

Economic and Social Commission for Asia and the Pacific  
ICT and Development Section, ICT and Disaster Risk Reduction Division

## TECHNICAL PAPER SERIES ON ICT FOR RESILIENT DEVELOPMENT

ICT continues to grow rapidly with widespread diffusions, novel applications as well as unforeseen challenges. This policy brief series aims to increase the policy relevance underlying the secretariat's analytical work and thereby enhance the contributions that ICT can make in the shift towards more inclusive and sustainable development processes.

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### E-resilience: the role of ICT infrastructures during disasters

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Information and communication are critical both in pre- and post-disaster phases. This technical paper is focused on the role of ICT in the effective management of post-disaster relief and recovery only<sup>1</sup>. If this awareness is translated into practical systems and procedures that are put in place prior to the disaster, the results will be superior. For information and communication to be optimally used, attention must be paid to ensuring their resilience in the face of hazards of various forms.

#### KEY RECOMMENDATIONS

##### **Pan-Asia-Pacific Fiber Optic Network**

ESCAP should promote the concept of a diverse and resilient Pan Asia-Pacific optical fiber network which incorporates robust terrestrial and submarine connectivity. This network will enable member states to improve international backhaul, including lowering costs and enhancing reliability. Ideally, the terrestrial components of this network will utilize the existing Asian Highway, Trans-Asian Railway and electrical grid rights of way. In the interim, the integration of existing and new bilateral terrestrial and undersea cable segments into regional networks should be promoted.

##### **Tampere Convention**

ESCAP should raise awareness of the possibilities of requesting help through the Tampere Convention among government decision makers, especially those from countries that are vulnerable to earthquakes and tsunamis and from small island nations.

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<sup>1</sup> The role of ICT in pre-disaster, especially early warning is the subject of a forthcoming technical paper in the 2014 series

## THE ROLE OF ICTs DURING DISASTERS

Disasters disrupt order. In restoring normalcy, information and communication networks may not appear as important as access to clean water, food and shelter. But access to relevant and timely information and communication helps promote more efficient disaster response. In order for information to be communicated, the underlying network must function. Similarly, the supporting soft infrastructure (e.g. institutions and policies) must be available and reliable.

Information and communication technology (ICT), usually understood as electronically-mediated communication, storage and manipulation, allows for documentation of needs and resources, spatial coordination, communication and facilitation of payments in the aftermath of disaster. In addition, ICTs are critical in alleviating the effects of hazards through early warning, but that aspect is outside the scope of this policy brief.

The enhanced information processing and visualization capabilities of modern hardware and software can, by themselves, enable better documentation of the needs that have to be met, ranging from registries of the missing and injured, to medicines and food for the affected. ICTs enable coordination of spatially separated actors, especially when a disaster has a geographically wide scope and when physical transportation systems may have been degraded. ICTs can also give voice to affected people, in terms of empowering them in relation to the authorities. Payment through mobiles has great potential in disaster relief.

### E-RESILIENCE: RELIABLE ICT INFRASTRUCTURES

If the above functions are to be performed, it is necessary that ICT infrastructures survive the disaster. The many disasters experienced in the Asia Pacific in recent years have yielded insights that can contribute to ensuring greater e-resilience.

Following the 2004 Tsunami, mobile network operators in the Maldives replaced the previous series topology with a ring topology. In terms of the increasingly critical international backhaul connecting the Asia Pacific to Europe and North America, there is a need to go further and adopt mesh architectures that avoid the vulnerabilities associated with the Egypt/Suez and Luzon Strait choke points among others and also allow routing around other threats. Cable cuts caused by earthquakes

or other causes highlight the need to reduce excessive reliance on undersea cables in Asia.

An ESCAP report "[An In-Depth Study of Broadband Infrastructure in the ASEAN Region](#)" shows that most backhaul traffic in Asia transits via the international bandwidth hubs in Singapore and Hong Kong. The bilateral links that exist between countries are either missing, or where they exist they are of low capacity, and do not form a coherent network. Their full potential is thus not realized. If a regional network can be created by filling the gaps in the existing links and opening access to all operators, seamless regional integration will result, prices will decline and quality will improve.

Wireline and wireless access networks pose different challenges in terms of ensuring resilience. Post-disaster analysis of wireline networks in Japan showed that aerial cables were susceptible to greater damage than buried cables. As a result, experts in Japan have promoted the use of ducts and buried cables. Post-disaster analysis of wireless networks has pointed to the criticality of power supply to Base Transceiver Stations (BTS). Provision of battery and generator back up to a large number of BTSs is costly. Supplying fuel to BTS in the aftermath of a disaster is difficult when roads are damaged or blocked. As with any form of redundancy, increased capacity of back-up power throughout a mobile network can be cost prohibitive. Therefore, selected strategically located BTSs (e.g. BTS that are situated close to government buildings, hospitals etc.) may be equipped with enhanced backup capacity.

Liberalization of telecom industries has provided alternatives to reliance on centralized facilities such as those that were subject to the near complete destruction of the network in Mexico City in 1985. Solutions such as emergency sharing of infrastructure and domestic roaming, which are best facilitated in liberalized environments, now exist. In addition, regular contingency planning and careful consideration of the need for broad sharing of infrastructure should be undertaken before disasters strike. Critical elements must be hardened and adequate redundancies ensured in order to increase resilience.

Liberalization may have lessened the relevance of the Tampere Convention on the Provision of Telecommunication Resources for Disaster Mitigation and Relief Operations that came into effect in 2005, as evidenced by the fact that it has never been invoked. However, it has relevance for small states, which can benefit from greater awareness of its provisions. These states can also benefit from creating or extending the current catastrophe risk management initiatives (such as PCRAFI) to include a sub region or multiple countries.

## RECOMMENDATIONS

### INTERNATIONAL ORGANIZATIONS

1. Promote the concept of a diverse and resilient Pan Asia-Pacific optical fiber network which incorporates robust terrestrial and submarine connectivity. This network will enable member states to improve international backhaul, including lowering costs and enhancing reliability. Ideally, the terrestrial components of this network will utilize the existing Asian Highway, Trans-Asian Railway and electrical grid rights of way. In the interim, the integration of existing and new bilateral terrestrial and undersea cable segments into regional networks should be promoted.
2. In the interim, promote the integration of existing and new bilateral terrestrial and undersea cable segments into regional networks.
3. Raise awareness of the possibilities of requesting help through the Tampere Convention among government decision makers, especially those from countries that are vulnerable to earthquakes and tsunamis and from small island nations.
4. Disaster response responsibility is shifting to community-based organizations (a local empowerment/self-help model) rather than the more traditional government-led (top-down/charity) model of disaster relief. As such, it is recommended to design and promote new initiatives that look to build relevant capacity with local organizations.
5. Outage has been a common phenomenon in the global infrastructure of the Internet. Carriers, however, rarely disclose any such occurrences unless they can be attributed to natural disasters. Often, regulatory agencies lack the tools and authorities to monitor such network outages. These effects make the true reliability of these critical infrastructure components less transparent, leading to ineffective decision-making. Therefore, ESCAP should assess the “health” of country-wise Internet to sensitize the policymakers to necessary reforms.

### GOVERNMENT

1. Assess country-level vulnerability to natural hazards and thereafter assessing the feasibility of creating or extending the current catastrophe risk management initiatives (PCRAFI or similar) to include a sub region or more countries.
2. Regulators should factor in redundancy and resilience when promoting telecommunications infrastructure sharing. Specifically, rules regarding

critical infrastructure and essential facilities such as undersea cable stations should be formulated taking into account the need to reduce disaster risk.

3. Governments, especially in small island countries where there are few suitable sites, should earmark locations that are least vulnerable to disasters and ensure that they are made available to ICT infrastructure operators.
4. Government and regulators should encourage private sector suppliers to diversify locations of critical infrastructure and deploy multiple technologies, for example, by ensuring that backup satellite connectivity is maintained even after fiber connectivity is widely deployed. Reliance on undersea cables should be balanced by terrestrial cables where possible, and vice versa. Diversity of cable routes should also be a policy objective.
5. Governments should consider encouraging terrestrial cable systems that run alongside the Asian Highway and the Trans Asian Railway Network.
6. Government should develop criteria for declaring a “state of exception” within which ICT sector rules such as expedited customs processing of communication equipment and domestic roaming which will come into effect. It is important that the conditions under which the state of exception ends also be specified.
7. Governments should consider using the potential of cell broadcasting over public mobile networks for supplementary first-responder communications and also for post-disaster communication to citizens in specific localities.
8. Governments may consider public education campaigns to educate citizens on the responsible use of public communication networks in the immediate aftermath of disasters; protocols for load-shedding based on prioritized number blocks may also be considered.
9. Governments should encourage social media platforms that will allow disaster-affected citizens to communicate their concerns to authorities
10. In order to increase resilience and provide additional options for deployment of emergency assistance, governments give due consideration to the development of interoperable mobile payment systems to transfer funds to disaster-affected citizens.
11. Emergency first responders should be provided with private, robust communication systems that are not fully interconnected to public networks. Availability of spectrum for such public-security systems should be ensured.

## INDUSTRY

1. Standardization of channel allocations in cell broadcasting has been widely considered but not implemented. Given its importance and usefulness in post catastrophe situations, actively engaging in setting standards for cell broadcasting regionally or internationally should be pursued.
2. Assess the use of priority telephone numbers and the standardization of emergency numbers within countries in the Asia Pacific region
3. Assist in implementing a disaster management software package with long-term recovery organizations similar to that of the Sahana implementation in New York.
4. Operators should adopt mesh topologies for their networks to the extent possible, with ring topologies as the minimum, in order to reduce risks of network failure and promote e-resilience.
5. Operators should be required to report the extent of aerial cables they deploy, especially in critical backhaul segments, and encouragement provided to bury cables as much as possible.
6. Disaster managers in every country should have access to phones that can directly communicate through satellite systems.
7. To promote resilience, special attention should be paid to developing redundant solutions for power supplies to critical ICT infrastructure. The most appropriate solutions will differ by country.
8. Performance and reliability metrics should be developed for different segments of networks. Operators should be mandated to report performance indicators to the regulator so that evidence on the resilience of systems can be compiled. The regulator should ensure that the data are accurate through periodic audits and make the data available to stakeholders and the public.
9. All mobile operators should be encouraged to develop interoperable mobile payment systems to facilitate the distribution of assistance in crisis

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