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A South African disaster legislative perspective of information management and communication systems

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Dates:
Received: 16 Mar. 2022
Accepted: 11 Aug. 2022
Published: 18 Oct. 2022

Background: Establishing a disaster information management and communication system (IMCS) is a mandate of the South African National Disaster Management Framework of 2005 (NDMF). The inception of such systems is supposed to be at the initial set-up of disaster management centres. The comprehensive functioning of a disaster centre will require an interoperable system that can collect, process, store and disseminate data. The lack of such a system might result in poor disaster risk reduction (DRR) and ineffective response.

Objective: This article identified and described IMCSs from the South African disaster policy perspective.

Methods: Qualitative in-depth interviews were used to investigate the status quo of all nine provincial disaster management centres (PDMCs) regarding the existence, functioning and understanding of IMCSs. The NDMF informed the interview questions administered to 29 purposively selected participants. Themes from descriptions by informants were used to analyse the data.

Results: All the centres operating for more than 10 years lack integrated IMCSs. The disaster managers perceive IMCSs as more information technology, computers and other physical devices and less human input systems and governance capabilities. The lack of integrated and well-governed disaster information and communication affects disaster management operations and service delivery mandate.

Conclusion: To date, no studies have explored the establishment and management of interoperable IMCSs in disaster management centres. Therefore, this study contributes to the literature on disaster information and communication discourse and practical contributions to improve the capacity of PDMCs. This article provides insight into the significance of IMCS for building resilient communities and recommendations for establishing and maintaining the systems.

Keywords: disaster communication; information management; disaster governance; disaster legislation; Fourth Industrial Revolution (4IR); data.

Introduction

An increase in the occurrence and magnitude of hazards globally triggered intolerable social, environmental, physical, political and economic devastations (Botzen, Deschenes & Sanders 2019; Kunguma & Skinner 2017). A peculiar hazard that recently brought about immense and negative impacts on all aspects of life was coronavirus disease 2019 (COVID-19), which the World Health Organization (WHO 2020) declared a global pandemic. Just as disasters have gained momentum, so have disaster management prevention, preparedness, mitigation, response, recovery and rehabilitation. These activities demand current, reliable and accurate information management and communication systems (IMCSs). To this end, the Fourth Industrial Revolution (4IR) has made great waves increasing in speed, breadth and depth, aiding in the effective risk reduction and response to disasters. Several scholars believe improving information and communication technologies nowadays is exceptional (Jin 2017; Roztocki, Soja & Weistroffer 2019). The recent COVID-19 pandemic era has even seen the significance of 4IR, especially with the imposed restrictions on movement to mitigate and prevent the spread of the virus (Dwolatzky & Harris 2020).

Both the increase in disasters and the arrival of the 4IR have tested the disaster risk reduction (DRR) and management capabilities of the South African disaster management fraternity. Despite

the enormous technological advances in weather forecasting, knowledge-sharing and risk avoidance, culture promotion among at-risk communities remain lagging (Chagutah 2014).

Kunguma, Ncube and Mokhele (2021), Pietersen (2020) and Van Niekerk (2014) further argued that disaster managers in South Africa are struggling with the implementation of the recently promulgated *Disaster Management Act (DMA) No. 57* of 2002 (amended Act No. 16 of 2015) and the *National Disaster Management Framework* of 2005 (NDMF). Therefore, this study investigates the NDMF, Section 5, 'Enabler 1: Information Management and Communication Systems' implementation and optimal utilisation. This enabler is a key component of the policy that was supposed to be implemented during the disaster management centre establishment. Most disaster management centres, especially in the provinces, which have been operating for more than 10 years have not established IMCSs. The lack of IMCSs is a significant problem because the NDMF stipulates that the centres must create the capacity to be information repositories and channels for DRR information in their respective areas. Inevitably, Wentink and Van Niekerk (2017) identified a lack of IMCSs as one of the challenges that affect the implementation of disaster management policies in South Africa. Supposedly, Wentink and Van Niekerk's (2017) thinking supports this study's postulation that if IMCSs were established at the initial set-up of centres, then the implementation of all the other components of the DMA and the NDMF would be fully instituted with limited challenges.

The precise dissection of the IMCS aimed to aid disaster management practitioners' easy comprehension of this key component. The need to review IMCS from a policy perspective is because the policy emphasises the need for centres to establish IMCS as an enabler that supports the implementation of the other disaster management components. The NDMF prescribes that the IMCS supports risk assessments, institutional arrangements, reduction of risks, response to disasters and recovery, funding and education. The slow progress in implementing the DMA and NDMF, as observed by some of the scholars (Jordaan 2018; Pelling & Holloway 2006; Van Riet & Diedericks 2009), supports the argument of this article that IMCS is one of the DMA- and NDMF-prescribed components that has not been implemented. Furthermore, information and communication are key components of all DRR and response activities. As a result, this brought the author's interest and motivation to investigate the status of disaster centres in establishing IMCSs. Through an empirical investigation, the author assessed the provincial centres' governance capabilities, progress in establishing IMCSs and the participants' understanding and utilisation of the system.

Literature review

With the world experiencing an accelerated technological transformation, all organisations should integrate and

coordinate to maintain this technological revolution. It is also the responsibility of citizens to guide and support technological evolution. The 4IR is a new era in human development enabled by technological advances (Schwab 2016). The 4IR is increasing in all aspects, making breakthroughs in the use of electronic and information technology such as artificial intelligence, for example, self-driving cars and drones, mobile devices to improve the quality of life, 3D printing and many others. Unfortunately, 4IR has also brought on some adaptation resistance, because people fear the unknown or a disruption in the norm (Richter & Sinha 2020). Despite the 4IR resistance, disaster management can benefit by using technology to reduce vulnerabilities and increase resilience by comparing costs and benefits, resource management and many more (Rao, Eisenberg & Schmitt 2007).

Rajaraman (2018) defined information technology as a system for acquiring and processing data to produce information and its dissemination. Decision-makers need this information to make timely decisions because their knowledge would have improved (Abubakara et al. 2019). On the other hand, the *Merriam-Webster Dictionary* (Merriam-Webster 2021) sees technology as the application of scientific knowledge to the practical aims of human life or in a particular area using technical processes to accomplish a task. The *Merriam-Webster Dictionary* concurs with Rajaraman's definition, showing that technology assists or contributes to achieving a certain task. While technology aids the management of information, Hinton (2011) defined information management as the conscious process by which information is gathered and used to assist decision-making at all levels of an organisation. Therefore, the management of information requires critical thinking with the decisions to be made, systematic planning and constructive communication. As presented in the earlier definitions, all the processes lead to the dissemination of information to accomplish a certain task, such as disaster communication by disaster managers to a targeted group that needs information. It also involves sharing information with various stakeholders regarding DRR and response activities (Kunguma & Skinner 2017; Mason et al. 2019).

It is imperative to discuss the challenges of managing and communicating disaster information. In 2013, the Global Platform for Disaster Risk Reduction validated a community on Information and Knowledge Management for DRR (IKM4DRR) (UNISDR 2013). The IKM4DRR believes that IMCSs and skilled, dedicated stakeholders are required for informed decision-making. This community was formed after the identification of challenges with IMCSs. Kunguma (2020), Sweta (2018), Mutasa (2013) and UNISDR (2013) observed the following challenges in their IMCSs studies:

- Information is scattered among various stakeholders, limiting sharing and access.
- There is resistance to change or adaptation to new technologies or a way of doing things.
- Information is stored on personal laptops.

- Officials wait to look for information during a disaster, causing strain and confusion.
- Information on risks, vulnerabilities, hazards, capacities and past disasters for lessons learnt are not collected and stored systematically.
- There is limited data analysis because of a lack of research design and methodology.
- Historical data and indigenous knowledge are not used for policies and decisions.
- Stakeholders are not willing to share information, attributed to power struggles and politics.
- Sectors conceal information about risks and vulnerabilities, fearing criticism for service delivery failure.
- Information dissemination is affected by the varying job designations of the heads of centres and the varying placement of the centres in the government structure.

Management of disasters is a continuous and integrated process of planning and implementing risk reduction and response measures by several sectors and disciplines. Therefore, according to Kunguma and Terblanche (2013), Republic of South Africa (2005) and Republic of South Africa (2002), disaster managers will require the following type of information to achieve their mandate:

- data on past, current and impending hazards or disasters and how they were managed
- information on organs of state compliance with the DMA and the NDMF
- disaster funding information and emergency response resources (e.g. police, hospitals, fire-fighting, schools, airports and churches, among others)
- information on recruitment, training and participation of disaster management volunteers
- capacity-building, training and education institutions and information on all stakeholders involved in disaster management (in the form of a comprehensive directory)
- data on vulnerable areas and communities and existing indigenous knowledge
- plans, strategies, programmes and research of all stakeholders.

## Legislation and policy perspective of systems

According to the Republic of South Africa (2002) and the Republic of South Africa (2005), the DMA and NDMF emphatically prescribe the institutionalisation of disaster centres in each sphere of government and focal disaster management points in organs of the state. This need for disaster centres and focal points supports the effective operationalisation of disaster management in South Africa (Van Niekerk 2006). However, institutions alone are deficient and require various components, including IMCSs.

The DMA emphasises the development of comprehensive and integrated IMCSs across all disaster centres. Another DMA prescription is that the national centre must develop and maintain a directory of stakeholders, establish communication links, be an archive and channel for disaster information and maintain a free and accessible electronic database (Republic of South Africa 2002). Similar activities are also expected at the provincial level. The DMA suggested establishing a national framework to ensure an integrated and uniform approach to managing disasters across all spheres (Republic of South Africa 2002). The framework, as stated earlier, prescribes that at the first establishment of a disaster management centre, integrated institutional capacity (key performance area [KPA] 1) and IMCSs (enabler 1) must be concurrently established. This prescription denotes that both these components have a symbiotic relationship. To show the significance of IMCSs, a specific enabler on IMCSs forms part of the NDMF. Enabler 1 has an objective, which is to provide guidance on the development of integrated IMCSs and establish communication links with all disaster management stakeholders.

This enabler's objective can only be achieved if the system has the following capabilities, presented in Figure 1 (Republic of South Africa 2005).

In support of the given capabilities, the NDMF, enabler 1, defines IMCS as '… a system that enables the receipt, analysis, storage, dissemination and exchange of information in support of integrated disaster risk management' (Republic of South Africa 2005). The purpose of the system, as illustrated in Figure 2, is to target primary interest groups and identify their information needs. Information sources from credible stakeholders must be identified and collected qualitatively or quantitatively. It is then analysed, stored and maintained. For the information to be disseminated, integrated communication links must be established for stakeholders to make informed decisions. The entire system and its contents must be monitored and evaluated for quality management. The bar on the left side of the figure shows the experts required to operate the entire system. Although the world is experiencing the 4IR, the NDMF (Republic of South Africa 2005) considers that the information and communication system must
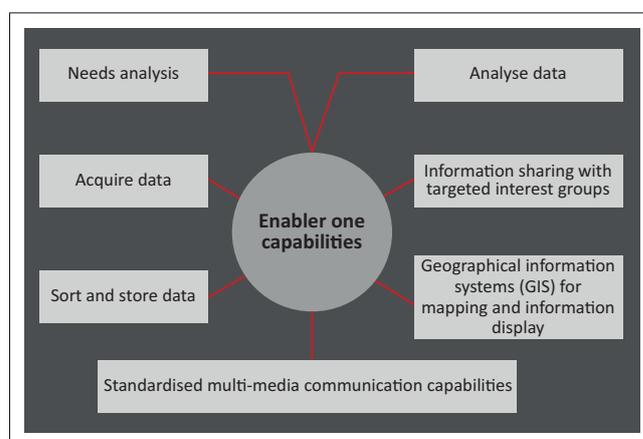
FIGURE 1: Capabilities for a full functioning information management and communication system.

accommodate the lack of technological infrastructure in some communities. Therefore, the system must consider traditional methods of managing information and its dissemination.

While all enablers support all the four KPAs, as illustrated in Figure 3, enabler 1 supports all the KPAs and the other enablers. Figure 2 shows that enabler 1 addresses the information and communication needs of all the KPAs and enablers.

As stated by Kunguma (2020) and the Republic of South Africa (2005), KPA 1 guides the enactment of integrated institutional support. The KPA requires the IMCS to assist it with activities such as stakeholder directory, the roles and responsibilities of stakeholders, meeting records, a 24-h communication facility and many others. Key performance area 2 supports establishing a holistic approach to disaster risk assessment and monitoring for effective planning by all stakeholders. This KPA requires the IMCS to provide spatial and nonspatial information and produce electronic GIS-based risk profiles. Key performance area 3 on DRR ensures the development and implementation of integrated disaster risk management plans and risk reduction programmes. For KPA 3, the IMCS must have an integrated planning functionality for access by all stakeholders when developing their disaster risk management plans. Furthermore, KPA 3 must facilitate including DRR strategies in integrated development plans (IDPs), contingency plans, templates and other components.

Key performance area 4 on disaster response and recovery requires easily accessible real-time information. Enabler 2 supports the capacitation of stakeholders through integrated education, training and scientific research public awareness programmes (Republic of South Africa 2005). The IMCS should record and monitor training and research activities and store a list of the service providers. Enabler 3 guides the establishment of disaster funding, requiring the IMCS to maintain a database with all disaster management funding matters (Kunguma 2020).

Disaster risk management bears the major task of coordinating and implementing disaster management activities and is expected to be the conduit and repository of disaster information (Republic of South Africa 2002; Van Niekerk 2006). Moreover, the DMA mandates the formation of disaster management advisory forum committees at all spheres of government. The committee members convene to consult, advise and coordinate disaster management-related activities to effectively implement the DMA and NDMF (Republic of South Africa 2002). In these circumstances, the effective functioning of the committees then requires an integrated, fully functioning IMCS.

Research methods

This article executed exploratory research to better understand the disaster IMCSs from a policy perspective, particularly the NDMF, enabler 1. Data were purposely collected from provincial disaster management centres (PDMCs) because as per the *Constitution of the Republic of South Africa* (No. 108 of 1996) (Part A, Schedule 4), provinces are functional areas of
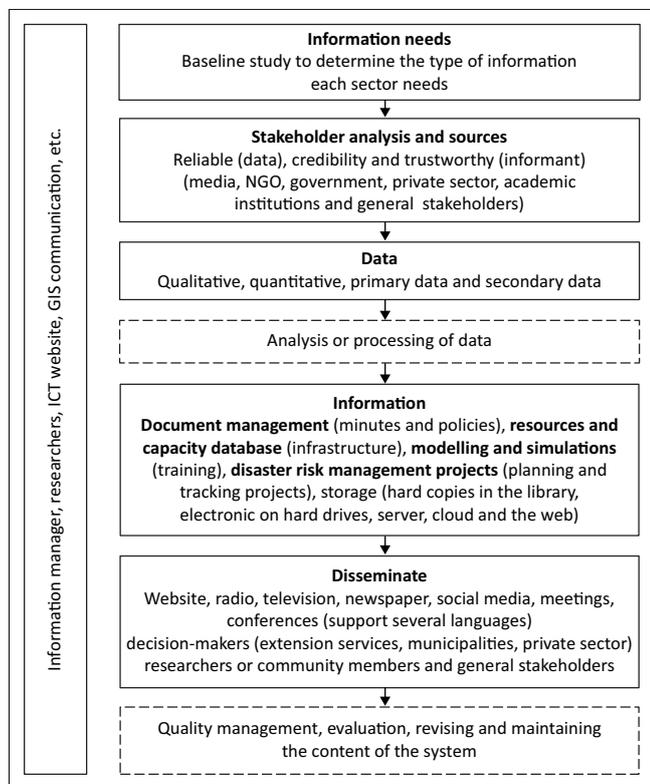
Source: Republic of South Africa, 2005, *National Disaster Management Framework of 2005*, Government Printers, Pretoria

NGO, nongovernmental organisation.

FIGURE 2: Disaster information management and communication system model.
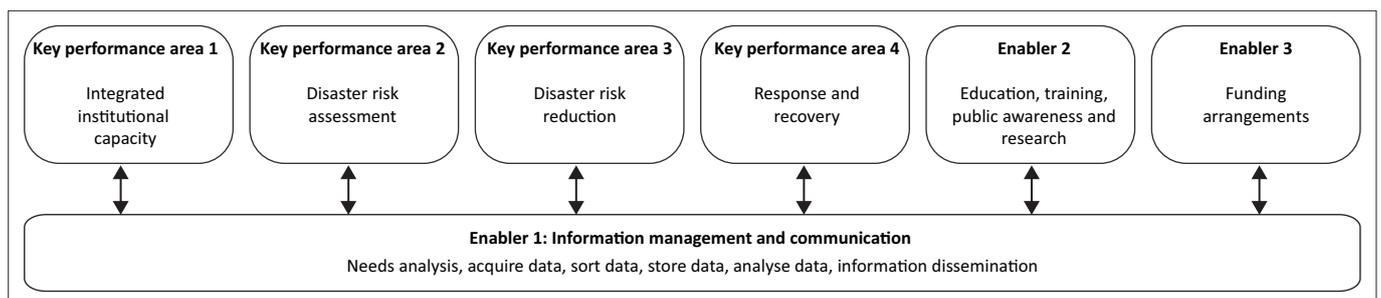
Source: Republic of South Africa, 2005, *National Disaster Management Framework of 2005*, Government Printers, Pretoria

FIGURE 3: Information management and communication system support for key performance areas and enablers.

concurrent competency (Republic of South Africa 1996). This prescription empowers PDMCs with the duty to make sure disaster management activities are fulfilled. The provinces collect the information from the municipalities and relay it to the national centre.

For this reason, this qualitative case study purposively selected all nine PDMCs to obtain data through interviews. In total, 29 participants in senior positions participated in the study. Microsoft Excel (Microsoft Corporation, Redmond, Washington, United States) spreadsheets were used to capture, transcribe and determine the codes from the interviews. Through deductive coding, predetermined codes were developed based on the generic IMCSs. The codes were then used to derive themes and present narrative key findings. Some of the data were presented verbatim.

Information management and communication systems depend on how the centres are governed and effective governance depends on the capabilities of the human resources. At the same time, disaster IMCSs contribute to the effective governance of the centres. Therefore, the study collected information on the disaster managers' qualifications, work designation, the PDMCs' years in operation, the PDMCs' progress in achieving the legislation and policy objectives (KPAs and enablers) and progress in establishing the IMCSs. All the information collected contributed to the empirical understanding of disaster IMCS based on the PDMC practitioners' perceptions.

Findings and discussions

This section presents empirical findings from the PDMCs, coded as PDMC 1 to PDMC 9 for ethical reasons.

Qualifications

The heads of the centres held qualifications such as PhD in Public Management, Disaster Management Master's degree or National Diploma, MBA, BA Honours in Psychology, Master's in Health Professions Education and Honours degree in Geography and Fire Technology. It is significant to have proper and adequate training in disaster management to manage the centres. Studies by these scholars (Holloway 2009; Kunguma et al. 2021; UNISDR 2015; Van Riet & Van Niekerk 2012) asserted the importance of sufficient education to manage disasters successfully. According to the South African NETaRNRA (National Education, Training and Research Needs and Resources Analysis) report by the National Disaster Management Centre (NDMC 2010), the most suitable qualification for people working at a disaster management centre is a disaster management qualification. As observed in the list of qualifications held by the head of the centres, only a few have specific qualifications in disaster management. The lack of senior managers with qualifications in disaster management could be attributed to negligence in implementing the NETaRNRA policy that guides the appointment of senior managers with disaster management qualifications. Conversely, the

inappropriate qualifications for the disaster management field could mean that the heads of the centres are not fully conversant with disaster information management and communication strategies. One participant added, 'we need in-house training because this centre does not have properly qualified personnel'.

Work designation of the heads of centres

Half of the heads of centres are appointed as chief directors, some as directors and the rest as deputy directors. A typical departmental government structure in South Africa consists of five designations, from the lowest to the highest. The lowest is a deputy director at sub-sub level, director at sublevel, chief director at a programme level, deputy director general at branch level and director general at departmental level (Jordaan 2018). Heads of centres at the deputy or director level encounter stringent reporting lines such as 'red tape'. This process is a negative organisational operation that includes excessive workload, document use and a long reporting line (Altunok 2018). Disaster managers at this lower level designation might be experiencing operational difficulties.

Furthermore, a lack of uniformity is observed within the disaster management fraternity at a provincial level in South Africa because of the inconsistent designations in the PDMCs. The lack of uniformity is attributed to the South African Constitution of South Africa, which promotes the spheres of government to be decentralised. While decentralisation is a positive government aspect, it has its fair share of challenges. The province's Premier and the executive council member decide where to place a PDMC. These politicians' management and knowledge skills regarding disaster management are limited. Therefore, intervention by the national government is limited:

> 'The more the senior one is in the government, the more they can access more structures. For example, the appointment as a deputy director general (DDG), you can call the shots.' (Participant 1/Male/age 55–64)

The placement of the disaster management function and heads of centres designation reveal how much politicians prioritise the function in each province. In this state, the function is of low priority.

Years in operation

The participants shared the years when the PDMCs were established. In 1998, PDMCs 9 and 3 were established. The PDMCs were established under the *Civil Defence Act 82* of 1990 and the February 1998 Green Paper on Disaster Management. Established under the Civil Defence legislation, these PDMCs were operating with the principles of civilian control, focusing mostly on disaster response and less on DRR. According to the Republic of South Africa (2005), the NDMF states that the 1999 White Paper on Disaster Management paved the way for the promulgation of the DMA. The White Paper guided the establishment of PDMC 6

in 2000. After the DMA, PDMC 8 was instituted in 2003. When the NDMF was passed in 2005, PDMCs 2 and 5 were also established. In 2007, PDMC 1 was established and PDMC 4 in 2008. Provincial disaster management centre 7 was established the earliest in 2015.

Provincial disaster management centres established in 2005–2015 were founded under the NDMF, which prescribed clear guidance on the components of a disaster management centre, unlike those established before 2005. Provincial disaster management centre operations are mandated under the DMA and the NDMF. Therefore, even those established before 2005 had to adjust from civil defence thinking to DRR. Additionally, the earlier international frameworks such as the Yokohama Strategy and Plan of Action for a Safer World and the South African Constitution mandated the institution of the centres.

Progress in achieving key performance areas and enablers

Achieving the objectives set in each KPA and enabler was of significance to the study. Therefore, the progress was assessed according to each KPA and enabler. However, focusing only on enabler 1, PDMC 1 that has been operating since 2007, PDMC 2 since 2005, PMDC 3 since 1998, PDMC 4 since 2015, PDMC 5 since 2005, PDMC 7 since 2015 and PDMC 8 since 2003 all indicated that they 'partially achieved' the enabler. Provincial disaster management centre 6, operating since 2000, 'neither achieved nor unachieved' the enabler. This status was because they have the infrastructure but lack sufficient capacity and qualified personnel to manage information and communication. Operating since 1998, PDMC 9 indicated that enabler 1 was 'unachieved'.

Deriving from the given results, all PDMCs revealed that the system had not been developed. The lack of achievement is attributed to various reasons, mostly stated by the participants. The reasons included unsuitable qualifications held by the heads of centres, lack of knowledge on how to establish the system, limited capacity that ranges from as little as 6 to 28 personnel in the PDMCs, rented office space, heads of centres acting and not permanently employed, heads of centres heading other departments, limited and unequal annual equitable shares received for operation from as little as R8 to R68 million and many others. The equitable shares received per PDMC depend on the health, education, poverty, basic, population and economic activity components. Unfortunately, the equitable shares allocated to each PDMC do not consider the fact that each PDMC must oversee various local, districts and metropolitan municipalities. Consequently, no policy guides how much a PDMC should receive. All the PDMCs indicated that they did not receive the startup grant from the NDMC.

The DMA mandated the provinces to establish disaster centres by 01 April 2004, 2 years after the promulgation. This would revoke the operational style of the centres established before 2004 under the *Civil Protection Act* of 1977. The NDMF adds that establishing centres was urgent and a national priority and that the government should fund the startup costs with a conditional grant (Republic of South Africa 2005). Based on the participants' responses, the national government opted not to fund the centres. In this case, the NDMF provides two options. The first option states that the national government can fund through a centralised mechanism and the second option that it can decide not to fund, placing the responsibility on the provinces' equitable shares or revenues.

The effects of the NDMCs' decision not to fund is observed in the status of the provinces. With the earlier mentioned possible reasons for the lack of enabler 1, scholars such as Wentink and Van Niekerk (2017) argued that the attention of disaster management personnel on disaster management activities is limited because they head other government departments. Lastly, the allocation of shares to disaster management also depends on the political prioritisation of the function in that province, as they are based on the components of the equitable share by province, for example, the education component (Roos 2020).

Participants' understanding of information management and communication

Based on the IMCS capabilities identified earlier, the study sought to investigate the PDMCs' sources of data, methods of data collection, storage and dissemination methods.

Data sources

The participants stated that they consult various data sources for their operations. The most consulted sources were 'media' with a specific mention of radio, newspapers and television. Concerning the media as a source of information, one respondent said 'information from the media is not 100% reliable because it is sensationalised. However, media has been used as a source from time to time'. The second-highest consulted were 'sector or government departments', with a specific mention of the Department of Health, Department of Human Settlement, Water and Sanitation, Working on Fire and South African Weather Services (SAWS). Other sources were scientific research, advisory forum meetings, community members, and WhatsApp groups. Credible sources of information are significant for the effective operation of the IMCS.

Data collection methods

Table 1 shows some of the data collection tools the participants use. Incident report templates or incident assessment reports were the data collection method used the most, followed by e-mail inquiries. One participant said, 'we do not have a scientific research design and methodology; we just collect information informally or on *ad hoc*'. As observed in Table 1, most of the data collection methods are for disaster response purposes, and in support of what the participant stated, the PDMCs do not proactively collect data to inform their risk reduction and effective response activities.

Data storage methods

Table 2 shows the data storage methods used in the PDMCs. Almost all the participants indicated that they use 'personal computers' and 'hard copies or manual filing' to store the PDMCs' data. The prioritised utilisation of manual filing and personal computer storage of files indicates that the PDMCs' 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:

> 'The centres' information storage is not good at all. Information is stored in fragments in personal computers, hard drives, memory sticks and reports e-mailed 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. The NDMC has shared with us a cost analysis form where we had to populate the financial costs of past hazards. 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.' (Participant 1/Female/age 55–64)

It seems the limited usage of these facilities is ascribed to the unwillingness to learn and use new methods and poor leadership.

Information sharing and stakeholder relations

As the disaster legislation support cooperative governance with other stakeholders to coordinate disaster management activities, the 'advisory forum meetings' are used significantly. 'E-mails' were also identified as a significantly used method. Most participants also identified 'SMSes', which are important for the target audiences' widespread and quick reach in risk reduction and disaster response information dissemination. A few participants use 'public awareness' campaigns; this is regardless of the disaster legislation stipulating 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 (Kunguma & Terblanche 2013; Republic of South Africa 2002, 2005). If the institutional capacity and arrangements were fully functional, all communication channels would be used equally and fully. Table 3 shows the methods the participants identified for sending and receiving information.

Regarding information sharing with other stakeholders, most participants indicated that they share information with nongovernmental organisations (NGOs), the private sector, state organs, community members, academics and faith-based organisations. Nongovernmental organisations play a significant role in supporting centres during disaster response, such as providing relief (Mondal, Chowdhury & Basu 2015). The private sector assists disaster management by offering services such as training in search and rescue, technology such as more advanced water-saving mechanisms and funding (Srinivas 2022). Organs of the state are stakeholders accountable to the government for service delivery. Regarding academics, scientifically informed DRR activities are fundamental. However, the provinces' involvement in research and training activities with academia is minimal. Faith-based organisations are important for obtaining volunteers, shelter and donations. Information sharing and the identification of interest groups' information needs is the first phase in understanding and making the disaster IMCS operational. Effective disaster risk governance is successful through appropriate and organised institutional arrangements. Moreover, stakeholder relations and good governance practices help to lessen disaster impacts and improve disaster response (Mudavanhu et al. 2015; Shin 2017; UNISDR 2017).

Conclusions and recommendations

Although disaster IMCSs are mostly understood as software and computer hardware, this study identified this approach as insignificant. The study expounded that it is a process of acquiring, processing and disseminating information. Therefore, such activities are beyond mechanical devices and require systematic human operation. It is a misconception that information management and communication is only about technology. Stakeholder relations and decision-making also form part of the process. In addition, challenges that affect the development and maintenance of disaster IMCSs were presented to inform practical solutions. Concurrently, for disaster management activities to be effective, scientific data are needed, and the study identified some generic types

TABLE 1: Data collection methods.

Checklist	Running log form	Fieldwork	Community-based assessment questionnaire
Situational reporting system	Desktop research	Capacity building template	Provincial assessment report form
Standardised disaster management template	Hydronet	Quarterly report template	Telephone inquiries
Informal interviews	Resource template	GPS	Risk assessment reports
Monitoring and evaluation reports	Incident report template	Municipal reports	Compliance template

GPS, global positioning system.

TABLE 2: Data storage methods.

Shared network drive	Server	Hard copy files	Department archive or COGTA server
Memory stick	CDs	Cost analysis form	-
Situational reporting system	Storage volt or store room	Call log	-
Hard drive	Incident command system (web-based)	Reports at NDMC	-
Chief directorate	Registry	Personal computers	-

COGTA, Cooperative Government and Traditional Affairs; NDMC, National Disaster Management Centre.

TABLE 3: Information sharing methods.

E-mails	Telephone	Meetings	SMS
Informal conversations	Radio	Advisory forum meetings	Website
Public awareness	Capacity building meetings	Social media	Pamphlets
Workshops	Intergovernmental meetings	Municipal visits	Media
WhatsApp	Municipal portfolio committee	-	-

of data that are required for this purpose. Of course, the type of data needed is contingent on the nature of the event the disaster manager is dealing with at that time. Hence, the need for proactive and systematic human input in managing all the IMCS processes. Although the DMA and NDMF prescribe IMCS as a supporting enabler (enabler 1) for all disaster management activities, the study found that such systems were lacking in all PDMCs.

The lack of these systems is attributed to several reasons, such as the limited understanding of the IMCS processes and what such a system entails; inappropriate qualifications, which might affect the understanding of IMCS; the low-level work designation of some of the disaster managers, which might affect the decisions on information management and dissemination; ultimately, NDMCs' decision to not fund startup costs could be one of several other reasons. It is envisaged that if funding were provided, it would have come with specifications of what an IMCS should encompass. Concerning the findings on the participants' understanding of IMCSs, the comprehension and appreciation of the processes were minimal. The PDMCs were not fully consulting the abundant sources. Data collection methods were limited to templates used during disaster response and fewer of those for during DRR activities or proactive planning. Information preservation is at risk because the PDMCs store their data on personal computers and mostly in hard copies. Information sharing with stakeholders is also minimal, just like the usage of communication channels for disseminating disaster risk information. Regarding the use of various technologies to mitigate the impacts of disasters, the centres are not fully exploring what the 4IR has to offer.

This article argues that there is a need for disaster centres to act as repositories of information and conduits for disaster information dissemination. They must have a well-managed and maintained IMCS which serves as a 'nerve-centre' (meaning the control centre of an organisation or operation) that guides and supports the lessening of disaster risks and vulnerabilities through the provision of scientific and accurate information. Just as information provision and management are important, so is the need to establish stakeholder relationships for sharing and exchanging information and participation in decision-making for building resilient communities. Disaster managers engage in DRR and response activities and strategies. Accordingly, for these strategies to be effective in building resilient communities, they need to be communicated to the relevant stakeholder. Therefore, the disaster management centre needs to establish an information and communication system as a prioritised division of the centre. This division must view IMCS as a mindset and value human input for the effective and consistent management of information and communication. With the proactive collection and management of information, they can anticipate disasters early, make quick decisions, strengthen capacity and take quick action.

Moreover, an improvement in the disaster risk governance of the centres will be beneficial to the prioritisation and management of the centres' information and communication. Furthermore, the elevation of disaster management centres to the highest political office improves their efficiency and operations. Also, in building community resilience, disaster managers can therefore not avoid emerging information, communication and technological developments. In so many ways, the 4IR is making enormous waves and can aid risk reduction to build resilience.

Acknowledgements

Competing interests

The author declares that she has no financial or personal relationships that may have inappropriately influenced her in writing this article.

Author's contributions

O.K. conceptualised, compiled and proofread the article.

Ethical considerations

Ethical clearance to conduct this study was obtained from the Ethics Committee of the Faculty of Natural and Agricultural Sciences of the University of the Free State (ref. no. UFS-HSD2019/1049).

Funding information

Data availability

This study was carried out based on qualitative data collected from Provincial Disaster Management Centres. If needed, the data can be shared upon request.

Disclaimer

The views and opinions expressed in this article are those of the author and do not necessarily reflect the official policy or position of any affiliated agency of the author.

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