



**Economic and Social Commission for  
Asia and the Pacific**



**International Think Tank for  
Landlocked Developing Countries**

**Building e-Resilience: Enhancing the Role of ICTs  
for Disaster Risk Management in Mongolia  
30 April 2015**

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## EXECUTIVE SUMMARY

Mongolia is one of the coldest countries in the world and affected by most harsh natural disasters (drought and “dzud” severe winter with heavy snow). This report will examine the current development of information and communication technology (ICT) and its infrastructure, services and applications in Mongolia while focusing on their role in disaster risk management (DRM) and disaster risk reduction (DRR) to prevent from natural disasters by providing early warnings. As given importance to the concept of e-resilience, i.e. the development and utilization of ICT systems to provide early warnings, prevent from natural disasters as well as its ability to resist and recover from natural disasters. Also, the study will raise questions about the quality of performance and lack of infrastructure development of ICT and backbone infrastructure in Mongolia in order to identify priorities for future infrastructure deployments and to provide guidance for policymakers, Government institution related with DRM and citizens etc.

### **Key findings and recommendations in the report include:**

- As a conclusion from interviews, there are significant lack of technique technologies, human capacity, training facility and financial constraints, which is critical for Mongolia and other developing countries.
- In terms of ICT, there is a major digital divide between urban and rural areas, although ICT development is on a considerable level. Of course there is still room for improvement of networks and extension of these networks to remote areas of Mongolia.
- Also, there is ample necessity to enhance DRM knowledge and education of citizens, residents of remote areas on e-resilience and DRM as well as DRR.
- The Government of Mongolia should take into consideration that the effectiveness of the utilisation and integration of Information and Communication Technology to its policies regarding disaster risk reduction and management activities and consider investing more into that sector.
- Government should consider providing more financial and technical support to facilitate necessary technology for ICT development towards universal access in order to facilitate early alerting systems throughout the country.
- There is a need to combine proper and smart urban planning with the need of having more DRR equipment.
- Awareness rising and promotion as well as basic education regarding disaster preparedness should be one of key areas of public spending.

### ***In the DRM institutional level:***

- Greater need for developing disaster risk reduction management plans at the community level using ICT technology (social media, evaluation and monitoring applications etc.).
- Further develop and assist the Disaster research centre of Mongolia, establishment of a database for the research on losses, target areas and communities needed.
- Establishment of a national disaster information management database system accessible to all stakeholders and to the communities needed.

### ***In terms of ICT development:***

- Constraints of Mongolian unique nomadic lifestyle, population density, landscape and natural conditions, and poor development of basic infrastructure such as road, energy.
- Appropriate legal and regulatory environment, specially IT applications, interconnection and tariff, network security, e-commerce and etc.
- Constraints of investment for ICT infrastructure.
- Sustainable long term solution, systematic infrastructure development from Government of Mongolia

## **BACKGROUND**

The Information and Communications Technology and Disaster Risk Reduction Division (IDD) of the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) is conducting research on strengthening regional connectivity through ICT infrastructural development in Asia and the Pacific. According to the Development Account Tranche 8, ESCAP is implementing a project “Strengthening information and communications technology capacities for disaster risk reduction and development: addressing information, knowledge and policy gaps in Asia”.

One of the main objectives of the project is to conduct a study on ICT usage to mainstream disaster risk reduction (DRR) into development planning in Mongolia. The main aspect of this research is to analyse ICT development, its role in disaster management and risk reduction, and determine constraints in Mongolia’s connectivity (as a landlocked country) to regional ICT infrastructure for disaster response preparation. This includes a comprehensive quantitative and qualitative analysis of bandwidth conditions, identifying the main constraints and missing links in the network infrastructure, and analysing aspects of the digital divide.

These project activities are being implemented along with ESCAP Resolution 69/10 on “Promoting regional information and communications technology connectivity and building knowledge-networked societies in Asia and the Pacific”, adopted by the 69<sup>th</sup> session of the ESCAP Commission. This resolution calls for member States’ support for regional cooperation towards bridging the digital divide and to develop and implement comprehensive ICT policies which will build knowledge-networked societies. Therefore, analyses and examination of the development of ICT in correlation with DRR policies throughout landlocked countries in the ESCAP region is vital.

## **OBJECTIVE AND SCOPE**

The objective of this research is to review the utilization of information and communications technologies (ICT) in integrating disaster risk reduction into development planning in Mongolia, with the aim of facilitating the improved capacity of policymakers.

In the spirit of the UN World Conference on DRR held in Sendai, Japan in March 2015, particularly the development of the Post-2015 Framework for Disaster Risk Reduction and the Sustainable Development Goals (SDG), this research covers an overview of the development and role of ICTs for DRR planning. It focuses on the aspect of e-resilience along with SDG Goal 9: ‘Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation’.

The research will examine the readiness, quality and resilience of ICT infrastructure of Mongolia in terms of providing early warnings, withstanding disaster events and helping in recovery, while addressing the current condition of fibre optic connectivity networks and broadband as critical infrastructure for disaster risk management (DRM), as well as universal and affordable access to the Internet for Mongolians by highlighting the ‘digital divide’.

In terms of application, the main focus is to look at several practices of how ICTs have been used to enhance DRM, including Government and private sector initiatives, and those offering opportunities for public-private partnerships (PPP) in Mongolia.

Increasing the needs of ICT for early alert, warning, enhancing and improving older techniques, introducing advanced technologies in the areas of DRM, as well as initiatives to organize and empower individuals and communities to be alert and respond to a disaster were regarded as crucial and an attempt has been made to address those in the examples (Chapter 2), followed by the lessons learned and recommendations made for providing a constant telecommunication service and for directly protecting lives, providing the necessary basic needs to comfort affected people instantly after a disaster, and for assisting in immediate reconstruction efforts.

## **1. INTRODUCTION**

Natural disasters can occur at any place irrespective of the developed, developing or landlocked status of countries. From the Indian Ocean tsunami to the South Asian earthquake, from the devastation caused by hurricanes and cyclones in the United States, the Caribbean and the Pacific, the heavy flooding across Europe and Asia, hundreds of thousands of people have lost their lives and millions have lost their livelihoods due to natural disasters. The human misery and huge economic losses resulting from disasters could be minimized through disaster risk management initiatives.

After the 2005 earthquake in Kobe in Hyogo, Japan, Governments around the world have committed to take action to reduce disaster risk and have adopted a guideline to reduce vulnerabilities to natural disasters and agreed on the Hyogo Framework for Action (HFA). The HFA assists the efforts of nations and communities to become more resilient to, and cope better with, hazards that threaten development gains. The HFA has since resulted in some important successes, including the reduction in the number of people directly affected by natural disasters in Asia, where most disasters occur among almost one billion people.

Over the past decade, disasters have continued to cause harmful effects by killing more than 700,000 people and displacing another 144 million. Overall, more than 1.5 billion people have been affected by disasters in various ways; with women, children and people in vulnerable situations being those disproportionately affected. As the HFA is set to expire this year, the world community met in Sendai, Japan from 14-18 March 2015 to adopt its successor framework called the Sendai Framework for Disaster Risk Reduction 2015-2030. The new framework will guide national strategies and international cooperation on disaster preparedness, response and targets to reduce damage to infrastructure, disruption to basic services (including health and education facilities), to increase access to early warning systems and information for the public. It also highlights the importance of engaging local authorities and communities affected by disasters.

ICT can be used to minimize the impacts of disasters in many ways. Disasters come in all shapes and sizes, but one thing they all have in common is that they encompass a geographic location that needs to be prepared for facing disasters. Individuals and organizations responsible for emergency management before, during and after disasters need an instrument they can use to integrate, organize, and analyse challenges and difficulties arising from disasters. They use different instruments to save lives, reduce human suffering, and preserve economic assets before, during and after a catastrophic event. The advancement in ICT in the forms of Internet, Geographic Information Systems (GIS), remote sensing, satellite communication etc. can provide that sort of

support and ease the process of tackling such challenges. GIS has the power to improve the quality and undertake in-depth analysis of natural hazards assessments, guide development activities, and assist emergency workers in the selection of measures and implementation of emergency preparedness and response action.

The Government of Mongolia has committed itself to modernize its telecommunications network and steadily introduce advanced communication services to the public. The Government considers national infrastructure development as a high priority, and in particular, it has focused on the development of the telecommunication sector, seeing it as central to the overall development of the country.

The Government of Mongolia approved its first satellite in late 2012, clearly signalling the height of the country's ambitions for improving ICT and transforming the economy into a knowledge-based economy by 2021. In addition to the satellite project, National Broadband Programme (2011-2015), is a Government plan to ensure that over 50% of households have access to inexpensive broadband connections for bandwidth-intensive services, high-speed Internet, and television. The Government also plans to provide wireless broadband services to 40% of households in remote areas of the country.

Coverage in rural areas improved in 2013, as a result of a World Bank project creating a network of 152 satellite public telephones for herders in remote areas beyond the reach of mobile networks. 4G long-term evolution (LTE) technologies are expected to be deployed in the next few years, as the market shifts from traditional voice and message services and their associated declining margins to a future revenue stream from services such as IPTV, high-speed mobile Internet, VoIP, content and applications.

The Information Technology, Post and Telecommunication Authority of Mongolia is implementing six major national programmes including e-Government, the National Satellite Programme, the National Programme to Ensure Information Security, Postal Service for Every Household, Transition from analogue to digital terrestrial TV, and e-Mongolia National Programme and the National Programme to Establish Registration and Information Unified System successfully.

The most significant change has been the extension of the fibre optic backbone network to up to five times its length in 2014. The backbone is now 34,000 kilometres long, connecting all of the country's 21 *aimags* (provinces) and also linking 330 *soums* (county). However, a number of issues need to be addressed to further boost ICT development in Mongolia. There is great need to formulate a more favourable policy and regulatory environment, develop human resource capacity, foster coordination and cooperation amongst different stakeholders.

## **1.1 NATURAL DISASTERS IN MONGOLIA**

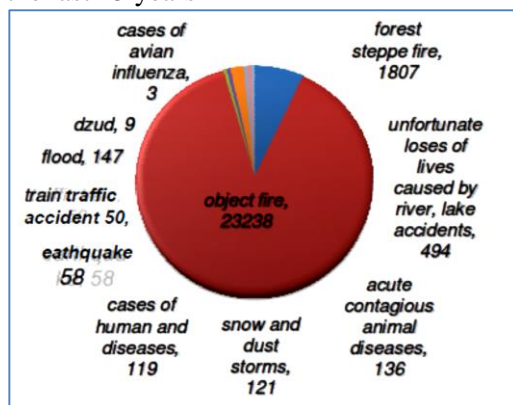
### **RISK OF NATURAL DISASTER**

Mongolia is a large country with a scale of (1,553,560 sq. kms) and is exposed to several types of serious natural hazards. Among all the natural disasters that Mongolia faces drought, *dzud* (severe winter with heavy snow), severe snow desertification, severe snow and dust storms, steppe and forest fires are the most eminent.

The economic losses caused by disasters and hazardous phenomena in Mongolia increased by 10-14 times in comparison with the previous decade, negatively

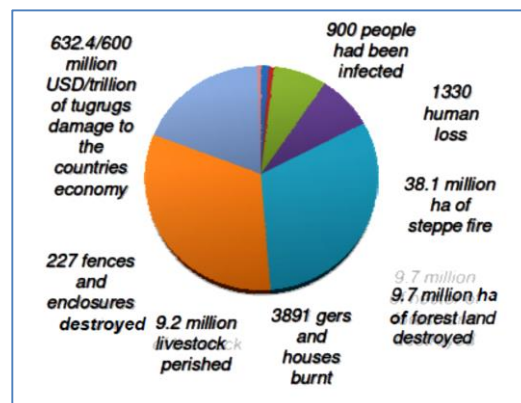
influencing the country's social and economic sustainable development. Mongolia's densely populated capital area is subject to potentially severe seismic activity. The occurrence of unfelt seismic activity has been increasing since 2005. The severe Mongolian *dzud* is a natural hazard that combines extreme weather conditions which destroy herds that are already weakened by summer drought conditions (see Annex 1: Natural hazard risk of Mongolia).

Figure 1. Hazard accidents that happened in the last 15 years



Source: ADRC, 2011

Figure 2. Incurred losses

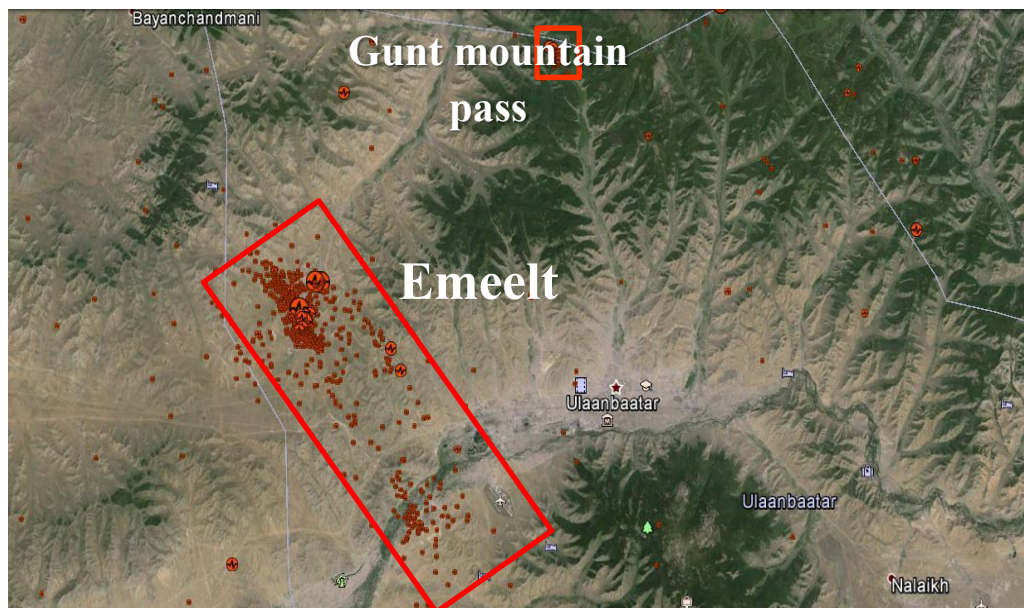


The most recent disaster of the *dzud* which struck Mongolia in 2009-2010, with severe snowfall and extreme coldness, affected 80.9% of the total territory of Mongolia and 57.3% of whole herder families (97,500 people), causing the death of 9.7 million livestock valued at \$US 0.5 billion. 8,711 herder families lost all of their livestock or their whole livelihood subsistence, while 32,756 families lost more than 50% of their livestock. 1,400 herder families that left without their livestock have migrated to urban areas seeking other subsistence sources of income, also negatively affecting the sustainable development of the country. This led to increased migration to rapidly growing urban areas.

The occurrence of unfelt seismic activity around Ulaanbaatar City has been increasing since 2005, and particularly since 2009, to the extent that the Capital Area of Ulaanbaatar is surrounded by four faults that can produce earthquakes of a magnitude of 7 on the Richter Scale (M7). Based on a 2000 simulation, the National Academy of Mongolia estimated that 300 buildings and 60,000 residents would be affected, if a M7 earthquake were to strike Ulaanbaatar City. In the first three months of 2015, a total of 328 earthquakes were recorded, with 188 in the Emeelt area. Since 2015, a new earthquake swarm has been observed near the Gunt area, north of Ulaanbaatar. From 13-18 January 2015, a total of 35 earthquakes were registered. The maps in Figures 1, 2 and 3 show the earthquake occurrences.

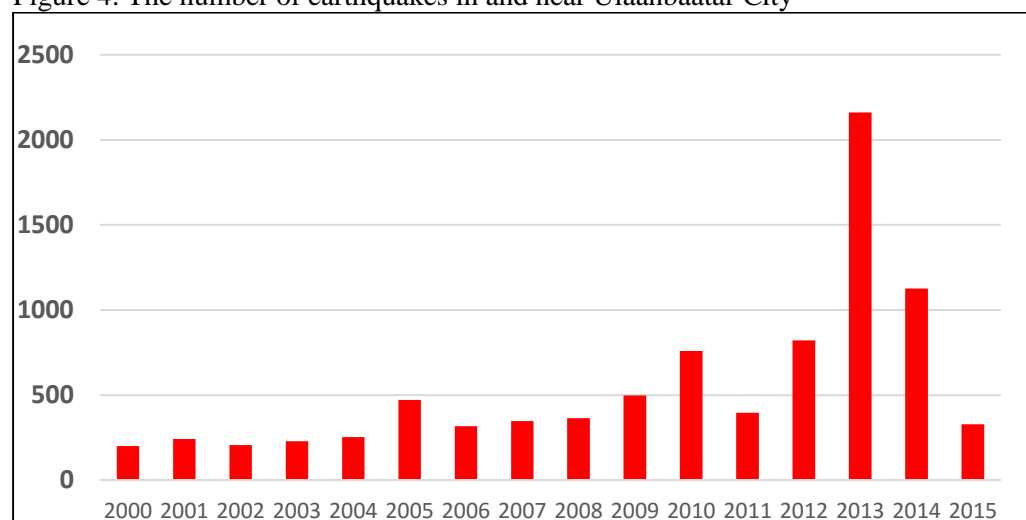
Figure 3. Earthquake in the Emeelt area and the new earthquake swarm near the Gunt area, north of Ulaanbaatar City.





Source: NEMA

Figure 4. The number of earthquakes in and near Ulaanbaatar City



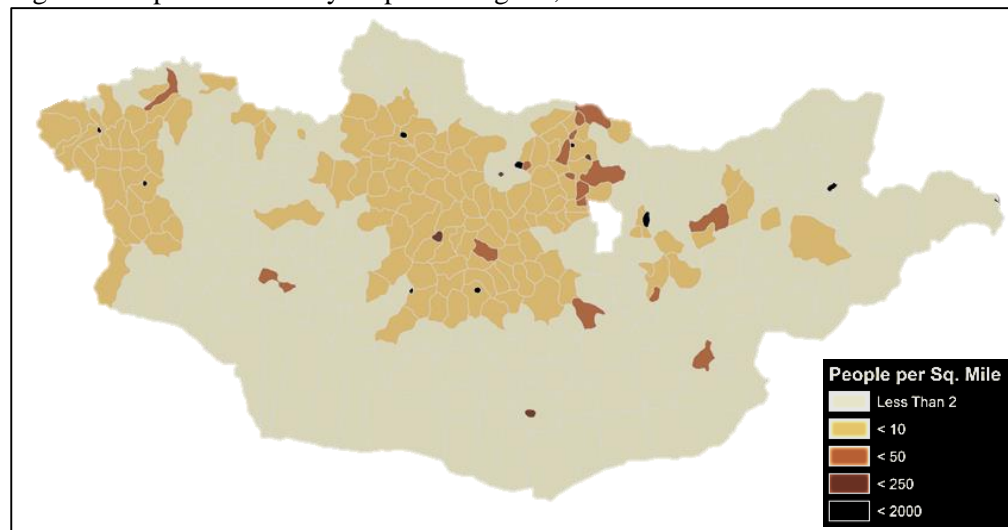
Source: NEMA

Figure 5. Total number of earthquakes in 2000 – 2015 (shown in graph)



The number of earthquakes near Ulaanbaatar City have increased by two times in 2005, four times in 2012, and 10 times in 2013 than the previous years. In the first three months of 2015, earthquakes occurred 328 times, and it shows that the earthquake swarm will not decrease further.

Figure 6: Population density map of Mongolia, 2010



Source: <http://www.rhumblinmaps.com/>

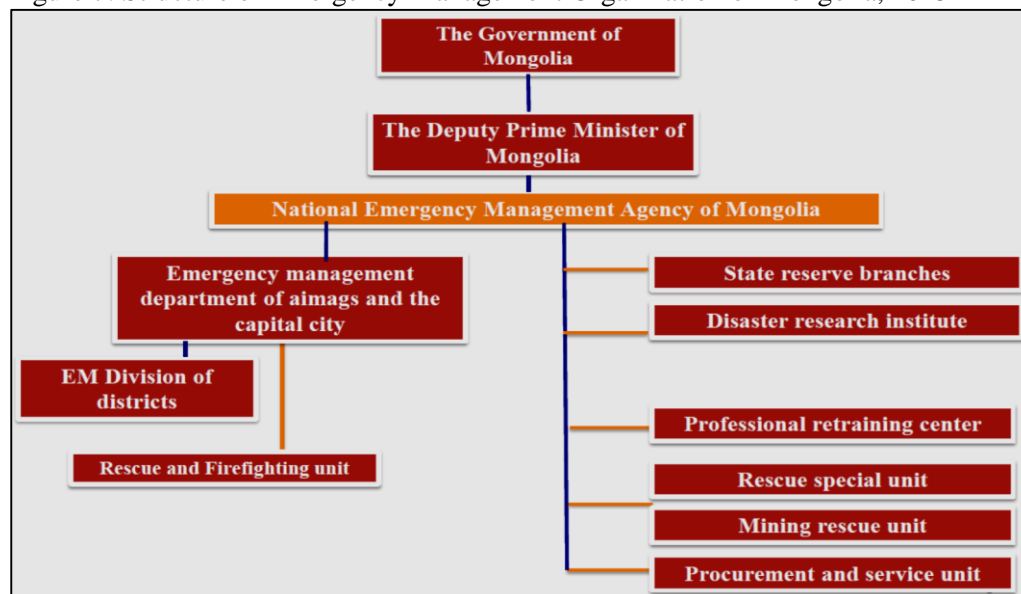
#### RELEVANT GOVERNMENT AGENCIES

In 2004, the Government of Mongolia has adopted a national law on Disaster Risk Management and established the National Emergency Management Agency (NEMA), merged the State Board for Civil Defence, the Fire Fighting Department and the State Reserve Agency. The National Emergency Management Agency is headquartered in Ulaanbaatar, and is represented in all 21 *aimags* of the country. The agency's main duties are to develop the legislative environment on disaster protection, to provide strategic management, to evaluate disaster risk and vulnerability, to implement activities on disaster prevention, to undertake disaster reduction and disaster preparedness at all levels, organize search and rescue work, response efforts, restore the main infrastructure and facilitate rehabilitation, strengthen the capacity of national disaster protection, cooperate with foreign countries and international organizations in the disaster protection field, monitor laws and legislations, and policy implementation on state reserve.

Mongolia intensively worked at the national and international levels to implement the priorities of the HFA, taking into consideration the importance of international collaboration also involving private sector, civil society and individuals in disaster risk reduction. The priorities of the Hyogo Framework for Action have been incorporated into the Comprehensive National Development Strategy, based on Millennium Development Goal of Mongolia for 2008-2021 being implemented.

The State Emergency Commission that has the responsibility to coordinate immediate disaster prevention, rescue, response and recovery was established under the Government, with the representatives of Governmental executive authorities, and operates and convenes on a regular basis.

Figure 7: Structure of Emergency Management Organization of Mongolia, 2015



Source: NEMA

The measures taken by the Government of Mongolia to implement the priorities of the Hyogo Framework for Action include approving the “Disaster risk and vulnerability assessment procedure” and establishing the National Council for protecting steppes and forests from fire, with wider involvement of Government organizations and civil society.

The latest progress in science and technology are being used for strengthening disaster information, communication networks, and creating a disaster database. The satellite images are applied for identifying forest fires in remote areas.

The campaign to teach the younger generation traditional methods and knowledge on forecasting hazardous phenomena; to publish manuals, handbooks and recommendations for disaster prevention based on herders’ experiences, observation, scientific analysis and research; and to disseminate information and knowledge through media is being implemented widely and effectively.

According to the survey of the last 60 years, the average annual increase of air temperature was 1.9-2.1°C which results in increasing desertification, pasture land degradation, and drying up of lakes, rivers and springs. Taking into consideration that the effects of climate change are already striking Mongolia, the Government of Mongolia is taking comprehensive disaster risk reduction measures step-by-step, such as improving pasture management, digging out wells, restoring springs and streams, increasing irrigated agriculture, and initiating index-based livestock insurance. In addition to that, considerable attention has been paid to potential earthquake prevention and the National Programme on Earthquake Risk Reduction and the Unified Earthquake Disaster Plan, approved respectively in 2009 and 2010.

The Standing Council headed by the Deputy Prime Minister was established with the goals to conduct sophisticated research in the seismically active area of Ulaanbaatar, to stock the required disaster reserve, to ensure the step-by-step funding of the purchase of high-end technology and equipment to enhance early warning systems, and to include the knowledge of basic earthquake drills into the school curriculum.

## **1.2 TELECOM AND BROADBAND INFRASTRUCTURE IN MONGOLIA**

Generally, telecom infrastructure and particularly telecommunications, in addressing disaster management, consists of three main layers:

- The access network
- The national backbone network
- International infrastructure

The access network is the key element in providing access for the end-user; such as individuals, private entities and organizations who use telecommunication services and applications. It includes the fixed-line infrastructure like conventional copper telephone lines and coaxial cable TV networks, as well as fibre optic connections connecting directly to premises and dwellings—so-called Fibre to the Home (FttH) or Fibre to the Premises (FttP)—and wireless/mobile connections which in many countries, including Mongolia, now increasingly use more than fixed lines. Also, mobile networks vastly cover hundreds of thousands of base stations throughout Mongolia, each of which serves a relatively small area of some square kilometres or less.

The national backbone network is the next main component to connect the numerous parts of the access network with each other; e.g. wireless base stations, switching centres, operation and maintenance (O&M) facilities, and international gateways. Main network lines are normally applied by fibre optic connections due to the high capacity demand on them. Also microwave radio links are often used because of their comparatively low operation costs, and are simple and speedy at the local level. But they are gradually being switched with fibre optic connections due to the growing demand for broadband data services on the access network, particularly in heavily populated areas. Moreover, satellite connections back-up national backbone connections, especially in remote areas.

The international infrastructure, the fundamental element to connect a country to the rest of the world, usually consists of fibre optic subsea cables with very high capacity that cover whole oceans and are also progressively replacing satellite technology. Landlocked countries connect with terrestrial transit connections through countries with coastal landing stations or by using satellites.

Principally, all three of the above mentioned layers are essential for complete operation along with effective communications, preferably with redundancy. In most markets around the world, all three layers are open to competition; i.e. there are several licensed service providers who have built their own network infrastructure and are offering services in competition with others. This in itself creates redundancy in network infrastructure covering the same geographical areas, but each operator will also strive to have redundancy within its own network in order to be able to provide uninterrupted service in case of temporary partial failures or outages.

## **THE UNIVERSAL SERVICE OBLIGATION FUND**

According to the Communications Law and the Government Special Fund Law of Mongolia, the Universal Service Obligation Fund (USOF) was established in 2006.

The main objectives of this fund is to provide access and deliver information and communications services to Mongolian citizens regardless of their locations and living conditions, and to bring service delivery infrastructure to remote areas. The activities

of the fund are maintained principles through non-discrimination of service providers, promotion of fair competition environment, and provisioning of transparency.

The Fund covers and implements projects and programmes in five fields covering mobile communications, Internet, radio, television, post, research and awareness.

During 2010-2013, through the projects and programmes implemented by the USOF, 42 *soums* and 35 remote settlements of 18 *aimags* have an access to mobile communications network. 25 *soums* of 14 *aimags* have connected to the information and communications infrastructures, with improved quality and coverage of existing mobile communications. Technical facilities of operators and power lines and fibre optic cables and antenna towers were established. Also, technical conditions of wireless Internet services for residents from three remotely located districts of Ulaanbaatar and 118 *soums* of 18 *aimags* are improved.

### **1.3 NATIONAL SYNOPSIS OF THE ICT READINESS ASPECTS OF DISASTER RISK MANAGEMENT IN MONGOLIA**

#### **1.3.1 ACCESS NETWORKS**

##### **Fixed networks**

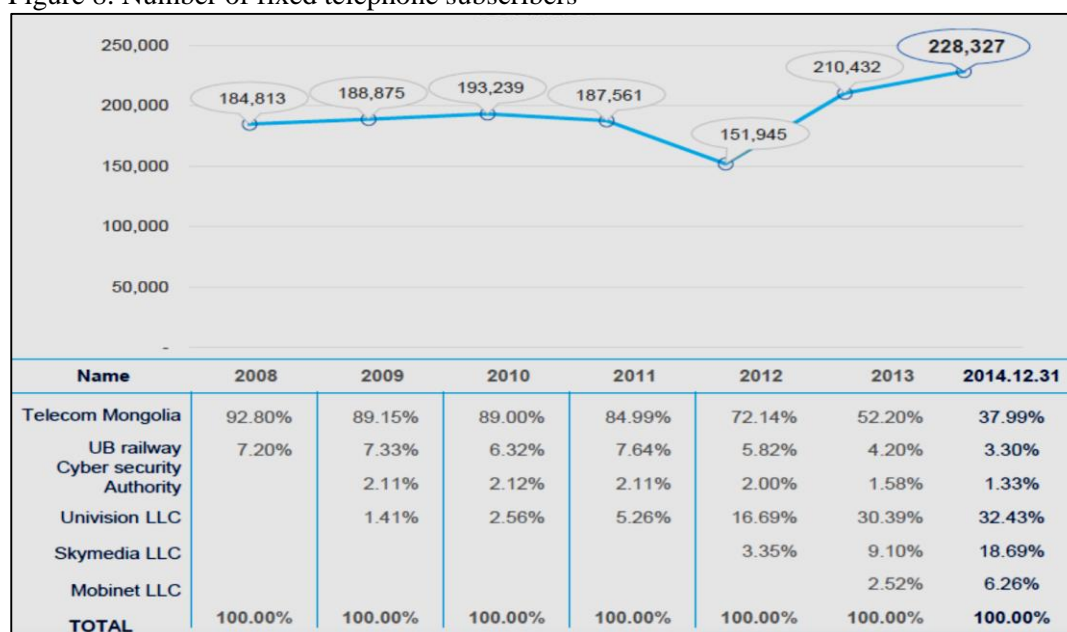
Historically, Mongolia had 200 telephone lines as of 1939, constructed open copper air lines in 1950, and the telecommunication service centre was established in 1960. In 1992, Mongolia introduced digital telephone switching. In 1994, the Earth Satellite station Naran was established. Today, Mongolia has only one national fixed-line network operator named Telecom Mongolia and it is also the biggest with 37.99% of total fixed telephone subscribers, and 7.2 telephones per 100 people at a total population 3,015,303 million.

After the introduction of mobile telephone technology, mobile telephone usage has increased dramatically around the world every year. In this regard, in Mongolia since 2006, the number of subscribers who subscribe to fixed telephone lines has decreased, but in the last few years the number has been increasing by over 70,000, resulting in a total number of fixed line subscribers of 228,327 in 2014 (see Figure 8).

The increase of fixed telephone subscribers is due to the penetration of triple play services (IPTV, Voice over Internet Protocol (VOIP) and Internet) offered by Univision (32.43%) and Skymedia (18.69%).



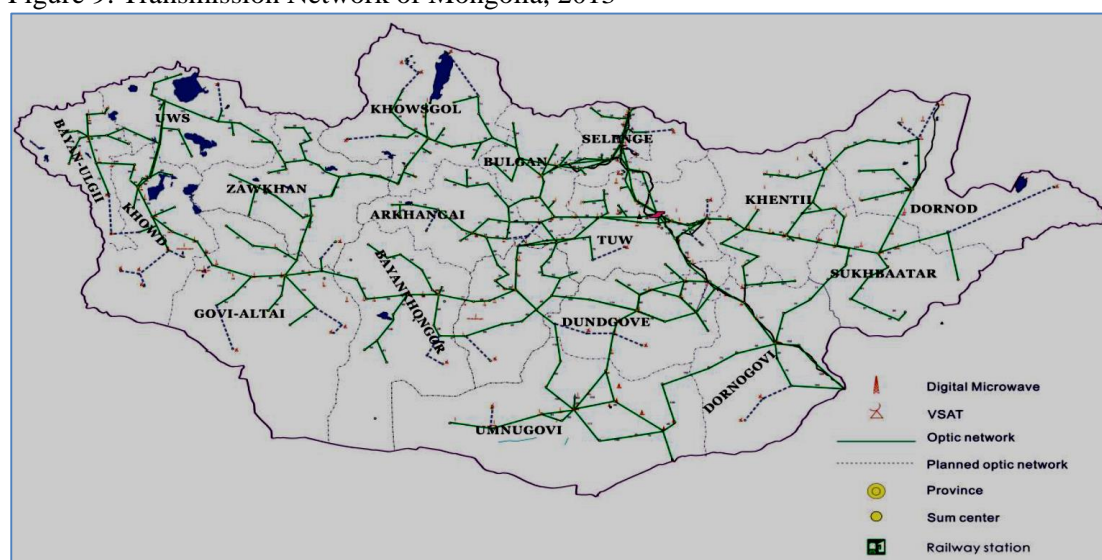
Figure 8. Number of fixed telephone subscribers



Source: Communications Regulatory Commission, 2014

According to the project on “Broadband access network to the *soums*” (2012-2014), the objective was to establish network access infrastructure for Internet services to 250 *soums* which have no access to the Internet; 21 *aimag* centres and 90 *soums* had access to networks during 2012-2013. In 2010-2013, technical conditions improved and facilitated access to internet services in 118 *soums* by state investment and the Universal Service Obligation Fund (USOF).

Figure 9. Transmission Network of Mongolia, 2013



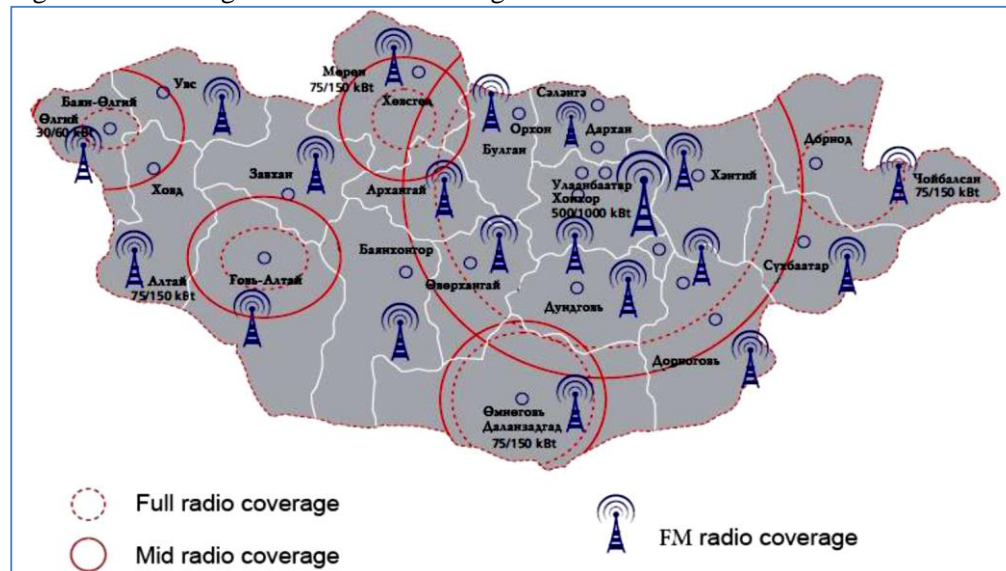
Source: White Paper 2014, ITPTA

Comparison of fixed telephone and mobile telephone subscribers shows that 7.2 telephones per 100 people (with a total population of 3,015,303 as of April 2015) and 148 mobile subscribers per 100 people shows that the mobile networks play a much greater role in disaster risk management when it comes to reaching and alerting people directly in affected areas, also because of the mobility advantage whereby people can

be reached on the move wherever they are. This aspect proves to be crucial, especially for a vast country like Mongolia and the nomadic lifestyle of herders in Mongolia.

However, fixed lines, specifically fibre optic, will always be superior to mobile access in facilitating very high data rates and low latency, so that they remain indispensable for aspects of DRM that involve very high bandwidth and real-time applications; such as the exchange of large amounts of GIS data and HD video streaming etc.

Figure 10. Coverage of radio broadcasting



Source: White Paper 2014, ITPTA

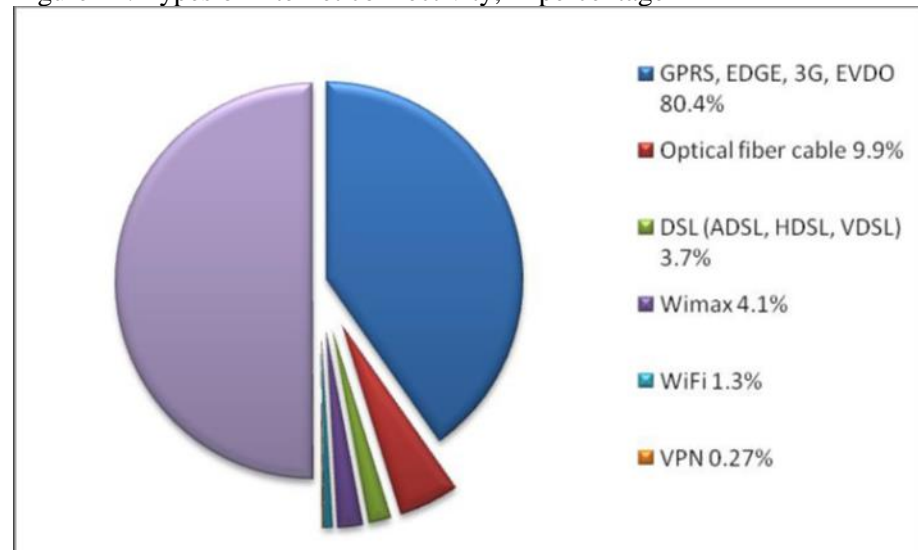
According to the White Paper of ICT Mongolia-2014<sup>1</sup>, Mongolia has 366 sets of medium and long wave radio listening zones and 349 sets of short wave radio listening zones today. In terms of capacity of the transmission stations in Ulaanbaatar and in some *aimags*, it was gradually upgraded and the total capacity improved 7.9 times within last 70 years, and by 6.3 times in rural areas with reliable listening zones.

The first time Internet was introduced in Mongolia was in 1996. As of 2013, there are 55 ISPs delivering Internet services to users through Dial-Up, DSL, and FttH fibre optic cable, coaxial cable, and GPRS, 3G, EVDO, WiFi, WiMAX and VSAT technologies. According to the 2015 statistics of the Communication Regulatory Commission, Mongolia has 1,962 thousand Internet subscribers, that increased 2 times compared with the previous year. In Mongolia, GPRS, EDGE, 3G and EVDO technologies are utilised mostly to connect to the Internet.

The Government's policy objective towards development of the ICT sector is to promote universal access of the Internet in rural areas, and make Internet services affordable and cheaper. In this regard, ITPTA is aiming to develop and expand the access network, introduce next-generation network mobile bandwidth using 3G and 4G, formulate national programmes to increase affordability and usage of the Internet in remote areas, and introduce tariffs of geographic non-discrimination between urban areas and rural areas.

<sup>1</sup> <http://itpta.gov.mn/mn/328>

Figure 11. Types of internet connectivity, in percentage



Source: White Paper 2014, ITPTA

Fiber optic technology has been introduced in the information-communications backbone network of Mongolia since 2002. There are several companies such as NetCom, Mobinet, Skytel, Railcom, Gemnet, G-Mobile and Skynetworks who provide services using their own established fibre optic and digital radio relay and satellite networks.

ICT infrastructure development of Mongolia is funded by foreign loans, public and private sector investments, and the public and private fibre optic network was totally built over 34,000 km covering 294 *soums* and settlements. There are a remaining 37 *soums* connected to the mobile communications network by a digital relay network and satellite network.

It is estimated that 16.8% of the world population are using Facebook, while 20.1% of the Mongolian population are Facebook users. The number of Facebook users has reached 640,000, which is 53% higher than the previous year, of which 580,000 users are from Ulaanbaatar.

## **Speed**

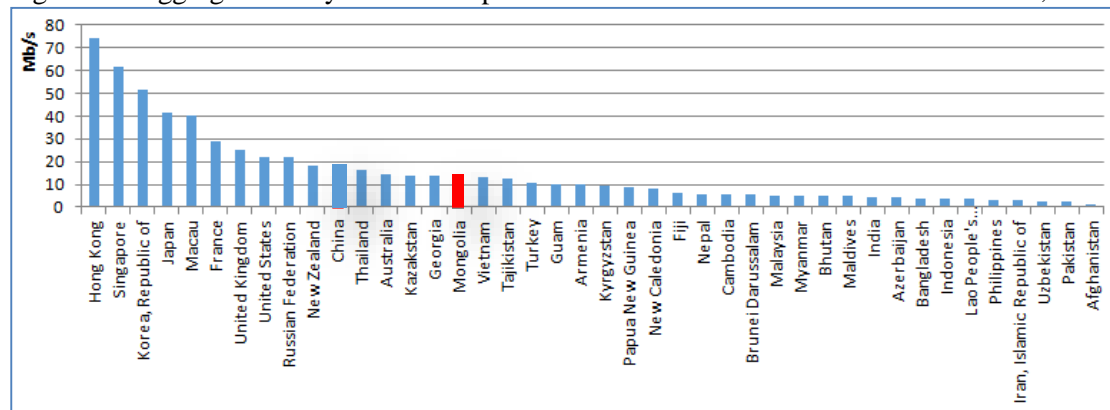
The Mongolian Internet transit line's bandwidth is 150 GB, the domestic internet bandwidth is 55.5 GB, and the local mix/exchanger of Mongolia in case servers can download with a 100 MB speed, internally.

In terms of technical capacity, Gemnet—the best national company—can transfer 55 MB, and it has established a fiber optic connection to the Hong Kong, Frankfurt, and Los Angeles exchange centres. However, according to speedtest.net, fixed broadband average download speeds in Mongolia were just over 10 Mbps in 2014 (as of August 2014, the Mongolian download speed using broadband is 13.93 Mbps). This is a relatively good result, given the country's geographic size and urbanisation demographics, but it lags significantly behind leading markets in Asia; namely Hong Kong, Singapore, Korea and Japan, as shown in Figure 12.

In terms of upload speeds, the gap between Mongolia and Asia's leading markets is shown in Figure 13. Mongolia lags behind countries like Georgia, Vietnam and Kazakhstan in this regard.

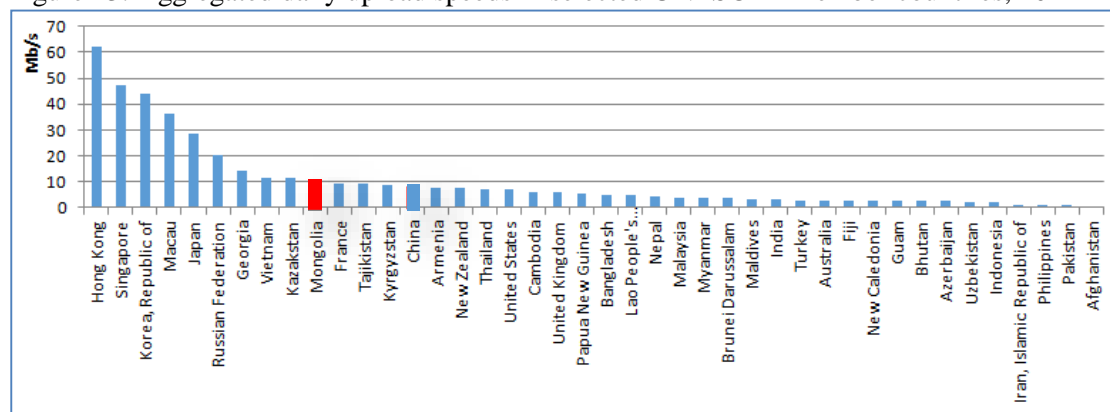


Figure 12: Aggregated daily download speeds in selected UNESCAP member countries, 2014



Source: UNESCAP, speedtest.net

Figure 13: Aggregated daily upload speeds in selected UNESCAP member countries, 2014



Source: UNESCAP, speedtest.net

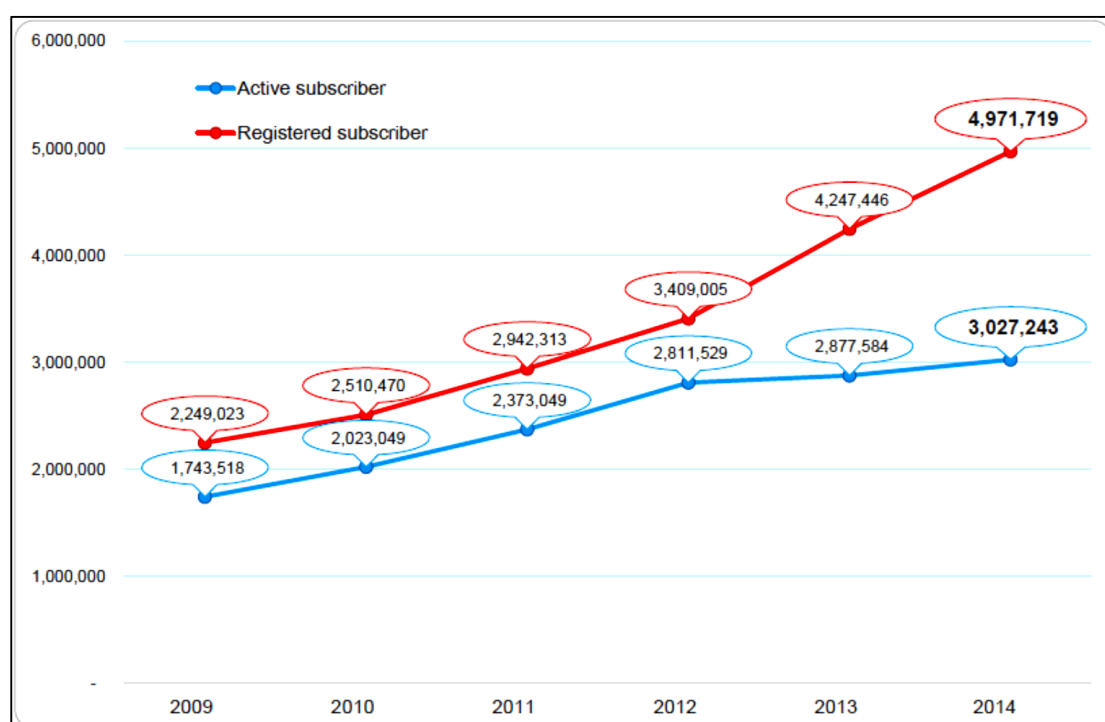
Download and upload speed do not depend on the quality of the access network alone, they are also influenced by the backbone network.

### **Mobile networks**

Mobile networks play a vital role in disaster management, because they reach a far greater percentage of the population than fixed networks. They offer mobility and they are more robust against damage because there are fewer potential points of failure per connection than fixed-line networks (although underground wires offer the best robustness). At least in densely populated areas, mobile networks also offer a certain degree of redundancy in case of local failure of individual base stations (BTS), since a neighbouring BTS will often be able to provide some degree of service in the affected area. Moreover, mobile networks can be scaled up relatively easily for temporary extraordinary traffic demand, for example in disaster areas, by bringing in mobile base stations or so-called 'cells on wheels' (COWs). Mobile networks, including mobile broadband access, therefore need to be included in any disaster risk management plan.

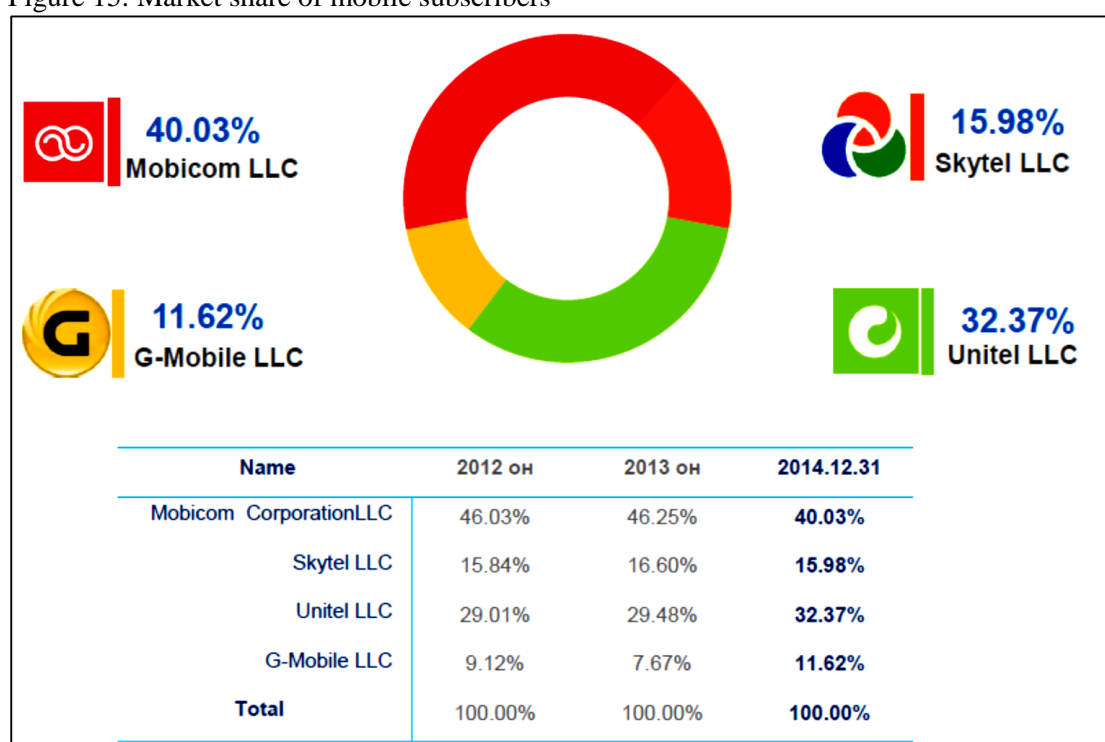
There are four mobile phone operators (Mobicom, Skytel, Unitel and G-mobile) in Mongolia. Their mobile networks cover almost 95% of the Mongolian territory, including the capital city, 21 *aimags* and 330 *soums*. According to CRC statistics, the number of registered mobile subscribers has reached 4.9 million in 2014.

Figure 14: Number of mobile subscribers



Source: Communications Regulatory Commission, 2014

Figure 15: Market share of mobile subscribers



Source: Communications Regulatory Commission, 2014

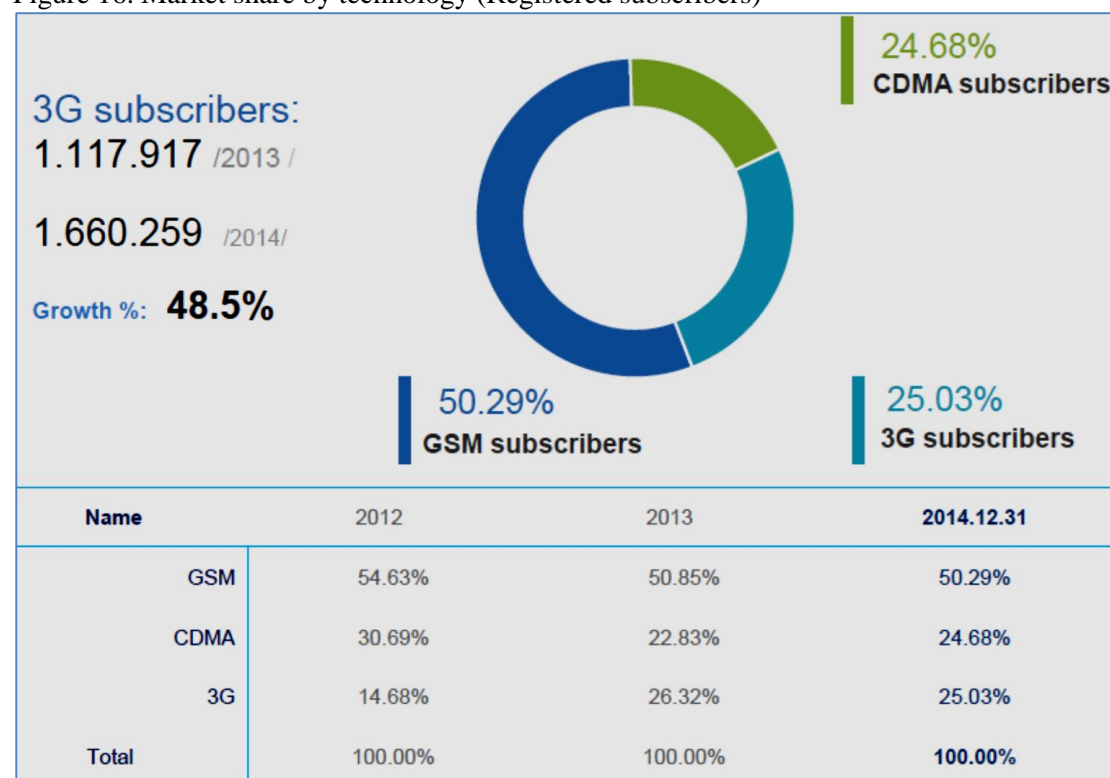
Mobile telephone services provide 75% of the total ICT sector revenue. In terms of mobile telephone service tariffs, the price is cheaper compared with the world market (with 5.8% decrease of average price compared to the average price of 2011).

## Transition from 2G to 3G and 4G

With regard to network compatibility and redundancy, a key component of e-resilience, the market structure in Mongolia is in fact not ideal. In terms of second generation (2G) technology, four out of the country's mobile operators—Mobicom and Unitel—operate GSM networks. The other two, Skytel and G-Mobile, operate a CDMA-2000 network which is incompatible with GSM. Since there are very few GSM/CDMA dual-mode handsets, a Skytel and G-Mobile customer would need to buy a separate GSM handset if he wanted to use one of the other networks to take advantage of competition or in a disaster situation, should the CDMA network be down. GSM users, on the other hand, only need a SIM card of the other GSM network to be able to use it with their existing handset.

3G mobile networks can deliver broadband data services at much higher speeds to more people than 2G networks, and in addition they offer significantly higher capacity for voice traffic and M2M (mobile-to-mobile) communication. So apart from the technology compatibility/redundancy advantage discussed above, they open up a whole new world of services and applications that are relevant to disaster risk management. However, while basic 2G and 3G (Skytel: CDMA-2000) services are available virtually nationwide as mentioned earlier, 4G coverage will take some time to become contiguous across all populated areas in Mongolia, and fewer people will be able to afford them initially due to the higher cost.

Figure 16. Market share by technology (Registered subscribers)



Source: Communications Regulatory Commission, 2014

There are 3,027,243 active mobile subscribers in Mongolia as of 2014, out of which 25.03% were 3G, which means only 25% of consumers use smartphones. Mobicom had 1.3 million mobile subscribers in 2014, out of which 520,000 were 3G-enabled. Mobicom needs to improve its technology to introduce 4G. Only the company Skytel,

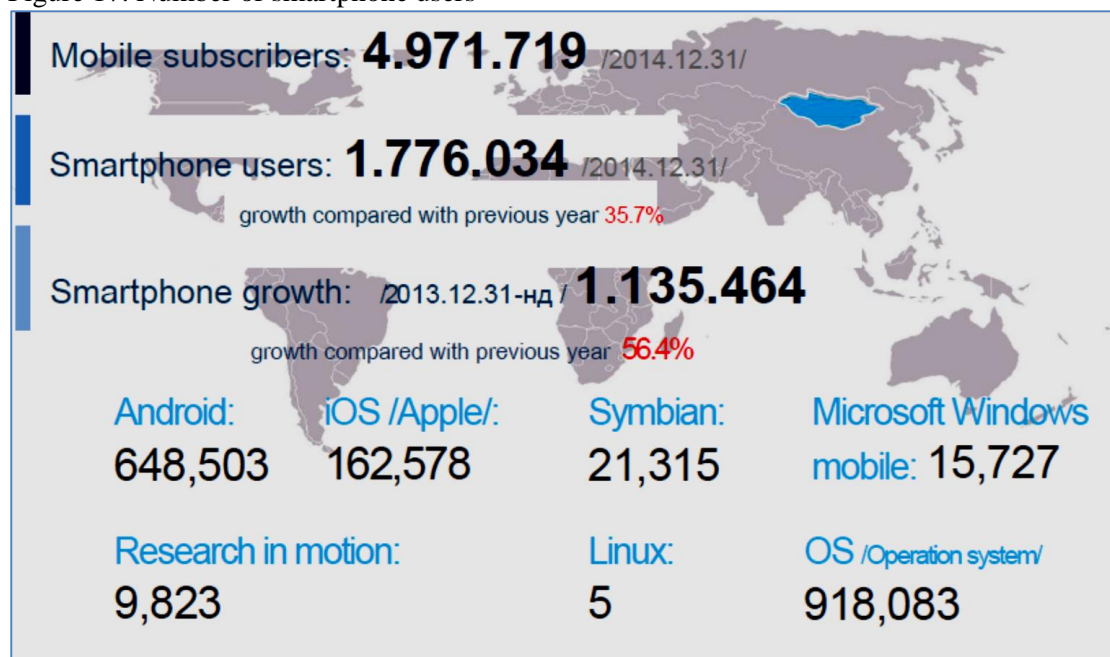
with 17% of all mobile subscribers out of which 2,40,000 are 3G users, has connected all 21 *aimags* and Skytel 3G network covering around 90% of the territory.

G-Mobile introduced 3G (CDMA2000 1x/EV-DO technology) at its five-year anniversary in 2012, and it has been deployed in the capital city of Ulaanbaatar, Zuun Mod *soum* of Tuv *aimag* and Hovd City of Hovd *aimag* respectively as well as to numerous other major cities and rural areas. Currently G-Mobile network covers 285 *soums* and settlements of 21 *aimags* and provides CDMA 2000 1x/EV-DO, DC-HSPA+ 3.99G technology to 500,000 subscribers nationwide. According to the officials of Information Technology and the Post and Telecommunications Authority of Mongolia, 4G will be introduced in 2016.

### **Mobile broadband**

According to 2014 CRC statistics, there are 4.963 million mobile subscribers, out of which 1.7 million are smartphone users who can access the Internet through their mobile devices. This highlights the importance of mobile networks not only for basic voice services, but for data services as well. As the officials of CRC pointed out, there is a forecast that consumption of data services will be increased in the near future. A lack of mobile broadband network coverage or the higher cost of ownership is likely to be the key reason for this, or a combination of both.

Figure 17. Number of smartphone users



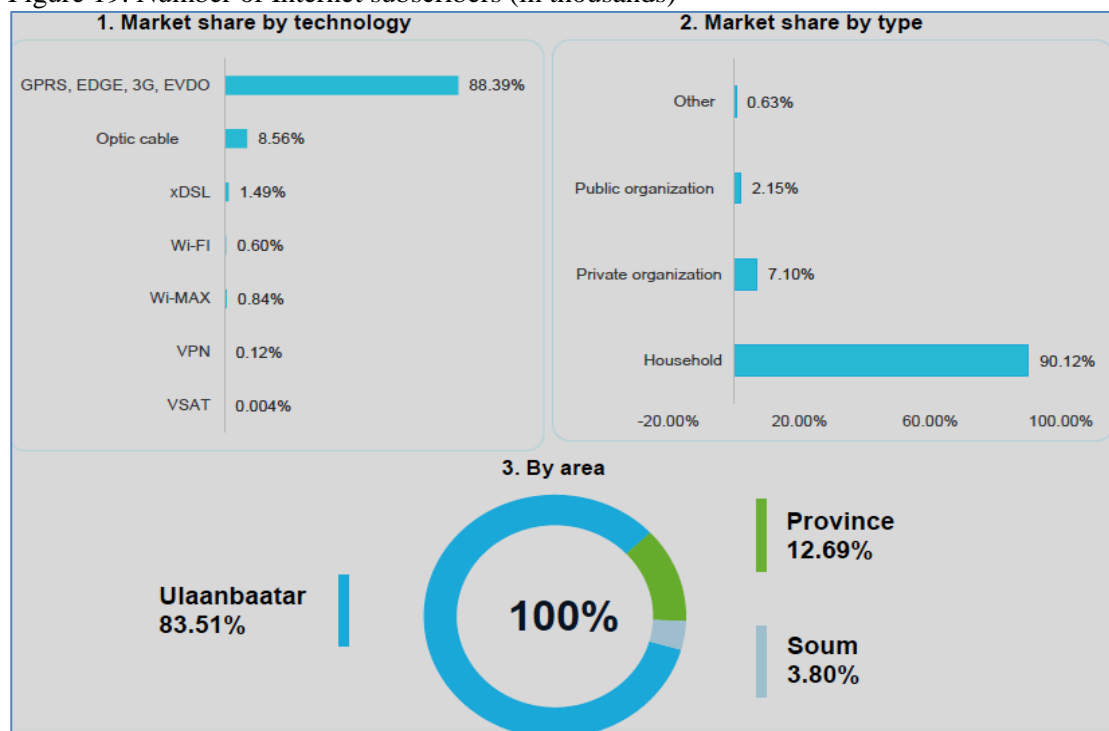
Source: Communications Regulatory Commission, 2014

Figure18. Number of Internet subscribers (in thousands)



Source: Communications Regulatory Commission, 2014

Figure 19. Number of Internet subscribers (in thousands)



Source: Communications Regulatory Commission, 2014

In Mongolia, there is no latency.

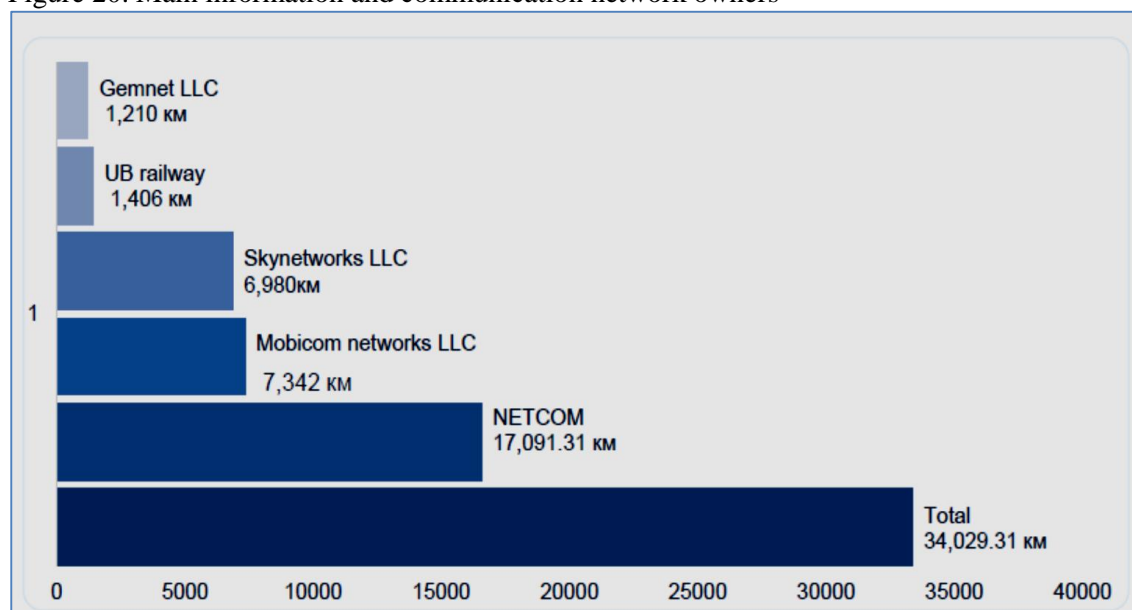
### 1.3.2 BACKBONE NETWORK INFRASTRUCTURE

#### Terrestrial fibre optic networks

Mongolia has five major backbone networks. The resulting major commercial networks are:

- Netcom
- Sky Networks
- Mobinet
- Gemnet
- Railcom (Ulaanbaatar Railway)

Figure 20. Main information and communication network owners



Source: Communications Regulatory Commission, 2014

Netcom is a state-owned information and communications network company, that owns around 17,000 km long fibre optic lines across country and has a commitment to ensure technical and technology background for delivering voice, Internet, radio and television broadcasting services to all people and communities throughout Mongolia by ensuring reliable operation and maintenance of the state-owned high speed networks at national, long distance and local levels.

Netcom's fibre optic network covers Ulaanbaatar, 21 *aimags* and 227 *soums*, and offers network wholesale services to service providers and operators that provide all kinds of information technology and telecommunications services.

The project on "Expansion and renovation of Information and communications backbone network" was carried out in 2013 and connected 140 *soums*.



Figure 21. Netcom fibre optic cable network



Source: Netcom

Netcom is the country's largest Internet Protocol (IP) network providing access for all major Internet service providers (ISPs) nationwide, through a 50 Gbps Multi-Protocol Label Switching (MPLS)-enabled IP backbone using Synchronous Digital Hierarchy (SDH) and Dense Wavelength Division Multiplexing (DWDM) technologies. The vast majority of backbone fibre is installed underground, providing the best possible robustness against damage, e.g. due to natural disasters.

Mobicom's MobiNet also covers all 21 *aimags* of the country, uses the same state-of-art technologies and offers many of the same features. The fibre optic backbone network has a total length of 7,342 km with a total trunk capacity of 7,664 Gbps. 190 Gbps are available for interconnection with other domestic operators.

### **Redundancy**

Network redundancy is important for ensuring the high degree of service availability and minimal downtimes in cases of failure that are expected from first tier operators, who guarantee certain performance parameters in service level agreements (SLA). SLAs typically include a *force majeure* clause which relieves the operator from performance obligations in cases of extraordinary events or circumstances beyond its control such as war, riots, strikes, crime, or natural disasters – in legal terms often referred to as an 'Act of God'. However, service reliability does, of course, become most vital especially in disaster situations.

There are several levels of redundancy that can improve network and service reliability in disaster situations. China's fibre optic backbone infrastructure is relatively well developed in this regard, but there are some areas of concern with the potential for improvement, as outlined below.

The Internet network used by Mongolian mobile operators is a ring type, and claims to have fully redundant backbone networks that doubles certain network components and databases by switching into standby to take over in cases of failure of the primary network element.

In terms of network topology, Mongolia's fibre optic backbone infrastructure consists of several big interconnected fibre rings. A ring structure is the best solution for creating redundancy, because if a ring is broken, virtually all locations along it can still be reached by routing traffic in the other direction around the ring. A total of 10 fibre rings can be identified on the map in Figure 2 (not including metropolitan fibre rings which are not visible in this map).

Figure 22: Terrestrial fibre optic backbone infrastructure in Mongolia



Source: ITU

The most vulnerable areas of disruptions for fibre optic backbone connectivity due to lack of redundancy are the central parts of Mongolia, where some of the country's worst earthquakes have occurred. On the other hand, floods are regularly causing problems to fibre optics in the extreme south and north of the country.

The Mongolia Internet Exchange (MIX) has been operating in order to save traffic congestion in the Internet link by inter-local transactions among the Mongolian ISPs, and also to provide users better latency time of local transactions and to reduce international leased lines since 2001. Switching centres of all Internet and mobile operators are in one place; namely in Ulaanbaatar city.

### **Terrestrial microwave**

Terrestrial microwave radio links have largely disappeared from Mongolia's long-haul backbone network and have been replaced by fibre optic cables which offer higher bandwidth, are not susceptible to radio interference or performance degradation during heavy rain, and have lower maintenance costs.

G-Mobile still uses the microwave backbone network throughout Mongolia more than the other three operators.<sup>2</sup> Other mobile operators utilise microwave network in fewer *soums* (approx. 30 *soums*), which are not connected with fibre optic. As previous chapters mention, most of them established their own fibre optic cables because

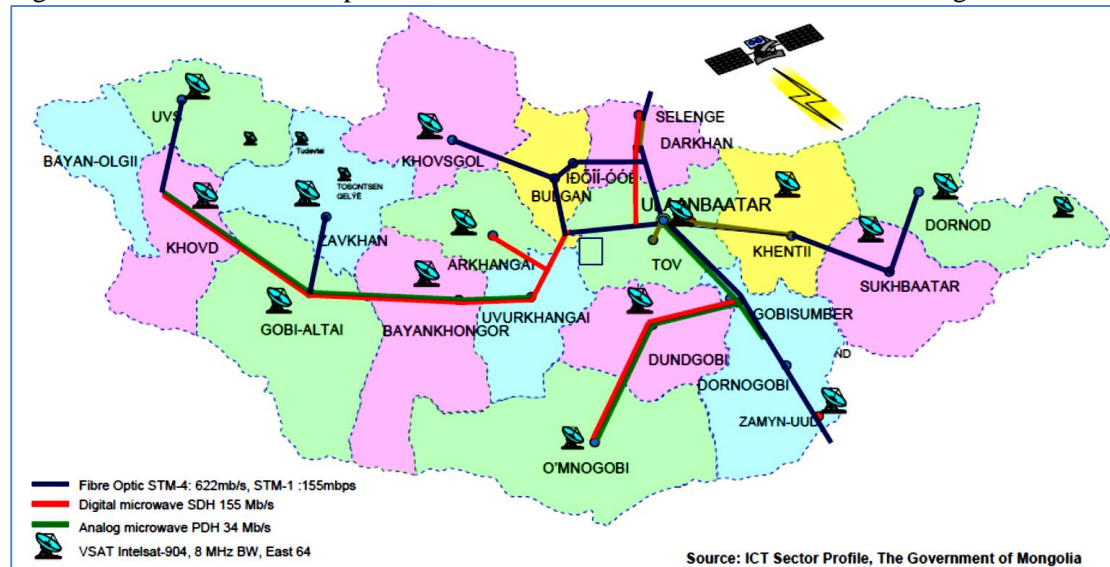
<sup>2</sup> In 21 *aimags* and around 180 *soums*.



microwave radio antenna and stations have high maintenance costs due to the extremely challenging terrain.

However, utilizing a microwave network in parallel with a fibre optic backbone network would ensure redundancy of ICT infrastructure during disasters; especially in more remote areas where there is less redundancy from ring structures in the fibre network. Besides microwave and fibre optic, it is advised to use satellites commonly to provide emergency backup for broken terrestrial links, but the capacity of satellites may be much lower and also has much higher latency.

Figure 23: Terrestrial fibre optic and microwave backbone infrastructure in Mongolia

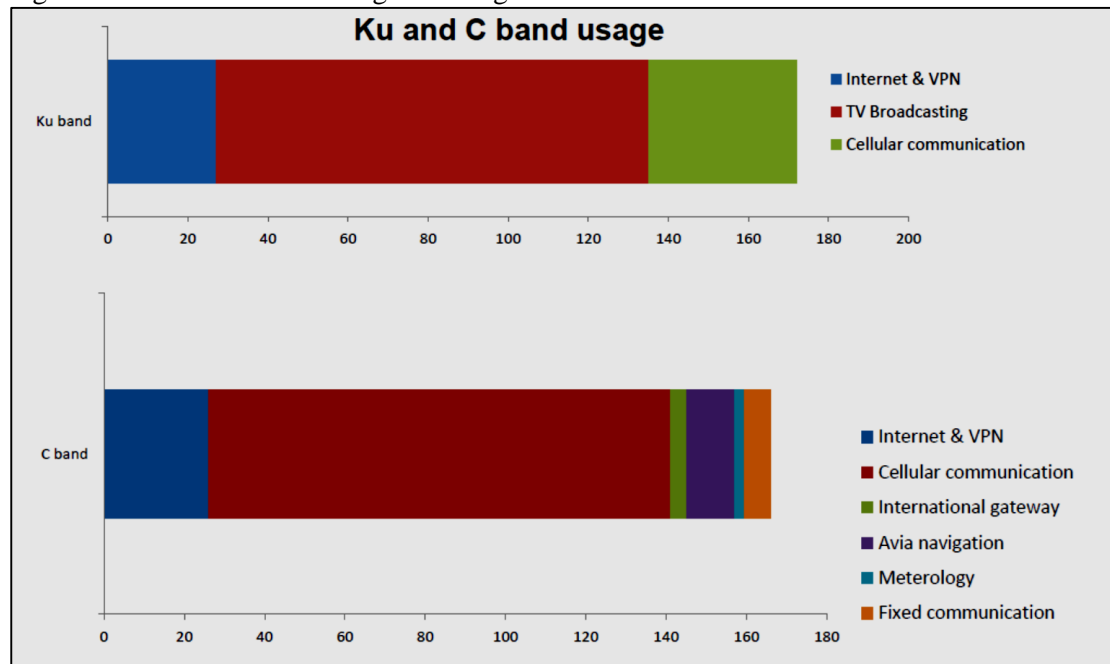


## Satellites

In Mongolia, Intelsat 906 (C), Intelsat 20 (Ku), APSTAR-V (Ku) satellites are being used. The bandwidth of those satellites is 335.7 MHz.

There are 11 licensed satellite network providers working in Mongolia. In Mongolia, remote sensing data is mainly used by researchers in universities for research and development. The National Remote Sensing Centre of Mongolia is the main institution, which facilitates the practical use of remote sensing technology; such as grassland distribution analysis, disaster information, land use change, desertification monitoring, geological maps, and mineral exploration etc.

Figure 24: Ku- and C-band usage in Mongolia



Source: ITPTA, 2014

There are three companies utilizing satellites for TV, Internet and communications network nationwide:

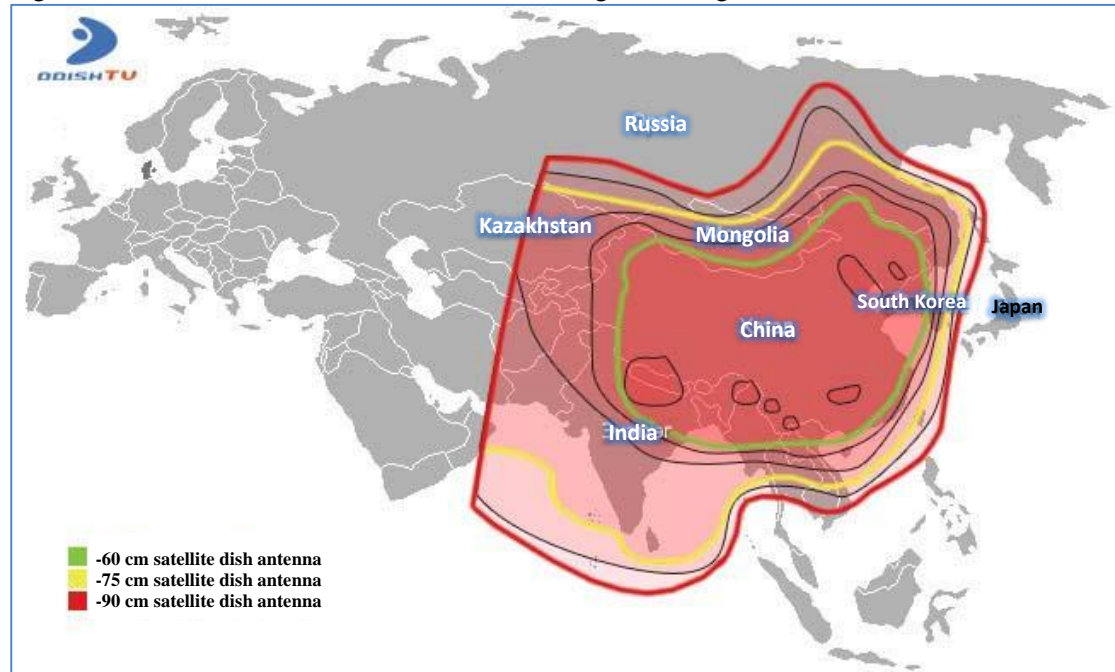
DDish TV LLC (G-mobile's daughter company) provides VSAT Internet connections, especially in rural areas of Mongolia. DDish TV broadcasts major Mongolian national broadcasting channels and some international channels across the country using Ku-band satellite with a dish and special box.

Incomnet LLC uses satellite band to provide services such as data communications network, satellite telephone call, and satellite Internet services in remote areas since its establishment in 2001.

Isatcom LLC is the only national satellite provider of Mongolia that provides VSAT Internet connections and a VPN network for organizations in rural areas since 2004.

The Government is planning to carry out the Mongolian National Satellite Project for communication to bridge the digital divide in rural areas and for promoting practical use Remote Sensing Technology for all sectors.

Figure 25: DDish TV APSTAR-V satellite coverage in Mongolia



Source: DDISH TV

#### 1.4 INTERNATIONAL INFRASTRUCTURE

Mongolia has two landing stations for international fibre optic cables in two border towns, connecting the country to its neighbours and the rest of the world:

- Netcom, state-owned
- Railcom, Ulaanbaatar railway
- Gemnet, a private company

The geographic spread of landing stations and the multitude of cables at each one provide the country with good diversity to protect against service disruptions. In terms of natural disasters, underground cables are most vulnerable to earthquakes, but they can also be affected by flooding.

Figure 26: International fibre optic cables in Mongolia



Source: ITPTA, 2013

Mongolia's international bandwidth transit speed is 150 GB.

## **1.5 MONGOLIAN ENERGY GRIDS**

A reliable, affordable and stable energy grid is a key component of a country to manage natural disasters. A sufficient energy supply is vital, not only for providing a constant telecommunication service, but also for directly protecting lives by providing the basic necessary needs to comfort affected people instantly after a disaster, and for assisting immediate reconstruction efforts.

Mongolia's total installed capacity is 1,050 MW. In the energy sector, the power plants are almost entirely based on fossil fuel, dominated by coal. In terms of generators, there are coal-fired power plants, hydropower plants, and some small diesel and renewable energy generators (see Annex 3 on the Mongolian Energy System).

There are three regionally divided electricity systems in Mongolia: the Central Energy System, the Eastern Energy System, and the Western Energy System. The Mongolian energy sector has connected nearly 400,000 (60%) households from a total of 678,000 to the grid and 318 *soums* to 333 to transmission lines.

Most parts of Mongolian energy sector, such as generators, electricity network, transmission and distribution lines, have aged and require upgrades. Transmission and distribution lines cover long distances with low efficiency which results in high losses. The Mongolian demand for power is increasing by 5-7% each year.

## **2. TRENDS IN APPLICATIONS**

This chapter's main focus is to introduce several practices of how ICTs have been used to enhance DRM in Mongolia. Improving needs of ICT for providing early alert, warning, enhancing older techniques, introducing advanced technologies in DRM, as well as initiatives to organize and empower individuals and communities to alert and respond to a disaster were considered crucial and have been attempted to be addressed using the following examples.

### **2.1 SPECIFIC, TANGIBLE EXAMPLES IN WHICH ICTs HAVE BEEN USED FOR DRR IN MONGOLIA**

Although satellites have a limited bandwidth to fully cover damaged areas or replace destroyed fibre optic and mobile telecommunications network infrastructure, they are still crucial in disaster management.

The Government of Mongolia approved the start of its first satellite project in 2012. Mongolia does not have domestic satellites in service, and pays USD 2 million every year for renting international satellites. In 2015, Mongolia planned to launch the provision of domestic communications; including TV, Internet, radio, e-services and government links along with objective of "Regardless of the geographic location, individuals, herdsman, households and organisations will have access to wireless communication services at a low cost nationwide".

Besides the satellite project, the Government of Mongolia has conducted the National Broadband Programme (2011-15), with a goal to provide access of inexpensive broadband connections for bandwidth-intensive services, high-speed internet, and television for at least 50% of all households and a wireless broadband service for 40% households in remote areas.

### 2.1.1 MOBILE AND SOFTWARE

The emergence of smartphones and tablets, coupled with rapidly increasing network coverage for mobile broadband services is creating new opportunities for new mobile applications in disaster management.

#### Earthquake Disaster Warning System (EDWS):

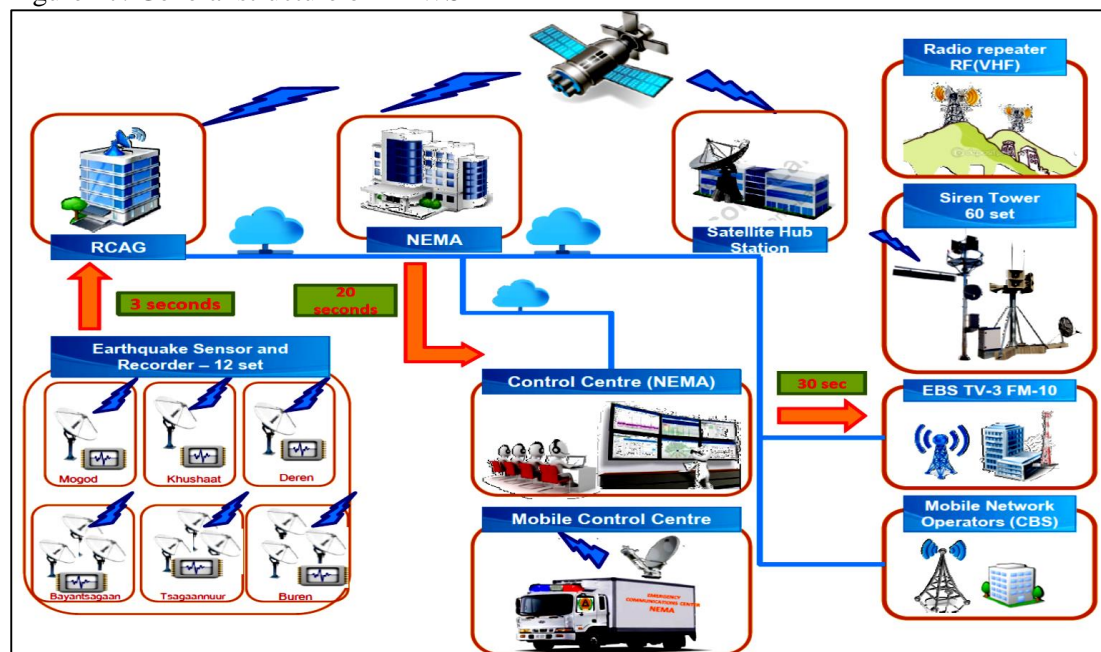
The EDWS project was initiated in 2012 by ITPTA and the National Emergency Management Agency (NEMA) of Mongolia. KT of the South Korean telecommunications provider has been chosen as the partner entity, and has been cooperating with the Government of Mongolia from 2012 to 2014 as a contractor implementing the project. The Government of Mongolia funded this project and the implementing agency was NEMA. This system is to help the Government use advanced ICT systems to protect citizens from disasters like earthquakes and floods.

In 2013, phase 1 of the abovementioned project was completed, which included a Control Centre (CC), 40 siren towers, three TV and five radio systems. Phase 2, which included earthquake monitoring sensors and a mobile control centre, was concluded successfully in 2014. This system will gather and analyse data being fed from sensors and broadcast information to respective stakeholders using wireless or wired networks in case of disasters.

Warning methods consist of siren towers, EBS (TV and Radio) and CBS (Cell Broadcasting Service for mobile network operators). In case of disasters, those methods will broadcast disaster information to people in about 30 seconds.

This system broadcasts warning messages to siren towers, EBS and CBS after getting disaster information from the Research Centre of Astronomy and Geophysics (RCAG) or the Meteorological Agency through special lines and controlling mechanisms by the CC in NEMA.

Figure 27: General structure of EDWS



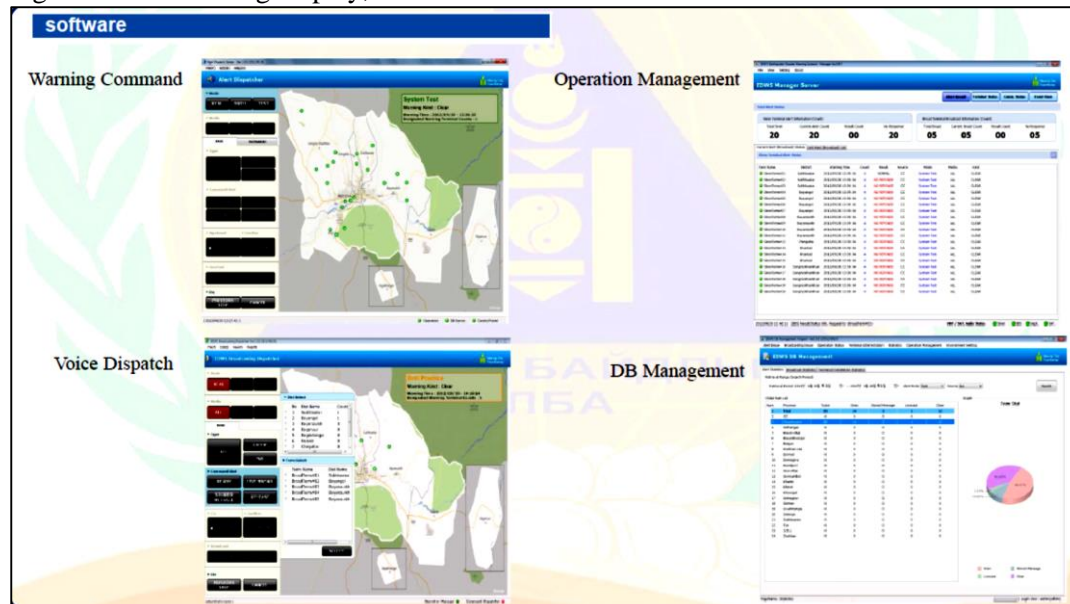
Source: NEMA



The **Control Centre (CC)**: Is the heart of the EDWS system. The CC provides one-stop command and control features with an automatic feedback system across the communication network. During normal conditions, the CC will monitor the network connection and status of all Siren Stations in order to ensure their readiness at all times. Under emergency situations, authorized staff in the CC will issue warning commands immediately. Also in case the CC fails, there is a Mobile CC for back-up.



Figure 28: Monitoring display, EDWS

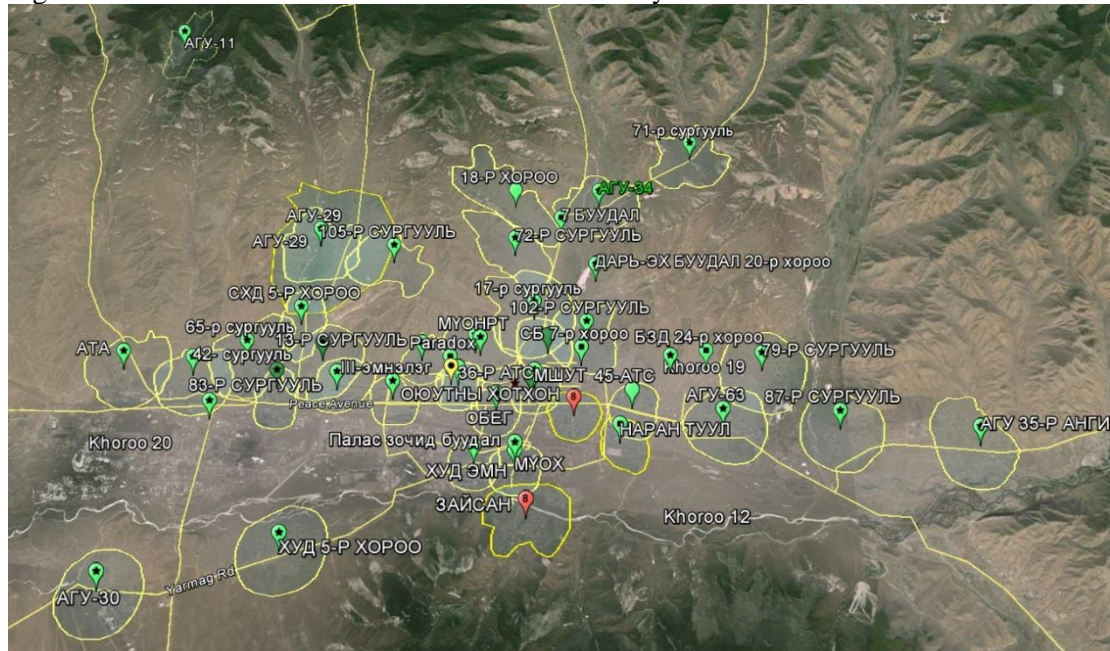


Source: NEMA

The **Mobile Control Centre (MCC)**: As a vehicle-type Control Centre, the MCC functions as a backup, in case the CC fails or is destroyed. The MCC is able to control operations like the CC regardless of its location. It can be used for shadow areas, as it has a self-siren function.

**Siren tower**: The key element of the siren tower is the remote siren terminal (RST) which has a reliable performance. RST is designed for remote siren activation from the CC, and generates various patterns of siren signals to notify the emergency situation to the public. RST automatically reports the activation result to the CC after the command execution. Live voice warning messages from the CC can be remotely delivered to the public for more clear notifications of the emergency situations.

Figure 29. Location of Siren Towers in Ulaanbaatar city

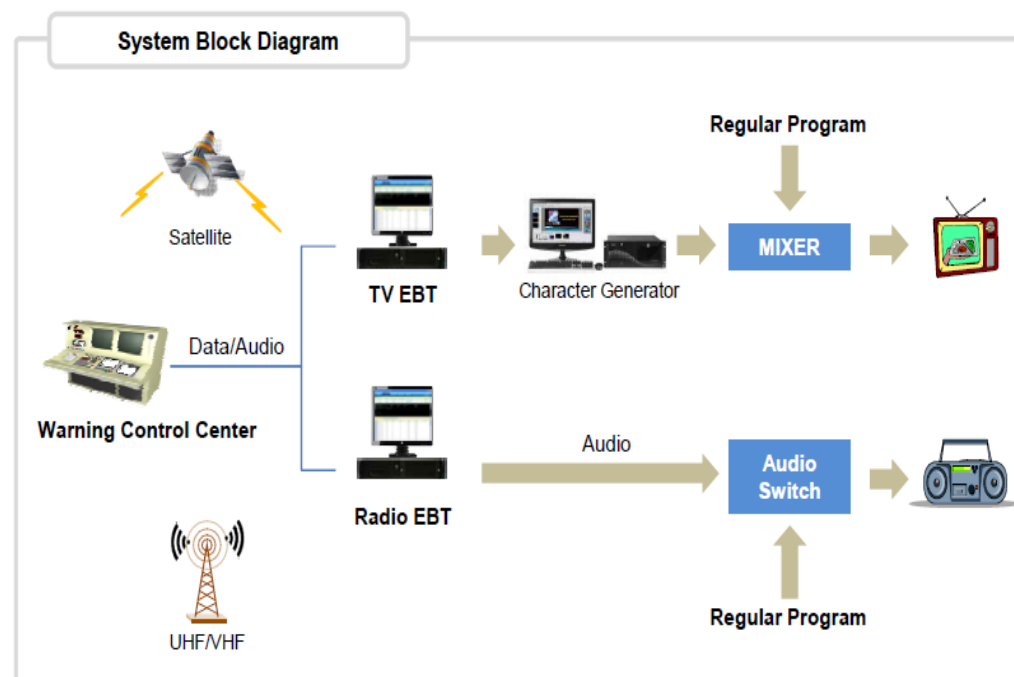


Source: NEMA

The working group has installed 40 siren towers in the first phase in 2013, and 20 siren towers in the second phase of the project respectively in Ulaanbaatar City.

The **Emergency Broadcasting System** (EBS): Sends notifications from the CC or the MCC to the radio broadcasting station using audio data and to the TV broadcasting station through text message. The EBT reports the result of notifications to the Centres. This system is connected to Control Centre via Satellite and VHF network. Other functions for maintenance include recording the history of operation and reporting the result of notifications, self-tests, status displays etc.

Figure 30. Emergency Broadcasting Terminal

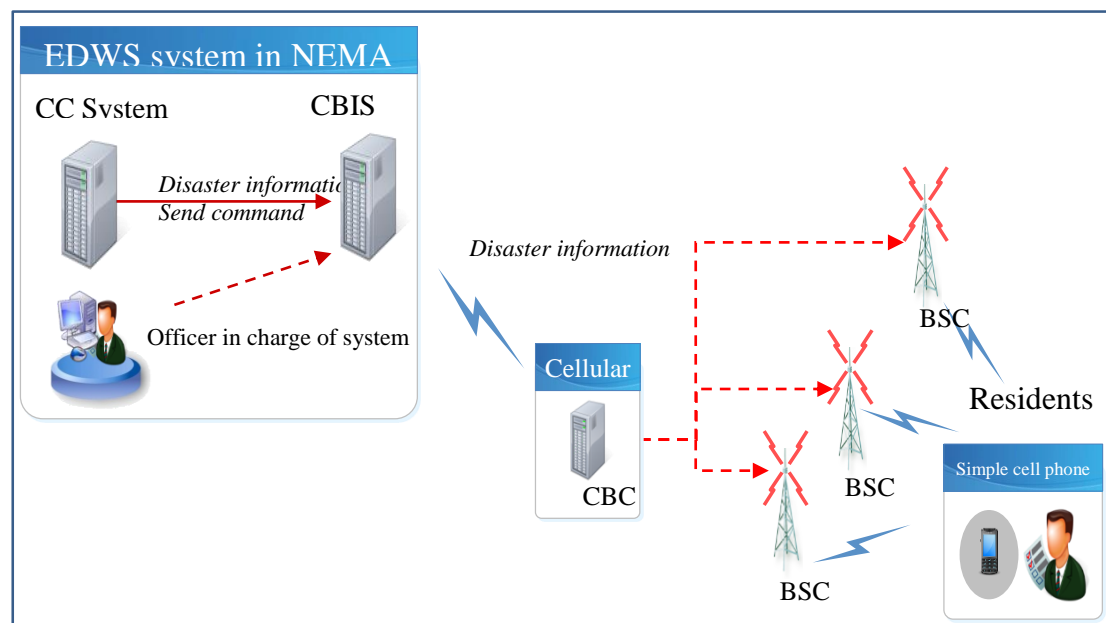


Source: NEMA

Warnings will be broadcasted through three broadcasting TVs across country (MNB, UBS and Mongol HD) and 10 FM radios (Mongolian national radio first channel, UB FM-102.5, Auto FM-96.3, Family FM-104.5, FM-97.5, FM-95.1, FM-107.5, Best FM-98.5, FM-107, FM-103.6).

The **Cell Broadcast Service** (CBS) is a service where emergency messages can be sent to mobile handsets sets in an area to warn citizens.

Figure 31. Cell Broadcast Service structure



Source: NEMA

The research centre for astronomy and geophysics receives data through VSAT from earthquake sensors and recorders. The earthquake monitoring and analysis system will (in real-time) monitor earthquake activities near Ulaanbaatar; predicting the time, place and intensity of the earthquake tremors. The national meteorological agency and environmental monitoring will send emergency weather forecasts to the CC to warn the public.

### **Project on strengthening early warning and dissemination mechanisms of forecasts, hazards and vulnerabilities (NEMA and UNDP):**

NEMA signed an MoU with the National Agency for Meteorology and Environment Monitoring (NAMEM) to cooperate in the areas of improvement of localized weather forecasts.

The main objectives of the project were:

- Providing three *soums* with automatic data loggers produced by Vaisala Oyj, Finland that is becoming a standard data logger for NAMEM nationwide.
- Relevant training on maintenance, data collecting, and processing have been conducted on the *soum* level NAMEM officers.

Another component of the project was to review and refine earlier tested EWS models:

- An appointed working group with representatives of relevant specialized organizations reviewed the earlier tested EWS from 16 to 20 March 2014 in Dundgobi *aimag* for improved effectiveness in further replication.



- On the basis of analysing historical weather and climate data of 30-40 years, frequency, predominant directions, and coverage of strong snow and wind storms in the eastern part of Mongolia was estimated.
- Territorial coverage of signal transmission by local FM radio stations was mapped.
- Recommendations were made by the WG on the EWS model to be replicated in the eastern steppe region of Mongolia.

Also, under the tri-partite MOU between NEMA, NAMEM and DDish TV LLC, a small project has been started for testing delivery of localized weather forecasts and dissemination of individual alerts to herders and rural residents through DDish TV. In the framework of this project, dissemination of warning messages on hazardous phenomena to herders through a mass messaging programme has been tested in 235 *soums* and 24 local emergency management units for further nationwide replication. Within this project, so called disaster managers were identified among rural residents and herders. Usually people with a good reputation who enjoy some level of respect in the community were selected and appointed. Warning messages would be sent to them, and they are trained to help disseminate these to community members. This so called people-centred early warning system must encompass 3 essential aspects: they must be reliable, they must reach the entire population even in the most remote areas, and they must be part of a chain within which people can take appropriate and timely action to protect themselves and their assets.

In fulfilment of this approach, the dissemination of localized weather forecasts and warning on hazardous phenomena through a mass messaging programme has been initiated within the project. The software programme for sending mass SMSs and 3G modems installed in the PC of a *soum* meteorological office enable delivering of early warning to herders living in remote areas simultaneously, regardless of the differences in mobile phone network operators.

As of today, a total of 235 *soum* meteorological offices and 24 local emergency management units have been provided with this possibility, and 366 meteorological staff and emergency personnel were trained in the application of the system.

During the recent snow storms that occurred from 19 to 21 February 2015, which affected the most regions of Mongolia, the dissemination of early warning messages through mass messaging was found to be very effective, and local residents were very pleased with the results. For instance, the wind speed reached up to 21 m/sec (the level of disastrous phenomenon) in Khentii *aimag* and provincially 32 warning messages were sent to 8,916 individuals of 3,408 households ensuring their safety and preparedness. NEMA reported that there were no losses and no search and rescue missions needed to be organized in Khentii *aimag*, unlike data from previous storms with the same wind speed.

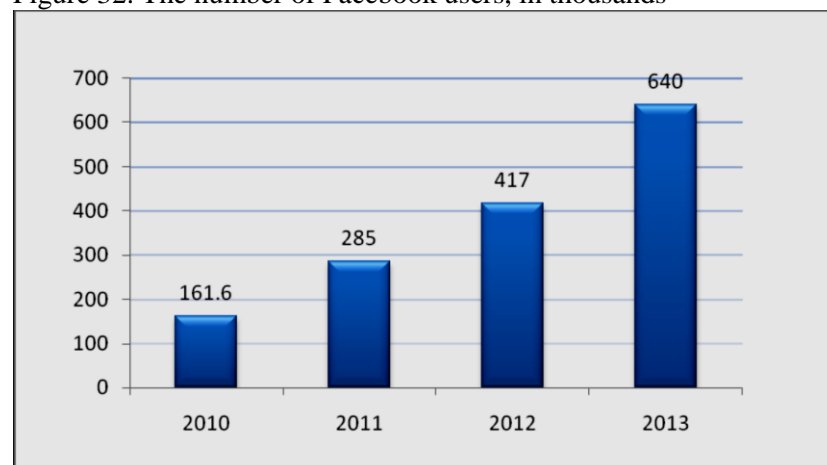
### **2.1.2 SOCIAL MEDIA**

The rapidly growing popularity and widespread use of social media is creating a realm of new possibilities for the development of applications and services for disaster management. Social media platforms offer a number of assets that make them particularly useful in disaster situations, but they also have some weaknesses that need to be taken into account.

In recent years, Mongolians have been enjoying using Internet-based social networks such as Facebook, Twitter, YouTube, Instagram and Biznetwork amongst others.

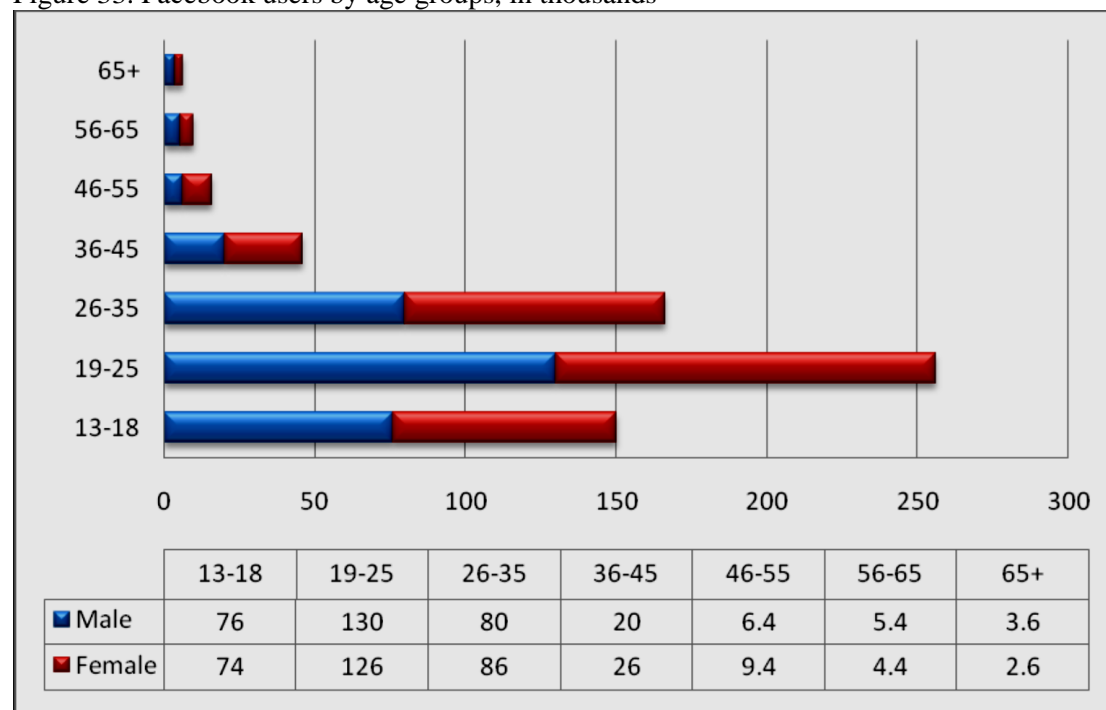
According to the statistics of ITPTA, there are 20.1% (16.8% of the world population) of the Mongolian population using Facebook. The number of Facebook users has reached 640,000, which is 53% higher than the previous year, of which 580,000 users are from Ulaanbaatar alone.

Figure 32. The number of Facebook users, in thousands



Source: White paper, ITPTA, 2014

Figure 33. Facebook users by age groups, in thousands



Source: White paper, ITPTA, 2014

According to global networking surveys (*Measuring the Information Society* report and the Networked Readiness Index 2014), Mongolia's rank has declined to 92<sup>nd</sup> in the annual *Measuring the Information Society* report of the International Telecommunication Union (ITU). In the meantime, Mongolia performed well in the Networked Readiness Index 2014 released by the World Economic Forum, achieving

the 61<sup>st</sup> place out of the 144 counties surveyed, a significant rise from the 85<sup>th</sup> in 2010-11.

### 3. THE DIGITAL DIVIDE IN MONGOLIA

As Mongolia is sparsely populated and a significant portion of the population still lives a nomadic lifestyle, the percentage of the Mongolian population using internet has been increasing dramatically every year. In the year 2000, only 1.1% of the Mongolian population had access to the Internet. By 2014, that percentage had increased to 36.7%. This data shows that the digital gap separating Mongolia and the rest of the world is narrowing. However, the digital divide among Mongolians remains strong. Even though all *aimags* and *soums* are connected via fibre optics, many Mongolian citizens are faced with issues of the digital divide because of their income, education or location.

Mongolian citizens that reside in urban areas are more likely to have access to all services and technology than those who live in rural areas. However, *ger* (yurt) districts do not have access to basic services such as electricity, water pipes, telephone access. The Internet penetration rate is 83.51% in Ulaanbaatar City, but only 12.69% in *aimags* and 3.80% in *soums* of Mongolia.

While the Government of Mongolia has made great efforts in improving the country's communication infrastructure as well as narrowing the overall digital divide, the gap between urban and rural areas of the country still remains. Due to a low population, bad infrastructure and distance, rural areas experience a comparatively high cost of investment in ICT infrastructure.

The rural and urban digital divide can only be overcome through large-scale investments, proper policy and planning for affordable costs of ICT and facilities, and an increase in income of the rural communities.

## 4. LESSONS LEARNED AND RECOMMENDATIONS

As a conclusion from the conducted interviews, there is a significant lack of technologies, human capacity, training facilities and financial constraints, which is critical for Mongolia and other developing countries.

In terms of ICT, there is a major digital divide between urban and rural areas, although ICT development is at a considerably good level. Of course, there is still a need for improvement of networks extending to remote areas of Mongolia.

Also, there is a need to enhance DRM knowledge and education of citizens, residents of remote areas, to initiate and take responsibility of the community, like other neighbouring countries, such as China ([http://china.org.cn/china/2013-04/24/content\\_28643049.htm](http://china.org.cn/china/2013-04/24/content_28643049.htm)), using Internet and social media to self-organise volunteer initiatives to early warnings, create a live crisis map (crowdsourcing through social media) during times of natural disasters, or introduce the necessary software, where the Government cannot directly reach because of geographic locations.

The Government of Mongolia should acknowledge the effectiveness of the utilisation and integration of ICT in its policies regarding disaster risk reduction and management activities, and consider investing more in this sector.

Communities need to be active, because they have the inherent capacity to respond to any disaster. They should also be aware of how to be prepared and help themselves by integrating their capacity and create their own warning and alerting mechanisms using social media (Facebook, Messenger applications and programmes) and telecommunication technologies etc.

The Government of Mongolia should consider providing more financial and technical support to facilitate necessary technologies for ICT development towards universal access in order to facilitate early alerting systems throughout the country.

There is a greater need to have proper legislation on how to regulate the communication between private landowners, legal entities and the Government regarding the use of their property to set up antennas and sirens. There is also a need to combine proper and smart urban planning with more DRR equipment, since landowners are not always willing to have sirens on their rooftops or give permission to operate on their private compounds.

The Government of Mongolia has to cooperate with Governments of other countries on sharing information and learning best practices in terms of how to enhance DRR and improve the management in general.

The Government of Mongolia should maintain effective communication with the mass media.

The Government of Mongolia is already pursuing a very effective policy on public-private partnerships, but it has to be inclusive when it comes to disaster risk reduction and preparedness.

Awareness-raising and promotion, as well as basic education regarding disaster preparedness, should be one of the key areas of public spending.

***For NEMA:***

Greater need for developing DRR management plans at the community level using ICT (social media, evaluation and monitoring applications etc.).

Investment in this sector is urgently needed in order to introduce advanced techniques and technologies in DRM organization (early warning, monitoring, information gathering, assessing software telecommunications, mobile and mobile stations etc.).

Further develop and assist the disaster research centre of Mongolia, the establishment of a database for the research on losses, target areas, and needed communities.

Establishment of a national disaster information management database system accessible to all stakeholders and to the needed communities.

***In terms of ICT development:***

- Constraints of the unique Mongolian nomadic lifestyle, population density, landscape and natural conditions, and poor development of basic infrastructure such as roads and energy.
- The appropriate legal and regulatory environment; especially IT applications, interconnection and tariff, network security and e-commerce etc.
- Common formats and zip coding, standards for ICT.
- The digital divide (urban and rural areas) and Universal Service Obligation Fund issues.
- IT literacy and the use of PCs.
- Constraints of investment for ICT infrastructure.
- Sustainable long term solutions and systematic infrastructural development from the Government of Mongolia.

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## List of Interviewed Officials

H.E. U. Khurelsukh, *Deputy Prime Minister of Mongolia in charge of Emergency Management*

L.Boldbaatar, *Colonel in charge of Disaster Management, NEMA*

Bat-Erdene, *Lieutenant Colonel, NEMA*

L.Enkhbold, *Major, Head of Emergency Management and Early Warning Centre, NEMA*

Ch.Ariunaa, *Strategic Policy and Planning Division, NEMA*

D.Bazarragchaa, *International Relations and Cooperation Division, NEMA*

Ch.Lkhamjav, *Senior Officer in charge of radio communication and early warning systems, NEMA*

D.Serjmyadag, *Ph.D, Scientific Secretary. Disaster Research Institute, NEMA*

L.Batbayar, *Public Administration and Cooperation Department, ITPTA*

Ts.Odkhuu, *Policy and Planning Department, ITPTA*

A.Luvsan-Ochir, *Director of the Market and Tariff Regulation Department, CRC*

L.Gantulga, *Director of the Regulatory Department, CRC*

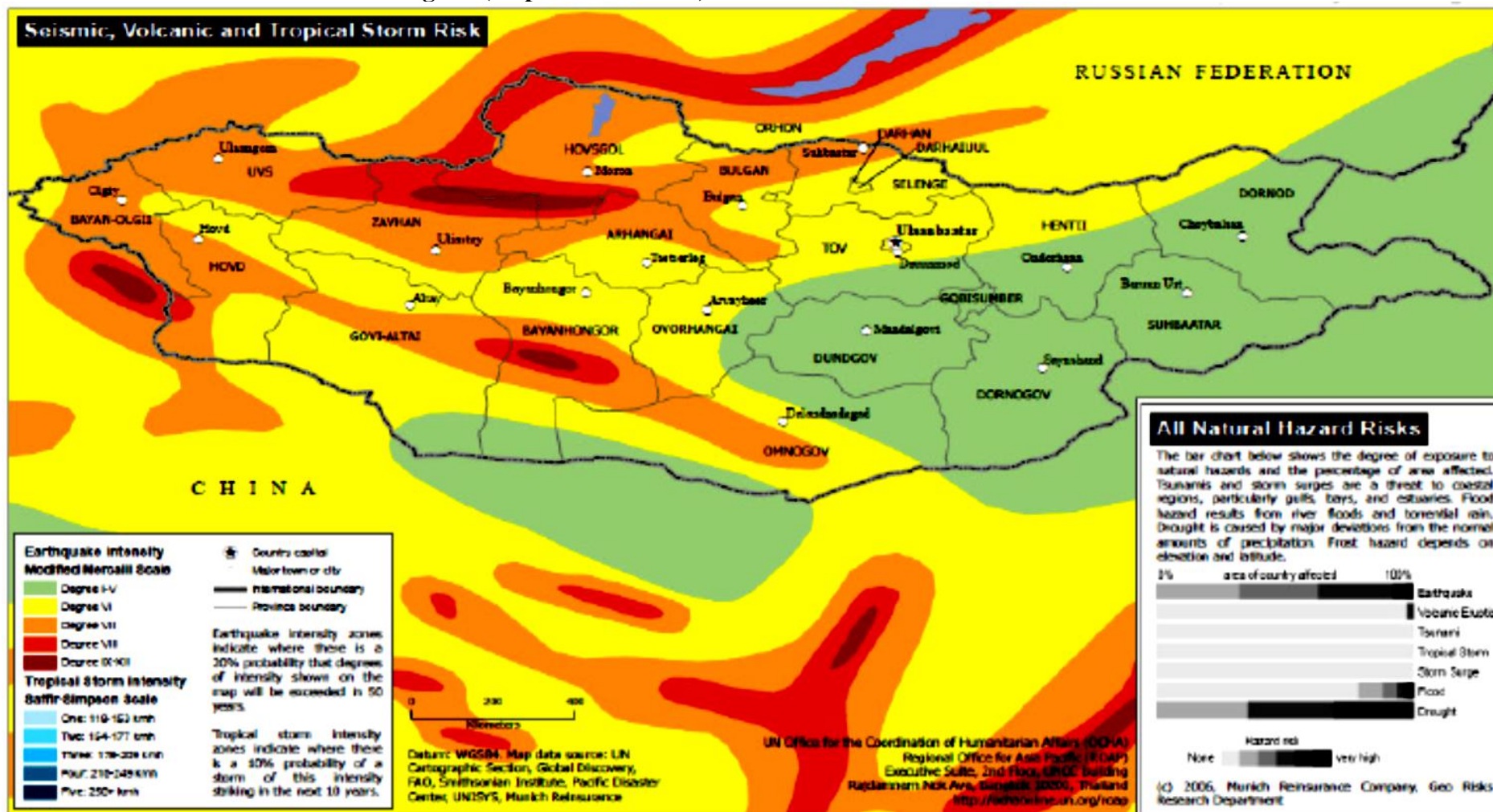
S.Mungunchimeg, *Director of the Human Resource Section, Mobicom LLC*

N.Tegshjargal, *Director of the Administration and Human Resource Division, Skytel LLC*

Ts.Purevdorj, *Director of the Business Development Division, Skytel LLC*

Sh.Batjargal, *Director of Technology, Skytel LLC*

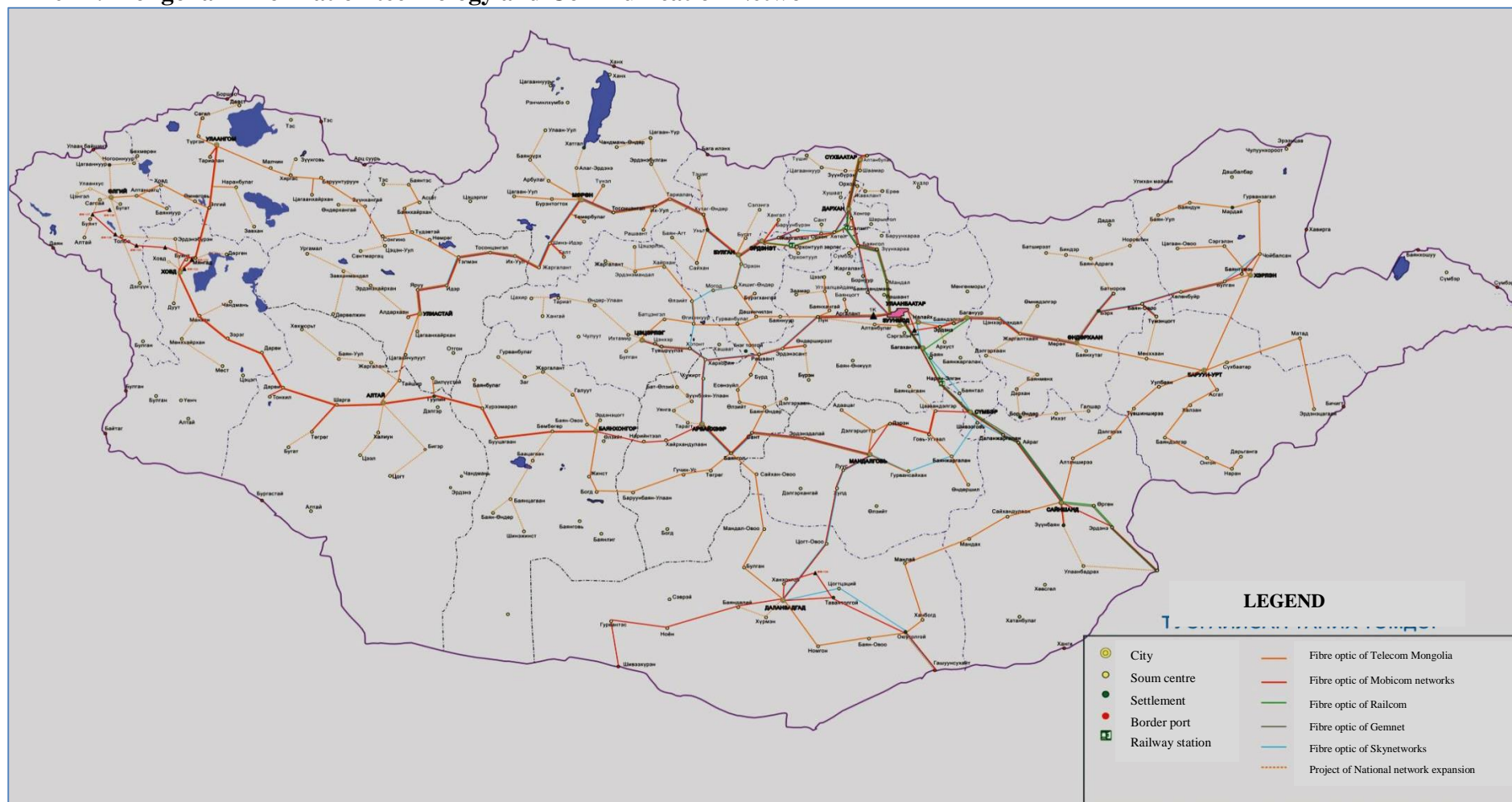
# Annex 1. Natural Hazard Risk of Mongolia (map issued in 2007)



Source: OCHA, 2007



## Annex 2. Mongolian Information technology and Communication Network



Source: IPTA

### Annex 3. Mongolian Energy System

