GTAC to assess identifying the proper placement of the disaster management function. The question of vertical integration working and decreasing the discrepancies experienced in the disaster management function remains. If we were to go according to the disaster management policy, for example placing the PDMC in the Premier's office, that means after the 5-year term the disaster management head, the rest of the officials might have to vacate office as well, and this is not feasible. Placement of the function is important, however, it is not the solution. Mostly to the various problems the disaster management function faces. The problem is the individual charged with managing the centre and the inter-relations with the various stakeholders, as well as the ability to influence.

Source: (Survey results, 2019)

The qualitative results

A narration of the disaster managers' lived experiences from each provincial centre is presented under three themes: (i) *Disaster risk governance of the centre concerning the infrastructure and organogram,* (ii) *Information management and communication systems status and general comments.* The study's theories, models, NDMF and literature, are revisited to support the discussion of the identified themes. The departure of the theme discussions commences with pictures from the observational walk and organograms shared by the PDMCs.

7.1.5 About PDMC 1
Picture 1 shows the infrastructure of PDMC 1.

Entrance from main gate 1

BROKEN WINDOW
Entrance from main gate 2

Entrance into building

Dark corridor 1

Dark corridor 2
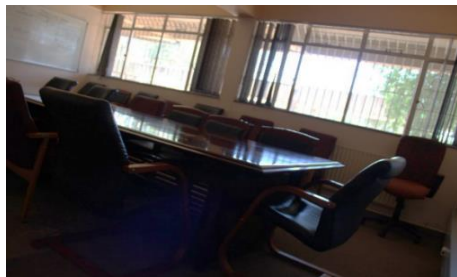
Boardroom

Respondent's office

Pictures 1: PDMC 1 infrastructure
Source: (Survey results, 2019)

7.1.5.1 Disaster risk governance of PDMC 1 concerning the infrastructure and organogram

As shown in Picture 1, and based on NDMF section 1.2.2.2 and 1.2.4.4, which prescribes the minimum infrastructural requirements for PDMCs, this centre seems underdeveloped. The disaster operations centre is significantly small to facilitate disaster risk management planning, operations and to support multidisciplinary strategic management of disaster operations. It does not have the integrated information management and communication system according to

enabler 1, nor a 24-hour central communications centre. A media and public information service are unavailable and they do not have an education, training and research facility. As shown in the pictures, the PDMC does not have adequate office accommodation and facilities for operational personnel. In support of the study's findings, Jordaan (2018:81) put forth this comment about PDMC 1: "PDMC 1 *has adequate office space but it is poorly maintained with a depressing atmosphere that is not conducive to productivity. The boardroom is too small for joint planning and coordination meetings. The centre does not have a JOC or any physical capacity to monitor, and coordinate provincial disasters...*" Since the promulgation of the DMA and NDMF, the study does not envisage a government institution to be in this state. The building looks abandoned with broken windows and dysfunctional lights in the corridor.

Figure 7.20 illustrates PDMC 1 organogram as supplied by the centre. The centre is a sub-directorate of the chief-directorate: Municipal Intergovernmental Support and Capacitation Governance in the Department of COGTA.
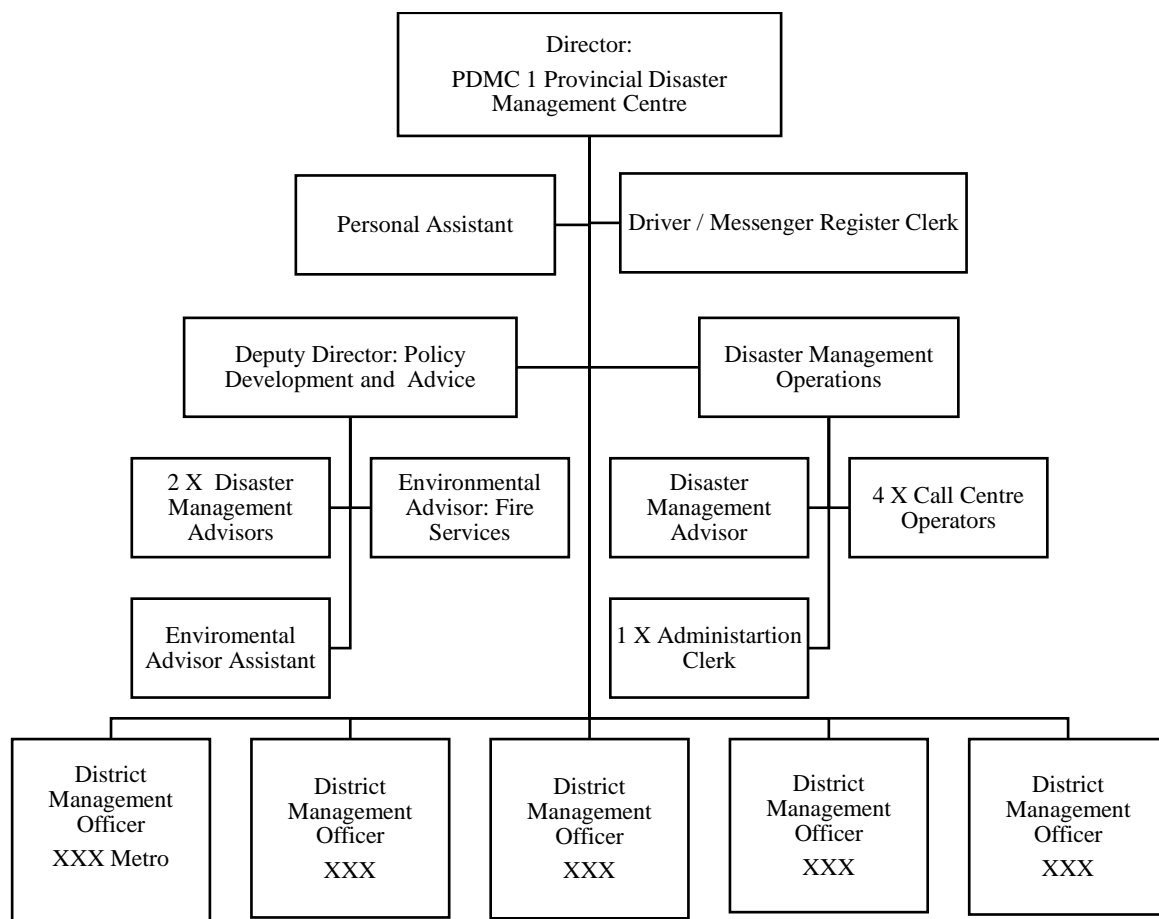
Figure 7.20 *PDMC 1 organograms*
Source: (Authors illustration as supplied by PDMC 1)

The location of the PDMC in a Chief Directorate shows that it experiences excessive administrative procedures, as a result of experiencing slow decision-making. For example, the Director of this PDMC has to report to the Chief Director before it can even reach the MEC. This PDMC's organogram or organisational table is client-based, meaning their focus is on servicing the municipalities and sector departments in the province. This approach is according to the NDMF section 1.2.4, which states that the PDMC provides support to the metropolitan and district disaster management centres in the province. This shows that the PDMC is maintaining its strategic overview of providing support and guidance to the lower spheres of government in the province. Based on a respondents comment, it seems they are not in support of this structure: "*We do not work in specific areas of expertise or focus on specific areas like KPA's and Enablers as managers. We are in charge of everything and being a generalist is not possible; it affects our ability to deliver and achieve results*". The reason for this might be the limited comprehension of the DMA and NDMF. This result accords with Smith's (1973) on discrepancies with policy implementation. Smith argues that policy implementation is hindered by insufficient direction and control from politicians, tension, strain and conflict among the policy implementers and the society (interest groups) affected by the policy.

Another respondent made this comment, which supports Smith's (1973) thinking: "*A lack of an effective organogram affects accountability because there are no specific roles and responsibilities defined. Our infrastructure is not suitable for a disaster management centre; we have lots of difficulties such as the electricity supply in this building is not good*". This comment supports the observations as shown in the pictures. Figure 7.20 also shows that the organogram does not support IMCS.

7.1.5.2 Information management and communication systems status and general comments

According to the observational walk and as depicted in the pictures, there were no signs of information and communication systems. As according to the NDMF section 1.2.4.1, the researcher did not observe an incident command or joint operations centre and a 24-hour system for disseminating early warnings. No Geographical Information Systems (GIS) with display applications and no multimedia communication systems were observed. Also, no hand-held Geographical Positioning Systems (GPS) devices were observed. The respondents indicated that electricity was a problem, as this affects internet connection. One respondent said: "*Our infrastructure is not suitable for a disaster management centre, we have lots of difficulties such as electricity supply in this building is not good. We store information on our*

personal computers with the fear of losing the information if the computer is stolen or lost.
When I am not at work no one has access to my information".

7.1.6 About PDMC 2
Picture 2 illustrates the observed infrastructure of PDMC 2.

View from the road 1

View from the road 2

Entrance to the building

Reception
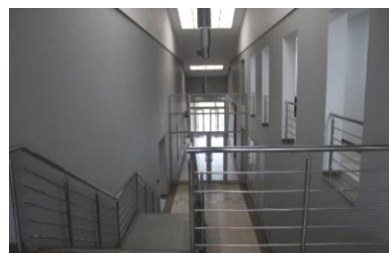
Corridor

Foyer / Entrance to offices

Convening / eating area

Corridor
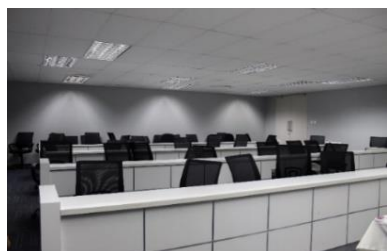
One of the boardrooms
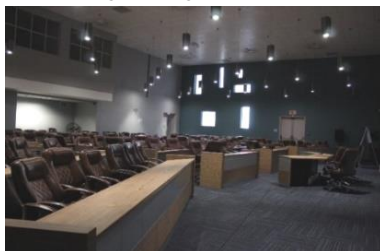
Conference room
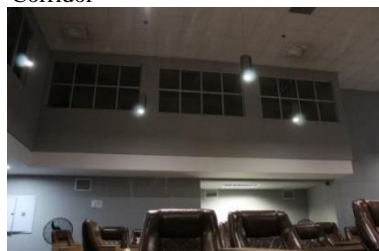
Discussion rooms above the conference room

Warehouse

Response vehicles

Pictures 2: *PDMC 2 infrastructure*
Source: (Survey results, 2019)

7.1.6.1 Disaster risk governance of PDMC 2 concerning the infrastructure and organogram

The pictures illustrated in Picture 2 from the empirical observations corroborate with some of the prescriptions in the NDMF section 1.2.2.2 and 1.2.4.4 on minimum infrastructural requirements. The PDMC does facilitate multidisciplinary strategic management disaster operations, as seen in their facilities. The Centre has ample office accommodation and facilities for operational personnel. The PDMC has adequate facilities for education, training and research. Interestingly, the NDMF does not prescribe a warehouse as a key facility for disaster management operations. Nevertheless, the PDMC is proactive in this regard and has a fully stocked warehouse.

Figure 7.21 illustrates PDMC 2 organogram as supplied by the Centre. In 2005, PDMC 2 established its Centre, which moved to the new premises in 2016, operating under the COGTA Department. A Chief Director designation for the head of the Centre shows some authority and as seen in the organogram, this PDMC applies a balanced disaster management approach. It has a full unit focusing on disaster risk reduction and planning and another unit on disaster management operations. The organogram illustrates some components of information management and communication, such as call centre operators. Although, some of these posts are vacant.
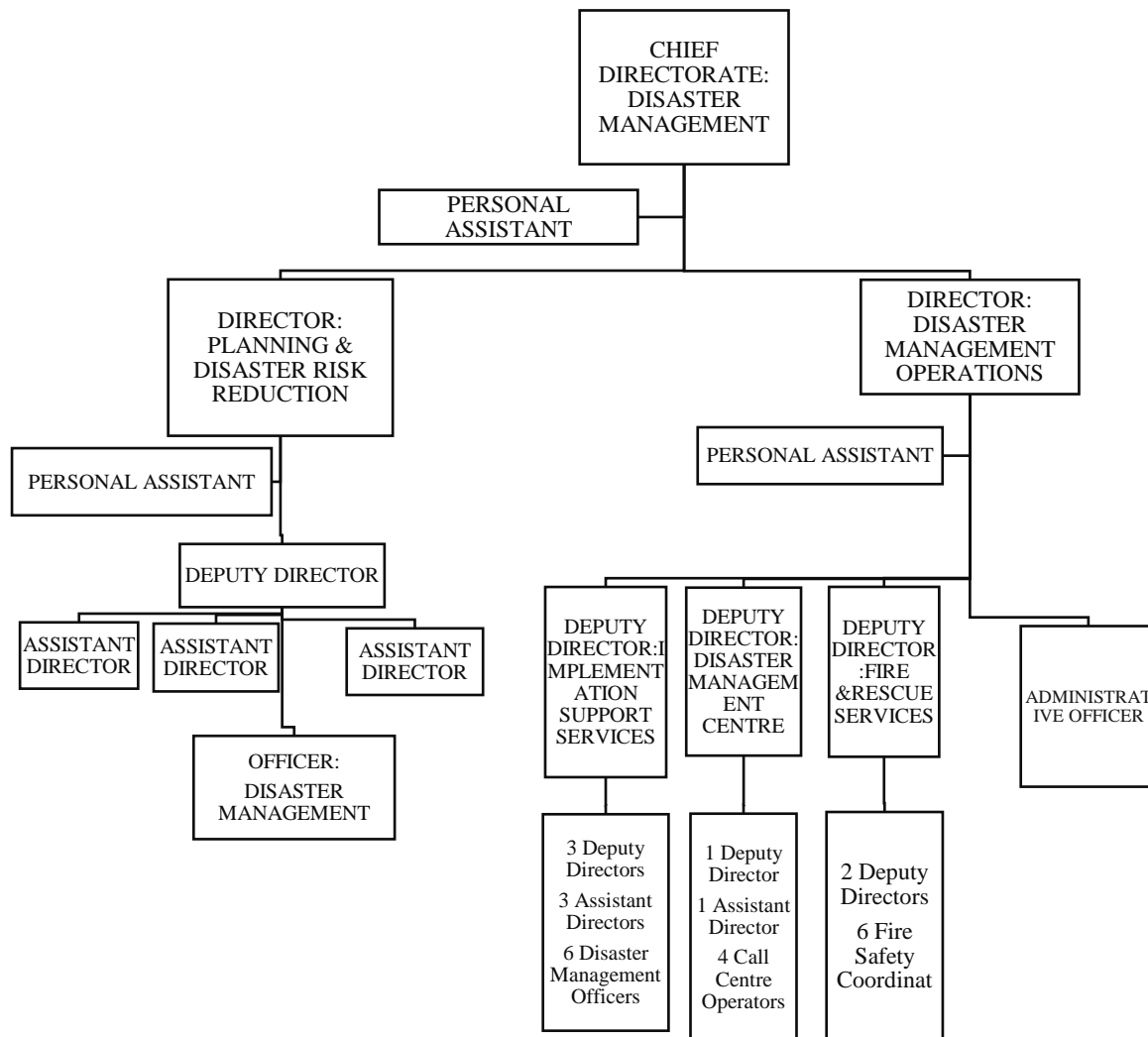
Figure 7.21 *PDMC 2 organogram*
Source: (Authors illustration as supplied by PDMC 2)

7.1.6.2 Information management and communication systems status and general comments

Based on the observational walk and as shown in Picture 2, there is potential for the centre to establish an IMCS. According to the NDMF, the researcher observed an incident command and joint operations centre. However, the study did not observe a 24-hour system for receiving calls and disseminating early warnings. There was no indication of GIS with display applications and no multimedia communication systems. Moreover, the researcher did not see any GPS devices.

The PDMC indicated that they are in the process of procuring an IMCS. In the respondents' accounts of the events surrounding the delayed establishment of the system, various responses emerged. One respondent said: *"2 years ago we developed a plan for the system and obtained*

funding for it but the procurement process has been difficult to get approved". This could be because of government red-tape bureaucracies. Another respondent said: *"Supply chain process takes a long time"*, confirming the other respondent's views. Another respondent said: *"We are struggling with establishing a system because of the top management within the COGTA Department".* Still on this issue, one of the respondents made this general comment, which gives more perspective on the Centre's experiences and plans regarding the systems: *"The centre does not have an IMCS as according to the standards in the NDMF because we are currently in the developmental stage of the centre. However, our operations are unaffected by the absence of an IMCS. We have enough funding and political support for the system, the problem is the procurement process. We are currently using a server that is linked to the COGTA Department. However, in the future; we would like to have a server that is linked to the municipalities, as well as the National Disaster Management Centre. The intended features for the IMCS will be a bulk SMS system linked to a database of grouped contact details e.g. XXX District Municipality will just be a click away. The IMCS should also have an Indigenous Knowledge database with all the Indigenous Knowledge disaster risk reduction strategies for each hazard assessed. The IMCS should also be able to link to fire detector cameras that we installed in partnership with the Fire Protection Association. The cameras will aid quick response to veldt fires and even in informal structures. XXX Municipality installed a Flood Detector System that helps in the warning communities. We also aim for our IMCS to connect to the municipalities systems. We anticipate a system that has radios connected in our response vehicles and linked to our office for real-time situational reporting. Availability of Information management and communication systems in a disaster management centre lays with the decision-makers. The decision-makers see the disaster management function as a "By the way" function and believe that our focus is only on response and recovery. Hence, IMCS is not prioritised. We cannot procure GIS because they are already in the Department of Planning and Development".*

In addition to this, one respondent made a general comment: *"Information Management and Communication Systems are important in all aspects of disaster management phases and its absence impacts on our operations negatively. We have a budget of about 100 million for the system, but the top management is not supporting us, because they do not understand the function. To show that they do not understand our function after a disaster declaration, they expect the funds to be released to the PDMC and not to the Sector Department and this upsets*

them. "My vision for the PDMC is to have a library where we store all our information in hard copy and soft copy, including historical reports as well".

A recurrent theme in the respondents' views was the problematic supply chain process that ties the Centre's progress in procuring systems that will aid in their operations. However, one divergent discourse emerged from the respondents' comments, which were the impact of the system on the Centre's operations with one saying their operations are affected and the other arguing that they are not affected. This finding indicates that there are limited understanding and full support for the policy that mandates disaster management.

In a preview into the working relationship between the PDMC and the NDMC, one respondent shared their views: "*The National Disaster Management Centre must understand the needs of the PDMCs and then provide clear guidelines on how to establish an IMCS. They should lead by example in this regard. We had to benchmark with other organisations instead of the NDMC. The NDMC in partnership with CSIR developed a Green Book; however, this system does not get up to the ward level. We need to have a central platform with organs of state to avoid duplication of risk reduction strategies. The centralisation process might not work because we have the capacity and infrastructure. How can the NDMC request centralisation when they do not have the capacity and even renting offices? They should lead by example, yet they are not".* Several issues emerged from this comment. First, the national government developed a policy that they intend to implement, but they are not helping the implementing institution to execute it. Second, there is a strong link between policy implementation and the establishment of a system. If the national government does not take the lead, the integration remains unachieved. Lastly, there are some traces of strain and conflict between the national government and the implementing institution as argued in the literature review by Smith (1973).

7.1.7 About PDMC 3

The following pictures show the infrastructure of PDMC 3 as observed during the data collection exercise.

Main entrance to the PDMC

Entrance into the building

Reception

Corridor to/Gym/Sickbay/ Emergency accommodation/General workers office

Storage volt

One of the boardrooms/JOCs

One of the tactical rooms/Communication room

One of the tactical rooms/Communication room

Server room
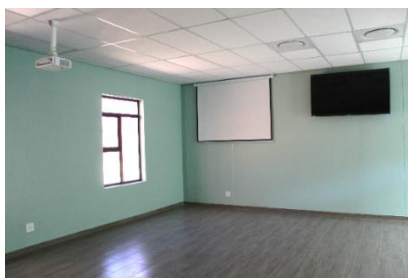
Media room

Canteen and Kitchen

Canteen and Kitchen

View from the helicopter landing

Pictures 3: PDMC 3 infrastructure
Source: (Survey results, 2019)

7.1.7.1 Disaster risk governance of PDMC 3 concerning the infrastructure and organogram

From the observations and evidence depicted from Picture 3, the study concludes that PDMC 3 is making some progress concerning policy implementation. According to the NDMF section 1.2.2.2 and 1.2.4.4, the PDMCs infrastructure has taken into consideration a central 24-hour communications centre, media room, as well as adequate office accommodation and facilities for operational personnel. A gym also forms part of the Centre's infrastructure. Infrastructure is fundamental to good governance, and in Chapter 4, Ibrahim (2018) identifies infrastructure under one of his categories to analyse governance. Figure 7.22 shows that the head of the Centre appointed at the Director level.
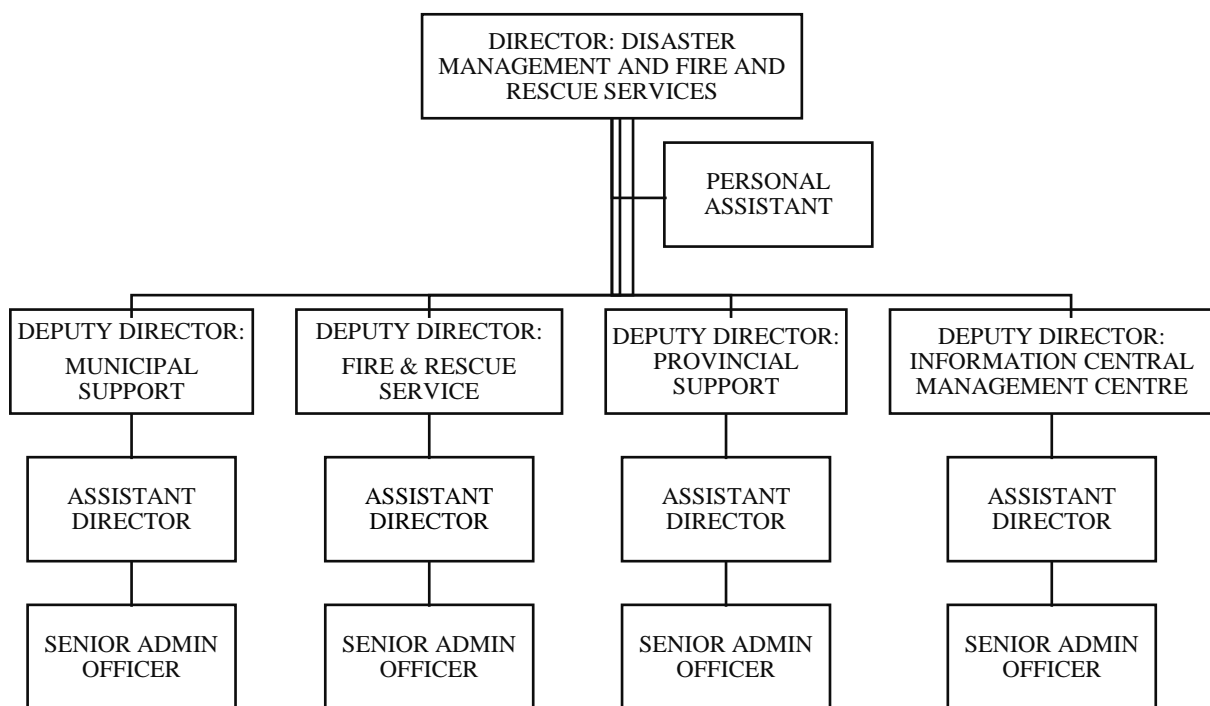
Figure 7.22 PDMC 3 organogram
Source: (Authors illustration as obtained from PDMC 3)

The PDMC has four sub-directorates, each with a nodal person coordinating disaster management functions within the province. The nodal person ensures the implementation of all KPAs and enablers at the provincial and municipal level. The head of the Centre indicated that their structure is client-based. One respondent stated that "*Our organisational structure is according to the Constitution schedule 4, schedule 152. So we have a nodal person at Provincial level to coordinate and implement or ensure the implementation of all KPAs and enablers*". Schedule 151 (4) of the Constitution states that the national or a provincial government may not compromise or impede a municipality's ability to exercise its powers or

perform its function. In the NDMF, section 1.2.4, the principal responsibility of the PDMC is to provide support to the disaster management centres in the province. Therefore, the PDMCs organogram is according to the legislation. However, the organisational structure only shows support for enabler 1, instead of all of them, since the PDMC decided to include enablers. In contrast to this, one respondent said, "*This province is 60% rural, and hence we have a skills shortage in disaster management because many people are not interested in working in the rural areas*".

7.1.7.2 Information management and communication systems status and general comments

At least the existence of an IMCS directorate, as shown in the organogram, is an indication of some progress towards the establishment of the system. This result agrees with Smith's (1973) model on the Idealised Policy component where the government's commitment to implement a policy is seen through the development of an institution. On the other hand, the existence of an IMCS directorate did not mean that the PDMC has an IMCS. Concerning the lack of an IMCS in this PDMC, one respondent said, "*We have political support and funding. We could not have the system, because we were still renting at the initial start-up of the centre*", "*Establishment of the system is currently in the progress. We have signed MOUs with the relevant and various sectors*". The PDMC was initially established in 1998, as mentioned by the PDMC, and in the year 2016, the PDMC moved from a rental office to its newly constructed building, which cost then R15 million (Threadingham, 2016; Infrastructure news, 2014). In support to this, another respondent said, "*New Centre*", another one said, "*Time and Action*", while the other respondent's reason was because of "*Lack of funding*", the last respondent contradicts the first respondent's views on the PDMCs lack of funding. In contrast to all the other respondents, this respondent shared this view "*It is not a prioritised function of disaster management. In terms of departmental budgets, it is given the least funding. The Multi-Hazard System that was developed by the CSIR is now redundant, some features are not functioning properly. The system requires sufficient funding for maintenance and updating. Even continuous training to learn and know about current technology*". The reason for these results is because of the limited comprehension of the significance of the system, lack of leadership, proper management and policy implementation support.

Concerning the current methods of collecting, storing and disseminating information, one respondent shared this: "*The centre's information storage is not good at all. Information is stored fragmentary in personal computers, hard drives, memory sticks and reports emailed to*

the NDMC. The forms we use for gathering data are only used when the centre is activated during an incident. We have a shared network drive, but it is empty. We do not have GIS software so most of our maps are outsourced. NDMC has shared with us a Cost Analysis Form where we had to populate the financial costs of past hazards. Hopefully, it can contribute to a cost-benefit analysis and invest more money in disaster risk reduction instead of response. Keeping abreast with the 4IR is crucial, however, I fear that it will lead us into purchasing technology that will quickly become redundant within a few years". One respondent made this indication: "*We have a problem of power outages and internet access especially in most of the Municipalities in North West*".

With these comments in mind, Chapter 4 discussed how the South African disaster management policy transitioned from the reactive 1966 civil defence to the proactive 2002 disaster management act. However, based on the respondents' comments it seems the reactive approach still takes precedence. People still have a misconception about 4IR, namely that it is only about gadgets. It is actually about human skills, infrastructure, as well as receptiveness and participation. It is about the government developing all the aforementioned first, and then creating an environment for harnessing the 4IR (Petje, 2019). Moreover, this study agrees with Van de Walle, Turoff and Hiltz (2010:6) as discussed in Chapter 5, that participation of stakeholders in issues of information management remains low. The comment on power outages and internet access reminds us of the NDMF prescriptions (section 1.4.2) that suggests that technology for an integrated IMCS should be compatible across all spheres and the environment.

7.1.8 About PDMC 4

Picture 4 is a collection of pictures taken during the data collection exercise. These pictures show the infrastructure of the PDMC.

Entrance

Entrance

Commemoration plaque 2003

Office of Respondent

Command Vehicle

Command Vehicle inside
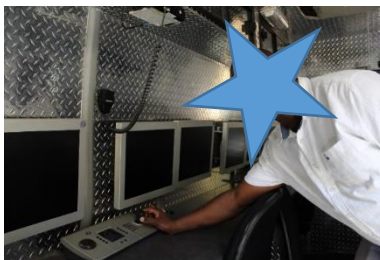
Command Vehicle

Command Vehicle

Pictures 4: *PDMC 4 infrastructure*
Source: (Survey results, 2019)

7.1.8.1 Disaster risk governance of PDMC 4 concerning the infrastructure and organogram

Picture 4 shows that the disaster management centre does not meet the minimum infrastructure requirements of a PDMC as according to the NDMF section 1.2.2.2 and 1.2.4.4. PDMC 4 comprises only of office space.

The organogram shown in Figure 7.23 illustrates that the disaster management centre is under the management of a Chief Director who is responsible for other directorates.
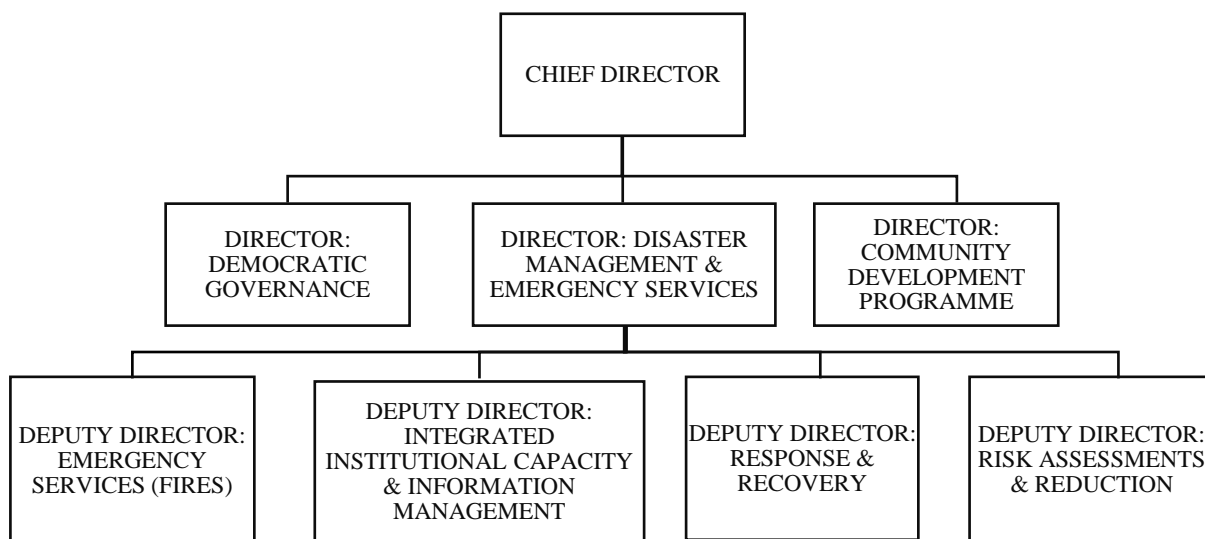
Figure 7.23 *PDMC 4 organogram*
Source: (Authors illustration as obtained from PDMC 4)

This result corroborates with Van Riet and Van Niekerk's (2012) finding, that disaster management staff members serve more than one department. Consequently, this shows that attention is divided, leading to the neglect of work in all the departments. This divided attention could be the reason for the Centre's slow growth. One respondent shared their views in this regard: *"The XXX PDMC is currently being restructured. The MEC COGTA took this decision as a strategy to strengthen the centre based on staff expertise and qualifications. The restructuring could have also come from the fact that the head of the centre is in charge of three departments, including disaster management. Heading three departments is a setback on the progress of the centre and robs from the advantages of sole management of the centre".*

The organogram also shows that the PDMC has a directorate that manages IMCS, but only with a focus on 'information management', neglecting 'communication'. Regardless of the existence of this directorate, the PDMC does not have an IMCS. The organogram also shows the neglect of other key functions, like enabler 2 and 3 and it only shows KPA 1, 2 and 4. Since the PDMC decided to follow the route of KPAs and enablers, it then needs to include all of them.

7.1.8.2 Information management and communication systems status and general comments

The PDMC indicated that they do not have an IMCS and this was evident during the observational walk. In an attempt to understand the absence of the system, a respondent shared their experiences on this matter: *" In 2008, the centre appointed Aurecon as a service provider*

to develop the system. The service provider installed a system called IT GEMC 3, in all the districts, however, this system was not functioning. In 2019, the centre went on a benchmarking exercise to inform the development of a unified system. We visited Ekurhuleni Metropolitan Municipality, the municipality has good systems, but they are in the process of acquiring a UNITI System (it comes with a hand-held device for data capturing), Call-taking, Dispatching System and Emergency Communication System (with radio communication). We also discovered that each fire station in the Metro will be linked to the UNITI System. The main purpose or usage of this system is for monitoring and reporting incidents. The Midrand Traffic Management Corporation has an Intelligent Transport System that manages the road network space through the use of camera surveillance to detect and react to road accidents. It also uses On Road Service response vehicles that are located at strategic points. The vehicles are dispatched within 12 to 15 minutes and have live tracking. It is connected to an iTraffic Website, electronic message boards, social media and google map to provide information on congested routes and accident warning. We also visited the City of Cape Town Traffic Management Centre which uses similar systems as Midrand. The City of Cape Town uses a web-based system called Emergency Police Incident Control. It enables call-taking, workforce management and real-time incident reporting. At the Western Cape PDMC, we found that they house the Emergency Medical Services for emergency medical related call-tacking and dispatching. Overberg District Municipality has also acquired the web-based UNITI system that allows them to load user groups, disseminate information via emails and SMS, early warning, incident updates, upcoming meetings or event reminders, save messages sent and received and allows the query of historical data which is provided in maps or graphs". Another respondent shared their views concerning the setbacks of government bureaucracy: *"Location in the department limits their procurement of technology because they are expected to make use of the departments".*

The respondents' comments lead to several assumptions. First, there is no indication of a benchmarking methodology, which indicates their needs, ideal systems, expectations, target audience and how they intend on incorporating their findings. With this, it is most likely that the benchmarking exercise could be a fruitless exercise. Second, most of the system being used by the Centres they benchmarked with are reactive in nature, like the Emergency Police Incident Control. For a disaster management centre, such systems are in contrast and not consistent with the proactive approach driven by the DMA and the NDMF.

One respondent shared their views concerning the NDMC and the establishment of their systems. The respondent said: *"The NDMC did not provide guidelines for the establishment of information management and communication system, if they did, there would be a uniform and standard system across all disaster management centres, unfortunately, each centre is having or acquiring different systems"*. The basis for this could be the fact that the NDMC itself does not have an IMCS.

7.1.9 About PDMC 5

Picture 5 illustrates that PDMC 5 is a new centre that was established in the year 2019 and shows the infrastructure.

Entrance into the centre

Commemorative plaque 2019

Open workspace
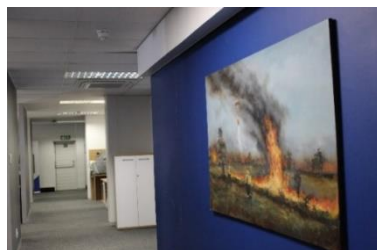
Corridor 2

Meeting rooms

Disaster Management Vehicles

Foyer to the meeting rooms

Conference room

Fire Extinguisher

Study research team and PDMC 5 personnel

***Pictures 5:** PDMC 5 infrastructure*
Source: (Survey results, 2019)

7.1.9.1 Disaster risk governance of PDMC 5 concerning the infrastructure and organogram

According to the NDMF section 1.2.2.2 and 1.2.4.4, which prescribes the minimum infrastructural requirements for a PDMC, PDMC 5 has adequate office space, a kitchen, boardrooms, conference rooms, breakaway rooms, an open-plan workspace and a server room. With a state of the art security entrance, PDMC 5 has a well-manned reception. This shows that the PDMC has made some progress in implementing the disaster management legislation.

Figure 7.24 shows the organogram of PDMC 5 and the head of the disaster management centre is appointed at Chief Director level. The appointment level of the head of the Centre shows that the Centre is privileged with some level of authority.

Figure 7.24 PDMC 5 organogram
Source: (Authors illustration as obtained from PDMC 5)

7.1.9.2 Information management and communication systems status and general comments

The PDMC does not have an IMCS; however, they indicated that they are making progress of establishing one. The respondent shared their view on this matter: *"A system has been developed under the guidance of our user requirements specifications. We are currently training two champions to manage the system. We are also in the process of signing a memorandum of agreement with municipalities and various organisations to have access to their activities, like real-time monitoring of disaster response. This will be through video calls where we can view their dashboards. The system anticipates receiving and storing emails in the system and not necessarily to individuals. The system also allows for the recording of telephone conversation"*. The study perceives drawbacks with the procedures the PDMC is following of appointing and training two people to manage the system, instead of all the stakeholders. The system requires information feeding; hence, every employee of the centre

needs system training. The respondent indicated difficulties with the usage of templates: *"The problem with templates for data collection is that the respondents give us the information requested. Hence, we sometimes just ask them for full reports".* This could be because of the limited methods the PDMC uses to collect data.

Another comment was relating to the reliance on media for information: "*Information from the media is not 100% reliable because it is sensationalised. However, we use the media as a source from time to time".* Hardie (2016) suggests that the media can induce a constant state of fear in its audience. It seems there is mistrust in the information the media delivers, but the NDMF supports a sound relationship between a PDMC and the media.

7.1.10 About PDMC 6
As illustrated in Picture 6, the infrastructural minimum standards of a disaster management centre seem partially achieved.

Entrance

Front of the building

Generator and fuel room

1st Floor / Foyer

Lockers / Changing rooms
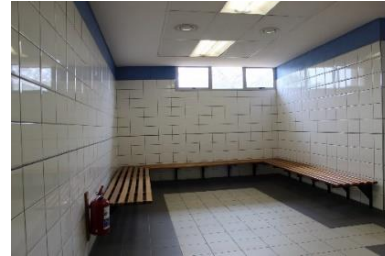
Changing rooms

Showers/Changing rooms
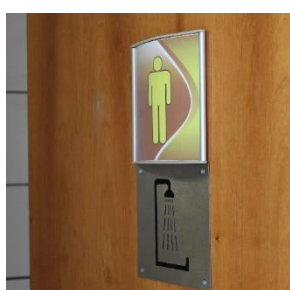
Kitchen

Kitchen / Canteen

Conference Room

Conference Room

Foyer

Joint Operations

Joint Operations / Boardroom

Store Room/Storage Vault

Pictures 6*: PDMC 6 infrastructure*
Source: (Survey results, 2019)

7.1.10.1 Disaster risk governance of PDMC 6 concerning the infrastructure and organogram

PDMC 6 has a state-of-the-art infrastructure designed and this is according to the first world and modern standards (Engineering company [CPPM], 2019; Jordaan 2018:80; Ngubane, 2004). A total of R12 million was invested into upgrading the PDMCs facilities on electrical, fire detection, as well as a security system. R7 million alone was invested in the heating ventilation and air conditioning system. According to the prescriptions in the NDMF section 1.2.2.2 and 1.2.4.4, this Centre has adequate office space and room for operational personnel with a bonus of locker rooms and showers. In the event of an electricity blackout, the centre has an electricity generator. It also has a fuel storage facility for emergency operations vehicles. In support of training and research as prescribed in the NDMF, the Centre has a fully furnished conference room, which hosts more than 100 people.

Figure 7.25 illustrates the organisational structure of PDMC 6, indicating that a Director heads the PDMC. The PDMC has two sub-directorates, the fire brigade services and information communication technology. This organisational structure does not reflect all the prescriptions of the NDMF section 1.2.2.2 and 1.2.4.4. Even though the PDMC has a directorate on

information communication technology, they still lack an IMCS as according to the NDMF prescriptions.
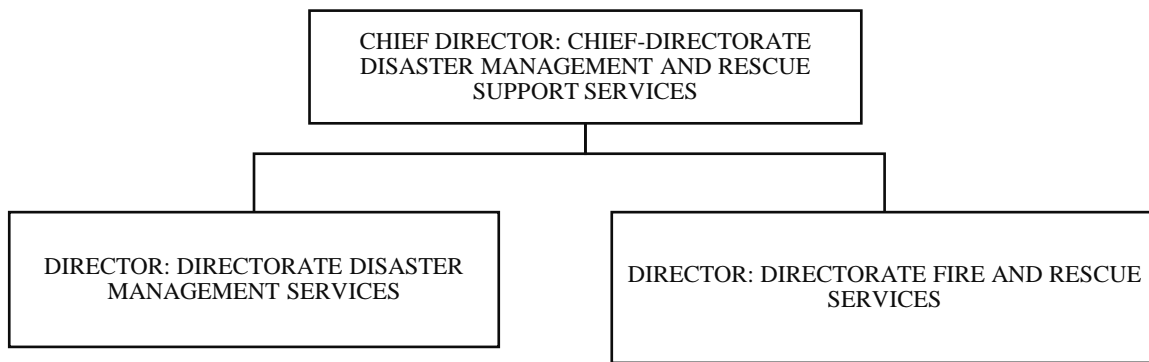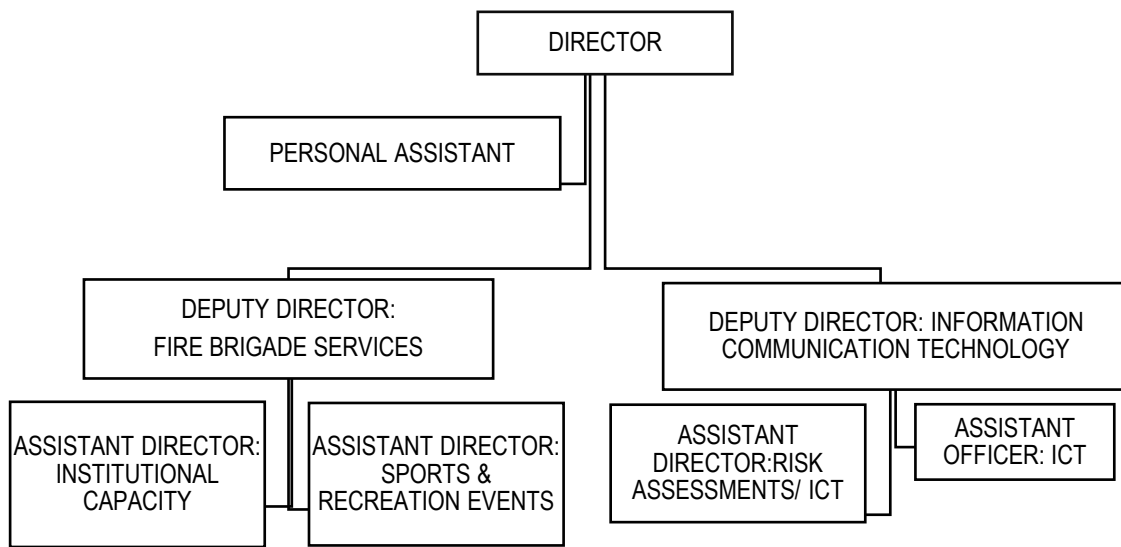

Figure 7.25 PDMC 6 organogram
Source: (Authors illustration as supplied by PDMC 6)

7.1.10.2 Information management and communication systems status and general comments

One respondent provided the reasons for the absence of an IMCS, "*No political support and a lack of collaboration with other municipalities*", another respondent said, "*Lack of capacity*" while the other respondent indicated that it was because of "*Lack of skills within the municipality*". These results reveal various processes that lead to the absence of an IMCS. Therefore, until these processes are addressed the system can then be established. With this in mind, one of the respondents supports the inadequate disaster management skills identified: "*The centre needs in house training. It also needs effective decisions from seniors*". This shows that effective leadership and proper management is lacking in this PDMC.

This PDMC stipulated that they have a Web-Based Incident Command System and a Shared Network Drive. However, there was an indication of unwillingness to use these systems, based on these respondents views: "*The staff members do not use it to store information*". This view corroborates with Freeman's (2004) thinking, that a stakeholder is an individual or group that can be affected or affect the achievement of an organisation's purpose. In this case, the personnel's limited support in the utilisation of the system affects the operations of the PDMC.

In an attempt to investigate the relationship between this PDMC and the NDMC concerning the establishment of their IMCS, one respondent shared their views: *"The Information*

Management and Communication System should come from the NDMC. They should also negotiate with relevant stakeholders for the maintenance and continuity of the system". This shows that there is limited support from the NDMC in this regard.

7.1.11 About PDMC 7
Picture 7 shows that the PDMC meets some of the NDMF minimum infrastructural requirements.

Entrance

Entrance

Entrance

Commemoration Plaque

Entrance

Media Room and Boardroom
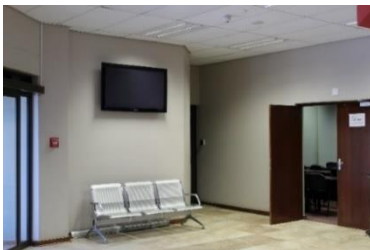
Entrance / Foyer

Boardroom
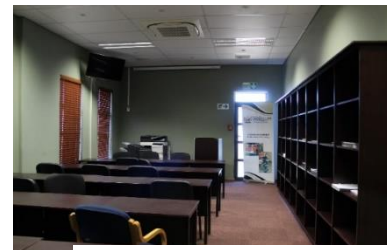
Media Room
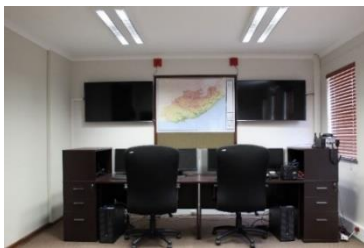
Emergency Communication Room / JOC
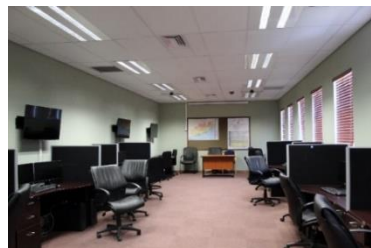
Emergency Communication Room/JOC
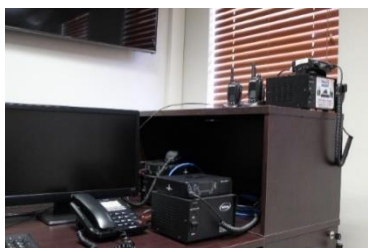
Emergency Communication Room/JOC

Emergency Communication Room / JOC

2-way radio
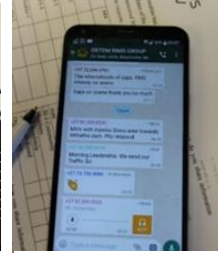
WhatsApp groups of different forums

Server Room

Store Room/Storage Vault

Helicopter landing

Generator

Water tanks
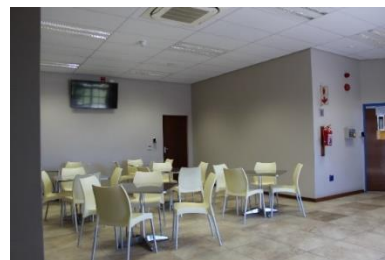
Kitchen and eating area

Pictures 7: PDMC 7 infrastructure
Source: (Survey results, 2019)

7.1.11.1 Disaster risk governance of PDMC 7 concerning the infrastructure and organogram

An amount of R34 million was invested into the construction of a disaster management centre with an Emergency Communication Room (ECR) for call-taking and dispatching with four Call Centre Operators working shifts. However, during the data collection period, the Call Centre Operators were not yet appointed. The ECR also serves as a *nerve centre* for dispatching information. The ECPDMC includes a Joint Operations Centre (JOC) for the direct monitoring of disasters. The JOC has permanent seats for the South African Police Services (SAPS), National Defence Force (NDF), Fire Services, Traffic Department and Ambulance Services. Other facilities the Centre has are a helicopter landing strip, boardroom and a media centre. The maximum capacity the Centre can accommodate is 60 people. Good disaster risk governance can be achieved with resources and proper infrastructure. This accord with these

scholars, Ansell and Torfing (2016); UNGA (2016) and Sithole (2014) who postulate that disaster risk governance can only be achieved through resources.

Figure 7.26 shows the organogram of PDMC 7, which is according to the NDMF KPAs and enablers.
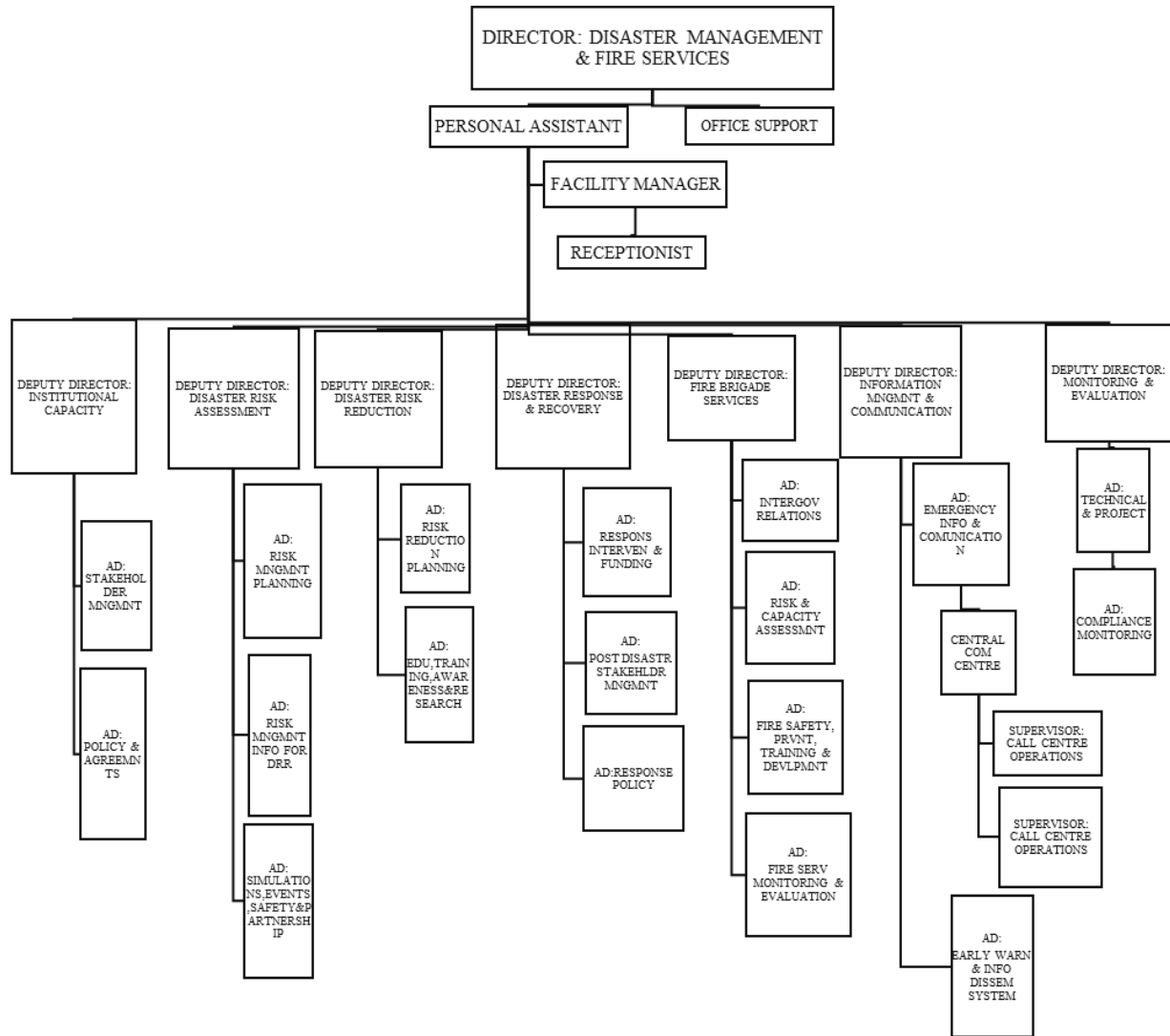
Figure 7.26 *PDMC 7 organogram*
Source: (Authors illustration as supplied by PDMC 7)

This shows that the PDMC can support the municipalities in all aspects of the KPAs and enablers, according to experts. However, the PDMC did not cover all the KPAs, like the enabler on education, training, awareness and research. It is placed under one KPA, instead of supporting all the KPAs as they provide support. At the time of the data collection, most of the positions were vacant. Concerning this issue, one respondent made this comment: *"We are struggling with our internal institutional capacity. Most of our staff members are under-*

qualified or not qualified for disaster management". Adequate human capacity seems to be problematic in disaster management centres.

Regarding this PDMCs organisational structure, the DMA and NDMF mandate this kind of organisational structure to be at the municipal level. As discussed in Chapter 4, the provincial sphere of government is a tactical level mandated to formulate budgets, acquire new resources and implement strategic plans. The metropolitan and district municipality is an operational sphere of government, mandated to carry out on-the-ground enforcement.

7.1.11.2 Information management and communication systems status and general comments

This PDMC indicated that they do not have an IMCS as according to the NDMF. One respondent shared his or her views concerning this: *"I think the will is not there, even if we were to have the information system, no one will feed it with information".* This result corroborates with Smith's (1973) thinking that willingness and management capabilities affect policy implementation. This shows that the disaster managers need to change their behaviours as supported by Garcia (2020) who argues that a simple shift in the way that you think might make all the difference. Another respondent shared their views on a similar matter: "*An Information Management and Communication System is difficult to establish if the centre's institutional capacity and arrangements are not in order. We are, however, in the process of developing this system, a service provider has been appointed and we hope to develop a web-based system that can improve our day-to-day activities and are not limited to during an incident. The municipalities in our province have their systems like the Incident Management Systems. Unfortunately, this system is reactive and not proactive, exactly what we are trying to move our focus away from. Our challenge is that here at the PDMC we do not have historical data, it is with the municipalities and it is stored haphazardly. Most of our disaster management plans are developed from desktop research".* This result shows that the PDMC supports the notion that stakeholder involvement is imperative for effective information management and communication. Further, the PDMC realises that a holistic approach is required because systems that are incident-oriented are not so useful.

Stakeholder participation is imperative for the success of an IMCS and this PDMC identifies Traditional Leaders as a significant source of information. Traditional leaders are a gateway to communities and play a central role in preserving customs and traditions. Their role in disaster management cannot be undermined (Zamisa & Mutereko, 2019). Also, the traditional leaders

are the custodians of indigenous knowledge, which can be used in coping, adapting, responding, preventing and reducing certain hazards.

7.1.12 About PDMC 8

Picture 8 exhibits PDMC 8s infrastructural status.

Entrance into the PDMC

One of the PDMC foyers

One of the boardrooms

Video hall/JOC
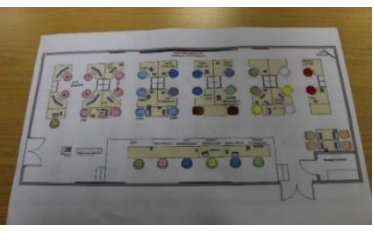
Video hall architectural plan
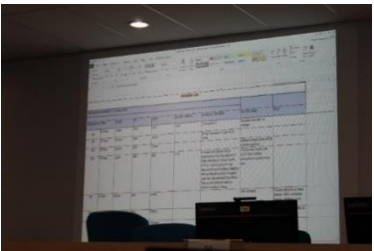
Incident Report Display

JOC

JOC
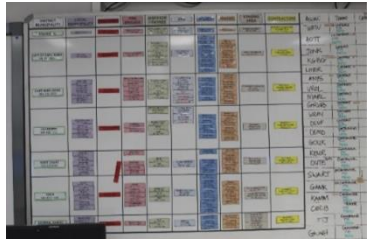
Stakeholder contact details / JOC
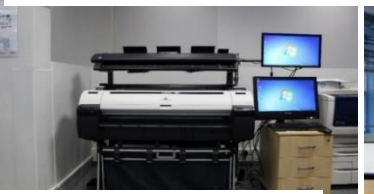
CAD printer / JOC

Emergency Services Call
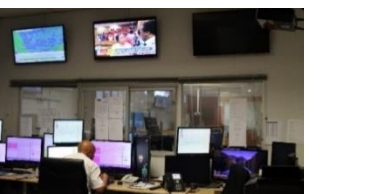
Emergency Services

Server Room

Pictures 8: PDMC 8 infrastructure
Source: (Survey results, 2019)

7.1.12.1 Disaster risk governance of PDMC 8 concerning the infrastructure and organogram

As prescribed by the NDMF section 1.2.2.2 and 1.2.4.4, the PDMC has sufficient office space for its personnel. It also boasts adequate boardrooms, a call centre (in partnership with emergency services), a server room, a joint operations centre and even sufficient parking space for personnel and emergency response vehicles. The PDMCs joint operations centre is high tech with modern technology like video wall screens, dual computer monitors and computer-aided design (CAD) printers. In adherence to the NDMF section 1.4.3, which states that disaster management centres must establish and strengthen their capacity by entering into mutual assistance agreements with other organisations, this PDMC has fulfilled the mandate. The PDMC houses the Emergency Management Services Call Centre, dispatch and traffic monitoring. Skinner and Rampersad (2014:4) support this approach, postulating that stakeholder participation and partnership-building are significant for the success of the organisation.

Figure 7.27 illustrates the organogram of PDMC 8, indicating that the PDMCs directorates are according to the disaster management continuum (mitigation, preparedness, response and recovery).
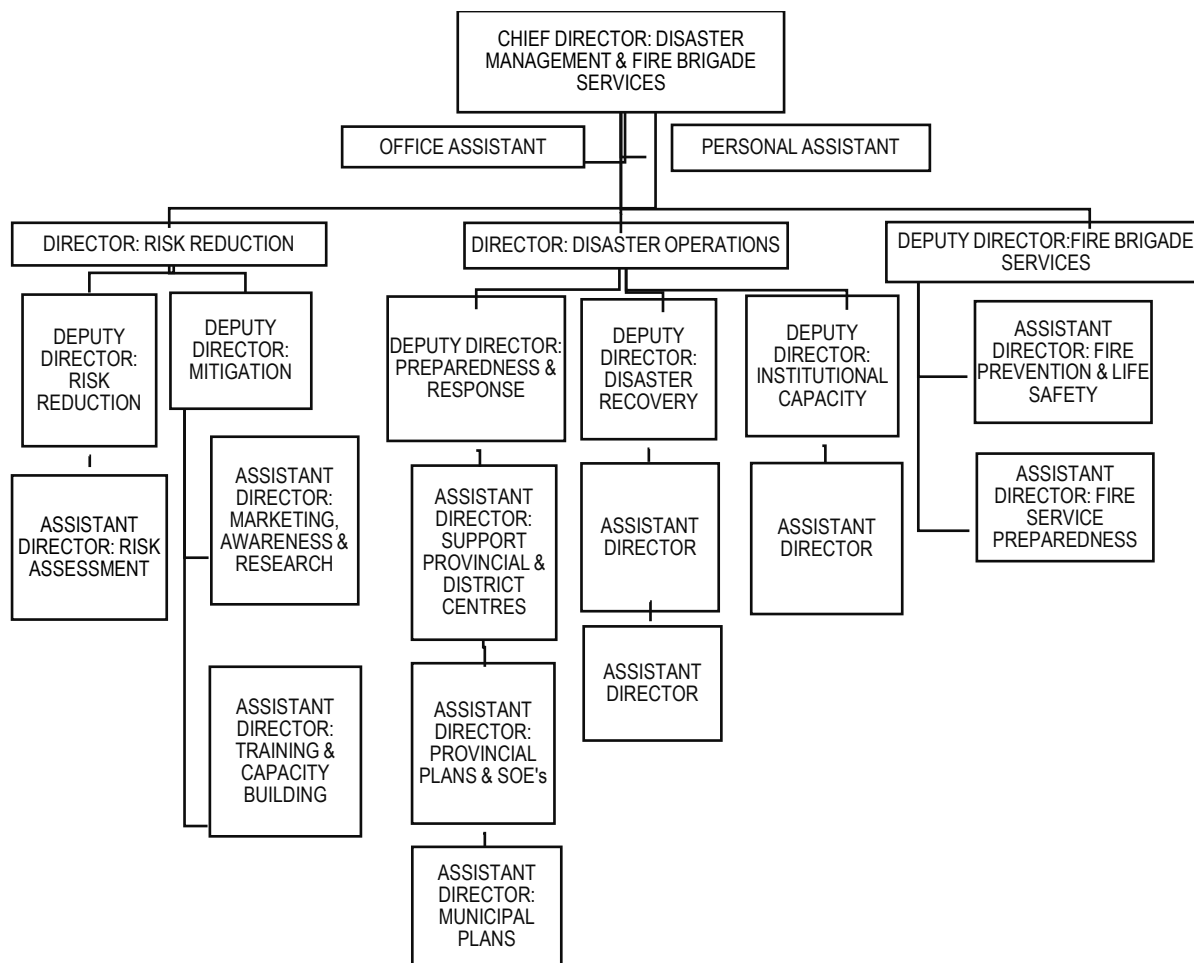
Figure 7.27 *PDMC 8 organogram*
Source: (Authors illustration as supplied by PDMC 8)

The respondents indicated that they were content with the organogram and that it worked for them. They are showing that the PDMCs is more operational than strategic. On the contrary, the appointment of the head of the Centre on the Chief Director level indicates that the Centre has a strategic function. Regarding issues of power in making decisions, the head of the Centre seems to be in an authoritative position as a Chief Director. Unlike other PDMCs, this one indicated that they report directly to the NDMC. Contrary to other PDMCs, the respondents indicated they do not form part of COGTA but are part of the Department of Local Government and Environmental Affairs (DLG&EA). Here we observe a significant difference in the placement of the PDMCs, realising that PDMC 8 also reports to the Minister of DLG&EA. The Constitution's (schedule 104) prescriptions on decentralisation and autonomous provinces

take precedence in this regard because the province decided the best location for the provincial disaster management centre.

7.1.12.2 Information management and communication systems status and general comments

Despite their good infrastructural status that meets some of the NDMFs minimum infrastructural requirements, PDMC 8 indicated that they do not have an IMCS. It is also apparent from the organogram that there is limited support for integrated information management and communication systems. Investigating the reasons for the lack of an IMCS, one respondent said: *"No support from the NDMC"* and that they were in the progress of establishing one: "*Currently in the process of procuring one. We even shared our specifications with the NDMC*". Another respondent shared his or her view on this matter: *"The PDMC used to use the UNITI System that was procured by NDMC in 2010 during the World Cup. All municipalities in the Province would access the system, upload documents, comment on them, access, upload maps, and carry out situational reporting. After the 2010 World Cup, the system stopped working. The centre is currently in the process of procuring information management and communication system through the Centre for E-innovation. The anticipated system aims to support all the KPAs and enablers. It will have functions like recovery database and funding and expenditure. The NDMC only offers us a single system that will not support all KPAs like the Situational Reporting System, which only supports the Response, and Recovery KPA; they offered us this system in 2011. The PDMC encourages and supports its staff members to continue studying. We even have Standard Operating Procedures (SOP) training session twice a year to aid effective operations of the centre".* Based on this comment, there is a sense of limited support from the national government. Concerning some of these systems, it is apparent that the NDMCs focus is on systems that assist with incidents, indicating a reactive approach thinking at national government level.

An investigation into the PDMCs relationship with the NDMC revealed that their relationship is poor. One PDMC respondent attested to this saying that: *"We report to them and they rarely assist us. We once asked for a declaration and classification document and the NDMC said they do not have time to send it and they never did".* Interestingly, this comment reveals NDMCs neglect of some duties and responsibilities, especially with the fact that this PDMC reports directly to the NDMC.

7.1.13 About PDMC 9

Picture 9 shows the infrastructural status of PDMC 9 and as observed, the PDMC does not meet the NDMF minimum requirements of a disaster management centre.

The PDMC sign on the door	Open space office from entrance	Open space office, facing entrance
Open space office, right side	Open space office, left side	Discussion with a respondent

Pictures 9: *PDMC 9 infrastructure*
Source: (Survey results, 2019)

7.1.13.1 Disaster risk governance of PDMC 9 concerning the infrastructure and organogram

In professional ethics, the PDMCs poor infrastructural status could violate human dignity. In Chapter 4 of this study, Ibrahim (2018:7) defined governance as the provision of political, social, economic services and public goods to every citizen who has the right to expect that from the state, and the state has the responsibility to deliver to its citizens. Therefore, PDMC 9 might be challenged regarding delivering service to its citizens, because it is unable to procure its resources, such as an office building. Tyrocity (2019) argues that office space infrastructure should not be taken for granted, as it is a requirement for the smooth functioning of any organisation. The study attributes the PDMCs infrastructural status to the lack of political support, leadership, proper management and top management support.

Figure 7.28 shows an illustration of the PDMCs organogram, revealing that the authoritative powers are significantly low because a Deputy Director heads the Centre. Figure 7.28 also shows that the organisational structure is focused on response and recovery. Though the organogram shows a directorate on IMCS, the PDMC lacks this IMCS.

DEPUTY DIRECTOR:
DISASTER MANAGEMENT

DEPUTY DIRECTOR:
RESPONSE & RECOVERY

DEPUTY DIRECTOR:INFORMATION MANAGEMENT & COM
SYSTEMS & DRR

ASSISTANT DIRECTOR

ASSISTANT DIRECTOR

SENIOR ADMIN OFFICER: FUNDING ALLOCATION (FIRE)
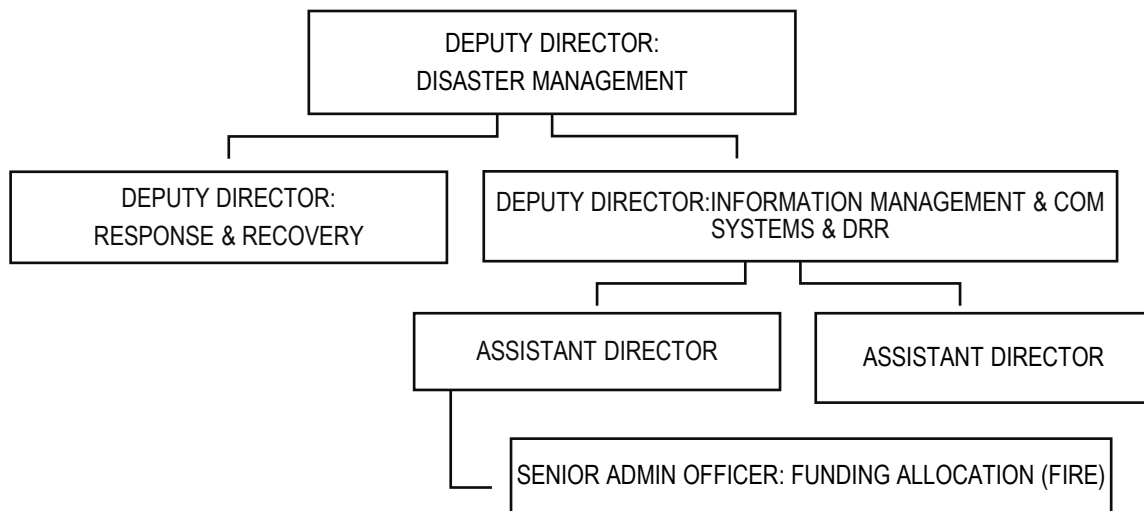
Figure 7.28 PDMC 9 organogram
Source: (Authors illustration as obtained from PDMC 9)

The position of the head of the Centre also indicates that the head of the Centre has minimal powers regarding the operations of the Centre. In support of this view, a respondent made this comment: "*Our operations are also affected because we rely on the department of development and planning to fund us, taking away our autonomy to manage our funds*".

Varying from other PDMCs, this PDMC is under the Department of Co-operative Governance, Human Settlements and Traditional Affairs (COGHSTA). Besides, it seems the province's operations are completely different from the NDMCs because, at ministerial level, the Ministry of COGTA houses disaster management issues. The PDMC is further located in the directorate Development and Planning. This concealed location conflicts with the NDMF mandate, where section 1.2.1 highlights the granting of authority to disaster management centres with a provision for political backing, resulting in a fast-track of decision-making and minimal red-tape. To achieve this, the PDMC should either be a disaster management authority or entity, or if not it should be placed in the highest office of decision-making, in this case, it should be the Premier's office, however, this is not the case. In Chapter 4, Agbadam (2017:1) defines governance as the processes of decision-making in which implementation of decisions occurs. The PDMC experiences a significant amount of red-tape bureaucracy and is under a complex system. This shows that the PDMCs hands are tied and their disaster risk governance is compromised.

7.1.13.2 Information management and communication systems status and general comments

Since the PDMC indicated that they lack an IMCS, they shared the reasons for this lack, stating that: "*I feel that we are so left behind as we lack the know-how of establishing such a system*". Another respondent said: "*The NDMC must develop a uniform IMCS. Currently, we rely on the department's spokesperson for our communications, which is not ideal, hence dedicated communications expect for the centre must be a pre-requisite*". The other respondent said: "*We do not have a server of our own. There is a centralised server seating in the department COGHSTA*". While the other one said: "*Our infrastructure clearly shows that we are an underdeveloped Centre. We do not have simple things like the internet. What makes it worse is the fact that we do not have systems like information management and communication to aid us in running the centre. The only advanced system the NDMC has shared with us was the Situation Reporting System which they do not even encourage us to utilise*". Ultimately, the respondents' views agree with the discussions on governance in Chapter 4 and Smith's (1973) model, which argues that political support is key to disaster risk governance. In concluding the conversation with the PDMC, a respondent said: "*The PDMC is struggling*". This PDMCs status is attributed to what this scholar suggests: poor governance in Africa is caused by incompetence, ignorance, lack of capacity from leaders, inadequate infrastructure, corruption and poor institutions among other causes (Agbadam, 2017).

Summary of PDMC findings

As mentioned in the introduction to the qualitative results, the status of the provincial disaster management centres was based on three themes. Concerning the disaster risk governance and the information management and communication systems of the Centres, there are distinct variations for PDMCs that are mandated by the same legislation and policy. These variations ranged from different organograms of the PDMCs that are also led by heads with different work designations such as Deputy Director, Director and Chief Director. Another notable variation was the equitable shares each PDMC receives, where some PDMCs receive more than the others. On the other hand, there was one similarity found, and that was the lack of integrated information management and communication systems as prescribed by the NDMF. The following section presents the findings from the NDMC.

7.1.14 About the National Disaster Management Centre and disaster governance

The national centre is currently renting offices in Centurion, and Picture 10 shows the building in which they are renting some office space.

Pictures 10*: NDMC rented offices (3rd floor)*
Source: (Survey results, 2019)

The study found that the NDMC has been renting its office space since the Centre was instituted in the year 2003. The NDMC is the national government mandated to promote an integrated and coordinated national disaster management policy. The South African government established the NDMC a year after the promulgation of the DMA. The DMA, the NDMF and these scholars, Venter (2007) and Van Riet and Van Niekerk (2012:4) postulate that provincial disaster management centres and other disaster management spheres of the government are supposed to be the exact replicas of the NDMC, however, this is not the case. The NDMCs infrastructural status contradicts this postulation, as the PDMCs cannot emulate the rental of office space. Their rental status was vigorously criticised by some respondents from the provincial disaster management centres. For example, one respondent said: "*...How can the NDMC suggest centralisation when they do not have the capacity and even renting offices? They should lead by example, yet they are not"*. This comment corroborates the ideas of Smith (1973) who suggests that policy implementation brings about conflict and that there are discrepancies between what is an ideal state and an actual situation.

Notwithstanding the discussed discrepancies, the NDMC meets some of the minimum infrastructural requirements. The Centre has a well-equipped boardroom, communication room or Joint Operation Centre and some meeting rooms. However, the NDMC Directors and other lower-level personnel are seated in an open office space. This result shows a compromise of professional work ethics. While open-workspaces are becoming the norm, loss of focus,

productivity, noise, cleanliness and many more etiquette issues are experienced (European Business Review, 2019).

Figure 7.29 shows the NDMC organogram obtained from their website. The researcher struggled to obtain recent and updated organogram. As seen in the organogram, the head of the NDMCs title is Deputy Director General (DDG). Under the DDGs management, there are five Chief Directorates. It seems two of the Directorates are vacant. Smith (1973) draws our attention to the ideal situation of a government office that should have full administrative personnel. Unfortunately, the actual situation is that most posts are vacant and this leads to structural level tension, due to the discrepancy between the ideal and the actual situation. In agreement with this, one respondent said: *"The challenges faced in the disaster management function is that in the NDMC we are short-staffed. Then at the political level, there is a lack of political support with regards to capacitating the PDMCs because the politicians disregard the function and do not prioritise it"*. Another key problem with this situation is that uniformity with the lower spheres of government is affected. For example, if there is a risk assessment office at the provincial office, the national office should also have a similar office for information-sharing and reporting. To this end, scholars like Jordaan (2018:69) questioned the effectiveness of the NDMCs organogram, recommending it requires a more focused approach on disaster risk reduction and response.

Figure 7.29 *NDMC organogram*
Source: (National Disaster Management Centre Website)

7.2 Summary of findings

It was important to revisit the research questions to present the findings for each. Therefore, the findings presented here were synchronised and discussed in the context of all the participants' views and the researcher's empirical observations. The findings summarised exposes issues that are working against the achievement of effective and operational disaster information management and communication systems. The main research question of the study was: 'What are the status quo and dynamics for establishing operational information management and communication systems in the South African provincial disaster management centres and what such systems should entail?' To accomplish this main research question, the study asked four critical sub-questions.

Before proceeding to exhibit the various findings for each research question, the study provides a generic study finding. The study found that both the National Disaster Management Centre and all the Provincial Disaster Management Centres lack an integrated IMCS. Although funding was identified by a significant number of the respondents as a major hindrance to establishing IMCSs, the study disagrees with the respondents. As pointed out in the literature, section 1.2.2, 1.2.4 and 1.2.5 of the NDMF mandate the disaster management centres to include the cost of developing an IMCS into the start-up costs for establishing a Centre. Since all the PDMCs do not have IMCS, then it is an indication of neglect and poor policy implementation. Ultimately, the study further believes that the key reasons are poor leadership, lack of stakeholder willingness, participation and expertise.

i) *How does the implementation of disaster management legislation affect the establishment of information management and communication systems?*

Revisiting this question posed at the beginning of the study, and the results presented in this chapter, the study found that the way disaster management policies are implemented affects the enactment of information and communication systems. The specific findings presented unravel how this research question rings true. With that in mind, the study found the following:

- Having revealed the non-existence of IMCSs in the Centres is an indication of the neglect to implement disaster management policies. In particular, the enabler 1 section in the NDMF. Information management and communication systems are one of the prescriptions and mandates of the South African Disaster Management Act (57 of 2002 as amended 16 of 2015) and the National Disaster Management Framework of 2005. The policies clearly

state that at the inception of each provincial disaster management centre, these systems are supposed to be part of the inception. The first PDMCs were established in 1998 with the most recent one in 2015. Two decades later, the Centres lack these systems. Therefore, this finding is in agreement with the literature findings that, South Africa has well-developed policies and laws, but are experiencing a fair share of poor policy implementation practices. Further, in his critical analysis of the DMA and the NDMF, Van Niekerk (2014) precisely states: *"Implementation of the policy and legislation has not been entirely successful"*. Hence, given the ample time, they neglect to pay attention to the enabler 1 section of the NDMF, as a crucial part of the policy at the inception of the Centres, affects the existence of the IMCS.

- Other findings which corroborate with Smith (1973); Humby (2012); Van Niekerk (2014); African New Agency [ANA] (2019) and Smith (2019), are management of the Centres by unqualified personnel with irrelevant qualifications. Therefore, this affects the comprehension, appreciation and ability to implement the policy. A classic example found, is that of an Acting Director's highest qualification, which is Matriculant (National Senior Certificate/Grade 12). Some of the heads of centres hold qualifications in geography, health profession, law and industrial psychology (see Table 7.1). The other employees hold a South African Qualifications Authority (SAQA) at National Qualifications Framework (NQF) level 5. It is possible that with these qualifications, there is a compromise on the implementation of the disaster management policy. Smith (1973) suggests that skilled personnel are fundamental to policy implementation. In addition to qualifications, work experience and practical exposure are also a form of learning and knowledge acquisition.

- There is a lack of political support and comprehension of the disaster management function, which came out strongly. Similarly, this hindrance makes policy implementation difficult and is affecting the progress in enacting IMCSs. The lack of political support affects the procurement process.

- Red tape in the government bureaucracy is a problem that affects the procurement of information technology for use in information management and communication. Hence, how the DMA and the NDMF were formulated and is currently being implemented affects the operations of the PDMC's. For example the discrepancies in the placement within the provincial governmental structure, like the PDMC which is located in the directorate Development and Planning, which is in another chief directorate, that is under the head of

COGTA. The hands of the PDMCs head are tied when it comes to procurement because the head has to follow a bureaucratic red-tape.

- Poor policy implementation accords with other studies findings, such as:
  - i.) Lack of clear guidance for policy and legislation implementation;
  - ii.) Inadequate capacity;
  - iii.) Inadequate equipment and infrastructure;
  - iv.) Inadequate funding;
  - v.) Discrepancies in the placement of the disaster management function in the provincial government structure;
  - vi.) The political, economic, environmental, and sociocultural contexts in which disaster risk solutions take place; and
  - vii.) The poor comprehension of the DMA and NDMF, because of the confusing wording.

Given all the above, to attain good governance, the disaster management centres will have to provide clear guidance on how to implement policies (Collins, Jones, Manyena & Jayawickrama, 2015; Van Niekerk, 2014; Botha, Van Niekerk, Wentik, Coetzee, Forbes, Maartens, Annandale, Tshona & Raju, 2011; Van Riet & Diedericks, 2009; Van Niekerk, 2005; Smith, 1973). Therefore, with the absence of the key findings stated above, integrated information management and communication systems remain compromised.

ii) What is the current state of the South African Provincial Disaster Management Centres, concerning information management and communication systems for achieving disaster management goals?

The second question in the study sought to investigate the IMCS status of the PDMCs as the nerve centre for achieving effective disaster management. The following specific findings presented, reveals unexpected findings:

- The lack of IMCSs revealed that from the expected capabilities an IMCS should have, such as data collection, analysis, storage and information dissemination, there are numerous discrepancies. First, there are no qualified researchers solely for data collection and analysis. Second, there is a lack of standard and formal research design and methodologies for disaster management of the Centre. Third, the Centre's institutional knowledge is at risk because the disaster managers are storing information on personal computers and personal hard-drives. Fourth, a disappointing finding was that most of the PDMCs do not have

servers; they rely on the department's (COGTA) servers. Fifth, information dissemination is mostly through emails, WhatsApp, landlines, cellphones and meetings such as Advisory Forum Meetings.

- The NDMC and PDMCs online presence are poor even though we are in the Fourth Industrial Revolution era.

- There is a misconception of information technology and information systems. Information technologies are defined as the design, development, application, implementation and management of computer-based information systems. Besides, it is the integration of computers with telecommunication equipment for storing, retrieving, manipulating and storage of data. As for information systems, Juneja (2019) defines them as a set of a coordinated network of components that act together towards producing, distributing and processing of information. Information systems consist of people, processes and technological machines. Most of the PDMC's were referring to the purchasing of certain types of information technologies to carry out information management and communication.

- The infrastructure of some of the PDMCs is poor and dilapidated in such a way that the Centres' infrastructure will unfortunately not be able to accommodate advanced information technologies. While we are in the 4IR, some Centres are still struggling with internet access and connectivity.

iii) What efforts have the National Disaster Management Centre put in place to assist the Provincial Disaster Management Centres in establishing information management and communication systems?

The third question in the study set out to determine the kind of support the NDMC provides to the PDMCs, in particular with the establishment of IMCSs. The following main issues presented, reveal unexpected findings:

- The NDMC as the national government for disaster management is not supporting the PDMCs entirely. This is based on the neutral responses from the 6 heads of centres out of 9 heads. Those that stated that they were satisfied with the support received, were 3 heads of centres out of the 9 heads. Deriving from specific comments made in Table 7.3, such as: "*The NDMC should lead the PDMC in the development of a uniform IMCS*", the expected

support is not being provided. Therefore, the study revealed that there is minimal support for the establishment of the IMCS.

- The NDMC has not developed guidelines mandated in enabler 1. According to the NDMF, the NDMC is supposed to develop national guidelines for the implementation of the integrated IMCS in all spheres of government. Interestingly, since the promulgation of this NDMF, the study found that these guidelines were not developed. The only guidelines developed so far and late, are the guidelines of the infrastructural requirements, containing minimal IMCS requirements.

- With this in mind, there is a lack of uniform integrated systems. A significant number of the provincial centres like PDMC 7, PDMC 8 and PDMC 5 have developed their guidelines. In the end, the systems are not compatible and do not communicate easily with each other nor with their municipalities.

- The NDMC provides limited support to the lower spheres of government. The NDMC mostly attributes the limited support to the Constitution of the Republic of South Africa 108 of 1996, schedule 151 (4). The schedule states that the national or a provincial government may not compromise or impede a municipality's ability to exercise its powers or perform its function. Hence, the NDMC stipulates that because of this schedule, that decentralises autonomy, then they cannot intervene in the matters of the PDMCs. It seems, the national government is failing to notice its legislations and rather chooses to focus on the Constitution. However, the researcher believes that as the national government serving on ministerial committees, they have the power to challenge the Constitution. It is, however, encouraging to compare these findings with those of Van Niekerk (2014) who found that there is indeed limited authority over the PDMCs, which affects accountability amongst other things. Unfortunately, all of this affects the development of a uniform, standard and integrated IMCS. In this investigation on the NDMCs efforts, the study found that the NDMC is making efforts to curb the problem of semi-autonomy and lack of mandate on the PDMCs through introducing vertical integration. The NDMC expressed that they are in the process of introducing the possibilities of re-engineering disaster management structures. Explaining that with the re-engineering, the PDMC will start reporting directly to the NDMC. While this study commends this approach, the qualitative feedback from the PDMC's was not receptive of the idea. However, from the study's perspective, this approach will help aid in uniformity and integrated information management and communication

systems across all spheres. But then again, as postulated by Smith (1973), new policies or changes in policies gives rise to strain and tension during the implementation process.

iv) How can the theories and models discussed in this study contribute to the development of a framework for establishing information management and communication systems for disaster management?

The fourth question of the study sought to analyse the theories and models that underpin the phenomenon under investigation and to determine how they can contribute to the development of the proposed framework. The study found the following:

- The Model of the Policy Implementation Process – Smith's (1973), as well as the NDMF (2005) Model of Integrated Information Management and Communication System for Disaster Risk Management and Freeman's (1984) Stakeholder Theory, supported the study's findings. These three models also supported the presentation and interpretation of the research findings. Therefore, these models and theory did make a noteworthy contribution to the framework for establishing information management and communication systems for disaster management.

- With a focus on the Stakeholder Theory, the study found that there is an unequal relationship between the PDMCs and the various stakeholders. The PDMCs are in constant contact through information-sharing with a certain group of stakeholders and less with others.

- Even though the study did not make use of a significant number of reference to the UNISDR (2013) information and knowledge management for disaster risk reduction framework, the study found that many relevant variables inform the proposed framework.

7.3 Conclusions

In conclusion, this chapter presented and provided an in-depth discussion of the study's empirical findings. Following a sequential research methodological approach, the study provided a clear picture of descriptive statistics, followed by narratives of findings from each provincial disaster management centre and the national disaster management centre. Interesting to note in this chapter was that the narratives helped uncover salient aspects of the Centres. In particular their organisational structures, infrastructural status, financial standing and many other issues. All of these were fundamental to the understanding of the dynamics surrounding the enactment of information management and communication systems. Therefore, in light of

the discussions in this chapter, the following chapter discusses the proposed framework for establishing information management and communication systems for disaster management.

CHAPTER 8: STUDY CONCLUSIONS AND RECOMMENDATIONS

8.1 Introduction

Effective disaster management requires the existence and proper management of information and its dissemination to the relevant and targeted stakeholders. Accordingly, the researcher conceived the study to investigate the governance of disaster management of Provincial Disaster Management Centres concerning IMCS. In succession, the study proposed a framework for establishing an Integrated Information Management and Communication System. In general, the Collins Dictionary (2020) defines a Framework as a set of rules, foundation, structural plan, ideas or beliefs explored to deal with problems or to decide what to do. Therefore, this final Chapter of the study contains recommendations, which include the proposed Framework and conclusions of the entire study.

8.2 Study conclusions

The literature study showed, among other things, that good disaster risk governance is key to the fulfilment of the entire mandate of disaster management in South Africa. Important to note are the various factors the literature pinpointed in Chapter 4 of the study that contributes to good disaster risk governance. The factors were as follows: stakeholder engagement, proper usage of resources, implementation of legislations, provision of political, social, economic services and public goods by the state, private and civil society, transparency, and inclusivity to everyone. The literature concludes that the above factors are because of decision-making processes for eventual implementation. Since the implementation of legislation is one of the mentioned factors that contribute to good governance, the literature showed that South Africa is one of the countries in the world with excellent policies. Sadly, implementation is lacking because the empirical findings revealed that there are a significant number of disaster management legislation components that remain unimplemented. The study, therefore, concludes that the South African disaster management centres, in particular, the provinces, have not yet reached the 'good disaster risk governance' juncture.

Pertinent to this study was the revelation that the national government and its subsidiary provincial centres do not have the IMCS. These are supporting systems of great importance in the South African disaster management legislation. This discovery is amidst the arrival of the Fourth Industrial Revolution (4IR) that is taking a significant number of organisations to

unprecedented heights. Additionally, the literature showed that information and communication are pivotal to disaster management success. They enhance the preservation of institutional knowledge, knowledge from the information aids effective response, communication of the information aids in stakeholder engagement and reduction of risks, as well as exposures to vulnerabilities.

The detailed examination of the system in Chapter 3 brought the study to an understanding that the IMCS is not only about information technology, but they are a holistic interrelated system. A system that requires technology, software, data, information, communication, networking, people, organisational structures and tasks that work together to support decision-making. The empirical inquiry revealed the thinking that IMCSs are technology-based and require funding. The study concluded that information management and communication systems start with, and require support from top management, prioritisation of disaster risk information management and communication, understanding the importance of institutional knowledge preservation, proper leadership, guidance on policy implementation, team-work, internal stakeholders' willingness to prioritise and participate in managing information and its communication. Therefore, the PDMCs thinking that IMCSs require significant amounts of funding to establish, is not a means to an end. Another interesting finding in the literature was that IMCSs are contextual to the environment in which they are used. Some of the IMCSs' components might or might not be useful in certain environments. Chapter 5 stated that the environment in this instance is the hazards occurring in the area, work sector or discipline, community or country, geographic location and so on.

Through the research design and methodology chapters' guidance, the study was able to carry out an empirical inquiry into the study's research questions. Both the quantitative questionnaire and the qualitative observation methods proved to be useful in collecting the required data. However, the researcher did not anticipate the lengthy and in-depth discussions they had with the respondents while administering the questionnaire. Nevertheless, the discussions contributed immensely to the qualitative data. The observations, assisted by the unanticipated in-depth discussions, provided the study with some realism and richness that quantitative methods alone would not have yielded.

Finally, the empirical findings lead to the last, but not least chapter of data presentation and analysis. This chapter successfully revealed, critically analysed and presented the status of the

NDMC and the PDMCs concerning information management and communication. The most surprising finding was the lack of these systems at both the national and provincial level. Acknowledging the fact that the world is in the Fourth Industrial Revolution era, all the Centres unanticipated, stated that store the Centres' data on personal computers. Ultimately, this was the most significant finding in the study.

8.3 Study contributions

This is the first and completed PhD study to focus on the status quo and dynamics of establishing disaster risk IMCS in South Africa. The study contributed through the consolidation and review of local and international disaster risk information and communication systems. In particular, the critical analysis of enabler 1 of the NDMF, thereby creating literature on IMCSs. The findings should make an important contribution to the field of disaster management, especially on issues of the governance of the provincial disaster management centres and some important insights into the implementation of legislation. Further, based on the literature review and empirical findings, the study offered an exciting opportunity to advance disaster information and communication systems' knowledge by developing a Framework. The study is confident that disaster management fraternity can implement enabler 1 and establish fully functional IMCSs through the guidance provided in the proposed Framework.

8.4 Recommendations

Deriving from the above conclusions, a thorough review of the body of knowledge, followed by the analysis of the mixed-methods empirical findings are given. This section of the study provides recommendations grouped in two (2) categories, namely the proposed framework and the disaster risk governance of PDMCs.

8.4.1 The proposed Strategic Framework for Developing and Managing an Integrated Disaster Information and Communication System

The Framework intends to serve as a comprehensive guide to addressing the problem of the lack of integrated information management and communication systems in the South African provincial disaster management centres. The contents of the proposed Framework are informed by the contents from the literature review (*see Chapter 2*), empirical findings and these theories and models. The theories and models are Stakeholder Theory (ST) by Edward Freeman (2010), the MIIMCSDRM by the South African National Disaster Management Framework of 2005, the Information and Knowledge Management for Disaster Risk Reduction (IKM4DRR)

Framework by the IKM4DRR Community (2013) and, the Model of the Policy Implementation Process by Smith (1973). In as much as the proposed Framework is for the provincial disaster management centres, the Framework applies to the other spheres of disaster management.

Establishing an IMCS is a project divided into sequential phases with some overlapping. The project involves a lot of planning, time schedules, coordination, consultations and budgeting (Centres for Medicare and Medicaid Services [CMS], 2005). The Framework contains eight (8) phases that should be read and applied in the context of the KPAs and enablers. Additionally, the project must consider exogenous factors such as technology, political, environmental, legislative, economic and social features. In Chapter 1, these scholars (Collins, Jones, Manyena & Jayawickrama, 2015:67) argued that the realities of governance in Southern Africa where disaster risk solutions take place, in specific political, economic, environmental, and sociocultural contexts, cannot be ignored. These realities play a vital role in the implementation of legislation. It must also be noted that good governance is required for integrated information management and communication systems to be established and sustainably managed.

The phases in Figure 8.1 are (Phase 1) Policy Review and Information Needs Analysis, (Phase 2) Stakeholder Analysis, (Phase 3) Organisational Restructuring, (Phase 4) Information Technology Analysis, (Phase 5) Communication Channels Analysis (Phase 6) Benchmarking Exercise, (Phase 7) Develop the IMCS and Governance, and (Phase 8) Develop a Monitoring, Evaluation and Quality Management Plan.

	1.Policy Review & Information Needs Analysis	-Revisit the internal policies, Disaster Management Act, National Disaster Management Framework and internationa policies. -Develop a method for identifying the PDMCs Information needs
	2. Stakeholder Analysis	-Map out stakeholders and identify their roles and responsibilities.
	3. Organisational Restructuring	-Develop a reorganisation plan; -The plan must accommodate the IMCS as a priority.
	4. Information Technology Analysis	-Research technology solutions, problems and risks; -Identify requirements, specifications and technical needs for the PDMC
	5. Communication Channels Analysis	-Detailed analysis of communication channels and target audience preferences;
	6. Benchmarking Exercise	-Develop objectives for the benchmark exercise - Best practice analysis (national & international); -Identify internal and external stakeholders to benchmark exercise with; -Identify best practice systems to adapt
	7. Develop the IMCS & Governance	-Identify objectives for the system -Develop a holistic approach to managing information and its dissemination -Develop methods for needs analysis, data collection; data analysis,data storage and information dissemination.
	8.Monitoring, Evaluation & Quality Management	-Develop an integrated plan to monitor and evaluate compliance and performance of the information management and communication system

NDMF – KPA 1, KPA 2, KPA 3, KPA 4, Enabler 2, Enabler 3

EXOGENOUS FACTORS – Technology, political, environment, legislative, Economic, Social

Figure 8.1 *Strategic Framework for Developing and Managing an Integrated Disaster Information Management and Communication System*
Source: (Authors own)

Phase 1. Policy Review and Information needs analysis – The study found that poor policy implementation affects the lack of IMCS in the PDMCs. Therefore, revisiting the existing organisations' internal, local and international policies, relevant to disaster management, is important, because policies are fundamental for establishing IMCS and good governance. Good governance requires clear guidance on how to implement policies, intense support and commitment from top management, the organisation's internal stakeholders must adapt to the policies, and they must have appropriate qualifications (Smith, 1973). Key to the development

of the IMCS is the serious adherence to the Disaster Management Act 57 of 2002, Part 2, section 30 to 41, prescribing the powers and duties of the provincial disaster management centre.

The DMA and the NDMF clearly state all the information needs for each KPA and enabler. However, the PDMCs need to carry out an empirical information needs assessment. This can be done through qualitative and quantitative methods or both. It is, however, important to gauge which method is important for the PDMC and selecting

Phase 2. Stakeholder Analysis - Freeman (2004), the author of the Stakeholder Theory defines a stakeholder is an individual or group that can be affected or affect the achievement of an organisation's purpose. Similar to Freeman's definition is this one provided by the Merriam Webster Dictionary (2019), namely a stakeholder is a person who has an interest or investment in something and is impacted by the course of its action. Moreover, whoever owns a problem should be a co-owner of the solving process (Reed, Graves, Dandy, Posthumus, Klaus, Morris, Prell, Quinn & Stringer, 2009). It is with the above definition's that we can relate to the disaster management ideology, where disaster management is multi-disciplinary and multi-sectoral (Republic of South Africa, 2003:45). Therefore, everyone in the Republic of South Africa is a stakeholder, for they affect the operations of disaster management and the impacts and effects of hazards affect them. With this in mind, the PDMC will have to do a stakeholder analysis, stakeholder prioritisation, identification of stakeholder roles, and responsibilities, and develop specific programmes for each stakeholder group for the successful operation and implementation of disaster management.

A typical example of stakeholder mapping and identification of roles and responsibilities is shown in Figure 8.2. It is a stakeholder mapping for a national drought information and communication system. The map identifies the stakeholders feeding the system with information and the stakeholders receiving information. The ensuing table shows the list of stakeholders and their roles and responsibilities.

	Information Custodians	Roles and responsibilities
1.	National Disaster Management Centre	-Develop a methodology for data collection and analysis; -Research projects which include national drought data collection and analysis; -Maintain the national drought data repository; -Disseminate information through the identified conduits.
2.	Provincial Disaster Management Centre	- Research projects which include national drought data collection and analysis; -Conduct provincial drought risk assessments; -Support the NDMC with drought data from the province.
3.	Municipal (Metro&District) Disaster Management Centres	- Collect drought information from local municipalities and other role players; -Promote drought research in the municipal area; -Disseminate drought information in the municipal area to vulnerable communities and relevant role-players; -Supply drought prevention and mitigation strategies information to the province and national.

Figure 8.2 *Typical stakeholder mapping example for drought*
Source: (Authors own)

Phase 3. Organisational Restructuring – The study revealed that the PDMCs, including the NDMC, have dissimilar organograms. As a result, this negatively affects information-sharing, because there is a lack of similar offices from the national cascading down to the provincial government. Additionally, the organisational structures do not show any support for IMCS. Therefore, the study proposes an organogram that all PDMCs can adapt to achieve uniformity and deliver on their mandate. With this in mind, maintaining a strategic overview of disaster management projects and programmes in the province suggests an organisational structure that

is more tactical than operational. Worboys, Lockwood, Kothari, Feary and Pulsford (2015); Lucey (2005); Van Niekerk (2005) and Ngubane (2004) support this thinking, saying that at the provincial level, plans developed at a strategic level, are implemented here. For example, the formulation of policies, guidelines, budgets, acquisition of resources and other activities.

In discussing the proposed organisational structure, the study focuses on the IMCS directorate (enabler 1), which is highlighted in red. The IMCS directorate together with other enablers are in the Office of the Chief Director. The reason for placing the enablers in the Office of the Chief Director, which is the highest hierarchy within the organisational structure is because according to the NDMF the three supportive enablers are required to achieve the objectives set out in all the KPAs (Republic of South Africa, 2005: 2). Placing the enablers on a higher hierarchy is thought that the enablers will hold the authoritative power that is needed to aid the KPAs in achieving their objectives. For example, with authority, the information management and communication (enabler 1) can effectively collect, manage and disseminate information for institutional arrangements (KPA 1) without experiencing difficulties like insubordination. Since the NDMF places emphasis on institutional arrangements and IMCS at the initial inception of the PDMC, the study named the directorate: "*Integrated Institutional Capacity & Information Management and Communication*". The proposed organisational structure emulates the functional organisational structure where people who do similar tasks are grouped, based on their areas of speciality (Sullivan, 2019). This structure is informed by the organograms from the PDMCs as well as the discussion held in Chapter 7 concerning personnel capacity and the ability to oversee a province with municipal disaster management centres, and high population.
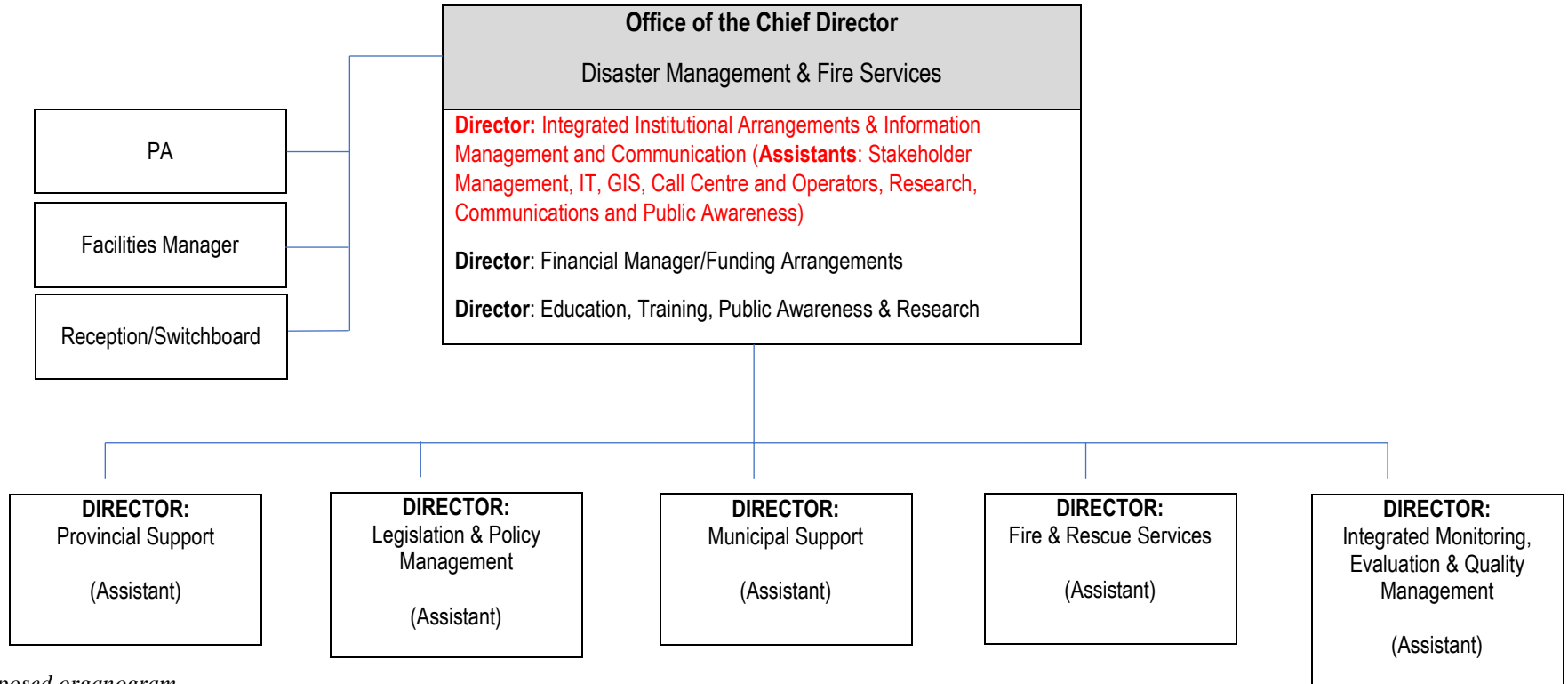
Figure 8.3 *Proposed organogram*
Source: (Authors own)

- *Assistant Director: Stakeholder Management* – Manage stakeholders for engagement in technical advice in disaster management planning and operations. Provincial disaster management advisory forums (PDMAFs), Intergovernmental Committees (Disaster Assistance Response Teams [DART], specialist teams, e.t.c) and other consultative forums are managed in this directorate. Establish and manage institutional arrangements, the organs of state focal points, NGOs, CBOs, institutions of higher education, the private sector, technical experts, communities, traditional leaders and volunteers. The Stakeholder Manager develops and maintains a directory of contact details and the roles and responsibilities of key personnel stakeholders, involved in disaster management. They develop and maintain Community Participation plans. Additionally, this directorate must develop a plan or register for volunteers and manage it. Together with the Legislations directorate, this directorate must enter into mutual agreements with the various stakeholders identified and neighbouring governments, e.g. Free State Province and Lesotho and data custodians.

- *Assistant Director: Information Technology* – Develop policies and procedures for information technology management and security. Establish standards to ensure that technology required for an integrated IMCS is compatible across all spheres. Identify and develop capabilities for the Fourth Industrial Revolution (4IR), including the overhaul of the DMA and NDMF to keep up with these changes. Manage the COE for interoperability. They provide ongoing training in working with new digital tools.

- *Assistant Director: GIS and Remote Sensing* - Facilitate risk analysis, disaster risk assessments, mapping (for different types of hazard), monitoring and tracking hazards. They enable timely and appropriate decision-making to ensure a rapid and effective response. Together with the IT department, they record and track real-time disaster response and recovery information. Work closely with all the directorates, especially the risk assessments researchers in providing spatial data (current and historical) on vulnerability monitoring, hazards, their impacts and damage caused.

- *Assistant Director: Call Centre Manager* – Manage the emergency communication system, joint operations, reporting, evaluating and disseminating early warnings on a 24-hour basis. The proposed four (4) call centre operators are for rotation (night and day).

- *Assistant Director: Communication and Public Awareness* – Identify and define information needs, as well as a communication channel analysis. Compile and share

directories of institutional role players across the spheres. Disseminates the minutes of meetings, the record of decisions and recommendations made in meetings to all role players, affected by the decisions. Establish communication links and a variety of communication mechanisms and media, taking into account the lack of technological infrastructure in targeted communities. Develop key messages or communication plans for the achievement of all KPAs and enabler objectives. Work closely with all the directorates and COGTAs communications departments. Develop and implement an integrated communication strategy for the province as informed by the provinces risk profile. Facilitate timely dissemination of early warnings, public awareness and preparedness, especially for at-risk people, households, communities, areas and developments. Together with the IT directorate, they manage the website, developing content. Monitor positive and negative publicity regularly. Work closely with the internal and external stakeholders, encouraging them to formulate and implement appropriate public awareness campaigns, aligned to the provincial strategy.

- *Assistant Director: Research and Information Management* – Develop templates, research design and methodologies for data collection, analysis, storage and dissemination. The data collected is for all the KPA and enablers, as prescribed in the NDMF. This directorate has a library, information database and resource centre for maintaining the institutional resources database, reporting and performance measurement. Together with the GIS department, they facilitate risk analysis, risk profiles, disaster risk assessments, mapping, monitoring and tracking hazards. Manage information on education, training and research. They also manage information on funding and financial management. Develop a disaster management research agenda and engage with disaster risk scientists. They also assess and work closely with consultants.

In concluding this section, the study revealed that there is a lack of skills guide to determine the exact qualifications required in a provincial centre. Therefore, after presenting the proposed organisational structure and a detailed discussion of the IMCS directorate, the study hopes it gave a perspective into the type of qualifications required for a PDMC.

Phase 4. Information Technology Analysis – Having identified the stakeholders, it is easy to identify the internal and external stakeholders to work within, analysing the

technological requirements. As established in the NDMF, the IMCS needs to have capabilities for data collection, analysis, storage and dissemination. While keeping in mind the fact that we are now in the 4IR, it is important to identify systems which are compatible with the environment and the skills available in the PDMC, thus identifying the solutions, problems and risks that come with the technology chosen. At the end of the analysis, a specifications document should be produced.

The diagram illustrated in Figure 8.4 shows a typical, generic IT infrastructure for the Gauteng Provincial Disaster Management Centre as an example. The system shows us the devices and servers within the Gauteng Centre, which should be similar to the municipalities in the province. The systems are connected through the servers and all the local, district, metropolitan and other stakeholders are connected. There are servers for all applications (KPAs and enablers) and general database servers. The system has a cloud storage capability for remote access. Access, security and information-sharing are controlled by defined procedures and policies.
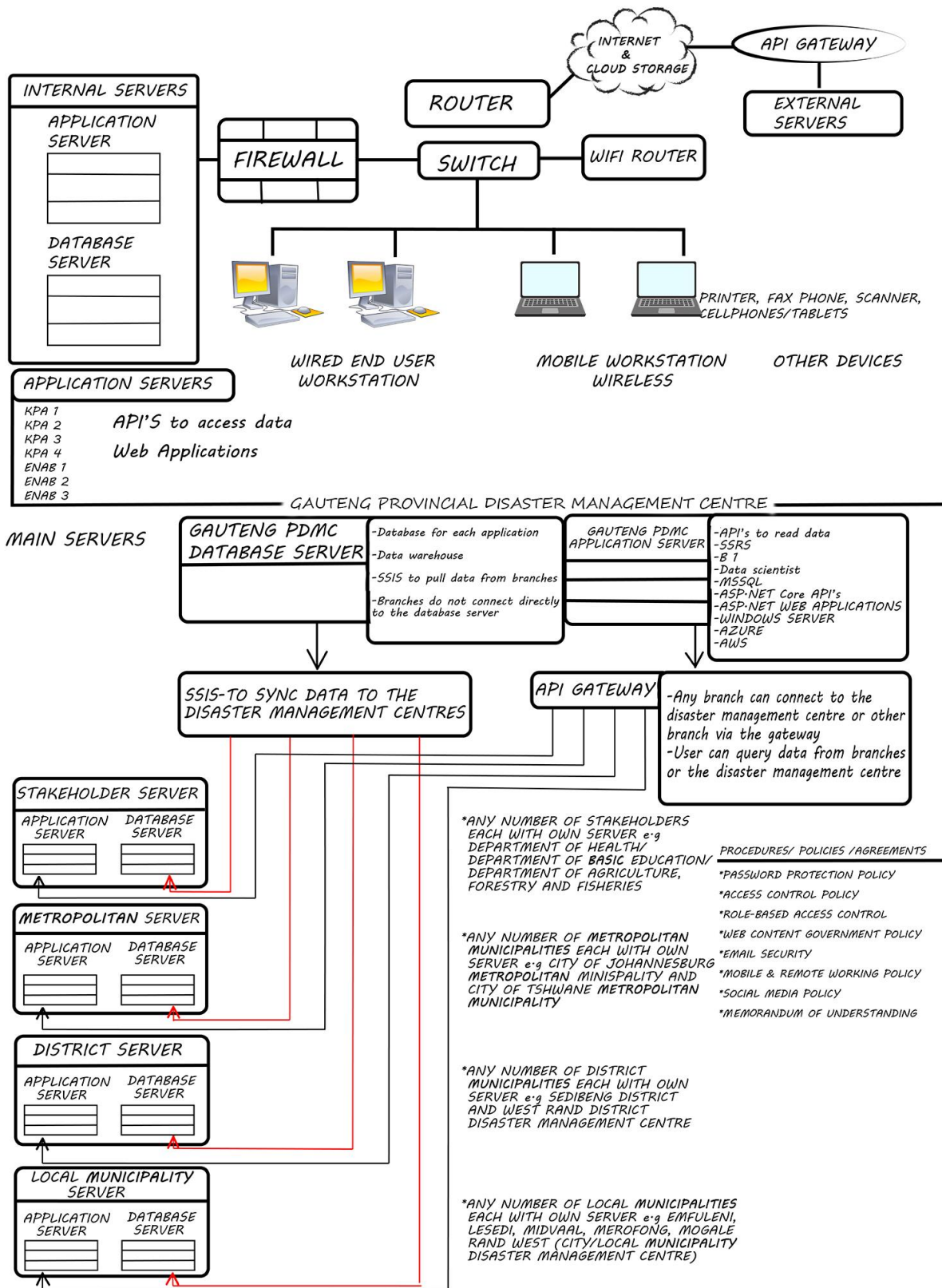
Figure 8.4 *Typical example of an Interoperable IT infrastructure*
(Source: Authors own)

Phase 5. Communication Channels Analysis – A detailed analysis of the communication channels that the targeted audience prefers is imperative to the success of the message sent. In her research on conducting a communication channel analysis, Sinickas (2005) warns us of choosing an integrated mix of communication channels that might not be preferred by the audience. Sinickas (2005), therefore, recommends a pattern analysis methodology, which helps the communicator make information channel choices that are likely to be well received by the audience for the different messages sent out. The pattern analysis is a series of four (4) questions asked to a pilot group of audience on a set of 10 to 15 subjects or topics the organisation mostly communicates on. The four (4) questions asked for each subject are: (i) What is your interest in learning about this subject?, (ii) How well informed (understand) are you on the subject? (iii) What are your top two current sources of information? (iv) What are your top two preferred sources?. This activity will help Management know how best to communicate the issues the audience must know about or need to know about.

A communication plan needs to be developed and it must include the target audience, the topic, the communicator, the schedule, the channel and feedback. The plan must include a media relations plan. The NDMF section 4.3.4 states that responsibilities and protocols for media liaison, including press releases and media interviews, in the event of a disaster occurring or threatening to occur, must be determined (Republic of South Africa, 2005:60).

Phase 6. Benchmarking Exercise – This exercise is a result of the revisit and review of the policy, information needs, stakeholder analysis, IT analysis, communication channels analysis and the provinces' situational analysis. At this phase, the PDMC develops a clear plan on the stakeholders to team up with, the institutions to visit, when to visit and what to look for during the exercise. The PDMC can put together an IMCS committee if needed. Important to note is that the benchmarking exercise explores and inputs some of the principles and key concepts from the IKM4DRR (2013). They are demand-driven; information standards e.g. interoperability and compatibility; collaborative; sustainable; transparent; and monitored.

The plan should include clear objectives and a checklist as a methodology to assess the benchmarked systems. The pros and cons of the systems must be identified to help determine their suitability with the PDMCs' needs and environment. One disadvantage

this study foresees is the PDMC benchmarking with disaster management centres that do not have IMCS, as according to the NDMF, or even worse, with emergency services and other sector departments that are not relevant to disaster management. The NDMF, section 5.6 states that, a comparative analysis to identify the difference between the actual or current system and the desired, future system described in the NDMF, must be undertaken. The analysis must incorporate relevant standards and inputs from all stakeholders, therefore, informing the entire development process. At the end of the exercise, the benchmarking team or committee should be well informed and knowledgeable about IMCS. Their knowledge should be documented in an in-depth report that will inform the development of the PDMCs IMCS.

Phase 7. Develop the IMCS and Governance – In this phase, the PDMC and their various stakeholders are well informed and knowledgeable about how the provinces' IMCS should be like. The benchmarking report leads to the development of an IMCS specifications document. This document includes all the details on the following: the information needs for all KPAs and enablers, relevant IT systems, communication systems, people and their specific roles and responsibilities and processes (Bourgeois, Smith, Wang & Mortati, 2019). The system needs to be guided by the NDMFs enabler 1. The objective of enabler 1 is to: "*Guide the development of a comprehensive information management and communication system and establish integrated communication links with all disaster management role players*" (Republic of South Africa, 2005:130). The following capabilities are required to achieve this objective, of which the study added the first two capabilities:

- Information needs analysis;
- Identify information sources;
- Acquire data;
- Sort data;
- Store data or information;
- Analyse data;
- Information-sharing with targeted interest groups;
- GIS for mapping and information display;
- Standardised multi-media communication capabilities (Republic of South Africa, 2005:63).

Governance of the IMCS requires the identification of clear roles and responsibilities of the assigned stakeholders. Support and clear guidance from the top management is fundamental to the governance of the system. The system has to apply significantly, the principles stated in the Model of the Policy Implementation Process by Smith (1973). The fundamental principles are the government's commitment to implementing the policy, leadership support for the policy, stable administrative structures and personnel with appropriate qualifications, enough capacity within the implementing organisation, and environmental factors like political, cultural and social.

Table 8.1 shows a classic example of a checklist that the PMDC information management and communication committee can use as a guide to establishing the IMCS system. The researcher randomly consulted a few disaster managers for their perception concerning this checklist and they ratified it.

Table 8.1 Information Management and Communication Checklist Guide

Object code #	Components	Incorporated	
1.	**Hardware/Gadgets/Technology**	**YES**	**NO**
1.1	CPU/Monitor/keypad/Mouse		
1.2	Laptop/Mouse		
1.3	Power Supply/Uninterruptible power supply/Power outlets USB		
1.4	Smart TV/Television with live news		
1.5	Voice recorder/Audio Sound System		
1.6	Landlines/Radio Communication/Switchboard		
1.7	Cellphones/Tablets		
1.8	Fax Machine/Scanner/Photocopier/Printer		
1.9	Tollfree number		
1.10	Video Conferencing		
1.11	Solar panels/Fuel generator		
1.12	Satellite Dish		
1.13	Shredder		
1.14	Routers/Modems		
1.15	Camera/Video Recorder		
1.16	Network Cables & Trunking		
1.17	Public Address Systems		
1.18	Projector/Projector screen/ Whiteboards		
1.19	External Storage/USB/Harddrives		
1.20	Drone (s)		
1.21	GPS (s)		
1.22	Response vehicles/Mobile venue operations vehicles		
1.23	-Other		
	-		
2.	**Software**	**YES**	**NO**
2.1	Microsoft Office Package		
2.2	Web browsers		
2.3	Cloud Storage		
2.4	Remote Sensing/GIS		
2.5	Multimedia Messaging Services(MMS)		
2.6	Bulk Short Messaging Service/Software(SMS)		
2.7	Bulk Email Sending		

2.8	Financial Software		
2.9	Database Software/Resources Database		
2.10	Photoshop/Coreldraw software		
2.11	Social Networking Access (Facebook, Twitter, Linkedin e.t.c)		
2.12	Situation Reporting System/Incident Logging		
2.13	Project Management Software		
2.14	Other-		
	-		
3.	**Server**	**YES**	**NO**
3.1	Server Room		
3.2	Web-based server		
3.3	Air-conditioned		
3.4	Fire Protection		
3.5	Other-		
	-		
4.	**Network**	**YES**	**NO**
4.1	WiFi internet		
4.2	Wires or optic cables internet		
4.3	Shared network drive		
4.4	Other-		
	-		
5.	**Policies**	**YES**	**NO**
5.1	IT Purchasing Policy		
5.2	Software Usage		
5.3	Personal Devices Usage		
5.4	Security Policy		
5.5	Administration Policy		
5.6	Website Policy		
5.7	Electronic Signatures/Approvals		
5.8	Agreements (interoperability)		
5.9	Backup & Recovery		
5.10	Standby Policy		
5.11	Other-		
	-		
5.	**People**	YES	NO
5.1	Data Custodians (NDMF: 66)		
5.2	IT		
5.3	GIS & Remote Sensing		
5.4	Meteorologist		
5.5	Communications		
5.6	QUAL + QUANT Data Collection & Analysis/Researchers		
5.7	Librarian/Information Management/Media Management		
5.8	Other-		
	-		
6.	**Non-electronic Information Storage facilities**	**YES**	**NO**
6.1	Library		
6.2	Storage Volt		
6.3	Other-		
	-		
7.	**Infrastructural facilities**	**YES**	**NO**
7.1	Disaster Operations Centre		
7.2	Central Communications Centre/Voice logging system		
7.3	Training, Media & Public Information Centre		
7.4	Boardroom(s)		
7.5	Other-		
	-		

Source: (Authors own)

Phase 8. Monitoring, Evaluation, and Quality Management – To help assess compliance and performance of the IMCS to improve the systems function, an integrated Monitoring and Evaluation (M&E) must be developed and implemented. Hobson, Mayne, and Hamilton (2013) define monitoring as an ongoing collection and analysis of information concerning a project or programme, while evaluation is a retrospective assessment of a concluded project or programme. M&E makes use of qualitative and quantitative data collection tools (periodic workshops, meetings, focus groups, media coverage, policy changes, interviews, observations, questionnaire etc.), which help answer questions on 'what', 'how many', 'when', 'why', 'how', 'perceptions', 'attitudes' and 'beliefs' about the project.

The M&E plan must be able to assess the IMCS in categories, of which the categories are: (i) M&E for integrated institutional capacity for disaster management, (ii) M&E for disaster risk assessment, (iii) M&E for disaster risk reduction, (iv) M&E for response and recovery, (v) M&E for education, training, public awareness and research, and, (vi) M&E for funding arrangements.

Ultimately, the identified phases need to be read in conjunction with the 'System Requirements' detailed in section 5.6.1 of the NDMF (Republic of South Africa 2005:73).

8.4.2 Recommendations for the disaster risk governance of PDMCs
Good disaster risk governance is the starting point for the effective operation of disaster management centres. With good governance, all aspects of disaster management legislation are implemented and functioning effectively. Of concern in this regard, is the management of disaster risk information and communication. The following recommendations promote a holistic approach to governing provincial disaster management centres.

- The NDMC should consider incorporating the proposed framework for establishing an integrated information management and communication systems in the guidelines they will develop. Section 5.8 of the NDMF prescribes the NDMC to develop national guidelines for the implementation of the integrated information and communication system in provincial and municipal spheres (Republic of South Africa, 2005). The proposed Framework might require the NDMC to develop the recommended guidelines to accompany its usage. The proposed Framework is

holistic and comprehensive as it promotes stakeholder participation, leadership and team-work.

- The NDMC and the PDMCs should commit, appreciate and explore the distinct support provided by the NDMF in establishing and managing an integrated IMCS.

- In the same respect, they should ensure that there is support from the management, proper leadership guidance and, the internal stakeholders' willingness to prioritise and participate in managing information and its communication.

- The NDMC and PDMC must prioritise institutional knowledge preservation. This suggests that a directorate solely for stakeholder relations, data collection, analysis, storage and communication is placed on a higher level of the organisational structure. On that level, the directorate can encourage and monitor the participation and management of information and communication amongst all the employees.

- It is important to consider the interest of all stakeholders and focus on how the organisation can create value for their interests (Kinyua, Amuhaya & Namusonge, 2015:141). All the stakeholders identified in Figure 27, including traditional leaders, international bodies and many more, have a significant role to play in disaster management. Hence, Freeman (2010:36-52) propounded the belief by Ackoff (1974), that support, participation and interaction of multiple stakeholders in pursuing the organisation's mission, solves societal problems.

- Prioritisation of information for institutional knowledge preservations requires the NDMC and the PDMCs to improve their practices to yield the full benefits of the systems. They have to change the way they see and understand IMCS as technology, to seeing it and appreciating it as a comprehensive system that requires, for example, qualified and dedicated people to operate IMCS. Sharman, Rao, Upadhaya and Cook-Cottone (2010:13) support this thinking, saying that information technology is insufficient for disaster management.

- The NDMC needs to take the lead in establishing these systems, otherwise, information-sharing and preservation are going to be distorted if uniform systems are not developed. They need to stop hiding behind the argument that the Constitution of South Africa's decentralisation approach affects their assistance to the lower spheres of government.

- The NDMC, together with DMISA, a professional association for disaster management professionals in Southern Africa, should encourage the Premiers and MECs (Member of the Executive Council) of the various provinces to appoint people

with disaster management qualifications in the PDMCs. This approach will address the issue of underqualified personnel and the appointment of personnel that have irrelevant personnel. As a result, the job market for disaster management professionals is created.

- Along with this, the NDMC and DMISA should develop a disaster management job requirements or job qualification skills manual. The manual should be used as a guide for appointing PDMC personnel.

- The study recommends a strategic and legislative planner at director level who is qualified with an NQF level 9 (Masters) and the subordinates to hold an NQF level 8 (Honours) qualification. NQF level 8 and 9 are relevant for this strategic level because learners engage in a specialist research field where they will show a higher capacity of critical thinking, leadership, and independent learning.

- Further, since there are 4 KPAs and 3 enablers (that means 7 areas of expertise), the study suggests that for example, a district should have a minimum of 7 personnel in charge of each KPA and enabler, excluding the head of the Centre and support staff. Since a PDMC provides support, then in a province with 5 districts and 26 municipalities, the PDMC should have a minimum of 31 personnel (5 District Support Managers + 26 Local Municipality Support Managers = 31 personnel) who ensure the implementation of the DMA and NDMF in the entire province through the district and local municipalities.

- To circumvent the lack of support or minimal comprehension of the disaster management function by the politicians, the Centres should hold annual workshops or imbizos with politicians to sensitise them on the significance of the function. If the politicians understand the function, then all the operations of the disaster management centres become smooth-flowing, in particular the information management and communication function.

- The NDMC should address the inconsistent placement of the PDMCs in the sector departments and the inconsistent post designation of the heads of the Centres. They need to recognise that disaster management is a coordinating function, therefore it requires all the necessary power it can get. The PDMC can, therefore, be placed below the Head of Department COGTA or as a Chief Directorate in COGTA.

- Taken together, the responses in Table 20 concerning the issues of the placement of the disaster management function, suggests several courses of action. First, the appointment of the Government Technical Advisory Centre to assess this matter is a

reasonable approach to tackle the issue. Despite the way the Constitution affects the NDMCs authority, the NDMC has the powers to solve this issue, because they established an ICDM. This platform allows them to seat with Cabinet members from all portfolios to present and argue for change concerning issues affecting the disaster management function. It is therefore important to note that disaster management is one of the areas listed in Part A of Schedule 4 of the Constitution, giving authority to the national and the provincial sphere of government, as well as the competency to develop and execute laws, powers and responsibilities relating to disaster management (Dyssel, 2018). Besides the ICDM, another institution the NDMC can use to influence the changes to the legislation is the National Council of the Provinces (NCOP). This will, however, require the support and participation of all provinces. At least the support of six of the nine provinces is all the NDMC requires to influence amendments to the DMA and NDMF legislation (Simeon & Murray, 2001). The existence of all these platforms contradicts the NDMCs' views that the Constitution restricts them from making some changes.

- The NDMC and the PDMCs have a limited online presence. Hence, the study recommends the incorporation of social media networking in their communication strategies as a means of playing on the 4IR platform. They need to explore 4IR packages like the Internet of Things (for example smart city technologies), as well as Artificial Intelligence (for example virtual assistant or chatbots on a Web to handle inquiries). To mitigate the possible fear of social media, they should develop social media policies and training for all employees on the pros and cons of communicating on social media platforms. An online presence should increase the Centres' international stakeholder engagement. The 4IR requires people to reskill so that they do things that machines can do to fit in the 4IR era. With the inadequate qualifications in the disaster management centres, 4IR might seem like a threat. In simple terms, it replaces the old way of doing things. Employees who lack technological skills in their respective areas require adequate training.

- The NDMC must challenge the Constitution of the Republic of South Africa 108 of 1996, schedule 151 (4) and re-engineer the disaster management structure. As a coordinating function, it needs to be placed in a higher office or the official designated with hire positions to assist them with powers to coordinate. The change in the structures will encourage the function to work more closely together. With the

NDMC gaining full autonomy of the PDMCs and other Centres, they can develop uniform structures, fix the disconnectedness and source resources.

- The NDMC and the PDMCs should collaborate with universities within their jurisdiction and beyond to assist with researching important issues. They should identify and establish a disaster management research centre or focal point. This focal point would oversee education, training, public awareness and research in partnership with the disaster management centre. Additionally, the focal point will help the Centre with data collection, analysis, storage and even dissemination. Community service and stakeholder engagements are some of the benefits the university will benefit from this collaboration.

8.5 Recommendations for further research

As the first and completed P.h.D study to focus on the status quo and dynamics of establishing disaster risk IMCSs in South Africa, it created many questions in need of further investigation, as well as opening new opportunities for research in the same area for other interested researchers. The following are some possible areas of research for further investigation:

- Based on the anticipated funding mentioned by the PDMCs, what are the PDMCs intended usage of the funds and how will they help better disaster management operations?
- What are the impacts of the lack of information and communication systems during a disaster declaration like COVID-19 or drought?
- To assess the impacts of the lack of disaster risk information management and communication systems on the effective operation of disaster management centres.
- What discrepancies exist with the implementation of the South African disaster management policies and how can the policymakers solve the discrepancies for more effective implementation. The researcher can use the Model of Policy Implementation Process (Smith, 1973) as a theoretical foundation of the study and review to accommodate the South African environment.
- To assess the interoperability, components and functioning of a fully established and operational disaster information management and communication systems in a South African disaster management centre.

- Investigate the South African disaster management organisational structures or organisational management to improve the standard operating procedures, improve uniformity, reporting structures and information-sharing structures.

8.6   Conclusion

In this chapter, the research provides conclusions for the entire study. The contributions the study made to the body of knowledge are also presented in this chapter. The researcher also provides recommendations in the form of a proposed strategic framework for establishing information management and communication systems as well as recommendations for the disaster risk governance of the disaster management centres.

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GENERAL/HUMAN RESEARCH ETHICS COMMITTEE (GHREC)

12-Aug-2019

Dear Miss Kunguma, Olivia O

Application Approved

Research Project Title:
South African Disaster Management Framework: Assessing the status and dynamics of establishing information management and communication systems in provinces

Ethical Clearance number:
UFS-HSD2019/1049

We are pleased to inform you that your application for ethical clearance has been approved. Your ethical clearance is valid for twelve (12) months from the date of issue. We request that any changes that may take place during the course of your study/research project be submitted to the ethics office to ensure ethical transparency. furthermore, you are requested to submit the final report of your study/research project to the ethics office. Should you require more time to complete this research, please apply for an extension. Thank you for submitting your proposal for ethical clearance; we wish you the best of luck and success with your research.

Yours sincerely

Prof Derek Litthauer
Chairperson: General/Human Research Ethics Committee

Digitally signed
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ANNEXURE 2: Data collection dates and contact details of PDMCs

	VISIT DATES	SOUTH AFRICAN PROVINCIAL & NATIONAL DISASTER MANAGEMENT CONTACT DETAILS
1	Friday 27 September 2019	Head of Centre: Mr Tebogo Gaolalowe Cell: 083 290 9039 / 076 173 8890; Tel: 053 807 9862 Email: tgaolaolwe@ncpg.gov.za; Alt email: kmokgele@ncpg.gov.za Address: 9 Cecil Sussman Road, Kimberley,8300
2	Monday 30 September 2019	Head of Centre: Mr Butler Markes Wayne Cell: 066 487 4896; Tel: 051 407 2001 Email: markes@fscogta.gov.za; Alt email: lizzy@fscogta.gov.za Address: Pelanomi Hospital, Bloemfontein
3	Wednesday 9 October	Head of Centre: Mr Rikhotso Masenyane Cell: 083 454 3350; Tel: 018 388 2386 Email: mrikhotso@nwpg.gov.za; Alt email: NMogoe@nwpg.gov.za Address: Corner Vryburg Road (N18) and Rhodes Crescent, Imperial Reserve, Mahikeng (near Police Station Headquarters)
4	Thursday 10 October 2019	Head of Centre: Sekonya Magerule Cell: 082 936 4454; Tel: 0800 222 111 / 015 284 5565; Michael Moja 083 455 9565, 015 294 5496 Email: sekonyamr@coghsta.limpopo.gov.za; Alt email: MojaMM@coghsta.limpopo.gov.za; Alt email: PhashaMM@coghsta.limpopo.gov.za Address: 20th street (From Market Street, Polokwane Ext 3, Polokwane
5	Friday 11 October 2019	Head of Centre: Mr Dhudhuhlu Silayiki Cell: 082 447 6001 Tel: 013 757 2081 Email: sdhludhlu@mpg.gov.za Alt email: rmanzini@mpg.gov.za / Ray Bheki Manzini 082 361 5711/Nozipho Nkosi 079 514 8737, 013 757 2005/ Khabo Thabethe 079 880 3290/ mr sikhathele shongwe 076 708 1145 Address: R40 road, Madiba, Mbombela, Nelspruit
6	Tuesday 15 October 2019	Head of Centre: Mabandla Philela Cell: Daniso 083 354 8317 / Mr Lunga 082 362 9178 / 073 649 4365 Tel: 040 602 6500 Email: philela.mabandla@eccogta.gov.za Alt contacts:Noxolo Mabilwana 073 264 4855 Noxolo.Mabilwana@eccogta.gov.za/ Puseletso Kolanchu 066 217 0827, 040 602 6500/ Address: Yellow Woods Road, Bisho
7	Thursday 17 October 2019	Head of Centre: Mr Colin Deiner Cell: 082 550 6770; Tel: 021 937 6301 Email: colin.deiner@westerncape.gov.za; Cell: 082 747 9605 / 083 382 6100 Shireen Kolbe; Alt email: shireen.kolbee@westerncape.gov.za; Alt email: Sonja.Chinnian@westerncape.gov.za Address: Francie Van Zijl Dr, Tygerberg Hospital, Cape Town
8	Wednesday 30 October 2019	Head of Centre: Mr Elias Sithole Cell: 082 490 9825 / 072 933 8977; Tel: 011 355 4018 Email: elias.sithole@gauteng.gov.za; Alt email: 072 324 1085 Lindokuhle.Ngubane@gauteng.gov.za / Ms Bongiwe Lisa 011 355 5760 bongiwe.lisa@gauteng.gov.za/ Mr Paul Molokamme 011 355 5760 paul.molokomme@gauteng.gov.za Address: 11 Janadel Avenue, Riverview Block B, Midrand, Gauteng
9	Thursday 31 October 2019	Head of Centre: Dr Tau Mmphaka Cell: 082 0529311; Tel: 012 334 0600 Email: MmaphakaT@ndmc.gov.za; Alt email: MeganL@ndmc.gov.za Address: Riverside Office Park, 1290 Heuwel Rd, Centurion Central, Centurion, 0046
10	Monday 4 November 2019	Head of Centre: Mr Jonty Ndlazi Cell: 082 260 3081 / 082 897 6696; Tel: 033 897 5627 Email: jonty.ndlazi@kzncogta.gov.za; Alt email:072 688 3803, 033 897 5627 thembeni.mncube@kzncogta.gov.za / Mr sibongiseni emmanuel ngema 066 475 2308/076 153 3685/ Thabisile Ntuli 078 193 5251 Address: Shortts Retreat Road, Pietermaritzburg

ANNEXURE 3: Questionnaire for the Provincial Disaster Management Centres

My name is Olivia Kunguma and I am a PhD candidate with the University of the Free State – Disaster Management Training and Education Centre for Africa (UFS-DiMTEC). I am also a lecturer at the same institution. I am conducting a study in all nine provinces of South Africa, in particular, the Disaster Management Centres. The focus of the study is on **assessing the status and dynamics experienced in establishing information management and communication systems**. The information obtained from this survey is for use in informing the development of information management and communication framework, for use by provincial disaster management centres in South Africa.

Confidentiality and Consent: Your answers to this survey are confidential and for academic purposes, only including dissemination through peer-reviewed publications and conference proceedings. We do not foresee that you will experience negative consequences by completing the survey. Your name will not appear on this form, and it is not intended for use in connection with any of the information given. However, your honest answers to these questions will help me better understand the disaster manager's experiences, perceptions and expectations, regarding information management and communication systems for disaster risk management. I would greatly appreciate your help in responding to this survey, you are also free to skip questions you are not comfortable answering. There is no reimbursement or incentive for participating in this survey. You are also free to discontinue the survey.

The research was reviewed and approved by the University of the Free States Ethics' Review Committee. The primary researcher, Olivia Kunguma, can be contacted at kungumao@ufs.ac.za or 051 401 2721.

Estimated time of questionnaire completion: 30 minutes

Do you consent to participate in this survey?

YES		NO	

Questionnaire #

Name of province

Date

Instructions: The head of the Centre should answer ALL the sections. Other respondents should answer *ONLY* the following: section A and section C. Please tick in or fill in the spaces provided

SECTION A: DEMOGRAPHIC DATA

1. Please indicate your gender

1.	Male	
2.	Female	

2. Please indicate your age

1.	Under 25	
2.	25-34	
3.	35-44	
4.	45-54	
5.	55-64	
6.	65 or above	

3. What is your highest level of education attained?

1.	Never went to school	
2.	Primary School	
3.	High School	
4.	Tertiary Education	
5.	Vocational Training	

4. Name 2 highest qualifications you have obtained (*1. Being the highest*)

1.
2.

5. Indicate your work designation

1. Manager	
2. Assistant Director	
3. Deputy Director	
4. Director	
5. Chief Director	
6. Deputy Director-General	
7. Director General (DG)	
8. Other, (*specify*)	

6. State which KPA or enabler you are in charge of?

7. How many years of work experience do you have working in the disaster risk management field?

SECTION B: THE STATUS QUO OF THE PROVINCIAL CENTRE

8. Which year was the provincial disaster management centre established?

State the year	

9. Did the NDMC provide the Centre with a conditional grant to cover the start-up costs of establishing the centre?

1.YES		2.NO	

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10. If answered YES in question 9, how much did the Centre receive in rand value?

R_____

11. Please explain how useful were the funds?

12. How much annual operational running costs are allocated to the PDMC?

R_____

13. Where do you receive your operational funds from?

1.
2.

14. Are you satisfied with the funding you receive?

1. YES		2. NO	

15. If answered NO in question 14, what estimated amount will be sufficient for the annual operation of the centre and why?

R_____

16. Where is the PDMC located in the government structure?

1.	Office of the Premier	

2.	Sector Department (*Specify*)	
3.	Other (*Specify*)	

17. In general, how do you rate your comprehension of the South African National Disaster Management Framework of 2005?

Very Easy (5)	
Easy (4)	
Neutral (3)	
Hard (2)	
Very Hard (1)	

18. To what extent are the objectives set out in each Key Performance Area and enablers achieved?

	Totally achieved 5	Achieved 4	Neutral 3	Partially Achieved 2	Unachieved 1
18.1 KPA 1					
18.2 KPA 2					
18.3 KPA 3					
18.4 KPA 4					
18.5 Enabler 1					
18.6 Enabler 2					
18.7 Enabler 3					

19. The South African National Disaster Management Centre supports the PDMC's disaster risk management operations

20. What assistance do you receive from the NDMC?

1.
2.

21. If you answered YES in question 19, how satisfied are you with the support you receive from the NDMC?

Extremely Dissatisfied (1)	Dissatisfied (2)	Neutral (3)	Satisfied (4)	Very Satisfied (5)

22. What kind of support do you expect from the NDMC?

1.
2.

23. In terms of institutional capacity, how many people are employed in the PDMC?

24. Each KPA and enabler has a person appointed to fulfil the mandates of the Act and NDMF? *If the respondent answered NO at any point, discuss with them the reasons.*

	YES 1	NO 2	NOT SURE 0
24.1 KPA 1			
24.2 KPA 2			
24.3 KPA 3			
24.4 KPA 4			
24.5 Enabler 1			
24.6 Enabler 2			
24.7 Enabler 3			

SECTION C: INFORMATION

MANAGEMENT AND COMMUNICATION SYSTEMS

25. Does the PDMC have an information management and communication system according to the standards set out in the National Disaster Management Framework of 2005, Enabler 1?

1. YES		2. NO	

26. The PDMC received guidelines from the NDMC on how to establish information management and communication system

1. YES		2. NO	

27. If the answer to number 25 is NO, then why?

1. No funding	
2. No political support	
3. Do not know how to establish it	
4. Other, (*Please specify*)	

28. Are internal stakeholders (for example among risk assessment/reduction/response practitioners) willing to share their data?

1.YES		2.NO	

29. Are external stakeholders (for example between this PDMC and other organs of state/private sector/ NGO's) willing to share their data?

1.YES		2.NO	

30. Which stakeholders do you share information with?

	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)
30.1 Non-Governmental Organisations					
30.2 Private Sector					
30.3 Other organs of state					
30.4 Community Members					
30.5 Academia					
30.6 Faith-Based Organisations					

31. In general, explain how you share information with the stakeholders mentioned in question 30.

1.
2.
3.
4.

32. With hazards experienced in your Province in mind, mention all **data sources** you consult for the centre's consumption, *for example, local newspapers. Order of*

1.
2.
3.
4.

importance.

33. With hazards experienced in your Province in mind, list all **methods** you use to collect data for the centre, *for example,*

1.
2.
3.
4.

questionnaires

34. With hazards experienced in your Province in mind, where or how do you **store** the information for the centre, *for example, in the centre's library*

1.
2.
3.
4.

35. With hazards experienced in your Province in mind, what methods do you use to **disseminate** the information collected by the centre? *For example, through the website*

1.
2.
3.
4.

36. Does the centre have support staff specifically designated to collect, analyse, store and distribute information?

1.YES		2.NO	

37. State 2 main hazards experienced in your Province and for each hazard, the **technology** you use to reduce or respond to the hazard *e.g Drones / Response vehicles with trackers and real-time monitoring system / GPS*

Hazards	Software
37.1	
37.2	

38. State 2 main hazards experienced in your Province and for each hazard, the **software** you use to reduce or respond to the hazard *e.g GIS & Remote sensing software*.

Hazards	Software
38.1	
38.2	

39. If answered YES in question **25**, from a scale of 1-5 (*1 being the lowest and 5 being the highest*), rate the **interoperability** of the PDMC's Information Management and Communication System in exchanging information for each function below:

	Lowest	Low	Medium	High	Highest
39.1 It provides an institutional resource database					
39.2 It facilitates information exchange between primary interest groups (e.g. Ambulance services, SAPS, Fire Services)					
39.3 It facilitates risk analysis, disaster risk assessment, mapping, monitoring and tracking					
39.4 It guides and informs focused risk management, development planning and decision-making					
39.5 It facilitates timely dissemination of early warnings, public awareness and preparedness for people at risk etc.					
39.6 It enables timely and appropriate decision-making for effective rapid response and recovery					
39.7 It facilitates integrated and coordinated multi-agency response management					
39.8 It records and tracks real-time disaster response and recovery information					
39.9 It facilitates education, training and research in disaster risk management					
39.10 It facilitates funding and financial management for the purposes of disaster risk management					
39.11 It facilitates information dissemination through multi-media communication					
39.12 What else does the system do? Other (*please specify*)					

40. Information management (IM) enables stakeholders to plan for disaster risks for effective **decision-making** and fulfilment of their roles, so,

	Strongly Disagree (1)	Disagree (2)	Not Sure (3)	Agree (4)	Strongly Agree (5)
40.1 Do you think a disaster management centre can operate effectively without information?					
40.2 Do you think every disaster management centre should have a methodology/set data collection tool for the collection of data?					
40.3 Should an effective information management system be able to store information?					
40.4 Do you think an information management system requires skilled people to operate and manage it?					
40.5 Do you think the management of information contributes to successful disaster risk governance?					
40.6 Do you think the PDMC must identify and analyse stakeholders for the effective management of the information management System?					
40.7 Do you think the PDMC's prioritization of stakeholders within a centre and externally is important for the effective operation of the system?					
40.8 Do you think stakeholders can affect or be affected by the absence of information?					

41. Communication systems (CS) are an integral component of disaster risk management **information dissemination**, hence,

	Strongly Disagree (1)	Disagree (2)	Not Sure (3)	Agree (4)	Strongly Agree (5)
41.1 Do you think a disaster management centre should have a **website** to help disseminate information to the online stakeholders?					
41.2 Do you think a disaster management centre should keep abreast with the 4th industrial revolution in building communities that are more resilient?					
41.3 Do you think the categorisation of social and traditional media usage plays an important role in the successful dissemination of information to targeted audiences?					
41.4 Do you think an effective CS must be highly interoperable amongst stakeholders internally and externally?					
41.5 Do you think an effective CS must include other methods of communication like video-conferencing?					
41.6 Do you think an effective CS must include non-electronic information access and dissemination capabilities like two-way radios and public address system?					

42. Any general comments you would like to make?

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THE END

THANK YOU SO MUCH FOR YOUR TIME AND SUPPORT

NOTES

Please indicate the question number for each comment

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My name is Olivia Kunguma and I am a PhD candidate with the University of the Free State – Disaster Management Training and Education Centre for Africa (UFS-DiMTEC). I am also a lecturer at the same institution. I am conducting a study in all nine provinces of South Africa, in particular, the Disaster Management Centres. The focus of the study is on **assessing the status and dynamics experienced in establishing information management and communication systems**. The information obtained from this survey is for use in informing the development of information management and communication framework for use by provincial disaster management centres in South Africa.

Confidentiality and Consent: Your answers to this survey are confidential and for academic purposes only including dissemination through peer-reviewed publications and conference proceedings. We do not foresee that you will experience negative consequences by completing the survey. Your name will not appear on this form, and it is not intended for use in connection with any of the information given. However, your honest answers to these questions will help me better understand the disaster manager's experiences, perceptions and expectations regarding information management and communication systems for disaster risk management. I would greatly appreciate your help in responding to this survey, you are also free to skip questions you are not comfortable answering. There is no reimbursement or incentive for participating in this survey. You are also free to discontinue the survey.

The research was reviewed and approved by the University of the Free States Ethic's Review Committee. The primary researcher, Olivia Kunguma, can be contacted at kungumao@ufs.ac.za or 051 401 2721.

Estimated time of questionnaire completion: 30 minutes

Do you consent to participate in this survey?	YES		NO	

Questionnaire #

Date

Instructions: The head of the centre should answer ALL the sections. Other respondents should answer *ONLY* the following: section A and section C. Please tick in or fill in the spaces provided

SECTION A: DEMOGRAPHIC DATA

1. Please indicate your gender

Male	
Female	

2Please indicate your age

Under 25	
25-34	
35-44	
45-54	
55-64	
65 or above	

3. What is your highest level of education attained?

Never went to school	
Primary School	
High School	
Tertiary Education	
Vocational Training	

4. Name 2 highest qualifications you have obtained
   (*1. Being the highest*)

1.
2.

5. Indicate your work designation

Director-General	
Deputy Director-General	
Chief Director	
Deputy Director	
Director	
Assistant Director	

Manager	
Other, (*specify*)	

6. How many years of work experience do you have working in the disaster risk management field?

SECTION B: THE STATUS QUO OF THE NATIONAL CENTRE

7. Which year was the national disaster management centre established?

State the year	

8. Seeing that the NDMC and all the PDMC's have different organograms, how do these differences affect the operations of the NDMC and the PDMC'?

9. Does the NDMC have an information management and communication system according to the standards set out in the National Disaster Management Framework of 2005?

1. YES		2. NO	

"Uniti Software - Umoya has developed a software solution called uniti which was born out of a need within the disaster management environment. uniti was deployed nationally across South Africa during the 2010 Fifa Soccer World Cup and used to assist government agencies and non-government agencies to communicate and collaborate across organizational boundaries. The collaboration via uniti assisted with improving levels of public safety" - (UMOYA, 2019).

10. Please mention the disaster risk management information management and communication systems the NDMC has acquired/used since the promulgation of the Act/NDMF?

1.
2.
3.
4.

11. What are your data sources?

12. How do you store the information received from the disaster management centres as well as other stakeholders?

13. How do you disseminate information to the various stakeholders?

14. How accessible is NDMC's information database to the various stakeholders?

"National government has two options: 1) It can fund disaster risk management through a centralised mechanism, 2)It can decide not to fund any disaster risk management activities....the advantage of funding disaster risk management is that it ensures that disaster risk management is implemented evenly within provincial...Guidelines produced by the NDMC for the minimum infrastructural requirements for disaster management centres can form the basis for the conditions attached to the grant...National government is required to fund the start-up costs for provincial......................"- (Section 7.3.1,7.3.3,7.4.2)

15. The NDMC's decision NOT to fund the start-up costs of establishing PDMC's somehow has a negative impact on the full establishment and operation of the PDMC's because of the lack of guidelines that come with the grant. What is the NDMC's perception of this?

SECTION C: SUPPORT FOR THE PROVINCIAL CENTRES

"Effective coordination demands that the various disaster management centres be granted the necessary authority to give effect to their respective disaster management frameworks and to ensure that all disaster risk management-related activities are aligned with the government policy..the provincial disaster management centres must have the authority, backed by political will"-(Section1.2.1 of the NDMF) Misplacement of the disaster management function in the government structure is one of the problems the PDMC's and various academic scholars have identified as a key problem for the partial operation of the function, hence, what efforts is the NDMC putting in place to address this?

"The multi-disciplinary nature of the disaster risk management function acknowledges the crucial need for uniformity in the approach taken by the diversity of role players and partners"

16. To what extent has the NDMC developed guidelines for each KPA and enabler?

	Underdevelopment (1)	Developed (2)
16.1 KPA 1		
16.2 KPA 2		
16.3 KPA 3		
16.4 KPA 4		
16.5 Enabler 1		
16.6 Enabler 2		
16.7 Enabler 3		

17. To what extent has the NDMC disseminated the developed guidelines for each KPA and enabler?

	To be disseminated (1)	Disseminated (2)
KPA 1		
KPA 2		
KPA 3		
KPA 4		
Enabler 1		
Enabler 2		
Enabler 3		

18. If you selected "disseminated" in question 17, please indicate which provinces you have disseminated the guidelines to.

	YES	NO	If yes, specify which KPA and Enabler
Free State			
Eastern Cape			
Gauteng			
Mpumalanga			
Northern Cape			
Western Cape			
North West			
Limpopo			
KwaZulu Natal			

19. Besides the *"Guidelines for minimum Infrustractural requirements for disaster management centres"* in the Disaster Management Act N. 57 OF 2002 GUIDELINES VOLUME 1 – 5.3.2, 5.3.4, 5.3.5, are there other guidelines that will be developed for the establishment of the Information Management & Communication System?

20. How important is an online presence for example through the department's website, Facebook, Twitter e.t.c? If "important", what efforts have you taken to encourage the PDMC's to use these platforms?

"Governments should be building clear strategies that entail all the benefits of a fourth industrial revolution. If not, they risk being left behind"- Ross Harvey

21. What strategies are the NDMC putting in place to enhance disaster risk management governance at all the spheres of the South African government through the application of the benefits of the Fourth Industrial Revolution?

SECTION C: YOUR PERCEPTIONS ABOUT INFORMATION MANAGEMENT AND COMMUNICATION SYSTEMS

43. If answered YES in question **8**, from a scale of 1-5 (*1 being the lowest and 5 being the highest*), rate the **interoperability** of the NDMC's Information Management and Communication System in exchanging information for each function below:

	Lowest	Low	Medium	High	Highest
19.1 It provides an institutional resource database					
19.2 It facilitates information exchange between primary interest groups (e.g. Ambulance services, SAPS, Fire Services)					
19.3 It facilitates risk analysis, disaster risk assessment, mapping, monitoring and tracking					
19.4 It guides and informs focused risk management, development planning and decision-making					
19.5 It facilitates timely dissemination of early warnings, public awareness and preparedness for people at risk etc.					
19.6 It enables timely and appropriate decision-making for effective rapid response and recovery					
19.7 It facilitates integrated and coordinated multi-agency response management					
19.8 It records and tracks real-time disaster response and recovery information					
19.9 It facilitates education, training and research in disaster management					
19.10 It facilitates funding and financial management for disaster management					
19.11 It facilitates information dissemination through multi-media communication					
19.12 What else does the system do? Other (*please specify*)					

44. Information management (IM) enables stakeholders to plan for disaster risks for effective **decision-making** and fulfilment of their roles, so,

	Strongly Disagree (1)	Disagree (2)	Not Sure (3)	Agree (4)	Strongly Agree (5)
20.1 Do you think a disaster management centre can operate effectively without information?					
20.2 Do you think every disaster management centre should have a methodology/set data collection tools for the collection of data?					
20.3 Should an effective information management system be able to store information?					
20.4 Do you think an information management system requires skilled people to operate and manage it?					
20.5 Do you think the management of information contributes to successful disaster risk governance?					
20.6 Do you think the PDMC must identify and analyse stakeholders for the effective management of the information management System?					
20.7 Do you think the PDMC's prioritization of stakeholders within a centre and externally is important for the effective operation of the system?					
20.8 Do you think stakeholders can affect or be affected by the absence of information?					

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21.6 Do you think an effective CS must include non-electronic information access and dissemination capabilities like two-way radios and public address system?					

46. Any general comments you would like to make?

THE END

THANK YOU SO MUCH FOR YOUR TIME AND SUPPORT

Take pictures of the following:

1. The NDMC/PDMC building;

2. The outside area of the building (warehouse, helicopter landing, parking space, electricity generator, vehicles, water tanks, fuel tanks e.t.c);

3. Office space (furniture, workshop rooms, conference rooms, media room, library, etc);

4. Office space other (Gym, kitchen, toilets, showers, dining area, etc.);

5. Server room (housed on-site);

6. Hardware (smart televisions, voice recorders, telephones, computers, fax machines, photocopiers, printers, document scanners, shredders, public address systems, network cables, routers, cabling, trunking, etc.);

7. Networks (computer networks that allow computers to share resources to communicate, high-speed internet using more than one connection type);

Michelle Woolley

WRITER EDITOR PROOFREADER TRANSLATOR

Associate Member of Professional EDITORS' Guild (PEG)

CERTIFICATE OF EDITING

This letter certifies that I have edited the thesis detailed below.

Title:

SOUTH AFRICAN DISASTER MANAGEMENT FRAMEWORK:
ASSESSING THE STATUS AND DYNAMICS OF ESTABLISHING
INFORMATION MANAGEMENT AND COMMUNICATION SYSTEMS IN
PROVINCES

Author:

Olivia Kunguma

Regards
Michelle Woolley

Date: 14/07/2020

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Professional
EDITORS
Guild