



Republic of Rwanda

NATIONAL EMERGENCY TELECOMMUNICATION PLAN (NETP)



September

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MINISTRY OF ICT AND INNOVATION

MINISTRY IN CHARGE OF EMERGENCY MANAGEMENT

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Executive Summary

This National Emergency Telecommunication Plan (NETP) document provides a three-year strategic roadmap (2025-2027), to establish a resilient, inclusive, and robust communication system and other necessary mechanisms to support disaster mitigation, preparedness, response, and recovery efforts across the country.

The plan seeks to ensure seamless coordination and real-time information sharing among stakeholders to reduce the impact of disasters and emergencies. It also highlights the importance of building a robust telecommunication infrastructure that remains operational during disruptions while covering rural and remote areas where communication gaps persist.

While Rwanda has achieved significant progress, including 95% mobile network coverage, the deployment of early warning systems, and a national fiber-optic backbone, challenges such as infrastructure vulnerabilities, limited backup systems, and cybersecurity risks require targeted interventions.

In this document, gaps in terms of ICT infrastructure, technology integration and other key aspects for disaster risk management are spotted through situation analysis including benchmarking with other countries. This NETP document addresses these gaps by integrating advanced technologies, such as satellite communication, IoT, and AI-based tools, to enhance monitoring, redundancy, and emergency response capabilities.

The plan emphasizes key implementation actions, including expanding telecommunication coverage by deploying additional towers in rural areas, ensuring backup systems for critical infrastructure, and strengthening interagency coordination.

Telecom operators, regulators, and government agencies are tasked with developing vulnerability analyses, updating hazard maps, and implementing contingency plans to ensure preparedness. Regular joint training, simulation exercises, and capacity-building programs are prioritized to strengthen disaster communication systems.

Additionally, raising public awareness and improving digital literacy are key components to ensuring that communities understand emergency protocols and early warning alerts.

A number of strategic action items for the four phases of disaster risk management (i.e. mitigation, preparedness, response, and recovery) are indicated and Monitoring and evaluation indicators are included in the implementation roadmap as to help to track the progress of implementation. By fostering collaboration among institutions, adopting innovative technologies, and improving mitigation, preparedness, response and recovery measures, the NETP positions Rwanda to respond effectively to emergencies, minimize disruptions, and protect lives and infrastructure in the face of disasters.

1. INTRODUCTION

1.1 Background

Rwanda, historically prone to natural and man-made disasters such as floods, landslides, droughts, earthquakes, and health epidemics, has faced significant challenges in disaster preparedness and response. The 1994 genocide against the Tutsi exacerbated the vulnerabilities of Rwanda's infrastructure and institutions, highlighting the critical need for organized disaster management systems. Over the years, while substantial progress has been made in expanding telecommunication infrastructure, with mobile network coverage reaching over 95% of the population, significant gaps remain, particularly in rural and remote areas where coverage is limited, and infrastructure is vulnerable to damage.

These shortcomings, combined with the lack of backup systems like satellite communication, limited coordination among stakeholders, and low digital literacy levels, have often hindered timely communication, early warnings, and effective emergency responses. The NETP seeks to address these gaps by providing a comprehensive framework that strengthens the resilience, inclusivity, and reliability of Rwanda's emergency telecommunication systems to ensure better coordination, preparedness, and response in the face of disasters.

The National Emergency Telecommunication Plan (NETP) for Rwanda is a critical framework designed to enhance the country's ability to respond effectively to disasters and emergencies through resilient, inclusive, and innovative communication systems.

Recognizing that reliable communication is at the heart of disaster preparedness, response, and recovery, the NETP provides a comprehensive approach to building robust infrastructure, fostering collaboration among stakeholders, and integrating modern technologies to ensure seamless information flow during crises. Rwanda, with its considerable progress in ICT infrastructure, including extensive mobile network coverage and a national fiber-optic backbone, aims to leverage these advancements to strengthen early warning systems, facilitate real-time data sharing, and improve coordination across government agencies, security forces, health services, and telecommunication providers.

The plan acknowledges existing challenges, such as the vulnerability of infrastructure to natural disasters, limited network coverage in rural areas, and the lack of backup communication systems like satellite networks. Addressing these gaps, the NETP prioritizes actions such as expanding telecommunication infrastructure, ensuring system redundancy, and integrating advanced tools like IoT and AI for disaster monitoring and risk management. It also emphasizes the importance of capacity building

through training programs, public awareness campaigns, and digital literacy initiatives to empower communities to respond effectively during emergencies. Partnerships among government institutions, telecom operators, and international stakeholders are highlighted as a cornerstone for successful implementation.

The NETP includes an actionable implementation plan that outlines clear strategies, responsibilities, and timelines to ensure effective deployment and monitoring. Activities such as updating hazard maps, developing contingency plans, and conducting regular simulation exercises will ensure preparedness at all levels. A robust monitoring and evaluation framework is embedded to track progress, measure outcomes, and provide periodic updates to stakeholders. By prioritizing resilience, inclusivity, and innovation, this three-year NETP reflects Rwanda's commitment to safeguarding its citizens, infrastructure, and economy against the impacts of disasters while building a future-ready telecommunication system for emergency management.

1.2 Vision, Mission and Core Values

Vision

In terms of coping up and handling emergencies, Rwanda envisions to establish a robust, resilient, and reliable communication infrastructure that ensures seamless coordination and information sharing during emergencies. It aims to reduce the impact of disasters by ensuring that all stakeholders, including government agencies, first responders, and the public, can access real-time, accurate information for effective decision-making and response.

Key aspects of the vision include:

- **Universal Access:** *Ensuring all parts of Rwanda, including rural and hard-to-reach areas, are covered by emergency communication networks.*
- **Resilience:** *Building telecommunication systems that can withstand disruptions caused by natural or man-made disasters.*
- **Timeliness:** *Facilitating rapid communication and response to emergencies to minimize damage and loss of life.*

Mission

The rationale of having in place a National Emergency Telecommunication Plan is to provide an integrated communication framework that enhances coordination among stakeholders in disaster management, emergencies situation handling and response. The National Emergency Telecommunication Plan seeks to:

- **Coordinate** *telecommunication services across all relevant institutions (MINEMA, RURA, MINICT, telecom service providers,*

police, defense forces, health services, etc.) for unified emergency response.

- **Ensure rapid deployment** of communication tools and technologies during disasters to guarantee the flow of information.
- **Strengthen preparedness** by training personnel, upgrading infrastructure, and conducting regular drills and simulations.
- **Improve public safety** by establishing a reliable early warning system that can reach all citizens quickly in the event of an emergency.

Core values

The core values guiding Rwanda's National Emergency Telecommunication Plan include:

- **Resilience:** The system is designed to remain operational even under extreme conditions, ensuring continuity of communications during and after a disaster.
- **Inclusivity:** The plan promotes the inclusion of all sectors of society, ensuring that vulnerable populations have access to emergency communication services, regardless of location, disability, or socio-economic status.
- **Collaboration:** The plan emphasizes strong partnerships between government agencies, private sector, telecommunication providers, international organizations, and communities to create a coordinated and effective emergency response.
- **Innovation:** Promoting the use of cutting-edge communication technologies, such as satellite communication, mobile networks, and drones, to enhance emergency communication capabilities.
- **Accountability:** Ensuring that all institutions involved in disaster communication are transparent and responsible in their operations, with clear lines of responsibility and regular monitoring.
- **Proactivity:** The plan emphasizes the importance of preparedness and early warning systems to reduce the time between the onset of an emergency and the activation of response measures.

1.3 Description of the Four Phases of Disaster Management

Disaster risk management (DRM) has two distinct stages: risk management and crisis management. In the first stage, measures are taken to predict and warn of a disaster in advance as well as to prevent and/or mitigate its damage. These efforts occur under normal or non-emergency circumstances and correspond to the mitigation and preparedness phases.

In the second stage, crisis management takes place during emergencies and includes actions such as search and rescue, response coordination, damage assessment, the activation of a policy response, and the mitigation of a secondary disaster. This second stage of DRM corresponds to the response and recovery phases.

Mitigation

The mitigation phase seeks to carry out actions that aim to prevent an emergency, reduce the probability of its occurrence, and limit the negative effects of unavoidable threats. This phase includes activities such as identifying existing hazards and risks, conducting vulnerability assessments, constructing and/or maintaining critical telecommunications infrastructure, and developing written plans and procedures, such as the NETP.

During this phase, the role of telecom/ICTs is to help analyse the risk of potential disasters, disseminate information about impending hazards and on how to mitigate its impacts so that hazards do not lead to disasters, identify communities at risk, and help implement strategies, technologies, and processes that can reduce those negative effects.

Activities carried out during the mitigation phase include establishing legal and regulatory frameworks that support the use of emergency telecom/ICTs, conducting risk analyses of critical telecom/ICT infrastructure, taking steps to reduce the vulnerability of telecommunications networks and improve their capacity of recovery, develop contingency plans, and assess vulnerabilities in order to develop multi-hazard early warning systems with the appropriate technology for each case. These strategies should be implemented before and after the emergency.

Preparedness

The preparedness phase includes the planning and preparations necessary to respond to an emergency event. These include the establishment of multi-hazard early warning systems, training, operational processes, and the implementation of those written plans and procedures developed during the mitigation phase.

Telecom/ICT in this phase are essential to facilitate the dissemination of information and alerts so that the public is aware of the actions they must take during an emergency. Likewise, they must facilitate the coordination and communication of those involved in disaster management. Telecom/ICTs can also prove useful during the preparedness phase by helping with data collection, coordinated planning and, in general, streamlining anticipatory actions. Digital tools can provide functional information to increase the knowledge of hazards and vulnerabilities that different areas may face.

During this phase, it is important to make and implement plans that reduce the likelihood of communications interruptions, continuously carry out training and drills, and regularly carry out activities designed to create awareness about impending hazards among those involved, including campaigns in different formats accessible to the entire population

regarding potential hazards and the activities that people must carry out during the response phase.

Response

The response phase is carried out during the emergency itself and includes humanitarian activities such as search and rescue, the evacuation of people from affected areas, and the opening of shelters, among others.

The role of telecom/ICT during this phase is vital for connecting stakeholders such as first responders, government stakeholders and government agencies, communities at risk, shelters, health centres, and non-governmental organizations (NGOs), among others. This is especially important considering that several entities carry out a variety of activities and procedures at the local, national, and international levels.

During the response phase, the contingency plans, standard operating procedures, and regulatory framework, among other activities developed during the mitigation and preparedness phases to mitigate the impact of the emergency, must be executed. The more prepared to respond to the emergency and the less improvisation needed, the higher the likelihood to save lives and reduce material loss.

Recovery

The recovery phase runs after a few weeks in the aftermath of disasters and focuses on providing the necessary aid to return to, at least, the initial levels of safety and functionality the community had before the disaster. Activities during this phase include infrastructure reconstruction, restoration of public sector operations, and debris removal, among others. Telecom/ICTs can play an important role in these activities. For instance, by assessing the damage with satellite images, or by mapping out lost infrastructure or plantations with remote sensing technologies, among other possibilities.

It is important to point out that the restoration and reconstruction during this phase must include the telecom/ICT infrastructure, especially due to the fundamental role that the sector plays within the community. The reconstruction should be based on the lessons learned and the principle of building back better.



Figure 1. Phases of Disaster Risk Management -Adapted from ITU (2020)

1.4 Legislation Related to Disaster Risk Management (DRM) in Rwanda

Legislation and regulations are key for DRM, as they are the foundation that defines the roles and responsibilities of all stakeholders involved in the DRM process. These are the frameworks upon which coordination mechanisms, communication channels, and standard operating procedures are determined and upon which decision makers in relevant agencies are identified.¹ Thus, it is important to assess the country's current legislative and regulatory framework for DRM as part of the development of a NETP based on these norms. This framework for Rwanda is described in the following subsections.

Constitution of Rwanda²

The Constitution of Rwanda provides that the President of the Republic has the powers to declare a state of emergency or a state of siege, following approval by the Cabinet. A declaration of a state of siege or emergency must be clearly justified, and must specify the part of national territory to which it applies and its consequences. It cannot be extended beyond a period of 15 days without approval of Parliament.

¹ United Nations International Strategy for Disaster Reduction. (2018). Implementation guide for local disaster risk reduction and resilience strategies—A companion for implementing the Sendai Framework target E.

² Constitution of Rwanda. (2003, rev. 2015).

The Constitution also establishes that a state of siege or emergency cannot violate basic rights of the population, nor affect the powers of the President of the Republic, the Prime Minister, the Parliament or the Supreme Court. A state of emergency can be declared on the entire or part of the national territory when the country faces a public disaster or constitutional crisis whose gravity does not warrant the declaration of a state of siege.

Disaster Management³

According to Law N° 41/2015, disasters are into four categories in terms of coverage and intensity:

- Category 1: is any disaster which has occurred in a sector and is managed using resources available in that sector.
- Category 2: are disasters which occur in a District and which are managed with resources available in the district.
- Category 3: being a disaster which occurs in any District and is managed using the resources from the Ministry.
- Category 4: are disasters beyond the country's means.⁴

In relation with the mitigation phase, this law establishes that the Ministry in Charge of Emergency Management, that is, MINEMA (see section 3.1 of this document), together with other organs in charge of DRM, shall develop a warning system for disasters to alert and warn the people in order to prevent and mitigate negative effects. The law in particular determines that MINEMA and the DRM organs shall also put in place a mechanism for providing the inhabitants of Rwanda with information related to different disasters. MINEMA is held accountable for making follow-up on the implementation of these provisions related to warning system and information sharing.⁵

Regarding the disaster preparedness phase, the law determines that, among other provisions, the ministries, districts, sectors and other organs in charge of DRM shall, for the purpose of building capacity in disaster management, provide training and any other necessary means for the government officials and the population.⁶

In the case of the response phase, the law establishes that it is the responsibility of the administration, depending on the category of the disaster, to “immediately”, after the disaster outbreak, carry out an initial assessment of the situation and impact of the disaster. Based on the gravity, scale and impact of such disaster, NADIMAC shall give advice to the

³ Law N°41/2015 of 29/08/2015, relating to disaster management.

⁴ Law N°41 of 2015. Article 4.

⁵ Law N°41 of 2015. Article 13.

⁶ Law N°41 of 2015. Article 16.

President regarding the necessity or not of declaring a state of siege or emergency. In the case of category 4 disasters, NADIMAC shall also advise the Government to seek international response and assistance. The Government may accept or refuse international response and assistance offered.⁷

Finally, regarding rehabilitation and recovery due to disasters, the law establishes a disaster response fund, sourced from state budget allocations, partners' grants and donations. And provides for the modalities on rehabilitation and recovery after disasters; for instance, establishing priorities to access rehabilitation and recovery programmes for people who suffered injuries or trauma following the disaster, people affected by the disaster, properties and infrastructure affected by the disaster.⁸

1.5 Organs and Institutions Involved in Disaster Risk Management (DRM) in Rwanda

The legislation indicates that five organs are in charge of DRM in Rwanda: 1) National Disaster Management Committee (NADIMAC), 2) National Disaster Management Technical Committee (NADIMATEC), 3) District Disaster Management Committee (DIDIMAC), 3) Sector Disaster 4) Management Committee (SEDIMAC) and 5) National Platform for Disaster Management (NPDM). The composition and main functions of each of these organs are indicated in the table below⁹.

Table 1: Five DRM organs

Organ	Role	Composition
National Disaster Management Committee (NADIMAC)	- Provides disaster management guidelines based on national strategies, advise relevant bodies on each of the phases of DRM, coordinate relief efforts within all institutions, take necessary decisions on which actions must be taken in case of categories 3 and 4 disasters, and advise on the state of emergency declaration	MINEMA (chair), Ministry of Defence, National Police, Ministry of Health, Minaloc, Ministry of Infrastructure, Ministry of Finance, and other institutions
National Disaster Management Technical Committee (NADIMATEC)	- Offers technical support to NADIMAC in developing and implementing disaster management policies and plans.	MINEMA (chairperson), Rwanda Defence Force (vice chairperson), Ministry of Agriculture and Animal Resources, Ministry of Foreign Affairs, Housing Authority,

⁷ Law N°41 of 2015. Article 21.

⁸ Law N°41 of 2015. Article 32.

⁹ Based on Prime Minister's Order N°98/03 of 2018, which determines the organization and functioning of the Disaster Management Organs in Rwanda, as well as Law N°41 of 2015 of 29/08/2015, relating to disaster management.

Organ	Role	Composition
	<ul style="list-style-type: none"> - Conducts risk assessments and provides evidence-based recommendations. - Coordinates technical actions across ministries, agencies, and other stakeholders. 	<p>National Police, and Rwanda Meteorological Agency, among others</p>
<p>District Disaster Management Committee (DIDIMAC)</p>	<ul style="list-style-type: none"> - Oversees the implementation of disaster management plans at the district level. - Builds local capacities for preparedness, response, and recovery. - Coordinates efforts between sectors and communities in the district during disasters. 	<p>Mayor of the District (chairperson), the senior Military Commandant deployed in the district (vice chairperson), the District Police Commandant, and the Director of infrastructure, of development and of hospitals in the district, among other representatives of different organizations</p>
<p>Sector Disaster Management Committee (SEDIMAC)</p>	<ul style="list-style-type: none"> - Implements disaster management measures at the sector level. - Raises community awareness about risks and preparedness. - Acts as the first responder in collaboration with local authorities and affected populations. 	<p>Executive Secretary of the Sector (chairperson), the Senior Military Commander in the Sector, the Sector Police Commander, and representatives from other organizations such as the Red Cross and the health centre in the sector</p>
<p>National Platform for Disaster Management (NPDM)</p>	<ul style="list-style-type: none"> - Multi-stakeholder coordination to strengthen disaster risk management across the country. It facilitates collaboration between government institutions, NGOs, the private sector, and international partners to ensure a unified and strategic approach to disaster risk reduction (DRR). NPDM supports the formulation and implementation of national policies and strategies, promotes public awareness and advocacy on disaster preparedness, and builds the capacity of stakeholders at all levels. Additionally, it mobilizes resources, monitors and evaluates DRR initiatives, and integrates disaster risk reduction into development planning to enhance community resilience and sustainable development. 	<p>MINEMA(Chair) Members of NADIMATEC; A representative of the private sector; A representative of United Nations agencies intervening in disaster management; A representative of non-governmental organisations intervening in disaster management; A representative of faith-based organisations intervening in disaster management</p>

Table 2: Organizations-names of key organizations and their roles in DRM

Institution/ Organization	Key Roles
Ministry in charge of Emergency Management (MINEMA)	- Develops and implements disaster management policies and frameworks.
	- Coordinates disaster preparedness, response, and recovery efforts.
	- Mobilizes and oversees humanitarian aid and resources.
Ministry of ICT and Innovation (MINICT)	- Develops and implements technology-driven solutions for disaster communication and data management.
	- Facilitates digital platforms for early warning systems and disaster response.
Rwanda Utilities Regulatory Authority (RURA)	- Regulates critical utilities (telecommunications, energy, water) to ensure resilience and continuity during disasters.
	- Oversees compliance with disaster response protocols for service providers.
Ministry of Health (MOH)	- Coordinates emergency medical services and public health responses during disasters.
	- Manages health crises, including epidemics and provision of healthcare during emergencies.
	- Provides security, crowd management, and law enforcement during disasters.
	- Leads search and rescue operations and facilitates evacuations.
National Cybersecurity Agency (NCSA)	- Ensures the security and resilience of critical ICT infrastructure during disasters by protecting essential systems and data from cyber threats. It manages cyber incidents, maintains communication networks, and safeguards early warning and response platforms. Additionally, it develops cybersecurity policies and builds stakeholder capacity to enhance disaster preparedness and response.
Ministry of Defense (MoD)	- Deploys military resources for large-scale disaster response, including logistics and personnel.

Institution/ Organization	Key Roles
	- Supports search and rescue missions and infrastructure recovery.
Telecom Operators (MTN, Airtel, KT Rwanda Network)	- Disseminate early warning alerts through SMS and other communication platforms.
	- Maintain network connectivity during disasters to ensure communication.
Broadcasters (Radio and TV)	- Broadcast early warning messages and real-time updates during disasters.
	- Raise public awareness about disaster preparedness and mitigation strategies.

1.6 Policies and Strategies on Disasters and Emergencies Management

Rwanda’s disaster and emergency management framework is built on the National Disaster Management Policy (2012), which outlines a holistic approach to disaster prevention, preparedness, response, and recovery.

The policy aims to minimize the impact of disasters through risk reduction strategies, integration of disaster risk management (DRM) into national development programs, and strengthening institutional capacities at all levels (Ministry of Disaster Management and Refugee Affairs [MIDIMAR], 2012). It emphasizes decentralized disaster management, where local governments are empowered to assess, prepare for, and respond to disasters in their respective areas. Furthermore, the policy focuses on increasing community resilience through public awareness campaigns and capacity-building programs.

In 2018, Rwanda introduced the National Disaster Risk Reduction Strategy (2018–2025), which complements the 2012 policy by providing a more detailed, long-term plan for reducing vulnerabilities and enhancing resilience. This strategy aligns Rwanda’s disaster risk reduction (DRR) efforts with the global Sendai Framework for Disaster Risk Reduction (2015–2030), focusing on risk identification, early warning systems, disaster preparedness, and post-disaster recovery (Ministry of Emergency Management [MINEMA], 2020).

A central feature of the strategy is the integration of DRR into various sectors, including agriculture, infrastructure, and urban planning, ensuring that resilience is embedded into the country’s development agenda. The strategy also highlights the need for stronger inter-agency coordination and collaboration with international organizations.

The National Contingency Plan (2018) offers detailed preparedness and response guidelines for different types of disasters, including floods, droughts, earthquakes, and epidemics. It provides clear roles and responsibilities for government agencies, the private sector, and civil society during emergencies (MINEMA, 2018). The plan emphasizes swift resource mobilization, real-time coordination among stakeholders, and community engagement in disaster response activities. By outlining specific actions for various disaster scenarios, the contingency plan ensures that Rwanda is better equipped to mitigate the impact of disasters and provide rapid assistance to affected populations. The plan also incorporates mechanisms for post-disaster recovery and reconstruction, ensuring that recovery efforts contribute to building long-term resilience.

Rwanda's disaster management policies and strategies are also aligned with international telecommunications standards set by the International Telecommunication Union (ITU).

The National Emergency Telecommunication Plan (NETP) to be developed in coordination with other national agencies will integrate ITU guidelines, while focusing on using telecommunications systems for early warning, information dissemination, and post-disaster communication.

ITU's Guidelines for National Emergency Telecommunication Plans stress the importance of resilient telecommunications infrastructure, real-time data sharing, and the integration of communication systems into disaster management frameworks (ITU, 2020). Rwanda's policies reflect these principles by promoting the use of mobile technology and satellite communication in emergency response.

The relationship between Rwanda's disaster management strategies and ITU policies strengthens the country's capacity for rapid, technology-enabled disaster responses, especially in rural and remote areas.

2. SITUATIONAL ANALYSIS AND RECOMMENDATIONS

This section depicts situation analysis in the four phases of disasters management. When it comes to the phase of mitigation, the section presents a comparative analysis in relation other countries including Kenya, South Africa, Germany, USA for benchmarking reason when it comes to the telecommunication system for handling emergency.

2.1 Mitigation Phase

The mitigation phase seeks to carry out actions that aim to prevent an emergency, reduce the probability of its occurrence, and limit the negative effects of unavoidable threats. This phase includes activities such as identifying existing hazards and risks, conducting vulnerability assessments, constructing and/or maintaining critical telecommunications infrastructure, and developing written plans and procedures, such as the NETP.

2.1.1 NETP maturity status and membership to disasters management organs

The country's national emergency telecommunication plan is not developed and not clear and strategic actions are not well defined as of the end 2024.

Recommendation 1: *Developing and updating of the National Emergency Telecommunication Plan*

MINICT is not a member of NADIMAC, yet the ministry appears to be a potential player in terms of telecommunication aspects in disaster risk management and RURA is not a member of NADIMATEC.

Recommendation 2: *The MINICT should be included as a permanent member of the National Disaster Management Committee (NADIMAC). Furthermore, RURA should also be part of the National Disaster Management Technical Committee (NADIMATEC).*

2.1.2 Vulnerability to Disasters from Natural Hazards in Rwanda

See ANNEX. 1 As can be seen, the probability for having a severe drought varies from 0% in the Western part of the country to 42% in the East. According to MINEMA, normally the eastern part of the country records more rainfall anomalies than the western part. With Kayonza and Kirehe districts receiving the lowest precipitation, and the mountainous part of the country -especially in volcano's park and the southwest (Rusizi district) and all along the Cong-Nile crest-receiving higher precipitations, therefore showing less risk.¹⁰

¹⁰ MINEMA. (2015). The National Risk Atlas of Rwanda.

Recommendation 3: *Maintain the hazard maps for the different types of hazards to which Rwanda is prone to be updated and geo-referenced.*

2.1.3 Telecom/ICT Sector in Rwanda

Overview on Telecommunication Infrastructure and capabilities. The country made significant progress in expanding its telecommunication infrastructure. Mobile network coverage exceeds 95% of the population, with major telecom providers like MTN and Airtel providing services nationwide (RURA, 2021). The country has invested heavily in building an advanced ICT infrastructure, including an extensive national fiber-optic backbone (MINICT, 2020). The country also has radio and TV infrastructure for broadcasts to the public. This infrastructure enables faster and more reliable communication during emergencies, particularly for government agencies and institutions responsible for disaster management.

Leveraging the existing ICT infrastructure and network coverage, Rwanda has put in place early warning system to send automated SMS alerts for weather-related disasters, such as floods and landslides (RURA, 2021). This system helps provide information to vulnerable populations. However, the following are challenges:

Infrastructure Vulnerabilities and Limited Technological Integration and Backup Systems. The country's emergency telecommunication infrastructure remains vulnerable to damage from natural disasters, such as floods, earthquakes, and landslides. Telecommunication towers, fiber-optic cables, and other critical infrastructure can be damaged, leading to significant communication breakdowns when they are most needed (MINEMA, 2020).

Although the country has adopted technologies for emergency communication, reliance on mobile networks and the lack of satellite or other backup systems poses risks. In case of major disasters that damage infrastructure, such as floods or earthquakes, communication systems can fail, and there is limited capacity for emergency communication through alternative channels (RURA, 2021). Disruptions in communication infrastructure during disasters can cause delays in delivering critical information to affected populations, thus hampering response efforts.

Rural Telecommunication Gaps. Despite the strong overall network coverage, certain remote and rural areas still face significant telecommunication gaps, making it difficult to reach all populations during emergencies (NISR, 2020). This challenge is particularly severe in regions prone to natural disasters, such as floods or landslides, where communication infrastructure is often sparse or vulnerable to damage.

Limited Redundancy in Communication Systems. There is a lack of backup communication systems that can be activated in case the primary mobile or internet networks fail during emergencies. Satellite communication systems, which could provide redundancy in such situations, are underdeveloped in Rwanda. This absence of robust backup systems poses a risk to emergency response efforts, particularly in disaster-prone areas (RURA, 2021).

Resource and Capacity Constraints. Despite the existing disaster management framework, there are resource limitations, particularly in terms of equipment, trained personnel, and financial resources at the local level. This is especially evident in rural and remote areas, where disaster response capacities are weaker due to limited resources (MINEMA, 2020). Resource constraints can delay emergency response times and limit the scope of rescue operations, particularly in remote areas that are more vulnerable to natural disasters.

Cybersecurity Vulnerabilities and Limited Cybersecurity Measures

Rwanda's emergency telecommunication system, while effective, it can be vulnerable to cybersecurity risks. The integration of digital platforms in disaster management makes them susceptible to cyber-attacks, and there is limited capacity to handle such threats, especially during emergencies (RISA, 2020). Cybersecurity is an emerging area of concern in Rwanda's emergency telecommunication systems. While there is a national cybersecurity policy in place, the integration of cybersecurity measures into emergency telecommunication infrastructure is still limited (RISA, 2020). During emergencies, systems can become more vulnerable to cyber-attacks, potentially leading to disruptions in the communication flow, which can further exacerbate the crisis.

Comparative Analysis on Telecommunications system for handling emergency

The following table depicts a comparative overview of Rwanda's emergency handling mechanisms in terms of telecommunication systems alongside practices from Kenya, South Africa, Germany, and the USA. The focus is on four specific aspects: coverage and infrastructure limitations, system integration and coordination, technical and operational constraints, and cybersecurity threats.

Aspect	Rwanda	Kenya	South Africa	Germany	USA
Coverage and Infrastructure Limitations	<ul style="list-style-type: none"> - Rapidly expanding mobile network; challenges in rural areas (Rwanda Utilities Regulatory Authority, 2022). - Focus on universal access initiatives. 	<ul style="list-style-type: none"> - Mixed coverage; urban areas better served than rural (Kenya National Communications Authority, 2021). - Mobile penetration is high but infrastructure still lags in remote areas. 	<ul style="list-style-type: none"> - Comprehensive infrastructure but disparities exist (Independent Communications Authority of South Africa, 2021). - Urban focus leads to rural blind spots. 	<ul style="list-style-type: none"> - Robust infrastructure; extensive fiber optics and satellite links (Bundesnetzagentur, 2022). - Strong emergency communication capabilities. 	<ul style="list-style-type: none"> - Extensive infrastructure with high mobile coverage (Federal Communications Commission, 2022). - Emphasis on redundancy and resilience.
System Integration and Coordination	<ul style="list-style-type: none"> - Centralized emergency management through Rwanda National Police (2021). - Strong inter-agency collaboration. 	<ul style="list-style-type: none"> - Coordination challenges between agencies; reliance on mobile networks for emergency services (National Disaster Management Authority, 2021). 	<ul style="list-style-type: none"> - Integrated disaster management system but coordination gaps exist (National Disaster Management Centre, 2022). - Provincial and local agencies have varying capacities. 	<ul style="list-style-type: none"> - Highly integrated systems with federal and state coordination (Bundesamt für Bevölkerungsschutz und Katastrophenhilfe, 2022). 	<ul style="list-style-type: none"> - Federal Emergency Management Agency (FEMA) oversees integration; strong inter-agency communication (FEMA, 2022).
Technical and Operational Constraints	<ul style="list-style-type: none"> - Limited technical capacity in rural areas (Rwanda Development Board, 2022). - Need for training and infrastructure upgrades. 	<ul style="list-style-type: none"> - Operational challenges due to network congestion during emergencies (Kenya ICT Authority, 2021). 	<ul style="list-style-type: none"> - Technical challenges with outdated systems in some areas (Disaster Management Act, 2002). 	<ul style="list-style-type: none"> - Advanced technology adoption; regular upgrades to emergency systems (Federal Ministry of the Interior and Community, 2022). 	<ul style="list-style-type: none"> - Continual upgrades; issues with legacy systems in some localities (FEMA, 2022).

Aspect	Rwanda	Kenya	South Africa	Germany	USA
Cybersecurity Threats	- Increasing cyber threats targeting emergency systems (Rwanda Information Society Authority, 2022). - Efforts underway to strengthen cybersecurity.	- Vulnerable to cyber threats, particularly in urban areas (Cybersecurity and Data Protection Bill, 2021).	- Significant concern regarding cybersecurity in critical infrastructure (South African Cyber Security Policy, 2021).	- Strong regulations and frameworks to protect against threats (Federal Office for Information Security, 2022).	- Comprehensive cybersecurity framework; regular audits and updates (Cybersecurity and Infrastructure Security Agency, 2022).

Recommendation 4: The analysis of the existing telecom infrastructure and the comparative study paints a picture that there is a need for reinforcing Telecommunication Infrastructure capabilities (close rural telecommunication gap) and integrate modern technologies (5G networks for disaster management, IoT, AI predictive models and Drone Technology for disaster response).

Mobile Services- See Annex 2

Satellite

Currently there are satellite operators in Geostationary Earth Orbit (GEO) and Low Earth Orbit (LEO) offering services in Rwanda. Data transmission services and Internet access through Very Small Aperture Terminal (VSAT) technology are offered by different operators. These service offers vary in terms of speed ranges according to each provider, which mainly use frequency bands S, C, Ku, and Ka and have coverage up to the entire national territory and can be used for satellite communications, remote sensing and earth observation applications.¹¹

Recommendation 5: Update telecom/ICT network Inventory and coverage maps

- *Maintain an updated geo-referenced network inventory of mobile and fixed telecom/ICT operators (last mile and national backbone) as well as radio and television broadcasting.*
- *Maintain an updated satellite footprint and technical specifications (e.g., frequencies, capacities) as well as an inventory and location of satellite terminals with technical specifications.*
- *Maintain an updated geo-referenced network inventory related to first responders’ (e.g., police).*

¹¹ RSA. (2023). Satellite Communication. <https://space.gov.rw/project-details/?project=satellite-communication>.

- *Build telecom/ICT coverage geo-referenced maps based on population settlements.*
- *Maintain an updated database with the focal points responsible of technical issues as well as with focal points responsible of communication of alerts and relevant information regarding any disaster.*

Recommendation 6: Coordination between MINICT/RURA and MINEMA

Continuous coordination and sharing of information regarding geo-referenced hazard maps (action item 3) and network infrastructure (action item 4).

2.1.4 Vulnerability Analysis of Critical Telecom/ICT Infrastructure

The different telecommunications operators and government agencies responsible for government telecom/ICT networks in Rwanda must conduct and present a vulnerability analysis of the critical infrastructure of their networks based on the risk maps and assessments of the different types of hazards.

Telecommunications operators should include coverage maps of their networks in this vulnerability assessment, an inventory of the telecommunications infrastructure and evaluations of the power supply to support it, and the capacity to manage the maintenance of the telecommunications infrastructure and equipment.

Recommendation 7: Vulnerability analysis of critical infrastructure

- Telecom/ICT operators, mobile and fixed, as well as radio and television broadcasting operators, should develop (or update) a vulnerability analysis of their networks based on the hazard maps, identifying critical infrastructure.
- Government telecom/ICT networks should also develop (or update) a vulnerability analysis of their networks based on the hazard maps, identifying critical infrastructure.
- In their vulnerability analysis power supply risks and construction risks that can have an impact on connectivity should be addressed.

Recommendation 8: Contingency plans

- Based on the network vulnerability analysis of critical infrastructure, contingency plans should be developed (or updated) by the telecom/ICT operators (mobile, fixed, radio and television broadcasting).
- Government agencies, responsible of network management, should also develop contingency plans.
- Contingency plans should include actions that allow operators to keep providing services after a hazard, such as:
 - Mobile base stations (Cell on Wheels -COW)
 - Satellite capacity and terminals (warehouse)
 - Secondary energy sources
 - Network redundancy

Action Item	Target	Responsible
Contingency plans	Contingency plans to be developed by telecom operators (mobile, fixed, radio and television broadcasting)	Operators MINICT/RURA MINEMA
	Contingency plans to be developed by government agencies responsible of telecom networks	First responders And others

2.1.5 Specific Telecom/ICT Regulatory Framework for Disaster Management

The ICT Law¹² establishes the legal and economic framework for governing information and communication technologies in Rwanda. Regarding disaster management, the ICT Law provides for the obligation imposed on every licensed operator for providing a special service during emergencies.

Also, the ICT Law establishes that the regulatory authority (RURA) may direct a licensed electronic communications service provider to develop, in consultation with any relevant organ of the country, a disaster management plan for the survival and recovery of any network facilities, network service, applications service or content applications service in case of a disaster, crisis or civil emergency. The licensed electronic communication service provider, according to the ICT Law, must further have or build the capacity to contribute and assist in any national emergence rescue operations and services.

Finally, the ICT Law also determines that any person who makes emergency calls must present his or her telephone number, so that, subject to legal provisions preventing the rights to use and store electronic communications data, the telecommunications provider can store the data indicating the location of the person who makes the emergency call.

Radio Frequency Management

The regulation on radio frequency management¹³ puts in place the licensing framework for effective and efficient management of the radio frequency spectrum in Rwanda. In particular, this regulation seeks to promote an efficient use of the radio frequencies and ensure fair competition and innovation, among other objectives. According to the regulation, the radio frequency spectrum planning, management and assignment in Rwanda shall be based on the National Table of Frequency Allocation (NTFA), as well as the regional and international standards adopted in Rwanda.¹⁴

¹² Law N°24/2016 OF 18/06/2016, governing information and communication technologies.

¹³ RURA. (2019). Regulation N°007/r/SM-ICT/RURA/2019 of 15/11/2019 on radio frequency management.

¹⁴ Rwanda NTFA is available at: https://rura.rw/fileadmin/Documents/docs/Table_NFA.pdf.

The International Telecommunication Union (ITU) Region 1 frequency arrangements for broadband PPDR in the 694-894 MHz frequency range in accordance with the African Telecommunication Union (ATU) are presented in

Table 7: Frequency arrangement for broadband PPDR in the 694 – 894 MHz frequency range

Frequency arrangement	Paired arrangements				Notes
	Mobile station TX (MHz)	Centre gap (MHz)	Base station TX (MHz)	Duplex separation (MHz)	
a)	698-703	50	753-758	55	Core band broadband PPDR Based on 3GPP LTE Band 68 for broadband PPDR
b)	703-733	25	758-763	55	Broadband PPDR for CBW = 10, 15 MHz Assumes 3GPP LTE Band 68 or Band 28A specs for $F_c < 723$ MHz @ CBW 10 MHz Band 28 for $F_c > 723$ MHz @ CBW > 10 MHz
c)	733-736	52	788-791	55	Assumes 3GPP LTE Band 28B CBW: 1.5, 3 MHz

Source: Recommendation ITU-R M.2015-2

The implementation of broadband PPDR in these frequencies is based on International Mobile Telecommunications (IMT) technology with channel bandwidths between 1.3 and 10 MHz, and is in line with 3GPP LTE Band 68, Band 28, Band 28A and Band 28B.¹⁵

There are three models for PPDR using these frequencies:¹⁶

1. Model one: Exclusively public safety-dedicated network, with spectrum being used exclusively by public safety users.
2. Model two: Shared public safety and commercial network, with distinct public safety and commercial network cores, and priority access and pre-emption rights for public safety use during emergencies and other times of need.
3. Model three: Commercial network, *i.e.*, public safety users obtain services from one or multiple commercial providers.

The model to be used should be based in a specific study for Rwanda, and should include an analysis of the compliance of the following general principles:¹⁷

- Interoperability: Allow first responders on the network to access other users, as authorized, from anywhere and at any time.

¹⁵ ITU (2018) Recommendation ITU-R M.2015-2.

¹⁶ Following “Progress Report on National Public Safety Broadband Network”, Canada (2020).

¹⁷ Id.

- Permanent access: Allow first responders to have permanent, immediate and uninterrupted access to the network.
- Coverage: Provide access in uncovered urban, rural and remote areas.
- Resilience: Be resilient and robust in meeting the access requirements mentioned above.
- Provide mission critical services: Offer mission critical services to first responders, including data and video.
- Security: Include network security mechanisms for information and data.
- Sustainability: Be friendly to the environment and establish resources to keep updated in the future, meeting the goals and needs required.
- Accessibility: Be accessible to the entire community of first responders.
- Spectrum use: Use spectrum efficiently and effectively.

Telecommunication/ICT Regulations for Disaster Risk Management

Apart from the regulations currently in place (described above), the Government of Rwanda should develop additional specific regulations for the telecommunication/ICT services related to disaster risk management, including, among others, the following:

Mitigation and Preparedness Phases:

1. Commercial and community radio broadcasting operators as well as public and private television broadcasting operators should transmit information campaigns, free of charge, for the prevention of disasters and emergencies (besides the mandatory communications during emergencies). These campaigns must be developed in coordination with the RURA, the Ministry of ICT and Innovation and the MINEMA, and should have a prescribed duration and broadcasting chronogram.
2. Regulations for temporary spectrum licences as well as special service licences for up to six (6) months, extendable only once, should be implemented to allow telecommunication/ICT providers to offer services during the response and recovery phases of disaster risk management.
3. Temporary spectrum licences as well as special service licences granted specifically for the purpose of facilitating communications during emergency response and recovery should be exempted from any type of charge.
4. If the Tampere Convention is adopted by Rwanda, as recommended in Section 9.2, then regulations to implement the Convention at the national level should be established.

Response Phase:

1. Ensure that providers of commercial fixed and mobile telecommunications services take the necessary measures to make their networks available with sufficient capacity for communication to the authorities and affected population, free of charge and in a timely manner and as soon as a disaster situation or emergency is declared.
2. Require mobile service operators to provide SMS messages to their customers and encourage them to use these messages instead of mobile data services. Also, require that commercial telecommunications, as well as fixed and mobile service providers, limit the duration of their calls to, for example, a maximum of 2 minutes in the geographic disaster area for a period of 12 hours following the event that generated the emergency. These

norms would not apply to calls made from or to numbers of the authorities involved in the emergency response.

3. Ensure that providers of commercial fixed and mobile telecommunications services give priority to communications to calls made by the authorities for a period of 24 hours after the emergency is declared, extendable as determined and decided by the responsible authority (e.g., MINEMA and RURA).
4. Oblige telecommunications service providers to immediately assess any damage to their networks and implement the previously prepared contingency plans, to re-establish communications as soon as possible.
5. The RURA could facilitate the issuance of temporary spectrum licenses to national and/or international organizations for a period not exceeding six (6) months in order to attend to the emergency. No charges should be generated for the temporary use of the radioelectric spectrum during the emergency.

Recovery Phase:

1. Require commercial and telecommunications service providers to re-establish permanent solutions after a disaster and restore and improve communications to end users with the aim of building back better.

Recommendation 9: Telecommunications regulatory framework

MINICT/RURA should be responsible for establishing a regulatory framework that includes the provisions in the following table.

Action Item	Target	Responsible
Telecommunications Regulatory Framework	Spectrum management provisions for emergency telecom: <ul style="list-style-type: none"> • Allocation of frequencies for PPDR broadband • Decide on PPDR spectrum utilization models • Temporary spectrum licenses • Secure frequencies for satellite emergency services 	MINICT/RURA
	Priority call routing fully implemented	MINICT/RURA Operators
	Congestion network management for emergency response requirements in place	MINICT/RURA Operators
	Network redundancy requirements in place	MINICT/RURA Operators
	Information campaigns requirements in place	MINICT/RURA Operators
	Contingency plans requirements in place	MINICT/RURA Operators

Action Item	Target	Responsible
	Expedite process for the importation of telecom equipment for emergency response in place	MINICT/RURA Operators
	Type approval / homologation certificate exemptions for emergency response in place	MINICT/RURA Operators

Improve Public Awareness and Digital Literacy

Improving public awareness and digital literacy for emergency handling and response requires a multifaceted approach that integrates education, technology, policy, and institutional collaboration. The following activities will help to achieve this goal: Develop Targeted Public Awareness Campaigns, Strengthen Digital Literacy Programs, Leverage Existing ICT Infrastructure, Build Institutional Capacity for Awareness and Training

Recommendation 10: Improve public awareness and Digital Literacy

2.1.6 International Conventions or Treaties

Rwanda is signatory to international agreements that seek to the *reduction of disaster and environmental risks such as the Sendai Framework for Disaster Risk Reduction 2015-2030*¹⁸ and the Paris agreement 2016.¹⁹ Nonetheless, the country is not a party to the Tampere Convention, or any other agreement or treaty related specifically to emergency telecom/ICTs.

Tampere Convention²⁰

Rwanda is not a party to the Tampere Convention.²¹ However, becoming part of the Tampere Convention could help relax organizational barriers that impede the flow of information between the various elements of the international network for a positive disaster response. These include, among other elements, establishing immunity against the confiscation of equipment, the prompt issuance of corresponding licenses (e.g., telecommunications licenses, use of spectrum, etc.), the development of mechanisms for the timely export of the equipment used under the Convention, and facilitating approval for the departure of assistance personnel to their country of origin.

Consequently, Rwanda should become a signatory of the Tampere Convention and initiate the procedures to accede to the treaty that leads to its ratification, and take the necessary legislative actions to apply the content of the Convention to the current national legislation. If the country ratifies the Convention, it is important that both the RURA and the Ministry of ICT and Innovation, the National

¹⁸ Available at : https://www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf (Accessed on 2 February 2024).

¹⁹ Available at : https://unfccc.int/sites/default/files/resource/parisagreement_publication.pdf (Accessed on 2 February 2024).

²⁰ International Telecommunications Union. (2019). ITU Guidelines for national emergency telecommunication plans.

²¹ United Nations. Chapter XXV – Telecommunications.

Disaster Management Committee (NADIMAC), the Ministry of Foreign Affairs and International Cooperation, and the customs authority, initiate the required steps for its implementation. Likewise, it would be relevant to make related legislative and regulatory adjustments at the national level, thereby complementing the current regulations on international assistance for disaster management. These steps will help all those involved in DRM in Rwanda to internalize and effectively adopt this legal framework for full and successful cooperation.

In accordance with the above focuses, and within the framework of the Tampere Convention, the responsible authority regarding telecom/ICT regulation (RURA) must establish specific regulations for the implementation of the Convention, including, for example:

1. Exempt any type of charge, including charges for the use of the radio spectrum and service license, among others, for international aid provided through the Tampere Convention.
2. Temporarily and expeditiously issue any authorization for the use of the radio spectrum that is necessary, in line with the provisions of the national legislation.
3. Simplify or exempt any other existing regulation that prevents the use of telecom/ICT resources from international aid under the Tampere Convention.

To execute the agreement, in the event of its signature or ratification, it is also recommended to inform the government entities of the precise cooperation framework, so that all stakeholders have clear knowledge of the relevant legal provisions and can thus effectively apply them during disaster relief.

International Cooperation

Although Rwanda currently adheres cooperation with the UN and other international agencies, there are other mechanisms within the framework of international cooperation that the country may use -or continue to adhere to- to improve disaster risk management. States facing different disaster risk challenges, such as Rwanda, need adequate, sustainable, and timely provision of support, including through finance, technology transfer, and capacity building from international cooperation, tailored to their needs and priorities, as identified by them. In that sense, the Emergency Telecommunications Cluster (ETC), for example, can offer a set of tools that Rwanda can use to promote more efficient disaster risk management.²²

Also, in relation to international cooperation for the management of telecom/ICT for disaster risk management, it is recommended that Rwanda works together with the ITU, considering that it develops different activities on issues of telecommunications for emergencies. These activities include the publication of manuals on emergency telecommunications, emergency radio communications' specifications applicable to all phases of a disaster, databases of available frequencies for emergency radio communication services on land and space, and

²² International Telecommunications Union. (2019). ITU Guidelines for national emergency telecommunication plans.

the International Emergency Preferences Scheme and a common alert protocol, among others.²³

Currently, the law on disaster management in Rwanda establishes that states and international organizations wishing to provide response and assistance following a disaster outbreak shall apply for authorization in writing from the Ministry in charge of Foreign Affairs.²⁴ Upon request by NADIMAC, the Government may accept or refuse international response and assistance offered.

Recommendation 11: Tampere Convention and coordination with international agencies

Rwanda must initiate the process to become part of the Tampere Convention. To this end, it is recommended that the Ministry of Foreign Affairs and International Cooperation (MINAFFET), with support from MINEMA, RURA and MINICT, initiate the ratification of the Convention and, subsequently, the necessary legislative and regulatory adjustments for the effective implementation of that Convention.

MINICT/RURA must also establish specific regulations for the effective implementation of the Tampere Convention.

Coordination and collaboration with different international agencies, such as the ETC (Emergency Telecommunications Cluster) and the ITU (International Telecommunications Union) on issues of preparedness and response to eventual disasters or emergencies is imperative. Support on capacity building can be provided by these agencies.

Action Item	Target	Responsible
Tampere Convention and coordination with international agencies	Become signatory of the Tampere Convention	MINAFFET MINICT/RURA
	Establish specific regulation for the effective implementation of the Tampere Convention	MINICT/RURA
	Capacity building provided by ETC and the ITU	MINEMA MINICT/RURA

In short, recommendations and corresponding actions items for the phase of Mitigation are summarized in the table below:

²³ International Telecommunications Union. (2019). ITU Guidelines for national emergency telecommunication plans.
²⁴ Law N°41/2015 of 29/08/2015.

<i>Recommendation no.</i>	<i>Strategic Action item</i>
1,2,11	<i>Improvement on NETP Status and Membership</i>
4	<i>Enhance Telecom infrastructure and Technology Integration gaps</i>
4	<i>Strengthen Cybersecurity measures</i>
6	<i>Improve on Interagency communication</i>
3	<i>Maintain and Update Hazard maps</i>
5	<i>Conduct Telecom/ICT network inventory and coverage maps</i>
7	<i>Conduct Vulnerability analysis of critical infrastructure</i>
8	<i>Have Contingency Plans in Place</i>
9	<i>Improvement in Telecommunication Regulatory Framework</i>
10	<i>Improve Public Awareness and Digital Literacy</i>

2.2 Preparedness Phase

2.2.1 Standard Operating Procedures (SOP)

SOPs are defined as formal written guidelines or instructions for incident responses. They generally have both operational and technical components and allow emergency response personnel to act in a coordinated manner across all disciplines in the event of an emergency.²⁵ These detailed instructions or procedures promote a uniform and standardized response during emergency response operations. These SOPs should be aligned with the legislative and regulatory frameworks as well as with the specific policies and plans related to DRM.

In addition, from a technical point of view, SOPs should consider the existing interoperability possibilities and, if necessary, the allocation of radioelectric spectrum in a specific band that allows communication to take place, based on the existing radio equipment. As such, it is important for Rwanda to maintain updated SOPs, especially those related to telecom/ICTs.

Rwanda currently has SOPs for the development of early warning systems (see section 12.2); however, it is also necessary to develop SOPs for other processes and entities involved in DRM, especially in relation to telecommunications/ICT for disaster management.

²⁵ United States Department of Homeland Security. (2014). National Emergency Communications Plan.

Recommendation 12: Standard Operating Procedures

- *Develop or update standard operating procedures for emergency and disaster response related to communications within and among agencies and technical means for communication (voice/data), including interoperability.*
- *Define the government entities and the contact points (key decision makers) within these entities that must maintain communication during a disaster or emergency.*
- *Maintain an updated database with these focal points of every agency involved in disaster management.*
- *Analyse the possible interoperability between broadband equipment and devices (wireless or wireline) and the communication networks of the government entities.*
- *Establish a set of dedicated line / radio frequencies that can be used for the communications of the contact points (key decision makers), as well, as NADIMAC and first responders compatible with the radiocommunication equipment being used.*
- *Establish alternative methods of communications, if necessary, such as through existing communication operators.*
- *Develop connectivity plans for the satellite equipment available or new to be purchased with support from Rwanda Space Agency (RSA), to be used during a response phase as well as procedures for its use as primary or alternative communication among relevant stakeholders involved in disaster response.*

Contingency Plans

MINEMA has developed contingency plans for different hazards, including those to which Rwanda is more prone-to, such as Storms and landslides: ²⁶

- National Contingency Plan for El Nino-Related Epidemic Diseases (2015)
- National Contingency Plan for Storms (2015)
- National Contingency Plan for Population Influx (2018)
- National Contingency Plan for Drought (2018)
- National Contingency Plan for Storms (2018)
- National Contingency Plan for Floods and Landslides (2018)
- National Contingency Plan for Fire Incidents (2019)
- National Contingency Plan for Managing the Emergency Consequences of Terrorist Incidents (2019)
- National Contingency Plan for Earthquake (2019)
- National Contingency Plan for Volcanic Eruption (2019)

²⁶ MINEMA's contingency plans can be consulted at:

https://www.minema.gov.rw/publications?tx_filelist_filelist%5Baction%5D=list&tx_filelist_filelist%5Bcontroller%5D=File&tx_filelist_filelist%5Bpath%5D=%2Fuser_upload%2FMinema%2FPublications%2FContingency_Plans%2F&cHash=2184b5574be0ffaef8b4ed5a6b9efd0d

These plans seek to increase the knowledge of each type of hazard, anticipate the types of disasters the country might face, and ensure that stakeholders involved in the response know how to manage disasters when they do strike. This knowledge also includes having the systems and tools to respond fast to the emergency. In that sense, the contingency plans provide clear roles and responsibilities of different partners and humanitarian actors during disasters for each hazard. Also, the plans describe and identify the risks based on historic backgrounds, and model different scenarios of occurrence based on various assumptions. Based on the different scenarios, coordination for response activities is established, as well as roles and responsibilities for the different actors involved in such response.

Within these preestablished processes, there is a section for the management of operations in relation to communications and information sharing. For instance, in some of the above-mentioned contingency plans, it is established that once the plan for a specific hazard is activated, MINEMA/DIDIMAC will set an Emergency Operations Committee (EOC) to collect, verify and compile all the information regarding the crisis. This information will provide the inputs to a general assessment of the crisis and will help identify response and recovery needs and determine actions that require external experts. Also, the EOC will facilitate the exchange of this information among key partners and ensure the liaison with the NADIMAC and with the media. The information management procedures are as follow: ²⁷

1. All information must be transmitted by the Liaison officer appointed by the EOC who is also responsible for the collection and consolidation of data and transmission to all parties concerned.
2. Any information is validated by the Head of EOC before transmission and sharing.
3. The media will be managed and helped by the EOC in order to minimize the risk for them to interfere with response activities.

Along with these general contingency plans developed by MINEMA for different hazards, Rwanda's legislation also establishes that the RURA may direct a licensed electronic communications service provider to develop a disaster management plan for the survival and recovery of any network facilities, network service, applications service or content applications service in case of a disaster, crisis or civil emergency.²⁸ Therefore, the different telecommunications operators in Rwanda have Standard Operating Procedures (SOP) in place, which also include contingency measures such as a recovery plan and a business continuity plan. In addition, they have mobile/portable equipment (e.g. radio antennas) as emergency links to feed areas where network has been destroyed).²⁹

In general, contingency plans for telecom/ICT must include specific procedures depending on the unique characteristics of the location, such as the level of connectivity of the site, the available facilities or equipment deployed in the area, redundancy, and power sources, among other elements. This contingency planning should also include solutions and alternatives that can be deployed to

²⁷ MINEMA. (2019). National contingency plan for volcanic eruption.

²⁸ ICT Law N°24/2016.

²⁹ Information provided directly by government officials from MINICT, RURA and MINEMA.

maintain operations and communications in the affected area by the agents responsible for DRM. This would be helpful for making advance decisions on resource management and to develop procedures for the expected use of the full range of available technical and logistical responses, especially with respect to telecommunications.

2.2.2 Early Warning Systems. See Annex 3.

Recommendation 13: Monitoring Systems, Early Warning Systems and Common Alerting Protocol

MINEMA should continue to develop the following phases of the Early Warning Systems (EWS) for the different types of hazards Rwanda is prone to, e.g., storms, landslides, floods, droughts, among others. Support must be provided from other agencies of the government, such as Rwanda Meteorology Agency (RMA) and Rwanda Space Agency (RSA).

In addition, MINEMA, with support for MINICT and RURA, should implement a Common Alerting Protocol (CAP) alert aggregator that will centralize all alerts issued by the different alerting authorities defined by the government (e.g. RMA, RSA, Police, the President's Office, and MINEMA itself, among others). Through the alert aggregator, MINEMA will send alerts to the population at risk using different dissemination means, such as, mobile networks, and radio and TV broadcasting networks, primarily. Cell Broadcast Service (CBS) should be used to disseminate alerts through mobile networks.

Rwanda should adopt Common Alerting Protocol (CAP) as the alerting protocol to issue alert messages to the population.

2.2.3 Drills and Training

The law on disaster management establishes that the MINEMA, Districts, Sectors and other organs in charge of disaster management in the country shall, for the purpose of building capacity in disaster management, provide training and any other necessary means for the government officials and the population.³⁰

In this context, exercises should be also implemented regularly and designed especially for the telecom/ICT sector. The development of effective training and exercise programmes can reinforce the competence of emergency services with communications equipment as well as improve their ability to execute the policies, plans, and procedures that govern the use of telecom/ICT through all DRM processes.³¹ The Emergency Telecommunications Table-top Simulation Guide, developed by the ITU (2020), and the online training tool How to Develop Tabletop Simulation Exercises (TTX) provide all the relevant information needed to develop and carry out these types of exercises.³²

³⁰ Law N°41/2015 of 29/08/2015.

³¹ United States Department of Homeland Security. (2014). National Emergency Communications Plan.

³² These documents can be consulted via the following links: https://www.itu.int/en/ITU-D/Emergency-Telecommunications/Documents/Publications/2020/TTX_Guide.pdf and <https://academy.itu.int/index.php/training->

Recommendation 14: Training and Drills

Telecommunications trainings and drills for emergencies should be regularly carried out in order to improve emergency responders' capacity with communications equipment, as well as to enhance their ability to execute policies, plans, and procedures governing the use of communications networks and terminals. The telecom/ICT sector should actively participate in these drills and exercises as well as develop and carry out their own drills and exercises to effectively implement the NETP.

1. At least once a year develop a tabletop exercise for the telecom/ICT sector with the support from international organizations (e.g., ETC or ITU)
2. At least once every three years develop drills and full-scale exercises for the telecom/ICT sector

Support for People with Specific Needs

Telecom/ICTs are a key tool in disaster response and management operations to reach traditionally marginalized or especially vulnerable groups before, during, and after a disaster. Telecom/ICTs can use multiple modes and channels, such as TV, radio, SMS text messages, and the different Internet-based services and resources (e.g., video, instant messaging over the Internet, web conferencing, social networks), which allow instant communication and the sharing of photos and/or videos and satellite communications.³³

In that sense, the dissemination of disaster preparedness and planning content should be provided in multiple languages and formats. For example, subtitles can be included in visual communications so that persons with auditive difficulties could receive the message, or visual and sound alerts could be introduced in public spaces in order to meet the needs of as broad a swath of the population as possible.

Recommendation 15: Accessibility

Rwanda's authorities, such as MINEMA and MINICT, working together with network operators and telecom/ICT service providers, should develop mechanisms to understand the accessibility requirements needed to guarantee that vital digital communication technologies are inclusive and, therefore, accessible to all persons, including people with disabilities and/or with specific needs, the elderly, women and girls, and refugees and immigrants. This should be linked to the existing and developing early warning systems in the country so that people receive and understand the alerts for early actions to take place.

Implement mechanisms to guarantee that vital digital communications technologies are inclusive and accessible to all persons, including people with disabilities and/or specific needs

[courses/full-catalogue/practical-disaster-response-how-develop-table-top-simulation-exercises-ttx](#) (Accessed: 24 October 2023).

³³ United States Department of Homeland Security. (2014). National Emergency Communications Plan.

2.3 Response Phase

2.3.1 Communication and Coordination

In the response phase, all contingency plans and standard operating procedures established in the mitigation and preparedness phases must be executed. Telecom/ICTs must be established to enable communications between first responders and decision makers in the government and the community, i.e., executing of the standard operating procedures developed during the preparedness phase.

During the disaster response phase, authorities can establish emergency operations centres or communication and coordination command posts to provide critical communications to users in each organization involved. These positions can be fixed or mobile, be local or remote, and be located in a vehicle or shelter, among other possibilities.

The functions of these centres or posts are to assess the emergency situation, inform a dispatcher, and identify and request appropriate resources when necessary. Therefore, these command posts should be in contact with each other (one in a remote location outside the perimeter of potential danger and another at the site of the emergency, for example) in order to respond to the direct requirements generated in the emergency area, dispatch equipment and personnel, anticipate the need to provide more support and assistance, and position additional resources in the area.

Considering this, it is important to maintain interoperable and continuous communications between command posts and the rest of the stakeholders involved in the response to the emergency. As such, it is necessary to use all available means of communication and maintain close coordination with the various agencies involved.

SOPs and contingency plans, including temporary satellite connectivity and any other available means of communication, are particularly important when terrestrial networks are down, and key decision makers need to communicate to coordinate the emergency response.

Recommendation 16: Emergency command posts

Consider planning for the development of emergency command posts or communication and coordination command posts to provide critical communications to users in each organization involved during the response phase of a disaster.

These positions can be fixed or mobile, be local or remote, and be located in a vehicle or shelter, among other possibilities. Maintaining interoperable and continuous communications between command posts and the remaining stakeholders is vital for an effective response to the emergency.

Acquire and have pre-position the equipment necessary to deploy an Emergency Command PosECP when needed, including availability of satellite communications and terminals

2.3.2 Collection and Analysis of Information

A key element during the response phase of disaster management is to develop ICT assessments to prioritize the deployment of critical ICT infrastructure to the most affected areas and to collect and analyse information related to the immediate needs of the population affected by the emergency to manage the safe delivery of the response. Gathering and evaluating information are particularly important steps because this information can be communicated in a timely manner to the corresponding authorities (e.g., health entities, firefighters, civil police, among others) to respond to the needs of the affected population as soon as possible. To this end, it is necessary to use all the available telecom/ICT networks and to include the collection of geospatial information from the disaster in order to analyse the information obtained and coordinate the response planning geographically.

2.3.3 Emergency Awareness and Updates

During the response phase, it is also necessary to continue monitoring and warning of new risks to the affected population and to disseminate updates about the emergency situation. To achieve this goal, multiple methods of communication, such as sound and television broadcasting, text messages, and/or audio messages through mobile operators, social networks, and applications, among others, should be employed.

Call centres should be established in order to connect affected populations with their relatives during the response phase. Generally, these call centres can be located in shelters and should use means of communication that do not congest the networks, such as text messages. These call centres can also be established in collaboration with telecom/ICT operators in additional locations, such as hostels and hotels.

Recommendation 17: Call centres

During the response phase, call centres should be established to warn the affected population of new risks, disseminate updates about the emergency situation, and connect affected populations with their relatives. Generally, these call centres can be located in shelters and should use means of communication that do not congest the networks, such as text messages, when used by the affected population. To establish these call centres, Rwanda could use satellite networks and terminals that can be easily installed or seek collaboration with telecom/ICT operators or international organizations to establish the required telecom/ICT infrastructure.

Acquire and have pre-position the equipment necessary to deploy a call centre when needed, including availability of satellite communications and terminals.

2.4 Recovery Phase

Assessment of Damage, Reconstruction, and Improvement of Telecom/ICT Infrastructure

During the recovery phase, the damage caused to the telecom/ICT networks should be evaluated as a precursor to the timely reconstruction and improvement of the damaged infrastructure. This reconstruction should seek, at a minimum, to restore communications to the same conditions as they were before the disaster. However, preferably, the ICT infrastructure should be rebuilt on the principle of building back better—that is, reconstructing a more resilient infrastructure that can withstand future disasters.

It is necessary to maintain the availability of a minimum level of communications for those who carry out the damage assessment and reconstruction activity and to establish communication priorities in order to manage available communications resources.

Recommendation 18: Restoration and reconstruction of the telecom/ICT infrastructure

Restoration and reconstruction of the telecom/ICT infrastructure should be based on lessons learned and the principle of building back better. These activities should also involve the active participation of the private sector, including fixed, mobile, and satellite network and service providers.

In short, the following table shows strategic action items needed to be implemented per phase:

PHASE	RECOMMENDATION NUMBER	STRATEGIC ACTION ITEM
PREPAREDNESS	12	Have in place SOPs
	13	Strengthen Early warning system
	14	Conduct Training and Drills
	15	Integrate inclusive and accessible digital communication technologies
RESPONSE	16	Improvement on Emergency command posts

PHASE	RECOMMENDATION NUMBER	STRATEGIC ACTION ITEM
	17	Improvement on Call Center by introducing Public Safety Answering Point Systems (PSAP)
RECOVERY	18	Restore and rebuild

3. IMPLEMENTATION PLAN AND MONITORING AND EVALUATION MECHANISM

Implementation road map overview. Implementation plan appears in the annex. It consists of targeted outputs, specific activities to implement, responsible organization to implement to each activity, activity timeline, cost items to implement each activity and potential source of funds.

Budgeting. Budgeting is normally part of implementation plan but as agreed with key stakeholders on the client side, cost items are rather indicated. The implementation plan assumes that each activity leading institution/agency will use cost items to do the budgeting of the activity before implementation.

Monitoring and Evaluation. It is consists of targeted outputs, initiatives to track, key indicators, data source, responsible organizations, activity to collect data, baseline and targets from 2025 up to 2027. The monitoring and evaluation tool is also annexed.

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Ministerial Endorsement

This National Emergency Telecommunication Plan is developed jointly by the Ministry of ICT and Innovation and the Ministry in charge of Emergency Management.



September 2025

ANNEX 1: Vulnerability to Disasters from Natural Hazards in Rwanda

Rwanda has a mountainous topography with an average altitude of 1,700 meters, ranging between 900 meters and 4,707 meters. There are volcanic mountains at the northern border, and undulating hills in most of the central plateau. The eastern part of the country is relatively flat, with altitudes well below 1,500 meters. While the lowlands of the southwest, with an altitude of 900 meters, are part of the tectonic depression of the African Rift Valley. This topography gives Rwanda a mild and cool climate that is predominantly influenced by altitude. With an average annual temperature of 18.5 °C and an average rainfall of about 1,250 mm per year.³⁴

Rwanda can be divided geomorphologically into five regions from west to east:³⁵

- 1) The Congo-Nile Ridge which divides two of Africa's great watersheds, the Congo and the Nile basins. It extends from north to south through Western Rwanda at an average elevation of almost 2,743 meters.
- 2) The volcanic Virunga Mountains and high lava plains of north-western Rwanda. The Congo-Nile Ridge is dominated in the northwest by the volcanoes range which consists of five massifs, the highest of which is mount Karisimbi (volcano).
- 3) The narrow Great Rift Valley region along or near Lake Kivu. On the western slopes of the Congo-Nile Ridgeline, the land slopes abruptly towards Lake Kivu in the Great Rift Valley at the border of the country.
- 4) The rolling hills and valleys of the Central Plateau, which slope eastward from the Congo-Nile Ridge, and gradually reduce altitudes to the plains, swamps, and lakes of the eastern border region.
- 5) The savannahs and marshlands of the eastern and south-eastern border areas, which are lower, warmer, and drier than the central upland plateaus.

Given the country's location, as well as its hydrographic and topographic characteristics, Rwanda is prone to different types of disasters, including landslides and mudslides; floods; earthquakes; windstorms; rainstorms; hailstorms; thunderstorms; volcanic eruptions; lightning and thunderstorms; droughts; and epidemics, among others.³⁶

Nonetheless, the hazards that occur more regularly are floods, and epidemics, followed by droughts, and landslides, and finally earthquakes, storms, and volcanic eruptions. As shown in Table 3, since 1974 there have been 56 disasters caused by natural hazards in Rwanda. Twenty-eight of these events have been floods, which have resulted in the death of 604 people; while 12 of the 56 total number of disasters have been associated with epidemics, leaving more than 320 deaths. The third type of disaster with the highest number of occurrences have been droughts, with 237 deaths and more than 4 million people affected.

³⁴ MINEMA. (2015). The National Risk Atlas of Rwanda.

³⁵ MINEMA. (2015). The National Risk Atlas of Rwanda.

³⁶ Information provided directly by government officials from MINICT, RURA and MINEMA.

Categories of disasters in Rwanda between 1974 and 2023*

Disaster Type	Count	Total deaths	Total affected
Flood	28	604	2,100,345
Epidemic	12	322	7,399
Drought	6	237	4,156,545
Mass movement (wet)	5	113	37,979
Earthquake	2	81	2,286
Storm	2	3	6,553
Volcanic activity	1	-	13,365
Total	56	1,360	6,324,472

* Covid-19 pandemic not included.

Source: EM-DAT: The Emergency Events Database—Université catholique de Louvain (UCL)—CRED, D. Guha-Sapir—www.emdat.be, Brussels, Belgium

Of all the above disasters that have occurred in Rwanda since 1974, the 10 most serious by number of deaths have been 1 drought, 5 floods, 2 epidemics, 1 landslide and 1 earthquake. As shown in Table 4 only 2 disaster events have resulted in the death of more than 360 people: A drought in 1989, where 237 people lost their lives due to famine and more than 50,000 people were affected mainly in the southern parts of the country (Gitarama, Butare, and Gikongoro). And a flood occurred in May 2023, when heavy rain flooded part of Rwanda's western and northern provinces.³⁷

Individual disasters with the greatest impact by number of deaths (1974-2023) *

#	Disaster Type	Disaster Subtype	Year	Total Deaths
1	Drought	Drought	1989	237
2	Flood	Flood (General)	2023	131
3	Epidemic	Bacterial disease	2002	83
4	Flood	Flash flood	2020	72
5	Flood	Riverine flood	2002	69
6	Flood	Flood (General)	2016	67
7	Epidemic	Bacterial disease	1998	55
8	Mass movement (wet)	Landslide (wet)	2016	50
9	Flood	Riverine flood	1988	48
10	Earthquake	Ground movement	2002	45

* Covid-19 pandemic not included.

Source: EM-DAT: The Emergency Events Database—Université catholique de Louvain (UCL)—CRED, D. Guha-Sapir—www.emdat.be, Brussels, Belgium

When analysing the number of people affected, Table 5 shows that droughts are the most relevant disaster in this regard. Although the six disasters with the highest number of people affected did not show any associated deaths, the number of people affected almost reached six million in these six disaster events.

³⁷ Reliefweb. (2023). Rwanda: Floods and Landslides – May 2023. Recovered from: <https://reliefweb.int/disaster/fl-2023-000064-rwa>.

Also, it is worth noticing that the ten greatest disasters by number of affected populations in Rwanda have occurred in all six decades since 1974.

Individual disasters with the greatest impact by number of affected population (1974-2023) *

#	Disaster Type	Disaster Subtype	Year	Total Deaths	Total Affected
1	Flood	Flood (General)	1974	-	1,900,000
2	Drought	Drought	1976	-	1,700,000
3	Drought	Drought	2003	-	1,000,000
4	Drought	Drought	1999	-	894,545
5	Drought	Drought	1984	-	420,000
6	Drought	Drought	1996	-	82,000
7	Drought	Drought	1989	237	60,000
8	Flood	Flood (General)	2023	131	51,982
9	Mass movement (wet)	Landslide (wet)	2016	50	30,030
10	Flood	Flash flood	2018	24	26,051

* Covid-19 pandemic not included.

Source: EM-DAT: The Emergency Events Database—Universite catholique de Louvain (UCL)—CREED, D. Guha-Sapir—www.emdat.be, Brussels, Belgium

Moreover, 22 of the 56 disaster events registered since 1974, i.e., 39%, have occurred in the last 10 years, as shown in Table 6. Between 2014 and 2023, 497 people lost their lives mainly because of floods, that is 37% of the total deaths registered in the country since 1974, and nearly 3% (170,000) of the people was affected.

Deadliest Disasters in the last 10 years

#	Disaster Type	Disaster Subtype	Start Year	Total Deaths	Total Affected
1	Flood	Flood (General)	2023	131	51,982
2	Flood	Flood (General)	2022	15	787
3	Flood	Flood (General)	2022	11	513
4	Flood	Flood (General)	2022	3	-
5	Flood	Flood (General)	2021	-	6,500
6	Volcanic activity	Lava flow	2021	-	13,365

#	Disaster Type	Disaster Subtype	Start Year	Total Deaths	Total Affected
7	Flood	Flash flood	2020	72	16,210
8	Flood	Flood (General)	2020	19	498
9	Flood	Flood (General)	2020	9	-
10	Flood	Flood (General)	2020	8	505
11	Flood	Flood (General)	2020	3	5,242
12	Flood	Flood (General)	2019	16	5,393
13	Flood	Flood (General)	2019	12	565
14	Flood	Flash flood	2018	24	26,051
15	Flood	Flood (General)	2018	24	360
16	Mass movement (wet)	Landslide (wet)	2018	18	12
17	Flood	Flood (General)	2018	10	-
18	Storm	Severe weather	2017	-	679
19	Storm	Storm (General)	2017	3	5,874
20	Flood	Flood (General)	2016	67	-
21	Mass movement (wet)	Landslide (wet)	2016	50	30,030
22	Flood	Riverine flood	2015	2	3,431

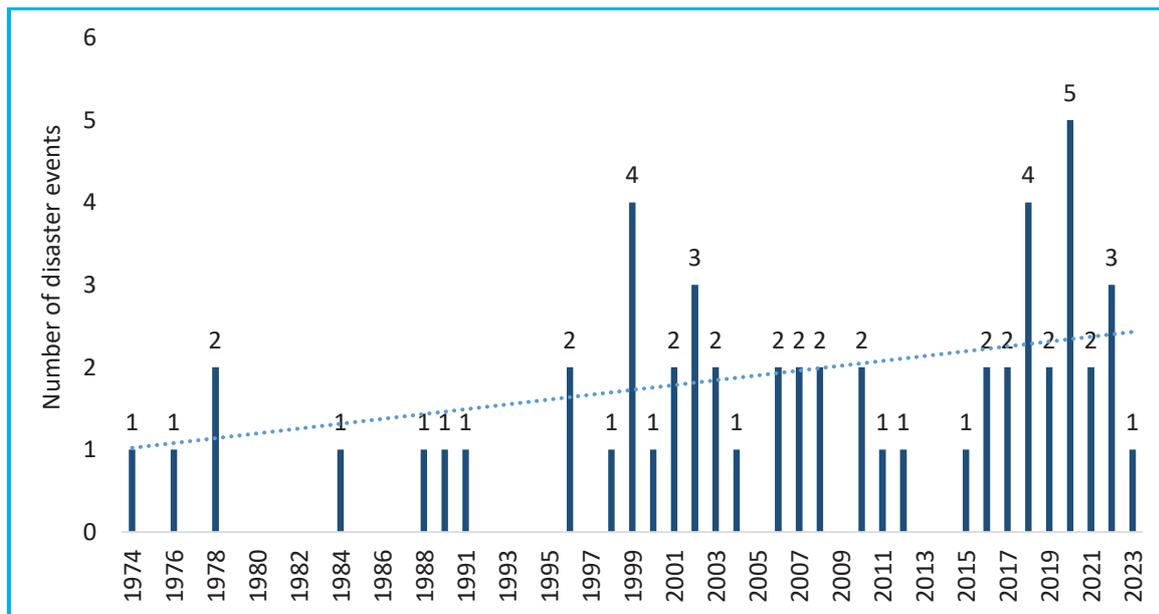
* Covid-19 pandemic not included.

Source: EM-DAT: The Emergency Events Database—Université catholique de Louvain (UCL)—CRED, D. Guha-Sapir—www.emdat.be, Brussels, Belgium

According to MINEMA, over the last decade the frequency and severity of natural disasters have significantly increased in Rwanda, particularly as a consequence of floods and droughts, with **increasing** toll of human casualties as well as **economic** and environmental losses.³⁸ Graph 1 shows the number of disaster events by year. Between 1974 and 1983 there were a total of 4 disaster events, however, forty years later, between 2014 and 2023, there were a total of 22 disaster events.

³⁸ MINEMA. (2015). The National Risk Atlas of Rwanda.

Graph 1. Number of disaster events and trend, by year



* Covid-19 pandemic not included.

Source: EM-DAT: The Emergency Events Database—Universite catholique de Louvain (UCL)—CRED, D. Guha-Sapir—www.emdat.be, Brussels, Belgium

Hazard Maps

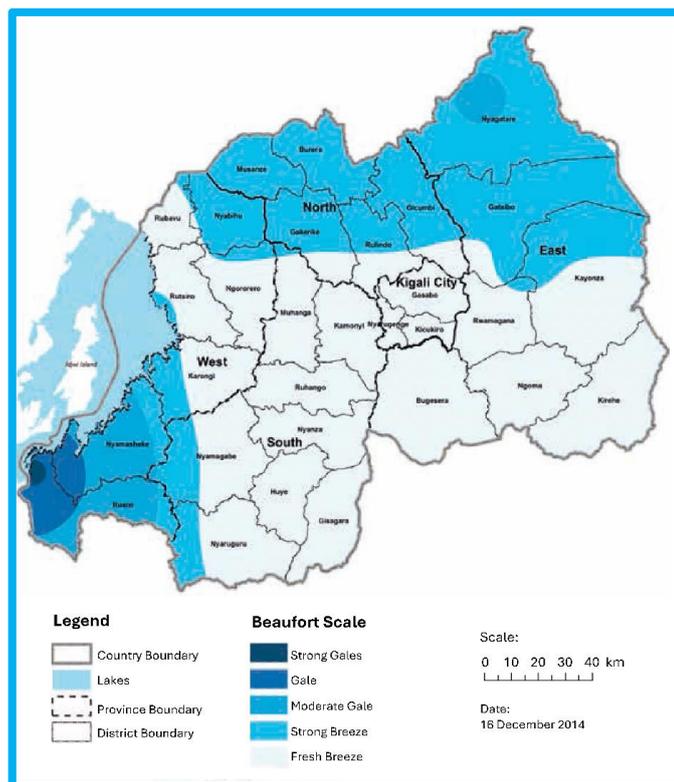
Maps of the risks to which Rwanda is more vulnerable to were developed by MINEMA and presented on a National Risk Atlas. The Atlas not only describes the main elements at risk and the hazard profile of the country, but also includes an analysis of the exposure and vulnerability of the country. It also provides an overview of the potential economic cost the country could incur given certain hazard scenarios and the levels of exposure and vulnerabilities.³⁹ Some of the more relevant maps and vulnerabilities developed by MINEMA are presented below.

Storms

According to the National Risk Atlas, the speed of regular winds in Rwanda is generally around 0.5-1.5 meters per second (m/s), although on some occasions it can reach 10.3-12.8 m/s, in which cases can cause damages to infrastructure, crops and other facilities made predominantly with weak materials.

Considering a 5-year period, 9% of the total area of the country can be affected by moderate to strong gales, specially at the northern and western parts of the country. According to MINEMA, the districts of Rusizi and Nyamasheke are the most exposed to moderate and strong Gales.

³⁹ MINEMA. (2015). The National Risk Atlas of Rwanda.

Map 1. Strong wind hazard map (5-year return period)

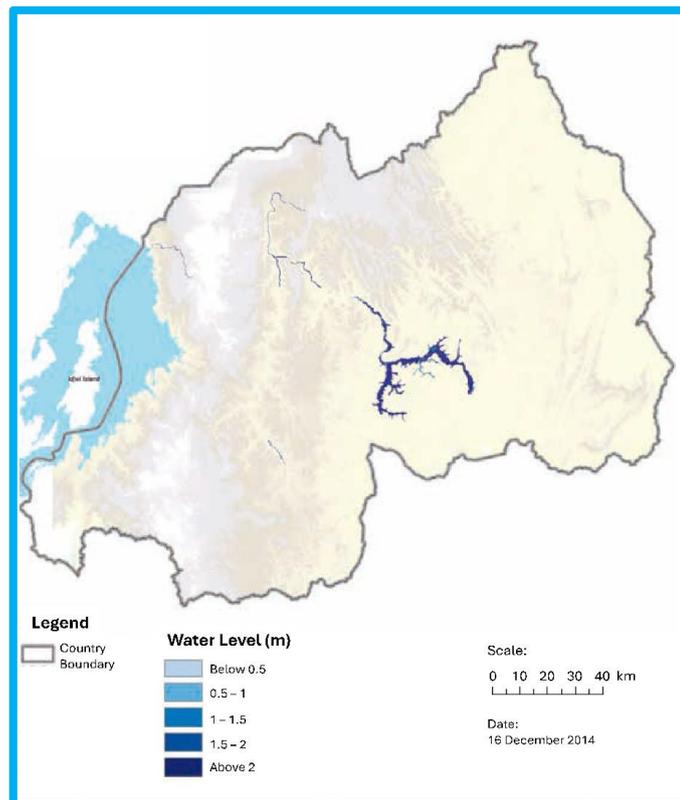
Source: Based on MINEMA. (2015).

Floods

The National Risk Atlas developed maps for different flood plain areas in Rwanda:

1. Nyabarongo, covering districts of Kamonyi, Bugesera, Kicukiro, Nyarugenge, Rwamagana and Ngoma;
2. Nyabisindu, in districts of Nyanza, Sebeya in the districts of Rubavu, Ngororero and Rutsiro;
3. Mukungwa, in districts of Musanze, Nyabihu, Muhanga, Gakenke; and,
4. Kagitumba in Nyagatare district.

Also, the Atlas depicts a national flood hazard map (Map 2), which shows that flood hazard affects people and activities generally located near major rivers Rwanda. In particular, the analysis shows that the total area affected by flooding is around 0.7% (197 km²) of the country.

Map 2. National flood hazard map

Source: Based on MINEMA. (2015).

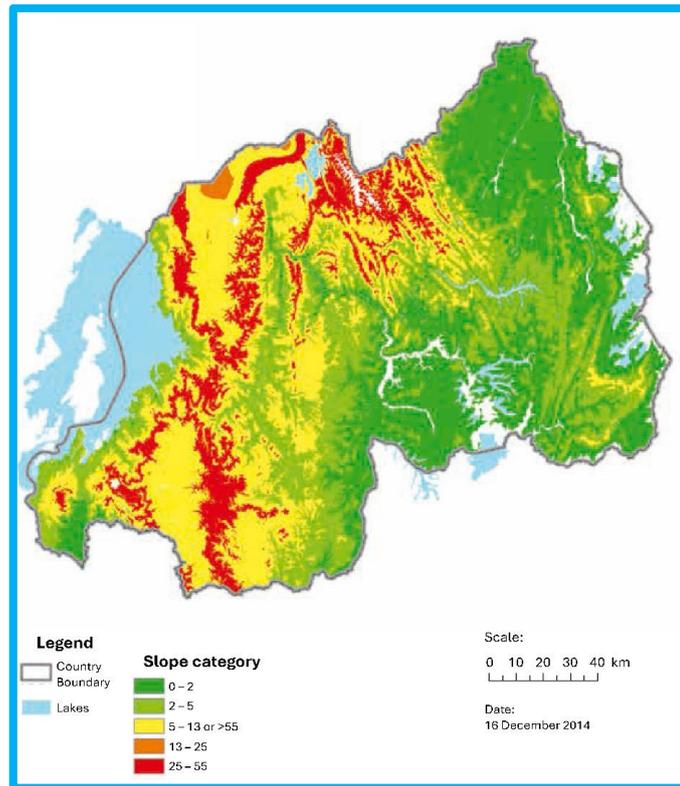
Landslides

According to MINEMA (2018), the vulnerability of Rwanda to floods and landslides is largely due to its topographic and demographic characteristics. And this is further exacerbated by the impacts of climate change, particularly as a consequence of the increasing variability in rainfall frequencies and intensity.⁴⁰

As depicted in Map 3, in Rwanda the western high lands are more prone to landslides, while the eastern lowlands have a low susceptibility to this type of hazard. In general, 42% of the country's area is classified with moderate to very high susceptibility. The districts with high to very high susceptibility are: Gakenke, Karongi, Muhanga, Ngororero, Nyabihu, Nyamagabe, Nyamasheke, Nyaruguru, Rusizi, Rubavu, and Rutsiro. Nyabihu, in particular, has the highest percentage (58%) of area exposed to high and very high slope susceptibility, and accounts for the highest number of deaths by landslides historically, and the highest number of houses destroyed or damaged by this hazard.⁴¹

⁴⁰ MINEMA. (2018). National contingency plan for floods and landslides.

⁴¹ MINEMA. (2015). The National Risk Atlas of Rwanda.

Map 3. Slope susceptibility map

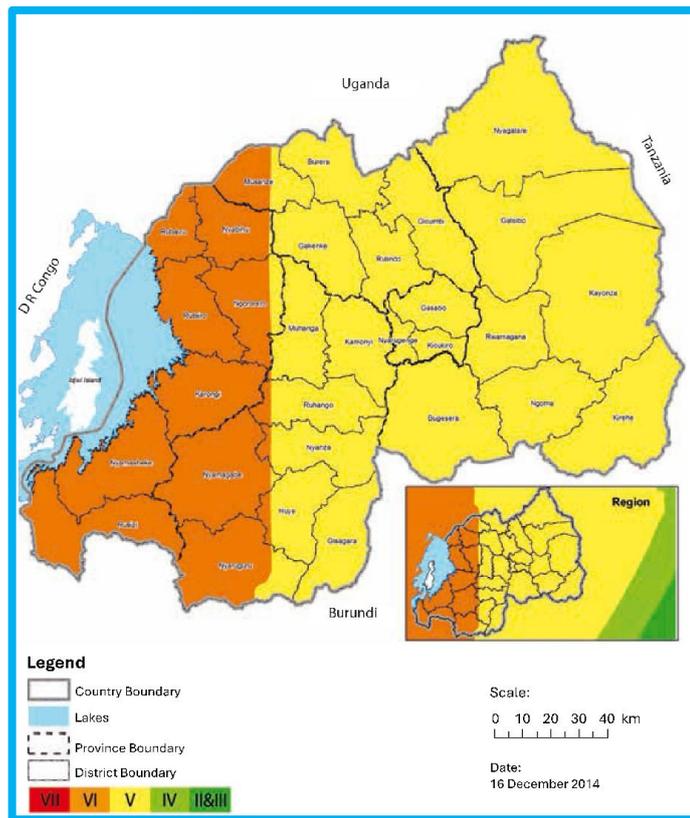
Source: Based on MINEMA. (2015).

Earthquakes

According to MINEMA (2015), the Western Rift Valley of Africa, in general, and Rwanda, in particular, have historically experienced severe destructive shallow earthquakes. The impact of these earthquakes is also steadily increasing as a consequence of the expansion of urbanization and development to earthquake prone areas. Map 4 shows the earthquake hazard zonation map at a 10% probability of exceedance in 50 years. As can be seen, the zones that are located close to the basin of Lake Kivu, that is, in the western part of the country, are more exposed to earthquake hazards. In contrast, the areas farther away from the Rift, i.e., towards the east of the country, have the lower earthquake intensity.⁴²

⁴² MINEMA. (2015). The National Risk Atlas of Rwanda.

Map 4. Earthquake hazard map



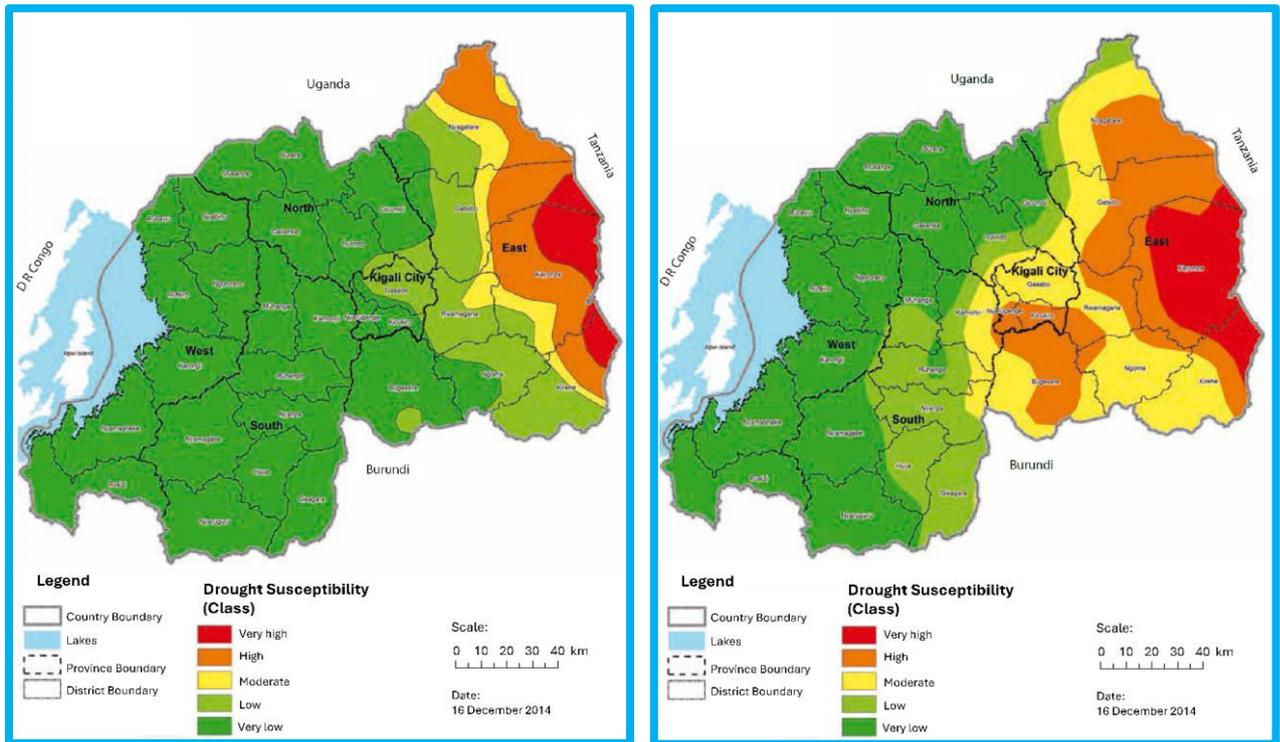
Source: Based on MINEMA. (2015).

Droughts

Regarding droughts, the National Risk Atlas analyses the different factors that influence the occurrence of this hazard. In addition to a deficiency of precipitation, variables such as evaporation, affected by temperature and wind; soil types and their ability to store water; the depth and presence of ground water supplies, and vegetation, are other factors that influence occurrence of droughts. Also, the National Risk Atlas considers three types of droughts that are commonly noted: meteorological, agricultural, and hydrological. And takes into consideration Rwanda's two rainy seasons, that correspond with agricultural seasons: Season A from September until the end of December, and season B, from March to May. Map 5 depicts the drought hazard zones for Rwanda in each of these rainy seasons.⁴³

⁴³ MINEMA. (2015). The National Risk Atlas of Rwanda.

Map 5. Drought hazard map (Season A left - Season B right)



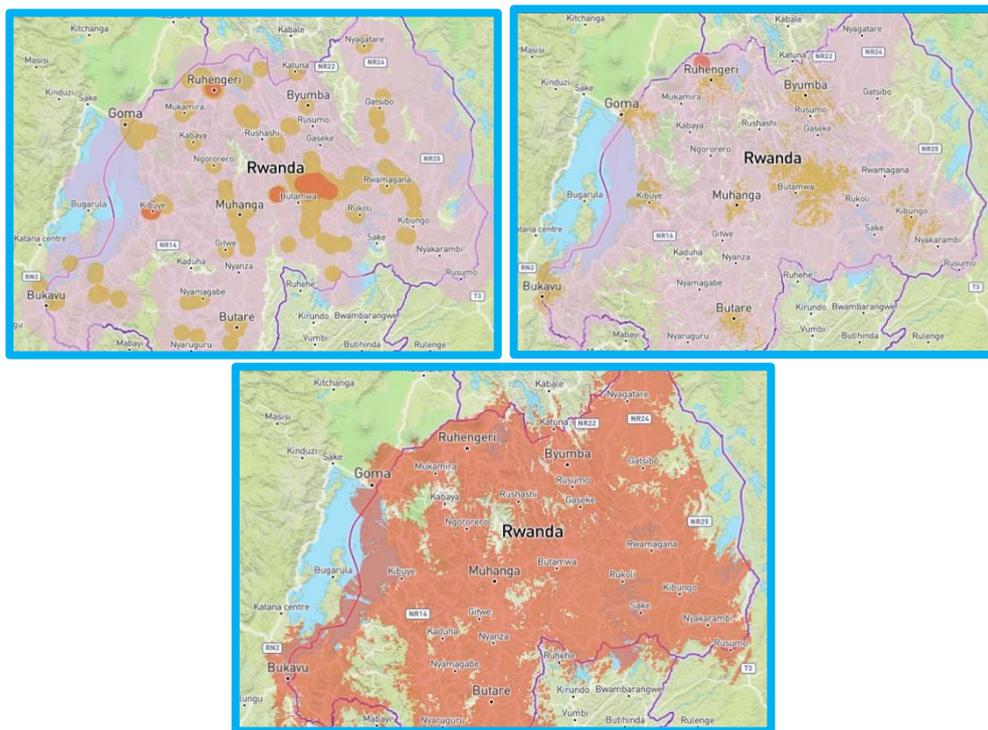
Source: Based on MINEMA. (2015).

ANNEX 2: Mobile Services

Currently there are three mobile operators providing services in Rwanda: MTN Rwandacell Plc (MTN), Airtel Rwanda Ltd (Airtel), and KT Rwanda Networks (KTRN) offering voice and data services.⁴⁴ The number of active mobile subscriptions reported at the end of September 2023 were 12,538,106 SIM cards, representing a penetration of 93%. The active SIM cards connected to the Internet within the last 90 days were 9,294,659, representing a penetration of 69.4%. According to RURA, as of September 2023, 53.9% of mobile Internet subscriptions were detected on 2G networks, while the 29.4% and 16.7%, respectively, were on 3G and 4G networks.⁴⁵ In Rwanda, nearly 98,8% of the population is covered by at least a 3G mobile network.

Both mobile providers, MTN and Airtel, have deployed 2G, 3G and 4G mobile technologies in Rwanda. Map 6 depicts MTN’s and Airtel’s mobile coverage in Rwanda for each technology based on GSMA coverage maps. KTRN offers mobile broadband services in Rwanda over a 4G LTE technology covering nearly 98% of the population (see Map 6).

Map 6. Mobile Coverage* (MTN left - Airtel right - KTRN bottom)



*LTE: red; 3G: yellow; GSM: pink

Source: GSMA, MTN: <https://www.gsma.com/coverage/#321>, Airtel: <https://www.gsma.com/coverage/#4659>, and KTRN: <https://www.gsma.com/coverage/#5815>.

Fixed Services

⁴⁴ Information provided directly by government officials from MINICT, RURA and MINEMA.

⁴⁵ RURA. (2023). Statistics report for telecom, media and broadcasting sector as of the third quarter (July–September) of the year 2023.

Fixed services offered in Rwanda include voice and data services. As of September 2023, fixed voice services offered by four operators⁴⁶ reached a total of 9,175 subscriptions, representing a penetration rate of 0.068% based on population, while fixed Internet services offered by twenty operators⁴⁷ reached a total of 57,559 active subscriptions, representing a penetration rate of 0.43% based on population.⁴⁸

Almost all fixed Internet subscriptions in Rwanda, 99.9%, were broadband speed subscriptions, that is, download speeds greater or equal to 256 kbps as defined by the ITU. However, 89% of fixed broadband subscriptions have speeds equal or above 10 Mbps.

Also, the highest market share of fixed Internet subscriptions, 89%, were through fibre-to-the-home/building technology. Satellite fixed Internet subscriptions have increased considerably in the last year from 32 to 1,679 subscriptions.⁴⁹

Table 5 summarizes some of the main variables related to fixed and mobile telecommunications services in Rwanda.

Table 6. Relevant telecom/ICT sector indicators for Rwanda

Indicator	2018	2019	2020	2021	2022	2023
Fixed-telephone subscriptions per 100 inhabitants	0.1	0.1	0.1	0.1	0.1	0.1*
Mobile-cellular subscriptions per 100 inhabitants	77.4	75.3	80.7	81.0	79.9	93.0
Fixed-broadband subscriptions per 100 inhabitants	0.1	0.1	0.1	0.2	0.4	0.4
Mobile-broadband subscriptions per 100 inhabitants	38.3	41.6	42.2	47.0	60.1	69.4
Population covered by at least a 3G mobile network	96.6	98.9	98.1	98.6	98.8	98.8
Population covered by at least an LTE network	96.6	98.9	98.1	98.6	98.8	98.8

* Rounded from 0.068%.

Source: ITU database. 2023 data based on RURA.

National backbone network

Based in information provided by MINICT, Rwanda has a resilient backbone network with four rings and near 4,500 kilometres (km) of fibre, covering all 30 districts and 12 border points (see Map 7). This wholesale network is run as a public-private partnership owned by the Government and Korea Telecom (KTRN), but access is open to all operators at cost-based prices.

⁴⁶ MTN Rwandacell Plc, Airtel Rwanda Ltd, Liquid Telecom Ltd, and BSC Ltd.

⁴⁷ Six of the twenty ISPs had more than 1,000 fixed Internet subscriptions each, reaching a market share of more than 99%. These operators are: MTN Rwandacell Plc, Airtel Rwanda Ltd, Liquid Telecom Ltd, BSC Ltd, GVA Rwanda and Starlink Rwanda Ltd.

⁴⁸ RURA. (2023). Statistics report for telecom, media and broadcasting sector as of the third quarter (July–September) of the year 2023.

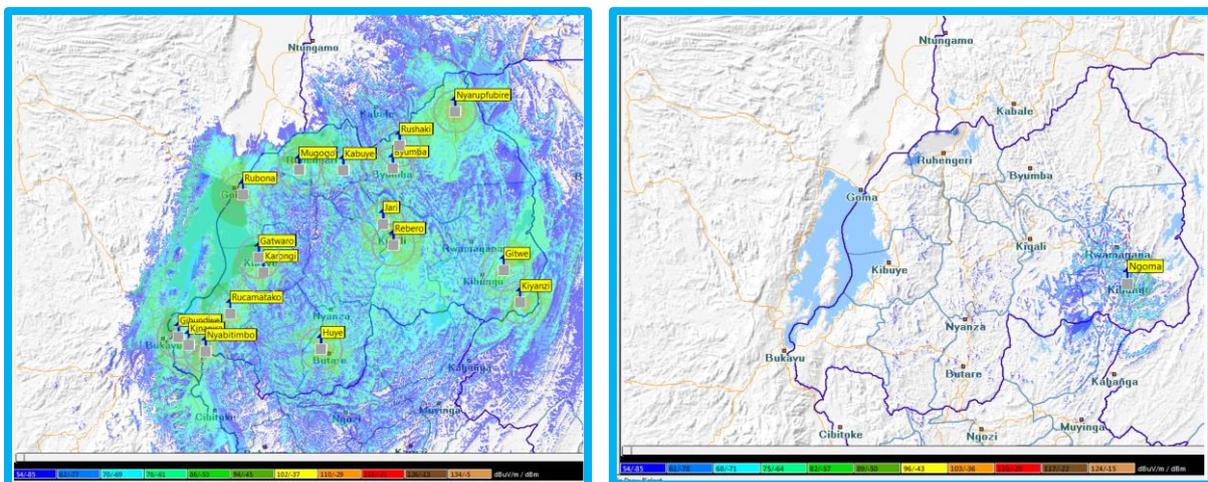
⁴⁹ RURA. (2023). Statistics report for telecom, media and broadcasting sector as of the third quarter (July–September) of the year 2023.

geographical coverage for few community radio TV stations. This coverage has been estimated through software simulations based on general assigned parameters such as antenna height and gain, transmitter power, signal type and propagation model, among others.⁵²

Below, Map 10 shows an example of the coverage of Radio Rwanda, 98% geographical coverage, and community radio, Radio Izuba, 15% geographical coverage.

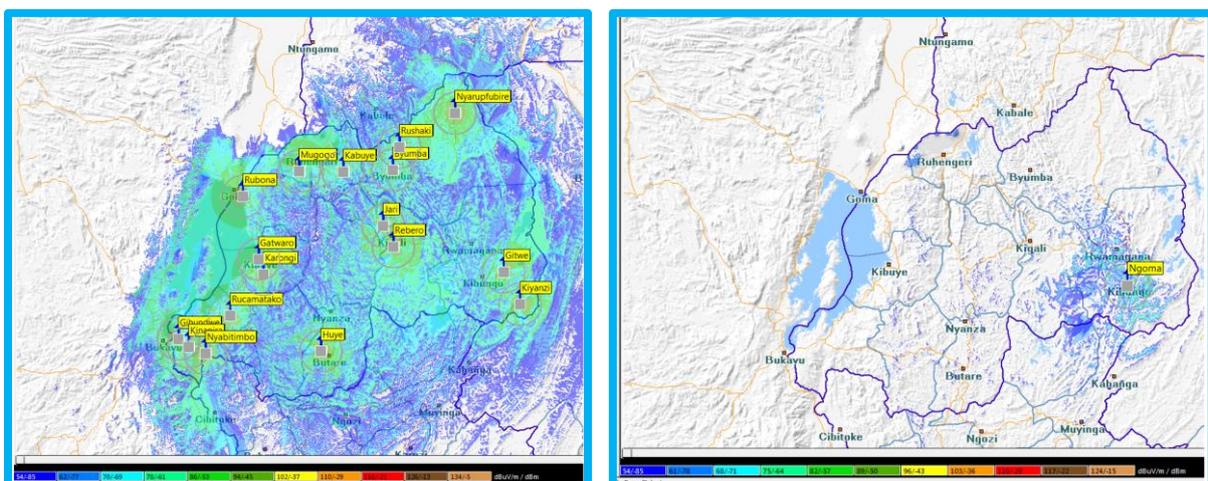
TV stations broadcast using the digital terrestrial television standard DVB-T. As an example, Rwanda Broadcasting Agency (RBA) with 14 transmitters located in 14 sites has a geographical coverage of 80%, while Panafrica Network Group Ltd (Panafrica), with 18 transmitters located in 5 sites, has a geographical coverage of 60% of the national territory (see Map 10).⁵³

Map 9. FM radio stations coverage examples (Radio Rwanda left and Radio Izuba right)



Source: RURA.

Map 10. Digital TV network coverage examples (RBA left and Panafrica right)



⁵² RURA. (2022). List of FM and TV stations operating in Rwanda and their approximate coverage.

⁵³ RURA. (2022). List of FM and TV stations operating in Rwanda and their approximate coverage. Note: Coverage is simulated using ICS Telecom software.

Source: RURA.

Finally, there were 521,404 pay TV subscribers recorded at the end of the third quarter of the year 2023, whereas the active subscribers were only 106,712.⁵⁴

ANNEX 3: Early Warning System

The law on disaster management determines that the MINEMA, together with other organs in charge of disaster management, shall develop a warning system for disasters in order to prevent them and mitigate their effects. They shall also put in place a mechanism for providing the inhabitants of Rwanda with various information related to disasters.⁵⁵

In line with this mandate, MINEMA has published a number of Standard Operating Procedures (SOPs) for the development of Early Warning Systems for five types of hazards: 1. Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE); 2. Floods; 3. Landslides; 4. Storms, and 5. Droughts.

These documents are detailed guidelines for the development of Early Warning Systems in Rwanda, and include not only a complete definition of the hazard in every case, but also an identification of the parameters or factors that trigger the respective hazards in various areas of the country. The SOPs also develop models that determine the probability of each of the hazards to occur across the country, and propose and advise for the required technologies for applying the model, as well as the response system needed. Along with the above, the SOP documents for each of the risks propose the specific responsibilities for the different agencies and actors in Rwanda in order to develop such Emergency Warning Systems.

According to Rwanda's DRM authorities, EWS are being developed by MINEMA and currently used in the case of landslides and storms. These EWS are in their first phase of development, and currently use messages (SMS) and emails for the dissemination of information, but other means of disseminating information will be added in next phases. MINEMA currently uses an SMS platform to disseminate the information.⁵⁶

In the case of landslides, for instance, the SOP developed by MINEMA establishes a protocol for the dissemination of information based on four risk levels: green, yellow, orange and red. These levels are triggered by rain gauge sensors installed in the riskier areas identified. Green awareness level implies the conditions are steel general and safe. On the contrary, yellow awareness level requires vigilance, and imply some landslides events maybe expected. On the orange and red awareness, severe situations are expected and require contingency preparedness.⁵⁷ Figures 3 and 4 depict the warning communication flows from the operational centre to the community for landslide hazards on the different levels of alert, according to the MINEMA's SOPs for landslides.

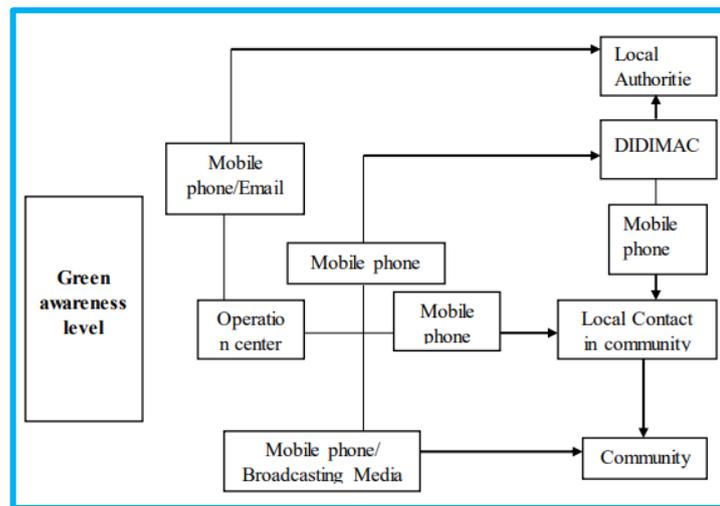
⁵⁴ RURA. (2023). Statistics report for telecom, media and broadcasting sector as of the third quarter (July–September) of the year 2023.

⁵⁵ Law N°41/2015 of 29/08/2015.

⁵⁶ Information provided directly by government officials from MINICT, RURA and MINEMA.

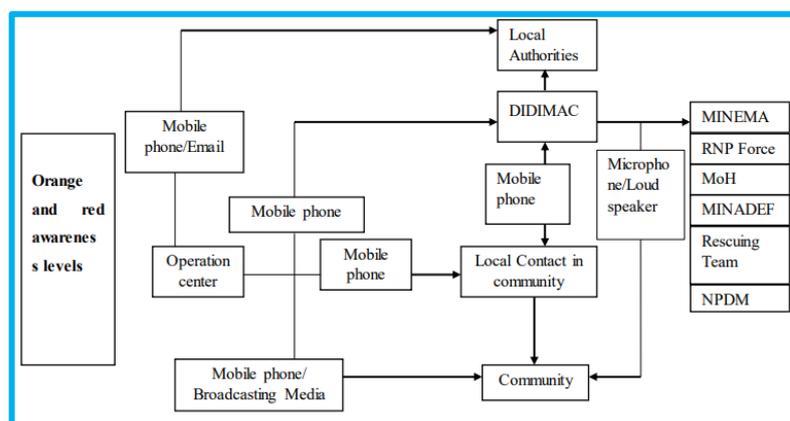
⁵⁷ MINEMA. (2020). Standards operating procedures for landslides early warning system in Rwanda.

Figure 3. Warning communication flows from operational centre to community FOR YELLOW AND GREEN LEVELS



Source: MINEMA. (2020).

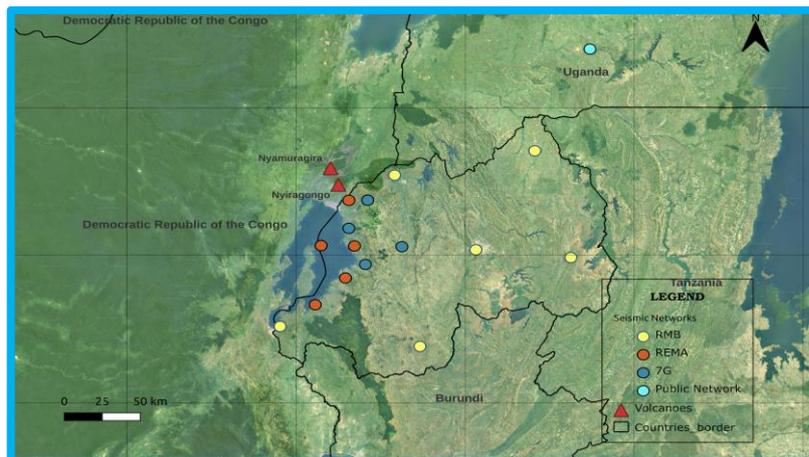
Figure 4. Warning communication flows from operational centre to community FOR ORANGE AND RED ALERT LEVELS



Source: MINEMA. (2020).

In the case of other hazards, such as earthquakes, Rwanda has a seismic network/System to record fast waves of earthquakes using sensors. This network can be used to warn about incoming destructive earthquakes before the waves arrive to inhabited zones.⁵⁸ Map 11 depicts the location of the seismic stations in the country.

⁵⁸ Information provided directly by government officials from MINICT, RURA and MINEMA.

Map 11. Map of Seismic Stations in Rwanda

Source: Information provided directly by government officials from MINICT, RURA and MINEMA.

Early Warning for All (EW4A)

This initiative was launched in 2022 with a newly defined action plan,⁵⁹ and it is based on the multi-hazard early warning system (MHEWS), an integrated system which allows people to know about incoming hazards, and informs how governments, communities and individuals can act to minimize impacts.⁶⁰ The four separate pillars of the MHEWS in which the initiative is based on are:⁶¹

2. Disaster Risk Knowledge: focuses on systematically collecting data and undertaking risk assessments. It seeks to develop knowledge for the community such as their hazards and vulnerabilities, or the patterns and trends of these factors.
3. Detection, observation, monitoring and forecasting of hazards: focuses on developing capacities such as to incorporate an impact-based approach to forecasting; or accessing, analysing and translating prediction model outputs into actionable warning messages, among other elements.
4. Warning dissemination and communication: seeks to ensure that an identified risk and alert can reach those people at risk.
5. Preparedness and response capabilities: building national and community response capabilities, including updated plans, for example, or the community's readiness to react to warnings, among others.

In relation to the third pillar, the ITU highlights the use of multichannel dissemination alerting (including radio, TV, sirens, Internet, social media, etc) and the opportunities that the spread of ICTs provide in reaching more people.

Today, the reach of mobile networks is growing and increasingly becoming an important communication channel to deliver alerting messages to people at risk.

⁵⁹ Available at: https://library.wmo.int/index.php?lvl=notice_display&id=22154#_Y9PG2nZByM9 (Accessed: 1 February 2024).

⁶⁰ WMO. (2022). Early Warnings for All: Executive Action Plan 2023–2027 (The UN Global Early Warning Initiative for the Implementation of Climate Adaptation).

⁶¹ WMO. (2022). Early Warnings for All: Executive Action Plan 2023–2027 (The UN Global Early Warning Initiative for the Implementation of Climate Adaptation).

Therefore, an efficient mechanism for emergency authorities to use is sending one-touch notifications to cell phones in disaster affected areas. Alert messages can be communicated and formulated in a way that those who receive it can understand and act on the alert, using a standardized and consistent format such as Common Alerting Protocol (CAP).

ITU highlights the use of multichannel dissemination alerting (including radio, TV, sirens, Internet, social media, etc.) and the opportunities that the spread of ICTs provide in reaching more people (i.e. increased mobile broadband networks and ownership of mobile devices). One key advantage of disseminating alerts through mobile networks is that these networks are geo-located, so warnings can reach only those users located in a specific risk zone. Also, this communication technology (called cell-broadcast, and often complimented with location-based SMS) allows for warnings adapted to specific user requirements, such as a certain language, among other possibilities. This is a proven technology already used by almost all developed countries, and may be useful and effective too in countries like Rwanda, with a relatively high mobile penetration (see section 6).

Cell broadcast and location-based SMS

Since currently there are mainly two technologies that can be implemented on a PWS using mobile networks, it is important to do a comparison between the two, cell broadcast service (CBS) and location-based SMS (LB-SMS). Table 8 presents a comparison between CBS and LB-SMS on specific characteristics.

Table 8: CBS and LB-SMS comparison

Characteristic	Cell broadcast Service	Location-Based SMS
	(CBS)	(LB-SMS)
Mobile networks supported	2G, 3G, 4G, 5G	2G, 3G, 4G, 5G
Devices supported	Smartphone and feature phones	Smartphone and feature phones
Transmission type	Point-to-area messaging (broadcast)	Point-to-point messaging
Bi-directionality	Indirect (message should include a URL or web links or number to reply)	Direct (users can respond to the sender via SMS)
Geographic alerting capability	Inherent to the technology	Needs a Mobile Location Center (MLC) for location-based capability
Alert dissemination	Most devices in the region of interest will receive the alert	Subscription needed (SIM)
Visitor devices (roaming)	Alert messages are received by visitor devices	Roaming agreements needed, rate might be charged

