Chapter 4

ICT for Disaster Management and Emergency Telecoms – Preparation, Migration and Recovery for the Island of Mauritius

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Abstract

Effective crisis management relies on integration of emergency plans at all levels of government and non-government, both in Mauritius and Rodrigues. It is evident that by no means, can natural or human-made disasters be fully prevented. Information and communications technology (ICT) is used in almost all phases of the disaster management process. In the disaster mitigation and preparedness process, ICT is widely used to create early warning systems. An early warning system (EWS) may use more than one ICT medium in parallel and these can be either traditional (radio, television, telephone) or modern (SMS, cell broadcasting, satellite radio, internet and email, online media). In the immediate aftermath of a crisis, special software packages built for the purpose can be used for activities such as registering missing persons, administrating online requests and keeping track of relief organisations or camps of displaced persons. In addition, geographic information system (GIS) and remote sensing software/hardware are used effectively in all phases of disaster management. A spatial data infrastructure – a prototype web-based system that facilitates spatial data collection, access, dissemination and usage for proper disaster management – is a very handy tool. This chapter discusses in some detail considerations for the adoption of ICT for disaster management and emergency telecoms in the Republic of Mauritius.

4.1 Introduction

The creation of a regional information system, which is significant for assessing damage and needs of all kinds, is an action that is highly dependent on the use of ICT. Data banks also save time, since all of the information is gathered together and could be needed in co-ordination for immediate action. Furthermore, communication is the key element in all of the phases in the process. ICT is also significant for successful implementation of post-disaster management. The use of information technologies is increasing, yet there are some problems. Some of the major difficulties encountered include lack of data and weaknesses of IT systems that already exist, failure of

managers to consider the needs of users, lack of organisation, weakness of available software, deficient quality and the content of the information, especially given the chaotic nature of World Wide Web.

A number of key factors contribute to the successful introduction of ICT into the field. Among these are: mobility, ruggedness, flexibility, simplicity and sustainability. ICT that has been designed for crisis management only in a standalone mode is unaffordable and, therefore, partnerships with business is a precondition for secure, sustainable and updated ICT solutions for crisis management. The cost of developing individual ICT systems is enormous, and this forces organisations to look hard at what is commercially available right from the start. ICT solutions for crisis management should be based on open standards and open data or use of open source software where feasible. It is evident that disasters cannot be fully prevented by any means; only the loss caused by these events can be prevented or minimised. Disasters disrupt life, livelihoods, economies, political systems, belief systems – in short, everything that makes society work.

However, the first important steps towards reducing disaster impact are to correctly analyse the potential risk and identify measures that can prevent, mitigate or prepare for emergencies. While on some occasions the impact and severity of a disaster's outcome is unpredictable, ICT can play a significant role in highlighting risk areas, vulnerabilities and potentially affected populations by producing geographically referenced analysis through, for example, a geographic information system (GIS). The importance of timely disaster warning in mitigating negative impacts can never be underestimated. For example, although damage to property cannot be avoided, developed countries have been able to reduce loss of life due to disasters much more effectively than their counterparts in the developing world (Flanagan et al. 2011). A key reason for this is the implementation of effective disaster warning systems and evacuation procedures used by the developed countries, and the absence of such measures in the developing world. While saving everyone during a disaster is practically impossible, the use of ICT in warning people and helping them does without doubt save many lives.

4.2 Literature review

4.2.1 Disaster management

Disaster management (also known as disaster risk management) is the discipline that involves preparing, warning, supporting and rebuilding societies when natural or human-made disasters occur. Effective disaster management relies on thorough integration of emergency plans at all levels of government and non-government involvement. Multi-hazards include cyclones, torrential rains, floods, landslides, tsunamis, high waves, water spouts, tornadoes and droughts (Cutter et al. 2010). The importance of timely disaster warning in mitigating negative impacts can never be underestimated.

A warning can be defined as the communication of information about a hazard or threat to a population at risk, in order for them to take appropriate actions to mitigate

any potentially negative impacts on themselves, those in their care and their property. The occurrence of a hazard does not necessarily result in a disaster (Erdelj et al. 2017). While hazards cannot be avoided, their negative impacts can be mitigated. The goal of early public warning is to ensure to the greatest extent possible that the hazard does not become a disaster. Such warnings must be unambiguous, communicate the risks succinctly and provide necessary guidance. The success of a warning can be measured by the actions that it causes people to take, such as evacuation or avoiding at-risk areas. In a disaster situation, there is no doubt that timely warnings allow a person to take actions that saves lives, reduce damage to property and minimise human suffering. It has been observed in Mauritius that to facilitate an effective warning system, there is a major need for better co-ordination among the early warning providers, as well as those handling logistics and raising awareness about disaster preparedness and management. While disaster warnings are meant to be a public good, they are often most effectively delivered through privately-owned communication networks and devices.

4.2.2 Case of the Republic of Mauritius

Mauritius has vast experience in dealing comprehensively with natural disasters, like floods and cyclones in particular. Indeed, since the 1960s, the government's Central Cyclone and other Natural Disasters Committee (CCNDC) has been a national platform which has efficiently ensured cyclone risk reduction. In 2004, the Asian Tsunami Disaster impacted Rodrigues Island and reached the shores of mainland Mauritius. This prompted the Government of Mauritius to capitalise on the CCNDC's multisectoral and science-based experience to prepare a National Tsunami Early Warning and Response System and to capitalise on assistance offered through by the Indian Ocean Tsunami Warning and Mitigation System (IOTWS). In addition, the government also committed to the development of an integrated regional information network (IRIN), with the goals of creating of an early warning system for the islands in the Indian Ocean and ensuring adequate equipment to manage natural disasters, including tsunamis.

The government is leaving 'no stone unturned' in addressing the concern of disaster management. One major achievement has been the setting up and operation of a Natural Disaster and Operations Coordination Centre (NDOCC) at the Line Barracks. The centre is under the operational command of the commissioner of police. The NDOCC constitutes a national platform for co-ordinating the efforts of various agencies dealing with mitigation and relief, and is responsible for assisting agencies in initiating necessary actions to deal with national disasters (both natural and human-made) and to harmonise decisions of all stakeholders for a co-ordinated approach. For the NDOCC, the police department is the operational arm, whereas the Prime Minister's Office (PMO) is the administrative arm.

On 16 November 2009, the government decided to create a National Disaster Management Centre (NDMC) to take overall responsibility for the management of natural disasters in Mauritius; it was set up under the aegis of the Prime Minister's Office. The creation of this centre is in line with the recommendations of the Fact

Finding Committee on the Ex-Lola Flooding. Lola was a cyclone that affected Mauritius in 2008, resulting in torrential rain caused by a trail of torrential rain clouds. Other responsibilities of the NDMC comprise emergency operations management; long-term disaster mitigation; and management of post-disaster activities. However, the existing Central Cyclone and Other Natural Disasters Committee continues to constitute the central system to supervise, monitor and co-ordinate the activities of other authorities and take critical decisions, as appropriate. The Coordinating Committee is chaired by the Secretary for Home Affairs / Permanent Secretary of the Prime Minister's Office. It has members from different ministries, the Police Department, Meteorological Services, Government Fire Services, the Central Water Authority, Central Electricity Board, local authorities and the university. The Meteorological Services collect and disseminate most of the information related to natural calamities.

In April 2012, an earthquake which hit the coast of Indonesia triggered panic in the country, but also showed the shortcomings of ICT use in disaster management. While tsunami detection systems appear to have worked, the quake exposed flaws in the diffusion of warnings and effectiveness of evacuation plans. For instance, in Mauritius, a form of panic did prevail since different institutions were providing different information. While the Meteorological Services were on alert, no official tsunami warnings were issued. At the same time, flash information from the media worldwide and Mauritius as well were not providing adequate information, but instead created general apprehension. While the Indian Ocean was placed on alert, one major flaw from the media was to announce that tide waves would be sweeping the Indian Ocean and hitting the coastal region, while no such thing actually occurred. A surge in people seeking information created much more panic in the population. This shows that with better co-operation and sharing of proper information, such incidents would be avoided.

4.2.3 Support from the international community

Mauritius was also selected to receive capacity-building assistance from the UN International Strategy for Disaster Reduction (ISDR)-led international consortium of partners for an improvement of its tsunami preparedness and mitigation levels. Funded through the tsunami consortium framework of international donors, and implemented by UN Development Programme (UNDP) Mauritius and Seychelles, the project produced the following achievements: setting up of tsunami detection equipment, provision of equipment to an Emergency Operations Centre, delivery of public awareness activities, and training of key staff in tsunami preparedness and warnings.

A workshop on Disaster Preparation and Response in Mauritius was held at Le Labourdonnais Hotel in Port Louis from 24 to 26 August 2010. The workshop was conducted by the United States Africa Command (AFRICOM) Civil Military Emergency Preparedness Program (CMEP). The CMEP Program is designed to build capacity for partner nations to manage the consequences of all hazards (natural

and human–made). CMEP is part of a wider US Department of Defence programme. Three resource persons from CMEP were in Mauritius to conduct the workshop, which was attended by officers from government and parastatal institutions involved in disaster management. These included the Mauritius Police Force, the Government Fire Services and the Mauritius Meteorological Station, among others.

The workshop focused on several elements of disaster preparation and response over the three days. The CMEP team conducted presentations on 'Standard Operating Procedures for Response', 'Emergency Management Cycle', community and citizen preparedness and HAZMAT Response – that is, the response in cases of contamination that could threaten Mauritius and the measures in place to respond to this kind of situation. Mauritian participants had the opportunity to present and discuss elements from the local national plan for disasters.

4.2.4 NDMC risk management priorities

The National Disaster Risk Management Centre (NDMC) has earmarked the following as key priorities:

1. To develop a rational Disaster Risk Management Plan which will focus on mobilisation, deployment and co-ordination of national resources and requests for international assistance.

2. To prepare Disaster Risk Management Plans at the district level.

3. To develop and train community-level disaster response teams.

4. To target the initial efforts on the risk management of floods and droughts.

5. To focus on capacity building of government officers and personnel of associated agencies form the community level to the national level and on community mobilisation, i.e. motivating and supporting people to organise and take appropriate action to protect themselves, their property and their communities against hazards.

6. To improve disaster preparedness through:

   • a clear and comprehensive policy which addresses all elements of disaster risk management planning;

   • effective disaster planning and linkages at the district level and in the region, including Rodrigues Island and the regional islands as a basis for co-ordinated action with clear allocation of role and responsibilities;

   • operational planning for all concerned government and non-government agencies to ensure effective response actions in times of emergency;

   • effective implementation of specialist programmes;

   • early warning systems for floods and droughts; and

   • public awareness and training.

7. Support for the development of self-reliance and self-help at the community level to focus disaster prevention and mitigation on:

   • agricultural and sectoral programmes aimed at food, income and water security, and on reducing community vulnerability; and

   • Protection of key economic facilities.

8. To improve disaster response and recovery by improving emergency management systems such as command, control and co-ordination, damage and needs assessment, relief distribution and 'food for work' rehabilitation and reconstruction programmes.

4.2.5 Development of a National Disaster Management Plan

Beside the National Strategy, action plans on disaster management are formulated in accordance with various sector plans. The National Disaster Management Action Plan consists of various programmes, expressing the general vision to 2020.

The General Objectives of the Action Plan to 2020 are:

• Continuation of the programme on building institutional arrangements of disaster management (DM) within the Island of Mauritius at all levels.

• Establishment of a focal point and identification of a contact person in every institution, and developing an effective co-ordination and co-operation culture between agencies in DM.

• Organisation of effective early warning and information management systems. This guarantees timely and effective dissemination of early warning information to the community level.

• Building storage systems at the regional level in order to effectively dispatch material resources for relief and rehabilitation.

• Organisation of public awareness and education programmes that aim at educating all members of society on the causes of disasters, along with development of training programmes for all government departments and the public sector.

• Establishment of rescue and emergency response teams and establishment of an Information Centre for Disaster Management.

• Organisation of simulation exercises for disaster preparedness and linkage programmes between disaster management.

• Linkage programmes between disaster management and other sector programmes.

4.3 Methodology

4.3.1 Case study approach and expert reference group

This research used a case study approach and an expert reference group discussion approach, whereby all disaster management stakeholders in Mauritius were involved

and consulted. A national working group was mandated by the Information and Communication Telecommunication Technologies Authority (ICTA) of the Republic of Mauritius under the aegis of the Ministry of Information and Communication Technology. This project was compiled as part of other projects under Working Group 5. The stakeholders involved were the government, district councils, non-governmental organisations (NGOs), the private sector, the media, international bodies, and the scientific and academic community. Regular meetings were carried out and eventually a list of recommendations was produced to put in place so as to provide an effective framework for disaster management in Mauritius. The ownership of particular actions to be carried out was also established in order to prevent duplication and ensure the efficiency of the process.

Given this spectrum of players, and the important role of each, a fundamental need in developing an effective disaster information network is finding new ways to foster consensus and enhance co-ordination, co-operation and teamwork by involving representatives of all stakeholders in a meaningful way. Finally, what is proposed is a Disaster Information Network is to reduce losses from disasters by providing timely and accurate information to anyone who can use it to decide on appropriate actions to mitigate disasters, prepare for them, or improve response and recovery.

4.3.2 Objectives

The objectives of setting up such as system for disaster management and emergency telecoms is described below.

- *Reduce damage and deaths*

  Effective disaster management reduces or avoids morbidity, mortality, and economic and physical damage from a hazard. The methods used to achieve this include hazard and vulnerability analysis, preparedness, mitigation and prevention measures, and the use of predictive and warning systems.

- *Reduce personal suffering*

  Disaster management reduces personal suffering, such as morbidity and emotional stress following a hazard. The methods used to prevent suffering include hazard and vulnerability analysis, preparedness, and mitigation and prevention measures.

- *Speed recovery*

  The third objective is to speed recovery. The methods to accomplish this objective include effective response mechanisms and the institution of recovery programmes and assistance.

- *Protect victims*

  Disaster management provides protection to victims and/or displaced persons. Facilities utilise preparedness, response mechanisms, recovery programmes and assistance to address shelter needs and provide protective services.

4.3.3 Assumptions

The government recognises disaster risk management as a key development priority that will encompass hazard mitigation and vulnerability reduction through an effective preparedness strategy aimed at reducing the effects of natural and human-made disasters, particularly in rural areas. As such, the National Disaster and Operations Coordination Centre (NDOCC), under the aegis of the PMO and with the collaboration of a public–private partnership (PPP), will have to work in close co-operation to carry out the following responsibilities:

- Create a strategic plan.

- Stimulate and enhance private sector participation.

- Improve state and local utilisation of central capabilities.

- Act as a catalyst and co-ordinator for precipitating ideas and actions to improve disaster information systems.

- Carry out effective preparedness and capacity to provide an efficient emergency response when disaster strikes. This will have a real impact in combating poverty and promoting sustainable development in Mauritius and Rodrigues.

- Build consensus among public and private stakeholders at the central, state and local levels.

- Facilitate interaction among providers, disseminators and users through meetings, newsletters, journals, training sessions and exercises.

- Maintain a structure for providing advice from a broad constituency.

- The roles of the Ministry of Gender Equality, Child Development and Family Welfare and also the Ministry of Social Security, National Solidarity and Reform Institutions are paramount in the post-disaster management of the welfare of citizens. During the post-disaster period, these two ministries are the key players to protect, promote and provide assistance for the rebuilding of society.

4.4 Recommendations

The recommendations of the working group are summarised in Table 4.1 and are followed by relevant discussions for the creation of such a system for disaster management and emergency telecoms.

4.5 Discussions

4.5.1 Technical feasibility

'Technical feasibility' refers to the capability of current technology and methods of operation in meeting user requirements. The technical feasibility in the Republic of

Table 4.1 Recommendations

No.	Recommendation	Ownership	Remarks
1	Empowering the NDOCC under the aegis of Mauritius Police Force (MPF) to handle all issues related to ICT for disaster management.	MPF/PMO	PMO should empower MPF for NDOCC to be empowered as well.
2	Involvement of all key stakeholders from both public and private sector to work in close collaboration to implement this project.	NDOCC	Relevant ministries and telecom operators as well should be fully involved in the project.
3	Re-use of existing infrastructure and telecommunication facilities to ensure the operational feasibility of the project, including: i. communications equipment; and ii. amateur radio, also known HF, VHF, UHF radio spectrum frequencies between the different stake holders (e.g MPF, fire services) in worst case scenarios.	NDOC	For example, MPF has already procured communications equipment for police stations in phase one of the Crime Occurrence Tracking System (COTS) project. The network Infrastructure can be used for communication only in case of disasters, without affecting COTS data/servers.
4	Use of already existing IT systems such as **Sahana, Desinventar, Voxiva & Groove** (Microsoft), **Google Person Finder** so as to maximise all resources to help track families and co-ordinate work among all participating recovery organisations before, during and after a disaster. In addition, using existing software will help curb development costs.	**The private sector** (Microsoft, Google and other international IT companies)	Microsoft representative for Indian Ocean, Mr Paul Bunting, proposed to help in providing information with regards appropriate software. A half-day workshop could be organised with Microsoft's help to build up the concept of national responsibility.
5	Involvement of external bodies such as the Red Cross, UNDP, the European Union (EU), etc.	NDOCC, others	Help from the Red Cross, UNDP, the EU & other institutions will be needed.

(Continued)

Table 4.1 Recommendations (*Continued*)

No.	Recommendation	Ownership	Remarks
6	Education, training and public awareness.	NDOCC & PMO	Workshops would have to be organised by MPF and relevant ministries under the aegis of PMO would collaborate in building up public awareness.
7	Government should setup policies and legislation with respect to this project.	PMO & SLO	
8	A one-press button facility should be taken into consideration to facilitate co-ordination between the NDOCC, ministries, the Fire Service, the SAMU service, among others.	NDOCC	The one-press button would act as the main alert to link all relevant services in case of a disaster. This would speed up the response service and make it more effective. Furthermore, since most ministries are linked to the Government Online Centre (GOC), it is recommended that the Line Barracks be connected to the GOC for communication in case of emergency through a 'one-press button'.
9	The concept of a mobile camera service for real-time pictures/ photos should be taken into account.	**Relevant operators**	For instance, the co-ordination of the Maha Shivaratree festival was rendered easier with the help of Emtel, which helped with live coverage. More recently, a simulation operation was organised at Rose Belle and mobile cameras were used as well during the rescue operation. The same concept would be a 'plus' to the rescue team.
10	The concept of cell broadcasting **should** be implemented by all telecom operators, whereby messages are sent in the three main languages used (English, French and Creole) and would serve as a preventive measure in warning the public. This can be part of the CSR or NSR policy of the government.	**All telecom operators**	National corporate responsibility (NCR) and corporate social responsibility, or even the Universal Service Fund (USF), could be sources of financing for the cell broadcasting concept.

Table 4.1 Recommendations (*Continued*)

No.	Recommendation	Ownership	Remarks
11	The creation of a Disaster Management Database for the early warning system would enhance the efficiency and effectiveness of NDOCC.	NDOCC	The benchmark set for the Disaster Management Database would depend upon the type of disaster that occurs. For instance, the benchmark for a tsunami would not be the same as the benchmark for a terrorist attack.
12	• The involvement of hotels in this project will eventually ensure good warning systems for the security of coastal regions, mainly for tsunamis and cyclones. • Cases of oil spills will require the involvement of petroleum companies.	Ministry of Tourism and Leisure and petroleum companies	
13	The collaboration of the Mauritius Meteorological Services, Mauritius Police Force and Mauritius Oceanographic Institute is essential.	NDOCC	Involvement of foreign agencies. Existing protocol: Meteo France and Pacific Tsunami warning centres.
14	• A private network between stakeholders and NDOCC should be established. • Stakeholders such as the different ministries can be communicated with through the existing infrastructure of Government Online Centre (GOC), which is already linked to several ministries across the country.	NDOCC	A dedicated network could link stakeholders and NDOCC. As such, the rescue operation and dissemination of relevant information would be easier and much more effective.
15	Strategic positioning of sirens, for example at police stations in coastal regions and places where there is CCTV.	NDOCC	

Mauritius depends primarily on the key players in disaster warning (refer to operation feasibility) and the proper channels used for disaster warning, listed as follows:

- *Radio and television*

  Considered the most traditional electronic media used for disaster warning, radio and television have a valid use. The only possible drawback of these two media is that their effectiveness is significantly reduced at night, when they are normally switched off.

- *Telephone (fixed and mobile)*

  Telephones can play an important role in warning communities about the impending danger of a disaster. This arrangement not only ensures the timely delivery of the warning message, but also ensures the minimum duplication of effort. However, the drawback is the congestion of phone lines that usually occurs immediately before and during a disaster, resulting in many phone calls that cannot be completed in that vital period.

- *Short message service*

  Short message service (SMS) is a service available on most digital mobile phones that permits the sending of short messages (also known as 'text messages', 'SMSs', 'texts' or 'txts') between mobile phones, other handheld devices and even landline telephones. It may be that many residents of affected areas are unable to make contact with relatives and friends using traditional landline phones. However, they could communicate with each other via SMS more easily when the network is functional. This is because SMS works on a different band and can be sent or received even when phone lines are congested. SMS also has another advantage over voice calls in that one message can be sent to a group simultaneously.

- *Cell broadcasting*

  Most of today's wireless systems support a feature called 'cell broadcasting'. A public warning message in text can be sent to the screens of all mobile devices with such capability in any group of cells of any size, ranging from one single cell (about 8 kilometres across) to the whole country, if necessary. CDMA, D-AMPS, GSM and UMTS phones have this capability. There is no additional cost to implement cell broadcasting. It is already present in most network infrastructure and in the phones, so there is no need to build any towers, lay any cable, write any software or replace handsets. Nor is it affected by traffic load; therefore, it will be of use during a disaster, when load spikes tend to crash networks. In addition, cell broadcasting does not cause any significant load of its own, so it would not add to congestion. Cell broadcasting is geo-scalable, so a message can reach hundreds of millions of people across continents within a minute. It is also geo-specific, so that government disaster managers can avoid panic and road jamming by telling each neighbourhood specifically if they should evacuate or stay where they are. The only possible disadvantage to cell broadcasting is that not every user may be able to read a text message when they receive it.

- *Satellite radio*

  A satellite radio or subscription radio is a digital radio that receives signals broadcast by communications satellite, which covers a much wider geographical range than terrestrial radio signals. Satellite radio functions anywhere there is line of sight between the antenna and the satellite, given there are no major obstructions such as tunnels or buildings. Satellite radio audiences can follow a single channel regardless of location within a given range. Satellite radio can play a key role during both the disaster warning and disaster recovery phases. Its key advantage is the ability to work even outside of areas not covered by normal radio channels. Satellite radios can also be of help when the transmission towers of the normal radio station are damaged in a disaster.

- *Internet/email*

  The role the internet, email and instant messages can play in disaster warning entirely depends on their penetration within a region and usage by professionals such as first responders, co-ordinating bodies, etc. While these media can play a prominent role in a developed country, where nearly half of all homes and almost all offices have internet connections, this is not the case in the developing world. In many developing countries, less than 5 per cent of the population uses the internet and even those who are users do not use it on a regular basis. In such a situation, it is difficult to expect the internet and email to play any critical role. In spite of these drawbacks, many disaster-related activities are already underway within the internet community. For example, a new proposal for using the internet to quickly warn large numbers of people of impending emergencies is currently being drafted by the Internet Engineering Task Force.

- *Amateur radio*

  Amateur radio may be of use especially when traditional communications infrastructure breaks down. In such a situation, amateur radio operators transmit emergency messages on voice mode about the well-being of survivors and information on casualties to friends and relatives. As was evident during the Indian Ocean Tsunami that destroyed electricity and communications infrastructure in the Andaman and Nicobar Islands, amateur radio operators were the critical link between the islands and the Indian mainland and helped in the co-ordination of rescue and relief operations. Besides disseminating voice-based messages, some amateur radio operators can also transmit in digital modes that include technologies such as radio teletype, tele-printing over radio, packet radio transmission and the recent Phase Shift Keying, 31 Baud – a type of modulation. Amateur radio broadcasters are authorised to communicate on high frequency (HF), very high frequency (VHF), ultra-high frequency (UHF) or all three bands of the radio spectrum. They require a license from the licensing authority to ensure that only competent operators use their skills. However, depending on the country, obtaining a license can be a long process.

- *Sirens*

  Though not necessarily an ICT-based solution, sirens can be used in tandem with other ICT media for final, localised delivery.

- *Geographic information system (GIS) and remote sensing in disaster management*

  GIS can be loosely defined as a system of hardware and software used for storage, retrieval, mapping and analysis of geographic data. Spatial features are stored in a co-ordinate system (latitude, longitude, state, plane, etc.), that references a particular place on the earth. Descriptive attributes in tabular form are associated with spatial features. Spatial data and associated attributes in the same co-ordinate system can then be layered together for mapping and analysis. GIS can be used for scientific investigations, resource management and development planning.

  By utilising a GIS, agencies involved in the response can share information through databases on computer-generated maps in one location. Without this capability, disaster management workers have to access a number of department managers, their unique maps and their unique data. Most disasters do not allow time to gather these resources. GIS thus provides a mechanism to centralise and visually display critical information during an emergency. There is an obvious advantage to using a map with remote sensing or GIS inputs instead of a static geographical map. A static map is mostly analogous and is not interactive. By comparison, a vulnerability map with GIS input provides dynamic information showing cause and effect relationships.

- *The 999 Emergency Response Management System in Mauritius*

  The Police Information & Operation Room (PIOR) is working on a project to acquire an Emergency Response Management System shortly for 999 telephone calls received by the police. The new system will adopt modern technologies such as computer telephony integration (CTI), geographic information system (GIS) and integrated communications to improve the efficiency of actions to respond to public emergencies. One of the important features of the system will be to identify and locate the caller at the time of an emergency call, so as to be in a position to give prompt assistance by the nearest resource available.

  The police have already sought the co-operation of all telephone service operators (including mobile phone operators) for the new system to interact and have online information from them at the time a member of the public calls to report an emergency. Letters have been sent to the Data Protection Commissioner and the Solicitor-General for advice concerning exchange of data in such cases. The Data Protection Commissioner advised that data sharing for the purpose of protecting the vital interests of the data subjects involved was exempted from the application of Section 24 of the Data Protection Act.

4.5.2 Operational feasibility

'Operational feasibility' refers to the ability of the enhanced system to fit the operational pattern and resources of the organisation. The project is feasible, but it

would require the involvement and support of both local (public and private) and international institutions.

- *Government*

  Government should have considerable knowledge of the hazards to which the country is exposed. It must be actively involved in the design and maintenance of early warning systems, and understand information received to be able to advise, instruct or engage the local population in a manner that increases their safety and reduces the potential loss of resources on which the community depends.

  The government is responsible for policies and frameworks that facilitate early warning, in addition to the technical systems necessary for the preparation and insurance of timely and effective hazard warnings for the country. It should ensure that warnings and related responses are directed towards the vulnerable regions through the design of holistic disaster response and early warning frameworks that address the specific needs of the related micro- and macro-level actors. The provision of support to districts to develop operational capabilities is an essential function to translate early warnings knowledge into risk reduction practices.

- *Legislation*

  Government should put the appropriate legal framework in place in order to get the full co-operation and support of telecom operators. The law should bind telecom operators to provide, inter-alia, cell broadcasting facilities to the population at large – ideally free of charge in the event of a warning prior to a potential disaster – and also post-disaster communication, as deemed appropriate by the met office. Co-laterally, the law should also hold liable any stakeholders who have directly or indirectly failed in their duties and responsibilities in providing timely and effective assistance to the NDOCC in terms of infrastructure, logistics and utilities, communications and decision-making.

- *Districts councils*

  District councils, particularly those most vulnerable, are vital to people-centred early warning systems. Their input into system design and their ability to respond ultimately determine the extent of risk associated with natural hazards. District councils should be aware of hazards and the potential negative impacts to which they are exposed and be able to take specific actions to minimise the threat of loss or damage. As such, the geographic location of a district is an essential determinant in the selection of disasters upon which the system should focus its district education. For example, coastal districts need to be educated and prepared for the possibility of a tsunami, while a mountain community can be educated to respond to an early warning system for landslides.

- *Non-governmental organisations (NGOs)*

  NGOs play a critical role in raising awareness among individuals and organisations involved in early warning and in the implementation of early warning systems, particularly at the community level. In addition, they play an important advocacy

role to help ensure that early warning stays on the agenda of government policy-makers.

- *The private sector*

  The private sector has a diverse role to play in early warning, including developing early warning capabilities in their own organisations. The private sector is also essential, as businesses are usually better equipped to implement ICT-based solutions. The private sector has a large, untapped potential to help provide skilled services in the form of technical staff, know-how, or donations of goods or services (in-kind and cash), especially for the communication, dissemination and response elements of early warning.

- *The media*

  The media plays an important role in improving the disaster consciousness of the general population and in disseminating early warnings. The media can be the critical link between the agency providing the warning and the general public.

- *International bodies*

  International bodies should provide support for national early warning activities and foster the exchange of data and knowledge between individual countries. Support may include the provision of advisory information, technical assistance, and the policy and organisational support necessary to ensure the development and operational capabilities of national authorities or agencies responsible for early warning practice.

- *The scientific community*

  The scientific community has a critical role in providing specialised scientific and technical input to assist governments and communities in developing early warning systems. Its expertise is critical to analysing the risks communities face from natural hazards, supporting the design of scientific and systematic monitoring and warning services, fostering data exchange, translating scientific or technical information into comprehensible messages, and disseminating understandable warnings to those at risk.

4.5.3 Financial feasibility

Financial feasibility will depend on the involvement of all key players and channels used for developing and implementing the system for ICT disaster management. While the setting up of a fund should be provided in the national budget, and with ICT being the main pillar, licensed telecom operators could on their side contribute an 'x' percentage of their annual revenue to the fund. For this to be rendered possible, it would have to be added to the ICT Act 2001 by Ministry of Information and Communication Technology (MICT). The fund would be under the supervision of a ministerial committee comprising the different ministries and under the supervision of the Ministry of Finance and Economic Development (MOFED). The private sector (hotels, banks, etc…) as well, could contribute a 'y' percentage of their revenue in to the

fund under the form of a new terminology, CNR (corporate national responsibility), which would contribute in the flourishing of the fund.

4.5.4 Other considerations

The implementation of this project needs to be carried out in different phases. Below are some considerations that may be taken into account in the future, although initially the focus should be on the recommendations mentioned above. These considerations can be broadly classified in three categories, namely communication, simulation and identification.

Communication

1. There is the need for emergency agencies to interconnect on intervention sites, but currently the police, fire services and ambulance services rely on commercial networks to talk to each other, because they each have and maintain incompatible communication networks, often a mix of analogue / digital standards. Ultimately, moving towards a national digital network will offer centralised maintenance, easier levelling up to new standards, easier backups of critical components and will guarantee the same features for all. This national network should be able to encompass smaller intervention teams like those from social security. It is critical for emergency agencies and related teams not to rely on commercial networks in crisis situations, to completely free up commercial networks for civilian communication.

2. The technical implications for cellular operators to use each other's networks in case of destruction of their own capacity need to be considered. They already share the same mast in many cases.

3. The technical implications for international emergency agencies to interface with Mauritian telecommunication networks should also be taken into account, in case local operators are not able to maintain their services.

4. There is a need for a call prioritisation system to help rescue teams use commercial networks in crisis situations when these networks are saturated by civilians.

Simulation

1. There is the need for a software simulation of destruction, per disaster, which is able to predict the resilience of Mauritian communications, interventions, force positioning and movement of populations due to panic.

2. Fire services should be helped to digitalise their data on buildings and on other infrastructures (access, structures and contents) to ease up their interventions. This information should be shared with all emergency agencies.

Identification

1. Consideration should be given to a face recognition system embedded on handheld devices for field identification of victims.

2. A common database standard by all ministries concerned with identification of citizens needs to be used.

3. The technical implications and sharing of a location system of persons via their mobile phones should be considered.

4. A national DNA database associated with mobile DNA analysis systems needs to be designed.

5. There is a need for data recovery of these databases.

4.6 Conclusion

The primary responsibility for disaster management is at the local level and then at the regional level. Thus the need for co-ordination extends through all levels of government. Non-government entities complete the spectrum of players, with fundamental, critical roles in disaster management activities. Private industry, insurers and providers of lifeline services such as telecommunications, gas, electricity, etc., have heavy investments at risk in the event of disasters. They also expend significant resources for disaster mitigation, preparation, response and recovery. Non-government organisations (NGOs) created to support all phases of disaster management also provide critical resources and support to the emergency management process. Given this spectrum of players, and the important role of each, a fundamental need in developing an effective disaster information network is finding new ways to foster consensus and enhance co-ordination, co-operation and teamwork by involving representatives of all stakeholders in a meaningful way.

Effective design and implementation of such a system needs to be grounded in a detailed understanding of what information is available and how different users need to access that information. This involves much more than market research, because the basic issue is one of building consensus on needs and approaches in the provider, disseminator and user communities. Much of the implementation will need to be done in the much decentralised paradigm of the internet and World Wide Web by many different people and organisations. The problem is not one of organising a top-down business, but rather bottom-up teams and information exchanges that cut across many businesses, organisations, disciplines, etc.

Another purpose of a Disaster Information Network is to enhance communication among stakeholders through discussions over the network and exchange of ideas via newsletters, bulletin boards, and virtual or standard meetings. The problem is one of enhancing connectivity and encouraging teamwork. For this project to be successful, the participation of the government, especially Mauritius Police Force, Mauritius Meteorological Services, Mauritius Oceanographic Institute and other stakeholders – most importantly license operators, UNDP, the EU, the Red Cross and hotels in Mauritius – is essential. As such, the Natural Disaster and Operations Coordination Centre (NDOCC), which would take ownership of the project with support of the government, should develop the disaster management plan. The process needs to include participatory planning and stakeholder consultations to ensure that the plan reflects the needs and realities in disaster management.

Acknowledgements

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