



Building e-Resilience in China

Enhancing the Role of Information and Communications Technology for Disaster Risk Management

The secretariat of the Economic and Social Commission for Asia and the Pacific (ESCAP) is the regional development arm of the United Nations and serves as the main economic and social development centre for the United Nations in Asia and the Pacific. Its mandate is to foster cooperation among its 53 members and 9 associate members. It provides the strategic link between global and country-level programmes and issues. It supports Governments of countries in the region in consolidating regional positions and advocates regional approaches to meeting the region's unique socioeconomic challenges in a globalizing world. The ESCAP secretariat is in Bangkok. Please visit the ESCAP website at <http://www.unescap.org> for further information.



The shaded areas of the map indicate ESCAP members and associate members.

Building e-Resilience in China: Enhancing the Role of Information and Communications Technology for Disaster Risk Management

© United Nations, 2016

This study was prepared by Peter Lange in 2015.

The views expressed herein are those of the author, and do not necessarily reflect the views of the United Nations.

The designations employed and material presented do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries. References and maps obtained from external sources might not conform to the United Nations editorial guidelines. Mention of firm names and commercial products does not imply the endorsement of the United Nations.

For more information contact:

Information and Communications Technology and Disaster Risk Reduction Division
United Nations Economic and Social Commission for Asia and the Pacific

The United Nations Building
Rajadamnern Nok Avenue
Bangkok 10200
Thailand

Telephone: +66 2 288 1234
Fax: +66 2 288 1000
Email: escap-idd@un.org
Website: <http://www.unescap.org/idd>

Contents

List of Figures	iv
Abbreviations and Acronyms	v
Executive Summary	vi
1. Background	1
2. Objective and Scope	1
3. Introduction	2
4. Natural Disasters in China	3
4.1 Natural Disaster Risk	3
4.2 Relevant Government Agencies	5
5. Telecom and Broadband Infrastructure in China	5
5.1 Access Networks	6
5.1.1 Fixed Networks	6
5.1.2 Mobile Networks	9
5.2 Backbone Network Infrastructure	12
5.2.1 Terrestrial Fibre Optic Network	12
5.2.2 Terrestrial Microwave	20
5.2.3 Satellites	20
5.3 International Infrastructure	21
5.4 Smart Grids	23
6. Trends in Applications	25
6.1 Space Technology	25
6.2 Mobile and Cloud GIS	26
6.3 Social Media and Big Data	28
6.4 Free and Open Source Software	30
7. The Digital Divide in China	31
8. Lessons Learned and Recommendations	35
8.1 Narrow the Digital Divide	35
8.2 Promote Technology-Neutral Licensing and Spectrum Re-Farming	36
8.3 Provide Licensing for More Service Providers	36
8.4 Develop First Responder Network	36
8.5 Improve the Resilience of the Backbone Network	37
8.6 Review Building Codes and Incorporate DRR Elements	37
8.7 Improve the Provisioning of Emergency Communication Equipment	37
8.8 Liberalize Applications and Content	38

List of Figures

Figure 1: Natural disasters in China from 1980 to 2010	4
Figure 2: Location of major natural disasters in China, 1900 - 2000	5
Figure 3: Aggregated daily download speeds in selected ESCAP member countries, 2014.....	8
Figure 4: Aggregated daily upload speeds in selected ESCAP member countries, 2014	8
Figure 5: Aggregated daily download and upload speeds in China, 2008 – 2014	9
Figure 6: Shift from 2G to 3G and 4G mobile technology in China, 2011 – 2020	10
Figure 7: Speed and Latency on China Unicom's mobile network, 2015	11
Figure 8: Speed and Latency on China Telecom's mobile network, 2015	12
Figure 9: Speed and Latency on China Mobile's mobile network, 2015.....	12
Figure 10: China Unicom's domestic MPLS Virtual Private Network	13
Figure 11: Terrestrial fibre optic backbone infrastructure in China and population density ...	14
Figure 12: Terrestrial fibre optic backbone networks and nodes in China.....	15
Figure 13: Mean server distance in speed tests as per Figure 3 and Figure 4, 2014	15
Figure 14: Network latency in selected ESCAP member countries, 2013	16
Figure 15: Network latency in milliseconds and percentage change, 2010 – 2013.....	16
Figure 16: Packet loss in selected ESCAP member countries, 2013.....	17
Figure 17: Packet loss in per cent and percentage change, 2010 – 2013.....	17
Figure 18: Terrestrial fiber optic backbone infrastructure in China, single and multiple links	19
Figure 19: China Unicom's domestic backbone network	19
Figure 20: IPSTAR satellite coverage in China	21
Figure 21: International submarine fibre optic cables in China	22
Figure 22: International submarine fibre optic cable landing stations in China.....	22
Figure 23: International Internet bandwidth in China, July 2014.....	23
Figure 24: SuperMap Mobile GIS system architecture	27
Figure 25: Mobile GIS mapping of Yushu earthquake, 2010	27
Figure 26: Active social media accounts in China, January 2015.....	28
Figure 27: Crowdsourced crisis map of Beijing floods, 2012	30
Figure 28: Mobile penetration in selected Chinese province, 2011 vs. 2013	32
Figure 29: Internet users and Internet penetration rate in China, 2014	33
Figure 30: Internet penetration in China by province, 2013.....	33
Figure 31: Urban vs. rural Internet users in China, 2013 – 2014	34
Figure 32: Internet, urbanization, income & illiteracy regression analysis by province, 2013	34

Abbreviations and Acronyms

2G	Second Generation
3G	Third Generation
4G	Fourth Generation
CNNIC	China Internet Network Information Centre
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DSL	Digital Subscriber Line
ESCAP	Economic and Social Commission for Asia and the Pacific (United Nations)
FOSS	Free and Open Source Software
FtTX	Fibre to the X (a generic term for fibre deployment to the premise, home, building, etc.)
GIS	Geographic Information System
GSMA	Global System for Mobile Communications Association
HFA	Hyogo Framework for Action
ICT	Information and Communications Technology
IP	Internet Protocol
MIIT	Ministry of Industry and Information Technology
MPLS	Multiprotocol Label Switching
NDRC	National Disaster Reduction Centre
NGO	Non-Governmental Organization
SDG	Sustainable Development Goal
SLA	Service Level Agreement
SMS	Short Message Service
TASIM	Trans-Eurasian Information Super Highway
TAE	Trans-Asia-Europe (a terrestrial cable network between Europe and Asia)
VoIP	Voice over Internet Protocol

Executive Summary

China is one of the world's most disaster-affected countries. This report examines the role of the information and communications technology (ICT) infrastructure, services and applications in disaster risk management (DRM) and disaster risk reduction (DRR). Particular attention is given to the concept of e-resilience, i.e. the ability of ICT systems to withstand, recover from and change in the face of an external disturbance such as a natural disaster. The study looks at the gaps and performance weaknesses in the ICT infrastructure, from its local access networks and national backbone, to its international connectivity. The study also assesses the extent of the 'digital divide' in China, with the aim to identify priorities for future infrastructure deployments and to provide guidance to policymakers.

Key findings in the report include the following:

- There are significant regional differences across China in its deployment of the ICT infrastructure, and the availability and affordability of ICT services to the local population. Most natural disasters in the country affect densely populated areas where, on the positive side, the telecommunications infrastructure is relatively well developed. But even in these areas, their e-resilience can be further enhanced.
- Like in most countries around the world, mobile phones have replaced fixed-line telephones as the preferred means of communication in China, both for voice calls and access to the Internet. Mobile network coverage is available to nearly 100 per cent of the population, while 3G and 4G mobile broadband coverage is still in the process of being extended beyond the urban areas.
- While major cities in China already have mobile and Internet market penetration rates comparable to fully developed countries, a 'digital divide' exists in the country where only around half of the population own a personal mobile phone or have access to the Internet. The divide is mainly caused by differences in disposable income, and this has an impact on the effectiveness of ICT systems for DRM.
- Indicators related to the quality of the ICT services, such as average download and upload speeds and packet loss in China, are mostly in line with regional averages, but significantly lags behind Asia's leading markets. Latency on China's mobile broadband networks is generally not very good. On the positive side, significant improvements have been made in recent years in most categories.
- The mobile market structure in China is not ideal for fostering competition and innovation, which has had negative consequences for the overall e-resilience of the country's mobile infrastructure. The market would benefit from an additional network operator or regional operators in underserved areas.
- China's national fibre optic backbone offers good redundancy in terms of network topology in the more densely populated eastern part of the country, but many important routes are operated by only one dominant carrier. The less populated western part of the country has fewer fibre links and is therefore more vulnerable to disruptions. Licensing additional backbone network operators would increase competition and improve the overall resilience of the national backbone.
- At the international level, China is well equipped with many submarine fibre optic cables landing at various locations along the east coast, providing good diversity to protect against service disruptions. Strengthening terrestrial fibre links to Europe and India would

create additional redundancy and provide additional bandwidth to the underdeveloped regions in the western part of the country.

- China's international Internet bandwidth per Internet user is very low in comparison with the global average; an effect from the country's ban of many international websites, applications and social media platforms. There are good examples of home-grown software, applications, web and social media platforms that have been successfully used in DRM, but the sector would clearly benefit if international platforms were more easily accessible.
- A USD 600 billion expansion and modernization of the power grid is underway, to be completed by 2020, including Smart Grid technology that will make the network more efficient, stable and resilient.

预览已结束，完整报告链接和二维码如下：

https://www.yunbaogao.cn/report/index/report?reportId=5_3246

