



# **Building a Resilient Industry: How Mobile Network Operators Prepare for and Respond to Natural Disasters**

An Interactive Guide for MNOs Based  
on Experiences with the Humanitarian  
Connectivity Charter



## GSMA Mobile for Humanitarian Innovation

The GSMA represents the interests of mobile operators worldwide, uniting more than 750 operators with almost 400 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces the industry-leading MWC events held annually in **Barcelona**, **Los Angeles** and **Shanghai**, as well as the **Mobile 360 Series** of regional conferences.

For more information, please visit the GSMA corporate website at [www.gsma.com](http://www.gsma.com)

Follow the GSMA on Twitter: [@GSMA](https://twitter.com/GSMA)

**Zoe Hamilton**, Insights Manager,  
GSMA Mobile for Humanitarian Innovation

**Dulip Tillekeratne**, Senior Market Engagement Manager,  
GSMA CleanTech

The GSMA Mobile for Humanitarian Innovation programme works to accelerate the delivery and impact of digital humanitarian assistance. This will be achieved by building a learning and research agenda to inform the future of digital humanitarian response, catalysing partnerships and innovation for new digital humanitarian services, advocating for enabling policy environments, monitoring and evaluating performance, disseminating insights and profiling achievements. The programme is supported by the UK Department for International Development.

Learn more at [www.gsma.com/m4h](http://www.gsma.com/m4h) or contact us at [m4h@gsma.com](mailto:m4h@gsma.com)

Follow GSMA Mobile for Development on Twitter: [@GSMAM4d](https://twitter.com/GSMAM4d)



This document is an output of a project funded by UK aid from the Department for International Development (DFID), for the benefit of developing countries. The views expressed are not necessarily those of DFID.

## ABBREVIATIONS

<b>BCM</b>	Business Continuity Management	<b>EHS</b>	Environment, Health and Safety	<b>NDR</b>	Network Disaster Recovery
<b>BCP</b>	Business Continuity Plan	<b>EWS</b>	Early Warning System	<b>NOC</b>	Network Operation Centre
<b>BTS</b>	Base Transceiver Stations	<b>HCC</b>	Humanitarian Connectivity Charter	<b>SMS</b>	Short Message Service
<b>CAP</b>	Common Alerting Protocol	<b>HR</b>	Human Resources	<b>SOP</b>	Standard Operating Procedures
<b>CBS</b>	Cell Broadcast System	<b>ICS</b>	Incident Command Structures	<b>TSF</b>	Télécoms Sans Frontières
<b>CDR</b>	Call Detail Records	<b>IT</b>	Information Technology	<b>UN</b>	United Nations
<b>CEO</b>	Chief Executive Officer	<b>ITU</b>	International Telecommunications Union	<b>UN OCHA</b>	UN Office for the Coordination of Humanitarian Affairs
<b>CMT</b>	Crisis Management Team	<b>IVR</b>	International Voice Response	<b>UPS</b>	Uninterruptible Power Source
<b>COLT</b>	Cell on Light Truck	<b>KYC</b>	Know Your Customer	<b>VHF Radio</b>	Very High Frequency Radio
<b>COW</b>	Cell on Wheels	<b>MNO</b>	Mobile Network Operator	<b>VSAT</b>	Very Small Aperture Terminal
<b>CSR</b>	Corporate Social Responsibility	<b>NET</b>	National Emergency Telecommunication	<b>VR</b>	Virtual Reality
<b>DEWN</b>	Disaster and Emergency Warning Network	<b>NGO</b>	Non-Governmental Organisation	<b>XML</b>	Extensible Markup Language
<b>ETC</b>	Emergency Telecommunications Cluster				

# Contents

<b>Introduction</b>	2
Humanitarian relief and the mobile industry	5
Using this guide	5
<b>Internal impact</b>	6
Business Continuity Management (BCM)	6
Disaster management team structure and preparation	8
Staff safety and well-being	14
Access and transport	16
Infrastructure	20
Core networks and network equipment	22
Power systems-related preparedness plans	28
<b>Direct external impact</b>	32
Supporting customers	32
Suppliers and managing supply chains	38
Policymakers and supporting national disaster response systems	40
<b>Indirect external impact</b>	50
Coordination with responders	50
Working with other MNOs	56
Additional humanitarian support	58
<b>Case studies</b>	60
KDDI and NTT DOCOMO (Japan)	62
Digicel Group (Caribbean)	64
<b>Conclusion</b>	66
<b>Additional resources</b>	68



# Introduction

Since the birth of the mobile industry in the early 1970s, there has been a significant increase in the number and frequency of natural disasters. The [United Nations estimates](#) that disasters affect 350 million people every year and cause billions of dollars of damage and the situation is unlikely to improve as the effects of climate change intensify.

At the same time, the world is increasingly connected through mobile communications—two thirds of the global population, [5.1 billion people](#), are mobile subscribers. **In this largely networked, globalised society, information communications and mobile technology have become a lifeline during natural disasters for governments, humanitarian organisations and individuals alike.**

Since 2012, the GSMA has been working with Mobile Network Operators (MNOs) and policymakers as they navigate disasters and crises.<sup>1</sup> In 2015, the GSMA launched the [Humanitarian Connectivity Charter \(HCC\)](#), an industry initiative to support MNOs in providing improved access to communication and information for those affected by crisis in order to reduce loss of life and positively contribute to humanitarian responses. This guide highlights lessons that the GSMA and MNOs have learned in preparing for and responding to sudden onset natural disasters.

<sup>1</sup> A “disaster” is a situation where widespread human, material, economic or environmental losses have occurred and exceeded the ability of the affected organisation, community or society to respond and recover using its own resources. A “crisis” is a situation with high level of uncertainty that disrupts the core activities and/or credibility of an organisation and requires urgent action.

## Overview of this guide

This guide highlights industry best practices and lessons learned to help the wider mobile ecosystem better prepare for sudden onset natural disasters. Structured into 13 operational areas, it focuses primarily on the key phases and steps involved in preparing for and responding to disasters. The primary audience for this guide is MNOs that are beginning to think through their disaster response plans and are looking for guidance on how to improve their preparedness and response.

Within each operational area, on the guide covers:

- **the potential risks** MNOs should consider;
- **key considerations** for MNOs when preparing for and responding to disasters; and
- **examples** of challenges and solutions MNOs have experienced in these areas.

The measures MNOs can take will vary considerably depending on the local context and circumstances. However, the information in this guide can help MNOs consider a range of potential measures and initiatives.

The 13 operational areas are divided into three overarching sections:




### A. Internal impact

Includes information on what MNOs can do to make their core operations more resilient.

1		<b>Business Continuity Management</b>	Overall planning and how MNOs can create structures to analyse risks and ensure continuity of services.
2		<b>Disaster management teams</b>	Designating individual and team responsibilities and training staff to respond appropriately during a disaster.
3		<b>Staff safety and well-being</b>	Ensuring staff are safe and provided for during a disaster.
4		<b>Access and transport</b>	Ensuring key sites can be reached for restoration activities.
5		<b>Infrastructure</b>	Building resilience into infrastructure.
6		<b>Core network and equipment</b>	Building resilience into an MNO’s core network and network equipment.
7		<b>Power systems</b>	Preparing backup power sources and securing the required inputs, such as fuel.




## B. Direct external impact

Provides key considerations and experiences related to operational areas and stakeholders that are external to the MNO, but have a direct impact on operations. MNOs will be obliged to work closely with these groups to prepare for and respond to disasters.

8		<b>Supporting customers</b>	Providing support to subscribers.
9		<b>Suppliers</b>	Coordinating with relevant suppliers and ensuring supply chains are resilient.
10		<b>Policymakers</b>	Working with sector regulators and other policymakers to ensure an enabling regulatory environment. This section also includes information on supporting government emergency response measures, like early warning systems.

## C. Indirect external impact

Includes recommendations and experiences related to operational areas and stakeholders that are not directly linked to the operations of the MNO. In most cases, MNOs can choose to support and work closely with this wider ecosystem.

11		<b>Coordination with responders</b>	Coordinating with and supporting humanitarian responders.
12		<b>Working with other MNOs</b>	Coordinating with other MNOs to share resources or information during disaster response.
13		<b>Additional humanitarian support</b>	Providing direct humanitarian support to the wider community, beyond the MNO's direct customer base.

## Humanitarian relief and the mobile industry

In the immediate aftermath of a natural disaster, humanitarian responders and affected populations urgently need information to react quickly to changing circumstances and make decisions. Access to information [has been described](#) as being as important as access to food, water, medicine and shelter. [Today](#), MNOs have a responsibility to not only protect business interests during disasters, but also to facilitate communication around relief efforts and support both their subscribers and the wider community.

In March 2015, after two years of consultation, the [Humanitarian Connectivity Charter \(HCC\)](#) was launched to support MNOs in improving disaster preparedness, resilience and coordination with the humanitarian sector. The Charter consists of a set of shared principles adopted by key players in the mobile industry, and endorsed by prominent humanitarian organisations, to support improved access to communication and information for those affected by crisis to reduce loss of life and positively contribute to humanitarian responses.

The three principles of the Charter are:

- to enhance coordination within and among MNOs before, during and after a disaster.
- to scale and standardise preparedness and response activities across the industry to enable a more predictable response.
- to strengthen partnerships between the mobile industry, government and the humanitarian sector.

There are currently 156 MNO signatories of the HCC operating in over 108 countries. More information about the HCC can be found on the [Humanitarian Connectivity Charter website](#). While the principles of the HCC extend more broadly to humanitarian crises, this guide focuses on lessons drawn from MNOs experiences in preparing for and responding to sudden onset natural disasters.

Watch Video



## Using this guide

At the request of stakeholders, and through consultations with signatories of the HCC, this guide was created to assist MNOs that are beginning to plan and create disaster preparedness and response mechanisms. Of course, the contexts in which MNOs operate around the world are very different, both in terms of geographical risks and the scale of operations and budgets available for disaster preparation. Therefore, this guide does not make specific recommendations for procedures or budgets. Rather, it outlines key considerations for MNOs developing contextualised protocols.

In each section, these considerations are followed by examples of how MNOs have implemented these protocols in their markets. This guide is not intended to be read from front to back — different sections will be relevant to different departments as plans are developed. The final section of the guide includes [case studies](#) of the disaster preparedness and response measures of three MNOs: KDDI and NTT DOCOMO in Japan and Digicel Group in the Caribbean.

This guide provides an overview of disaster preparedness and response activities in 13 operational areas. A comprehensive list of additional resources that could also be useful are included at the [end of the guide](#).

# Internal impact

This section outlines what MNOs can do to build internal resilience and capacity to respond to events that could have a negative impact on core operations and network restoration.



## Business Continuity Management (BCM)

### Introduction

MNOs encounter a variety of risks when disaster strikes. Depending on the type, scale and location of a natural disaster, MNOs can suffer severe losses to assets and revenues. **However, investing in preparation can result in significant savings.** Of course, the cost of preparation must be weighed against the likelihood of a disaster and the level of risk an MNO might face, and this will vary considerably between MNOs. For all MNOs, Business Continuity Management (BCM) planning provides a framework for preparing for and responding to disasters. Having a business continuity plan (BCP) enables an MNO to continue operations under adverse conditions, as appropriate resilience strategies and recovery objectives can be built into existing business operating and regulatory frameworks. While several of the following sections include elements that could become part of a BCP, this section focuses on how MNOs can use a BCM framework to develop their plan.

### Key considerations

**BCM planning can provide a structure for overall planning, as well as outline specific roles and responsibilities for staff.**

The goal of a **business continuity plan (BCP) is to reduce friction and provide clarity and flexibility during a disaster.** The GSMA report, [Business Continuity Management: Planning for Disaster Resilience in Mobile Networks](#), provides details on areas for MNOs to consider when developing a BCM plan, along with examples. However, even the best laid plans will not be sufficient given the unpredictability of sudden onset disasters. **Therefore, BCM plans must allow for innovation and flexibility as conditions and circumstances change.**

#### BCM planning is typically divided into five stages:

1. **Assessment:** MNOs assess risks, including specific vulnerabilities and hazards, internal capacity assessments, impact evaluation and criticality determination. This assessment helps to identify focus areas for planning and resourcing.
2. **Planning:** based on the requirements identified in the assessment, create a BCP to restore and maintain the business in times of crisis.
3. **Action/Build:** implement the BCP within the organisation and with key stakeholders (e.g. energy suppliers, [see section 8](#)), identify and train key staff and develop processes.
4. **Simulate/Test:** regular simulations are needed to test BCPs. This should be a mix of internal and external simulations with relevant government authorities and [humanitarian responders](#).
5. **Update:** regularly review and update the BCP based on lessons from simulations or actual experiences. The BCP should be tested using an iterative approach.

### MNO experiences

The following are examples of situations, challenges and solutions MNOs have experienced, and may offer insights for MNOs working in other contexts.

- **Jawwal (Palestine)** created its BCP with the help of external consultants. Together, they identified risks and critical functions that would need to be considered in an emergency and identified personnel to be included on the emergency team. From the core network to IT, staff from across different departments were identified and trained in various protocols. Jawwal is based in the Palestinian territories and faces unique political risks. Some of its core locations are in Jordan, the UK and Israel, so extra planning was required to implement geo-redundancy.
- **Zain Group** engages in BCM planning at the group level using standardised templates and procedures customised at the operating company (opco) level. Some elements remain the same while others are adapted to local risks. Group-level representatives visit opcos annually to review the top risks. When a full disaster plan is not feasible, mitigating controls are put in place. Within opcos, responsibilities are assigned and champions identified across departments. These roles are incorporated in performance assessments to make this work mandatory.



## Disaster management team structure and preparation

### Introduction

Having trained crisis management teams in place can prevent chaos after a disaster. Without clear and established structures, roles and responsibilities, an effective response will be challenging. These roles need to be practiced through drills and simulations to ensure staff are fully prepared.

*“Every manager in the crisis team must keep their managerial, specialist and technical skills up to date. It is also fundamental to develop the personal and behavioural characteristics that people called on to act in an emergency need to have: balance, self-control, multitasking, lucid and rapid decision-making, problem solving, but also willingness to intervene at any time of the day or night to deal with long periods of stress.”*

– TIM, [Italy Earthquake Response](#)

### Key considerations

**Create a core crisis management team that includes senior executive and department heads.**

The Crisis Management Team (CMT) should consist of key executives, supporting players and heads of departments to provide a cross-cutting view of the organisation. Each should have defined roles and responsibilities for implementing the crisis management plan. The **CMT should be selected based on business function, leadership skills and ability to work in high-pressure environments. Working groups should be responsible for critical functions and include key personnel and be responsible for the communication channels.** Larger MNOs in areas particularly prone to disasters may want the CMT to be full-time staff.

**Clear roles, chains of authority and communication channels must be determined in advance.**

Staff must be aware of what is expected of them when the BCP is activated, and a hierarchy of decision making should be in place to avoid confusion. This includes clear decision-making authority and escalation points, where necessary. Key focal points responsible for communicating with relevant [government agencies](#), humanitarian [responders](#) and [MNOs](#) should also be identified in advance to avoid duplication in communication.

**Align Incident Command Structures.**

Understand the Incident Command Structures (ICS) across responder teams, operators and key stakeholders, where possible. Whether it is NIMS in the US or UK Gold, Silver and Bronze, understanding these structures and terminology, and aligning them where possible, can reduce response times and build trust and understanding between teams.

**Guidelines need to be clear for field staff who will be facing new and potentially dangerous situations.**

If employees need to travel to field sites, it is important that they are trained in safety measures and working in disaster situations. They must know what identification is required to access sites and what transportation options are available. Network engineers and staff deployed to evaluate sites may not have worked in emergency situations before, and while they may be able to assess damage to equipment they may not be aware of risks to their own safety. Training and guidelines can help field staff prepare to navigate decision-making processes in high-stress environments, and could also include psycho-social training to support work in disaster zones.

**Ensure there are clear instructions for non-critical employees on how to contribute.**

Non-critical employees can play indirect support roles. Information on how they can support or contribute should be available in advance or clearly communicated during a disaster, if possible.

**Practice, training and testing are vital to ensure staff are prepared and plans are functioning properly.**

Critical employees need to be well trained and tested in simulations to determine their ability to respond to difficult environments. Exercises should assess, in a safe environment, whether BCPs and emergency response plans are fit for purpose. These exercises can help to identify gaps in planning and test whether individuals understand their roles. Drills can be as simple as **table-top exercises**, or teams discussing what their responses would be in a variety of scenarios. A slightly more time-consuming test is a **technical simulation**, which creates certain conditions for a group to rectify. Finally, a **complex simulation** can be a practical, real-time, multi-agency and multi-MNO exercise spanning several days. Simulations can be run with little or no notice for employees to accurately evaluate their responses under pressure.

Of course, none of these measures will fully prepare staff for a disaster, but simulations can provide a framework for a response. Multi-agency simulations in particular have the benefit of demonstrating how different organisations would respond and how to coordinate plans. **A full debrief is required after simulations to ensure that outcomes are incorporated in disaster response plans.** Planning should be an agile process developed over time as new technologies, procedures and lessons are incorporated.

**External experts can be brought in to manage key functions in a disaster situation, if necessary.**

If it is decided that external experts, such as vendors or group-level personnel, may need to be deployed, this should be coordinated in advance with immigration requirements in place. Emergency personnel like network engineers or riggers may be needed to evaluate and restore sites, and will likely need to be identified in advance and undergo psycho-social training to support work in high-stress situations.

## MNO experiences

The following are examples of situations, challenges and solutions MNOs have experienced, and may offer insights for MNOs working in other contexts.

### Team roles and structures

- **Telefonica** has a Foundation that oversees humanitarian responses. Volunteer staff members with identified technical expertise are flown from headquarters into affected disaster areas to work with local volunteer staff.
- **Smart (Philippines)** has put local sales teams in charge of local disaster response, since they best understand the realities on the ground.

*"They lead us to the areas for emergency relief support. They are closest to the ground, sales people have links with local government officials so they can coordinate with them, find out which areas are most affected and need relief. That's been the key for us. We see our role as developing best practices and installing them in the parts of the organisation where they are best positioned. It also makes commercial sense for our sales people to do this and builds ties with local community and government. The practical reason is that they are the closest to the ground. If you equip them, they are the best people to respond."*

– Smart Philippines

- The CEO of **Ncell (Nepal)** was out of the country during the 2015 Nepal earthquake, but stayed in close touch with the team to support them. The Deputy CEO was granted local execution rights within two hours of the disaster. **Contingencies and delegated responsibilities help to clarify responsibilities and the chain of command in a changing and unpredictable situation.**
  - **C&W (Antigua and Barbuda)** has regional and local crisis management teams in place. When the 2017 Atlantic hurricanes hit, a "war room" was set up in Antigua that served as a logistics hub for the region. Frequent and efficient communication was maintained with sites, and from the war room C&W could ensure staff were supported, food and water provisions were organised, assets were
- protected, generators were refuelled and vehicles were moved to strategic areas of the affected islands. Since then, it has further streamlined its disaster management and response procedures to cover the entire footprint of Liberty Latin America, which owns C&W, across the Caribbean and Latin America. These procedures have been successfully activated to respond to events including earthquakes and civil unrest across the region, most recently Hurricane Dorian in the Bahamas and civil unrest in Chile in late 2019.
- **Digicel Group** has set up a crisis management team (CMT) comprised of technical operations, human resources (HR), communications, supply chain management and customer service teams. At the group level, Digicel manages and works with teams on different islands to ensure they are prepared to respond to natural disasters. The CMT was initially set up to manage threats related to hurricane season, but it has now become a permanent team that operates throughout the year. When a hurricane approaches an island, a nearby transit island is identified and Digicel works closely with staff there to prepare. In most cases, the time between initial alert and landfall is one to five days.
  - **AT&T** has a core team of full-time staff members in its **Network Disaster Recovery (NDR) team** and over 100 people in its emergency management volunteer team, which is responsible for business continuity in emergencies. The permanent NDR team is divided into functional groups, but often works across several functions. The part-time volunteer team is comprised of staff with different skills from across the company (network engineers, IT staff, corporate real estate and HR) and ensures the NDR team is equipped with expertise in all areas.

## Simulations and drills

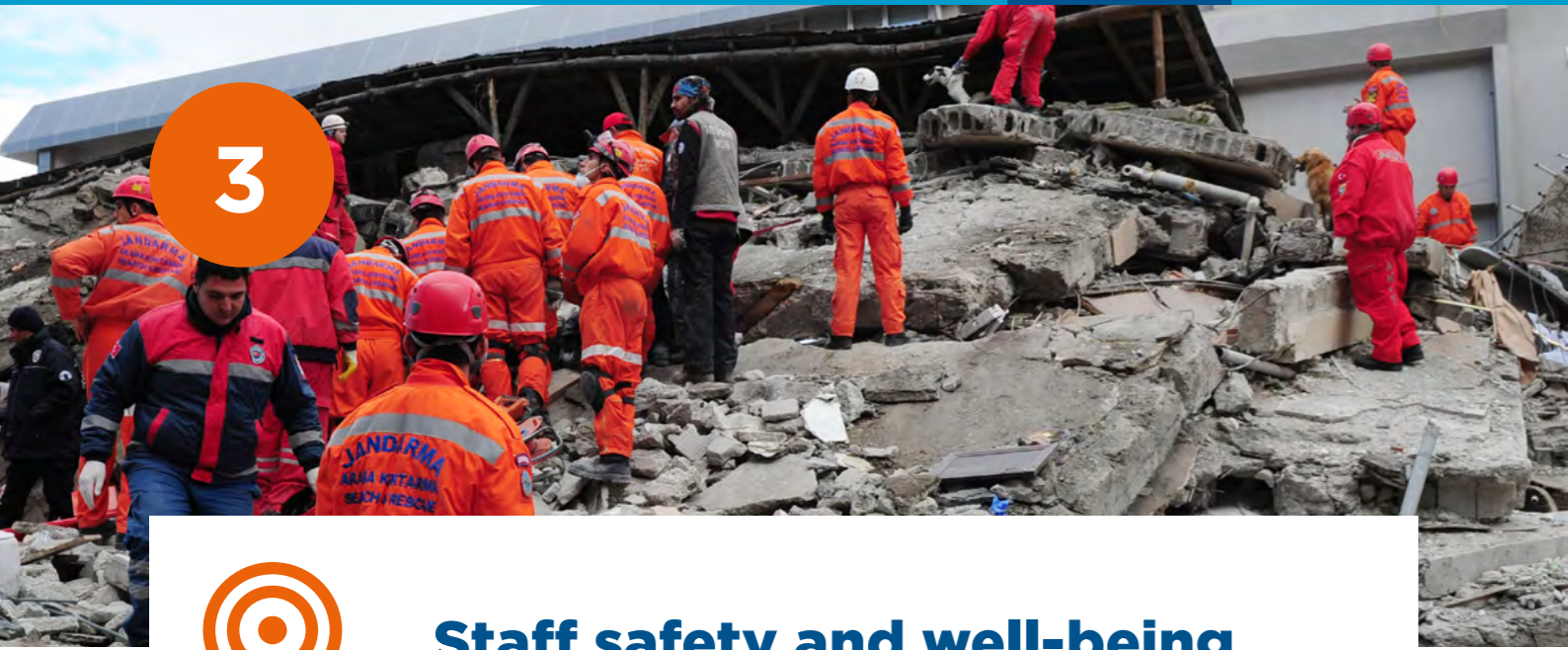
- **Globe and Smart (Philippines) conduct at least one integrated simulation exercise every year.** In 2014, the Metro Manila Development Authority conducted its first annual drill of the Metro Manila Earthquake Preparedness Plan. The Metro Manila Shake Drill, popularly known as the #MMShakedrill, is typically held every July, and all Globe offices in and around Metro Manila have participated. The drill includes a simulation of Globe's Crisis Management Plan with a special focus on the Earthquake Response Plan. In 2019, Globe participated in the Office of Civil Defence's quarterly earthquake drills, which are held in different areas of the country. In the last two years, it has tested a variety of scenarios, including:
  - Activation of crisis command centres in and outside metro Manila;
  - Set-up of temporary shelters for Globe employees;
  - The ability of critical suppliers to provide support to Globe;
  - Coordination with private and public partners on disaster management;
  - Coordination with local and national government on disaster response requirements;
  - Use of emergency communication tools (e.g. satellite phones, VHF radios, alternate SIMs); and
  - Deployment of emergency communications equipment to critical government installations.

**AT&T has held over 75 disaster recovery exercises** since 1993. Each drill typically lasts about 10 days. NDR exercises usually take place in an open parking lot, but have also been held on city streets (Phoenix, USA), vacant urban land (St. Louis, USA), open fields (Arlington, USA) and inside halls (Paris, France 2014). The drills have been held in a variety of weather conditions: 100+ degree Fahrenheit heat (Denver, USA), 95-degree Fahrenheit heat plus humidity (Arlington and Tampa, USA), and 24 inches of snow (Salt Lake City, USA). Working through real-world variables ensures the team is prepared for a response anywhere at any time of the year. Over the course of two to five days, an empty lot is transformed into a modern telecommunications network office, replicating the steps that would be followed in an actual response, from establishing incident command to track the movement of assets and people, to positioning trailers, to setting up and turning on power facilities, cabling and technologies, to establishing crew facilities, medical services, security and environmental, health and safety (EHS) stations.



- Japanese MNOs **KDDI** and **NTT DOCOMO** conduct comprehensive staff drills in collaboration with law enforcement. As designated public corporations, KDDI and NTT DOCOMO are responsible for strengthening integrated disaster prevention and restoration activities between government and private organisations, and drills are one of the requirements. KDDI runs internal drills twice a year and occasional comprehensive drills with the government, municipalities and Self-Defence Forces. The NTT DOCOMO team also conducts thorough simulation exercises for staff. Some of its disaster prevention training activities can be viewed [here](#).
- **Digicel Group** runs a comprehensive preparedness programme in all markets ahead of the hurricane season. Every year, one or two markets are targeted for an additional intense simulation exercise. Markets that are not selected for the simulation complete training modules, such as desk-based simulations. All markets undergo regular checks.





## Staff safety and well-being

### Introduction

In the wake of a disaster, the safety of staff is a top priority. **It is important to be able to account for the whereabouts and well-being of staff, and ensure they are familiar with protocols to make operations run smoothly throughout the recovery period.**

### Key considerations

**Have a plan to communicate with staff to confirm their safety and whereabouts.**

MNOs should have standard operating procedures (SOPs) in place to communicate with their staff and confirm their safety and whereabouts following a disaster. Employees may be affected, traumatised, hurt or outside their normal place of residence. **Clear protocols should be established so that employees know what to do and when.** They should be trained on how to check in, know the primary and backup channels for staff communication and key points of contact. This could include a dedicated app for staff communication, SMS or rally points at physical locations. **Some MNOs have developed apps with staff-specific functionality, including outage maps, hazard assessment methods, contact numbers and relevant processes.** This type of app could also provide early disaster warnings for staff and track their locations if an emergency evacuation is necessary.

**When staff homes and families are affected, MNOs can plan ahead to ensure shelter and provisions are available and that staff can work remotely, if necessary.**

MNOs can make arrangements to ensure staff can work flexibly, from home or remotely, if their function is critical and their home or family has been affected. If staff are required to come into work, MNOs can make provisions for families to join them. MNOs should make it clear to staff what provisions will be made for their families, such as food and water, communication channels and shelter.

**Providing psychological support and maintaining morale can help staff during prolonged recovery periods.**

MNOs can take steps during recovery and restoration periods to ensure staff morale and motivation remain high, especially in a prolonged crisis. This could include counselling services or activities to comfort staff and families. Staff support activities should be documented and planned in advance.

### MNO experiences

The following are examples of situations, challenges and solutions MNOs have experienced, and may offer insights for MNOs working in other contexts.

- **Celcom (Malaysia)** has developed an app that enables staff to confirm they are safe and pin their location. Celcom also arranges and covers hotel stays for staff who lose their homes in disasters.
- **Smart (Philippines)** has developed an app for staff that provides two-way messaging services, which is particularly useful during disasters. The mobile app has a button to mark individuals as safe and, if not, to request help. In extreme cases, the app can be used to request evacuation. The app also sends out bulletins with updates on the current situation. If enough warning is possible and the storm is predicted to be extreme, **Smart** will recruit outside expert consultants, as local teams will need to look after their families.
- **Digicel Group** ensures it is ready to close its offices before a disaster strikes, enabling staff to focus on taking care of their families and homes. In many islands affected by the 2017 dual hurricanes, the Digicel senior management team went above and beyond HR policies to ensure that staff were looked after and provided extra fuel allowances, not only to travel, but also to use for generators in their homes. Digicel also built up stocks in its main office four weeks before the hurricane, bringing in food supplies and setting up kitchens with stoves and tinned foods. It also had the capacity to accommodate key staff with beds, a 1,000-gallon water tank and two generators.

4



## Access and transport

### Introduction

In the immediate aftermath of a natural disaster, it is imperative that network engineers and riggers can access key sites to assess damage and repair or replace equipment. Infrastructure can be spread over large areas, including in remote or rural areas that may be difficult to access in the best of times. During an emergency, disruptions to normal transportation links and obstacles created by extreme weather can pose additional barriers. Roads might be blocked due to debris or flooding, fleets could be damaged and restrictions placed on travel. **It is critical to map out the possible obstacles to accessing key sites and make arrangements with transportation providers and relevant authorities in advance.**

### Key considerations

#### Identify new and unconventional transportation methods and partners.

This could include all-terrain vehicles, chartered planes, helicopters or boats, depending on the local geography and common natural hazards.

It is important for MNOs to consider the different types of disasters that could happen in their zones of operations and how these might affect access to critical sites. Vulnerable sites include those located in low-lying or coastal areas at risk of flooding, or those in particularly hard-to-reach areas, such as mountainous regions.

In more severe disasters, it might be necessary to consider alternative transportation methods and partnerships, including those that could provide access to more isolated areas, like humanitarian responders or government officials.

#### Arrange priority access with relevant authorities in advance and/or arrange to share emergency transport facilities to improve the efficiency of the response.

Ensure that relevant authorities have agreed to priority access and ensure these arrangements are embedded in the [National Emergency Telecommunication \(NET\) plan](#), if the country has one in place.

#### Depending on the location, some sites may require armed security to visit and protect resources.

In the wake of a disaster, desperate populations may turn to looting and unrest. MNOs may want to consider what security measures would be necessary to protect assets.

#### Communicate with key suppliers about their access and transportation plans and permissions, if necessary.

Key suppliers, for example, for network equipment or fuel for generators, should also be identified and communicated with to ensure they have thought through their disaster preparedness plans. This may include their ability to transport key pieces of equipment and fuel to critical sites.



**MNOs can work with governments and humanitarian organisations before a disaster to identify critical areas for network coverage.**

It is prudent to identify these sites and assess transportation links in advance, while recognising these may change in an actual disaster.

After a disaster, sites are restored based on accessibility, feasibility, transportation options, equipment availability, population density and humanitarian need. For example, hospitals and key government sites will have acute communication needs. It is therefore important to assess the transportation and access options available within existing regulations and which sites to prioritise (in addition to key network sites). **A list of critical sites for humanitarian assistance** (e.g. hospitals, key government facilities, humanitarian staging areas, evacuation/gathering hubs) **should be developed in advance with governments and humanitarian partners.** However, given the unpredictable nature of natural disasters, MNOs should always be prepared for new priority sites to emerge during a response. This requires active communication and collaboration between government, humanitarian actors and MNOs before, during and after a disaster.

## MNO experiences

The following are examples of situations, challenges and solutions MNOs have experienced, and may offer insights for MNOs working in other contexts.

- In [Puerto Rico](#), following Hurricane Maria in 2017, MNOs faced delays accessing fuel for their backup generators. Although the Puerto Rican authorities had given MNOs special provision to obtain fuel for their sites, **the fuel delivery vehicles were not given special access** and had to wait in long queues to fill up, causing delays.
- **Celcom (Malaysia)** revised its transportation planning after the 2014 floods in eastern Malaysia when some sites were cut off by road and the only way to reach them was by boat. Celcom did not have access to boats nor the diesel fuel to power them. **In a post-disaster evaluation, Celcom decided that pre-positioning transportation was a priority area for improvement.** Additionally, in conjunction with the government, committees were formed in each locality of the country headed by a district officer in charge of evaluating and executing response activities, including securing permissions for transportation.
- Typhoon Haiyan was one of the most powerful tropical cyclones ever recorded, and for **Smart (Philippines)**, the biggest challenge was securing transportation. Affected areas were very difficult to reach for about a week, and although Smart was able to restore some sites remotely, without access to fuel it was impossible to keep them running. Smart worked with the government and armed forces to gain access to the areas, and **today has an informal agreement with the Philippines air force and navy to provide transport during emergencies. They also pre-position staff, usually network engineers, near critical sites because of the difficulty for them to travel once a typhoon makes landfall.**
- After any natural disaster in Japan, if coastal areas cannot be reached easily by ground, **KDDI (Japan)** considers using its base station-equipped ship, **KDDI Ocean Link**. It is only in recent years that transmissions from mobile sites have been allowed in Japan, and when the Tohoku earthquake struck in 2011, authorisations were not in place for mobile base stations. In 2012, KDDI initiated discussions with the Ministry of Internal Affairs and Communications, the Municipalities of Telecommunications and the Japanese Coast Guard, and after years of consultation, laws were amended to allow mobile base stations in February 2016. Now, when a disaster affects KDDI base stations, **the ship can be harboured in a nearby port and provide connectivity to coastal areas.** The KDDI Ocean Link was used for temporary connectivity in 2018 after the Hokkaido earthquake and managed to cover a 20 kilometre area. In September 2019, KDDI added a second ship equipped with a base station tower, the **KDDI Cable Infinity**.
- **Digicel Group** positions Cell on Wheels (COWs) in strategic locations to ensure most markets have access to at least one. In an emergency, they are deployed from these locations to the island where they are required. **Digicel has also made arrangements with transportation companies to pre-book planes or helicopters for personnel and equipment.**

5



## Infrastructure

### Introduction

Cell towers are the primary structure used to extend mobile network coverage. These can range from self-standing towers to rooftop sites and in-built towers. Self-standing towers must be able to withstand the direct impact of a natural disaster. Other types of towers depend on the structural stability of the building on which they are positioned. The ability of cell sites to withstand a disaster is a key part of resilience. Self-standing and rooftop sites in particular take longer to restore.

### Key considerations

#### MNOs should conduct structural stability studies for all cell sites.

MNOs should consider conducting a comprehensive structural stability study of rooftop sites, the buildings on which cell towers stand, as well as self-standing towers. By looking at the results in areas of a country with the greatest risk of natural disasters, MNOs can identify sites that may be at higher risk of collapse or damage.

#### Selection of tower locations should take geographical risks into account.

MNOs have different matrices and guidelines they follow when selecting a location for a mobile site. This is often a combination of external guidelines and regulations and internal guidelines and policies. Ideally, an MNO would consider the risk map or matrix, as well as other factors, such as the susceptibility of soil to landslides or proximity to the coast. These are usually available from the government, either the National Disaster Management Authority (NDMA) or the building regulator.

#### Correct adherence to building standards is important.

Different countries may have different levels of adherence to building construction standards. MNOs renting buildings for rooftop sites might be encouraged to accept lower building standards in exchange for a lower rental price. While strong adherence to building standards might make the site selection process longer and more expensive, it is vital in the long term. If an MNO is merging with a local operator or acquiring a new market, this type of monitoring can be built into the due diligence process. While some groups insist that the same standards be applied across opcos, even when these standards exceed local regulations, others leave it to the opco to meet local standards.

### MNO experiences

The following are examples of situations, challenges and solutions MNOs have experienced, and may offer insights for MNOs working in other contexts.

- In Cambodia, the monsoon season brings rain and small-scale floods. Noting that floodwater levels seemed to be slowly rising year after year, the technical team at **Smart** looked at recent water levels in flood-prone areas and elevated its network equipment to a height just over twice the highest recorded flood level.
- **Turkcell (Turkey)** designs and builds its network facilities with reinforced components to make them more resilient to seismic events, and aims to keep them running even in earthquakes up to 9.0 on the [Richter scale](#). In addition to reinforcing building structures, critical equipment and systems like power, mechanical and IT racks, also have seismic installations. To minimise risks, sites are located at a certain distance from rivers, seas, airports and military bases.
- After the tragic Dhaka garment factory collapse in 2013, the regulator requested **Bangladeshi MNOs** to conduct structural stability tests on all buildings with rooftop towers. If the buildings did not meet standards, they were asked to move the towers. MNOs tested all sites and eventually had to move some of them.
- **KDDI** and **NTT DOCOMO (Japan)** recognise the importance of base station structure and stability, and have reinforced telecom buildings and facilities to ensure their **physical networks** are as resilient to natural disasters as possible. KDDI draws on experiences from past disasters to estimate the [design requirements](#) for its network facilities. While Japan's standards law requires earthquake-resilient structures, KDDI ensures its sites meet or exceed these standards. Strict fire protection measures are also followed when setting up towers. For example, no windows are allowed in telecom machine rooms, shutters and doors are installed to prevent the spread of fire and fire extinguishers are in place. **NTT DOCOMO** has [earthquake resistance standards](#) for all its sites.
- Because it can be challenging to reach damaged towers, **NTT DOCOMO (Japan)** created large-range base stations capable of covering a radius of seven kilometres (LTE). The network equipment can be adjusted remotely to cover the desired area. It also has medium-range base stations that can cover three to four damaged base stations. NTT DOCOMO's large-range base station was in active use following the 2018 Hokkaido earthquake. It currently has 106 large-range base station sites and 1,760 medium-range base station sites that can be activated in a crisis situation.
- Like most other MNOs operating in the Caribbean, **Digicel Group** has tower structures that can withstand winds up to [Category 4 or 5](#). **The strength of tower structures has improved significantly and towers also have a strong foundation that gives them more stability in strong winds.**

6



## Core networks and network equipment

### Introduction

Network equipment, including antennas, data centres, Network Operation Centres (NOCs), servers and fibre are at the core of an MNO's operations. Under normal circumstances, MNOs must take a variety of precautions to safeguard them. However, during a natural disaster, there is high risk of widespread damage to equipment and parts of the network, resulting in network loss for customers and other users. Core network and equipment can be vulnerable to both widespread disasters like earthquakes, as well as local disasters like fires or floods. **Network congestion also often increases after a disaster, both within and outside the affected area, as people search for information and attempt to contact loved ones.**

## Key considerations

### How different disasters can affect mobile networks:

- **Fibre/cable:** underground cabling is less prone to disruption, but it is at risk in areas affected by flooding, earthquakes, cyclones, tsunamis, fires and other disasters. Above-ground cabling is at risk of support/pole failures and breaks from debris/falling objects (trees) and tension breaks from extreme wind.
- **Microwave links:** disruptions to satellite microwave communications can occur due to high levels of rain fade or attenuation.
- **VSAT units:** physical damage can occur from wind or debris, or alignment issues can arise from wind and increased attenuation/rain fade.

It is important to note that in areas where multiple types of disasters occur, it can be challenging to select a network infrastructure that is resilient to all risks. These are difficult choices that the MNO will need to make.

**Accurate, real-time data is needed during an emergency to make informed decisions about affected sites. MNOs should test how this information will be gathered ahead of time.**

Assessments of vulnerable sites and plans made prior to an emergency might not cover the sites actually damaged during a disaster. Information on overall network functionality can be gathered from the NOC, assuming it is still functional, but on-site assessments will likely be necessary. **Running regular simulations at the NOC with the operational team** can help different operational teams understand how information will be presented and how it can be interpreted compared to the reality on the ground.

**Ensure key sites are identified and network redundancy plans are in place.**

In disaster-prone areas, it is critical that MNOs consider how to ensure key sites are designed with redundancies. Innovative network design can minimise the number of single points of failure in transmission backhaul.

#### Redundancy measures can include:

- **Service duplication:** running systems that mirror each other in different locations so if one fails, the other can pick it up.
- **Building in geo-redundancy:** ensuring sites that are far apart geographically can pick up the load of another should it fail.

### Develop strong traffic overload management plans.

Measures to manage increased traffic can include:

- **Overload handling:** running redundant capacity so if a system is overloaded, extra capacity can be added easily in key sites.
- **Backup and reinforcement:** moving a mobile network reinforcement (Cell on Wheels (COW), Cell on Light Truck (COLT), drones, backpacks) into areas experiencing higher traffic.
- **Network traffic management plan and prioritisation:** prioritising key messages, such as early warning disaster alerts or government information centre messages, over regularly scheduled messages, such as marketing alerts and normal customer traffic.
- **Customer awareness of best practices following disasters:** [“text not call” campaigns can be used to reduce traffic.](#)
- **Prioritising data or voice traffic depending on what other communication channels are available:** for example, if a data-based public message board is being used, MNOs can prioritise data to ensure people can access it.

### Backhaul resilience can be achieved through a combination of redundant channels, including fibre, satellite and microwave.

Ideally, these would be available to each node in the design of the network. Mesh-based networks are more effective in reducing the impact of a complete node outage.

### Virtualised networks:

Transitioning from a highly centralised to distributed network will build resilience.

### Build umbrella or large range base stations in key areas.

Large radio zone base stations may be used to cover base station outages. Building these in mission-critical locations can provide the coverage needed to ensure continuity of services.

### COWs and instant networks can restore coverage quickly, if capacity is available.

COWs, COLT or other mobile network solutions can be used to replace non-functioning base stations and is one of the fastest methods of restoring a network. By deploying temporary and portable cell sites, damaged Base Transceiver Stations (BTS) can be replaced. These work by attaching mobile antennas to a pneumatic mast on a trailer or light truck to provide a mobile network through a backhaul link using either satellite or microwave.



## MNO experiences

These are examples of situations, challenges and solutions MNOs have experienced, and may offer insights for MNOs working in other contexts.

- In Japan, both **KDDI** and **NTT DOCOMO** have a comprehensive NOC. Base station sites are monitored and, when issues are discovered, steps are taken to restore the towers as soon as possible. Some changes can be made remotely via the NOC, but when damage cannot be monitored or fixed centrally, restoration actions are coordinated with regional offices.

### Pre-positioning equipment

- Weather prediction technology typically provides five- to seven-day advance warning of a typhoon, giving **Smart (Philippines)** enough time to position repair materials and teams and to take down equipment, depending on the size of the predicted storm. In the past, Smart has deployed engineers and equipped staff with satellite phones in areas where it expects facilities will be damaged, so that damage assessments and repairs can be made as soon as possible. Earthquakes remain a major challenge because very little warning is possible.

## Instant networks

**Vodafone Instant Network** is a portable GSM network that fits in three boxes. It weighs under 100 kilograms, making it easy to transport by commercial air service, and can be set up in under 40 minutes. It provides GSM, 2G, 3G or 4G connectivity, and secure connectivity via a firewall and VPN to a radius of up to 10 kilometres on 1800 and 900 MHz spectrum bands. The portable GSM BTS is designed to be deployed rapidly to wherever it is needed, in partnership with local MNOs. The Instant Network is one of Vodafone's key corporate social responsibility (CSR) activities and is part of the Vodafone Foundation. It was initially based on Huawei's "no frills" BTS, and was further developed jointly with Huawei and Vodafone Group Technology Networks in Madrid. Deployment of the Instant Network can be initiated by the Vodafone Foundation, by a local Vodafone business unit or requested by a partner.

- **XL Axiata and Vodafone:** In Indonesia, after a recent earthquake and tsunami, the Vodafone Foundation called XL Axiata to see if they needed assistance. However, the Indonesian government was regulating foreign aid very closely, and by the time XL Axiata had the appropriate customs

clearances, 80 per cent of networks had been restored. If the partnership had been formed earlier, regulatory clearance could have been secured in advance.

- **Smart (Philippines) and Vodafone:** Smart and the Vodafone Foundation have one such working partnership. When a disaster is severe, either Vodafone or Smart will call to offer or ask for assistance. Vodafone Foundation then deploys a team with equipment (bearing all the costs) and Smart helps to import the equipment and provide logistics for the tech teams to set it up.

*"They were here last year for a storm in the North in the mountains. They set up a station in the northern provinces. It's a very small base station. We look for the critical areas – either due to the impact of storm or the degree of isolation, that's when these are most useful. Normally it's where a lot of relief effort is being focused."*  
– **Smart (Philippines)**

- **Telefonica** has connectivity kits in Spain that can be deployed to restore networks quickly, and it has also partnered with Loon to deploy its COW in Peru. [Loon](#) uses a technologically equipped balloon to extend the LTE network to hard-to-reach areas. The balloons navigate at 20 kilometre altitudes, twice the height of commercial flights, and have multiple access sectors, each with a 40-kilometre radius, that can connect directly to mobile devices. They also have point-to-point links between them, allowing them to generate "flying fibre networks." In Peru, the balloons were tested to respond to the El Niño flooding in 2017, which affected fixed infrastructure.

- Both **KDDI** and **NTT DOCOMO (Japan)** have various types of vehicles pre-positioned with network equipment that travel to affected areas to provide temporary connectivity. The vehicles are equipped with satellite receivers that receive a satellite connection, convert it and then transmit it to the surrounding area. **KDDI** has set up network equipment on a commercial car that is easily powered by the car's battery and takes only 15 minutes to set up (a typical network on wheels takes up to 40 minutes) and start operating.

## Geo-redundancy and resilience

- **Jawwal (Palestine)**'s urban fibre network in the city has several alternative parallel lines. In 2016, when the political and security situation in Palestine was less stable, it decided to install additional fibre lines to protect against outages if one line was damaged. Jawwal has also created geo-redundant systems in its key sites.

*"You can't do that for every site but only for the most important components, the switches and other core systems. Because we have core locations outside of the country, it pushed us to invest in redundancy solutions at all levels from the hardware and power systems. It should be redundant even at hardware level. Wherever we can build in redundancy, we go for it."* – **Jawwal**

- **Ncell (Nepal)** conducts scheduled redundancy tests of critical equipment to ensure its systems are operational. It has also procured and pre-positioned backup equipment like COWs and COLTs. However, neither were available during the 2015 earthquake response because although disaster response plans had recently been developed, they had not yet been implemented. To fill this gap, Ncell relied on the ingenuity of its staff to repurpose active equipment. **Nine ad hoc COWs were created by mounting spare equipment onto the back of 4x4 trucks to provide connectivity while new equipment was being delivered.**

- In the 2017 Atlantic hurricane season, **Digicel Group** had sufficient warning to ensure antennas were tightened, grounding cables were removed and sites unlikely to withstand hurricane-force winds were taken down and moved to alternative locations.
- Given the strength of hurricanes in the Atlantic, **Digicel Group** strategically removes some network equipment from its towers before a hurricane, sending out a message to customers in the area in advance to alert them of the planned network loss. Although removing the equipment minimises damage and it is faster to put equipment back in place than repair it, these benefits must be weighed against customers losing connectivity in the immediate run-up to a storm. In some markets, **Digicel Group** leases a satellite connection as a backup connectivity option, either making the arrangement with the satellite company well in advance or, on rare occasions, approaching the company just before the hurricane season.

7



## Power systems-related preparedness plans

### Introduction

Commercial power outages after a natural disaster can have an enormous impact on an MNO's operations. Even if the core network has not been damaged, MNOs must rely on power backups if power grids are not functioning. Having appropriate backup technology, including sufficient fuel to run them, is essential. In many instances, grid failure and insufficient fuel to run generators can lead to long outages.

### Key considerations

**Plan for resilient and alternative power systems if there is an outage in the commercial grid.**

In countries with a high-functioning commercial grid, it is important to consider emergency energy infrastructure. In countries where outages are more common, backup solutions will likely already be in place. However, it is important to consider what power backup options are available in both types of contexts, such as generators or power banks. It will be important to have enough power to run base station sites until the grid is up and running. In extreme cases, this could take weeks or even months.

**Ensure fuel can be located and distributed to priority sites. This means creating supply chain plans with relevant stakeholders.**

MNOs should consider whether it is necessary to pre-position fuel in key locations to run generators for longer periods. MNOs might also want to consider how to locate and distribute fuel, and work with suppliers to ensure it has sufficient supplies in accessible areas.

**Classify priority network bands.**

For example, use only 4G or 2G to reduce battery consumption of backup power sources.

**Prioritise power supply and fuel distribution and arrange this with government authorities in advance.**

This includes guaranteeing priority access with relevant government authorities to ensure it reaches sites that need it most. In some situations, MNOs have coordinated with electricity or power companies to ensure resources are used efficiently.

**Backup power supplies**

Backup power supplies (batteries, diesel generators, fuel cells) should be checked regularly to ensure they are functioning properly.

**Equipment vendors**

If possible, during normal operations, coordinate with equipment vendors to ensure power supply technologies are up to date and power consumption is minimised.



## MNO experiences

The following are examples of situations, challenges and solutions MNOs have experienced, and may offer insights for MNOs working in other contexts.

- **Digicel Group** operates in an extremely challenging ecosystem. Its market includes several hundred islands in the Caribbean and Atlantic with poor or no grid power presence, and many towers running on fuel generators alone. In this context, Digicel's main priority is ensuring that sites are refuelled and have full power capacity to operate. A typical base station tower can run for about a week when fully fuelled. Digicel Group therefore has a policy that when hurricanes are approaching, technicians are sent out to ensure all sites are fully fuelled. Time is set aside to identify sites that need refuelling.
- In Turkey, fuel for generators is one of **Turkcell's** biggest issues. As a result, it has pre-positioned 200,000 litres of fuel in both western and eastern Turkey using different suppliers. This is the upper limit of fuel that can be stored before requiring a licence for fuel distribution in Turkey. Turkcell's data centres can store enough fuel to last 36 hours. There is at least one additional level of generator redundancy, as well as fuel storage and filling systems at its facilities. **Turkcell** works with a minimum of two vendors to ensure it can access additional fuel if necessary. Additionally, stationary battery backups are used across its network. The size of backup batteries depend on site conditions, including factors like power grid quality and site power consumption. In some cases, site design may limit the types of batteries that can be used for backup solutions. Some installations require special solutions like lithium batteries depending on the physical space or load-bearing limits.

Turkcell has also designed a **portable solar base station**, enabling it to power its base stations with renewable energy in areas without an electricity grid. Portable solar base stations are also used in rural areas to expand coverage, and in a disaster or emergency, these base stations can be transported to locations where they are needed most.

- Because Japan has a reliable national electricity grid, base stations are almost completely powered by the grid. However, this dependency creates challenges for MNOs when the national grid is down. Given the large number of base stations, it is not possible to have backup power at all sites. **NTT DOCOMO** has identified critical sites and installed backup power systems that can operate for 24 hours. **KDDI** has over 600 mobile generators on wheels that it has located across different regions of Japan. In a crisis, it can mobilise these in affected areas. However, if grid power is out for over 24 hours, operating the towers becomes a critical challenge.



# Direct external impact

This section includes key recommendations and experiences related to stakeholders that are external to MNOs, but have a direct impact on operations. MNOs will be obliged to work closely with these groups before, during and after disaster situations.



## Supporting customers

### Introduction

As mobile phone penetration has increased, customers and humanitarian responders depend on mobile technology more than ever. In a crisis, mobile phones provide a lifeline, connecting people to information and coordinating humanitarian assistance. Immediately after a disaster, customers will have an urgent need for information about the situation and to communicate their safety to loved ones. **This often leads to high levels of network congestion, which can be compounded if the network has been damaged and has reduced capacity. In addition to network signal or congestion issues, customers may face other communication barriers, such as being unable to top up their credit or charge their handsets.**

Maintaining network connectivity and providing services to customers during a crisis is not only good business, it is also a social obligation. This was one of the motivations to create the [Humanitarian Connectivity Charter](#). Thinking through how to best support customers during this time and reduce barriers to services can save lives.

### Key considerations

#### MNOs can provide free credit for data, calls and SMS.

Toll-free data, calls and SMS can all be provided as additional forms of customer support. This can be arranged by providing specified credit for a limited period or by waiving bills while the network is affected. This mitigates the challenges customers may face in accessing top-up facilities. **When MNOs decide to provide these services, it is important to clearly communicate to customers that free or subsidised top-up may affect network congestion.**

#### Zero-rated data and calling services can be provided to specific websites and phone numbers.

For websites and phone numbers providing vital information and services, the cost of data and call credit used for browsing can be zero rated.

#### Reactivate suspended accounts.

Allowing customers who have had their accounts suspended due to non- or late payment to use their existing number and account to communicate for a defined period after a disaster can provide a lifeline to those who may otherwise be disconnected.

#### Free calling centres

MNOs can set up free calling centres in strategic locations to allow subscribers and non-subscribers to make short calls.

#### Reducing roaming charges can allow visitors and foreign humanitarian responders to communicate easily.

MNOs can work together to establish agreements to offer reduced roaming tariffs for international response agencies or subscribers in emergencies abroad for a defined period.

**MNOs can permit national interoperator roaming to enable users to access whichever network is functioning in their area after a disaster.**

This would require collaboration between MNOs and approval from appropriate regulators.

**Support “text not talk” campaigns to raise awareness among subscribers about network congestion.**

This can help to reduce congestion and increase subscribers’ chances of communicating. SMS take up less bandwidth than calls, and the way in which they are sent increases the chance of a message reaching its intended recipient when the required connectivity is available. Low call quality and risk of disconnection are high when networks are congested.

**To facilitate communication, MNOs can provide free WiFi in areas where commercial power is not available or in key humanitarian areas, such as hospitals or emergency shelters.**

**WiFi hotspots and COWs can provide emergency connectivity in shelters and key locations.** This requires careful planning and liaising with local stakeholders and responders.

**MNOs can provide charging stations.**

MNOs can choose to provide handset charging facilities, for example, connecting to generators in areas where the grid is unavailable or in strategic locations. These may be co-located with free call centres or located separately.

**MNOs can consider maintaining emergency telecommunications bandwidth to manage increased congestion and demand.**

The ability of MNOs to expand capacity will depend on physical infrastructure constraints (the capacity of transmitters on the towers and backhaul capacity), software-based systems (which work off licensing agreements with relevant vendors) and available spectrum.

Typically, spectrum licence covers a certain amount of bandwidth with finite capacity. **It could be beneficial to engage with regulators and other MNOs to explore the possibility of reconfiguring the network during crises to make use of adjacent spectrum. This would need to be agreed in advance as it is a complex solution.**

**Develop a communication strategy that regularly informs subscribers on restoration activities.**

**It is important that accurate information about network status and restoration activities is disseminated regularly and transparently.** Customer service teams may need to be trained in these protocols. Providing up-to-date information on when and where customers can expect to access connectivity and other services from the MNO can help to build trust.

**Providing advisory updates to subscribers can help with preparedness. Educate customers about key information they may need during an emergency and steps they can take during an emergency, particularly those related to staying connected.**

Preparedness information can include programming emergency contact numbers into phones and keeping phones charged before a disaster hits, closing apps to save battery life, keeping backup chargers and placing items in waterproof bags to reduce the chance of damage. **Information about emergency communication services can also help keep customers informed and up to date.**

**Where regulatory approval is required, MNOs should make the government or regulatory body aware of their customer support plan and seek approval to avoid unforeseen penalties.**

If a customer support plan is implemented during a crisis without prior approvals, there could be repercussions, such as penalties. **Ideally, MNOs should communicate with regulators as part of a unified market approach.**

**Work with regulators to relax KYC requirements.**

Know your customer (KYC) criteria can be temporarily relaxed after a disaster to enable those who have lost their identification documents to access SIM cards and accounts.

## MNO experiences

The following are examples of situations, challenges and solutions MNOs have experienced, and may offer insights for MNOs working in other contexts.

### Congestion management

- To manage network congestion during a crisis, **Japanese MNOs** run a disaster message board. Anyone can check the board and anyone with a mobile connection through a Japanese MNO can post about their safety and whereabouts. The landing page of each MNO's website includes a link to the message board during disasters. Additionally, the **KDDI MAPSTAR** tool provides the KDDI team with a live map of the number of connected users in each of their sites. This map not only enables them to identify and try to manage areas with high traffic, it can also provide indications of population migration after a large-scale disaster.
- **Smart Communications** and **Globe Telecom** in the Philippines have both run successful text-not-talk campaigns to reduce network congestion after natural disasters.
- **Ncell (Nepal)** launched the 9008 emergency communication number from its call centre. This allowed customers to call and have messages relayed to families and friends.

### Providing free call credit and charging stations

- In Nepal, **Ncell** ensured subscribers with low balances received regular top-ups in the days and weeks following the [2015 earthquake](#). Later, the government taxed them for these top-ups, which was a challenge. **Nepal Telecom (NTC)** also zero rated all services, which generated five times its usual amount of traffic and required it to operate at full capacity. **Ncell** also suffered network congestion, but more controlled levels.
- After the [2016 earthquake in Italy](#), **MNOs** suspended billing and credit management activities for affected subscribers and offered free voice and data. It also provided social media updates on national response activities, as well as charging stations, new handsets and SIM cards.
  - **TIM** suspended deadlines for subscriber billing and blocked credit management actions to allow customers to continue to access services. It credited customer accounts with 10 euros and 2GB in affected areas. Dedicated social media accounts sent service information, offered support and informed customers of the current disaster situation. Finally, a camper van with charging stations, SIM cards and new phones circulated to support customers.
  - In the same situation, **Vodafone** suspended all marketing activities, and all calls and SMS messages were provided free to customers for four weeks. It also set up its Instant Charge facilities in emergency camps to support those affected. The Instant Charge system is a durable and portable outdoor mobile charger that allows 66 devices to be charged simultaneously, and can be set up in under 10 minutes.
  - **Telefonica** always provides free data and calling for its customers in the event of an emergency, including the ability to contact neighbouring countries. For example, if a disaster hits Mexico, Telefonica will ensure that calls to the US are free so that people can contact their family across the border. It has also created an app called [SafePost](#) that enables users to mark themselves as safe and send their location in an emergency. It also allows users to send an SMS to several social media platforms to mark themselves as safe and identify their location.

9



## Suppliers and managing supply chains

### Introduction

The key to effective disaster response is identifying interdependencies and planning ahead. **While an MNO may be well prepared for a disaster, the suppliers it relies on may not be. Suppliers need to be as ready as MNOs to respond to disasters.** It is important to identify key areas of the supply chain that will be crucial during a disaster and coordinate with those actors.

### Key considerations

**Identify and periodically update a list of key suppliers, vendors and partners, both domestically and internationally. Communicate with these key suppliers to ensure they have taken appropriate measures and have their own BCP in place. Agreements can be established to ensure procurement readiness.**

Suppliers, vendors and partners need to be aware of expectations, priorities and procedures in emergency situations. Normal procedures cannot be assumed to be sufficient for emergencies. Together, MNOs should define key and backup equipment with suppliers, identify where inventory is in place or how it can be procured quickly and efficiently. When dealing with external resources, it is important to ensure there is clear communication, expectations and facilitation.

**Ideally, vendors should have sufficient stock/inventory to meet the demands of MNOs in multiple states. If possible, it is best to work with local suppliers located in key regions, which can often respond faster. However, there is a risk that these suppliers will also be affected by the disaster.**

In a best-case scenario, key pieces of equipment would be in country and positioned in regions around the country, ready to be deployed in an emergency. If that is not possible, ensuring that suppliers have some backup stock in areas less likely to be affected by natural disasters is a good starting point.

**If it is not possible to have stock or inventory in country, procurement processes should be clarified and emergency approvals and customs for suppliers should be arranged in advance.**

MNOs and suppliers should communicate with appropriate regulatory bodies to ensure priority access and fast-track approval. This should be integrated in the country's emergency response plan, if possible. Most governments will agree that mobile networks are critical infrastructure, but a "green channel" to expedite vital equipment may not be provided, which can lead to delays. By securing fast-track approvals in advance, these delays can be avoided. The [Tampere Convention](#) seeks to address this problem and simplify regulatory barriers to communications services in disasters.

### MNO experiences

These are examples of situations, challenges and solutions MNOs have experienced, and may offer insights for MNOs working in other contexts.

- During the [2015 Nepal earthquake](#), many MNOs faced challenges getting equipment into the country. **Ncell**, however, overcame this by communicating with the Chair of the National Telecommunication Agency, **who allowed Ncell to secure approvals while the situation stabilised and a formal process could be followed.** In future, it would be preferable that all MNOs had access to relevant government ministries for pre-approval and fast-tracking through customs under defined emergency situations.
- **Zain Group** has established framework agreements with key strategic suppliers, especially for network equipment. These agreements are made at the group level and included in supplier contracts. The contract specifies that suppliers are expected to have disaster response plans and to test those plans on an annual basis. Zain's audit teams ensure that these terms are implemented.
- Several years ago, **Digicel Group** worked with only one supplier for all its network-related procurements. While this was not the safest practice, the supplier was present across the Caribbean and it simplified coordination in disasters. However, in recent years, Digicel has mitigated the inherent risk of relying on just one supplier and expanded its supplier list to at least two to three suppliers in each market.



10



## Policymakers and supporting national disaster response systems

### Introduction

The mobile industry is a licensed and regulated industry, which means MNOs must adhere to regulations on every aspect of their operations. However, a country may or may not have national emergency telecommunications (NET) plans or established regulations. In many instances, the lack of such frameworks creates challenging situations when disaster strikes, as MNOs may be unable to meet the demands of normal regulations and may need to take unprecedented actions. Given the complexity of these situations, thoughtful planning, proactive engagement with policymakers, and communication with peers on disaster preparation and response will all assist MNOs in times of disaster.

MNOs have access to critical infrastructure and data that can feed into national disaster response mechanisms. Initiatives like early warning systems (EWS) can provide essential life-saving support. By working with the right national frameworks and organisations, MNOs can significantly improve the ability of national bodies to prepare for and respond to natural disasters.

### Key considerations

#### Understand the disaster management ecosystem of the operating market.

The disaster management ecosystem in any country can be complex as different organisations, agencies and ministries can have individual or shared roles. Because MNOs are part of the private sector, in some instances, stakeholders may not understand an MNO's desire to participate in disaster management. Additionally, in some countries, the telecommunications regulator may not be familiar with the national disaster management policy. Therefore, to engage effectively, MNOs must be well versed in how the ecosystem is organised and communicate with appropriate regulators before implementing disaster response initiatives.

#### When working with government bodies, it may be beneficial to establish a framework that delineates roles, identifies key decision makers and designates key points of contact in each organisation.

It is important to establish clear lines of communication and determine how telecommunications fits into local, regional and national response efforts before a disaster happens. MNOs should nominate individuals to act as focal points to coordinate with relevant government agencies, humanitarian organisations and NGOs. Where regulatory concerns cross two or more agencies, coordination is vital to success, and it will be important to identify key liaison personnel.

#### Engage proactively with the regulator before a disaster hits. Meetings should be scheduled regularly to review existing policy and procedures and to plan effectively.

Conversations on emergency telecommunications policy are best held before a disaster happens, when all stakeholders can thoroughly address the matter. If there is no NET plan or regulation in a market, MNOs should initiate the conversation or guide other partners to do it. To ensure buy-in, include all major stakeholders, such as national disaster management authorities or agencies, customs, MNOs and equipment providers.

The [International Telecommunication Union \(ITU\)](#) has recently developed [Global Guidelines to Develop National Emergency Telecommunication Plans](#).

#### Industry consultations and information sharing on specific initiatives are vital.

It is important to hold industry-wide conversations on disasters since these affect all mobile customers. It may also be important to ensure all relevant divisions are engaged in these discussions and an effective feedback mechanism is built in to share information and improve the effectiveness of disaster preparedness.

### Sharing best practices can be effective.

In many instances, MNOs may find that the regulator and their staff, and even the National Disaster Management Centre staff, may not be well versed in emergency telecommunications practices. Sharing best practices from other markets and materials on emergency telecommunications may help to improve understanding and communicate the importance of these practices. The GSMA has [prepared an industry position](#) that MNOs may find useful.

### Clarity on regulatory positions can minimise bottlenecks during disaster response.

In many instances, these discussions with regulators have not taken place before a disaster strikes. Following a disaster, MNOs could consider having discussions with relevant regulatory authorities and government agencies on the potential challenges before, during and after a disaster, as well as possible solutions that might help them to, for example, add spectrum for emergency communications, spend more time restoring sites or authorise entry of telecommunications equipment and personnel to an affected area.

It is important to coordinate with relevant government bodies in each country of operation. A national disaster management framework is likely already in place and, depending on the government's level of preparedness, MNOs can support this framework.

Important government agencies and departments to coordinate with might include:

- **National Telecommunications Regulatory Authority:** This may be the primary point of contact and will have a strong influence on any disaster planning requirements that leverage MNO assets.

- **National Disaster and Emergency Authority:** This will usually be the primary authority coordinating disaster response and management. In addition to serving as command centres for all communications and information relating to response operations, this authority builds capacity in crisis response and disaster resilience at various levels of government.
- **Customs and Immigration:** Can be important for recovery efforts. In addition to response personnel, all telecommunications equipment that is temporarily imported for a response operation and/or re-exported after a rescue effort should be cleared with customs at the first port of entry into a market. Clear and flexible engagement processes are vital during a disaster.

### Wherever feasible, consider participating in joint industry and government disaster recovery drills or simulations to identify potential issues with existing plans.

MNOs should endeavour to participate in drills and simulations with partners, including government, humanitarian and other stakeholders, to strengthen partnerships and disaster preparedness.

### MNOs can support national disaster response systems by contributing their own data.

To fine-tune a response team's capabilities and identify training needs, incident managers record key metrics or challenges faced during a response effort. These are continuously reviewed to improve processes and responses. MNOs can play a key role in a country's national disaster management system by inputting this data or providing tools and databases that support the collection and organisation of data. This can be implemented in a variety of ways:

- as mandatory participation in a national initiative (i.e. responding to a government request);
- as a partnership with a national agency;
- as a CSR initiative; or
- as a business solution MNOs are paid to provide.

### Within the framework created between MNOs, regulators and disaster response agencies, MNOs may want to agree on how services will be used for emergency communication with communities.

Different types of information can be provided to communities, and what MNOs are expected to contribute should be agreed in advance. This information can include:

- **informational services**, such as the location of refuge centres, quarantine areas and preventative health information.
- **communication services**, such as family reunification, offline messaging, voice messaging over IP or message boards.
- **information upload** of local situations, such as text and photos.

MNOs are in a unique position to support two-way flows of communication with affected populations, and can work with governments, communities and humanitarian organisations to facilitate this communication. Fixed short codes, IVR systems and broadband technology can all be used to facilitate communication, but a common humanitarian short code may be most effective. MNOs should make concerted efforts to work with regulators to identify, and place on standby, a zero-rated short code that can be activated to support humanitarian information services after a disaster.

**MNOs can work with relevant government bodies to create early detection and warning systems to alert the general population before a disaster strikes.**

“There is little doubt that an effective Public Warning System (PWS) is an essential part of an effective early warning system and can substantially reduce deaths and damage from certain disasters by giving the population time to flee a tsunami, flood or severe storm and enabling them to protect their property wherever possible.”

**– Mobile Network Public Warning and Rise of Cell-Broadcast [pdf]**

According to the [World Bank](#), Early Warning Systems (EWS) are one of three key initiatives in which investment could make a big difference and significantly reduce loss of life during natural disasters. This type of system needs to be supported by government and regulatory bodies. MNOs can help to provide detection of early signs of impending disasters by linking to remote sensor networks, linking to national alert programs or drawing data and analytics from crowdsourcing apps on smartphones. Monitoring of social networking services can also detect and inform authorities of disaster issues. To disseminate the warning, a good system needs a multi-channel approach (TV, radio, mobile, etc.), but MNOs can help by disseminating information over cell broadcast, SMS, IVR, or through a disaster alert app.

**The 3rd Generation Partnership Project (3GPP)** was launched in 2006 to define the requirements of a public warning system to enhance reliability, security and resilience. This technical specifications document provides criteria for the delivery of alerts, message content and handset features.

**Additional considerations include:**

- messages for MNOs should be prepared in advance and be an appropriate length, so MNOs do not have to waste time shortening them and risk changing the meaning.
- consider ensuring that messages cannot be blocked by users.
- translate messages into the most-spoken languages in the region.

**More information on EWS**

The European Telecommunication Standards Institute produced a [report](#) [pdf] on mobile-based technologies that became the basis for an emergency messaging service. Among the key requirements identified were:

- **Capacity and speed:** Alerts should take a maximum of three minutes to arrive and reach 97 percent of people in a targeted area within five minutes.
- **Network congestion:** The system must be able to deliver high message volumes across congested networks.
- **Security and authentication:** Public warning messages should only be sent from authorised

users. Subscriber privacy should be maintained.

- **Performance:** The system must be configured for high availability and geographical redundancy where possible.
- **Handset or device requirements:** Emergency messages should be instantly recognisable as an alert and remain on a handset until manually cancelled by the user. The system should allow for different alert levels to be set.

The report suggested several mobile technologies (paging, CBS, SMS, TV, MBMS, MMS, USSD, email, IM service) and concluded that Cell Broadcast Service (CBS) and Short Message Service (SMS) were among the most suitable technologies for delivering a mobile-driven EWS.

**SMS versus CBS**

- **SMS** is most familiar to people, but for bulk messaging it requires a database of numbers to be established. Messages must also be sent individually to each number in the database, which can lead to further congestion. There is no guarantee that the recipient is present in an area where a warning is needed, and while it is possible to dynamically retrieve from the network which handsets are present in the target area, this is complicated.

- **Cell Broadcast System (CBS)** is not as familiar to people, but it has characteristics that make it well suited to EWS. First, it can be displayed on a handset and a warning tone can be sounded with no user interaction. Messages can be delivered in multiple languages, and since it works on a broadcast (one-to-many) basis, messages can be sent to millions of devices quickly within a targeted area. This area can be as large as a network or as small as a cell. Recipients are anonymous because the system does not require numbers to be registered or a database to be maintained. CBS can only be sent by authorised personnel who have been given access. However, CBS can only be used for one-way communication and the display on handsets has not been standardised, so there are varying levels of support across handset models.





**Whatever customer support plan MNOs agree upon, the government or regulatory body should be aware of and approve the plan (where regulatory approval is required). This will help an MNO avoid unforeseen penalties.**

**Working with regulators, relax KYC requirements.**

If a plan is implemented during a crisis without prior approvals, there could be repercussions. Ideally, MNOs should adopt a unified market approach and communicate with the regulator.

Know your customer (KYC) criteria can be temporarily relaxed in post-disaster contexts to enable those who have lost their identification documents to access SIM cards and accounts.

## MNO experiences

These are examples of situations, challenges and solutions MNOs have experienced, and may offer insights for MNOs working in other contexts.

### Collaborating with regulators

- In **Nepal**, the GSMA Disaster Response team coincidentally hosted several roundtables the week before the 2015 earthquake. However, the attendees had not yet had time to determine protocols or guidelines, so the government, specifically the national telecommunications authority, granted special authorisations for MNOs to allow them to respond quickly.
- Regulators in the **Caribbean** requested ad hoc information that MNOs felt was irrelevant, commercially sensitive and limited their ability to report regularly. Communicating with regulators in advance about information-sharing procedures could mitigate this challenge in the future.
- **Zain Group** must comply with various regulations across their operations. For example, in Bahrain, Jordan and Saudi Arabia, there are specific regulations on BCM plans.
  - **Bahrain** – Zain must submit a list of critical factors that could affect end user availability, as well as a disaster recovery plan for each identified area. If an incident occurs that affects services for users, Zain needs to inform the regulator within 24 hours.
  - **Saudi Arabia** – Every two years, the regulatory body requires licensees to submit outlines of disaster response and testing plans. This is particularly important to plan for Hajj season when there is a huge influx of pilgrims from around the world.
  - **Jordan** – Zain Cash falls under the regulatory purview of the Bank of Jordan. The app must have disaster recovery plans in place, be tested and plans documented. These plans are audited by an external party.
- In **Malaysia**, regulators bring industry players together to improve disaster preparedness. For example, there is an industry initiative underway to ensure base stations are elevated. **Celcom** is encouraging the government to include broadcasting disaster alerts in its preparedness efforts, but ultimately the regulator has to enforce this.
- **DEWN Early Warning System**: After the devastating 2004 tsunami in South Asia, **Dialog Axiata** in Sri Lanka developed the Disaster and Emergency Warning Network (DEWN). The system connects subscribers, emergency responders, community leaders and the general public to a national emergency monitoring centre, housed at the National Disaster Management Centre. The system disseminates messages through as many channels as possible, including handsets, TV, radio and special DEWN alarm devices.
- **Telefonica**, in collaboration with the Spanish government's emergency response teams, has created [anti-fire drones](#) [pdf] to detect forest fires. Sensors detect fires, take photos and send them back to a designated emergency team. This helps to prevent fires from spreading. A pilot has been conducted with 112 emergency teams from Madrid, and another with the DGT (General Traffic Directorate), and will soon be commercialised.
- **Smart (Philippines)** hosts the ICT Bayanihan Communications Summit Series, to which they invite the private sector, media, government, utilities and amateur radio operators. The summit aims to enhance coordination between all organisations involved in the provision of communications in the country and develop a regional rapid emergency telecommunications team.



## Early Warning Systems

- **Ncell** has partnered with Nepal's Department of Hydrology and Meteorology since 2016 to broadcast early warning SMS to people living along major river basins when there is a risk of floods or landslides. In 2017, over six million SMS were sent over a one-week period to residents living in downstream river basin areas, preventing the potential loss of life and livestock. In 2018, the partnership extended to another 250 sites.
- Given that **Japan** is earthquake prone, the Meteorological Department of Japan has set up an early warning system to automatically send alerts to phones. Because the warning time for earthquakes can be as little as five to 15 seconds, the system is fully automated with all MNO systems. Sensors located across the island detect changes in frequency prior to a tremor and automatically generate an alert called [Area Mail](#). This is sent out directly through the MNOs' early alert systems. The alerts appear on handsets with a loud siren noise.
- **Digicel Group** sends out warnings to customers at the onset of the hurricane season reminding them it is that time of the year and they should start preparing. These communications aim to ensure customers take precautions, including charging their phones, having battery banks available and ensuring their account is topped up before a hurricane makes landfall.
  - When there is an approaching hurricane, Digicel Group will prepare an early warning alert to warn customers. However, this is not sent out until the local disaster management agency has approved the messaging to ensure coordination. When antenna equipment is taken down before a storm, customers in the area are alerted so they can make preparations or alert loved ones in advance.

## Common Alerting Protocol

The key to working across channels and partners is [Common Alerting Protocol \(CAP\)](#), an Extensible Markup Language (XML)-based data format that standardises and simplifies the exchange of data for public warnings and emergencies. It allows warning messages to be transmitted consistently and simultaneously over multiple warning systems, increasing the effectiveness of the warning. It does not rely on a particular communications method, but rather addresses

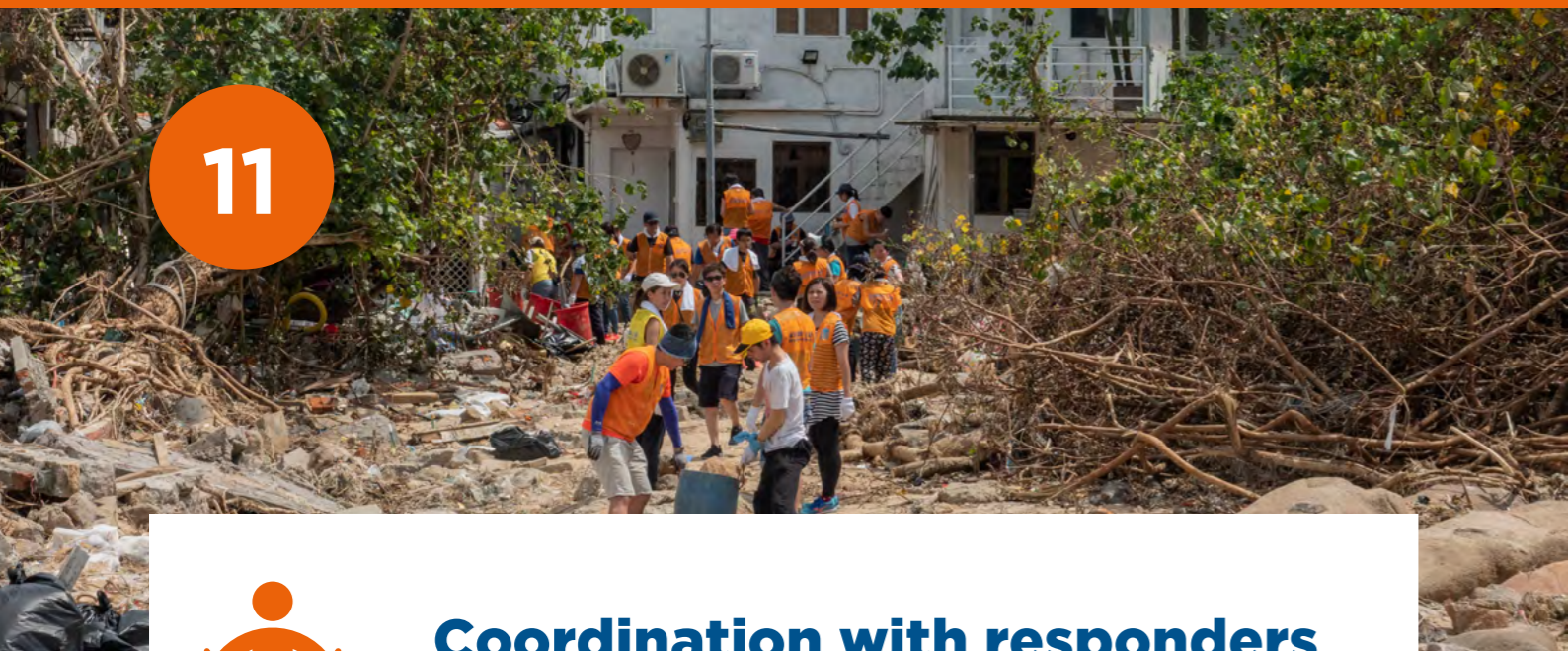
the message itself. The key benefits of CAP are that it reduces costs and operational complexity, message formats can be converted into any type of sensor or alerting technologies and it forms the basis of a national and international "warning internet."

CAP-enabled emergency alerts are typically disseminated by MNO platforms. A [2019 workshop on CAP](#) was held in Mexico City and shared lessons and updates from around the world.

# Indirect external impact

This section includes recommendations and experiences related to operational areas and stakeholders that are not directly linked to the operations of an MNO. MNOs can support and work closely with this wider ecosystem.

11



## Coordination with responders

### Introduction

First responders, including international agencies, NGOs and national disaster response bodies, rely on mobile network connectivity to coordinate and communicate between themselves and with affected populations. MNOs can therefore help to reduce the loss of life. They play a vital role in helping these organisations understand their needs in times of crisis and working to ensure they have this critical connectivity.

Coordination with responders is in accordance with the [Sendai Framework](#), a 15-year, UN-led disaster risk reduction agreement that advocates a multisector, inclusive and effective approach to disaster management. The framework, which runs from 2015 to 2030, states that governments have the primary responsibility to mitigate and respond to disasters

through effective cooperation. In the industry context, therefore, governments must establish enabling regulations and policies empowering the private sector (MNOs) and the wider technology community to share knowledge and up-to-date, non-sensitive data to minimise risks.

### Key considerations

**MNOs should participate in the Emergency Telecommunications Cluster (ETC), the main coordinating body for relief efforts in this sector.**

The ETC is a cluster within the UN system that coordinates the recovery of telecommunications systems in humanitarian emergencies. The ETC is a global network of organisations that works together to provide shared communications services in humanitarian emergencies. The UN must be engaged by a host government and the ETC must be activated in order to take this lead role. The ETC is typically present only in larger disasters. Once activated, within 48 hours of a disaster, the ETC aims to provide security communications services and voice and internet connectivity to assist responders conduct life-saving operations.

By working with the ETC, efforts can be coordinated between actors, including humanitarian agencies, government bodies and the private sector, to prevent duplication of efforts and share relevant information that entities can act on. For coordination on the ground, local ETC working groups are often established in collaboration with government bodies, including disaster management offices and telecommunications regulatory bodies. These local working groups are usually supported by the Global ETC, led by the UN World Food Programme (WFP). MNOs can engage with the ETC to facilitate their engagement.

In addition to the ETC, there are several relief organisations that work specifically on information and communications-related issues, and an MNO might work with to support relief efforts. However, it is important for MNOs to coordinate this work through the ETC to ensure roles are clear and efforts are not duplicated. The relief organisations listed below are all partners of the ETC.

#### Ericsson Response

Ericsson Response is a global volunteer initiative established in 2000 ([video](#): Ericsson Response 15 years) that works with humanitarian partners to provide telecommunications support during disasters and in other aid and development contexts.

#### NetHope

NetHope is a group of NGOs that work together to solve problems through technological innovation. NetHope's collaborative model uses public and private partnerships to deliver information technology solutions to lower income countries and in disasters.

#### Télécoms Sans Frontières (TSF)

TSF is an NGO that provides emergency telecommunications to victims of natural disasters and conflicts and to other humanitarian aid organisations, including telecommunications and internet support for first responders (e.g. search and rescue teams, local governments, NGOs, UN agencies) and free calling programs for cut-off populations and refugee camps. It also participates in assessments of telecommunications infrastructure. TSF only works where MNOs do not have a network or where MNO networks are temporarily unavailable. Once commercial options return, TSF withdraws from the region. It is therefore important to inform TSF and the other entities listed here of the status of network restoration. The ETC can disseminate this information.

### Successful partnerships must be mutually beneficial.

The best partnerships should leverage the subject matter expertise of the humanitarian sector and the core communications competency and scale of MNOs. It is important to understand the capacity, limitations, expectations and interests of each partner at the outset of any partnership. Clear partnership agreements can help provide clarity. The GSMA has developed a guide to assist with the formation of successful partnerships: [Partnership Guidelines: Building Effective Partnerships Between MNOs and NGOs in Complex Environments and Crises](#).

### It is important to manage expectations and understand the differences in models and approaches.

MNOs and humanitarian responders have very different organisational structures and expertise. It is important to be open about potential limitations that may exist on each side, such as funding constraints, mobile coverage, regulatory conditions and policies. The roles and responsibilities of each partner should be clearly defined, and it is important to be aware of “language barriers” — differences in terminology, acronyms and definitions.

### Identify critical sites for humanitarian response in advance.

Identify critical sites for humanitarian response in advance (if possible) or plan communication channels to determine this after a disaster. This information can often be obtained from the ETC coordinator. It is important that responders have access to network connectivity for communications, especially in key humanitarian relief sites. For example, search and rescue teams must have access to network connectivity, as well as hospitals and key government sites.

### Anonymised, aggregated data can be activated on request by the UN or local authorities.

MNOs can provide powerful and unique insights based on anonymised, aggregated network data that can assist humanitarian organisations in their response. For example, population movement data can help public health organisations respond more effectively to epidemics and plan targeted health interventions. Anonymised, aggregated network data can help emergency relief agencies direct their resources more accurately and efficiently in times of crisis, while allowing governments to better understand the impact of pollution and climate change on people.

### Additional considerations for MNOs coordinating with humanitarian responders

- Humanitarian organisations do not always have expertise in telecommunications. Use plain language.
- Humanitarian organisations often have multiple offices, teams and structures within a single crisis zone. Establishing clear points of contact can help make communication and service launch more efficient. In this instance, coordinating with the ETC can be helpful.
- Humanitarian organisations may need approval from several levels, which can create delays. Set clear expectations for timelines.
- Humanitarian organisations are less interested in the delivery of commercial/value-driven services, especially in the first weeks of a disaster. Phase in cost-based services over time.
- Humanitarian organisations do not always coordinate with each other efficiently, particularly in the intense environment of a disaster response. MNOs might be approached by several organisations for similar cooperation.

### The most successful partnerships between MNOs and humanitarian actors begin before a humanitarian relief effort.

These partnerships can be tested through joint participation in simulations, drills and preparedness activities. Developing partnerships in stressful or complex operational environments is challenging. It is important to take the time to develop relationships early on. MNOs can identify partners in a non-crisis period, create standby agreements if necessary and be upfront about desired timeframes and limitations.

### Plan for sustainability, scale or exit.

It is important to have a plan to ensure the outcomes of a partnership can be sustained, either during a particular period or on an on-going basis.

### Guidelines on privacy during the Ebola outbreak

During the Ebola outbreak response, call data records were used to help target response efforts. However, MNOs wanted to ensure the privacy of mobile users was respected and protected, and that associated risks were addressed. [These GSMA guidelines](#) outline the privacy standards that mobile operators can apply when using a customer’s mobile data. Robust technical and organisational measures can protect against unauthorised access and use, especially:

- the numbers of subscribers making calls/texts should be anonymised on MNO premises and with an MNO’s own equipment. Numbers should be replaced with anonymous codes and a secure SHA-3 algorithm used.
- Anonymised data should not be transferred outside the MNO’s systems/premises. Access

should be controlled and only given to pre-approved and authorised personnel. The record of access should be maintained and auditable. Access to algorithms and the ability to decrypt data should be further protected and access limited.

- All analysis should take place on the operator’s system under operator supervision.
- No analysis should be conducted that singles out or identifies individuals, and no attempt should be made to link data about an individual that may infringe on their privacy or cause harm.
- Only the output of analyses should be made available to relevant and approved aid agencies. No sensitive data should be made available to third parties.

### MNOs can work with relevant government bodies to develop early detection and warning systems to alert the general population of an impending disaster.

More information can be found in the [EWS section, ‘Supporting customers’](#).



## MNO experiences

These are examples of situations, challenges and solutions MNOs have experienced, and may offer insights for MNOs working in other contexts.

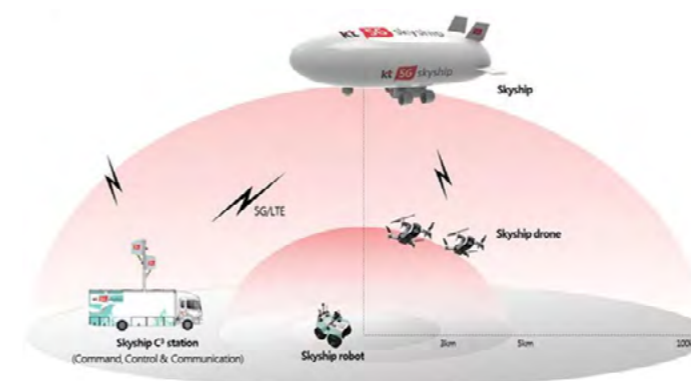
- **Flowminder** is a non-profit based in Sweden and the UK that has pioneered the analysis of mobile network data to support responses to natural disasters. Flowminder is developing an open source code to provide MNOs with tools to analyse Call Detail Records (CDR) and monitor population flows before and after disasters. Once developed, the source code will be installed at operator data centres in country, providing automated analytics that will enable MNOs, along with their partners, to understand where to target relief efforts immediately after a crisis. Initial

testing will take place in Haiti with Digicel, with the World Food Programme acting as a humanitarian advisory partner.

- The Flowminder team distributed reports on population displacement in Nepal following the April 2015 earthquake. They partnered with Ncell (Nepal), and analysed and visualised population flows across the country using de-identified data on SIM card movements. Reports were produced with the UN Office for the Coordination of Humanitarian Affairs (UN OCHA).

- After the [earthquake in Italy in 2016](#), once MNOs were able to assess damage they reported it to the National Civil Protection service, the body in charge of preventing various types of risks and coordinating emergency recovery activities. MNOs coordinated their activities to ensure that relief centres had network coverage, and **Vodafone** deployed Instant Network volunteers to affected areas to check that network coverage was optimal for rescue teams.
- **Korea Telecom (South Korea)** developed a **Skyship** to help first responders understand the extent of the impact of natural disasters, and manage the response through search and rescue functions. This is particularly useful in large cities or mountainous areas where responders may have difficulty assessing physical damage quickly.

The Skyship can provide a bird's-eye view, transmitting information to first responders in real time. The platform consists of four main components: the Skyship itself is a helium airship-drone, the Skyship C3 station (command, control and communication) and Skyship drones and robots. The Skyship takes videos and transmits these images to the monitoring and control platform in real time for first responders. Airship experts can pilot the airship remotely and monitor and control the disaster situation. The airship also carries a Skyscan unit and a Skyship pod that contain cameras, network modules and drones.



Skyscan can monitor the presence of survivors by detecting their smartphone signals within a 50-metre radius and cross-references them with MNOs' mobile customer databases to identify personal information. Once survivors are detected, the drones and robots can help to locate their exact location. The robots can connect survivors, if necessary, to emergency physicians through attached cameras. In April 2019, KT launched the 5G broadband network in South Korea, enabling the airship and platform to rescue survivors and communicate with first responders and assistant crews more effectively.

- The **KDDI** team recently developed a simulation tool for government train drivers to help them prepare for natural disasters. Using virtual reality (VR) technology, the tool simulates the experience of an earthquake and a tsunami, using visuals of a railway track and the impact of the tsunami. Learn more about the tool and watch videos of the simulation [here](#).
- **Digicel Group** develops materials and communication plans for customers facing different types of disasters. The teams are in direct contact with national disaster management centres so that all messaging can be checked and validated with the teams on each island. In the aftermath of Hurricane Maria, Digicel Group joined the ETC's global calls, updating the ETC on restoration efforts. The Digicel team shared its restoration maps for Dominica with the ETC to support and better coordinate with humanitarian responders.



## Working with other MNOs

### Introduction

MNOs can also coordinate among themselves during a disaster to ensure that resources and information are shared efficiently. **MNOs can identify where they might contribute support to other members of the mobile ecosystem in the event of a disaster.**

### Key considerations

**MNOs can collaborate on joint humanitarian efforts, including early warning systems, common message boards or disaster knowledge campaigns.**

Standardising these types of initiatives can ensure that the general population is familiar with the protocols, systems and services available to them. More information on early warning systems can be found in the [‘Supporting customers’ section](#).

**Regular methods of communication to share information should be established between MNOs before a disaster. MNOs should have agreements in place outlining how information can be used.**

Information can be shared between MNOs, for example, on the state of the network, to ensure each zone has at least one tower working. MNOs can develop mechanisms to share current information about restoration activities, coverage outages and other disaster preparedness initiatives to create a database on preparedness.

**MNOs can choose to share towers, if the regulator grants permission, to reduce the number of towers in a territory and improve efficiencies.**

**MNOs can donate or loan emergency or spare equipment to other MNOs or vendors to help restore networks quickly.**

**MNOs can come together as an industry to approach the regulator about establishing national telecommunications emergency protocols, if these do not already exist.**

### MNO experiences

The following are examples of situations, challenges and solutions MNOs have experienced, and may offer insights for MNOs working in other contexts.

- In the **Caribbean**, MNOs conduct annual preparedness activities as an industry from January to May, ahead of hurricane season, which runs from July to November. After a disaster, with regulatory approval, they share infrastructure, using each other’s connection when their own is down. They also work together on restoration. After Hurricane Maria, **MNOs in Puerto Rico** had daily meetings to share details of restoration activities. This ensured that at least one operator was in each area. The National Business Emergency Operations Centre, under the Federal Management Agency of the US, also ran daily calls to discuss response efforts.
- **NetHope** worked directly with **Claro** in Puerto Rico after Hurricane Maria and linked its towers with WiFi backhaul and VSAT in exchange for free ISP to key sites on the island.

13



## Additional humanitarian support

### Introduction

Beyond supporting customers or supporting responders in their relief efforts, MNOs can also support the broader community by providing direct humanitarian assistance.

### Key considerations

**MNOs can run CSR initiatives to help their local communities.**

Supplies like tents, blankets and other physical support can be urgently needed in relief centres. Working with on-going relief efforts and humanitarian organisations to understand needs can ensure that MNOs are providing appropriate relief and that risks are mitigated.

**MNOs can run text-to-donate campaigns to channel relief funds to responders.**

Fundraising campaigns focused on engaging subscribers or employees, usually an SMS campaign, with information on the funding need, a short code and instructions on how to donate can be effective in channelling humanitarian aid.

### MNO experiences

The following are examples of situations, challenges and solutions MNOs have experienced, and may offer insights for MNOs working in other contexts.

- After the 2016 [earthquake in Italy](#), all MNOs in the country, in coordination with the National Civil Protection Service, activated a pre-arranged short code, 45500, to raise funds for the affected population. Italian subscribers could donate two euros by texting or dialling the number. This was in place from the immediate aftermath of the earthquake and continued for several months. **Wind** and **3 Italia** customers donated over 4.9 million euros throughout the campaign. Wind and 3 Italia employees could also contribute to the fundraising effort through payroll donations.
- When a fire broke out at the Maldives Water and Sewage Company Generator Unit in 2014, drinking water for over a third of the population of the Maldives was affected. **Ooredoo** [activated its business continuity team](#) and asked staff to volunteer to distribute water stocks. On the second day of the crisis, Ooredoo shared information over SMS and its social media accounts to help reduce panic. Its existing SMS short code became a Water Crisis Helpline, the number was advertised through social media channels and calls were routed to the Maldives Water and Sewage Company where agents provided information. Ooredoo helped spread information on the location of water delivery trucks (through GPS tracking) to reduce wait times and frustration.
- **Telefonica** runs an [Innovation Fund](#) to encourage innovative thinking about how Telefonica's business can be used to have a positive social and environmental impact. Telefonica initially ran the fund internally, calling for ideas from staff, but last year it opened the fund to suppliers and start-ups, too. This year, the Fund has expanded even further to include universities. Ideas submitted must be related to Telefonica's core business and be developed with one of its departments, usually the innovation department. 2019 marked its fifth call for proposals, and it will support three ideas, providing around 30,000 euros for each one.
- **Axiata Group** has established a partnership with Mercy Malaysia. Axiata has committed financial support in the event of any disaster within its footprint, and can reach out to Mercy Malaysia as a partner to provide humanitarian assistance in these areas. When disaster strikes, Mercy Malaysia provides Axiata with information on what they know and propose an immediate mission based on requirements, which Axiata then approves. This could include measures like creating a temporary hospital or supplying hygiene kits. On average, Mercy Malaysia conducts about three missions a year through the partnership.

# Case studies

This section provides an overview of what KDDI, NTT DOCOMO and Digicel do to prepare and respond to sudden onset natural disasters. This information was provided in earlier sections, but it is also included here, in its entirety, to provide a snapshot of how these three MNOs have approached their disaster preparedness plans holistically.



## CASE STUDY

# Japan



### Disaster management teams:

KDDI and NTT DOCOMO conduct comprehensive staff drills in collaboration with law enforcement. As designated public corporations, each is responsible for integrated disaster prevention and restoration activities between government and private organisations. Drills are one of these requirements, and KDDI runs internal drills twice a year and occasional comprehensive drills with the government, municipalities and Self-Defence Forces. The NTT DOCOMO team also conducts thorough simulation exercises for staff. Some of its disaster prevention training activities can be viewed [here](#).



### Access and transportation:

If coastal areas cannot be reached easily by ground after a natural disaster, KDDI considers using its base station-equipped ship, KDDI Ocean Link. It is only in recent years that transmissions from mobile sites have been allowed in Japan, and when the Tohoku earthquake struck in 2011, authorisations were not in place for mobile base stations. In 2012, KDDI initiated discussions with the Ministry of Internal Affairs and Communications, the Municipalities of Telecommunications and the Japanese Coast Guard. After years of consultation, laws were amended to allow mobile base stations in February 2016. Now, when a disaster affects KDDI base stations, the ship can be harboured in a nearby port and provide connectivity to coastal areas. The KDDI Ocean Link was used for temporary connectivity in 2018 after the Hokkaido earthquake and managed to cover a 20 kilometre area. In September 2019, KDDI added a second ship equipped with a base station tower, the KDDI Cable Infinity.



### Infrastructure:

1 Both KDDI and NTT DOCOMO recognise the importance of base station structure and stability, and have reinforced telecom buildings and facilities to ensure their physical networks are as resilient to natural disasters as possible. KDDI draws on experiences from past disasters to estimate the [design requirements](#) for its network facilities. While Japan's standards law requires earthquake-resilient structures, KDDI ensures its sites meet or exceed these standards. Strict fire protection measures are also followed when setting up towers. For example, no windows are allowed in telecom machine rooms, shutters and doors are installed to prevent the spread of fire and fire extinguishers are in place. NTT DOCOMO has [earthquake resistance standards](#) for all its sites.

2 Because it can be challenging to reach damaged towers, NTT DOCOMO has set up large-range base stations capable of covering a radius of seven kilometres (LTE). The network equipment can be adjusted remotely to cover the desired area. It also has medium-range base stations that can cover three to four damaged base stations, and its large-range base station was in active use after the 2018 Hokkaido earthquake. It currently has 106 large-range base station sites and 1,760 medium-range base station sites that can be activated in a crisis situation.



### Core networks:

1 KDDI and NTT DOCOMO both have a comprehensive NOC. Base station sites are monitored and, when issues are discovered, steps are taken to restore the towers as quickly as possible. Some changes can be made remotely via the NOC, but when damage cannot be monitored or fixed centrally, restoration actions are coordinated with regional offices.

2 KDDI and NTT DOCOMO have various types of vehicles pre-positioned with network equipment that travel to affected areas to provide temporary connectivity. The vehicles are equipped with satellite receivers that receive a satellite connection, convert it and then transmit it to the surrounding area. KDDI has set up network equipment on a commercial car that is easily powered by the car's battery and takes only 15 minutes to set up (a typical network on wheels takes up to 40 minutes) and start operating.



### Power systems:

Because Japan has a reliable national electricity grid, base stations are almost completely powered by the grid. However, this dependency creates challenges for MNOs when the national grid is down. Given the large number of base stations, it is not possible to have backup power at all sites. NTT DOCOMO has identified critical sites and installed backup power systems that can operate for 24 hours. KDDI has over 600 mobile generators on wheels that it has located across different regions of Japan. In a crisis, it can mobilise these in affected areas. However, if grid power is out for over 24 hours, operating the towers becomes a critical challenge. In this case, NTT DOCOMO's large- and medium-zone base stations provide backup power.



### Supporting customers:

To manage network congestion during a crisis, Japanese MNOs run a disaster message board. Anyone can check the board and anyone with a mobile connection through a Japanese MNO can post about their safety and whereabouts. The landing page of each MNO's website includes a link to the message board during disasters. THE KDDI MAPSTAR tool also provides the KDDI team with a live map of the number of connected users in each of their sites. This map not only enables them to identify and try to manage areas with high traffic, it can also provide indications of population migration after a large-scale disaster.



### Policymakers:

Given that Japan is earthquake prone, the country's Meteorological Department has set up an early warning system to automatically send alerts to phones. Because the warning time for earthquakes can be as little as five to 15 seconds, the system is fully automated with all MNO systems. Sensors located across the island detect changes in frequency prior to a tremor and automatically generate an alert called [Area Mail](#). This is sent out directly through the MNOs' early alert systems. The alerts appear on handsets with a loud siren noise.



### Coordination with responders:

The KDDI team recently developed a simulation tool for government train drivers to help them prepare for natural disasters. Using virtual reality (VR) technology, the tool simulates the experience of an earthquake and a tsunami, using visuals of a railway track and the impact of the tsunami. Learn more about the tool and watch videos of the simulation [here](#).

## CASE STUDY

# Digicel Group

Digicel



### Disaster management teams:

1 Digicel Group has set up a crisis management team (CMT) comprised of technical operations, human resources (HR), communications, supply chain management and customer service teams. At the group level, Digicel manages and works with teams on different islands to ensure they are prepared to respond to natural disasters. The CMT was initially set up to manage threats related to hurricane season, but it has now become a permanent team that operates throughout the year. When a hurricane approaches an island, a nearby transit island is identified and Digicel works closely with staff there to prepare. In most cases, the time between initial alert and landfall is one to five days.

2 Digicel Group runs a comprehensive preparedness programme in all markets ahead of the hurricane season. Every year, one or two markets are targeted for an additional intense simulation exercise. Markets that are not selected for the simulation complete training modules, such as desk-based simulations. All markets undergo regular checks.



### Staff safety:

Digicel Group ensures it is ready to close its offices before a disaster strikes, enabling staff to focus on taking care of their families and homes. In many islands affected by the 2017 dual hurricanes, the Digicel senior management team went above and beyond HR policies to ensure that staff were looked after and provided with extra fuel allowances, not only to travel, but also to use for generators in their homes. Digicel also built up stocks in its main office four weeks before the hurricane, bringing in food supplies and setting up kitchens with stoves and tinned foods. It also had the capacity to accommodate key staff with beds, a 1,000-gallon water tank and two generators.



### Access and transportation:

Digicel Group pre-positions Cell on Wheels (COWs) in strategic locations to ensure most markets have access to at least one. In an emergency, the COWs are deployed to the island where they are required. Digicel has also made arrangements with transportation companies to pre-book planes or helicopters for personnel and equipment.



### Infrastructure:

Like most other MNOs operating in the Caribbean, Digicel Group has tower structures that can withstand winds up to [Category 4 or 5](#). The strength of tower structures has improved significantly and towers also have a strong foundation that gives them more stability in strong winds.



### Core networks:

1 In the 2017 Atlantic hurricane season, Digicel Group had sufficient warning to ensure antennas were tightened, grounding cables were removed and sites unlikely to withstand hurricane-force winds were taken down and moved to alternative locations.

2 Given the strength of hurricanes in the Atlantic, Digicel Group strategically removes some network equipment from its towers before a hurricane, sending out a message to customers in the area in advance to alert them of the planned network loss. Although removing the equipment minimises damage and it is faster to put equipment back in place than repair it, these benefits must be weighed against customers losing connectivity in the immediate run-up to a storm. In some markets, Digicel Group leases a satellite connection as a backup connectivity option, either making the arrangement with the satellite company well in advance or, on rare occasions, approaching the company just before the hurricane season.



### Power systems:

Digicel Group operates in an extremely challenging ecosystem. Its market includes several hundred islands in the Caribbean and Atlantic with poor or no grid power presence, and many towers running on fuel generators alone. In this context, Digicel's main priority is ensuring that sites are refuelled and have full power capacity to operate. A typical base station tower can run for about a week when fully fuelled. Digicel Group therefore has a policy that when hurricanes are approaching, technicians are sent out to ensure all sites are fully fuelled. Time is set aside to identify sites that need refuelling.



### Suppliers:

Several years ago, Digicel Group worked with only one supplier for all its network-related procurements. While this was not the safest practice, the supplier was present across the Caribbean and it simplified coordination in disasters. However, in recent years, Digicel has mitigated the inherent risk of relying on just one supplier and expanded its supplier list to at least two to three suppliers in each market.



### Policymakers:

1 Digicel Group sends out warnings to customers at the onset of the hurricane season reminding them it is that time of the year and they should start preparing. These communications aim to ensure customers take precautions, including charging their phones, having battery banks available and ensuring their account is topped up before a hurricane makes landfall.

2 When there is an approaching hurricane, Digicel Group will prepare an early warning alert to warn customers. However, this is not sent out until the local disaster management agency has approved the messaging to ensure coordination. When antenna equipment is taken down before a storm, customers in the area are alerted so they can make preparations or alert loved ones in advance.



### Coordination with responders:

Digicel Group develops materials and communication plans for customers facing different types of disasters. The teams are in direct contact with national disaster management centres so that all messaging can be checked and validated with the teams on each island. In the aftermath of Hurricane Maria, Digicel Group joined the ETC's global calls, updating the ETC on restoration efforts. The Digicel team shared its restoration maps for Dominica with the ETC to support and better coordinate with humanitarian responders.

A hand holding a smartphone against a bokeh background of warm, glowing lights. The background is a soft-focus array of circular light spots in shades of orange, yellow, and green, creating a warm and ethereal atmosphere. The hand is positioned in the lower right, with the phone held vertically. The overall image has a high-quality, artistic feel.

## Conclusion

The information provided in this guide is intended to help MNOs think through their disaster preparedness and response plans. The GSMA is eager to support MNOs as they navigate this process and to help open communication and collaboration between MNOs and the humanitarian sector. The examples above are a testament to the hard work that has been done in the sector to support humanitarian organisations and ensure connectivity during disasters.

# Additional resources

[Humanitarian Connectivity Charter \(HCC\)](#)

## Policy recommendations and guidelines

[Towards a Code of Conduct: Guidelines for the Use of SMS in Natural Disasters](#)

[Industry Position: Emergency Telecoms Regulation](#)

[Partnership Guidelines: Building effective partnerships between MNOs and NGOs in complex environments and crises](#)

[Business Continuity Management: Planning for disaster resilience in mobile networks](#)

[GSMA Mobile Policy Handbook](#)

[Enabling Access to Mobile Services for the Forcibly Displaced: Policy and Regulatory Considerations for Addressing Identity-Related Challenges in Humanitarian Contexts](#)

[Connectivity for Refugees: Displaced and Disconnected](#)

[The Partnering Initiatives](#)

[Global Guidelines to Develop National Emergency Telecommunication Plans](#)

[Designing an Effective Disaster Preparedness & Response Programme \[pdf\]](#)

[Mobile Network Public Warning Systems and the Rise of Cell-Broadcast \[pdf\]](#)

## Case studies

[Disaster Preparedness & Response Workshop: Focus on Earthquakes \[pdf\]](#)

[Managing disaster response through mobile: Asia Pacific](#)

[Responding quickly to natural disasters in Japan](#)

[Mobile Network Restoration & Humanitarian Response: The Vodafone Foundation Instant Network Programme](#)

[Italy Earthquake Response and Recovery: A Disaster Response Case Study \[pdf\]](#)

[Preparing for Disaster: An Analysis of Turkcell's Disaster Management System](#)

[GSMA Guidelines on the Protection of Privacy in the Use of Mobile Phone Data for Responding to the Ebola Outbreak](#)

[Business as Usual: How AT&T deals with Natural Disasters](#)

[Preparing for the Unexpected: Ooredoo responds to a Water Crisis in the Maldives](#)

[DEWN: Dialog's Disaster and Emergency Warning Network](#)

[Disaster Response - Nepal Earthquake Response and Recovery Overview](#)

[The 2017 Atlantic Hurricane Season: Mobile industry impact and response in the Caribbean](#)

[Utilising real-time mobile analytics to inform emergency disaster response in Turkey](#)

gsma.com



For more information, please visit the GSMA website at [www.gsma.com](http://www.gsma.com)

**GSMA HEAD OFFICE**

Floor 2  
The Walbrook Building  
25 Walbrook  
London EC4N 8AF  
United Kingdom  
Tel: +44 (0)20 7356 0600  
Fax: +44 (0)20 7356 0601

